CLASS 318, ELECTRICITY: MOTIVE POWER SYSTEMS

SECTION I - CLASS DEFINITION

BASIC SUBJECT MATTER OF THE CLASS:

This is the generic class for system of electrical supply and/or of control for one or more electric motors where the electric motor is claimed in combination with such systems of supply and/or control and the electric motor as claimed constitutes the ultimate and sole electrical load device supplied by the system or constitutes the ultimate and sole electrical device being controlled.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

GENERIC OR NORMALLY RECITED ELECTRIC MOTOR.

1. Generic Motor System With Disclosed But Not Claimed Electric Motor.

Motor systems where the disclosure states that any one of a plurality of motors may be used in the system, one of which is an electric motor and another is a non-electric motor, and there is no claim limiting the system to having a non-electric motor, are classified in this class (318).

Where the system includes two or more motors, see Electric Motor Combined With Other Driving Means.

2. Motor Recited By Name Only

The mere inclusion of the electric motor by name only (e.g., an “electric motor”) as an element of the combination is sufficient basis for classification in this Class. That is, no details of structure of the motor or no details of relationship between the motor and the system of supply and/or control--other than merely being connected so as to be supplied and/or controlled by the system--are necessary.

Where, however, the electric motor is not specifically claimed as such, but is claimed only broadly as “a load device”, an “electric translating device”, “a power consuming device”, or any other general load device expression which does not necessitate that the load device be an electric motor, classification is not in this class, but in some other appropriate class which provides for the electric system, per se. This is true even if the only disclosed load or controlled device is an electric motor. However, where the load or controlled device is disclosed as an electric motor but is claimed in general terms and an operating characteristic is significantly ascribed to such device which characteristic (e.g., speed, revolutions, limit-of-travel), is substantially only associated with electric motor, classification will be in this class on the assumption that an electric motor is in fact claimed. Likewise, where characteristic parts of an electric motor are recited classification is herein even though the expression “electric motor” or its equivalent is not literally present in the claims.

MOTOR AS ULTIMATE LOAD DEVICE (FOLLOW-UP SYSTEMS)

The fact that the electric motor is the ultimate load device of the system or that it is the ultimate device being controlled may not always be apparent from the language of the claims. For example, an arrangement wherein means responsive to a condition (such as motor speed) of the motor is provided to actuate motor control or supply means to control the motor is a motor system.

Applying this to a “follow-up” type of motor control wherein a motor is started, stopped and reversed in response to a condition of unbalance of an electrical network and wherein the operation of the motor also rebalances the network, the arrangement is a motor system since the network and its rebalance constitutes the control for the motor.

However, if the above motor drives a specific load device provided for in another class then the patent is excluded from this class. For example, if the above motor drives an indicator for indicating the voltage of a system to which the network is connected, the overall arrangement is a voltage measuring system classified in Class 324. Similarly if the above motor drives a rheostat which regulates the voltage of a generator, the combination is a generation system classified in Class 322.

LOAD DEVICE DRIVEN BY THE MOTOR (INCLUDING POWER, MOTION, FORCE, OR TORQUE TRANSMITTING DEVICES)

1. This class provides for systems of electric supply and/or control for electric motors in combination with load devices driven by the motor when such combination is not provided for in other classes. The definition of, and/or the patents in, the several art classes which provide for the combination of particular load devices and the motive power means therefor will determine the lines that exist between the several classes and this class.

Consequently, the lines as thus determined may be different for different classes.

2. Motor Driven Device Not Significantly Claimed.

In general, however, this class provides for electric systems of supply and/or control for electric motors in combination with the load device driven thereby where the load device is claimed so broadly that it has no particular significance in the system as claimed other than a mere load device. Thus the combination of an electric motor system and a load device driven by the motor wherein the load device is recited in general terms only (such as, for example, “a load device”, a “Variable load”, a “highly fluctuating load”, “means actuated by the motor”, a “Gradually increasing load”, etc.) or in specific terms, but by name only (such for example, as a “vehicle”, an “airplane”, a “rolling mill”, “grinding rolls”, “gearing”. etc.) and wherein no details of the structure of the specific load device or no details of relationship between the motor system and the specific load device, other than that merely necessary broadly to locate the motor or to constitute a support for the motor or to merely connect the motor to the load device, are set forth, is classified in this class.

3. Motor Driven Device Significantly Claimed

This class, also provides for the combination of an electric motor system in combination with specific load devices wherein details of structure of the specific load device or details of relationship between the motor system and the specific load device are set forth only when no provision is made for such combination in any other class.

4. Plural Motor Driven Devices

Where two or more motor driven load devices are claimed, classification will be in some other class. For example only, in electric welding apparatus, the combination of electric motor actuating welding electrodes and a fan directed to cause air to circulate around the electrodes, which fan is actuated by another electric motor, classification is in the art which provides for such combinations; namely, Class 219. If no other class provides for the combination of the specific plural motor driven load devices, classification will be in an appropriate subclass in Class 318 depending on whether or not one or more of the load devices are significantly claimed. See Classification of Motor Driven Load Devices in this class, below. However, note that subclass 39 of Class 318 provides for work and feed or indexing combinations, that is, motor systems having two motors, one motor driving the work and tool with respect to each other, and the other motor driving the means for positioning or feeding the tool with respect to the work.

5. Classification Of Motor Driven Load Devices In This Class

The combination of a motor system and a load device driven thereby where the load device is claimed broadly (by name only) is classified in this class on the basis of the motor system and not on the basis of the combination of the motor system and the load device.

The combination of a motor system and a specific load device which is classified in this class (see Motor Driven Device Significantly Claimed above), is classified in this class on the basis of the combination in subclasses 3+. See the reference to Motor Driven Power, Force or Torque Transmitting Devices below.

6. Motor Systems And Power, Motion, Force Or Torque Transmitting Devices Driven Thereby.

The applications of Load Device Driven by the Motor above, with respect to a motor system where the motor drives a clutch or gearing is as follows:

(a) Clutches. An electric motor system where the motor drives or actuates a clutch is not classified in this class (318) when (a) details of structure of the clutch, (b) details of relationship between the motor (or the electrical system therefor) and the clutch (or its control means) other than a mere driving or connecting relationship, or (c) operating or control means for the clutch are set forth. Where, however, the clutch is so broadly claimed (such as by name only) as to merely constitute a load device actuated by the electric motor, classification is in this class. The motor driven clutches excluded from this class (318) are differently classified. Electric or magnetic clutches of the type in which the transmission of force is solely through the agency or medium of a magnetic field of force are classified in Class 310, Electrical Generator or Motor Structure, subclass 92; fluid clutches or fluid drives in which the transmission of force is solely through the agency of a fluid are classifiable in Class 60, subclasses 52+; and mechanical clutches for the main part are classified in Class 192.

(b) The combination of an electric motor system of the type classifiable, per se, in this class (318) with gearing of the type classifiable, per se, in Class 74 (Machine Element or Mechanism) is as follows: Where a gearing arrangement is set forth with or without an electric

motor drive means therefor and with control means for the gearing other than the drive means, classification is in Class 74, even though the control means includes an electric motor actuator. Where a significant electric motor system is set forth as the driving means for significant gearing, classification is in this class (318), subclasses 3+, provided no means for controlling the operation of the gearing is claimed. Where a significant electric motor system is set forth as driving means for gearing recited by name only, the gearing is considered to be "load" and classification is in this class (318), the subclass depending on the significant electric motor control or supply set forth.

(c) The combination of an electric motor system of the type classifiable, per se, in this class (318) with a positive stop mechanism of the type classifiable, per se, in Class 192 (Clutches and Power-Stop Control) is as follows: Where an electric motor driven device is combined with a mechanical stop mechanism, and the mechanism stops the drive independently of any motor control or deenergization, even though the stopping of the drive incidentally causes control or deenergization of the motor, classification is in Class 192, Clutches and Power-Stop Control. Where the stopping operation requires control of the motor as well as operation of the stop mechanism classification is in this class (318).

(d) Class 477, Interrelated Power Delivery Controls, Including Engine Control, was formed in 1993 from patents in Classes 74 and 192 relating to interrelated controls between an engine and a transmission, brake, or clutch. Therefore the line between Class 318 and Class 477 is the same as exists between Class 318 and Classes 74 and 192 as set forth in Motor Systems and Power above.

7. Electric Motor Control And/Or Supply System As A Control Means In A More Comprehensive System

Where an electric motor drives or actuates specific means for controlling a specific device, classification will, in general, be in the art relating to the specific controlled device or in the art relating to the specific controlling means. For example, an electric motor control system automatically responsive to the speed of an internal combustion engine combined with means actuated by the electric motor for moving the throttle of the internal combustion engine to maintain the speed of the engine constant would not be classifiable in this Class (318), but would be classifiable in the art relating to throttle control of internal combustion engines.

Where, however, the same motor control system is claimed, per se, (i.e., without being limited to actuating the throttle) classification would be in this class. And this is true even if the motor were controlled in response to the speed of the internal combustion engine, if the motor is not limited to controlling the engine.

8. One Electric Motor Control System Connected To Operate The Controls Or The Supply For Another Electric Motor.

Where one electric motor is disclosed for the purpose of operating some useful load device and has means for controlling the motor, the controlling means including a second electric motor system whose sole purpose is to control the load motor, classification of such combination is in this class (318) on the basis of the control of the (single) load motor and not on the basis of plural motors.

ELECTRIC MOTOR SYSTEMS COMBINED WITH OTHER ELECTRICAL SYSTEMS

1. Combined With Adjunctive Or Ancillary Systems.

The combination of an electrical system of supply and/or control for an electric motor of the type classifiable, per se, in this Class with electrical systems for producing some useful effect or result other than supplying and/or controlling the electric motor, which latter systems are subordinate to and operate in conjunction with the motor, the devices driven thereby, and/or the system of supply and/or control for the motor, to perform some effect or result thereupon or to indicate, test, measure, record, calibrate, etc. conditions in (or of) the motor, the devices actuated thereby and/or the system of supply and/or control for the motor, is classified in this class (318).

For example: A system of current, voltage and power-factor measurements connected to measure electrical conditions in various parts of an operative electric motor speed control system is classified in this class (318).

For example: A system for periodically recalibrating a bridge network to cause it to be maintained at some standard operating condition in combination with that bridge network connected to an electric motor so as to control the electric motor, is classified in this class (318).

2. Combined With Coordinate Electrical Systems

The combination of an electrical system of supply and/or control of the type classifiable, per se, in this Class

with one or more other electrical systems the function of which other system is to produce or effect a result which is distinct from the motor control or supply system but which may, however, be related to the operation of the motor system so as to cooperate therewith or which may have some portion thereof constituting a portion in common with both systems, is classified in some other appropriate class. See References to Other Classes referencing this section.

For example: A system of supply and control for an electric motor in combination with a communication system for sending signals and messages not restricted to the control and operation of the electric transmission circuit, would not be classifiable in this class (318).

ELECTRIC MOTOR COMBINED WITH OTHER DRIVING MEANS

This class provides for the combination of one or more electric motors operating as driving means with one or more driving means which are not electric motors only when such combination is not elsewhere provide for.

In general, however, plural driving means when all or one more thereof are other than electric motors, are provided for elsewhere.

However, typical of the art not provided for elsewhere and which is included herein, are the combinations of one or more electric motor (operating as driving means) with axle-operated driving means or manually-operated driving means.

ELECTRIC MOTORS NOT USED TO CONVERT ELECTRICAL ENERGY TO MECHANICAL ENERGY

Electric machines although designated as “electric motors” but which are so connected and used to function as means not for converting electrical energy into mechanical energy but for some other purpose, are not classified herein. Electric motors to be classifiable herein must be connected or controlled so as to function as electric motors.

ELECTRIC MOTOR STRUCTURE

The structure of electric motors (as distinguished from the systems of supply and control) is excluded from this class. See References to Other Classes, below,

SYSTEMS GENERIC TO MOTORS OR GENERATORS

Where the system includes a dynamo-electric machine, and the machine is disclosed but not claimed as either an electric motor or an electric generator, the patent is excluded from this class. See References to Other Classes, below, for the appropriate class.

MOTOR SYSTEMS OTHER THAN ELECTRIC MOTOR SYSTEMS

See References to Other Classes, below, for a reference to a compilation of all types of motors.

SECTION III - SUBCLASS REFERENCES TO THE CURRENT CLASS

SEE OR SEARCH THIS CLASS, SUBCLASS:

445+, include the motor systems where automatically controlled means control the starting and/or stopping.

543+, include the motor systems where the system includes a three or more position motor controller to control the starting and/or stopping.

SECTION IV - REFERENCES TO OTHER CLASSES

SEE OR SEARCH CLASS:

4, Baths, Closets, Sinks, and Spittoons, subclass 213 for ventilating devices for railway-car closets where an air pump is operated by an electric motor.

30, Cutlery, appropriate subclasses for electric motor driven cutlery tools.

38, Textiles: Ironing or Smoothing, subclass 38 for platen presser smoothing, (ironing) machines having two press platens with a pivotedally electric motor operated movable head or bed.

40, Card, Picture, or Sign Exhibiting, subclasses 470+ for electric motor operated changeable exhibitors.

57, Textiles: Spinning, Twisting, and Twining, subclass 100 for electrically driven textile apparatus for spinning, twisting or twining.

60, Power Plants, subclass 6 for the combination of plural diverse motors (including electric motors combined with nonelectric motors), and subclass 97 for plural nonelectric motors. See Clutches in this definition.

60, Power Plants, - notably subclasses 698+. For examples, plural, diverse types of motors

which are nonelectric motors. See "Electric Motor Combined With Other Driving Means" in Lines With Other Classes, above.

60, Power Plants, in the class definition for a compilation of all types of motors. See "Motor Systems Other Than Electric Motor Systems" above.

70, Locks, subclass 271 for predetermined elapsed time interval controlled electric locks operated by an electric motor, 277 for electric motor operated lock operating mechanism, 434 for electric motor operated recorders for recording the condition of a lock operating mechanism.

74, Machine Element or Mechanism, see Motor Systems and Power, Motion, Force or Torque Transmitting Devices Driven Thereby in the class definition.

84, Music, subclasses 3, 9, 11, 19, 107, 113, 405, and 407 for electric motor operated musical devices, subclass 123 for electric motor operated note selector sheet winding and rewinding mechanisms.

105, Railway Rolling Stock, subclasses 35 and 49+ for electric motor driven locomotives.

124, Mechanical Guns and Projectors, subclass 3 for electromagnetic guns and projectors for projecting missiles through the air.

132, Toilet, subclass 75.8 for electric motor driven manicuring.

160, Flexible or Portable Closure, Partition, or Panel, subclass 310 for electric motor operated roll type flexible panel or fabric (roller blinds or shades) devices, and subclass 331 for motor operated arrangements having drape type flexible panel or fabric type devices.

180, Motor Vehicles, subclass 220 for electric powered two wheel vehicles; subclass 65 for miscellaneous electric powered vehicles, subclass 443 for electric powered steering for vehicles.

185, Motors: Spring, Weight, or Animal Powered, is the generic class of motors.

187, Elevator, Industrial Lift Truck, or Stationary Lift for Vehicle, subclasses 247+ for computer control of an elevator, subclasses 277+ for an electric control for the power source of the drive means of an elevator, and subclass 280 for a door actuated electric control for the power source of the drive means of an elevator.

188, Brakes, appropriate subclasses for miscellaneous braking systems and devices see subclasses 157 and 158+ for electric motor operated brakes. The general line between electric motor braking in Class 318 and the braking art in Class 188 and 303 is as follows. The nominal combination of an "electric motor" and a particular brake or braking system for braking the electric motor, in which combination no details of structure of the electric motor or no electric motor circuit relationships are set forth in the claim, is classified in Classes 188 and 303. Where any particulars of structure characteristic of an electric motor or any electric motor circuits relationships are set forth, classification is in Class 318. However, see "Note 1" appended to the search reference to Class 192, immediately following, for further information regarding the line between Class 318 and other classes for "motor control and brake" combinations. Whenever the braking means are connected or arranged or operated to brake a device actuated by the motor and thus only indirectly brake the motor, classification is in Class 318 provided that the motor is always braked whenever the brake is made effective and provided also that the load device to which the motor is connected does not determine classification elsewhere. However, if the braking means as claimed are effective at any time to brake the load device without simultaneously braking the motor or if the braking means is effective at any time to brake any device not actuated by the motor, classification is not in Class 318.

192, Clutches and Power-Stop Control, subclass .02 for electric motor control and clutch; subclasses 1.1+ for electric motor control and brake. See "Motor Systems and Power, Motion, Force, or Torque Transmitting Devices" in Lines With Other Classes, above, for the line between Classes 192 and 318 with respect to motor control and clutch control. The line between Class 192, subclasses 1.1+, motor control and brake control, and Class 318 is as follows: Where there is any control of the electric motor combined with additional means for braking the motor wherein the motor is always braked whenever the braking means is rendered effective, classification is in Class 318. Where the braking means is applied to some device not actuated or driven by the electric motor, or where the braking means is applied to a device which is actuated or driven by the electric motor, but wherein means are provided for discontinuing the driving relationship between the motor and its driven device so that braking can be applied to the driven device without simultaneously braking the motor, classification is in Class 192.

198, Conveyors: Power-Driven, appropriate subclasses, for electric motor driven conveyors.

200, Electricity: Circuit Makers and Breakers, subclass 80 for electric motor driven centrifugal switches.

212, Traversing Hoists, subclass 226 for electric motor driven overhead cranes, subclasses 331+ for electric motor operated self propelled hoists.

219, Electric Heating, appropriate subclasses for electric motor actuated and controlled electric heating systems, see subclass 4 for electric welding apparatus having electric motors for moving the welding electrodes.

222, Dispensing, subclasses 52+ for electric motor controlled dispensing apparatus.

236, Automatic Temperature and Humidity Regulation, for temperature and humidity regulating systems which include an electric motor, particularly subclass 74 for electric motor actuated systems.

244, Aeronautics and Astronautics, subclasses 175+ is the generic subclass for systems and apparatus for automatically controlling the steering of a mobile device in two or three dimensions by electrical means. See the Search Notes to subclasses 175+ for the other classes which provide for systems and apparatus for the control of the steering or motion of mobile craft by means of electric motors and for a statement as to the line between the classes. Also see Load Device Driven By The Motor in the class definition of Class 318.

246, Railway Switches and Signals, subclass 221 for electric motor actuated signal systems.

251, Valves and Valve Actuation, subclass 129.01 for electric motor actuated valves.

290, Prime-Mover Dynamo Plants, subclasses 9+ for prime mover dynamo plants involving electric traction motors; subclasses 10+, 22+, 30, 31+, 36+, 38, 46, 47, and 48 for electric motor starters for prime mover dynamo plants.

303, Fluid-Pressure and Analogous Brake System, for fluid-pressure brake systems, per se, of general application. The line between Class 303 and Class 318 parallels the line between Class 188 and Class 318, and is stated in the remarks under the search reference to Class 188, above.

307, Electrical Transmission or Interconnection Systems, subclasses 11+ for plural load circuit systems, and see Combined With Coordinate Electrical Systems in Lines With OTher Classes, above.

310, Electrical Generator or Motor Structure, appropriate subclasses for structure of electrical motors, and see Clutches and Electrical Motor Structure in Lines With Other Classes, above.

310, Electrical Generator or Motor Structure, appropriate subclasses for the structure of electric motors (as distinguished from the systems of supply and control). See “Electric Motor Structure” above.

314, Electric Lamp and Discharge Devices: Consumable Electrodes, subclass 62 for control systems for controlling the operation of a consumable electrode type discharge device (arc lamp) where the system is controlled in response to the speed of an electric motor, subclasses 68+ and the subclasses specified in the Notes to the definition of those subclasses for electric motor driven feeding mechanism for feeding an electrode in a consumable electrode type discharge device (arc lamp), see indented subclasses 69+ where the motor is a rotary electric motor, and subclasses 105+ and 113+ consumable electrode discharge devices having electromagnetic motor means for separating the electrodes from each other.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclasses for a generator source for a battery or capacitor charging or discharging system.

322, Electricity: Single Generator Systems, electric motor systems are found throughout the class both as driving means for the generator and as a control therefor. Although the following subclasses have many motor systems, the list is neither complete nor exhaustive. See subclass 16 for electric motor driven generator systems having simultaneous control of motor and generator; subclass 39 for electric motor driven generator systems having electric motor control; subclasses 70, 71, 80, and 84 for generator control systems employing electric motor systems therein. See Systems Generic to Motors or Generators in the class definition of Class 322.

322, Electricity: Single Generator Systems, where the system includes a dynamo-electric machine, and the machine is disclosed but not claimed as either an electric motor or an electric generator, the patent is included in this class if the claimed system is otherwise within the definition of Class 322, and provided that no structure or circuit is claimed that limits the system to being a motor system (in case the

machine is disclosed as being a motor). Where the machine is claimed as being either a motor or generator, the patent is classified in Class 322. See "Systems Generic To Motors Or Generators" above.

323, Electricity: Power Supply or Regulation Systems, subclasses 201 through 204 for dynamoelectric systems; and subclasses 220-354 for regulators which may include motors.

324, Electricity: Measuring and Testing, appropriate subclass for electrical measuring systems which include electric motor systems.

335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclass 2 for electromagnetically actuated switches, especially subclasses 68+ for motor operated switches, subclasses 209+ for magnets and electromagnets with or without armatures.

337, Electricity: Electrothermally or Thermally Actuated Switches, subclasses 15+ for thermal current thermostatically operated switches.

340, Communications: Electrical, for electric signaling systems which include electric motor systems, particularly subclass 870.43 for telemetric systems which include electric motor systems, such as, for example, follow-up systems.

342, Communications: Directive Radio Wave Systems and Devices (e.g., Radar, Radio Navigation), subclasses 61+ and 73+ for control where reflected or otherwise returned radio wave energy (e.g., radar) is utilized. See the search notes in the class definition of Class 342 for the other subclasses and classes which provide for radiant energy systems for controlling devices and apparatus.

361, Electricity: Electrical Systems and Devices, subclasses 139+ for relay and electromagnet circuits.

362, Illumination, subclass 272 for projectors having electromagnetic motor operated tiltable or rotatable reflector and bulb unit and subclass 286 for projectors having electromagnetic motor operated adjustable light source.

363, Electric Power Conversion Systems, appropriate subclasses for systems for rectification, derectification, phase conversion, frequency conversion, or combinations thereof. See subclasses 102+ for dynamoelectric current converter systems; subclass 150 for dynamoelectric phase converter systems; and subclasses 174+ for dynamoelectric frequency converter systems.

368, Horology, subclasses 66, 76, 218, and 321 for electric motor driven clocks and the electric systems therefore, and subclasses 250 and 250-254 for electrically operated alarms for clocks.

369, Dynamic Information Storage or Retrieval, subclasses 132+ for an electric motor (piezoelectric or electromagnetic) driven recording stylus and driving circuitry.

375, Pulse or Digital Communications, subclasses 354+ for synchronizing systems for digital communication in general.

416, Fluid Reaction Surfaces (i.e., Impellers), for electric motor driven impellers (propellers).

417, Pumps, subclasses 410.1+ for electric motor driven pumps and subclass 416 for pumps driven by a reciprocating electric motor.

440, Marine Propulsion, for significant boat and ship structure combined with electric motor propulsion means.

446, Amusement Devices: Toys, subclasses 144+, 483, 484+ for toy electrically driven machinery.

483, Tool Changing, generally for a process or apparatus including a tool transfer means combined with a tool support or storage means.

505, Superconductor Technology: Apparatus, Material, Process, subclasses 150+ for high temperature (T_c > 30 K) superconducting devices, and particularly subclasses 166+ for motors or generators.

601, Surgery: Kinesitherapy, subclasses 70+, 87+, 93+, and 101+ for electric motor operated kinesitherapy (message) devices.

700, Data Processing: Generic Control Systems or Specific Applications, subclasses 1 through 89 for generic data processing control systems. This subclass will accept the following claimed subject matter: (a) electric control systems where the end load or device is not an electric motor; (b) control systems which may include a positional servo system but the ultimate claimed load is not a positional servo control; (c) control systems where a positional servo means is not the sole load; and (d) control systems where a specific stored programmable digital computer is used in a positional control system. This is generally indicated by the presence of a flow chart for data processing; subclasses 90-306 for control systems which are limited by the claims to a particular process or have a specific utility, particularly subclasses 245-264 for control systems where the ultimate load is a robot arm or arm segment.

901, Robots, subcollection 2+ for robot arm motion controllers.

SECTION V - GLOSSARY

ACCELERATION CONTROL

Controlling the change of speed of an electric motor from zero speed to some running speed value and vice versa, or from one running speed value to another running speed value. Mere starting of the motor is not considered to be acceleration control unless the acceleration of the motor is controlled after the starting operation. Acceleration control includes deceleration control. Deceleration control differs from motor braking in that in deceleration control no means are utilized for applying an opposing torque or output force to the driving member of the motor. In deceleration control, for example, the power input to the motor is varied to decelerate the motor. See the definition of braking below. Mere stopping of the motor by opening the supply circuit is not deceleration control in the absence of any means to control the rate of stopping, but is mere stopping.

For the distinction between acceleration control and running speed control, see the definition of Running Speed Control.

ALTERNATING-CURRENT COMMUTATING MOTOR

A motor having a commutator electrically connected to a winding of the motor, the motor being designed to operate on alternating current. Such motors are sometimes referred to as “series A-C motors”, “universal motors”. See the definition of Repulsion motor above, and the definition of self-commutated impulse or reluctance motors below.

AUTOMATIC STARTING AND STOPPING

Starting, stopping, or the combination of these two operations is treated in this class as a single motor operation. Automatic starting and stopping (i.e., starting or stopping which is initiated in response to a condition) is classified for the most part in subclass 445 or in the subclasses specified in the notes to the definition of those subclasses. If the stopping control involves motor braking, then the patent is classified in the braking control subclasses. If the stopping control involves motor deceleration control, but not motor braking, then the patent is classified in the motor acceleration control subclasses. If the starting control involves motor acceleration control, then the patent is classified in the motor acceleration subclasses. See diverse motor operations for the classification where the system has means for automatic starting or stopping of the motor and also means for performing another control operation. Where the motor is stopped and then started in the reverse direction of motion, the patent is classified in the motor reversing control subclasses. See below, for a definition of Reversing Control. Where the motor armature or primary current is controlled during the starting and/or stopping period other than for acceleration, deceleration, or braking control, see definition of Motor Load Control.

CIRCUIT MAKING AND/OR BREAKING DEVICE

A device for fully establishing and/or fully interrupting the electrical conductivity of an electrical path or circuit between two or more points in an electrical circuit by relative movement of electrically conductive elements into and/or out of physical contact with each other.

DIVERSE MOTOR OPERATIONS

For the purpose of classification in the subclasses entitled “plural, diverse motor operations control” the following limitations are applied relative to the nature of the several operations:

(I). Starting, stopping, or the combination of these two operations is treated as a single motor operation control. However, since mere starting or stopping is an incident to many other motor operations (such, for example, as acceleration, reversing, braking to a stop, etc. in which actual starting or stopping may take place) such mere starting and/or stopping will not be considered a motor operation control which is included in this subclass as combinable with other motor operations, unless means are provided for effecting an automatic starting and/or stopping in response to a predetermined condition. Thus, ordinary (e.g., manual) starting or stopping combined with running-speed control is not included in the plural diverse motor operations control subclasses, whereas automatic starting and stopping in response to thermal changes combined with means for causing the motor to run in either direction (reversing) is included as plural diverse motor operations control. For example; automatic opening of motor circuit at limit of travel plus

simultaneously shorting the armature for dynamic braking is classified as combined braking and automatic starting and/or stopping. Likewise, automatically opening the circuit of the motor while running at an appreciable speed coupled with a braking operation simultaneously with or shortly thereafter is considered a plural operational control. The following motor operations controls are included in the plural diverse motor operations control subclasses: (a) Reversing control; (b) Acceleration control; (c) Running-speed control; (d) Braking control; (e) Motor load control, and (f) Automatic starting and/or stopping. For definitions of the various individual controls listed above see the other sections under Definitions of Motor Operation Control of this class which pertain to the several individual motor controls. The following are not included herein as combinable motor controls: (a) Phase or Power Factor Control; (b) Temperature control of the motor, including heating or cooling thereof; (c) Signalling, testing, indicating or measuring of conditions in or about the motor; (d) Ordinary or mere starting and/or stopping of the motor; (e) Phase splitting or phase conversion to adapt a motor for operation from a source of electrical supply having a different number of phases than that for which the motor is wound; and (f) Means for lubricating the motor.

ELECTRIC MOTOR:

A machine which transforms electric energy into mechanical energy.

IMPEDANCE OR IMPEDANCE DEVICE

A means having inductance, capacity, resistance or any combination thereof and excluding any source of electric energy.

HOMOPOLAR OR UNIFORM-FIELD MOTORS

A noncommutating motor having a magnetic field producing means combined with one or more electric conductors mounted to move relative to and in proximity to the field producing means, the field producing means being so constructed or energized that the magnetic field produced thereby is, at any instant of time, of the same polarity or direction throughout its extent with reference to the path of travel of the movable electric conductor or conductors.

IMPACT, MECHANICAL SHOCK, OR VIBRATION-PRODUCING MOTOR

An electric motor having means for moving one of the motor parts into impact or percussive contact with one or more other parts of either the motor structure or a part which is structurally combined with the motor structure, or a motor whose prime or essential function is to transmit mechanical shock or vibrations to a device or mechanism secured to the motor or upon which the motor may be mounted, (e.g., rotary motor with the rotor unbalanced to produce vibrations which are transmitted to its support.

INDUCTION MOTORS

An asynchronous alternating current motor which operates during running speed conditions as a result of electromagnetic induction and which has at least two electrical conductors which are mounted or positioned in electromagnetic relationship with each other and for movement relative to each other, and in which alternating current energy delivered to one of the conductors (“primary” or “inducing” member) induces in the other of said conductors (“secondary” or “induced” member) an alternating current and the mechanical energy is obtained as a result of the electromagnetic inductive action between the magnetic field generated by the alternating current in the one conductor and the magnetic field generated by the induced current in the other conductor. The secondary or induced winding is usually short circuited or shunted by means of an impedance. An example of an induction motor is the squirrel cage motor, that is, a motor where the secondary winding consists of a plurality of short-circuited bars. See the definition of a “repulsion motor”.

LINEAR MOVEMENT MOTORS

A motor having means for causing the working element to move in a substantially linear or uni-directional path. The path may be straight, curved, tortuous, or even closed upon itself, provided the movable element is not pivoted for rotation about an axis. The motor may have means for reversing the direction of movement of the movable element. Where the reversing means includes means for periodically or repeatedly reversing the motor at predetermined intervals, the motor system is considered to be an oscillating or reciprocating motor system. See the Glossary definition of Oscillating Or Reciprocating Motor.

MAGNETOSTRICTIVE MOTOR

A motor having a magnetizable member or which has its dimensions changed as a result of changing currents in the electromagnetic field producing means which effects the magnetizable member, the physical distortion or change in dimensions producing the mechanical energy.

MOTOR BRAKING CONTROL

Includes any device or means for applying a torque or force to the power output element of the electric motor in a direction which is in opposition to the motor torque or force (resulting from electrical energization of, or the kinetic or potential energy stored in, the motor) and tending to retard, stop or prevent movement of the motor--excepting, of course, mere useful load devices actuated by the motor, or such forces that are normally inherent in the motor structure, per se, such as bearing friction, windage, eddy current reaction, etc. However, means providing for substantially increased or accentuated eddy currents in the motor structure to increase the retarding or braking effect, are classified herein. Examples of braking means included herein, include, auxiliary eddy-current disks, electric generators, fans, pumps, propellers and other motor shaft loading devices when such devices are limited in the claims to the function of braking the motor. When such shaft loading devices are not limited as claimed to the function of braking, classification is not herein, but in some other appropriate place. For the distinction between braking control and deceleration control see the definition of Acceleration Control in the Glossary. Braking of the motor to control the running speed of the motor (e.g., to maintain the speed constant) is classified in the running speed control subclasses. For the distinction between motor braking and motor reversing, see reversing control below.

MOTOR DECELERATION CONTROL

See the definition of motor acceleration control in the definition of motor deceleration control.

MOTOR LOAD CONTROL

Controlling the mechanical load actuated by the motor or controlling the motor armature or primary current during the starting and/or stopping period of the motor. Where the current is controlled to control the acceleration or deceleration of the motor, the system is classified as motor acceleration or deceleration control, see section IB4a of the class definition. Where the current is controlled to effect motor braking the system is classified as braking control see the definition acceleration control.

MOTOR OPERATION CONTROL

See the Glossary terms Acceleration Control; Automatic Starting and Stopping; Motor Braking Control, Motor Deceleration Control; Motor Load Control, Reversing Control, Running Speed Control; Starting And/Or Stopping; Diverse Motor Operations.

NONMAGNETIC MOTOR

A motor having means other than a magnetic field producing means for producing a mechanical force. Example of nonmagnetic motors are piezo-electric crystals, thermo-electric motors.

RECIPROCATING OR OSCILLATING MOTOR

A motor which is structurally arranged or constructed so as to have a limited degree of movement, and which is provided with means for moving the movable (working element) of the motor to-and-fro repeatedly over substantially the same path or arc of movement (including rotations about an axis co-incident with the geometrical or center-or-gravity axis of the movable element of the motor). Compare this definition and the definition of “LINEAR MOVEMENT MOTORS”.

SPECIAL TYPES OF MOTORS:

The several designations applied to distinguish the several types of motors such as series motors, induction motors, synchronous motors, etc., shall apply to those motors whose normal running characteristics are so described. Thus a synchronous motor is one which runs as a synchronous motor under normal running or load conditions. This is true even though the motor may be driven by some other device either (mechanical or electrical) during the starting and/or accelerating period or may operate on some other motor principle during the starting or accelerating period. Such an instance may be illustrated by a synchronous motor which is provided with means to cause it to start as an induction motor and subsequently and normally run at synchronous speed. Such a motor is considered to be a synchronous motor, since under normal running conditions, it exhibits all the characteristics of a synchronous motor.

SYNCHRONOUS MOTOR

An alternating-current or a pulsating current motor which, under running-speed conditions, operates at an

average speed which is always exactly proportional to the frequency or periodicity of the source which supplies electric energy to the armature or primary circuit of the motor and which speed is independent of the voltage of the source, the magnitude of the field excitation, or the load on the motor.

REPULSION MOTOR

An induction motor (defined in INDUCTION MOTORS above) in which the secondary or induced member is provided with a commutator, the commutator being engaged with a pair of circumferencially spaced short-circuited brushes, and in which either means (e.g., an auxiliary winding) is provided in inductive relation to the secondary to produce a magnetic field in time phase with, and displaced in relation to, the field produced by the primary or inducing member, or the brushes are displaced from the mid-position between adjacent primary (winding) pole positions whereby the motor may operate continuously under running-speed conditions. See the definition of self-commutated impulse or reluctance motors.

SERIES MOTOR

A motor having at least one field producing winding and at least one armature winding, all of the field-producing windings which are connected to be energized being electrically connected in series-circuit relationship with all of the armature windings which are connected to be energized.

SELF-COMMUTATED IMPULSE OR RELUCTANCE MOTORS

A rotary motor of the type in which the rotor element tends to assume a predetermined angular position when the motor is continuously energized and is provided with a commutator or circuit making and breaking device which is actuated by the motor to determine the instants of time at which the field producing windings thereof are energized and de-energized relative to the angular position of the rotary element. See the definition of a Repulsion Motor above.

REVERSING CONTROL

Motor systems in which means are provided for operating the motor in one direction at one time and in the opposite direction at another time, or for causing the motor to operate in a direction opposite to that in which it has previously been operating. In reversing motor systems, means must be provided for causing the motor to produce a torque in both directions of operations. Where the motor current is controlled only to bring the motor to a stop or to brake the motor, there being no operation in the reverse direction, the system is classified as motor braking or as motor deceleration control, depending upon whether the motor is merely braked or whether the rate of deceleration is controlled. See the class definition for a definition of deceleration control and motor braking control in the class definition for a definition of braking control.

RUNNING SPEED CONTROL

Motor systems in which means are provided for regulating or controlling the speed of an electric motor after it has been accelerated to some operating speed at which it is designed to run until the work or useful load device driven by the motor has performed its duty at that speed.

(1) Note. Means for controlling the speed of the motor during the starting or accelerating period of operation (i.e., means for controlling the rate of change of speed) are not classified herein even though the claims may term such control as “speed” control, but are classified under “acceleration”. For a definition of acceleration control, see section IB4a, of the class definition. Since it is common practice to use the acceleration means for also controlling the running-speed of the motor, patents in which both acceleration and running-speed are claimed and in which both controls are effected by precisely the same means in whole or in part, classification will be on the basis of acceleration control only. Under these circumstances of control when some claims refer only to “running-speed” control and/or some other claims refer only to acceleration control, classification will only be on the basis of the acceleration control. When, however, acceleration and running-speed control means are claimed in combination and any means not a part of the acceleration means are used to control the running-speed, classification will be on the basis of combined motor-operation controls including acceleration and running-speed control. Where means are employed to affect the magnitude of the running-speed of an electric motor and the magnitude of the means (e.g., resistance, reactance, voltage, etc.), or the position (e.g., angle of brush position), of the running-speed control

means is not varied or changed, either inherently or otherwise, at any time during the period of acceleration, classification will be on the basis of running-speed control and not on the basis of acceleration control even though there may be some effect on the rate of acceleration. For example, a motor speed control system comprising a fixed resistor connected in the armature circuit, the magnitude of the resistance of which resistor does not vary appreciably under the conditions of use and which resistor is not varied or removed from the circuit during the acceleration period is classifiable under running speed control and not under acceleration control. Since some running-speed control means may be similar or even identical with some acceleration control means, searches for motor acceleration control should be, in appropriate instances, extended to include the running-speed control art.

STARTING AND/OR STOPPING

Generally, the only motor systems classified as starting and stopping are those where the supply circuit to the motor is merely closed in the case of starting, or the supply circuit is opened in the case of stopping, there being no control of the rate of starting or stopping, or no auxiliary means to brake the motor. See the definition of acceleration control of the class definition for the starting and/or stopping systems which include motor acceleration and/or deceleration control means. See the definition of motor braking control of the class definition for the stopping systems which include motor braking. See the definition of motor braking control for the class definition for motor systems where the armature or primary circuit is controlled during the starting and/or stopping period for purposes other than motor acceleration, deceleration or braking control. Motor systems having only starting and/or stopping control are classified in the miscellaneous subclasses of this class. See Subclass References to the Current Class for motor systems where automatically controlled means control the starting and/or stopping and for the motor systems where the system includes a three or more position motor controller to control the starting and/or stopping.

SUBCLASSES

1 ELECTRIC MOTOR WITH NONMOTOR DRIVING MEANS (E.G., AXLE DRIVE, MANUAL DRIVE):

This subclass is indented under the class definition. Subject matter in which one or more electric motors are combined with one or more means (other than a motor) for driving or actuating one or more load devices, e.g., axle drives.

(1) Note. See Electric Motor Combined With Other Driving Means in the Class Definition for the line between this class and other classes which provide for the combination of an electric motor and a nonelectric motor.

(2) Note. Where the electric motor or motors and other driving means drive or are part of an art device, classification is with the art device and not in this class. See Load Device Driven By The Motor in the Class Definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

5, for plural electric motor drives for plural particular load devices.

8, for plural electric motor drives for single particular load devices.

34+, for plural electric motor drives arranged to drive one or more general load devices.

150, and 161, for motors combined with flywheels for actuating load devices.

SEE OR SEARCH CLASS:

60, Power Plants, subclass 698 for the combination of plural diverse motors, including electrical motor combined with nonelectrical motors.

91, Motors: Expansible Chamber Type, subclasses 165+ and 508+ for plural expansible chamber motors.

185, Motors: Spring, Weight, or Animal Powered, is the generic class of motors.

2 Manual driving means:

This subclass is indented under subclass 1. Subject matter in which one or more electric motors are combined with manually actuated

means for driving or actuating one or more load devices.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 479.01 for plural controlling or actuating elements for levers and linkages in general and subclasses 625+ for alternate hand or power operators, where no electric motor control is claimed.

322, Electricity: Single Generator Systems, subclass 9 for systems wherein a generator is actuated by plural driving means, one of them being manual.

475, Planetary Gear Transmission Systems or Components, subclasses 1+ for inputs from independent power sources to a planetary gear transmission.

3 WITH PARTICULAR MOTOR-DRIVEN LOAD DEVICE:

This subclass is indented under the class definition. Subject matter in which one or more electric motors are connected or arranged to be connected to actuate one or more particular or specific load devices which load devices must constitute a significant part of the combination; and in which means are also provided for controlling or supplying electric energy to the electric motor or motors.

(1) Note. See Load Device Driven By The Motor, in the Class Definition for a statement in regard to the combination of electric motors and load devices driven thereby included to this class.

(2) Note. Significant power, torque, force or motion transmitting mechanism is considered to be a particular or specific load device for classification in this or the indented subclasses. See Motor Systems and Power, Motion, Force or Torque Transmitting Devices Driven Thereby, in the Class Definition for the combinations of motor supply and/or control and the power, torque, force or motion transmitting mechanism driven thereby which are included in this class.

(3) Note. Where the particular load device is a flywheel merely, classification is not herein but in appropriate subclasses below. See the Search notes below.

(4) Note. See the classes listed under the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

39, for electric motor systems of the work and feed or indexing type of motor combination where there are a plurality of motors.

161, for an electric motor driving a flywheel, see (2) Note above.

4 Plural, diverse or diversely controlled load device:

This subclass is indented under subclass 3. Subject matter in which there are two or more particular load devices driven by one or more electric motors and in which one or more of the load devices are structurally different from or are operated or controlled differently (e.g., with respect to time, mode or degree of operation or control, particular means employed to effect the operation or control) than one or more of the other of the load devices.

(1) Note. Where the plural driven devices operate as a unit, all receiving the same kind and degree of control so that they function as a single (although sometimes variable) unit, classification will be in this class along with the single driven devices.

(2) Note. Where two or more load devices are claimed and at least one of the load devices is significantly claimed, classification will be in this subclass or a subclass indented hereunder.

(3) Note. This and the indented subclass include the combination of an electric motor driving a particular or specific load device and a power, force or motion transmitting mechanism, the latter mechanism having means for driving a load device other than the first mentioned particular or specific load device.

5 Plural motor drive:

This subclass is indented under subclass 4. Subject matter in which two or more electric motors are provided to drive the driven devices and in which one of the motors is arranged to drive one of the driven devices and another of the motors is arranged to drive another of the driven devices; or, in which one of the motors is supplied with electrical energy differently or is controlled differently with respect to time, load, speed, etc., from another of the motors, or in which one of the motors is substantially different structurally from another motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

1, for subject matter within the class definition having an electric motor driving means and a nonmotor driving means.

8+, for plural electric motors driving single particular load devices.

34+, for miscellaneous plural electric motor systems within the class definition.

39, for electric motor systems of the work and feed or indexing type of motor combination where there are a plurality of motors.

SEE OR SEARCH CLASS:

91, Motors: Expansible Chamber Type, subclasses 165+ and 508+ for plural expansible chamber motors.

6 Tension-maintaining type of motor-control system:

This subclass is indented under subclass 3. Subject matter in which means are provided for controlling one or more electric motors so as to control the tension or tautness in a material being driven, conveyed, or otherwise moved by the motor at some predetermined value or within some predetermined limits.

SEE OR SEARCH THIS CLASS, SUBCLASS:

362+, for patents relating to braking of load devices driven by electric motors.

432, for patents relating to constant motor current or load or torque control.

436, for patents relating to motor systems for producing torque while the motor is not running but is still energized.

SEE OR SEARCH CLASS:

72, Metal Deforming, subclass 6 for a metal-shaping apparatus combined with a condition responsive device for automatically controlling the operation of the apparatus and subclass 183 for a metal deforming apparatus for deflecting successively presented portions of work by tension applied thereto.

112, Sewing, subclass 254 for tensioning devices for sewing machines.

114, Ships, subclasses 213+ for tension relieving devices on ships.

226, Advancing Material of Indeterminate Length, subclass 10 for a feeder controlled by the tension in a strand or web.

242, Winding, Tensioning, or Guiding, subclasses 410+ and 147+ for a device for controlling tension in a running length of elongated material.

254, Implements or Apparatus for Applying Pushing or Pulling Force, subclasses 274+ for apparatus for hauling or hoisting a load, including a cable-pulling drum having a mechanism linked to the drum, or a rotating element of the drive for the drum, for generating a control impulse to the drive motor of the drum when the torque on the drum varies.

440, Marine Propulsion, subclass 34 for ship towing by cables, wherein means may be provided for controlling the cable tension or tautness.

474, Endless Belt Power Transmission Systems or Components, subclasses 101+ for means for adjusting belt tension in a power transmission.

7 Plural, diverse or diversely controlled motors:

This subclass is indented under subclass 6. Subject matter in which two or more motors are controlled and in which one or more of the motors are controlled differently from one or more other of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

34, and the subclasses specified in the notes to the definitions of those subclasses, for plural electric motor systems in general.

8 Plural, diverse or diversely controlled driving motors (e.g., driving differential gearing):

This subclass is indented under subclass 3. Subject matter in which two or more electric motors are employed to drive a particular load device and in which one or more of the motors (1) are substantially different, structurally, or (2) are controlled or operated differently with respect to time, load, speed, etc., from one or more other of the motors.

(1) Note. This subclass includes subject matter within the class definition where plural diverse or diversely controlled electric motors drive differential gearing.

SEE OR SEARCH THIS CLASS, SUBCLASS:

1, for subject matter within the class definition having an electric motor driving means and a nonmotor driving means.

5, for plural electric motors driving plural diverse, or diversely controlled particular load devices.

7, for this subject matter where the plural motors control the tension or tautness of a material being driven, conveyed or moved by the motor.

34, and the subclasses specified in the Notes to the definitions of those subclasses for other plural electric motor systems within the class definition.

39, for electric motor systems of the work and feed or indexing type of motor combination where there are a plurality of motors.

SEE OR SEARCH CLASS:

60, Power Plants, subclass 716 a system of plural motors having a common output and not provided for elsewhere. See the search note in the definition of subclass 698 of Class 60.

91, Motors: Expansible Chamber Type, subclasses 165+ and 508+ for plural expansible chamber motors.

9 Power- or motion-transmitting mechanism:

This subclass is indented under subclass 3. Subject matter in which the particular motor driven device comprises means for receiving and transmitting mechanical power, torque, force, or motion from the electric motor to some load device adapted to be actuated thereby.

(1) Note. Motor Systems and Power, Motion, Force or Torque Transmitting Devices Driven Thereby in the class definition for the combinations of an electric motor and a power, torque, force or motion transmitting mechanism included in this class.

(2) Note. This subclass excludes motor driven clutches and motor driven magnetic field type of transmitting device. See Search Class below.

SEE OR SEARCH THIS CLASS, SUBCLASS:

4+, for such transmitting mechanisms in combination with other particular load devices, all actuated by electric motors, the transmitting mechanism having means for driving a load device other than the particular load device.

8, for such a transmitting mechanism driven by two or more electric motors.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclasses 75+ for electric motors having drive mechanism therefor, and subclasses 92+ for the combination of an electric motor and a magnetic field type of transmitting mechanism. See (1) Note above.

477, Interrelated Power Delivery Controls, Including Engine Control, for interrelated control between a motor and a transmission, clutch, or brake. See (1) Note above.

10 Reversible drive mechanism:

This subclass is indented under subclass 9. Subject matter in which the means driven by the motor is adapted to drive a load shaft or device in a forward and in a reverse direction without reversing the direction of operation of the motor.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclasses 202, 355, 361, 376+, 404, and other appropriate subclasses for reversing gearing, and also "Mechanical movement" subclasses involving oscillating or reciprocating motions.

192, Clutches and Power-Stop Control, subclass 21 for the combination of a clutch and a reversing gear.

474, Endless Belt Power Transmission Systems and Components, subclasses 1+ for control for forward and reverse in an endless belt power transmission.

475, Planetary Gear Transmission Systems or Components, appropriate subclasses for reversing gearing in planetary transmissions.

476, Friction Gear Transmission Systems or Components, subclasses 15+ for friction gear transmissions having a forward and reverse feature.

11 Variable speed mechanism:

This subclass is indented under subclass 9. Subject matter in which the transmitting mechanism is adapted to drive a load device at two or more speeds for a given single speed of the electric motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8, for variable speed power or motion transmitting mechanism (differential gearing) driven by plural diverse or diversely controlled electric motors, as by driving two input shafts, to obtain a variable speed of the output shaft of the gearing.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, appropriate subclasses for the particular mechanical variable speed transmission device, per se.

310, Electrical Generator or Motor Structure, subclasses 92+ for variable speed magnetic-field type clutch driven by electric or other motors.

474, Endless Belt Power Transmission Systems or Components, appropriate subclasses for a variable speed endless belt power transmission.

475, Planetary Gear Transmission Systems or Components, appropriate subclasses for variable speed gearing in planetary transmission.

12 Gearing:

This subclass is indented under subclass 11. Subject matter in which the variable speed transmission is mechanical gearing provided with means for producing two or more output speeds when the input or receiving element thereof is being driven at a single speed.

(1) Note. For a definition of "mechanical gearing", see (1) Note under subclass 15, hereinafter.

(2) Note. See the combination of an electric motor system of the type classifiable in the class definition, for a reference to the electric motor driven gearing in this class.

SEE OR SEARCH THIS CLASS, SUBCLASS:

15, for miscellaneous electric motor driven mechanical gearing within the class definition. See Note 1 above.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclasses 640+ for the structure of the variable speed gearing, per se.

310, Electrical Generator or Motor Structure, subclass 83 for gear drives for electrical generators or motors.

475, Planetary Gear Transmission Systems or Components, appropriate subclasses for variable speed planetary gearing.

13 Differential type:

This subclass is indented under subclass 12. Subject matter in which the variable speed gearing is a differential gearing with means for varying the output speed of the gearing when

the speed of the driving electric motor is at a predetermined single value.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8, for this subject matter where the differential gearing is driven by plural, diverse, or diversely controlled electric motors.

14 Motion-converting mechanism:

This subclass is indented under subclass 9. Subject matter in which the power transmitting mechanism is a device which receives a force or motion from an electric motor having one type or kind of motion (i.e., rotary, linear, etc.) and delivers the force or motion by an element of the device which moves with a different type or kind of motion (i.e., linear, reciprocating, rotary, etc.).

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclasses under "Mechanical Movements" beginning with subclass 20 for details of the motion converting mechanism, per se.

310, Electrical Generator or Motor Structure, subclasses 80+ for motion converting drive mechanism for an electric motor and subclasses 92+ for magnetically energized motion converting means.

15 Mechanical gearing:

This subclass is indented under subclass 9. Subject matter in which the power transmitting mechanism is a mechanical gearing or gear.

(1) Note. For purposes of this class, "Mechanical Gearing" is described as a device comprising two or more relatively rotatable solid bodies each provided with interengaging elements or frictional contact surfaces whereby one or more of the relatively rotating bodies, operating in rolling contact with another of said bodies, will transmit to or receive force or motion from said other body by virtue of such rolling contact. This includes belt gearing. Also a "gear" is described as one of the relatively rotating bodies in the preceding paragraph.

(2) Note. See the combination of an electric motor system of the type classifiable, for a reference to the electric motor driven gearing in this class.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8, for mechanical gearing driven by plural diverse or diversely controlled electric motors.

10, for electric motor driven reversible gearing.

12, for electric motor driven variable speed gearing.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, for gearing, per se.

310, Electrical Generator or Motor Structure, subclass 83 for gear drives for electric motors.

474, Endless Belt Power Transmission Systems or Components, appropriate subclasses for an endless belt power transmission.

475, Planetary Gear Transmission Systems or Components, for planetary gearing, per se.

16 SUPPLIED OR CONTROLLED BY SPACE-TRANSMITTED ELECTROMAGNETIC OR ELECTROSTATIC ENERGY (E.G., BY RADIO):

This subclass is indented under the class definition. Subject matter in which the electric motor is supplied with and/or controlled by electric space-transmitted electromagnetic or electrostatic energy. (e.g., radio energy).

(1) Note. Unitary or structurally organized devices commonly known as electromagnets, electric motors, electrostatic motors, etc., in which an air gap or a displaceable dielectric or nonmagnetic substance is present and across which electromagnetic or electrostatic lines of force extend to an armature thereof, are not included in the above recited means.

(2) Note. The magnitude of the distance between the transmitter of energy or signals and the receiver is not critical since they may be separated merely by a thin

membrane, a wall between rooms, or miles between stations.

SEE OR SEARCH THIS CLASS, SUBCLASS:

480, and the subclasses specified in the Notes to the definition of that subclass for motor systems within the class definition which are controlled by radiant energy, other than electromagnetic or electrostatic energy.

SEE OR SEARCH CLASS:

191, Electricity: Transmission to Vehicles, subclass 10 for electrical transmission to vehicles by magnetic induction.

244, Aeronautics and Astronautics, subclasses 175+ is the generic subclass for systems and apparatus for automatically controlling the steering of a mobile device in two or three dimensions by electrical means, including such control systems which utilize radiant energy. See the Notes to the definition of that subclass for the other classes which provide for systems and apparatus for the control of the steering or motion of mobile devices and for a statement as to the lines between the classes.

334, Tuners, subclass 9 for a remote controlled variable tuner having an electromagnetic operator.

340, Communications: Electrical, subclasses 12.22, 12.5-12.53, and 13.24-13.26 are the generic subclasses for systems for the control of apparatus and devices at a distance by means of radio wave energy.

342, Communications: Directive Radio Wave Systems and Devices (e.g., Radar, Radio Navigation), subclasses 61+ for radio wave signal control if reflected or otherwise returned (e.g., radar) energy is utilized; subclasses 422+ provides for direction finding receivers having movable antennas which are orientated in the direction of the received signal by means of an electric motor system. See the search notes in Class 342 for other subclasses and classes which provide for radiant energy systems for controlling apparatus and devices.

17 PORTABLE-MOUNTED MOTOR AND/OR PORTABLE-MOUNTED ELECTRICAL SYSTEMS THEREFOR:

This subclass is indented under the class definition. Subject matter in which means are provided for portably supporting an electric motor or the electrical system of supply and/or control therefor, the supporting means being particularly adapted for moving the motor or the system from one place to a different place.

(1) Note. By way of example only, the following means are illustrative of portably-supporting means included in this subclass: runners or skids, wheels or rollers, drags or “stone-boats”, floating devices or boats, vehicle, airplane, lighter-than-aircraft, etc.

(2) Note. Where the motor is limited to actuating means which propel the supporting means therefor, classification is not in this class but in motor vehicles or in some other appropriate class except in those instances where the combination is nominal and is classified on basis of subcombination elsewhere in this class.

(3) Note. Handles, hooks, eyes, etc., connected to, attached, or built-in a motor are not considered as portably mounting means.

(4) Note. Electric motors with means for adjustable positioning the motor on an otherwise fixed support for the purpose of alignment, levelling, belt-tightening, etc., are not included herein.

(5) Note. See the classes listed under “Search Class” in the class definition for other classes which provide for portably mounted electric motors or portable systems for electric motors.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 47 for portable or hand held rotary magnetic motors and subclass 50 for portable rotary electric motors.

34 PLURAL, DIVERSE OR DIVERSELY CONTROLLED ELECTRIC MOTORS:

This subclass is indented under the class definition. Subject matter in which there are two or more electric motors forming the ultimate load on the system of which one or more thereof are: (1) Substantially structurally different than, or (2) Supplied by substantially different sources of electrical supply than, or (3) Controlled substantially differently than one or more others of the motors.

(1) Note. For example only, it is interpreted that: (1) Motors differ structurally when they are different in size, capacity, structural details, etc.; (2) Motors are supplied by different sources of supply when the sources differ (a) in kind or type (e.g., AC and DC, generators and electrical converters, different types of electrical converters, different types of generators, etc.) or (b) when the sources differ in size or capacity, or in magnitude of an electrical characteristic thereof, such for example as frequency, voltage; (3) Motors are controlled differently when they are controlled at different times, in different degrees or magnitude, by different control means, by control means in different motor circuits, etc.

(2) Note. When the system of supply and control is not limited as above, that is, when the motors are controlled as a unit, classification will be in the subclasses with single motors.

(3) Note. The several motors must have a useful output severally and individually (i.e., they must be "work" motors). When a motor merely actuates a control element for controlling another motor, such motor is not a useful output or work motor such as is classified herein.

(4) Note. Plural motors implies the existence of two distinct motors. Two distinct motors may be encased in a common housing, be intricately interfitting, or mounted on a common base. However, each must have its distinct field structure and its distinct primary or armature structure, and each must be magnetically distinct, from the other. A motor element having a common field structure, a common field flux or a common path for the field flux, even though excited by separate windings fed from each armature and two separate armature structures, is not considered a plural motor device. Likewise, a common armature with separate windings supplied by different sources, but in which the fluxes traverse common parts or paths is not a plural motor device.

(5) Note. Motor systems having a plurality of motors, one or more of which run at a constant speed or are not provided with any significant motor control means, and only one of the motors being provided with significant control means, are not classified in subclasses 34+, but will be found in the subclasses below which provide for the control system for the single motor which is controlled.

SEE OR SEARCH THIS CLASS, SUBCLASS:

5, for this subject matter where two or more motors drive plural particular load devices.

7, for this subject matter where the plural motors control the tension or tautness of a material being driven or moved by the motors.

8, for this subject matter where two or more motors drive a particular load device.

19, for this subject matter where the system has two or more follow-up motors.

SEE OR SEARCH CLASS:

60, Power Plants, subclasses 698+ for plural motors in general, including the combination of an electrical motor and a nonelectrical motor. See the search notes in the definition of subclass 698 of Class 60 for a listing of plural motor subclasses.

91, Motors: Expansible Chamber Type, subclasses 165+ and 508+ for plural expansible chamber motors.

290, Prime-Mover Dynamo Plants, subclass 4 for electric generation systems having two or more prime mov-

ers, at least one of which is a nonelectric prime mover, for actuating a generator or generators.

310, Electrical Generator or Motor Structure, subclasses 112+ for plural rotary dynamo-electric units electrically distinct but structurally united; subclasses 114+ for rotary electric motors or generators having plural rotors; subclasses 127+ for electric motors having two or more commutator and/or sets of slip rings.

35 Motors with diverse motions (e.g., reciprocating and rotary motors):

This subclass is indented under subclass 34. Subject matter in which there are one or more motors having one kind of driving or output motion (e.g., rotary motion) and one or more other motors having another king of output or driving motion (e.g., linear motion) and wherein the motors are each adapted to drive or actuate a useful load device separately or in common.

37 Plural reciprocating or oscillating motors:

This subclass is indented under subclass 34. Subject matter in which two or more of the diverse or diversely controlled motors are reciprocating or oscillating motors.

(1) Note. See Reciprocating or Oscillating Motor, for the definition of a "reciprocating or oscillating" motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

119+, for miscellaneous reciprocating or oscillating motor systems in this class.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclasses 15+ for reciprocating motors and subclass 36 for oscillating motors.

38 Plural linear-movement motors:

This subclass is indented under subclass 34. Subject matter in which two or more of the diverse or diversely controlled motors are linear-movement motors.

(1) Note. For the definition of "linear-movement motors", see Linear Movement Motors. of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

135, for miscellaneous linear-movement motors in this class.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclasses 12.01 through 12.33 for a linear motor, per se.

39 Work and feed motors (e.g., indexing):

This subclass is indented under subclass 34. Subject matter in which one or more electric motors, hereinafter referred to as "work" motors, are arranged to actuate means for producing relative motion between: (1) a thing to be treated, traversed or operated on, hereinafter referred to as the "work", and (2), a tool, or traversing or operating mechanism, hereinafter referred to as the "tool", the tool being adapted to perform some work or operation on or with respect to the work, combined with one or more other electric motors, hereinafter referred to as the "feed" or "indexing" motors, arranged to control; (3) the rate of feed of the "work" to the "tool" or vice versa, or (4) the position of the "tool", spacially or angularly, relative to the path of movement of the work or the tool whichever is driven by the work motor.

(1) Note. In accordance with the class definition, when the work and feed motor combination is limited to actuating particular driven devices, classification will not be in this subclass (39) but will be classified in some other class. See Lines With Other Classes and Within This Class. Inclusion of the devices operated by the motors by name only, such as a "reciprocating table", or "a carriage", a "movable tool holder" where no significant structure of the machine operated by the motors, will not be sufficient to exclude the patent from this subclass. When, however, the motors are claimed as being related as work and feed or indexing motors with respect to each other and their operations are related to each other, classification will be in this

subclass. Designation of the motors as "work" and "feed" or "indexing" motors is sufficient basis for classification herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

3+, for motor systems having particular load devices, see subclass 4 where the motors drive a plurality of load devices, and subclass 8 for plural motor drives for a single particular load device.

SEE OR SEARCH CLASS:

29, Metal Working, work and feed motor arrangements are found throughout the class, particularly note subclasses 33+ for combined machines employing work and feed motor combinations.

408, Cutting by Use of Rotating Axially Moving Tool, subclasses 5+, 8+ and 14+ for the combination of a drilling machine of that class type with a control means actuated by an external stimulus.

409, Gear Cutting, Milling, or Planing, especially subclasses 10+, 50+, 75+, 79+, 183+, 185+, 332, and 339+ for a work feed motor arrangement in combination with a gear cutting machine.

451, Abrading, cork and feed motor arrangements are found throughout the class, most being found in subclasses 1+, 294, and 331+.

40 Motor biased against rotation:

This subclass is indented under subclass 34. Subject matter in which means, other than an electric motor, are provided for causing the rotary work-element of one or more of the electric motors to tend to return to a previously occupied position when moved therefrom as a result of energization of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

119+, for motor systems having reciprocating or oscillating motors which are biassed to cause the movable element of the motor to move in one direction of the reciprocating movement.

159+, for miscellaneous motor systems having a motor which is biassed against rotation.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 470 for resiliently connected levers and linkage systems.

267, Spring Devices, for structure of spring devices, per se.

310, Electrical Generator or Motor Structure, subclasses 15+ for the structure of reciprocating motors having biasing means for causing the movable element to move in one direction of the reciprocating movement.

324, Electricity: Measuring and Testing, subclass 131 for electric meters having biased pointers or indicators.

41 Having electrical synchronizing interconnections:

This subclass is indented under subclass 34. Subject matter in which means are provided for electrically interconnecting the winding of an electric motor to the winding of another electric motor, or for electrically interconnecting a winding on an auxiliary dynamo-electric machine connected to the rotor of an electric motor to the winding of an auxiliary dynamo-electric machine connected to the rotor of another electric motor; said interconnections being so arranged that when the two electric motors operate at predetermined relative speeds and/or phase relationships substantially no current flows in said interconnections, but that when said relative speeds or phase relationship depart from said relationships current flow occurs in the interconnection in a direction which tends to restore the said speed and/or phase relationships between the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

24, and 30, for follow-up electric motor systems of the synchronous type in which the transmitter (a dynamo-electric machine) is electrically interconnected with the receiver (an electric motor) and in which movement of one machine tends to cause intercirculating currents to flow resulting in a tendency toward synchronous movement

therewith of the other dynamo-electric machine.

45, for mechanically interconnected electric motors.

68, for miscellaneous plural motor systems having means for controlling the relative speeds of the motor.

SEE OR SEARCH CLASS:

60, Power Plants, subclass 702 for synchronizing arrangements for nonelectric motors.

348, Television, subclasses 500+ for television systems having synchronizing systems for synchronizing motors at the transmitting and receiving stations with respect to each other.

358, Facsimile and Static Presentation Processing, subclasses 409 through 424 for facsimile systems having synchronizing systems for synchronizing motors at the transmitting and receiving stations with respect to each other.

370, Multiplex Communications, subclasses 303+ for a multiplexing system having a rotary distributing switch at the transmitting and receiving stations.

375, Pulse or Digital Communications, subclasses 354+ for synchronizing systems for digital communications in general.

416, Fluid Reaction Surfaces (i.e., Impellers), subclass 34 for plural impellers having synchronizing means.

42 Between windings on auxiliary dynamo-electric machines:

This subclass is indented under subclass 41. Subject matter in which an auxiliary dynamo-electric machine is connected to the rotors of each of two or more electric motors, and the synchronizing interconnections are connected between the windings on the auxiliary dynamo-electric machines.

(1) Note. These dynamo-electric machines normally operate as generators when the motors are operated at a predetermined speed and/or phase relationship and develop voltages that are substantially equal and in opposition to each other. When, the predetermined speed and/or phase relationships do not exist the magnitude or the phase of the opposing voltages is such as to cause one of the dynamo-electric machines to supply electric energy to the other, the delivering dynamo-electric machine thereby tending to load and hence reduce the speed of the motor to which it is connected and the receiving dynamo-electric machine tending to aid the electric motor to which it is connected and, hence, to tend to increase the speed thereof whereby the two motors are subjected to forces tending to restore the predetermined speed and/or phase relationship therebetween.

SEE OR SEARCH THIS CLASS, SUBCLASS:

71, for two or more motors each driving a tachometer generator the armature circuits of which are connected in series opposition with each other and also in series with some electric current responsive device to detect current flow in the circuits of the interconnected generators and as a result initiate changes in the relative speeds of the motors.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 32 for electrical systems in which two or more load circuits have control means for proportioning or dividing the total load therebetween; subclass 84 for parallel generators which supply energy to a useful load.

43 D.C. or A.C. commutator motors with slip rings:

This subclass is indented under subclass 41. Subject matter in which each of the interconnected motors is either a direct-current motor or an alternating current motor having both a commutator and one or more slip rings, the synchronizing interconnections being connected to the slip rings.

(1) Note. See Alternating-Current Commutating Motor, for a definition of an “alternating current commutator” motor.

44 Between induction motor secondaries:

This subclass is indented under subclass 41. Subject matter in which two or more of the motors are induction motors, the interconnections being made between the secondaries (induced windings).

SEE OR SEARCH THIS CLASS, SUBCLASS:

818+, for controlling induction motors by controlling the secondary circuit thereof.

45 Mechanically coupled in fixed ratio of movement:

This subclass is indented under subclass 34. Subject matter in which means are provided for coupling, mechanically, the driving or output members of two or more motors in a fixed or predetermined ratio of movement.

(1) Note. Where one motor is connected to actuate an element of a second motor which element is not the working or output member of the second motor, classification is not in this subclass or subclasses indented hereunder but in some other appropriate subclass.

(2) Note. The following coupled motors are included in this subclass: (1) two motors rigidly and directly connected to a common load shaft whether in a common or separate housing so long as each of the motor units is a distinct unit capable of operating by itself; (2) two or more motors coupled together through a variable speed gearing which is adjustable to effect different coupling or speed ratios between the motors but when adjusted to any particular ratio, does not permit the motors to operate at any other ratio of speeds; (3) two or more motors positively but resiliently, connected to a common load shaft so that each motor is capable of slight movement relative to its shaft but further movement in the same direction is inhibited; (4) Two or more motors geared to a common load.

(3) Note. The following motors are not included in this subclass: (1) Two or more motors connected to a common load by any means where slippage or racing of one motor may occur relative to another; such, for example, as two motors driving separate wheels of a vehicle which wheels are not positively geared or linked together by a means other than the common smooth rail or roadbed. See subclass 52 for this subject matter.

SEE OR SEARCH THIS CLASS, SUBCLASS:

52, see Note 3 above.

137, for motor systems which include an auxiliary motor for producing mechanical torque on the principal during starting or acceleration periods only.

SEE OR SEARCH CLASS:

105, Railway Rolling Stock, subclasses 49+ for multiple motored electric locomotives the several wheels or axles of which may be mechanically interconnected by means of parallel or side rods.

192, Clutches and Power-Stop Control, subclass .02 for two motors coupled through a clutch.

46 Motors having unlike operating characteristics:

This subclass is indented under subclass 45. Subject matter in which one or more of the motors have electrical or mechanical characteristics which are different than the corresponding characteristic of one or more others of the motors.

(1) Note. For example, two motors having materially different speed-torque characteristics are included herein.

47 Synchronous and nonsynchronous motors:

This subclass is indented under subclass 46. Subject matter in which one or more of the motors is a synchronous motor and one or more others of the motors is a non-synchronous motor.

(1) Note. For a definition of a synchronous motor, see Synchronous Motor, of the class definition.

48 Mechanically coupled in torque opposition:
This subclass is indented under subclass 45. Subject matter in which one or more of the motors are connected to a rotary member so as to exert a torque therein in one direction and one or more others of the motors are connected to the same rotary member so as to exert torque therein in the opposite direction (either simultaneously or otherwise).

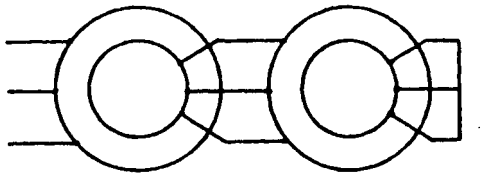
(1) Note. Usually, where the torque is applied simultaneously, the shaft is turned in one direction by the motor generating the largest torque.

49 Motors electrically connected in cascade or tandem:
This subclass is indented under subclass 34. Subject matter in which there are one or more motors adapted to be connected to one or more sources of electric energy to convert part of the energy into mechanical energy and part into electrical energy and in which there are one or more other motors combined with means for supplying the last named motors with the converted electrical energy.

(1) Note. Arrangements within the definition of this subclass include: (1) a wound-secondary induction motor in the secondary circuit of which is connected the primary or armature windings of another AC motor, both motors, being adapted to perform useful work; (2) A direct current motor adapted to perform useful work and in addition thereto driving a d-c generator the output of which is supplied to another electric motor.

(2) Note. Means may be provided for also connecting the same motors in other relations with each other. For example the circuit may be arranged so that the motors may be connected in cascade, or in series or in parallel.

(3) Note. For cascade arrangements the armatures of the several motors may not be connected conductively in series; that is, the same current may not pass through one motor and then be conducted on to another motor electrically in series with said one motor. Usually, the armature of one motor is connected to the secondary of another (induction) motor. The s:graphic in this Note may be considered to depict plural motors with separate sources of supply, also they may be considered to be electrically in series.



(4) Note. When electric energy is led to one machine which may be referred to as a "motor" but which serves only to convert electrical energy and to supply the converted energy to a motor which has a mechanical energy output, the first machine is merely considered a converter and not a motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

45+, for this subject matter where two or more cascade connected motors are mechanically coupled together in a fixed or predetermined ratio of movement.

731+, for doubly fed induction motor systems e.g., where both the primary and secondary windings of the motor are connected to sources of electric energy.

50 With means for effecting other motor interconnections:
This subclass is indented under subclass 49. Subject matter in which means are provided for connecting the motors in electrical relationship with each other in other than cascade or tandem relation.

(1) Note. For example, the system may be arranged so that the motors may be connected in cascade or tandem, or in series, or in parallel.

51 Plural, diverse motor controls for different motors:

This subclass is indented under subclass 34. Subject matter in which means are provided for controlling one or more motors to effect one operational control thereof and for controlling one or more other motors to effect a different operational control thereof.

(1) Note. This subclass is designed to include systems in which the controls for different motors (which may be of the same type) differ from each other; i.e., substantially the same operational control is not exercised over all motors. The same kind or type of control applied to different motors merely at different times is not included herein. For example, see subclass 67 for plural motor systems where means are provided for running one motor at a different speed from another, and subclass 91 for plural motor systems having means to accelerate or decelerate the motors in succession or selectively.

(2) Note. For example, means may be provided for controlling the running speed only of one motor and for controlling the rate of acceleration only of another motor whether at the same or different times.

SEE OR SEARCH THIS CLASS, SUBCLASS:

35, for plural motor systems where one motor has a different type of motion from the motion of another motor (rotary motor and reciprocating motor).

39+, for work and feed or indexing motor combinations involving different controls for different motors.

53, for plural motor systems where the system includes means for effecting two or more diverse operations of the motors (reversing, running speed control, braking, acceleration, deceleration, automatic stopping or starting) the control operations being effected upon all the motors, either simultaneously or in sequence.

67, see Note 1 above.

91, see Note 1 above.

52 Slipping and/or racing control for electric motors:

This subclass is indented under subclass 34. Subject matter in which means are provided for reducing the speed of, or reducing the electrical power input to, one or more electric motors when one or more of the electric motors is slipping or racing while operating as a motor.

(1) Note. This subclass includes means which sense: (1) A sudden increase in speed (that is, a high rate of change of speed) of one or more electric motors, or (2) A speed of one or more electric motors the speed of which is considerably in excess of normal or rated speed thereof, or (3) A substantial change in the relative speeds of two or more motors connected to operate a common load device or physically interconnected load devices so that the motors normally tend to operate at a predetermined ratio of speeds and effects a reduction in speed of one or more of the motors when the above speed conditions exist.

(2) Note. “Slipping” usually occurs when the motor fails to drive its load, through failure of the mechanical connection between the motor and load, and thereby increases its speed due to a lack of load on the motor. An example of slipping is the case of a traction motor driving a wheel, the wheel may fail to grip the rail or road bed and “spin”, thereby reducing the load on the motor.

(3) Note. Where the control means affects the operation at all speeds loads such as maintaining the speed of or load on the motor or motors constant, or maintaining a predetermined load division between several motors, classification is not in this subclass, but is classified herein below in the appropriate subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

68+, for plural motor systems having relative running speed control of plural motors.

98+, for plural motor systems having loads or currents division between two or more motors.

53 Plural, diverse motor controls:
This subclass is indented under subclass 34. Subject matter in which means are provided for effecting two or more diverse operations of two or more motors.

(1) Note. Combinations of the following single operations are included in this subclass: (a) Reversing control, (b) Acceleration control; (c) Running-speed control; (d) Braking control; (e) Motor Load control; (f) Automatic stopping and/or starting. The following are not considered to be a single operation such as when combined with only one of the operations in (a) to (f) or with each other form plural diverse motor-operation control for classification in these subclasses: (1) Phase or Power Factor control; (2) Temperature control of the motor; (3) Signalling, Testing, Indicating or measuring conditions in the motor or its system; (4) Ordinary (manual) stopping and/or starting; (5) Phase splitting or phase conversion to supply the motor; (6) Lubricating the motor. For example, operation (a) with any one or more of operations (1) to (6) are not classified in these subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:
51, for this subject matter where the system includes plural motors in which one or more of the motors is controlled differently than one or more of the others.
67, for plural motor systems where the system includes means for running one of the motors at a different speed from the speed of another motor.
255+, for motor systems having plural, diverse motor operations control the single electric motors.

54 Motor-reversing:
This subclass is indented under subclass 53. Subject matter in which one of the control means is a means for reversing the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:
65+, for plural motor systems having means for controlling the reversing of the motors.
256+, for single motor systems having control means for reversing the motor.

55 With running-speed control:
This subclass is indented under subclass 54. Subject matter in which means are provided for also controlling the running-speed of the motors.

(1) Note. When the means which is used for controlling the acceleration and/or deceleration of the motors is also used for controlling the running speed of the motors, no other running-speed control means being claimed, classification will be in an appropriate subclass which includes acceleration control. See subclasses 58, 61, 64 below.

SEE OR SEARCH THIS CLASS, SUBCLASS:
59+, and the subclasses specified in the search Notes thereto for other plural motor systems having means for running-speed control of plural motors, and another means for a different motor control operation.
64, and the subclasses specified in the Notes to the definition of that subclass for other plural motor systems having means for controlling the acceleration of the motor and means for performing a different type of motor control operation. See Note (1) above.
257+, for single motor systems having the combination of reversing and running-speed controls.

56 And braking:
This subclass is indented under subclass 55. Subject matter in which means are also provided for controlling the motors by braking the same.

SEE OR SEARCH THIS CLASS, SUBCLASS:
63, and the subclasses specified in the search Notes thereto, for other plural

motor systems having controls of plural motors including braking thereof and another diverse type of operation.

258+, for single motor systems having means for the combined reversing, running-speed control and braking.

57 And braking:

This subclass is indented under subclass 54. Subject matter in which means are also provided for controlling the motors by braking.

SEE OR SEARCH THIS CLASS, SUBCLASS:

56, for this subject matter where the system includes means for reversing and braking with running-speed control of the plural motors.

63, and the subclasses specified in the search Notes thereto, for other plural motor systems having means for controlling the braking and another different type of operation of the motor.

258+, and 261+, for the single motor systems having control means for reversing and braking the motor.

58 And acceleration control:

This subclass is indented under subclass 54. Subject matter in which means are provided for also controlling the rate of the motors acceleration and or deceleration.

SEE OR SEARCH THIS CLASS, SUBCLASS:

64, and the subclasses specified in the Notes thereto, for plural motor systems having means for controlling the acceleration and/or deceleration of the motors and means for performing a different motor control operation.

259, and 260, for single motor systems having means for the reversing and acceleration and/or deceleration of the motor.

59 Running-speed control:

This subclass is indented under subclass 53. Subject matter in which means are provided for controlling the running speed of the motors in addition to one or more other motor operations.

(1) Note. Where the same means which is used for controlling the acceleration and/or deceleration of the motors is also used to control the running speed of the motors, no other running speed control being claimed, classification will not be herein but in the appropriate acceleration subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

64, and the subclasses specified in the definition of that subclass for plural motor systems having means for controlling the acceleration of the motor and for performing another motor control operation.

66+, for plural motor systems having means for controlling the running speeds of the motors.

101+, for this subject matter where the system includes running-speed control and reversing control.

268, for single motor systems which have means for controlling the running speed of the motor and having means for performing another control operation.

60 And braking:

This subclass is indented under subclass 59. Subject matter in which means are also provided for braking the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

56, for this subject matter where the system includes means to control the running-speed, the braking and reversing.

63, and the subclasses specified in the Notes thereto for plural motor systems having means for controlling the braking of the motors and for performing another control operation.

269+, and the subclasses specified in the search Notes thereto for single motor systems having combined running speed control and braking control.

61 And acceleration control:

This subclass is indented under subclass 59. Subject matter in which means are provided for also controlling the acceleration and/or deceleration of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

55+, for this subject matter where the system includes means to control the running speed, acceleration and/or deceleration and reversing and with or without braking control of plural motors.

58, for this subject matter where the system includes means to control the acceleration and/or deceleration and reversing.

64, and the subclasses specified in the Notes to the definition of that subclass for other plural motor systems having means to control the acceleration and/or deceleration and to perform a different motor control operation.

271, and the subclasses specified in the search Notes thereto, for combined running speed and acceleration and/or deceleration controls of single motors.

62 And automatic starting and/or stopping and/or with time delay:

This subclass is indented under subclass 59. Subject matter in which means are also provided for automatically starting and/or stopping the motors in response to one or more predetermined conditions and/or with means to effect a predetermined time delay in one or more operational controls of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

101, for plural motor systems having means for controlling the starting and/or stopping of the motor.

272, for single motor systems having combined running speed control and automatic starting and/or stopping for single motors.

63 Braking:

This subclass is indented under subclass 53. Subject matter in which means are provided for braking the motors in addition to one or more other operational controls of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

56, for this subject matter where the system includes means for braking, controlling the running speed and reversing.

57, for this subject matter where the motor system includes means for braking and reversing.

60, for this subject matter where the motor system includes means for braking and controlling the running speed.

273, and the subclasses specified in the Search Notes thereto for single motor systems having braking control combined with other motor-operation-controls.

64 Acceleration control:

This subclass is indented under subclass 53. Subject matter in which means are provided for controlling the rate of acceleration and/or deceleration of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

55, for this subject matter where the system includes means to control the acceleration and/or deceleration, the running speed and reversing.

58, for this subject matter where the system includes means to control the acceleration and/or deceleration and reversing.

61, for this subject matter where the system includes means to control the acceleration and/or deceleration and the running speed.

63, for this subject matter where the system also includes means to control the braking.

90+, for plural motor systems provided with means for controlling the acceleration and/or deceleration of the motors.

276, and the subclasses specified in the Search Notes thereto, for single motor systems having acceleration and deceleration control combined with other motor operational controls.

65 Motor-reversing:

This subclass is indented under subclass 34. Subject matter in which means are provided for causing two or more electric motors to operate in one direction at one time and in a reverse direction at another time.

(1) Note. Reversing the motor connections or reversing the application of power to the motors while running, and terminating the application of power to the motors prior to or substantially at the time when the speed of the motors approach zero speed is not included herein but is classified under braking. See subclasses 86+, for braking control for plural motors. There must be a substantial operation of the motors in a reverse direction to be classified herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

54+, for this subject matter where the system has means for reversing and performing a different control of plural motors.

86+, see Note (1) above.

280+, and the subclasses specified in the Notes to the definition for single motor systems with reversing control.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 127 for switching systems which respond to a reverse polarity.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclasses, especially Digest 15, for polarity control in a battery or capacitor charging or discharging system.

322, Electricity: Single Generator Systems, subclasses 5+ for generator polarity control.

66 Running-speed control:

This subclass is indented under subclass 34. Subject matter in which means are provided for controlling the running speed of two or more electric motors.

(1) Note. Where the same means which is used to control the acceleration and/or deceleration of the motor is also used to control the running speed of the motors, no other running control means being claimed, classification will not be herein but in the more appropriate acceleration subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

59+, and the subclasses specified in the Notes to the definition of those subclasses for this subject matter where the system includes means for running speed control and another different type of motor control.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 53+ for load current division among a plurality of generators, frequently by control of their running speed.

388, Electricity: Motor Control Systems, subclasses 800+ and 825+ for single motor running-speed control systems with, and without, feedback, respectively.

67 Diverse speeds for different motors:

This subclass is indented under subclass 66. Subject matter in which means are provided for running one or more motors at one speed and one or more other motors at another speed simultaneously.

(1) Note. At times, all the motors may be run at the same speed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

39, for work and feed or indexing motor control systems in which the work and feed motor may operate at different speeds.

68 Relative motor speed control:

This subclass is indented under subclass 66. Subject matter in which means are provided for controlling or regulating the speed of one or more electric motors relative to the speed of one or more other electric motors.

(1) Note. This or the indented subclasses do not include systems where the running speed of all the motors is controlled as a group.

SEE OR SEARCH THIS CLASS, SUBCLASS:

41+, for this subject matter where there are electrical synchronizing connections between a plurality of motors so that when the speed of one motor changes with respect to another motor, one of the motors will act either as a prime mover for a generator or as a generator to supply electric energy to the other motor.

45+, for plural motor systems where the motors have the driving members coupled mechanically together.

52, for this subject matter where means are provided for reducing the speed of or reducing the electric energy supplied to a motor when such motor is "slipping" or racing.

90+, for plural motor systems where the acceleration and/or deceleration of one motor may be related to the acceleration and/or deceleration of another motor.

SEE OR SEARCH CLASS:

60, Power Plants, subclass 700 for plural motors of other types in which the speed of one or more motors may be controlled with reference to the speed of one or more other motors.

91, Motors: Expansible Chamber Type, subclasses 511+ for controlling one expansible chamber motor in response to a condition of another.

290, Prime-Mover Dynamo Plants, subclass 4 for plural prime movers one of which is nonelectric, driving electric generators in which the speed of one or more prime movers may be controlled relative to speed of one or more other prime movers.

69 With speed-difference detector:

This subclass is indented under subclass 68. Subject matter in which means are provided for detecting or sensing a difference in speed between two or more of the motors and for initiating the operation of the means for controlling the relative speeds of the motors.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclass 507 for a device responsive to the difference in speed between two bodies.

322, Electricity: Single Generator Systems, subclass 36 for systems wherein the speed of a generator is compared with the speed of a reference device (which might be an electric motor) and means are provided for regulating the speed of the generator relative to the reference device.

388, Electricity: Motor Control Systems, subclasses 800+ for single motor running-speed control systems with feedback.

70 Electrical-type detectors:

This subclass is indented under subclass 69. Subject matter in which the speed difference detecting or sensing means comprises an electrical device which, per se, generates, converts or controls electrical energy, or is activated thereby.

(1) Note. The detecting or sensing means itself must be an electrical device an not merely a nonelectrical device constituting an actuator for an electrical device. For example, an electromagnet having two windings and an armature actuated thereby wherein one winding is energized by current varying with the speed of one motor, the other winding energized by current varying with the speed of another motor and the armature, responsive to the resulting energization of the electromagnet, constitutes an electrical type detector; namely, an electromagnet. However, a differential gearing device, one gear of which is moved at a rate which varies with the speed of one motor, another gear which is moved at a rate varying with the speed of another motor and the output element of the gearing connected to actuate an electric switch is not an example of an electrical detector; but is a mechanical type detector (namely, a differential gear) functioning as an operator for an electrical device; namely, the switch.

71 Voltage and/or current difference detector:
This subclass is indented under subclass 70. Subject matter in which each of two or more of the motors is provided with means for generating electrical voltages and/or currents or is provided with means for controlling a separate voltage or current, the detecting or sensing means being operated by the difference in magnitude between the two separately generated or controlled voltages or currents.

SEE OR SEARCH THIS CLASS, SUBCLASS:
41+, for plural motor systems where there are electrical synchronizing connections between a plurality or the motors.

72 Dynamoelectric machine detector:
This subclass is indented under subclass 70. Subject matter in which a dynamoelectric machine is provided for sensing or detecting the difference in speed between two or more motors.

(1) Note. A common arrangement of a dynamoelectric machines as a detector comprises connecting the armature structure thereof to one motor and the field structure thereof to another motor with the result that when the motors run at the same speed both parts of the dynamoelectric machine will operate at the same speed and, no e.m.f. will be generated in the machine. When the motors operate at different speeds, the parts of the dynamoelectric machine will have relative motion with respect to each other and will generate an e.m.f. which will have a magnitude which is proportional to the magnitude of the difference in speeds of the two parts of the dynamoelectric machine.

73 Synchronously operated impedance detectors:
This subclass is indented under subclass 70. Subject matter in which the detector comprises an impedance device having one or more parts driven synchronously with one or more motors and one or more other parts of the impedance driven synchronously with one or more other motors; or one or more parts of an impedance is actuated synchronously with one or more motors and one or more parts of another impedance device is actuated synchronously with one or more other motors.

74 Synchronously actuated switch detectors:
This subclass is indented under subclass 70. Subject matter in which the detector comprises one or more electric switches one or more parts of which switches are operated synchronously with one or more motors and one or more other parts of the switches are operated synchronously with one or more other motors.

75 Plural switches connected in series:
This subclass is indented under subclass 74. Subject matter in which the detector comprises two or more electric switches connected electrically in series with each other.

76 Differential-gearing detector:
This subclass is indented under subclass 69. Subject matter in which the detector comprises a differential gearing device in which an input element of the gearing is driven by one or more motors another input element is driven by one or more other motors so that the differential or output element of the gearing operates in response to the relative speeds of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:
8, for motor systems in this class having a plurality of motors driving a differential gearing as the load device for the motors.

SEE OR SEARCH CLASS:
475, Planetary Gear Transmission Systems or Components, appropriate subclasses for control of plural power sources and for differential planetary gearing, per se.

77 Controlling motor speed in response to speed of another motor:
This subclass is indented under subclass 68. Subject matter in which means are provided for controlling the speed of a motor in response to changes in speed of another motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

41+, for plural motor systems having synchronizing interconnections between the motors so that one motor may supply energy to another motor when the speed ratio varies.

78 Controlling A.C. frequency or rate of electrical impulses to other motor:

This subclass is indented under subclass 77. Subject matter in which means are provided for controlling the speed of said other motor by controlling the frequency of alternating current supplied to said motor or by controlling the rate at which electrical impulses are supplied to said other motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

723+, for synchronous motor systems having frequency control of the supply current for the motors.

807+, for induction motor systems having frequency control of the supply of AC to the motor.

79 Control of both armature (or primary) and field (or secondary) circuits:

This subclass is indented under subclass 68. Subject matter in which means are provided for controlling the armature (or primary) circuit of one or more of the motors in combination with means for also controlling the field (or secondary) circuit of one or more motors, simultaneously or separately.

(1) Note. The armature and field which are controlled may be of the same or different motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

82+, for plural motor systems having means for controlling the group speed of plural motors by controlling the armature circuit of the motors.

84, for plural motor systems having means for controlling the group speed of plural motors by controlling the field circuit of the motors.

92, for plural motors systems having acceleration and/or deceleration control by the combined control of the armature and the field circuits.

493, and the subclasses listed in the Search Notes thereto, for miscellaneous motor systems with combined control of the armature and the field circuits.

80 Armature or primary circuit control:

This subclass is indented under subclass 68. Subject matter in which means are provided for controlling the armature or primary circuit of one or more of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

41+, for plural motor systems having synchronizing interconnections between the motors so that the armature of one motor may be supplied with energy from the other motor when the speed ratio varies.

79, for this subject matter where the system includes armature circuit control combined with field circuit control.

82+, for plural motor systems having means for controlling the (group) speed of the plurality of electric motors by controlling the armature or primary circuits.

94+, for plural motor systems having armature circuit control means for controlling the acceleration and/or deceleration of a plurality of electric motors.

494+, and the subclasses specified in the search notes thereto, for motor systems having means for controlling the armature circuits.

81 Field secondary circuit control:

This subclass is indented under subclass 68. Subject matter in which means are provided for controlling the field or secondary circuit of one or more of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

79, for this subject matter where the system includes field or secondary circuit control in combination with armature or primary circuit control.

84, for plural motor systems having field or secondary circuit control for con-

trolling the (group) speed of a plurality of electric motors.

97, for plural motor systems having field circuit control for acceleration and/or deceleration control of the motors.

521+, and the subclasses specified in the search notes thereto, for motor systems having field circuit control means.

82 Armature or primary circuit control:

This subclass is indented under subclass 66. Subject matter in which means are provided for controlling the armature or primary circuits of a plurality of motors to control the (group) speed of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

80, for this subject matter where the armature or primary circuit control is for controlling the relative speed of one motor with respect to another motor.

94, for plural motor systems having armature circuit control for controlling plural motors during the acceleration and/or deceleration of the motors.

494, and the subclasses listed under the search notes thereto, for miscellaneous motor systems having armature circuit control.

83 Series-parallel armature circuit connections:

This subclass is indented under subclass 82. Subject matter in which means are provided for connecting the armature conductors or windings of one or more motors in series relationship with the armature conductors or windings of one or more other motors at one time and in parallel relationship therewith at another time; or for connecting the armature conductors or windings of one or more motors in series with the armature conductors or windings of one or more other motors and simultaneously connecting the armature conductors or windings of one or more third motors in parallel with the armature conductors or windings of one or more other motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

93, for plural motor systems having series parallel connection of the armature circuits of plural motors during the acceleration thereof.

111, and the subclasses listed in the search notes thereto, for other plural motor systems having series parallel connections of the armature windings.

497, and the subclasses specified in the search notes thereto, for single motor systems having parallel connections of two or more armature or primary windings.

84 Field or secondary circuit control:

This subclass is indented under subclass 66. Subject matter in which means are provided for controlling the field circuit or the secondary circuit of two or more motors for controlling the (group) speed of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

79, for plural motor systems having combined armature and field circuit control for controlling the relative speed between two or more motors.

81, for plural motor systems having fields or secondary circuit control for controlling relative speed between two or more of the motors.

97, for plural motor systems having field or secondary circuit control of two or more motors during the acceleration period thereof.

521+, and the subclasses listed in the search notes thereto, for single motor systems having field circuit control for the motor.

85 Synchronizing or phasing control:

This subclass is indented under subclass 34. Subject matter in which means are provided for causing a movable motive element of one or more electric motors to occupy or assume a predetermined relative position or phase with respect to a movable motive element of one or more other electric motors either while stationary or while in motion.

SEE OR SEARCH THIS CLASS, SUBCLASS:

41+, for plural motor systems having electrical synchronizing interconnections between a plurality of motors for maintaining the motors in substantially constant speed and phase interrelationship.

45+, plural motor systems having a plurality of motors mechanically coupled (e.g., as by a common shaft) in a fixed or predetermined ratio of movement.

52+, for plural motor systems having means for controlling "slipping" or racing of one or more electric motors.

68+, for plural motor systems having speed control systems for controlling the running speed on one or more electric motors relative to the speed of one or more other electric motors including means for maintaining equal speeds and/or the same angular or phase relationships.

437, for single motor systems having means for phasing, or angular or linear positional control, of the motor.

SEE OR SEARCH CLASS:

60, Power Plants, subclasses 698+ for means for synchronizing plural motors in general.

178, Telegraphy, see the classes referred to in the search notes of subclass 53 for other classes which provide for electrical systems for synchronization of rotary shafts.

307, Electrical Transmission or Interconnection Systems, subclasses 85+ for systems for connecting or disconnecting a plurality of previously synchronized generators.

370, Multiplex Communications, subclasses 304+ for synchronization of rotary switches in a multiplex system.

375, Pulse or Digital Communications, subclasses 354+ for synchronizing systems for pulse communications in general.

416, Fluid Reaction Surfaces (i.e., Impellers), subclass 34 for plural impellers having synchronizing means.

86 Braking:

This subclass is indented under subclass 34. Subject matter in which means are provided for braking the motors.

(1) Note. See Motor Braking Control, of the class definition for a definition of braking control.

SEE OR SEARCH THIS CLASS, SUBCLASS:

51, for plural motor systems having means for braking one or more motors and means for performing some other operational control to one or more other motors.

63, and the subclasses listed in the search notes thereto, for plural motor systems having means for braking plural motors combined with some other motor operation control for the motors.

362+, and the subclasses listed in the search notes thereto, for single motor systems having means for braking the motors.

87 Motor used as braking generator (dynamic braking):

This subclass is indented under subclass 86. Subject matter in which braking is effected by means which cause one or more of the motors to operate as a generator thus retarding the motor and load devices operated thereby.

SEE OR SEARCH THIS CLASS, SUBCLASS:

375+, and the classes and subclasses listed in the Search Notes thereto, for single motor systems having dynamic braking of the motor.

88 Load or current division during braking:

This subclass is indented under subclass 87. Subject matter in which means are provided for controlling the magnitude of the current delivered by one or more of the motors being braked relative to the magnitude of the current delivered by one or more others of the motors being braked.

SEE OR SEARCH THIS CLASS, SUBCLASS:

51+, for plural motor systems having means for braking one of the motors and means for performing a different control operation upon another motor.

98+, for plural motor systems having means for load or current division between plural motors during motor operation.

SEE OR SEARCH CLASS:

290, Prime-Mover Dynamo Plants, appropriate subclasses for load division between nonelectric motor driven generators in general.

307, Electrical Transmission or Interconnection Systems, subclass 53 for systems of load current division among a plurality of generators or sources.

89 Motor as exciter for another motor:

This subclass is indented under subclass 87. Subject matter in which means are provided for connecting the generating or armature circuit of one or more of the motors to the field or exciting circuit of one or more others of the motors during the braking period to supply the exciting or field current to said other motors.

90 Acceleration control:

This subclass is indented under subclass 34. Subject matter in which means are provided for controlling the acceleration and/or deceleration of two or more electric motors.

(1) Note. See the class definition, Glossary for a definition of "Acceleration Control".

SEE OR SEARCH THIS CLASS, SUBCLASS:

64, and the subclasses specified in the Search Notes thereto, for plural motor systems having means for acceleration and/or deceleration control of two or more motors combined with another motor-operation control for the motors.

SEE OR SEARCH CLASS:

388, Electricity: Motor Control Systems, subclasses 842+ and 848+ for single motor acceleration control systems with, and without, feedback, respectively.

91 Accelerating motors in succession or selectively:

This subclass is indented under subclass 90. Subject matter in which means are provided for accelerating and/or deceleration of one or more electric motors and subsequently accelerating and/or decelerating one or more other electric motors; or in which means are provided for accelerating and/or decelerating two or more electric motors and with which means one or more of the motors can be accelerated and/or decelerated without accelerating one or more others of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

102, for plural motor systems having means for sequential or successive starting and/or stopping of two or more motors.

103, for plural motor systems having means for selectively starting and/or stopping one or more electric motors without starting and/or stopping one or more others of the motors.

92 Control of both armature (or primary) and field (or secondary) circuits:

This subclass is indented under subclass 90. Subject matter in which means are provided for controlling both the armature (or primary) circuits and the field or (secondary) circuits of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

79, and 82, for plural motor systems having combined armature (or primary) and field (or secondary) circuit control for running speed control of plural motors.

493, and the subclasses specified in the Search Notes thereto, for miscellaneous motor systems having combined armature (or primary) and field (or secondary) circuits control.

93 Series-parallel connected armature or primary circuits:

This subclass is indented under subclass 92. Subject matter in which means are provided for connecting the armature or primary circuits of two or more electric motors in series circuit relationship with respect to each other at one time and in parallel circuit relationship with respect to each other at another time; or for connecting two or more electric motors in parallel circuit relationship with respect to each other and simultaneously two or more motors in series circuit relationship with respect to each other.

(1) Note. One of more of the motors in the parallel connected group referred to in the latter part of the above definition may constitute one or more of the motors in the series connected group. For example, a single motor may be connected in series with a group of three motors which three motors are all connected in parallel relationship with respect to one another.

SEE OR SEARCH THIS CLASS, SUBCLASS:

95, for plural motor systems having means for connecting the motor armatures in series-parallel connections for acceleration and/or deceleration control.

111, and the subclasses listed under the Search Notes thereto, for other plural motor systems having series-parallel arrangements of the plural motors.

497, and the subclasses specified in the Search Notes thereto, for single motor systems having series-parallel connections of two or more armature or primary windings.

94 Armature or primary circuit control:

This subclass is indented under subclass 90. Subject matter in which means are provided for controlling the armature or primary circuits of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

82+, and the subclasses specified in the Notes to the definition of the subclass, for armature or primary circuit control of plural motors during the running speed operation thereof.

92, for this subject matter where the system has armature circuit control combined with field circuit control for acceleration and/or deceleration control.

104, for plural motor systems having armature or primary circuit control of the motors during starting and/or stopping of the motor.

494, and the subclasses specified in the search notes thereto, for single motor systems having armature or primary circuit control of single motors.

95 Series-parallel connections:

This subclass is indented under subclass 94. Subject matter in which means are provided for connecting the armature or primary circuits of two or more electric motors in series circuit relationship with respect to each other at one time and in parallel circuit relationship with respect to each other at another time; or for connecting the armature or primary circuits of two or more electric motors in series circuit relationship with respect to one another and simultaneously connecting the armature or primary circuits of two or more motors in parallel circuit relationship with respect to one another.

(1) Note. One or more of the motors in the parallel connected group, referred to in the latter part of the above definition, may constitute one or more of the motors in the series connected group. For example, a single motor may be connected in series with a group of three motors which three motors are all connected in parallel relationship with respect to one another.

SEE OR SEARCH THIS CLASS, SUBCLASS:

93, for this subject matter where means are provided for series parallel connection of the motor armatures combined with motor field control.

111, and the subclasses listed under the Search Notes in the definition of that subclass, for plural motor systems having series parallel arrangements of the motors.

495, and the subclasses specified in the Notes to the definition of that subclass for miscellaneous motor systems having series parallel armature connecting means.

96 With armature circuit impedance:
This subclass is indented under subclass 95. Subject matter in which means are provided for providing impedance in the armature or primary circuits of the motors.

(1) Note. See Impedance or Impedance Device of the class definition for a definition of "impedance".

97 Field or secondary circuit control:
This subclass is indented under subclass 90. Subject matter in which means are provided for controlling the field or secondary circuits of the electric motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

84, and the subclasses specified in the Notes to the definition of that subclass for plural motor systems having field circuit control for controlling the running speed of the motors.
100, for plural motor systems having field control for load control of the motors.
521, and the subclasses specified in the Search Notes thereto, for miscellaneous motor systems having field or secondary circuit control.

98 Load control:
This subclass is indented under subclass 34. Subject matter in which means are provided for controlling the magnitude of the load which is driven or actuated by the motors, or for otherwise controlling the magnitude or amount of work done by the motors; or for controlling the division of load or current between the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

5, and 8, for plural motor systems having plural motors employed to drive particular load devices, the system including motor load control means particularly in subclass 8 where plural motors drive an ultimate load device through a differential gearing whereby a predetermined ratio of load may be effected on the motors.
7, for plural motor systems where the relative torque on the motors may be controlled to effect a predetermined tension in a material driven or conveyed by the motors.
39, for plural motor systems of the work-and-feed-motor combination type where control of feed-motor may affect load on the work-motor.
41, for plural motor systems where the motors have electrical synchronizing interconnections in which the interconnection may affect the relative loads on the several motors.
45+, for plural motor systems where the armature or work output members of the motors are mechanically interconnected.
52, for plural motor systems having racing or slipping control which may affect the load on or between the several motors.
68+, for plural motor systems having the relative speed control between motors which may affect the load on or between the motors.
88, for plural motor systems having control of the load or current division between several motors during dynamic braking of motors.
101, for mere starting and/or stopping of the motors,
430+, for single motor systems having motor load control during the starting or stopping.
432, for single motor systems having means for maintaining a substantially constant load upon the motor.
434, for single motor systems having means for maintaining the load upon the motor from exceeding predetermined limits or going below a predetermined limit.
474, for single motor systems having automatic control of the motor in response to load conditions.

99 Fixed ratio of load or current division:
This subclass is indented under subclass 98. Subject matter in which means are provided for controlling the division of load current so that

the ratio of division is or can be maintained at some fixed or predetermined ratio.

(1) Note. The means may be adjustable so that the ratio can be varied from one fixed or predetermined value to another.

SEE OR SEARCH THIS CLASS, SUBCLASS:
88, for plural motor systems having load or current division between motors when acting as generators during dynamic braking.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclass 32 for systems for proportioning the electrical energy supply to a plurality of load circuits and subclass 53 for systems of load division among a plurality of generators or sources.

100 By field or secondary circuit control:
This subclass is indented under subclass 99. Subject matter in which means are provided for controlling the field or secondary circuits of the electric motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:
521+, and the subclasses specified in the Search Notes thereto, for miscellaneous motor circuits having field circuit control means.

101 Starting and/or stopping:
This subclass is indented under subclass 34. Subject matter in which means are provided for starting and/or stopping one or more of a group of two or more electric motors.

(1) Note. This subclass is a residual subclass for patents relating primarily to starting and/or stopping of electric motors. Starting and/or stopping of electric motors is an incident of, or is combined with many other motor operations controls. For example, when accelerating a motor from rest to its normal running speed the motor is started as a necessary incident; likewise in decelerating, or braking to a condition of inaction, a motor is stopped. Also in reversing, a motor is usually stopped and started in the reverse direction.

SEE OR SEARCH THIS CLASS, SUBCLASS:
18+, for follow-up systems of electric motor control wherein the motor is started as a result of the movement of the transmitter and stopped as a result of the stoppage of the transmitter.
53, for plural motor systems having automatic starting and/or stopping of plural motors in combination with other motor operations control.
90+, for plural motor systems having starting and/or stopping as a part of the acceleration and/or deceleration control of plural electric motors.

SEE OR SEARCH CLASS:
192, Clutches and Power-Stop Control, subclasses 116.5+ for means for terminating the transmission of power to various driven devices.

102 Sequential or successive starting and/or stopping:
This subclass is indented under subclass 101. Subject matter in which means are provided for starting or stopping two or more electric motors one after another.

SEE OR SEARCH THIS CLASS, SUBCLASS:
91, for plural motor systems having means for selectively accelerating and/or decelerating two or more motors one after another.

103 Selective starting and/or stopping:
This subclass is indented under subclass 101. Subject matter in which means are provided for starting or stopping one or more electric motors without starting and/or stopping one or more other electric motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:
91, for plural motor systems having means for accelerating and/or decelerating plural motors, the system being arranged so that one or more motors can be accelerated and/or decelerated

without accelerating and/or decelerating another motor.

104 Armature (or primary) circuit control:
This subclass is indented under subclass 101. Subject matter in which means are provided in the armature (or primary) circuit for starting and/or stopping the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:
494, particularly 519+, for single motor systems having starting and/or stopping control by means of armature circuit control.

105 Plural, diverse or diversely controlled sources of armature (or primary) supply:
This subclass is indented under subclass 34. Subject matter in which two or more sources of electrical supply are provided to supply energy to the armature or primary circuits of the motors, one or more of which sources of supply are different in kind, type, degree or magnitude or are differently controlled, with respect to one or more others of the sources.

SEE OR SEARCH THIS CLASS, SUBCLASS:
440+, and the subclasses specified in the Notes to the definition of that subclass for other systems which comprise plural sources of supply for the armature circuits of motors.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclasses 18+ for systems including a plurality of sources of supply for a plurality of loads, and subclasses 43+ for systems having a plurality of supply circuits or sources.
322, Electricity: Single Generator Systems, subclasses 86+ for generators having a field circuit energized from plural sources of supply.

106 Diverse sources:
This subclass is indented under subclass 105. Subject matter in which one or more of the sources are substantially different in respect to (1) structure of the sources or (2) the nature or magnitude of an electrical characteristic of the sources, than one or more others of the sources.

(1) Note. For example, an internal combustion engine driven dynamo and an electric converter, or a secondary battery and a thermocouple are examples of diverse or unlike sources by virtue of their different structures; while two sources may differ from one another in their nature in that one may be AC and the other DC, or in the magnitude of electrical characteristics such as having different voltages or different frequencies, or different capacities.

107 A.C. and D.C.:
This subclass is indented under subclass 106. Subject matter in which the sources comprise one or more AC sources and one or more DC sources.

(1) Note. A “pulsating” source is a DC source for purposes of this class. Where, however, a DC source and an AC source are connected to a circuit to produce a pulsating current or voltage in the circuit, classification will be on the basis of plural Sources.

SEE OR SEARCH THIS CLASS, SUBCLASS:
441, for motor systems having the combination of AC and DC sources for a single motor.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclasses 72+ for systems having a plurality of supply circuits or sources having unlike electrical characteristics.

108 Different voltages:
This subclass is indented under subclass 107. Subject matter in which one or more of the sources of supply, supply electric energy at one voltage magnitude and one or more others of the sources supply energy at another magnitude of voltage.

(1) Note. Two voltages are of different magnitudes if, at any time during normal operation, one of them has a magnitude

substantially different in effective value than the other. Hence, if the magnitude of one of the sources is varied relative to the magnitude of the other so as not to be the same, the two sources are considered to be of different voltages.

SEE OR SEARCH THIS CLASS, SUBCLASS:

109, for plural motor systems having similar types of sources (e.g., all ac sources or all DC. sources) for the motors in which one or more of the sources differ in voltage magnitude from one or more others of the sources.

442, for motor systems having plural sources of supply for a single motor in which the voltages of the sources differ in magnitude from one another.

109 Different voltages:

This subclass is indented under subclass 106. Subject matter in which one or more of the sources differs in magnitude from one or more others of the sources.

(1) Note. Two voltages differ in magnitude when at any time one of them has a magnitude which differs in effective value from the magnitude of the other. Hence, if the magnitude of the voltage of one of the sources is varied relative to the magnitude of the voltage of another source, in order to make them different the two sources are considered to be of different magnitudes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

108, for this subject matter where one of the voltage sources is an ac source and another is a DC source.

442, and the subclasses specified in the Notes to that subclass for motor systems having plural sources of supply for single motor.

110 Different frequencies:

This subclass is indented under subclass 106. Subject matter in which one or more of the sources have a different frequency than one or more others of the sources.

SEE OR SEARCH THIS CLASS, SUBCLASS:

440, and the subclasses specified in the Notes thereto, for motor systems having plural sources of supply for a single motor which sources may differ in frequency.

111 Series-parallel connected motors:

This subclass is indented under subclass 34. Subject matter in which means are provided for connecting the armature or primary windings of one or more electric motors in series circuit relationship with the armature or primary windings of one or more other electric motors at one time and in parallel circuit relationship at another time; or for connecting the armature or primary windings of one or more electric motors in series circuit relationship with the armature or primary windings of one or more other electric motors, and simultaneously connecting the armature or primary circuit of one or more electric motors in parallel circuit relationship with the armature of primary circuit of one or more other electric motors.

(1) Note. In the simultaneous series parallel relationship set forth in the latter half of the above definition, one or more of the motors connected in the series circuit relationship may constitute one or more of the motors which are connected in the parallel relationship.

SEE OR SEARCH THIS CLASS, SUBCLASS:

83+, for this subject matter where the series parallel connection of armature of primary circuits of the motors is for running speed control.

84, and 97, for series parallel connections of field windings of plural motors for running speed control and acceleration control, respectively.

93, and 95+, for this subject matter where the series parallel connection of the armature or primary circuits is for acceleration control.

95, see subclass 93 above.

97, see subclass 84 above.

497, and the subclasses specific in the Notes thereto, for motor systems having series parallel connections of plu-

ral armature or primary windings of a single electric motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 37 for plural load circuit systems in which the load circuits may be connected either in a series or parallel relationship, and subclass 71 for systems of plural electrical sources in which the sources may be connected either in a series or parallel relationship.

315, Electric Lamp and Discharge Devices: Systems, subclass 192 and the Search Notes thereto for series parallel connected lamps and space discharge devices.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclasses for series or parallel connection of batteries in a system for charging or discharging a battery, especially subclasses 116+.

112 Parallel connected motors:

This subclass is indented under subclass 34. Subject matter in which means are provided for connecting the armature or primary circuits of one or more electric motors in parallel circuit relationship with the armature or primary circuits of one or more other electric motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

88, for this subject matter where the armature or primary circuits are connected in parallel for load or current division during braking.

98, for this subject matter where the armature or primary circuits are connected in parallel for load control.

111, for this subject matter where the armature circuits are connected in series at one time and in parallel at another, or where there are parallel connected armature circuits of plural motors and series connected armature circuits of plural motors.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 11+ for systems in which a plurality of loads or load circuits may be connected in parallel, and subclasses 43+ for systems in which a plurality of sources or supply circuits may be connected in parallel.

315, Electric Lamp and Discharge Devices: Systems, subclasses 312+ and the Search Notes thereto for parallel connected lamps and space discharge devices.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclasses for series or parallel connection of batteries in a system for charging or discharging a battery, especially subclasses 116+.

113 Series connected motors:

This subclass is indented under subclass 34. Subject matter in which means are provided for connecting the armature or primary circuits of one or more electric motors in series circuit relationship with the armature or primary circuits of one or more other electric motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

49+, for motor systems having plural motors electrically connected in cascade or in tandem (that is, where the electrical output of one constitutes the electrical input to another).

111, for plural motor systems in which the armature or primary circuits of a plurality of motors are connected both in series and in parallel.

SEE OR SEARCH CLASS:

315, Electric Lamp and Discharge Devices: Systems, subclasses 185+ and the Search Notes thereto, for plural series-connected-electric lamp and space discharge devices.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclasses for series or parallel connection of batteries in a system for charging or discharging a battery, especially subclasses 116+.

114 IMPACT, MECHANICAL SHOCK, OR VIBRATION-PRODUCING MOTORS:

This subclass is indented under the class definition. Subject matter in which (1) means are provided for actuating one or more parts of an electric motor relative to and into impact or percussive contact with one or more other parts which are either parts of the motor structure or are structurally combined with the motor (i.e., not merely other parts which constitute a device or work piece to be operated on by the motor and to which the motor may be attached or relatively positioned temporarily); or (2) the motor is a shock or vibration producing type of motor the prime or essential function of which motor is to transmit mechanical shock or vibrations to a mechanism or device upon which the motor may be supported or to which the motor may be clamped or otherwise secured.

(1) Note. A motor system having electric motor which is limited to having any useful output member other than that for producing impact shock or vibration as defined in parts (1) and (2) above, is not classified herein, but is classified in one of the other appropriate subclasses and cross-referenced to this subclass for the impact, shock or vibration producing feature.

(2) Note. The shock or vibration producing motor may be a rotary electric motor in which the rotary element is decidedly unbalanced dynamically so that upon rotation it will produce pronounced reactive forces to cause the motor frame to transmit forces to the support or body with which it may be in contact and, hence, cause shock or vibration in said support or body. For example, mere reciprocating or oscillating motors which may or may not produce impact by the movable motor element, depending on the proximity of the motor having the movable element to the work or device to be operated upon or to be actuated by the motor are not included herein but will be found in subclass 119.

SEE OR SEARCH THIS CLASS, SUBCLASS:

119, see Note 2 above.

SEE OR SEARCH CLASS:

81, Tools, subclasses 463+ and see Notes thereto.

173, Tool Driving or Impacting, subclass 117 for an impacting device having a hammer head driven by an electric motor.

115 MOTOR WITH DIVERSE MOTIONS (E.G., ROTARY AND RECIPROCATING):

This subclass is indented under the class definition. Subject matter in which means are provided for giving the working or output member of the motor two or more types of motion either simultaneously or not.

(1) Note. For example only, an electric motor which is adapted to rotate and simultaneously reciprocate is included herein. Likewise, a motor designed to rotate while DC is applied to its terminals and reciprocate when pulsating or AC is applied to its terminals is classified herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

35, for plural motors systems in which one or more motors has one type of motion another motor has a different type of motion.

116 NONMAGNETIC MOTOR:

This subclass is indented under the class definition. Subject matter which the electric motor converts electric to mechanical energy by means other than magnetic induction.

(1) Note. Examples of nonmagnetic motors are piezoelectric crystals, thermal-electric motors, electrostatic motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

36, for this subject matter where the system includes a plurality of non-magnetic motors.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclasses 300+ for nondynamoelectric motors, per se.

117 Thermoelectric motor:
This subclass is indented under subclass 116. Subject matter in which the motor comprises a member which undergoes substantial changes in shape, position and/or dimensions when heated, and means for electrical heating, the member.

(1) Note. When electric current is conducted through the above mentioned member thereby causing the member to become heated, separate heating means are not necessary.

SEE OR SEARCH CLASS:
60, Power Plants, subclass 523 for a motor in which a confined unit of mass of gas is heated electrically to produce expansion; subclass 528 for a motor operated by the expansion of a solid mass heated by its resistance to flow of an electrical current; and subclass 513 for a motor operated by the expansion of fluid in an expansible chamber containing an electric heating means.
310, Electrical Generator or Motor Structure, subclass 306 for thermal or pyromagnetic electric motors.

118 MAGNETOSTRICTIVE MOTOR:
This subclass is indented under the class definition. Subject matter in which the motor is of the magneto-striction type.

(1) Note. See the class definition for a definition of a magneto-strictive motor. Commonly, the magnetizable member is (1) restrained from moving at a point along a dimension thereof but is free to move at other points along and in the direction of such dimension, and is (2) combined with a solenoid or winding which surrounds the magnetizable member and the axis of which winding is concentric or parallel with such dimension; as a result of which the magnetizable member will change in dimension when, the magnetic field is changed the mechanical motion of the member being available for power output purposes.

SEE OR SEARCH THIS CLASS, SUBCLASS:
119, for other motor systems having magnetic motors of the reciprocating or oscillating type.

SEE OR SEARCH CLASS:
310, Electrical Generator or Motor Structure, subclass 300 for magneto-strictive motors, per se.
335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclass 215 for magnetostrictive magnets, per se.

119 RECIPROCATING OR OSCILLATING MOTOR:
This subclass is indented under the class definition. Subject matter in which the motor is a reciprocating or oscillating type of electric motor.

(1) Note. See the class definition for a definition of reciprocating or oscillating type motor.

(2) Note. Either of the terms “reciprocating” or “oscillating” when used separately in the titles and definitions in this class will be construed to include the other, unless clearly indicated otherwise.

(3) Note. For motor systems having the conventional rotary electric motor constructed for unlimited degree of movement in a given direction combined with means for periodically reversing the motor (e.g., reversed (1) in response to a “limit of travel” in either direction of rotation, (2) under control of some time-measuring mechanism, (3) after a predetermined number of revolutions, (4) etc.), see appropriate subclasses hereinafter under “Reversing, periodic or repetitious”, subclass 281. Where the “motor” has means for actuating in one direction only (including arrangements whereby electric means or gravity and electric means can effect actuation in the one direction only) and consequently, the return movement must be effected manually or by some nonmotor means; classification is not herein. For example, a

motor system having a motor having a vertically disposed and freely movable element and electrical means for effecting an upward motion only and wherein gravity can effect the return or downward motion; classification is herein. However, where the movable member of the motor is horizontally disposed and no energy storing means, such as a spring or compressible gas chamber, is provided to return the member after actuated by electric means (which are effective in one direction only), classification is not herein, but is classified as "linear motor" system or as an electromagnet with armature.

SEE OR SEARCH THIS CLASS, SUBCLASS:

14, for reciprocating or oscillating motors combined with motion-converting mechanisms. (For example, the combination of a reciprocating electric motor supply and/or control system combined with means for converting the reciprocatory motion of the motor to a rotary motion will be found in subclass 14).

21, for this subject matter where the motor system is a follow-up system having a reciprocating or oscillating motor.

35, for this subject matter where the motor system has the combination of an oscillating or reciprocating motor and another motor having a different type of motor (e.g., combination of a reciprocating and a rotary motor).

37, for this subject matter where the system includes a plurality of reciprocating or oscillating motors.

116+, for this subject matter where the motor is a magneto-striction type of motor in which periodic magnetization of the core part effects periodic dimensional changes in the core part thus resulting in reciprocating motion of the core part.

135, for motor systems having a linear-movement motor.

159+, for motor system which has the rotor element biased against rotation by virtue of which the rotor element is returned when the motor is deenergized or the energization is reduced. 281+, see (3) Note above.

SEE OR SEARCH CLASS:

91, Motors: Expansible Chamber Type, appropriate subclasses for reciprocating and oscillating type expansible chamber motors.

123, Internal-Combustion Engines, subclasses 1 through 3 and 18+ and 198+ for internal combustion engines of the reciprocating type.

310, Electrical Generator or Motor Structure, subclass 15 for reciprocating electric motor structure, per se, and subclass 36 for oscillating electric motor structure, per se.

322, Electricity: Single Generator Systems, subclass 3 for reciprocating and/or oscillating generator systems.

335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclass 220 for electromagnets with armatures.

416, Fluid Reaction Surfaces (i.e., Impellers), subclass 64 for impellers of the reciprocating type and subclass 79 for impellers of the oscillating type.

120 Stopping after predetermined number of reciprocations or cycles (including single cycle):

This subclass is indented under subclass 119. Subject matter in which means are provided for stopping the motor after it has made a predetermined number of reciprocations or cycles.

(1) Note. For example, a reciprocating motor which when started operates to make one reciprocation, stroke or cycle and stops, is classified herein.

(2) Note. Where the stopping is effected by mechanical stopping means, such as brake, stop means, classification is not in this class but in some other appropriate class. Note Class 192, subclasses 116.5+.

SEE OR SEARCH THIS CLASS, SUBCLASS:

463, and the subclasses specified in the Notes thereto, for motor systems having automatic stopping of rotary

motors after a predetermined degree of movement of the motor.

SEE OR SEARCH CLASS:
192, Clutches and Power-Stop Control, subclass 116, see (2) Note above.

121 Having means to produce a progressing or traveling motor field flux:
This subclass is indented under subclass 119. Subject matter in which means are provided for producing a magnetic field of force in the motor, which field (or the resultant of the component elements thereof) is caused to occupy a succession of positions in the path or direction of travel of the reciprocable member of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
135, for motor systems having linear-movement motors with means for producing progressing or travelling field.
148, for induction and synchronous motors supplied by controlled generators.
195+, for motor systems having an induction motor with means for producing a travelling magnetic field.
700+, for motor systems having a synchronous motor with means for producing a travelling magnetic field.

122 Plural, diverse or diversely controlled motor windings:
This subclass is indented under subclass 119. Subject matter in which the motor is provided with two or more energizing windings one or more of which are different structurally, or energized or controlled differently than one or more others of the windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:
121, for this subject matter where the system includes two or more windings for producing a travelling or progressive magnetic motor field flux.
495, and the subclasses listed in the Search Notes thereto, for other motor control systems in which the motor has two or more energizing windings.

123 Polyphase or diverse or diversely controlled sources of motor supply:
This subclass is indented under subclass 122. Subject matter in which there is either a polyphase alternating current supply, or two or more sources of supply, one or more of which are different or differently controlled than one or more others of the sources, connected to supply energy to the two or more of the motor windings.

(1) Note. All the phases or sources of supply may be connected to each of the several windings, or one or more of the sources or phases may be connected to one or more of the windings and one or more others of the sources or phases may be connected to one or more others of the windings. The several sources or phases may be connected simultaneously or at different times.

SEE OR SEARCH THIS CLASS, SUBCLASS:
495+, and the Search Notes thereto, for plural motor systems having winding motors with plural sources therefor.
500, and the Search Notes thereto, for motor systems having plural sources of supply for a single motor having a single armature or primary winding.

124 A.C. and D.C. sources:
This subclass is indented under subclass 123. Subject matter in which at least one of the sources is a unidirectional current source (including pulsating DC current) and at least one other of the sources is an alternating (i.e., reversing polarity) current source.

SEE OR SEARCH THIS CLASS, SUBCLASS:
441, and the subclasses listed in the Search Notes thereto, for other motor systems having AC, and DC sources of supply for the motor.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclass 22 for plural load circuit systems supplied either from an AC of DC source, and subclasses 43+ for systems having a plu-

rality of supply circuits or sources which may be AC or DC.

125 Unidirectionally conductive devices in energizing circuit:

This subclass is indented under subclass 122. Subject matter in which one or more unidirectionally conductive devices are connected in the energizing circuit of one or more of the windings.

(1) Note. Systems where the unidirectionally conductive devices are connected in series with or in shunt to the windings are included.

SEE OR SEARCH THIS CLASS, SUBCLASS:

505, and the Search Notes thereto for other motor systems having space-discharge devices in the circuits thereof.

SEE OR SEARCH CLASS:

363, Electric Power Conversion Systems, subclasses 111 and 125+ for rectifying systems including unidirectionally conductive devices.

126 Energizing winding circuit control:

This subclass is indented under subclass 119. Subject matter in which means are provided for controlling the electric circuit which supplies the electric energy to the energizing winding of the motor.

(1) Note. The control of the electric circuit includes (1) control of the immediate circuit to the windings (as, for example, opening and closing the circuit, controlling a space-discharge device or an impedance connected in series with the circuit and the motor winding, or introducing an aiding or opposing source of e.m.f. in the circuit in addition to the main or prime source of e.m.f.) and also (2) control of the source of energy which supplies the energizing current to the motor (as, for example, controlling the energy input to the source, as by controlling a prime mover which drives a generator, or by controlling the electrical input to an electrical converter).

SEE OR SEARCH THIS CLASS, SUBCLASS:

140, for generator fed motor systems wherein the motor is controlled by controlling the generator.

494, and the subclasses specified in the Notes thereto, for other motor control systems wherein the armature or primary circuit thereto is provided with control means.

521, and the subclasses specified in the Notes thereto, for other motor control systems where in the field or secondary circuit thereto is provided with control means.

127 Automatic in response to predetermined position, movement or condition in or of the motor or driven device:

This subclass is indented under subclass 126. Subject matter wherein automatic means are provided so that the energizing winding is controlled in response to the position, movement, limit of travel, amplitude or rate of change of movement of the motor or the device actuated thereby; or in response to the noise, sound or mechanical vibrations produced by the motor parts or by the motor actuated device; magnitude of energizing current or occurrences of pulses in the energizing circuit.

(1) Note. This is a limited automatic subclass and does not include sensing means responsive to any but the above specified conditions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445+, and the subclasses specified in the Notes thereto, for other motor systems having automatic control responsive to predetermined conditions in general.

128 Noise, sound, vibration, movement or position of motor:

This subclass is indented under subclass 127. Subject matter in which the sensing means responds to noise, sound, or mechanical vibrations of or emanating from the motor being controlled or the device actuated by the motor, or responds to the amplitude or magnitude or the rate of movement of, or the limit-of-travel

or other position of the motor being controlled or the device actuated by the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

For other motor systems having automatic control in response to the particular conditions enumerated in the definition above, search the following subclasses and the pertinent subclasses listed in the Search Notes thereto.

452, for plural diverse conditions.

456, for rate-of-change of a condition.

460, for noise, sound, or mechanical vibrations.

461, for speed or rate of movement of motor or other body.

466, for movement, position, or limit-of-travel of motor or other device or body.

129 By means for producing periodic electrical pulses in the energizing circuit:

This subclass is indented under subclass 126. Subject matter in which means are provided for producing a succession of electrical pulses in the energizing circuit of the winding, the periodicity of the pulses being such that the motor to which the pulses are supplied is maintained in substantially continuous motion by the succession of pulses.

(1) Note. A mere means for producing electric pulses (i.e., there being no details of structure of the means or any details of relationship between the means and the motor to which the pulses are supplied--other than the mere connection thereto) is insufficient basis for classification herein. For example, recitation by name only of the means for producing periodic pulses such as “an a-c source”, a “source of pulsations”, an “oscillator”, etc., does not constitute a means for producing periodic pulses which is classifiable herein.

(2) Note. Where the means for producing the pulses may or may not produce the succession of pulses, classification is not herein. For example, a manually operated circuit interrupter in the supply circuit to the motor may be operated to produce a single pulse or a succession of pulses depending on the will of the operator and is not classifiable herein. Likewise, a circuit interrupter which closes the circuit in response to a condition (such as temperature or pressure) which condition may sometimes vary to cause the circuit to be periodically interrupted, is not classified herein. However, in the latter case, if the condition response means causes electrical pulses from a source of pulsating current to be supplied to the winding, such a system would be classified herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

122+, for systems under subclass 119 which include means for periodically energizing one or more windings of a plural winding motor.

127+, for this subject matter where the system includes means responsive to predetermined conditions in or of the motor for controlling the motor, including controlling the application or the periodicity of pulses to the motor.

503, and the subclasses listed in the Search Notes thereto, for other motor control systems in which periodic pulses are supplied to the motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 96+ for circuit interrupting systems for regulating the average value of current flowing through an electrical circuit, and subclass 132 for intermittent circuit interruption systems, such as “flashing systems”, of general application.

322, Electricity: Single Generator Systems, subclasses 69+ for systems wherein a generator field circuit is interrupted to regulate the field current.

130 Electrical oscillation or condenser charging and/or discharging circuits:

This subclass is indented under subclass 129. Subject matter in which the means for producing the periodic pulses comprise either an elec-

trical self-oscillating circuit or a condenser changing and/or discharging circuit.

(1) Note. Where the condenser changing and/or discharging is merely an adjunct to the system of supply such as a filter means, for example; and does not operate to have a substantial effect in determining the rate which the pulses are supplied to the motor, classification is not herein.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 108 for systems wherein a condenser is charged and discharged to produce a series of pulses.

320, Electricity: Battery or Capacitor Charging or Discharging, subclasses 166+ for a system for charging or discharging a capacitor.

331, Oscillators, appropriate subclasses, for self-sustained electric wave generators, per se, particularly subclasses 111+, 129+ and 143+ for relaxation oscillators utilizing an RC time constant network to determine the period of oscillation.

131 Motor or escapement-controlled means:
This subclass is indented under subclass 129. Subject matter in which the means for producing the periodic pulses includes a device of means which is actuated or controlled by a motor, or escapement device to control the periodicity of the pulses.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 1.5 for escapements, per se, of general application.

185, Motors: Spring, Weight, or Animal Powered, subclasses 5, 31, and 38 for escapement controlled spring and weight motors.

132 By space-discharge or unidirectionally conductive devices in energizing circuit:
This subclass is indented under subclass 126. Subject matter in which the means for controlling the energizing circuit of the motor includes a space-discharge device or an unidirectionally-conductive device connected in series with or in shunt to the energizing winding of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

125, for this subject matter where the motor has plural windings.

505, and the subclasses specified in the search notes thereto, for other motor control systems having space-discharge devices in the armature or primary circuit of the motor.

SEE OR SEARCH CLASS:

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 518+ for miscellaneous electron discharge device control circuits.

363, Electric Power Conversion Systems, subclasses 111 and 125+ for rectifying systems including space discharge devices and other unidirectionally conductive devices.

133 By impedance devices in energizing circuit:
This subclass is indented under subclass 126. Subject matter in which the control means comprises one or more impedance devices in series and/or in shunt to the motor windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:

132, for this subject matter where the impedance device is a space-discharge or unidirectionally conductive device.

508+, and subclasses specified in the search notes appended thereto, for other motor control systems wherein impedance devices are employed in the energizing circuit of an electric motor.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 364 through 370 for miscellaneous impedance systems.

134 By circuit making and/or braking devices:
This subclass is indented under subclass 126. Subject matter in which the control means comprise circuit making and/or breaking

devices in series with the energizing circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

129+, for this subject matter where the system includes circuit making and/or breaking devices combined with means for periodically actuating them.

519+, and the subclasses specified in the search notes appended thereto, for other motor control systems having circuit making and/or breaking means in the armature or primary circuit of the motor.

SEE OR SEARCH CLASS:

307, Electric Transmission or Interconnection Systems, subclasses 112+ for searching systems.

361, Electricity: Electrical Systems and Devices, subclasses 1+ for safety systems using circuit breakers, and subclass 139+ for relay and electromagnetic switch circuits.

135 LINEAR-MOVEMENT MOTORS:

This subclass is indented under the class definition. Subject matter in which the motor is linear movement type of electric motor.

(1) Note. See Linear Movement Motors, of the class definition for a definition of a linear movement motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

22, for linear-movement motors in follow-up systems.

35, for linear-movement motor combined with another electric motor having a different type (e.g., rotary) of movement.

38, for plural linear-movement motor systems.

115, for motor systems which have single motors having diverse types of motion, including linear movement.

119, for reciprocating or oscillating type motor systems.

SEE OR SEARCH CLASS:

104, Railways, subclasses 282 and 290+ for a railway vehicle and track claimed in combination with a linear propulsion motor and control system therefor.

124, Mechanical Guns and Projectors, subclass 3 for electromagnetic guns and projectors.

310, Electrical Generator or Motor Structure, subclasses 12.01 through 12.33 for a linear motor, per se.

136 AUXILIARY MEANS FOR PRODUCING MECHANICAL STARTING OR ACCELERATING TORQUE:

This subclass is indented under the class definition. Subject matter in which means, other than the motor being controlled and its electrical circuits, are provided for producing a mechanical turning effort to the rotor element of the motor during the starting and/or the accelerating period of operation of the motor, and which means is deenergized, disconnected, or otherwise incapacitated to assist in actuating the motor under running-speed conditions.

(1) Note. This subclass is designed to include those devices which are employed to start an electric motor which is inherently not-self-starting and also to include those which assist the motor in attaining running speed conditions in order to reduce the heavy demand of electric current required to bring a motor up to running speed when operating without starting assistance. The device must be distinct from the motor and produce a turning effort independently of the magnetic turning effort produced by the motor itself. The device can be structurally united with motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

1+, for motor systems which have an electric motor combined with a nonmotor driving means.

45+, for electric motor systems having plural motor mechanically connected or coupled in a fixed predetermined ratio of movement during normal running periods.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclasses 6+ for mechanical devices, per se, for starting engines in general.

91, Motors: Expansible Chamber Type, subclass 53 for expansible chamber motors of the engine rotating or starting type.

123, Internal-Combustion Engines, subclasses 179.1+, for starting devices for internal combustion engines.

290, Prime-Mover Dynamo Plants, subclasses 10+, 18+, 22+, 27, 28, 30, 31+, 36+, 38, 46, 47, and 48 for dynamo-electric machines used as starting motors for prime-mover dynamo plants.

137 By auxiliary motor:

This subclass is indented under subclass 136. Subject matter in which the auxiliary means comprises a motor.

(1) Note. See Search Notes for subclass 136 above.

139 BATTERY-FED MOTOR SYSTEMS:

This subclass is indented under the class definition. Subject matter in which the armature or primary circuit of an electric motor is supplied by electric energy from one or more primary or secondary electric batteries which constitute the only source of supply for the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

440+, for motor systems where there are plural sources of electric energy for the armature or primary circuit which include nonbattery sources.

SEE OR SEARCH CLASS:

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclass for charging or discharging a battery.

140 GENERATOR-FED MOTOR SYSTEMS HAVING GENERATOR CONTROL:

This subclass is indented under the class definition. Subject matter in which an electric generator is provided for supplying electric energy to the armature or primary circuit of an electric motor and in which means are also provided for controlling the generator to thereby control the operation of the electric motor.

(1) Note. An “electric generator” includes any means for converting nonelectrical energy into electrical energy. Thus it includes photo-electric and thermoelectric generators, primary or secondary batteries, etc.

(2) Note. Where more than one generator is provided to supply the energy, means must be provided for controlling each generator. See subclasses 440+ where no means are provided for controlling one of the generators.

(3) Note. Where the only generator control means comprises means connected in the circuit between the generator terminals and the motor terminals, classification is not in this or its indented subclasses but in some other appropriate subclass in the class.

(4) Note. Mere inherent regulation of the generator (i.e., regulation of the output of the generator resulting merely from structural features of the generator) is not sufficient basis for classification herein except in those instances where the regulation functions to substantially vary the operation of the motor. Thus a flat-compounded generator operates to produce a substantially constant output voltage with varying load and, hence, performs or produces no regulating function on the motor other than would any constant voltage source. Likewise, the proportion of parts and airgaps, degree of excitation, resistance of the several conductive elements of the generator, etc., are instrumental in determining the operating characteristics of the generator and generally tend toward generator operating characteristics which have no particular effect on the operation of the motor supplied thereby other than to supply a source of energy, the voltage variation of which is not substantially disadvantageous. However, a series-generator, or a decidedly over-compounded or a decidedly under-compounded gener-

ator, or one with a differentially wound series field exciting winding may have operating characteristics which very materially varies the operation of the motor with changes in motor load. This type of regulation is considered sufficient basis for classification herein. Any control or regulating means for maintaining constant current or power output from the generator with a varying motor load, by generator control, is sufficient basis for classification herein.

(5) Note. Means for "controlling the generator" include means for varying the speed of the generator by controlling the driving means therefor, or for adjusting the structure of the generator.

(6) Note. Means for controlling excitation of AC generator (supplying energy to primary circuit of synchronous motor) in response to motor primary circuit current to control pullout torque or to "stiffen the coupling between the generator and motor" is included herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

139, for this subject matter for motor systems having electric batteries for supplying electric energy to the motor.

440, see Note 2 above.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, for generator control of general application. The appropriate subclass or subclasses would depend on the particular generator control involved.

141 Automatic generator control and/or with time-delay means:

This subclass is indented under subclass 140. Subject matter in which means are provided for automatically controlling the generator in response to a predetermined condition, or in which time-delay means are provided for retarding or delaying the operation of the generator control means, whether initiated manually or otherwise.

(1) Note. The condition need not be one that exists in, about or pertaining to the motor or generator of the system.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445+, and the subclasses specified in the Notes thereto, for other automatic control systems for electric motors, and for other motor control systems which include a time-delay means for the control.

SEE OR SEARCH CLASS:

290, Prime-Mover Dynamo Plants, subclasses 1 through 44 for prime-mover generator plants in which the generator may be automatically controlled in response to some predetermined condition.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclass for a battery charging system supplied by a generator source.

322, Electricity: Single Generator Systems, subclasses 17+ for automatic control of generators in general.

142 Responsive to diverse conditions or with time-delay means:

This subclass is indented under subclass 141. Subject matter in which means are provided for automatically controlling the generator in response to two or more diverse conditions, or for automatically controlling the generator in response to one condition and with means for introducing a time-delay in the operation of the generator control.

(1) Note. Included in this subclass are systems in which the only time delay means operates to delay the operation of the means responsive to the condition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

452+, and the classes specified in the Search Notes thereto, for other motor control systems having the motor controlled in response to plural conditions.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 18 for automatic generator control with time delay; subclasses 22+ for automatic generator control in response to plural conditions.

143 Plural electrical conditions:

This subclass is indented under subclass 142. Subject matter in which two or more of the conditions comprise electrical conditions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

454+, and the subclasses specified in the Search Notes thereto, for other motor control systems having the motor controlled in response to plural electrical conditions.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclasses 24+ for automatic generator control in response to plural electrical conditions.

144 Armature or primary current of motor:

This subclass is indented under subclass 141. Subject matter in which means are provided for controlling the generator in response to the magnitude or rate of change of magnitude of the current in the armature or primary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

458, and the subclasses specified in the Notes thereto, for other motor control systems which are responsive to the rate of change of an electrical condition.

474+, and the subclasses specified in the Notes thereto, for other motor control systems which are responsive to the current in the armature or primary circuit of the motor.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 27 for automatic generator control in response to generator armature current.

145 Terminal voltage or counter e.m.f. of motor:

This subclass is indented under subclass 141. Subject matter in which means are provided for controlling the generator in response to the magnitude or the rate of change of magnitude of the terminal voltage or the counter electromotive force of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

458, and the subclasses specified in the Notes thereto, for other motor control systems which are responsive to the rate-of-change of an electrical condition.

459, and the subclasses specified in the Notes thereto, for other motor control systems which are responsive to the terminal or counter electromotive force of the motor.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 19 for generator control systems responsive to rate-of-change of an electrical condition; subclass 29 for automatic generator control in response to generator voltage.

146 Speed of motor or driven device:

This subclass is indented under subclass 141. Subject matter in which means are provided for controlling the generator in response to the speed of the motor or a device driven thereby.

SEE OR SEARCH THIS CLASS, SUBCLASS:

145, for this subject matter where the generator control is responsive to the terminal voltage or c.e.m.f. of the motor, which may vary with the speed of the motor.

461, and the subclasses specified in the Notes thereto, for other motor control systems which are responsive to the speed of the motor or of other devices.

147 Speed or frequency of generator or its drive means:

This subclass is indented under subclass 141. Subject matter in which means are provided for controlling the generator in response to the speed of the generator or the frequency of the

voltage or current generated thereby, or in response to the speed of the generator driving means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

145, for motor control systems which are responsive to the terminal voltage or the c.e.m.f. of the motor which may correspond with the armature circuit voltage of the generator and hence to the speed of the generator.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclasses 29+ for automatic generator control in response to the speed or frequency of the generator.

148 Alternating-current-motor system:

This subclass is indented under subclass 140. Subject matter in which the motor is an alternating current motor (i.e., a motor which operates when the armature or primary circuit is supplied with alternating current) and in which the generator supplies an alternating current to the armature or primary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

244, for other alternating current commutating motor systems.

700+, for other synchronous motor systems. 725+ for other repulsion motor systems. 727+ for other induction motor systems.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 159 for structural details of alternating current motors, per se.

322, Electricity: Single Generator Systems, appropriate subclasses for alternating current generator control systems. In Class 322 classification is not determined by whether the generator output is AC or DC and the appropriate subclass would depend on the particular control or response of the generator.

149 With plural, diverse or diversely controlled generators:

This subclass is indented under subclass 140. Subject matter in which there are two or more generators which supply the armature or primary circuits of the electric motor, in which one or more of the generators are structurally different or are controlled differently (e.g., with respect to time, degree or magnitude, etc.) than one or more others of the generators, and in which means are provided for controlling a plurality of generators.

SEE OR SEARCH THIS CLASS, SUBCLASS:

440+, and the subclasses specified in the Notes thereto; for motor systems having plural sources of supply for the armature or primary circuit of electric motors.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 72+ for plural generators or sources, having unlike electrical characteristics, which supply a common load circuit.

150 With flywheel on generator or on motor:

This subclass is indented under subclass 140. Subject matter in which a flywheel or other massive body is mounted for rotation with the rotor of either the generator or the motor.

(1) Note. Where the rotor, per se, of the generator or of the motor is specifically limited to being massive, classification is herein. Also where the flywheel or other massive body is mounted other than directly on the shaft of the rotor of the generator or motor but is mechanically connected in driving relation to the rotor, classification is herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

161, and the subclasses specified in the Notes thereto, for other motor systems wherein the motor has a flywheel or other massive rotary member.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 572.1 for energy storage-type flywheels.

322, Electricity: Single Generator Systems, subclass 4 for generator systems where the generator is provided with flywheels or massive moving parts.

151 Control of both the generator and the circuit to the motor:

This subclass is indented under subclass 140. Subject matter in which means are provided for controlling the electric circuit which extends from the generator armature to the motor armature and additional means are provided for controlling the generator.

SEE OR SEARCH THIS CLASS, SUBCLASS:

139, for this subject matter where the system is a battery-fed motor systems having control of the battery and the circuit therefrom to the motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, appropriate subclasses for control of electrical transmission lines either with or without control of the supply or load connected thereto.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclass for battery charging or discharging from a regulated source.

322, Electricity: Single Generator Systems, subclasses 7+ for combined control of generator and load circuit.

152 With motor control:

This subclass is indented under subclass 151. Subject matter in which means are also provided for controlling the motor, which means is in addition to the control of the supply circuit extending to the primary circuit of the motor and the control of the generator.

SEE OR SEARCH THIS CLASS, SUBCLASS:

491, and the subclasses specified in the Notes thereto, for other motor control systems having combined motor circuit and motor structure control.

493, and the subclasses specified in the Notes thereto, for other motor control systems having combined armature or primary circuit and field or secondary circuit controls.

153 Control of both the generator and the motor:

This subclass is indented under subclass 140. Subject matter in which means are provided for controlling the generator and additional means are provided for controlling the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

139, for the subject matter where the system includes a battery-fed motor and both the battery and the motor are controlled.

152, for this subject matter where the system includes means for the combined control of the generator, the transmission circuit to the motor, and of the motor.

SEE OR SEARCH CLASS:

290, Prime-Mover Dynamo Plants, for combined control of nonelectric prime-mover and the generator driven thereby, which generators may supply electric motors.

322, Electricity: Single Generator Systems, subclasses 14+ for combined control of the generator and the driving means therefor.

154 Control of excitation (field) circuit of both:

This subclass is indented under subclass 153. Subject matter in which the control means effect control of the field or secondary circuit of both the generator and of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

521, and the subclasses specified in the Notes thereto for motor field or secondary circuit control in motor control systems in general.

SEE OR SEARCH CLASS:
322, Electricity: Single Generator Systems, subclasses 59+ for generator field circuit control.

156 Plural, diverse or diversely actuated, generator control means:
This subclass is indented under subclass 140. Subject matter in which two or more distinct means are provided for controlling the generator, one or more of which control means are different structurally or are controlled differently (e.g., at different times, different degree or magnitude of control, etc.) than one or more others of the control means.

(1) Note. Means for controlling the generator driving means so as to vary the generator speed is considered a "generator control means."

SEE OR SEARCH CLASS:
322, Electricity: Single Generator Systems, subclass 45 for combined diverse generator controls.

157 Generator speed control:
This subclass is indented under subclass 140. Subject matter in which means are provided for controlling the speed of the generator by controlling the driving means therefor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
700+, for this subject matter where the system includes means for controlling the speed of the generator combined with other control means for the generator.

SEE OR SEARCH CLASS:
290, Prime-Mover Dynamo Plants, for variable speed nonelectric prime movers which drive generators.
322, Electricity: Single Generator Systems, subclasses 14+ for combined control of generator and driving means; subclasses 29+ for automatic control of generator or driving means control in response to speed or frequency of the generator; subclasses 38+ for generator driving means control; subclasses 40+ for power transmitting mechanism control.

158 Generator field circuit control:
This subclass is indented under subclass 140. Subject matter in which means are provided for controlling the field circuit of the generator.

(1) Note. Providing the generator with plural, diverse or diversely arranged, field windings, or providing means for varying the active length (such as by tapping) of the field winding are included in field circuit control, when such are such as to substantially modify the operation of the electric motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
154, for this subject matter where the system includes means for the combined control of the generator field and the motor field.
156, for motor circuits under subclass 140 having field circuit control combined with other control means for the generator.

SEE OR SEARCH CLASS:
322, Electricity: Single Generator Systems, subclasses 59+ for generator field circuit control in general.

159 HAVING ROTOR ELEMENT BIASED AGAINST ROTATION:
This subclass is indented under the class definition. Subject matter in which the motor comprises a rotatable power output element (rotor) combined with means for exerting a torque in opposition to and simultaneously with the motor torque.

(1) Note. Examples of means for producing the opposing torque which are included in this subclass: elastic or spring devices interconnecting the rotor and stationary part of the motor; a pulley or drum mounted on the rotor with a weighted flexible member attached thereto and adapted to rotate the rotor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
1+, for motor systems having nonelectric means for actuating a load device in

addition to an electric motor as an actuator.

45+, see Note 2 above.

119+, for reciprocating motor systems in which the reciprocating element may be biassed by gravity or by force-producing means in one direction of actuating and electrically in the other direction of actuation.

SEE OR SEARCH CLASS:

251, Valves and Valve Actuation, subclass 129.01 for valves with electrical actuators.

310, Electrical Generator or Motor Structure, subclasses 15+ for reciprocating electrical motors having a biassing means present.

324, Electricity: Measuring and Testing, subclass 131 for electrically driven or actuated meter movements having biassed indicating means.

160 By resilient biasing means (e.g., spring):

This subclass is indented under subclass 159. Subject matter in which the biassing means comprises a spring or other means which when flexed or distorted inherently tends to reassure its previous shape or dimension.

SEE OR SEARCH CLASS:

267, Spring Devices, for structural details of springs, per se.

161 WITH FLYWHEEL OR MASSIVE ROTARY MEMBER:

This subclass is indented under the class definition. Subject matter in which a flywheel or other massive rotatable mounted body is mounted in driving relationship with the motor rotor or other working member in such manner that energy transfer can take place from the motor to the flywheel or other massive rotary member and vice versa.

(1) Note. Systems in which the rotary or other working element, per se, of the motor is limited to being massive are included herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

45+, for motor systems in which the movable working element of one motor is mechanically interconnected with the movable working element of another motor which may have a flywheel effect.

150, for generator-fed motor systems which have flywheels or other massive bodies on the rotary elements of either the generator or the motor.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 572.1 for energy storage-type flywheels.

123, Internal-Combustion Engines, subclasses 179.1+ for inertia starters for internal combustion engines in which an electric motor may store energy in a rapidly revolving flywheel which is then connected to the engine to start it.

192, Clutches and Power-Stop Control, subclasses .02 through .098 and 116.5 for flywheels in combination with clutching means for connecting and disconnecting the flywheel through the clutch to the load or driven device, particularly to permit or to cause immediate stoppage of the load or driven device in cases of necessity.

322, Electricity: Single Generator Systems, subclass 4 for generators system which have generators with flywheels or massive moving parts.

162 CONTROL BY PATTERNS OR OTHER PREDETERMINED SCHEDULE MEANS:

This subclass is indented under the class definition. Subject matter in which means are provided for controlling the operation of an electric motor in accordance with a predetermined schedule, said means comprising patterns, templates, perforated sheets, or other shaped or treated control devices having a configuration or design varying in accordance with a predetermined schedule of control to which it is desired to subject the motor. The systems included herein are “open-loop” controls and thus are not servomechanisms.

(1) Note. The operations of the motor may comprise plural, diverse motor operations or variations in a single operation such as operating the motor at a plurality of running speeds.

(2) Note. For example merely, speed control means which are actuated by a perforated sheet running at constant speed in which a sensing or detecting means contacting the sheet senses the presence of the perforations and initiates the operation of speed control means to cause the motor to operate at one speed when sensing device contacts unperformed portion of the sheet and at other speeds when contacting the perforated portions of the sheet, would be included herein.

(3) Note. For plural cams on a common shaft, each effecting a single change in electric motor control, classification is elsewhere in this class.

(4) Note. Where the system is a closed loop position servomechanism, the classification is not herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

543+, for plural cams on a common shaft, each effecting a single change in electric motor control.

567, for where the system is a closed loop position servomechanism,

SEE OR SEARCH CLASS:

29, Metal Working, subclass 64 wherein the speed of metal working machines is controlled by pattern, templates, etc.

74, Machine Element or Mechanism, subclasses 567+ for cam means, per se.

200, Electricity: Circuit Makers and Breakers, subclass 46 for pattern sheet controlled electric switches.

901, Robots, subcollection 3 for the programming of a robot arm.

163 Motor running-speed control:

This subclass is indented under subclass 162. Subject matter in which means are provided for automatically varying the running speed of a motor in accordance with a predetermined schedule means.

(1) Note. For example merely, speed control means which are actuated by a constant speed perforated sheet or by a constant speed cam and follower arrangement so as to cause the motor to run at different speeds as different portions of the perforated sheet or cam surface past a control position, are included in this group.

164 Cyclically varying or repeated speed schedules:

This subclass is indented under subclass 163. Subject matter in which means are provided for repeating a predetermined speed schedule as a result of which the same speed-control cycle is traversed two or more times.

244 ALTERNATING CURRENT COMMUTATING MOTORS:

This subclass is indented under the class definition. Subject matter in which the motor is an alternating-current commutation motor.

(1) Note. See Alternating-Current Commutating Motor, of the class definition for a definition of alternating current commutator motor. Such motors are commonly referred to as a “series a-c motors”, a “universal motor”, and an “a-c commutator motor”.

SEE OR SEARCH THIS CLASS, SUBCLASS:

43, for plural motor systems having alternating-current commutating motors with electrical synchronizing interconnections between the windings of the motors.

135, for linear-movement motor systems with commutating means for progressively energizing an a-c supplied field winding of the motor.

400.1, through 400.42, for synchronous motor commutation control systems.

700+, for synchronous (AC motor systems where the motor is provided with commutators.

725+, for repulsion motor systems where the motor is provided with commutated windings.

737, and 738, for induction motor systems where the motor is provided with a commutated winding.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 173 for AC commutator motors, per se.

245 Universal or A.C.-D.C. motors:

This subclass is indented under subclass 244. Subject matter in which the motor is designed and constructed to run when connected directly and solely to either a direct-current or an alternating-current source.

SEE OR SEARCH THIS CLASS, SUBCLASS:

246+, and the subclasses specified in the Notes to the definition of those subclasses for series motor systems having series motor provided with commutators.

246 SERIES MOTORS:

This subclass is indented under the class definition. Subject matter in which the motor is provided with means for causing it to operate only as a series motor for at least an appreciable portion of its operation as a motor.

(1) Note. See Series Motor, of the class definition for a definition of a series motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

244, for AC series commutated motor systems.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 158 for universal (AC or DC) motors, and subclass 177 for DC motors.

247 Convertible for nonseries motor operation:

This subclass is indented under subclass 246. Subject matter in which means are provided for operating the motor as a series motor, and also operating the motor as a nonseries motor.

(1) Note. As an example, an elevator motor may be provided with means for causing it to operate as a series motor during the lift period, and as a shunt motor during the return period.

SEE OR SEARCH THIS CLASS, SUBCLASS:

375+, for motor systems having means for operating a motor as a generator during dynamic braking of the motor.

248 With plural, diverse or diversely connected or controlled sources of e.m.f.:

This subclass is indented under subclass 246. Subject matter in which two or more immediate sources of e.m.f. are provided to supply electric energy to the conducting elements of a series motor.

(1) Note. Two sources of e. m. f. connected in series opposition in the circuit of a motor winding are included herein. Two circuits from a single voltage divider or from spaced sets of brushes on a single generator commutator, are examples of sources of electro-motive-force included herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

500, and the subclasses listed in the Search Notes thereto, for miscellaneous motor systems having plural sources of armature circuit supply for the motor.

530, and the subclasses specified in the Search Notes thereto, for motor systems having plural sources of supply for the field or secondary circuit of the electric motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 43+ for systems having plural sources of supply of electrical energy for a single load circuit.

249 Control by motor circuit impedance:

This subclass is indented under subclass 246. Subject matter in which impedance means are provided for controlling the series motor circuits.

(1) Note. Space-discharge devices (including grid controlled vacuum tubes and gas-filled or vapor-filled tubes) are considered impedance devices when used to

regulate the magnitude of current flow in a circuit having a source of electric voltage connected therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

493, and the subclasses specified in the Search Notes thereto, for other motor systems controlled by means of impedance devices in the armature and field circuits of the motors.

508, and the subclasses specified in the Notes thereto, for motor systems controlled by means of an impedance in the armature circuit.

533, and the subclasses specified in the Notes thereto for motor systems controlled by means of an impedance in the field circuit.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 364 through 370 for miscellaneous impedance systems.

250 Impedance in series with field windings and in parallel to armature winding:

This subclass is indented under subclass 249. Subject matter in which the impedance means is connected in series with all, or a part, of the series field winding and simultaneously connected in parallel with part, or all of the armature winding of the motor.

251 Field circuit control:

This subclass is indented under subclass 246. Subject matter in which means are provided for controlling the circuit of the field-producing winding.

(1) Note. The mere provision of a plurality of diverse or diversely controlled field coils is sufficient basis for classification herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

249, for field-control of a series motor by means of impedance devices in the field circuit.

521, and the subclasses specified in the Search Notes thereto, for motor systems having field circuit control means for the motors.

252 Plural, diverse or diversely connected or controlled field coils:

This subclass is indented under subclass 251. Subject matter in which the motor is provided with two or more field windings, one or more of which are structurally different, or connected in the motor circuit differently, or controlled differently (e.g., with respect to time, degree or magnitude of control, etc.) from one or more others of the windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:

523, and the subclasses specified in the Notes thereto, for miscellaneous motor control systems wherein the motors have plural field windings.

253 HOMOPOLAR OR UNIFORM FIELD MOTORS:

This subclass is indented under the class definition. Subject matter in which the motor is a noncommutating electric motor and comprises a magnetic-field producing means combined with one or more electric conductors mounted to move relative to and in proximity to the field-producing means, said field-producing means being so constructed and/or energized that the magnetic field produced thereby is, at any instant of time, of the same polarity or direction throughout its extent with reference to the path of travel of the movable electric conductor or conductors.

(1) Note. The motors in this subclass are known as “homopolar motors”.

(2) Note. This subclass includes alternating current and direct current motors.

(3) Note. In the case of direct current field energization, the direction of the generated c.e.m.f. in the armature conductors is always unidirectional when the conductors move in a continuous direction.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 178 for homopolar dynamoelectric machines.

254.1 SWITCHED RELUCTANCE MOTOR COMMUTATION CONTROL:

This subclass is indented under the class definition. Subject matter in which the rotor element tends to assume a predetermined angular position when the motor is continuously energized and is provided with a commutator or circuit making and breaking device which is actuated by the motor to determine the instants of time at which the field producing windings thereof are energized and de-energized relative to the angular position of the rotary element.

(1) Note. In a switched reluctance motor, there are no permanent magnets and no windings on the rotor and the rotor assumes a position to minimize reluctance. Therefore, these motors are capable of high speeds, but produce little torque.

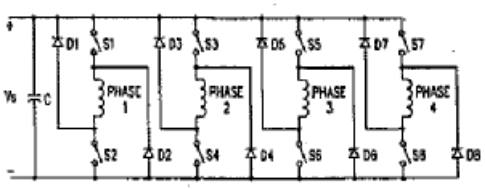
(2) Note. Typically, three-phase switched reluctance motors are in a 6/4 form, that is six stator and four rotor poles.

SEE OR SEARCH THIS CLASS, SUBCLASS:

701, for reluctance synchronous motors.

254.2 Having asymmetric half-bridge:

This subclass is indented under subclass 254.1. Subject matter wherein the circuit making or breaking means includes a bridge circuit wherein each side of the bridge contains both a transistor (or switch) and a diode and the motor is connected between the transistor and the diode.



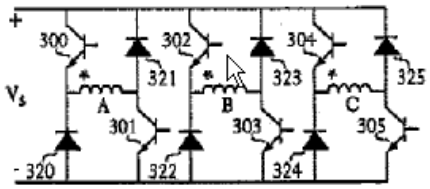


Figure 1. Typical circuit configurations.

SEE OR SEARCH THIS CLASS, SUBCLASS:

701, for reluctance synchronous motors.

255 PLURAL DIVERSE MOTOR CONTROLS:

This subclass is indented under the class definition. Subject matter in which means are provided for effecting or causing two or more diverse operations of an electric motor.

(1) Note. See Definition of Motor Operation Control, of the class definition for the various motor operations which are included in or excluded from the list of operations comprehended by this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

53+, for plural motor systems having means for effecting plural, diverse motor-operations for the motors.

201+, for induction motor systems having means for effecting plural diverse operations.

280+, for motor reversing systems.

301+, for motor running-speed control systems.

362+, for motor braking systems.

384+, for motor acceleration control systems.

432+, for motor load control systems.

445+, for automatic motor starting and/or stopping systems.

SEE OR SEARCH CLASS:

388, Electricity: Motor Control Systems, subclasses 800+ and 825+ for single motor running-speed control systems with, and without, feedback respectively; and subclasses 842+ and 848+

for single motor acceleration control systems with, and without, feedback respectively.

256 Motor-reversing:
This subclass is indented under subclass 255. Subject matter in which means are included for causing an electric motor to reverse its direction of operation.

(1) Note. For a definition of "motor-reversing", see Reversing Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:
54+, for plural motor systems provided with means for effecting plural, diverse motor-operations control, including reversing.
280+, and the subclasses specified in the Notes to the definition of those subclasses for motor-reversing in single motor systems.

257 With running-speed control:
This subclass is indented under subclass 256. Subject matter in which means are provided for also controlling the running-speed of an electric motor.

(1) Note. For a definition of "running-speed control" see the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:
55+, for plural motor systems having means for effecting plural motor operations including reversing and running speed control.
268+, and the subclasses specified in the Notes thereto, for motor systems having means for effecting running speed control and another control operation.

258 And braking:
This subclass is indented under subclass 257. Subject matter in which means are provided for also effecting braking of the electric motor.

(1) Note. For a definition of "braking" as applied to electric motors, see Motor Load Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:
56, for plural motor systems having means for effecting reversing, running speed and braking operations for the motors.
273+, and the subclasses specified in the Search Notes thereto, for miscellaneous motor systems having means for effecting motor braking control and another motor operation control.
362+, and the subclasses specified in the Notes to the definition of those subclasses for miscellaneous motor braking systems.

259 And acceleration control:
This subclass is indented under subclass 258. Subject matter in which means are provided for also controlling acceleration of an electric motor.

(1) Note. For a definition of "acceleration", see Acceleration Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:
56, for plural motor systems having means for effecting reversing, running-speed control, braking and acceleration of the motors.
276, and the subclasses specified in the Notes thereto, for miscellaneous motor systems having means for effecting acceleration control and another control operation.

260 And acceleration control:
This subclass is indented under subclass 257. Subject matter in which means are provided for also controlling the acceleration of an electric motor.

(1) Note. For a definition of "acceleration", see Acceleration Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:
55, for plural motor systems having reversing, running-speed control and

acceleration control for a plurality of electric motors.

259, for motor systems having acceleration control with braking, running speed control and reversing of the motor.

276+, and the subclasses specified in the Notes thereto, for motor systems having motor acceleration control and another motor control.

261 With braking:

This subclass is indented under subclass 256. Subject matter in which means are also provided for effecting braking control of the electric motor.

(1) Note. For a definition of "braking", see Motor Load Control, of the class definition.

(2) Note. Where braking is effected by phase reversal (i.e., by "plugging") while the motor is running and the application of power is terminated when motor substantially comes to a stop, braking only is effected. If power is left on and motor runs in reverse direction, classification is under combined reversing and braking controls in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

57, and the subclasses specified in the Notes to the definition of that subclass for plural motor systems having braking and reversing control for the motors.

258+, for motor systems having braking control and reversing control.

273+, and the subclasses specified in the Notes thereto, for motor systems having braking control and another control.

362+, for miscellaneous motor systems having braking control.

262 And acceleration control:

This subclass is indented under subclass 261. Subject matter in which means are also provided for acceleration control of the electric motor.

(1) Note. For a definition of "acceleration", see Acceleration Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

57, and the subclasses specified in the Notes thereto, for plural motor systems having acceleration with braking and reversing of the motors.

259, for this subject matter where the system is also provided with means for running-speed control.

276+, and the subclasses specified in the Notes thereto, for motor systems having acceleration control and another motor operation control.

263 With acceleration control:

This subclass is indented under subclass 256. Subject matter in which means are provided for also controlling the acceleration of the motor.

(1) Note. For a definition of "acceleration", see Acceleration Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

58, for plural motor systems having acceleration control and reversing control.

259, for this subject matter where the system includes means for running-speed control and braking control.

260, for this subject matter where the system includes means for running-speed control.

262, for this subject matter where the system includes means for braking control.

276, and the subclasses specified in the Notes thereto, for miscellaneous motor systems having acceleration control and another motor-operation control.

384+, for miscellaneous motor systems having acceleration control.

264 With automatic starting and/or stopping:

This subclass is indented under subclass 256. Subject matter in which means are also provided for automatically starting and/or stop-

ping the motor in response to predetermined conditions.

(1) Note. See Automatic Starting and Stopping, of the class definition for limitations on starting and/or stopping controls included herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

18, for follow-up motor systems in which reversible motors are started in one direction or the other either manually or automatically and stops automatically after the motor runs an amount proportional to (1) the change in position of a transmitter or (2) the change in some condition.

54+, for automatic starting and/or stopping combined with reversing in plural motor systems.

272, for motor systems having running-speed control and automatic starting and/or stopping control.

275, for motor systems having motor braking control and automatic starting and/or stopping control.

277, for motor systems having acceleration control and automatic starting and/or stopping control.

445+, and the subclasses specified in the Notes thereto, for miscellaneous motor systems having automatic starting and/or stopping of the motor.

265 Stopping upon predetermined movement of or position of motor or driven device:
This subclass is indented under subclass 264. Subject matter in which means are provided for effecting stopping of the motor after it or the load device driven thereby has moved a predetermined amount or has reached or attained a predetermined position.

SEE OR SEARCH THIS CLASS, SUBCLASS:

18+, for follow-up control systems for electric motors in which the motors are generally reversible and automatically stop when they reach a position (angular or linear) which corresponds to the degree of change of a transmitter.

54+, for plural motor systems having reversing with automatic starting and/or stopping including stopping upon predetermined movement or position of a motor.

466+, for miscellaneous motor systems having automatic starting and/or stopping in response to predetermined movement or position.

266 At limit-of-travel of motor or driven device:
This subclass is indented under subclass 265. Subject matter in which means are provided for stopping the electric motor when it, or a load device driven thereby, substantially reaches its limit of travel.

SEE OR SEARCH THIS CLASS, SUBCLASS:

468+, for miscellaneous motor system having limit-of-travel stopping control.

267 Dual control circuits alternately energized:
This subclass is indented under subclass 266. Subject matter in which the control means for reversing and starting and/or stopping comprise two circuits the energization of one of which controls the starting in one direction and the energization of the other of which effects starting in the opposite direction and in which the arrangements are such that, with one of the circuits energized for operation in one direction, when the motor is automatically stopped at its limit of travel, it cannot be started until the other circuit is energized.

(1) Note. In the systems in this subclass, each time the motor is stopped at the limit of travel it can only be restarted in the reverse direction by another circuit, i.e., it cannot be restarted in the same direction of operation.

268 Running-speed control:
This subclass is indented under subclass 255. Subject matter in which means are also provided for controlling the running-speed of the motor.

(1) Note. For a definition of “running-speed control”, see the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

59+, and the subclasses specified in the Notes thereto, for plural motor systems having running-speed control means and another diverse motor control means.

257+, for this subject matter where the system includes motor reversing control means.

269 With braking:

This subclass is indented under subclass 268. Subject matter in which means are provided for also effecting braking of the electric motor.

(1) Note. For a definition of "braking", see the Glossary in the Class Definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

60, and the subclasses specified in the Notes thereto for plural motor systems having braking control and running-speed control.

258+, for this subject matter where the system includes running-speed control means and motor reversing control.

261+, for this subject matter where the system includes means for motor reversing control.

273+, and the subclasses specified in the Notes thereto, for motor systems having braking control and another motor operation control.

362+, for miscellaneous motor systems having braking control.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclasses 76 and 77 for structured combinations of an electrical motor and a brake.

270 And acceleration control:

This subclass is indented under subclass 269. Subject matter in which means are provided for also controlling the acceleration of the motor.

(1) Note. For a definition of "acceleration", see Acceleration Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

60, and the subclasses specified in the Notes thereto for plural motor systems having running-speed control, braking control and acceleration.

259, for this subject matter where the system includes means for motor reversing control.

276+, and the subclasses specified in the Notes thereto, for motor systems having motor acceleration control and another motor-operation control.

271 With acceleration control:

This subclass is indented under subclass 268. Subject matter in which means are also provided for controlling the acceleration of the motor.

(1) Note. For a definition of "acceleration", see Acceleration Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

61, and the subclasses specified in the Notes thereto, for plural motor systems having running speed control and acceleration control.

259, for this subject matter where the system includes means for motor reversing control and braking control.

260, for this subject matter where the system includes means for motor reversing control.

270, for this subject matter where the system includes means for motor braking control.

273, and the subclasses specified in the Notes thereto, for motor systems having acceleration control and another motor operation control.

272 With automatic starting and/or stopping:

This subclass is indented under subclass 268. Subject matter in which means are provided for also automatically starting and/or stopping the motor.

(1) Note. For a definition of "Automatic Starting and/or Stopping" see the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

62, for plural motor systems having running-speed control and automatic starting and stopping.

445+, for miscellaneous motor systems having automatic starting and/or stopping control.

273 Motor braking:

This subclass is indented under subclass 255. Subject matter in which means are provided for also braking the electric motor.

(1) Note. For a definition of "braking" see Motor Load Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

63, and the subclasses specified in the Search Notes thereto, for plural motor systems having means for motor braking control and means for effecting another motor operation.

258+, for this subject matter where the system includes means for running-speed control and motor reversing control.

261+, for this subject matter where the system includes means for motor reversing control.

269+, for this subject matter where the system includes means for running speed control.

362+, for miscellaneous motor systems having braking control.

SEE OR SEARCH CLASS:

188, Brakes, for braking means, per se, for general purposes.

310, Electrical Generator or Motor Structure, subclasses 76 and 77 for structured combinations of an electrical motor and a brake.

274 With acceleration control:

This subclass is indented under subclass 273. Subject matter in which means are provided for also controlling acceleration of the motor.

(1) Note. For a definition of "acceleration" see Acceleration Control, of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

63, and the subclasses specified in the Notes thereto, for plural motor systems having braking control and acceleration control.

259, for this subject matter where the system includes means for motor reversing and for running-speed control.

262, for this subject matter where the system includes means for motor reversing control.

270, for this subject matter where the system includes means for running-speed control.

276, and the subclasses specified in the Notes thereto, for motor systems having acceleration control and another motor operation control.

275 With automatic starting and/or stopping:

This subclass is indented under subclass 273. Subject matter in which means are provided for also automatically starting and/or stopping the electric motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445+, for miscellaneous motor systems having automatic starting and/or stopping control.

276 Acceleration control:

This subclass is indented under subclass 255. Subject matter in which means are provided for also controlling the acceleration of the motor.

(1) Note. See the Glossary of the class Definition for "Acceleration Control".

SEE OR SEARCH THIS CLASS, SUBCLASS:

39, and the subclasses specified in the Notes thereto, for plural motor systems having means for effecting acceleration control and another motor control operation.

259, for this subject matter where the system includes means for motor reversing control, running-speed control and braking control.

260, for this subject matter where the system includes means for motor reversing control and running-speed control.
262, for this subject matter where the system includes means for motor reversing control and braking control.
263, for this subject matter where the system includes means for motor reversing control.
270, for this subject matter where the system includes means for running speed control and braking control.
271, for this subject matter where the system includes means for running-speed control.
274, for this subject matter where the system includes means for motor braking control.

277 With automatic starting and/or stopping:
This subclass is indented under subclass 276. Subject matter in which means are also provided for automatically effecting the starting and/or stopping of the motor in response to one or more predetermined conditions.

(1) Note. For limitations on the starting and/or stopping controls included in this subclass, see the Class Definition, Glossary, "Automatic Starting and Stopping."

SEE OR SEARCH THIS CLASS, SUBCLASS:
64, and the subclasses specified in the Notes thereto, for plural motor systems having acceleration control means and means for effecting another control operation, such as automatic starting and/or stopping.
445, and the miscellaneous motor systems having automatic starting and/or stopping control.

278 In response to an electrical condition:
This subclass is indented under subclass 277. Subject matter in which means are provided for starting and/or stopping the electric motor in response to one or more conditions of which at least one is an electrical condition.

279 Automatic stopping means less responsive during acceleration:
This subclass is indented under subclass 278. Subject matter in which the automatic control means comprises means responsive to an electrical condition for stopping the motor which means, however, has been rendered inoperative or is otherwise less responsive to the electrical condition during the acceleration period of the motor.

(1) Note. Characteristic of the subject matter of this subclass are those acceleration systems in which overload or excessive-current cut-outs are provided for automatically stopping the motor by opening the armature or primary circuit thereof when the armature or primary current exceeds a predetermined value during the full-speed operation of the motor but wherein means are provided for preventing or reducing the tendency of such cut-out to operate during the acceleration period of such motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
447, for miscellaneous automatic electric motor control systems in which the condition sensing means is rendered inoperative or less responsive during particular limited periods of operation of the motor.

280 MOTOR-REVERSING:
This subclass is indented under the class definition. Subject matter in which means are provided for causing an electric motor to operate in one direction at one time and in the opposite direction at another time, or for causing an electric motor to operate in a direction opposite to that in which it has previously been operating.

(1) Note. In reversing motor systems, means must be provided for establishing an electrically produced torque in both directions of operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

10, for the combination of an electric motor and reversible power or motion transmitting means actuated thereby.

48, for plural motor systems having the motors mechanically coupled in torque opposition.

65, and the subclasses specified in the Notes thereto, for reversing control in plural motor systems.

119+, for reciprocating or oscillating motor systems in which periodic reversal is an inherent function during normal operation of the motor.

159+, and the subclasses specified in the Notes thereto, for biassed motor systems, in which the biassing means will cause the motor to move to a prior position when the energization of the motor is reduced.

256+, and the subclasses specified in the Notes thereto for motor systems having reversing control means and means for effecting another control operation.

739+, and the subclasses specified in the Notes thereto, for reversal of induction motors.

281 Periodic- or intermittent-reversing:

This subclass is indented under subclass 280. Subject matter in which means are provided for repeatedly reversing the direction of operation of the motor in accordance with the schedule of operation of a continuously operating controller.

(1) Note. Means which operate to cause a motor to operate in one direction or another depending on a change in a condition, and in which the change may or may not occur, are not included herein. However, reversing means actuated repeatedly by a continuously running motor or a timing mechanism are included. The periodicity of reversal need not be regular, i.e., not as uniformly spaced periods of time.

SEE OR SEARCH THIS CLASS, SUBCLASS:

119, for reciprocating or oscillating motor systems having motors which periodically reverse their directions of operation.

443, and the subclasses specified in the Notes thereto, for other motor systems having periodically actuated motor control means.

282 In response to movement or position (e.g., limit of travel) of motor or driven device:

This subclass is indented under subclass 281. Subject matter in which means are provided for reversing the motor in response to a predetermined number of revolutions of or other movement or position of the electric motor or of the load device actuated thereby.

SEE OR SEARCH THIS CLASS, SUBCLASS:

286, for means for effecting a periodic reversals of electric motors automatically in response to the movement or position of the motor or the device driven thereby.

461+, and the subclasses specified in the Notes thereto, for other motor control systems having the motor automatically controlled in response to the speed or rate of movement of the motor or device driven thereby.

466+, and the subclasses specified in the Notes thereto, for other motor control systems having the motor automatically controlled in response to the movement, position or limit of travel of the motor or other body or device.

283 Automatic and/or with time-delay means:

This subclass is indented under subclass 280. Subject matter wherein means responsive to a predetermined condition are provided for controlling the motor reversing means or where time delay means are provided for controlling the motor reversing means after operation thereof has been initiated.

(1) Note. Where time delay means are provided, the control operation may be initiated manually.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445+, and the subclasses specified in the Search Notes thereto, for other automatic control systems for electric motors having the motor automatically controlled in response to predetermined conditions and/or having time delay means for the motor control means.

284 With means to delay reversing until motor substantially stops:

This subclass is indented under subclass 283. Subject matter in which means are provided for delaying the application of electric energy to the motor in the reverse direction for reversing the motor until the motor has substantially stopped or has substantially come to rest from a previous operation in the opposite direction.

SEE OR SEARCH THIS CLASS, SUBCLASS:

285, for motor systems with means for initiating the reversal of an electric motor at a particular instant of time or after the lapse or a predetermined interval of time, or to effect reversal thereof a predetermined time after the initiation of the reversing control of the motor.

374, for motor braking systems wherein braking is produced by "plugging" and the flow of energy is interrupted when the motor speed drops to zero.

285 Instant of, or passage or predetermined time or having time-delay means:

This subclass is indented under subclass 283. Subject matter in which means are provided for initiating the reversal of a motor at a particular instant of time (e.g., 8:30 A.M., 5:00 P.M.) or after the lapse or passage of a predetermined interval of time (e.g., 4 seconds, 4 hours) or for delaying or retarding the application of reverse power to a motor for a predetermined interval of time after the reversing control operation has been initiated.

SEE OR SEARCH THIS CLASS, SUBCLASS:

281, for this subject matter where there are periodic or intermittent reversals in response to passage or lapse of time.

284, for motor systems having means for delaying reversing of the electric motor until it has substantially stopped from a previous operation.

484+, and the subclasses specified in the Notes thereto, for other motor systems having time-delay means for controlling the motor control means after operation of the control means has been initiated.

286 Movement or position of motor or driven device:

This subclass is indented under subclass 283. Subject matter in which means are provided for reversing the motor in response to a predetermined number of revolutions or other movement of, or to a predetermined position of, the motor or a load device actuated thereby.

SEE OR SEARCH THIS CLASS, SUBCLASS:

119+, for reciprocating or oscillating motor systems in which reversal of the motor is automatically effected as the motor approaches the end or limit of its movement in each direction of movement.

282+, for this subject matter where there is periodic or repetitious reversal of the motor controlled in response to movement or position of the motor or the device driven thereby.

461+, and 466, and the subclasses specified in the Notes thereto, for other motor systems having automatic control of the motor in response to the movement or the position of the motor or a device driven thereby. See subclass 887 where the control is in response to the speed or rate-of-movement of the motor or driven device.

466+, see the reference to subclass 461.

287 Armature or primary circuit control:
This subclass is indented under subclass 280. Subject matter in which means are provided for effecting reversal of the motor by means in the armature or primary circuit of the motor.

(1) Note. This subclass includes armature or primary circuit control combined with the field circuit control and/or with motor structure control means for reversing the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
126, for reciprocating or oscillating motor systems with armature or primary circuit control of the motor.
494+, and the subclasses specified in the Notes thereto for miscellaneous motor systems having armature or primary circuit control.

288 Plural, diverse or diversely controlled armature windings:
This subclass is indented under subclass 287. Subject matter in which the reversal is effected by means of two or more armature or primary winding, one or more of which are structurally different or controlled differently from one or more others of the windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:
297+, for reversing motor systems where the motor has plural, diverse or diversely controlled, field windings.
495+, and the subclasses specified in the Notes thereto, for other motor systems where the motor has plural armature or primary windings.

289 Phase-reversal:
This subclass is indented under subclass 288. Subject matter in which the motor is an alternating current motor having two or more phase windings and in which means are provided for reversing the time phase sequence of the currents supplied to two or more of the phase windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:
121, for reciprocating or oscillating motor systems with means for reversing the motor by phase reversal.
207, for induction motor systems with means for reversing the motor by phase reversal.
373+, for motor systems having means for braking the motors by "plugging" which may be effected by phase reversal.
496, and the subclasses specified in the Notes thereto, for miscellaneous motor systems where the motor has polyphase windings.

290 Selectively energized windings:
This subclass is indented under subclass 288. Subject matter in which means are provided for selectively energizing one or more of the armature windings without energizing one or more others thereof to effect reversal of operation of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
122, for energizing two or more windings in sequence or alternation in reciprocating or alternating motor systems.
297+, for motor reversing systems where the motor is reversed by selectively energized field windings.
495+, and the subclasses specified in the Notes thereto, for miscellaneous motor systems where the motor has a plurality of diversely controlled armature windings.
750, for motor systems having means for reversing the motor by shading coils wherein one coil may be selectively operated (closed) for one direction or operation and another operated for a reverse direction of operation.

291 Armature or primary current reversal:
This subclass is indented under subclass 287. Subject matter in which means are provided for reversing the direction of current flow in the armature or primary circuit conductors of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

151, for generator-fed motor systems having means for reversing the motor.

300+, for motor systems having means reversing a motor by reversing the field circuit current.

373+, for motor systems having means for braking the motor by "plugging" or by reversing the power applied to the motor which includes reversing the armature current.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 127 for switching systems responsive to polarity or reverse current flow.

322, Electricity: Single Generator Systems, subclass 5 for generator systems having means to control the polarity of the generated voltage.

292 By shifting motor brushes or selecting appropriate set of brushes:

This subclass is indented under subclass 291. Subject matter in which means are provided for shifting the commutator brushes to which the armature circuit is connected, or in which means are provided for selectively using one set of brushes at one time and using another set at another time.

SEE OR SEARCH THIS CLASS, SUBCLASS:

541, and the subclasses specified in the Search Notes thereto, for miscellaneous motor control systems having motor brush adjustment or control means.

293 Reversing polarity of current supplied to armature circuit:

This subclass is indented under subclass 291. Subject matter in which means are provided for reversing polarity of the current supplied to the armature or primary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

140+, for the subject matter in generator-fed motor systems.

300+, for motor reversing systems where the polarity of the field circuit current is reversed.

373+, for motor braking by "plugging" wherein the armature current polarity is reversed.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 138 for polarity reversing systems for electrical switch contacts.

294 Wheatstone bridge type:

This subclass is indented under subclass 293. Subject matter in which a plurality of electrical devices are provided and connected in a Whetstone bridge arrangement, the output circuit of which arrangement is connected to the armature circuit of the motor.

(1) Note. For definition of Wheatstone-bridge arrangement" see (1) Note to the definition of subclass 29.

SEE OR SEARCH THIS CLASS, SUBCLASS:

29, for follow-up motor systems having a Wheatstone bridge arrangement for causing the motor to run in one direction or the other by controlling the polarity of the motor current.

509+, and the subclasses specified in the Notes thereto for miscellaneous motor systems having a Wheatstone bridge in the armature circuit.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclass 365 for miscellaneous Wheatstone bridge arrangements.

333, Wave Transmission Lines and Networks, subclass 169 for wave filters of the Wheatstone bridge or lattice type.

295 Potentiometer-controlled:

This subclass is indented under subclass 293. Subject matter in which means for providing current of reversible polarity comprise an impedance device having one or more conductors positionable in energy transfer relationship to the impedance and movable therealong.

(1) Note. Typical of polarity-reversing potentiometers is a resistor having DC input leads connected to the ends of the resistor and two output conductors connected to the motor armature each output conductor slidably engaging the resistor intermediate the ends thereof, so that by sliding one of the output conductors past the other, the polarity of the DC current supplied to the armature circuit is reversed.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclass 15 for voltage divider systems.
323, Electricity: Power Supply or Regulation, subclass 364 for miscellaneous resistance systems.
338, Electrical Resistors, subclass 68 for mechanically variable electrical resistors, per se, such as rheostats and potentiometers.

296 Field circuit control:
This subclass is indented under subclass 280. Subject matter in which means are provided for effecting reversal of the motor by means in the field circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
521, and the subclasses specified in the Notes thereto, for other motor control systems having motor field circuit control.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclass 104 for systems containing electromagnets or other highly inductive devices.
310, Electrical Generator or Motor Structure, subclass 180 for structure of the field windings.

297 Plural, diverse or diversely controlled field windings:
This subclass is indented under subclass 296. Subject matter in which the motor is provided with two or more field-producing windings one or more of which is structurally different, differently connected, or controlled differently than one or more others of the windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:
523, and the subclasses specified in the Notes thereto, for other motor control systems in which a motor has two or more field windings.

298 Simultaneous energization:
This subclass is indented under subclass 297. Subject matter in which means are provided for energizing all of the field windings at the same time.

SEE OR SEARCH THIS CLASS, SUBCLASS:
521+, particularly 524 to 527 and the subclasses specified in the Notes thereto, for miscellaneous control systems for motors having two or more field windings which are simultaneously energized.

299 With means for short-circuiting a winding:
This subclass is indented under subclass 298. Subject matter in which means are provided for establishing an electrical path of negligible impedance across the terminals of one of the field producing windings so that said winding becomes substantially de-energized when the electrical path is closed.

SEE OR SEARCH THIS CLASS, SUBCLASS:
528, and the subclasses specified in the Notes thereto, for other motor control systems wherein one or more windings of a plural field windings motor are short circuited.

300 Field-circuit current reversed:
This subclass is indented under subclass 296. Subject matter in which means are provided for reversing the flow of current in the motor field producing winding.

SEE OR SEARCH THIS CLASS, SUBCLASS:
293+, for motor systems having means for reversing the motor by reversing the current in the armature or primary circuit thereof.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 127 for switching systems responsive to polarity or reverse current.

322, Electricity: Single Generator Systems, subclass 6 for generator systems having means to control the polarity by controlling the generator excitation.

362 BRAKING:

This subclass is indented under the class definition. Subject matter in which means are provided for braking the motor.

(1) Note. For definition of motor braking control, see Class Definition, Glossary, "Motor Load Control".

(2) Note. Whenever the motor is braked by "plugging" (i.e., by power reversal while motor is running) and energization is continued so that motor operates in the reverse direction, classification is in combination reversing and braking. See subclass 261.

SEE OR SEARCH THIS CLASS, SUBCLASS:

86, and the subclasses specified in the Notes thereto, for plural motor systems having braking control.

159, for motor systems where the motor has means (e.g., springs) for biassing the motor against rotation.

161, for motor systems where the motor has a fly-wheel or other massive rotary member for retarding an increase in speed of the motor.

273, and the subclasses specified in the Notes thereto, for motor systems having braking control and another motor-operation control.

703, for braking means in synchronous motor systems.

757, and the subclasses specified in the Notes thereto, for braking means in induction motor systems.

SEE OR SEARCH CLASS:

188, Brakes, appropriate subclasses for miscellaneous braking devices in general. See the class definition of Class 318 for the line between Class 188 and 318.

303, Fluid-Pressure and Analogous Brake Systems, for miscellaneous fluid pressure brake systems. See the reference to Class 303 in the Notes to the class definition of Class 318 for the line between Class 303 and Class 318.

310, Electrical Generator or Motor Structure, subclasses 76 and 77 for structured combinations of an electrical motor and a brake.

388, Electricity: Motor Control Systems, art collection 932 for other single motor running-speed control systems wherein means are provided for braking the motor while still electrically energized for operation in the same direction in which the motor operated prior to the braking.

477, Interrelated Power Delivery Controls, Including Engine Control, for interrelated control between a motor and a transmission, clutch, or brake. See the notes in Motor Systems and Power, Motion, for the line.

363 "Spotting" or adjustment of braking controller during coasting:

This subclass is indented under subclass 362. Subject matter in which means are provided for controlling the back voltage or counter-electromotive-force of the motor while the motor is in motion and its armature or primary circuit is disconnected from its power source so that if or when the motor is reconnected to its source of power, a surge of current flow from the motor to the source will not take place, thus avoiding excessive or undesirable braking action at the time of reconnection to the source.

364 Automatic and/or with time-delay means:

This subclass is indented under subclass 362. Subject matter in which means are provided for sensing the existence of a predetermined condition which sensing means in turn initiates the operation of means for controlling the braking of the motor, or where time delay means are provided for controlling the motor braking means after the operation has been initiated.

(1) Note. Where time delay means are provided, the control operation may be initiated manually.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445, and the subclasses specified in the Notes thereto, for miscellaneous motor control systems which operate in response to predetermined conditions and/or with time delay means.

365 Plural diverse conditions or with time delay:
This subclass is indented under subclass 364. Subject matter in which sensing means are provided which respond to two or more conditions which are diverse in kind (e.g., temperature, voltage, current, etc.), or which respond to different characteristics (e.g., magnitude and rate-of-change of a condition) of a single condition, or which respond to one or more conditions in combination with means for effecting a predetermined time delay in the functioning of the braking means after the operation thereof has been initiated manually or otherwise.

SEE OR SEARCH THIS CLASS, SUBCLASS:

452, and the subclasses specified in the Notes thereto, for other motor control systems which are responsive to plural diverse conditions and/or to a single condition and which are also provided with time delay means for the control operation.

366 Condition of motor or driven device:
This subclass is indented under subclass 364. Subject matter in which the sensing means are responsive to a condition in or of the motor being braked or a device actuated by the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

449, through 477, inclusive, and the subclasses specified in the Notes thereto, for other motor control systems responsive to conditions in or of the motor being controlled or in or of the device actuated thereby.

367 Armature or primary current:
This subclass is indented under subclass 366. Subject matter in which the sensing means is responsive to the magnitude or the rate-of-change of the magnitude of the electric current in the armature or primary circuit of the motor being braked.

(1) Note. Where the sensing means comprises a relay which is responsive to the terminal voltage of the electric motor (i.e., connected to shunt to the motor armature circuit) such sensing means is treated as being responsive to the terminal or c.e.m.f. voltage of the motor and not to the armature current thereof, and is classified in subclass 368.

SEE OR SEARCH THIS CLASS, SUBCLASS:

368, see (1) Note above.

474, and the subclasses specified in the Notes thereto, for other motor control systems responsive to the armature or primary current of the motor being controlled.

368 Armature or primary circuit voltage or terminal or counter e.m.f. voltage:
This subclass is indented under subclass 366. Subject matter in which the sensing means are responsive to the magnitude of, or the rate-of-change of the magnitude of the terminal voltage or the counter-electromotive-force of the motor being braked.

SEE OR SEARCH THIS CLASS, SUBCLASS:

459, and the subclasses specified in the Search Notes thereto, for other motor control systems which are responsive to the terminal voltage or counter-electromotive-force of the motor being controlled.

369 Speed, acceleration, movement or position of motor or driven device:
This subclass is indented under subclass 366. Subject matter in which the sensing means are responsive to the speed (or rate-of-change thereof) degree or amount of movement, or the position (angular or linear) of the motor or device driven thereby.

SEE OR SEARCH THIS CLASS, SUBCLASS:

456, and the subclasses specified in the Notes thereto, for miscellaneous motor systems having automatic control means responsive to the rate-of-change of a condition.

460, and the subclasses specified in the Notes thereto, for miscellaneous motor systems having automatic control means responsive to sound, supersonic vibration or mechanical vibration.

461, and the subclasses specified in the Notes thereto, for miscellaneous motor systems with automatic control means responsive to the speed or rate-of-movement of a body.

466, and the subclasses specified in the Notes thereto, for miscellaneous motor systems with automatic control means responsive to the movement, position or limit of travel of the motor or a device driven by the motor.

370 Plural, diverse or diversely controlled braking means:

This subclass is indented under subclass 362. Subject matter in which two or more braking means are provided, one or more of which braking means are structurally different, or are differently controlled or are controlled by structurally different means than one or more others of the braking means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

188, Brakes, appropriate subclasses, particularly noting subclasses 4, 35, 64, 65.3, 68, 79, 105, 143, 156, and 204 for plural brake systems of general applications.

371 Including both friction braking "plugging" and/or dynamic braking:

This subclass is indented under subclass 370. Subject matter in which the plural braking means includes friction braking means combined with “plugging” and/or with dynamic braking.

(1) Note. For definition of “friction”, “plugging”, and “dynamic” braking, see definitions of subclasses 372, 373 and 375, respectively.

SEE OR SEARCH THIS CLASS, SUBCLASS:

372, for motor braking systems of the friction brake type.

373, for motor braking systems of the “plugging” or application of reverse power to the motor type.

375, for dynamic motor braking systems.

SEE OR SEARCH CLASS:

188, Brakes, appropriate subclasses, for the combination of diverse types of braking devices in general. Particularly note subclass 159 wherein one form of braking means is actuated by current from a motor (acting as a generator) which also brakes by virtue of its dynamic action.

372 Friction braking:

This subclass is indented under subclass 362. Subject matter in which the braking means comprises a frictional contact surface adapted to engage a cooperating frictional surface which is connected to or is a part of the movable output element of the motor being braked.

SEE OR SEARCH THIS CLASS, SUBCLASS:

370, for this subject matter where the system includes frictional braking means and another type of braking means.

SEE OR SEARCH CLASS:

188, Brakes, appropriate subclasses, for the structure of friction braking means, per se.

373 "Plugging" or application of reverse power to motor:

This subclass is indented under subclass 362. Subject matter in which means are provided for applying electric energy to an electric motor in such a direction or manner that a torque or force is developed in the motor as a result of such energization which torque or force opposes the tendency of the motor to continue in motion if in motion, or to move if not in motion.

(1) Note. This subclass includes those motor control systems in which the flow of energy to the motor is reversed while the motor is still in motion, or in which the motor is energized in a direction to hold the motor stationary or motionless when the motor is urged to move, while not energized.

(2) Note. Where the application of reverse power is continued after the forward motion of the motor has been reduced to zero so that the motor operates a substantial amount in the reverse direction, classification is not herein, but under combined reversing and braking controls in preceding subclasses. Note particularly subclass 261.

SEE OR SEARCH THIS CLASS, SUBCLASS:

210, for braking of induction motors by phase-reversal (i.e., by plugging).

261, and the subclass specified in the Notes thereto, for motor systems having braking by application of reverse power combined with continued reverse energization with consequent reverse operation of the motor. See (2) Note above.

280, and the Search Notes thereto, for motor systems having means for reversing the application of power to a motor for effecting a substantial operation of the motor in the reverse direction (Motor-reversing control).

SEE OR SEARCH CLASS:

105, Railway Rolling Stock, subclass 61 for electric controls for electric-motor driven locomotives that may involve "plugging" or application of reverse power for braking purposes.

374 Energy flow interrupted when motor stops:

This subclass is indented under subclass 373. Subject matter in which means are provided for interrupting the flow of energy to the motor substantially at the time that the motor speed is reduced to zero.

(1) Note. The termination of the flow of electric energy to an electric motor as the motor speed substantially reaches zero is considered part of the operation of braking and not another motor control operation, such as automatic stopping of the motor; and hence, such systems are not considered combined braking and automatic stopping systems but rather merely a braking system, per se.

SEE OR SEARCH THIS CLASS, SUBCLASS:

461, for motor systems having automatic control means for merely stopping the motor when the speed of the motor falls below a predetermined value.

519, for motor systems having an armature or primary circuit making and/or braking device for stopping the motor.

375 Dynamic braking:

This subclass is indented under subclass 362. Subject matter in which the motor to be controlled is braked as a result of the motor being converted into an electric generator, which supplies electric energy to an electric circuit.

(1) Note. An electric motor to be controlled can be converted into an electric generator (1) merely as a result of change in the operating conditions (such as mere change in speed of the motor so that its c.e.m.f. exceeds the applied voltage), (2) by appropriately changing the electric circuits of the motor, or (3) by properly changing the circuit constants in existing motor circuits so that the c.e.m.f. generated by the motor exceeds any value of voltage applied to the motor. An electric motor is converted to a braking generator whenever the generated e.m.f. within the motor exceeds in magnitude the opposing potentials, if any, that are applied to the motor and whenever the generating circuit is simultaneously connected to a closed electric circuit. The "closed electric circuit" may comprise a low resistance (dead) short circuit, a useful-load circuit (including the circuit which supplies the electric energy to the motor during motoring operation) or a purely resistive (dissipating) circuit.

SEE OR SEARCH THIS CLASS, SUBCLASS:

87, for dynamic braking of two or more electric motors.

373, for miscellaneous systems for "plugging" (application of reverse power) an electric motor.

759, for dynamic braking of an induction motor.

763, for "plugging" (application of reverse power) of an induction motor.

SEE OR SEARCH CLASS:

105, Railway Rolling Stock, subclass 49 (particularly noting subclass 61) for dynamic braking of electric locomotives.

180, Motor Vehicles, subclass 65 for vehicles having electric motors to supply the motive power and wherein dynamic braking may be effected to retard the vehicle.

188, Brakes, subclass 159 for electric operators for braking devices in which the operator therefor is energized by motors operating as generators.

310, Electrical Generator or Motor Structure, subclass 93 for dynamoelectric brakes.

322, Electricity: Single Generator Systems, for generation systems, per se, and the controls therefor.

376 Regenerative:

This subclass is indented under subclass 375. Subject matter in which means are provided for returning or delivering the electrical energy generated in the motor while operating as a generator to the circuit which supplies the electric energy to the motor when operating as a motor.

(1) Note. This type of braking is commonly referred to as "regenerative" to "recuperative" braking.

377 With additional source of e.m.f.:

This subclass is indented under subclass 376. Subject matter in which means are provided for producing a voltage comprising means other than that which constitutes the source of armature or primary circuit voltage for the motor when operating as a motor and other than the motor itself when operating as a generator during braking.

SEE OR SEARCH THIS CLASS, SUBCLASS:

89, for braking in plural motor systems wherein one or more motors are converted into generators for supplying exciting current to other motors operating as generators.

378 In series with armature or primary circuit:

This subclass is indented under subclass 377. Subject matter in which means are provided for connecting the additional source of e.m.f. in series with the armature or primary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

440, and the subclasses specified in the Notes thereto, for other motor control systems in which two or more diverse sources of supply are used for electric motors.

500, and the subclasses specified in the Notes thereto, for other motor control systems in which two or more electrical sources of supply are connected electrically in series with each other and in series with the armature or primary winding of the motor.

379 Locally closed armature circuit:

This subclass is indented under subclass 375. Subject matter in which means are provided for immediately connecting the terminals of the generating circuit of the motor through an electrical circuit, with or without additional control or dissipative devices in the last named circuit.

(1) Note. Where the motor is connected to supply energy to a distribution circuit adapted to supply various and sundry electrical devices and appliances at remote or indefinite points, classification is not herein. See Class 307, Electrical Transmission or Interconnection Systems, subclass 11.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 11, see (1) Note above.

380 Closed through impedance or the like:
This subclass is indented under subclass 379. Subject matter in which impedance devices or other current-controlling devices are connected in the locally closed circuit.

(1) Note. Where the "other current-controlling device" is a useful electric load device for performing some useful purpose other than as a mere current-controlling device, classification is not herein. For example, where the load device is a light generating device used for illumination purposes or is a secondary battery in which energy is stored indefinitely for any purpose, classification is not herein. See Class 307, electrical Transmission or Interconnection Systems, subclass 11.

SEE OR SEARCH THIS CLASS, SUBCLASS:
508, and the subclasses specified in the Notes thereto, for other motor control systems wherein impedance devices are connected in the armature or primary circuit of the motor.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclass 11, see (1) Note above.

381 With field or secondary circuit control:
This subclass is indented under subclass 379. Subject matter in which means are provided for controlling the field or secondary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
493, and the subclasses specified in the Notes thereto, for other motor control systems having both armature circuit control and field circuit control.
521, and the subclasses specified in the Search Notes thereto, for other motor control systems having field or secondary circuit control.

382 By auxiliary electric generator or by magnetic attraction or repulsion devices:
This subclass is indented under subclass 362. Subject matter in which the braking means comprise (1) an electric generator connected to be driven by the motor for the purpose of braking the motor or (2) Magnetic-Flux-producing means which operate directly through the agency of the flux, per se, to oppose, by magnetic repulsion or by magnetic attraction, the tendency of the motor to continue in motion, if in motion, or to move if not in motion.

(1) Note. Magnetic operators for other types of brakes (e.g., friction, fluid, etc.) are not included herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:
375, for systems wherein the motor itself is converted into an electric generator to operate as a braking means.

SEE OR SEARCH CLASS:
188, Brakes, subclass 104 for means for braking devices in general by means of generators or other magnetic devices.
322, Electricity: Single Generator Systems, subclass 39 and the subclasses specified in the Notes thereto for generator systems having a motor driven generator.
388, Electricity: Motor Control Systems, art collection 931 for single motor running-speed control systems wherein a generator is driven by the motor, while the motor is electrically energized, which generator acts as a retarding or braking means to affect the running-speed of the motor.

383 "ANTI-BRAKING" OR BRAKING-PREVENTION MEANS:
This subclass is indented under the class definition. Subject matter in which means are provided for preventing braking of an electric motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
362, and the subclasses specified in the Notes thereto, for means for merely

applying or removing the brakes (brake operators) from electric motors, and see indented subclasses.

364, and 365, for motor braking systems having means for merely delaying the application of braking to an electric motor.

SEE OR SEARCH CLASS:

188, Brakes, subclasses 105 through 189 for brake operators, per se.

400.01 Brushless motor closed-loop control:

This subclass is indented under subclass 700. Subject matter for controlling the currents or voltages in (or supplied to) the motor phases (or windings) to control motor performance (or produce torque) without motor-controlled mechanical switches (i.e., commutators, brushes, slip rings, etc.) by generating a feedback signal in response to any motor parameter (e.g., speed, position, load, torque, current, voltage, acceleration, etc.) and controlling the motor in response to the feedback signal.

(1) Note. Brushless motors are often called "self-commutating" motors.

(2) Note. This subclass may also include subject matter wherein the motor is controlled by an additional or remote parameter signal (e.g., light, temperature, fluid flow, position of a work piece, etc.). However, in this case, the motor is also controlled by a feedback signal in response to any motor parameter (e.g., speed, position, torque, load, current, voltage, acceleration, etc.).

SEE OR SEARCH CLASS:

388, Electricity: Motor Control Systems, subclasses 800 through 824 for closed-loop speed control of motors having commutators and subclasses 842-847 for closed-loop acceleration control of motors having commutators.

400.02 Vector control (e.g., dq-axis control, 3-2 phase conversion, etc.):

This subclass is indented under subclass 400.01. Subject matter in which the feedback loop includes a means to convert multiphase currents or voltages supplied to the motor phases (or windings) to a two-phase representation of a related motor parameter (e.g., flux, rotor angle current vector, etc.) which is used to control the motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 151 for miscellaneous electrical conversion systems.

341, Coded Data Generation or Conversion, appropriate subclasses for conversion of data, per se.

363, Electric Power Conversion Systems, subclasses 1 through 12 for frequency and phase converters and subclass 150 for phase conversion using dynamoelectric machines.

400.03 Plural reference comparison (e.g., reference changes during startup, upper/lower reference, etc.):

This subclass is indented under subclass 400.01. Subject matter in which the feedback signal is compared against more than one reference value.

400.04 Specific processing of feedback signal or circuit therefore (i.e., A-D conversion, compression, or modification):

This subclass is indented under subclass 400.01. Subject matter in which the feedback signal is altered, modified, or converted.

(1) Note. This subclass does not include nominally recited feedback circuits or processes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

615, for auxiliary feedback loops in a servomotor control circuit.

667, for a bridge feedback circuit.

SEE OR SEARCH CLASS:

73, Measuring and Testing, for measuring (or sensing) nonelectrical parameters.

324, Electricity: Measuring and Testing, subclasses 160 through 180 for electrical speed measuring.

361, Electricity: Electrical Systems and Devices, subclasses 236 through 244 for speed measurements and signal processing thereof.

388, Electricity: Motor Control Systems, subclasses 923 through 934 for specific feedback circuits for motors having commutators.

400.05 With reference signal generation (e.g., from external system, mechanical oscillator, etc.):
This subclass is indented under subclass 400.04. Subject matter comprising a circuit or method for obtaining or generating a parameter or value (i.e., the reference signal) by which a feedback signal can be compared.

SEE OR SEARCH THIS CLASS, SUBCLASS:

449, for automatic motor control with respect to a fixed standard.

451, for motor control via a mechanical reference, such as a tuning fork.

400.06 Comparator circuit or method:
This subclass is indented under subclass 400.04. Subject matter comprising a circuit or technique by which to compare the motor feedback signal with a reference or value.

SEE OR SEARCH THIS CLASS, SUBCLASS:

601, for digital comparison techniques in servo systems.

607, and 608, for frequency and phase comparison techniques in servo systems.

400.07 Plural diverse feedback (e.g., torque and speed, load and speed, etc.):
This subclass is indented under subclass 400.04. Subject matter wherein two or more motor conditions or parameters are detected and used as feedback signals.

(1) Note. The use of plural feedback circuits measuring the same parameter does not qualify to be included in this subclass (e.g., speed measurement for each phase of a three-phase motor).

SEE OR SEARCH THIS CLASS, SUBCLASS:

601, for digital comparison techniques in servo systems.

607, and 608, for frequency and phase comparison techniques in servo systems.

400.08 With nonmotor parameter or remote condition detected (e.g., temperature, light, airflow, position of diverse object, etc.):
This subclass is indented under subclass 400.04. Subject matter in which the control signal is a function of a condition spatially separate from the motor structure.

(1) Note. In the case of light sensing, this subclass does not include subject matter where optical means are used to sense rotor position for feedback to the commutation control circuit.

(2) Note. The motor shaft is a part of the motor structure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

400.4, for light sensing of rotor position.

471, for automatic motor control via thermal conditions.

638, through 670, for "error" detecting means, especially subclass 641 for temperature, subclass 643 for moisture, and subclass 644 for flow.

SEE OR SEARCH CLASS:

73, Measuring and Testing, for measuring (or sensing) nonelectrical parameters.

324, Electricity: Measuring and Testing, for measuring (or sensing) electrical parameters.

400.09 Plural mode control (e.g., open and closed loop, starting and braking, plural-phase and single-phase operation, open and closed loop, etc.):
This subclass is indented under subclass 400.01. Subject matter in which the motor is controlled in more than one distinct set or range of operational characteristics (e.g., high/low speed, forward/reverse, running/braking, high/low torque, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

255, through 279, for plural motor control systems.

362, through 382, for motor braking systems.

590, through 598, for multiple mode servo systems.

400.1 With timing or delay:

This subclass is indented under subclass 400.09. Subject matter in which a second mode of operation is initiated after a specified period of time.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445, through 489, for automatic motor control with a time-delay means (e.g., automatic starting or stopping).

400.11 With separate starting mode or "ramp-up" mode (e.g., open-loop control for startup, startup initialization, etc.):

This subclass is indented under subclass 400.09. Subject matter wherein the motor is controlled with one distinct set or range of operational characteristics prior to reaching running speed and a second set or range of operational characteristics at running speed.

(1) Note. Running speed is any speed for which the motor was designed to operate. A separate starting mode may, for example, be used to quickly establish a speed (by supplying more torque), prevent over-current situations (when starting from standstill), or to establish a set of starting parameters (e.g., position, etc.).

400.12 With table lookup, stored map, or memory table (e.g., speed table, stored current profile, etc.):

This subclass is indented under subclass 400.09. Subject matter wherein the control information for each of the plural modes is predetermined and stored in a table, map, or memory.

SEE OR SEARCH THIS CLASS, SUBCLASS:

567, for program- or pattern-controlled servo systems.

400.13 With timing, delay, or clock pulse counting circuit or generation:

This subclass is indented under subclass 400.01. Subject matter wherein a means by which a temporal assessment is used within the feedback system to provide control.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445, through 489, for automatic motor control with a time-delay means (e.g., automatic starting or stopping).

484, for time-delay means in automatic motor control systems.

400.14 Phase shifted as function of speed or position:

This subclass is indented under subclass 400.13. Subject matter wherein the currents or voltages to the motor phases or windings are advanced and/or made to lag in accordance with detected speed and/or position.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for the miscellaneous systems for controlling phase angle or voltage and/or current magnitude, and for the miscellaneous transformer and impedance systems.

400.15 With torque or load determination (e.g., by calculation, detection, or estimation, etc.):

This subclass is indented under subclass 400.01. Subject matter wherein the rotational force of the motor or resistance to rotation is determined by calculation, estimation, or detection.

400.16 Control or position information digitally stored on disk (e.g., computer hard drive position detection, etc.):

This subclass is indented under subclass 400.01. Subject matter wherein information concerning the position or control of the motor is digitally stored on a computer disk (e.g., a hard drive).

(1) Note. This subclass does not include disk control systems, per se.

SEE OR SEARCH CLASS:
720, Dynamic Optical Information Storage or Retrieval, for optical disks, per se.

400.17 Modification or waveshaping of switching control signal (e.g., switching control input to inverter, etc.):
This subclass is indented under subclass 400.01. Subject matter in which switching control signals used to control motor performance (or produce torque) are processed, modified, manipulated, or generated.

(1) Note. Typically, these "switching control signals" are used to control the inverter switches. This subclass does not pertain to the currents or voltages sent to the motor windings, but instead pertains to the signals that control or cause the currents or voltages to be sent to the motor windings.

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclass 106 for waveform determinative or pulse-producing systems.
327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 100 through 333 for signal or waveform converting, shaping, or generating.
388, Electricity: Motor Control Systems, subclass 915 for waveform generators used to control motors with commutators.

400.18 With manual control (e.g., foot switch, surgical tool, etc.):
This subclass is indented under subclass 400.01. Subject matter wherein a human operator provides motor control via an interface.

SEE OR SEARCH THIS CLASS, SUBCLASS:
551, for foot- or knee-controlled motor systems.

400.19 Slew rate control (e.g., slew limiting, etc.):
This subclass is indented under subclass 400.01. Subject matter wherein the time rate of change (or gradient) of voltage or current in either the phase windings or in a circuit for controlling the voltages or currents is varied or regulated.

(1) Note. Slew rate control is often employed to prevent switching transients, electromagnetic interference, and noise.

400.2 Phase voltage wave-shaping circuit or method (e.g., output from inverter, phase energizing signal, trapezoidal wave, etc.):
This subclass is indented under subclass 400.01. Subject matter in which the energy supplied to the motor field windings is modified and/or altered to achieve a desired result (e.g., wave shaping the drive pulses).

SEE OR SEARCH THIS CLASS, SUBCLASS:
43, for inverter input waveshaping (i.e., waveshaping ciruits for driving the inverter).

SEE OR SEARCH CLASS:
307, Electrical Transmission or Interconnection Systems, subclass 106 for waveform determinative or pulse-producing systems.
327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 100 through 333 for signal or waveform converting, shaping, or generating.
388, Electricity: Motor Control Systems, subclass 915 for waveform generators used to control motors with commutators.

400.21 Having protection means (e.g., switching circuit protection, stall protection, failure to start, "wrong" direction, etc.):
This subclass is indented under subclass 400.01. Subject matter in which any part of the motor, switches, feedback system, and/or commutation control hardware is protected against adverse effects.

SEE OR SEARCH THIS CLASS, SUBCLASS:

563, through 566, for servo systems having protective features.

706, and 707, for motor synchronization systems wherein failure to synchronize is determined.

SEE OR SEARCH CLASS:

361, Electricity: Electrical Systems and Devices, subclasses 1 through 138 for safety and protection of systems and devices.

400.22 Current or voltage limiting (e.g., over-voltage or over-current protection, etc.):

This subclass is indented under subclass 400.21. Subject matter in which current and/or voltage is limited, reduced, or compensated to prevent failure or malfunction.

SEE OR SEARCH THIS CLASS, SUBCLASS:

635, for current or voltage limiting in servomotors.

SEE OR SEARCH CLASS:

361, Electricity: Electrical Systems and Devices, subclasses 1 through 138 for safety and protection of systems and devices, especially subclass 93.9 for current limiting.

400.23 Torque ripple stabilization or acoustic noise attenuation (e.g., cogging prevention, etc.):

This subclass is indented under subclass 400.01. Subject matter in which the sound or mechanical vibration of the motor is attenuated or eliminated (or otherwise modified) and/or the motor torque is stabilized and variations are reduced.

SEE OR SEARCH THIS CLASS, SUBCLASS:

128, for controlling motor in response to noise, sound, vibration, or position of a motor.

400.24 Electrical noise attenuation (e.g., EMI, EMR, RFI, etc.):

This subclass is indented under subclass 400.01. Subject matter for reducing or eliminating electromagnetic radiation or electrical disturbances (e.g., transients or perturbations) which interfere with desired operation (e.g., feedback signal) of the motor.

SEE OR SEARCH CLASS:

200, Electricity: Circuit Makers and Breakers, subclass 19.4 for noise-preventing switching.

361, Electricity: Electrical Systems and Devices, subclass 800 for shielding structures.

400.25 Switching noise transient attenuation (e.g., switching error prevention, masking, blanking, etc.):

This subclass is indented under subclass 400.24. Subject matter in which the electrical disturbances or transients that result from transistor (i.e., in the inverter) switching during motor control are reduced or eliminated.

SEE OR SEARCH CLASS:

200, Electricity: Circuit Makers and Breakers, subclass 19.4 for noise-preventing switching.

361, Electricity: Electrical Systems and Devices, subclass 800 for shielding structures.

400.26 Switching circuit structure or component (e.g., inverter, bridge circuit, etc.):

This subclass is indented under subclass 400.01. Subject matter directed to circuits to make or break (i.e., switches) the electrical power to the windings.

(1) Note. This subclass includes single-phase inverters.

(2) Note. This subclass also includes the rectifier circuit commonly associated with inverter circuits to rectify an ac source to dc for use by the inverter switches.

SEE OR SEARCH CLASS:

200, Electricity: Circuit Makers and Breakers, for switches, per se.

363, Electric Power Conversion Systems, subclasses 135 through 139 for inverter systems (e.g., having thyristor).

400.27 Having both high-side and low-side switching elements for plural-phase motor:

This subclass is indented under subclass 400.26. Subject matter having a means to connect and disconnect a motor winding to a power supply (i.e., the high-side switching elements) and to connect and disconnect a motor winding to ground (i.e., the low-side switching elements).

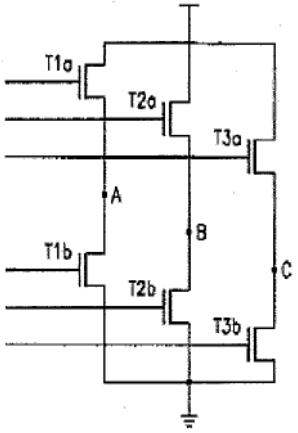


Figure 1. T1a, T2a, and T3a are high-side switching elements;T1b, T2b, and T3b are low-side switching elements; and A, B, andC indicate connections to the motor windings

SEE OR SEARCH CLASS:

363, Electric Power Conversion Systems, subclasses 135 through 139 for inverter systems (e.g., having thyristor).

400.28 Diverse high side or low side switching:

This subclass is indented under subclass 400.27. Subject matter wherein the means to connect and disconnect a motor winding to a power supply (i.e., the high-side switching elements) and the means to connect and disconnect a motor winding to ground (i.e., the low-side switching elements) are controlled in a different manner or by a different method.

SEE OR SEARCH CLASS:

363, Electric Power Conversion Systems, subclasses 135 through 139 for inverter systems (e.g., having thyristor).

400.29 H-bridge type:

This subclass is indented under subclass 400.26. Subject matter in which the motor is connected between two switches for connecting the motor to a voltage supply (high-side switching elements) and two switches for connecting the motor to ground (low-side switching elements).

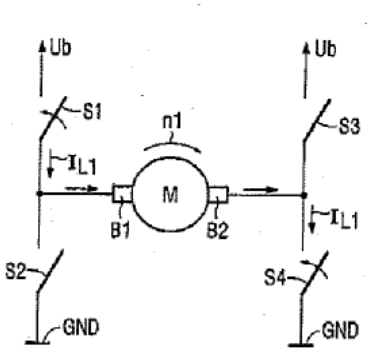


Figure 1. S1 and S3 are high-side switching elements; andS2 are S4 are low-side switching elements.

400.3 Power supply voltage feature (e.g., power supply voltage, V_{cc} compensation, rectifier circuit, power regulator, auxiliary or secondary power supply, etc.):

This subclass is indented under subclass 400.01. Subject matter pertaining to the supply of voltage or current to a circuit for controlling the motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 149 through 157 for miscellaneous "power pack" systems.

315, Electric Lamp and Discharge Devices: Systems, subclasses 91 through 93 for cathode or cathode heater including anode supply circuit but not including any grid-biasing circuit.

323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for the miscellaneous systems for controlling phase angle or voltage and/or current magnitude, and for the miscellaneous transformer and impedance systems.

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 530 through 550 for miscellaneous circuits combined with power supply or bias means.

363, Electric Power Conversion Systems, appropriate subclasses for inverter and/or converter systems.

400.31 Utilization or dissipation of stored or collapsing field energy (e.g., freewheeling, discharging one winding through another, etc.):
This subclass is indented under subclass 400.01. Subject matter wherein energy stored in a motor winding is controlled, modified, dissipated, or used.

400.32 Sensorless feedback circuit:
This subclass is indented under subclass 400.01. Subject matter in which motor parameters (e.g., rotor position, speed, etc.) are determined by measuring phase current or voltage.

(1) Note. While phase currents and voltages are "sensed," per se, sensors typically refer to physical units attached to the motor (or rotor) (e.g., Hall effect sensors, tachometers, etc.). Therefore, sensorless motors are those without the physical unit attached to the motor (or rotor).

SEE OR SEARCH THIS CLASS, SUBCLASS:

615, for auxiliary feedback loops in a servomotor control circuit.

667, for a bridge feedback circuit.

SEE OR SEARCH CLASS:

73, Measuring and Testing, for measuring (or sensing) nonelectrical parameters.

324, Electricity: Measuring and Testing, subclasses 160 through 180 for electrical speed measuring.

361, Electricity: Electrical Systems and Devices, subclasses 236 through 244 for speed measurements and signal processing thereof.

388, Electricity: Motor Control Systems, subclasses 923 through 934 for specific feedback circuits for motors having commutators.

400.33 Voltage injection detection (e.g., voltage injected at startup to determine position, etc.):
This subclass is indented under subclass 400.32. Subject matter wherein a usually small or test voltage (typically not large enough to generate torque) is applied to (i.e., "injected") the motor winding to determine position.

(1) Note. This is typically done to determine motor position prior at startup.

400.34 Electromotive force sensor (e.g., back or counter EMF sensor, etc.):
This subclass is indented under subclass 400.32. Subject matter in which phase EMF is detected to determine a motor attribute (e.g., rotor position and/or speed) which is fed back to provide commutation control data.

(1) Note. Back-EMF (or BEMF or counter-EMF or CEMF), is the voltage produced across motor windings, due to the winding turns (of the rotor/armature) passing through a magnetic field (of the stator/field), during rotation of the motor. The back-EMF is directly proportional to rotor velocity and opposite in polarity to the applied voltage. This static voltage arises from the generator action in a motor, even if the motor windings are not energized.

SEE OR SEARCH THIS CLASS, SUBCLASS:

459, for automatic motor control with time-delay using counter-electromotive force of controlled motor.

SEE OR SEARCH CLASS:

73, Measuring and Testing, for measuring (or sensing) nonelectrical parameters.

324, Electricity: Measuring and Testing, subclasses 160 through 180 for electrical speed measuring.

361, Electricity: Electrical Systems and Devices, subclasses 236 through 244 for speed measurements and signal processing thereof.

388, Electricity: Motor Control Systems, subclasses 923 through 934 for specific feedback circuits for motors having commutators.

400.35 With zero-crossing detection (e.g., polarity reversal, etc.):
This subclass is indented under subclass 400.34. Subject matter in which a polarity reversal (i.e., a change in sign) in an induced voltage or current in an undriven winding/coil is determined or sensed.

400.36 With center-tap feedback circuit:
This subclass is indented under subclass 400.32. Subject matter in which motor field windings are electrically connected to a common point and electrical parameters (i.e., current and/or voltage) are determined from the common point.

400.37 With sensor structure (e.g., tachometer, reed switch, cam-controlled switching, etc.):
This subclass is indented under subclass 400.01. Subject matter in which any motor parameter (e.g., speed, position, etc.) is generated into a feedback signal.

(1) Note. Here, the sensor is more than a sensing circuit and typically includes a physical unit attached to the motor, motor shaft, or any other structure and capable of determining a motor parameter.

(2) Note. In "sensorless" motors, motor parameters are determined by the use of a measuring circuit and not some physical unit attached to the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
463, for automatic motor control using a tachometer.

SEE OR SEARCH CLASS:
322, Electricity: Single Generator Systems, subclass 31 for tachometer devices.

400.38 Magnetic field sensor or responsive device (e.g., Hall element, magneto-resistance, etc.):
This subclass is indented under subclass 400.37. Subject matter in which a magnetic field is used to determine a motor parameter (e.g., position, speed, etc.).

SEE OR SEARCH CLASS:
73, Measuring and Testing, subclass 514.31 for inductive or magnetic sensing.
335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, appropriate subclasses for a magnet or an electromagnet, per se.
336, Inductor Devices, subclass 30 for an inductor device having an acceleration responsive inductance adjusting means.

400.39 Rotating sensor component separate from motor structure (e.g., resolver, magnetically sensed rotating disk, etc.):
This subclass is indented under subclass 400.38. Subject matter wherein the magnetic field is generated remotely (i.e., separately) from the motor structure (e.g., detected from a rotating disk attached to a shaft turned by the motor rotor).

SEE OR SEARCH THIS CLASS, SUBCLASS:
605, for the use of resolvers in servo systems.

400.4 Optical sensor (e.g., encoder, photodetector, etc.):
This subclass is indented under subclass 400.37. Subject matter wherein light or radiant energy is used to determine the motor parameter (e.g., position or speed, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:
577, for optical line followers for servo systems.
640, for photoelectric "error" detecting systems.

400.41 Having specific motor structure (e.g., bifilar windings, airgap dimension, auxiliary winding, phase winding with midtap, etc.):
This subclass is indented under subclass 400.01. Subject matter wherein the motor being controlled has a structural characteristic or feature (e.g., an element or dimension, etc.) that enhances, modifies, or otherwise affects motor performance.

(1) Note. The intent of this subclass is to include subject matter other than the controlling circuitry.

SEE OR SEARCH THIS CLASS, SUBCLASS:
491, for motor control of both circuit and motor structure.
538, through 542, for motor structure adjustment control.

400.42 Brushless motor open-loop control:
This subclass is indented under subclass 700. Subject matter for controlling the currents or voltages in (or to) the motor phases (or windings) to control motor performance (or produce torque) without motor-controlled mechanical switches (i.e., commutators, brushes, slip rings, etc.) and without feedback of any motor parameter.

(1) Note. This subclass contains documents that control a motor without the use of specific feedback parameters, such as position, speed, torque, load, voltage, current, etc.

(2) Note. Brushless motors are often called “self-commutating” motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:
34, through 113, for plural, diverse, or diversely controlled motors.
362, through 382, for motor braking.
560, through 688 , for servo system motors (e.g., stepper motors, etc.).
700, through 724, for synchronous motors.
727, through 832, for induction motors.

SEE OR SEARCH CLASS:
388, Electricity: Motor Control Systems, subclasses 825 through 841 for open-loop speed control of motors having commutators and subclasses 848-860 for open-loop acceleration control of motors having commutators.

430 MOTOR LOAD, ARMATURE CURRENT OR FORCE CONTROL DURING STARTING AND/OR STOPPING:
This subclass is indented under the class definition. Subject matter in which means are provided for controlling the mechanical load actuated by the motor or for controlling the motor armature or primary current, torque or force during the starting and/or the stopping period of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
255, for this subject matter where there is motor load control combined with automatic starting and/or stopping of the motor.

SEE OR SEARCH CLASS:
388, Electricity: Motor Control Systems, subclasses 842+ and 848+ for single motor acceleration control systems with, and without, feedback, respectively.

431 Initial, "cracking" or "starting from rest" torque control:
This subclass is indented under subclass 430. Subject matter in which means are provided for controlling the motor torque at the instant of starting in order to insure that the motor torque is great enough to overcome the starting-from-rest or static friction opposition to motor movement.

432 CONSTANT MOTOR CURRENT, LOAD AND/OR TORQUE CONTROL:
This subclass is indented under the class definition. Subject matter in which means are provided for maintaining substantially constant the magnitude of the motor armature or primary current, the watts supplied to the motor, the mechanical load connected or applied to the motor, or the torque or force exerted by the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

434, for motor systems in which means are provided for preventing the load driven by the motor, the motor current, or the watts supplied to the motor, or the torque exerted by the motor from exceeding a predetermined maximum or a minimum value. Where the system includes means to prevent the motor load, motor current, watts or torque from exceeding both a maximum and minimum value, the patent is classified in this subclass 432.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for constant current systems in general.

433 Control of motor load or device driven:

This subclass is indented under subclass 432. Subject matter in which means are provided for maintaining a constant motor current, load, and/or torque control by controlling the physical load device actuated by the motor.

434 LIMITATION OF MOTOR LOAD, CURRENT, TORQUE OR FORCE (E.G., PREVENTING OVERLOAD):

This subclass is indented under the class definition. Subject matter in which means are provided for preventing the load connected or applied to the motor, the armature or primary current of the motor, the watts supplied to the motor, or the torque or force exerted by the motor from merely exceeding a predetermined maximum or predetermined minimum value.

SEE OR SEARCH THIS CLASS, SUBCLASS:

432, for this subject matter where the system includes means for preventing the motor current, load, or the torque or force exerted by the motor, from exceeding both a predetermined maximum and minimum value.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 274 and 284 for regulators with threshold detection.

436 NONRUNNING, ENERGIZED MOTOR:

This subclass is indented under the class definition. Subject matter in which means are provided for energizing an electric motor to produce a substantial output force or torque which is insufficient under prevailing conditions to cause the motor to start.

(1) Note. This subclass is designed to include mere torque or force producing motors which, under the conditions of loading, cannot cause the useful load device to move appreciably, other than to effect a mere slack, play or back-lash take-up movement, but which motor nevertheless exerts a sustained torque or force on the load device.

SEE OR SEARCH THIS CLASS, SUBCLASS:

6, for motor systems specifically limited to maintain a tension in a cable, belt, strand or strip material under running or stationary conditions.

40, for plural motors systems having at least one motor biased against rotation.

159, for motor systems having means (other than a useful load device) for biassing the motor against rotation.

430, for motor systems having means for controlling the motor torque at the starting period to insure that the motor will start, and for motor systems having means for stalling or overloading the motor while the motor is energized.

SEE OR SEARCH CLASS:

324, Electricity: Measuring and Testing, subclass 98 for electric meters wherein the motive-power element of the meter is energized to exert torque on a non-moving pointer to hold it in an indicating position.

388, Electricity: Motor Control Systems, subclasses 848+ for single motor acceleration control systems wherein a motor is energized while stationary, but which motor immediately starts and controllably accelerates to a running condition.

437 PHASING OR ANGULAR OR LINEAR POSITIONAL CONTROL OF MOVABLE ELEMENT OF THE MOTOR:

This subclass is indented under the class definition. Subject matter in which means are provided for positioning or phasing the movable (working) element on an electric motor with reference to some object, fixed or in motion, or with reference to cyclic conditions or time.

SEE OR SEARCH THIS CLASS, SUBCLASS:

18, for follow-up systems of electric motor control wherein a motor is positioned relatively to a transmitting or controlling member or with reference to a predetermined condition.

41, for this subject matter where one motor is in predetermined relative position with respect to another motor by means of electrical synchronizing interconnections between the motors.

45, for this subject matter where two or more motors are mechanically coupled together so that their movable elements are constrained to maintain a predetermined relative phase or angular position with respect to each other.

68, for this subject matter where one motor has its speed and/or phase relationship controlled with respect to another motor under running speed conditions.

85, for miscellaneous motor systems having means for synchronizing, resynchronizing or phasing control of two or more electric motors.

136, for motor systems having means for starting or accelerating motors other than by electrical energization of the motor, including means for synchronizing or phasing the motors relative to an AC source of supply to which the motors are to be connected.

466, for motor systems having means for automatically stopping a motor when it reaches a predetermined position.

438 POWER FACTOR CONTROL OF ARMATURE OR LINE CIRCUIT:

This subclass is indented under the class definition. Subject matter in which means are provided for controlling the power factor (i.e., the phase angle between the line voltage and resulting line current which is supplied to the primary circuit) of the energy supplied by an alternating current source to the armature or primary circuit of an electric motor.

(1) Note. For the combination of power factor control and one or more motor operations control, see appropriate subclass for the particular operations control. Power factor control is not such a control as is combinable with other controls to constitute plural diverse controls.

SEE OR SEARCH THIS CLASS, SUBCLASS:

165, for motor systems having synchronous motor control, particularly field-circuit control, which may modify the power factor of the energy supplied to the motor. Particularly note subclass 179 for synchronous motor systems having automatic control means which is responsive to power factor, phase angle, power, or watts in the motor armature circuit.

508, and the subclasses specified in the Notes to the definition thereof for miscellaneous motor systems having the armature circuit controlled by means of impedances (reactors, condensers, etc.) in the armature circuit.

729, and the subclasses listed in the Search Notes thereto, for power factor control in induction motor systems.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 205 through 211 for power factor control systems.

440 HAVING PLURAL, DIVERSE OR DIVERSELY CONTROLLED SOURCES:

This subclass is indented under the class definition. Subject matter in which two or more sources of electrical energy are provided for the armature or primary circuit of electric motors one or more of said sources (1) having one or more characteristics (e.g., size, frequency, voltage, etc.) which are substantially different from one or more corresponding characteristics of one or more others of the sources, or (2) are controlled substantially differently (e.g., with respect to time, degree of control, type of control means, etc.) from one or more others of the sources.

(1) Note. Where a plurality of sources are connected in electrical series, or in series, or in series parallel in the armature or primary circuit of a motor, there being no significant diverse characteristics of the sources claimed or no different control of the sources claimed, the patent is excluded from this subclass. See subclass 504 and the subclasses specified in the Notes to the definition of that subclass for such excluded subject matter.

SEE OR SEARCH THIS CLASS, SUBCLASS:

105, for motor systems having plural diverse, or diversely controlled sources of armature or primary circuit supply for plural motors.

119, and 123, for motor systems having a polyphase source of supply for a reciprocating or oscillating motor.

149, for motor systems having plural, diverse or diversely controlled generators for supplying electric energy to the armature or primary circuits of motors.

248, for motor systems having plural, diverse or diversely controlled sources of e.m.f. for a series motor.

500, see Note 1 above. 731, for motor systems having plural sources of supply for an induction motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 18 for systems interconnecting a plurality of sources of electrical energy so that they supply a plurality of load devices or load circuits; subclass 43 for systems interconnecting a plurality of sources of electrical energy so that they can supply a common load or load circuit.

315, Electric Lamp and Discharge Devices: Systems, subclass 86 for automatic substitution of power supply; subclass 137 for polyphases source of supply; subclass 160 for plural power supplies, all for lamp or space-discharge device systems.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclasses, particularly subclass 138, for a plural source of supply for a battery or condenser in a charging or discharging system.

441 A.C. and D.C.:

This subclass is indented under subclass 440. Subject matter in which one or more of the sources are an alternating current type of source and one or more others of which are a direct current type of source.

(1) Note. A pulsating source in which the instantaneous polarity never reverses is classified as a direct current source.

SEE OR SEARCH THIS CLASS, SUBCLASS:

107, for plural motor systems having AC and DC sources of supply.

442 Different voltages:

This subclass is indented under subclass 440. Subject matter in which one or more of the sources have a different (effective value) voltage than one or more others of the sources.

SEE OR SEARCH THIS CLASS, SUBCLASS:

108, and 109, for plural motor systems having plural sources of supply one or more of which sources have a voltage which is different (in effective value)

than the voltage of one or more others of the sources.

443 PERIODIC, REPETITIOUS OR SUCCESSIVE OPERATIONS CONTROL OF MOTOR, INCLUDING "JOG" AND "INCH" CONTROL:

This subclass is indented under the class definition. Subject matter in which means are provided for effecting a motor operation two or more times in succession at regular or irregular intervals of time.

(1) Note. This subclass includes those systems of repetitious, periodic, or successive operations of a motor in which once the operation of the motor is initiated, either manually or automatically, the operation will take place a plurality of times by virtue of the inherent law or mode of operation of the control means.

(2) Note. Where the operation is controlled by some condition-sensitive device and the operation is effected each time a predetermined condition exists but where the condition may or may not exist so that as a result the operation may or may not occur or take place, classification is not herein but in some other appropriate subclass. See subclass 445 herein below, and the subclasses listed in the Search Notes thereto.

SEE OR SEARCH THIS CLASS, SUBCLASS:

102, for motor systems having means for successively starting and/or stopping or for periodically or repeatedly starting and/or stopping two or more electric motors.

119, for this subject matter where the motor is a reciprocating or oscillating electric motor which is periodic or repetitious in its operation by virtue of its normal mode of operation (i.e., its working or useful output member periodically stops and reverses).

162, for pattern, template, perforated sheet or other predetermined schedule means which can be operated to give repeated or cyclic motor operation controls.

281, for motor systems having means for periodically reversing a motor.

431, for motor systems having means for repeatedly applying starting impulses to a motor to overcome starting friction.

444 Variable periods or intervals between controlling operations:

This subclass is indented under subclass 443. Subject matter in which means are provided for changing the periodicity or time interval of different motor operations.

445 AUTOMATIC AND/OR WITH TIME-DELAY MEANS (E.G., AUTOMATIC STARTING AND/OR STOPPING):

This subclass is indented under the class definition. Subject matter in which (1) means are provided for sensing the existence of or the magnitude of a predetermined condition (e.g., temperature, time, speed of a device, etc.) combined with means for controlling the motor and in which the sensing means initiates the operation of the motor control means upon the occurrence of the predetermined condition; and/or (2) in which time-delay or retarding means are provided for retarding or delaying the operation of the motor control means whether the operation is initiated manually or automatically.

(1) Note. This subclass and the subclasses indented hereinunder will be the places where automatic starting and/or stopping, per se, of electric motors will be classified. See the class definition for automatic starting and/or stopping of electric motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

18, for electric motor follow-up systems in which a motor starts (including automatic starting in response to a change in a condition) and automatically stops when motor moves a distance proportional to the degree of movement of a controller or to the degree of change of a condition.

69, for speed difference detectors in plural motor systems for automatically controlling the relative speeds of the

motors in response to a difference in speed between the motors.

77, for motor systems having devices responsive to speed of one motor which controls speed of another electric motor.

120, and 127, for motor systems having means for automatically controlling a reciprocating or oscillating motor.

141, for generator supplied motor systems having means for automatically controlling the generator.

162, for motor systems having means for automatically controlling an electric motor by means of templates, perforated sheets and other predetermined schedule means.

174, and the subclasses specified in the Notes to the definition of those subclasses for automatic control of synchronous motors.

221, for induction motor systems having automatic control and/or time delay means for the control of an impedance type converter or dephasing means for controlling the armature or primary circuit of the motor.

283, and the subclasses specified in the Notes to the definition of those subclasses for miscellaneous motor systems having automatic control of the reversing of electric motors.

364, for miscellaneous motor systems having automatic controls of the braking of electric motors.

432, for miscellaneous motor systems having automatic means for maintaining constant load or constant current in electric motors.

700, for induction motor systems having automatic control and/or time delay means for the control of a primary circuit impedance of the motor.

822, for induction motor systems having automatic control of an impedance in the secondary circuit of the motor.

SEE OR SEARCH CLASS:

73, Measuring and Testing, see (4) Note of class definition and the search notes thereto, for condition responsive systems, per se.

334, Tuners, subclass 9 for remotely controlled variable tuners having an electromagnetic operator.

446 With nonautomatic control means (e.g., manual):

This subclass is indented under subclass 445. Subject matter in which means other than automatic means (e.g., manual means) are also provided for effecting a particular control of an electric motor.

(1) Note. The automatic control means and the nonautomatic control means may be arranged to operate conjointly or exclusively of each other.

SEE OR SEARCH THIS CLASS, SUBCLASS:

1, for motor systems having means in addition to an electric motor for actuating a load device.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 479.01 and the Search Notes thereto, for plural operators or controlling elements for single load devices in general.

447 Nonresponsive or less responsive for limited periods:

This subclass is indented under subclass 445. Subject matter in which means are provided for rendering the sensing mechanism entirely nonresponsive or incapacitated, or less responsive to the predetermined conditions for a particular and limited period of time which is less than the time required for an operating cycle of the motor.

(1) Note. For example, an overload cutout may be rendered inoperative during the starting period of a motor so that it will not trip during the particular and limited period that the motor is starting, but will be fully operative during the running period of the motor.

(2) Note. Where the sensing or control means is merely delayed or retarded (e.g., by means of a dash pot or other retarding means), so that the rate at which the sensing means responds or the

control means operates is reduced, classification is not herein, but in subclass 484 below.

SEE OR SEARCH THIS CLASS, SUBCLASS:

279, for means for rendering the overload sensing mechanism less responsive during the accelerating period of the motor.

484, see Note 2 above.

448 Anti-hunting:

This subclass is indented under subclass 445. Subject matter in which means are provided for preventing or for reducing the tendency of the motor control means to cause the motor to "hunt" overtravel or to be over-compensated. The systems included herein are "open loop" controls and thus are not servomechanisms.

(1) Note. "Overcompensation" is defined for the purposes of this class as that condition which exists when the automatic control means, in consequence of its sensing means responding to a change in some predetermined condition, cause the operation or control of the motor to be extended or continued beyond that necessary to restore the condition to the desired value. "Overtravel" is defined as the movement of the motor, or devices actuated thereby, beyond that necessary to cause the condition to be restored to the desired value and is the direct and proximate result of the "overcompensation" defined above. "Hunting" is defined as that condition which exists as a result of "overcompensation" or "overtravel" in which the sensing means again responds to the extended or excessive change in condition beyond that desired to cause the control means to effect a control of the motor in the opposite direction. Should the control means again overcompensate, the operation of the control means may be initiated for several or for an indefinite number of times. These successive operations or controls of the motor in an attempt to restore the condition to a predetermined value is known as "hunting"; and the means provided to prevent or reduce hunting are known as "anti-hunting" means.

(2) Note. Where the system is a closed loop position servomechanism, classification is not herein, but in subclass 611, above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

362, and the subclasses specified in the Notes thereto, for motor systems having means for braking a motor in order to prevent overtravel of a motor after the energy flow thereto has been terminated.

611, see Note (2) above.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 39 for anti-hunting means in electric generating systems.

333, Wave Transmission Lines and Networks, subclass 19 for differentiating or integrating networks of the passive type.

449 With respect to a fixed standard, master or reference device:

This subclass is indented under subclass 445. Subject matter in which means are provided for producing a force, motion, or other quantitative characteristic constituting a standard, master, or reference value or quantity, in combination with means for comparing such value or quantity with a value or quantity of a corresponding characteristic derived from or as a result of the operation of the motor to be controlled, and for controlling the motor in accordance with the magnitude or variations in magnitude of the resultant of the compared values or quantities.

SEE OR SEARCH THIS CLASS, SUBCLASS:

18, for electric motor follow-up systems in which when the "transmitter" is operated continuously the follow-up motor may vary in speed (see particularly subclass 23) in accordance with variations in the speed of operation of the transmitter which thus acts as a standard or reference device.

69, for plural motor systems having means for controlling the relative speed of two or more electric motors

wherein a speed difference detector is employed for comparing the relative speeds of the motor with respect to each other and means are provided responsive to the speed difference detector for controlling the speed of one motor relative to that of another.

77, for plural motor systems in which means responsive to the speed of one motor constitutes a speed controlling means for another motor.

329, for motor systems having means to control the motor running-speed in response to the speed or frequency of any master device other than the source of supply for the armature circuit.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 36 for generator control with respect to a standard master or reference device.

450 Electrical detector:

This subclass is indented under subclass 449. Subject matter in which the comparing means (i.e., the means which detects a change in, or a difference between, the values or quantities being compared) comprise electrical means, e.g., coils, electric meters or indicators, dynamoelectric machines, electrical impedances, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

70, for plural motor systems having electrical type detectors in running-speed control systems wherein the speed of one motor is compared by electrical means with the speed of another.

451 Mechanically vibrating device as reference device (e.g., tuning fork):

This subclass is indented under subclass 449. Subject matter in which a tuning-fork or other mechanically vibratable device is used as a standard, master, or reference device with which the operation or control of the motor is compared and controlled.

SEE OR SEARCH THIS CLASS, SUBCLASS:

119, for motor systems where the motor is an electrically driven tuning-fork.

SEE OR SEARCH CLASS:

84, Music, subclass 457 for tuning-fork, per se, when used for producing musical notes.

452 Plural, diverse conditions or with time-delay means:

This subclass is indented under subclass 445. Subject matter , (1) in which the sensing means are provided with means which respond to two or more conditions, one or more of which are diverse in type or character than one or more others of the conditions or (2) in which means are employed for sensing one or more conditions, diverse or otherwise, in combination with means for delaying or retarding the operation of the sensing means or the control means after control thereof has been initiated by the sensing means.

(1) Note. The magnitude of a condition (e.g., 40-volts) and the rate-of-change (e.g., 1 volt per second) of a condition are considered plural, diverse conditions for purpose of classification herein. Two magnitudes of a different order of the same condition (e.g., 40-volts and 60-volts) are not considered plural diverse conditions for purposes of classification herein.

(2) Note. Automatic starting of a motor in response to one condition and stopping in response to different kind of condition is included herein, for example.

(3) Note. The sensing means which responds to two or more diverse conditions may comprise either separate means one of which responds to one condition and another of which responds to another condition, or a single means which is simultaneously responsive to diverse conditions (e.g., an electromagnet having the winding made of a thermally responsive material, such as iron wire, which is inherently responsive to voltage or current and also temperature).

SEE OR SEARCH THIS CLASS, SUBCLASS:

142, for automatic control in response to plural diverse conditions and/or with automatic control in response to a condition in combination with time delay or retarding means, of a generator in a generator-fed-motor system.

365, for automatic control of motor braking in response to plural diverse conditions and/or with time-delay means.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 40 for generator control responsive to plural conditions.

453 Electrical condition:

This subclass is indented under subclass 452. Subject matter in which the sensing means is responsive to one or more electrical conditions (e.g., voltage, frequency, current, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

142, for automatic control of a generator in a generator-fed-motor system in which the sensing means is responsive to plural diverse conditions including one or more electrical conditions.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 41 for generator control in response to plural conditions including an electrical condition.

454 Plural, diverse electrical conditions:

This subclass is indented under subclass 453. Subject matter in which the sensing means respond to two or more predetermined electrical conditions, one or more of which conditions are different in kind or character (e.g., voltage, current, frequency, watts, power-factor, etc.) than one or more others of the conditions.

(1) Note. The magnitude of an electrical characteristic (e.g., 50-volts, 10 amperes, etc.) and the rate-of-change of magnitude of the same characteristic (e.g., 1-volt per second change, or 2-amperes per minute change) are considered to be diverse electrical conditions and, hence, are included within the definition of this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

143, for automatic control of generator-fed motor systems in response to plural, diverse electrical conditions.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 42 for generator control in response to plural electrical conditions.

455 Voltage and current (e.g., watts):

This subclass is indented under subclass 454. Subject matter in which the sensing means are responsive to both voltage and current including watts or watthours based on both voltage and current.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 43 for generator control in response to voltage and current.

324, Electricity: Measuring and Testing, appropriate subclasses, particularly subclasses 136, 137, 139, and 140 for watt or watt-hour meters, per se.

456 Rate-of-change of a condition:

This subclass is indented under subclass 445. Subject matter in which the sensing means is responsive to the rate-of-change of a condition (e.g., from 72° F to 73° F in 10 minutes, four (4) pounds pressure change per hour, etc.).

(1) Note. Means responsive to rate of change of position (i.e., the speed) of the motor or other body are not included herein but will be found herein below. See subclass 461. However, means responsive to rate-of-change of speed (i.e., acceleration) are classified herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

461, see Note 1 above.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 19 for rate of change responsive generator control.

333, Wave Transmission Lines and Networks, subclass 19 for differentiating or integrating networks of the passive type.

457 Interia-type detector:

This subclass is indented under subclass 456. Subject matter in which means are provided for sensing, detecting, or measuring the rate-of-change of a condition comprising a device having an inertia member which is relatively displaced in response to a rate-of-change of a condition.

458 Electrical condition:

This subclass is indented under subclass 456. Subject matter in which the sensing means is responsive to the rate-of-change of an electrical condition.

459 Terminal voltage or counter-electromotive force of controlled motor:

This subclass is indented under subclass 445. Subject matter in which the sensing means are responsive to the armature or primary circuit voltage, the terminal voltage, or the counter-electromotive-force of the motor being controlled.

SEE OR SEARCH THIS CLASS, SUBCLASS:

145, for generator-fed-motor systems having the generator controlled in response to the terminal voltage or counter e.m.f. of the motor.

368, for motor systems having the braking of the motor controlled in response to the terminal voltage or counter e.m.f. of the motor.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 29 for generator control in response to generator voltage.

460 Sound, supersonic vibration or mechanical vibration:

This subclass is indented under subclass 445. Subject matter in which the sensing means are responsive to noise, sound, or other mechanical vibrations of bodies.

(1) Note. Means for sensing (or which are responsive to) electrostatic or magnetic waves are not included herein, even if the said waves are produced or originated by mechanically vibrating bodies.

(2) Note. Means for sensing compressional waves transmitted by means of solids, liquids, or gases (including natural media such as earth, water, and atmosphere) are included herein regardless of the frequency thereof (i.e., whether audible or supersonic).

SEE OR SEARCH THIS CLASS, SUBCLASS:

128, for motor systems having automatic control of reciprocating or oscillating electric motors in response to the sound, noise, or vibration in or of the motors or devices actuated thereby.

480, for motor systems having automatic control of the motor in response to radiant energy.

SEE OR SEARCH CLASS:

340, Communications: Electrical, subclasses 12.22, 12.5-12.53, and 13.24-13.26 are the generic subclasses for systems for the control of apparatus and devices at a distance by means of wireless or radio wave energy. See the search notes in the class definition of Class 343 for the other classes which provide for means for the control of an apparatus or device by means of compressional waves.

461 Speed or rate-of-movement:

This subclass is indented under subclass 445. Subject matter in which the sensing means are responsive to the speed (angular or linear velocity) or rate-of-movement of the motor being controlled or of any other body.

SEE OR SEARCH THIS CLASS, SUBCLASS:

77, and the subclasses specified in the Notes to the definition of those subclasses for automatic running-speed control of one motor with reference to the running-speed of another motor.

128, for control of a reciprocating or oscillating motor in response to rate-of-movement thereof.

146, for automatic control of the generator in a generator-fed-motor system in response to the speed of the motor being controlled or of a device driven thereby.

286, for automatic reversing of the motor being controlled in response to movement (including speed) of the motor or of a device driven thereby.

369, for automatic control of braking of an electric motor in response to the speed thereof or of devices driven thereby.

715, and 721, for control of synchronous motor in response to speed thereof.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 30 for generator control in response to the speed of the generator.

462 Centrifugal-type detector:

This subclass is indented under subclass 461. Subject matter in which the sensing means comprises a centrifugally operating device for detecting the speed conditions.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclass 535 for a speed responsive device of the centrifugal weight type, per se.

322, Electricity: Single Generator Systems, subclass 31 for generator control in response to generator speed by means of a centrifugal device.

463 Tachometer-type detector:

This subclass is indented under subclass 461. Subject matter in which the sensing means comprises a tachometer device.

(1) Note. A "tachometer device" is defined as a device adapted to be connected to a moving body and to develop a force, pressure (including electrical potential) or other quantity which varies with the speed of the moving body which force, pressure or other quantity is availed of to actuate another device to a degree varying with the speed of the moving body.

SEE OR SEARCH THIS CLASS, SUBCLASS:

449, and the Search Notes thereto, for motor systems having a tachometer device in which the output thereof is compared with the output of a master or standard device for the purpose of automatically controlling motor operations.

462, and the Search Notes thereto, for speed responsive devices of the centrifugal type for motor control systems.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, appropriate subclasses for generator structure, per se, which may be used as electric tachometers.

322, Electricity: Single Generator Systems, subclass 32 for generator systems having generator control in response to generator speed wherein the sensing device is a tachometer.

324, Electricity: Measuring and Testing, subclass 160 for speed measuring systems wherein electric tachometers are used as speed indicators.

361, Electricity: Electrical Systems and Devices, subclass 236 for speed responsive means including tachometers for controlling electrical systems in response to the speed of some device.

418, Rotary Expansible Chamber Devices, for appropriate subclasses, for rotary expansible chamber devices, per se.

464 Electric generator tachometer:

This subclass is indented under subclass 463. Subject matter in which the speed sensing device comprises an electric generator connected to be driven by and in proportion to the speed of the motor or other moving body.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, appropriate subclasses, for motor driven generators in general.

465 In excess of a predetermined valve:

This subclass is indented under subclass 461. Subject matter in which means are provided for controlling an electric motor in response to speeds of motors or of other bodies when the speed is in excess or above a predetermined value.

SEE OR SEARCH THIS CLASS, SUBCLASS:

462, for this subject matter where the speed sensing means is a centrifugal device.

463, for this subject matter where the speed sensing means is a tachometer device.

466 Movement, position, or limit-of-travel:

This subclass is indented under subclass 445. Subject matter in which the sensing means are responsive to a predetermined (1) movement (e.g., mere condition of motion, number of revolutions, etc.), (2) limit-of-travel, or (3) other position (e.g., mere presence of, altitude or elevation, etc.) of the motor being controlled or of any body or device.

SEE OR SEARCH THIS CLASS, SUBCLASS:

18, for follow-up motor systems in which the motor is started and/or stopped in response to the position of the "Transmitter".

120, for motor systems having means for stopping a reciprocating or oscillating motor in response to a predetermined number of revolutions or cycles.

128, for motor systems having means for controlling a reciprocating or oscillating electric motor in response to movement or position of the motor or device actuated thereby.

286, and the subclasses specified in the Notes to the definition of that subclass for automatic control of motor reversing in response to movement or position of motor or device actuated thereby.

369, for motor systems having automatic control of the braking of a motor in response to movement or position of the motor or device driven thereby.

396, for motor systems having automatic control of the acceleration of a motor in response to the movement or position of the motor or device driven thereby.

461, and the subclasses specified in the Notes thereto, for motor systems having means responsive to rate-of-change of position (i.e., velocity, speed) of the motor or other devices.

467 Plural sensing means for determining plural positions or plural limits-of travel:

This subclass is indented under subclass 466. Subject matter in which two or more means are provided for sensing or determining two or more positions or limits-of-travel of the motor or other device. The systems included herein are "open-loop" controls and thus are not servomechanisms.

(1) Note. For example, a plurality of push buttons may be provided, each determining a different position or a different limit-of-travel at which the sensing means will function to initiate operation of the motor control means.

(2) Note. A single position or limit-of-travel determining means which is merely adjustable so as to initiate a motor control operation when any of a number of possible positions or limits-of-travel are reached, is not included herein.

(3) Note. Where the system is a closed loop position servomechanism, classification is not herein, but in subclass 600 or 672, above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

600, and 672, see Note (2) above.

468 Limit-of-travel control means:

This subclass is indented under subclass 466. Subject matter in which the sensing means is responsive to limit-of-travel of the working element of the controlled motor or of any other device.

SEE OR SEARCH THIS CLASS, SUBCLASS:

128, for motor systems having automatic means for controlling intermittent energization of an electric reciprocating or oscillating motor when at the limit-of-travel of the working element of the motor.

266, for motor systems having means for stopping motor at limit-of-travel thereof combined with other motor controls.

286, and the subclasses specified in the Notes to the definition of that subclass for motor systems having means for reversing an electric motor when it reaches the limit-of-travel thereof.

369, for motor systems having means for controlling the motor braking means at the limit-of-travel of the motor or of the means driven thereby.

469 Overloading limit-of-travel-type control means:

This subclass is indented under subclass 468. Subject matter in which means are provided for overloading the motor automatically when the limit-of-travel has been attained.

(1) Note. For example, when the motor or a device actuated thereby reaches its limit-of-travel it may contact a compression spring or an abutment device placed permanently or temporarily or momentarily in its path thereby placing increased load on the motor resulting in increased armature circuit current which may be availed of to effect the particular motor control desired.

470 Magnitude of movement or revolutions:

This subclass is indented under subclass 466. Subject matter in which the sensing means responds to the mere magnitude of movement (e.g., linear or angular displacements) of the motor being controlled or of any other device.

(1) Note. For example, the sensing means may be responsive to a predetermined linear movement of eight (8) inches, or of one (1) mile; or to a predetermined angular movement of thirty (30) degrees or of six (6) revolutions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

128, for motor systems having automatic control of a reciprocating or oscillating motor in response to mere magnitude of movement of the motor or means driven thereby.

286, and the subclasses specified in the Notes to the definition of that subclass for motor systems having automatic control of the reversing of the motor in response to movement of the motor or a device driven thereby.

369, for motor systems having automatic control of the braking of the motor in response to movement of the motor or a device driven thereby.

471 Responsive to thermal conditions:

This subclass is indented under subclass 445. Subject matter in which the sensing means responds to thermal or temperature conditions in or of any predetermined device or at any predetermined place or position.

(1) Note. Response of the sensing means to the particular temperature (e.g., 30°C, 70°F.) or amount of temperature change (e.g., 30°C. change) without reference to the actual temperature or the amount of available heat stored in a body (e.g., 100 calories) is included herein.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, appropriate (thermal) subclasses, noting subclasses 67 through 104 for thermally responsive means in automatic temperature control systems, and especially subclass 74, for thermally controlled electric motor actuated temperature control devices.

322, Electricity: Single Generator Systems, subclass 34 for generator control in response to thermal conditions.

472 Of motor control means:

This subclass is indented under subclass 471. Subject matter in which the sensing means is arranged to be responsive to the temperature or thermal conditions of an impedance in the cir-

cuit of the motor being controlled, or of other means employed for controlling the motor.

473 In or about the motor being controlled:
This subclass is indented under subclass 471. Subject matter in which the sensing means are connected or arranged to be responsive to thermal condition in or immediately about the motor being controlled.

(1) Note. Sensing means connected or arranged to be responsive to ambient temperature conditions which substantially represent the temperature of the medium (e.g., air, or oil if submerged in oil, etc.) in which the motor is located, are included herein.

SEE OR SEARCH CLASS:
322, Electricity: Single Generator Systems, subclass 35 for generator control in response to thermal conditions in the generator or driving means.

474 Motor load, armature or primary or secondary circuit current:
This subclass is indented under subclass 445. Subject matter in which the sensing means responds to a predetermined motor load, torque, armature or primary circuit current, or secondary circuit current.

SEE OR SEARCH THIS CLASS, SUBCLASS:
144, for automatic control of the generator in generator-fed-motor systems in response to the armature or primary circuit current of the motor.
367, for this subject matter for the automatic control of the braking of an electric motor in response to the armature or primary current of the motor.
706, and 714, for automatic control of a synchronous motor in response to the armature or primary circuit current.
825, for automatic control of a secondary circuit impedance in an induction motor in response to the primary or secondary current of the motor.

475 Mechanical-type detector (e.g., by yielding spring devices):
This subclass is indented under subclass 474. Subject matter in which a mechanical device is provided to sense or detect the existence of a predetermined load on the motor.

(1) Note. As an example, a resilient shaft coupling device, the load end of which is variably displaced under varying load conditions with respect to the motor end of the coupling, can be used in combination with contact devices or variable impedance devices whereby the relative movement between the parts of the coupling device is availed of to actuate the contacting or impedance device in response to changes in load to initiate operation of control means for the motor.

476 In excess of a predetermined magnitude:
This subclass is indented under subclass 474. Subject matter in which the sensing means responds when the magnitude of the load attains or exceeds a predetermined value.

477 Intentionally increased load:
This subclass is indented under subclass 476. Subject matter in which the load on the motor or the armature or primary circuit of the motor is caused to be increased to a magnitude in excess of or above a predetermined value at the will of an operator or by means which is designated to, and will cause the motor to be overloaded at a time selected by the operator or designer.

(1) Note. For example, an operator may deliberately increase the load on the motor by manually increasing the load actuated by the motor, or by manipulating the motor controls so as to cause the motor to draw an excessive current; or a temporary obstruction may be placed in the path of movement of the motor or device actuated thereby which will cause the motor to exert greater effort with resultant increase in motor current, as a result of which some motor control will be exercised.

SEE OR SEARCH THIS CLASS, SUBCLASS:

469, for motor systems having automatic means for controlling the motor at its limit-of-travel (by means located at the limit-of-travel of the motor or device actuated thereby for overloading the motor) in order to cause the circuit of the motor to be opened or otherwise controlled.

478 Electrical conditions in circuit other than controlled motor circuit:

This subclass is indented under subclass 445. Subject matter in which the sensing means responds to electrical conditions in circuits other than the circuit to which the motor being controlled is connected.

479 Voltage:

This subclass is indented under subclass 478. Subject matter in which the sensing means is responsive to the voltage of the other circuit.

SEE OR SEARCH THIS CLASS, SUBCLASS:

459, and the subclasses specified in the Search Notes thereto, for automatic motor control systems in which the sensing means is responsive to the terminal, line, or counter-electromotive-force of the motor being controlled.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 29 for generator systems wherein a motor responsive to generator voltage is used to control the generator or its driving means.

480 Radiant energy:

This subclass is indented under subclass 445. Subject matter in which the sensing means responds to the mere presence or absence of, or the frequency, (i.e., color) intensity, magnitude or amount of radiant energy.

(1) Note. Sensing means which respond to the visible spectrum of light are included herein. Those means which respond to the infra-red or heat waves are classified in subclass 471 above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

16, for motor systems in which the motor is controlled or operated by space transmitted electromagnetic or electrostatic energy.

460, for automatic control systems for electric motors where the motor is controlled by sound or supersonic vibrations.

SEE OR SEARCH CLASS:

250, Radiant Energy, subclass 200 and the classes and subclasses specified in the notes to the definitions of these subclasses for photo-cell controlled circuits and photo-cell apparatus.

481 Pressure in a fluid or granular material:

This subclass is indented under subclass 445. Subject matter in which the sensing means is responsive to the pressure in, (1) a fluid medium (i.e., gaseous or a liquid medium) or (2) a granular medium (i.e., a mass of particulate material or of discrete particles, such as, for example, sand, wheat, grains, shot, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

482, and the subclasses specified in the notes thereto, for motor systems having the automatic control of an electric motor in response to the level of a fluid or of a granular material.

482 Level of fluid or granular material:

This subclass is indented under subclass 445. Subject matter in which the sensing means is responsive to the level of (1) a fluid material or medium (i.e., a gaseous or a liquid material or medium) or (2) a granular (i.e., particulate or discrete particles) material or medium (e.g., sand, grain, shot, etc.).

SEE OR SEARCH THIS CLASS, SUBCLASS:

481, and the subclasses specified in the notes thereto, for motor systems having automatic control of the motor in response to the pressure in a fluid or granular material or medium.

SEE OR SEARCH CLASS:

417, Pumps, subclass 36, for a float controlled motor driving a pump.

483 Moisture content or wetness:

This subclass is indented under subclass 445. Subject matter in which the sensing means is responsive to the presence of, or the degree or amount of, moisture, wetness, or humidity, in a solid, liquid, or gaseous mass or body.

(1) Note. Systems of motor control responsive, for example, to the amount of moisture (i.e., water) in a lubricating oil, the amount of water vapor in a tobacco storage space, or the amount of alcohol in a fabric are included herein.

SEE OR SEARCH CLASS:

236, Automatic Temperature and Humidity Regulation, subclass 44 and the search notes thereto, for humidity sensing means in automatic humidity control systems.

484 Time or with time-delay means:

This subclass is indented under subclass 445. Subject matter in which the sensing means are responsive to the occurrence of a particular instant of time (e.g., 8:30 A.M., 5:00 P.M., etc.), or to the passage of a predetermined interval of time (e.g., 20-minutes, 4-hours, etc.), or in which means are provided for delaying or retarding the operation of the motor control means (e.g., by means of dash-pots, slow-speed operation of the motor control means by a slow-speed motor or through speed-reducing gearing, etc.).

(1) Note. Since in any automatic control system the waiting period for any predetermined condition to occur means, by necessity a passage of some intervening interval of time, every automatic motor control system involves, therefore, a time-delay in a broad sense. However, in such automatic control systems the time interval is indefinite and may vary in magnitude from an infinitesimally short period to an indefinitely long period. The time or time intervals intended to be included herein are of reasonably definite and of predetermined values and, consequently, the means included herein must be capable by its inherent mode of operation of causing a control to occur at some precise time or after the lapse of a reasonably definite and fixed (although adjustable) period of time.

SEE OR SEARCH THIS CLASS, SUBCLASS:

285, for this subject matter where the system includes means for the automatic control of the reversing of a motor in response to instants of, or passage of a predetermined interval of time, or where the control means includes time delay means.

447, for automatically controlled motor systems having means for rendering the condition-sensing means nonresponsive or less responsive for limited periods of time.

485 Dash-pot or other mechanical delay means:

This subclass is indented under subclass 484. Subject matter in which the time-delay means comprises a dash-pot or other mechanical braking device for effecting a time delay in the operation of the motor control means.

SEE OR SEARCH CLASS:

188, Brakes, subclass 266 for a fluid-resistance brake or dashpot of general utility.

486 Pilot- or servo-motors:

This subclass is indented under subclass 484. Subject matter in which the time-controlling or time-delay means comprises a motor connected to actuate the control means, the motor operating the control being designed so that an appreciable amount of time elapse during the movement of the motor before the control means is actuated.

SEE OR SEARCH CLASS:

91, Motors: Expansible Chamber Type, appropriate subclasses for expansible chamber motors, per se.

185, Motors: Spring, Weight, or Animal Powered, appropriate subclasses, for the structure of miscellaneous mechanical motors.

310, Electrical Generator or Motor Structure, appropriate subclasses for electric motor structure, per se.

487 Electromagnetic or inductive time-delay means:

This subclass is indented under subclass 484. Subject matter in which the time-controlling or time-delay means comprises an electromagnetic device in the control circuit of the motor, the electromagnetic device having means for affecting the rate of rise and fall of the current through the electromagnet or for affecting the rate of increase or decrease in the magnetic flux associated with the electromagnet, for the purpose of controlling the time of operation of the control means.

488 Responsive to stress in body or material:

This subclass is indented under subclass 445. Subject matter in which the sensing means are responsive to physical tension, compression or other stress in a body of material.

SEE OR SEARCH THIS CLASS, SUBCLASS:

6, for motor systems having a motor actuated means for maintaining a predetermined tension in a body of material.

460, and the subclasses specified in the Notes thereto, for automatically controlled motor systems having sensing means responsive to stresses due to waves of compression and rarefaction in sound transmitting mediums and bodies (e.g., sound, mechanical vibration).

471, for automatically controlled motor systems having sensing means responsive to thermal stresses.

481, for automatically controlled motor systems having sensing means responsive to stresses in fluids or granular material due to the pressure in, fluid or material.

489 Responsive to direction, inclination or angular position of bodies:

This subclass is indented under subclass 445. Subject matter in which the sensing means are responsive to direction, grade, inclination, angular position, or to a deviation or change from a predetermined value thereof. The systems included herein are "open-loop" controls and thus are not servomechanisms.

(1) Note. Where the system is closed loop position servomechanism, classification is not herein, but in subclass 580, above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

580, see Note (1), above.

SEE OR SEARCH CLASS:

33, Geometrical Instruments, subclass 300 for direction sensing and indicating.

74, Machine Element or Mechanism, subclass 5 for structure of gyroscopes, per se.

490 WITH SIGNALS, METERS, RECORDERS OR TESTING DEVICES:

This subclass is indented under the class definition. Subject matter in which means, in addition to the motor supply and/or control system, are provided for signalling, recording, metering or measuring, or testing conditions in or about the motor and/or its system of supply and/or control, or the operation or the state of operation of the motor.

(1) Note. The line that exists between the class (Class 318) and other classes which relate to signalling, recording, metering or measuring, or testing, per se, is, in general, as follows: (1) Where the claimed subject matter only nominally includes the motor or a conventional part or circuit thereof (such, for example, as "a motor", and "electric motor", a "motor armature", a "motor field winding", etc.) in combination with signalling, recording, metering or measuring, or testing means set forth in detail, classification will be on the basis of testing, metering, signalling, etc., in the classes appropriate thereto; (2) Where the claimed subject matter includes detailed motor control and/or supply circuits or where parts of the motor or its supply and/or control circuits are claimed which do not pertain directly, immediately and only to the signalling, metering or measuring, or testing means (claimed broadly or in detail), classification is in

this class. In other words where the motor and its supply and/or control circuits are significantly claimed (i.e., the claims are substantially and particularly limited to other than a mere or nominal motor circuit) classification is in this class; but when the motor or its circuit is included only nominally in the manner of an example or as a broad or general illustration, classification is in some other class appropriate to the signalling, recording, etc.; (3) Systems involving mere detecting or condition-sensing means but with no scale or indicator attached thereto are not classified in this subclass.

SEE OR SEARCH CLASS:

73, Measuring and Testing, appropriate subclasses for miscellaneous measuring and testing apparatus. See subclass 862 for dynameters.

116, Signals and Indicators, appropriate subclasses for miscellaneous signals and indicators.

235, Registers, appropriate subclasses, for miscellaneous counting and registering apparatus and systems.

340, Communications: Electrical, appropriate subclasses, for miscellaneous electric signaling systems.

346, Recorders, appropriate subclasses, for miscellaneous recording apparatus and systems.

491 CONTROL OF BOTH MOTOR CIRCUIT AND MOTOR STRUCTURE:

This subclass is indented under the class definition. Subject matter in which means are provided for controlling the physical structure (e.g., shifting commutator brushes, pole pieces or other magnetic structure, coil position, etc., relative to other structure) of an electric motor and for also controlling an electric circuit connected to the motor for affecting the supply of energy to, or the operation of the motor.

(1) Note. Rotary movement of a rotary electric motor resulting from electric energization of the motor is not bias for classification herein. However, axial movement of the rotor other than by the magnetic force of the motor is structure control included herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

538, and the subclasses specified in the Notes to the definition of those subclasses for electric motor systems having means for controlling the motor structure.

830, for combined control of motor structure and motor circuit in induction motor systems.

SEE OR SEARCH CLASS:

388, Electricity: Motor Control Systems, subclasses 835+ for single motor running-speed control systems having combined control of motor structure and motor circuit.

492 MOTOR MAGNETIC ENERGY DISSIPATION:

This subclass is indented under the class definition. Subject matter in which means are provided for effecting, or for controlling the dissipation of magnetic energy stored in magnetic circuit of the field or secondary winding of an electric motor.

(1) Note. Such means include means for reducing the tendency toward the generation of high potentials in the field winding circuit due to the collapse of the magnetic field flux when the field circuit is opened.

SEE OR SEARCH THIS CLASS, SUBCLASS:

379, for motor systems having means for locally closing the armature circuit of an electric motor for dynamic braking purposes, which may incidentally provide for dissipation of magnetic energy stored in the armature or primary winding circuit.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 104 for systems including electromagnets or other highly inductive devices.

361, Electricity: Electrical Systems and Devices, subclass 212 for means for discharging static electrical charges in general, and subclass 123 for electric circuits for electromagnets in general, in which means may be provided for dissipating the stored magnetic energy.

493 CONTROL OF BOTH ARMATURE (OR PRIMARY) CIRCUIT AND FIELD (OR SECONDARY) CIRCUIT:

This subclass is indented under the class definition. Subject matter in which means are provided for controlling the armature or primary circuit of the motor and also for controlling the field or the secondary circuit of the motor.

(1) Note. The above means may include a single control means (e.g., potentiometer type rheostat connected so as to be simultaneously in the field circuit and the armature circuit of a motor) or it may include a separate control means in each of the circuits of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

78, for plural motor systems having combined armature or primary circuit control for running-speed control.

92, for plural motor systems having combined armature or primary circuit control with field or secondary circuit control for acceleration control.

153, and the subclasses specified in the Notes thereto for motor systems having combined control of the generator and of the motor in a generator-fed motor systems, including such systems having control of the field or secondary circuit of the motor.

215, and the subclass specified in the Notes thereto for motor systems having combined primary and secondary circuits control for an induction motor systems.

527, for motor systems having means for connecting one or more circuit windings in series with the armature or primary circuit.

700, and 705, and the subclass specified in the Note to the definition of that subclass for motor systems having combined armature or primary control and field circuit control for a synchronous motor.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 45 for combined control of the armature or primary circuit and the field circuit of electric generators.

388, Electricity: Motor Control Systems, subclasses 801+, 803+ and 826+ for single motor running-speed control systems; and subclasses 843 and 849+ for single motor acceleration control systems; wherein the energization of a field winding, or of both a field winding and an armature winding, is controlled.

494 ARMATURE (OR PRIMARY) CIRCUIT CONTROL:

This subclass is indented under the class definition. Subject matter in which means are provided for controlling the armature or primary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

82, and the subclasses specified in the Notes thereto for this subject matter in plural motor systems having running-speed control.

94, for this subject matter in plural motor systems having acceleration control.

104, for this subject matter in plural motor systems having starting and/or stopping control.

105, for this subject matter in plural motor systems having plural sources of operational supply for the motors.

111, for this subject matter in plural motor systems having series-parallel connected motors.

112, for this subject matter in plural motor systems having parallel-connected motors.

113, for this subject matter in plural motor systems having series connected motors.

126, for this subject matter where the control is of the energizing circuit of a reciprocating or oscillating motor.

139, for this subject matter where the motor is supplied by primary or secondary batteries.

140, for this subject matter where the motor is supplied by an electric generator, the generator output being controlled to control the motor.

246, for this subject matter where the motor is a series motor.

254.1, and 254.2, for this subject matter where the motor is a self-commutated impulse or reluctance motor.

287, for this subject matter for the control of motor-reversing systems.

373, for this subject matter where the control is for "plugging" or is the application of reverse power to the motor for braking the motor.

375, for this subject matter where the control is for dynamic braking of the motor.

400.1, through 400.42, for motor commutation control systems.

430, for this subject matter where the armature current is controlled during the starting or stopping period.

432, for this subject matter where the system includes means to maintain the armature current approximately constant.

434, for this subject matter where the system includes means to prevent the armature current from either exceeding a maximum value or diminishing below a minimum value.

436, for this subject matter where the system includes means for energizing a motor while not in motion.

438, for this subject matter where the system includes means to the power factor of the armature or line circuit.

440, for this subject matter where there are plural sources of supply for a single motor.

474, and the subclasses specified in the Notes to the definition of those subclasses for this subject matter where the system has automatic means to control the armature circuit or has means to effect a time delay in the operation of the armature circuit control means.

493, and the subclasses specified in the Search Notes thereto, for armature or primary circuit control of an electric motor combined with the field or secondary control thereof.

720, and the subclasses specified in the Notes to the definition of that subclass where the motor is a synchronous motor.

767, and the subclasses specified in the Notes to the definition of that subclass where the motor is an induction motor.

SEE OR SEARCH CLASS:

388, Electricity: Motor Control Systems, subclasses 809+, 816+, 828+, and 830+ for control of the armature circuit only in single motor running-speed control systems with, and without, feedback respectively; and subclasses 844+ and 853+ for similar control in single motor acceleration control systems.

495 Plural, diverse or diversely controlled, armature or primary windings:

This subclass is indented under subclass 494. Subject matter in which two or more armature or primary windings are provided on the motor and (1) in which one or more of the windings are substantially different structurally from one or more others of the windings (including being different with respect to composition of winding, arrangement or shape of the winding, or physical dimensions thereof) or (2) in which one or more of the windings are controlled substantially differently from one or more others of the windings (including control at different time, different degrees of excitation, different kinds or types of energizing currents, or polarized differently).

(1) Note. As examples only, the following windings, are considered plural, diverse or diversely controlled windings within the meaning of this class: (I) Structurally unitary winding in which connections are made to conduct current from a point intermediate the ends thereof to either

end selectively or to both ends simultaneously, regardless of the relative polarity of the individual turns of the winding or the number of turns thereof on either side of the intermediate point of connection. (II) Structurally unitary winding in which some of the turns thereof are polarized differently from some of the other turns.

(2) Note. As examples only, the following windings are not considered plural, diverse or diversely controlled windings within the meaning of this class: (I) Structurally unitary windings in which all turns are polarized relatively the same (as determined when a polarizing current is conducted from one end of the winding to the other) and in which: (a) External connections are made so that current can be conducted through the winding from a point of the winding to one or more other points in the same direction along the winding, or (b) External connections are made to conduct current through the winding from any point of the winding to another point thereof and means are provided to shunt or by-pass the current around one or more turns intermediate the points at which the above external connections are made; (II) Structurally independent windings which are physically separated from each other but which in all other respects are not substantially different or are not controlled substantially differently with respect to each other.

SEE OR SEARCH THIS CLASS, SUBCLASS:

122, for this subject matter where the motors are reciprocating or oscillating motors having plural windings.

288, for this subject matter in motor reversing systems where the motors have plural armature or primary windings.

770, and the subclasses specified in the Notes to those subclasses for this subject matter where the motors are induction motors having plural primary windings.

781, for this subject matter where the motors are single phase motors having auxiliary primary windings for starting and/or running purposes.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 127 for dynamoelectric devices having two or more current collecting means, such as commutators or sets of slip rings, connected to different windings of the devices.

322, Electricity: Single Generator Systems, subclass 90 for generator systems where the generator has plural armature circuits or windings.

496 Polyphase windings:

This subclass is indented under subclass 495. Subject matter in which the armature or primary windings comprises two or more windings or sections thereof, one or more of which are displaced in space relation to one or more others of the windings and which windings or sections thereof are designed and adapted to be connected to a polyphase source of supply (i.e., two or more sources of alternating current having the same frequency and being displaced in time phase relation to each other).

SEE OR SEARCH THIS CLASS, SUBCLASS:

44, for this subject matter in plural motor systems having plural induction motors of the polyphase type having synchronizing connections between their secondaries.

49, for this subject matter in plural motor systems having plural motors connected in cascade or tandem, one of which motors generally being an induction motor of the polyphase type.

121, for this subject matter where the motor is a reciprocating or oscillating motor which is provided with polyphase windings to produce a progressing or traveling motor field flux.

123, for this subject matter where the motor is a reciprocating or oscillating type motor having polyphase windings.

289, for this subject matter in motor reversing systems having means for reversing the phases of the polyphase supply.

700, for synchronous motor systems many of which are polyphase motors.

768, 771 and 781, for this subject matter in induction motor systems where the motor is provided with split-phase or polyphase windings.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 132 for polyphase armature windings for plural collector dynamoelectric machines.

497 Series-parallel:

This subclass is indented under subclass 495. Subject matter in which means are provided for connecting the several armature or primary windings in series circuit relationship with respect to each other at one time and in parallel circuit relationship with respect to each other at another time; or for connecting two or more of the windings in parallel circuit relationship with respect to each other and for, simultaneously, connecting two or more of the windings in series circuit relationship with respect to each other.

(1) Note. One of the windings in a parallel connected group may constitute one of the windings in the series connected group as, for example, where one armature or primary winding may be parallel connected windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:

111, and the subclasses specified in the definition of that subclass for series parallel connections of armature or primary circuits of two or more motors, i.e., the motors are connected in series-parallel relationships with respect to each other.

771, for this subject matter in induction motor control systems wherein the polyphase windings may be connected in delta-star relationships.

498 Energized or controlled in predetermined sequence:

This subclass is indented under subclass 495. Subject matter in which means are provided for energizing or controlling a predetermined one of the windings and for, subsequently, energizing or controlling another winding (i.e., for energizing or controlling the windings in a predetermined order or sequence which means may, however, be adjustable so as to change from one predetermined order or sequence to another predetermined order or sequence).

SEE OR SEARCH THIS CLASS, SUBCLASS:

91, for motor systems for accelerating two or more motors in succession or selectively, which includes accelerating the motors in a predetermined sequence.

102, for motor systems for starting and/or stopping plural motors in sequence or in succession, which includes starting and/or stopping motors in a predetermined order or sequence.

499 Wound or energized in magnetic opposition:

This subclass is indented under subclass 495. Subject matter in which means are provided for energizing one or more windings or turns so as to produce a magnetic flux in one direction and for energizing one or more other windings or turns so as to produce a flux (in the magnetic circuit of the first named windings or turns) in a direction opposite to the first named direction.

(1) Note. The windings or turns may be energized or controlled concurrently or at different times.

SEE OR SEARCH THIS CLASS, SUBCLASS:

48, for motor systems having mechanically coupled motors energized in torque opposition.

290, for motor reversing systems in which motors having oppositely wound windings are selectively energized.

293, for motor systems having means for reversing the polarity of the current supplied to a single armature winding in order to reverse a motor.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 65 for generator systems having a generator with differentially wound field windings.

500 Plural sources of voltage (including counter e.m.f. cells):

This subclass is indented under subclass 494. Subject matter in which two or more sources of electromotive force are connected in series, parallel, or series-parallel-circuit relationship with respect to each other and in which one or more of the sources are different in structure or are differently controlled (e.g., with respect to time, magnitude of control, mode of interconnection, etc.) from one or more others of the sources so as to control the resultant voltage applied to the motor armature.

(1) Note. Idly running electric motors or electrolytic cells, for example, which are connected in series with a source of potential and armature circuit of the motor so as to develop or generate a counter-electromotive force are included herein.

(2) Note. Voltage drops across impedance devices merely connected in series with the motor, or the counter-electromotive forces developed within the motor armature winding are not included herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

105, for motor systems having plural diverse sources of supply for plural motors.

149, for this subject matter in generator-fed motor systems having plural controlled generators, generators being in the armature or primary circuit of the motor.

248, for series-motor systems having plural sources of voltage including plural sources connected in the armature or primary circuit.

293, for this subject matter in systems having opposed sources of supply in the armature circuit of the motor to determine the direction of current flow therethrough (polarity) for reversing the motor.

440, and the subclasses specified in the Notes to the definition of those subclasses for this subject matter where there are a plurality of diverse or diversely controlled sources of supply. If there is no significant diverse characteristics of the sources claimed or no different control of the sources claimed, the patent is classified in subclass 500 and not in subclass 440.

501 By shunting armature or primary winding:

This subclass is indented under subclass 494. Subject matter in which means are provided for shunting or short-circuiting in whole or in part the armature or primary winding of a motor by a conductor or circuit of low impedance.

SEE OR SEARCH THIS CLASS, SUBCLASS:

379, for this subject matter where the system has means for short-circuiting a motor armature winding in order to dynamically brake the motor.

528, and the subclasses specified in Notes thereto for motor systems having means for shunting or short-circuiting a motor field winding.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 91 generator systems for shunting or short-circuiting an armature winding.

502 Variable length or tapped armature winding:

This subclass is indented under subclass 494. Subject matter in which means are provided for varying or changing the effective length of the armature or primary winding of an electric motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

501, for this subject matter where the effective length is varied by short-circuiting part of the winding.

531, and the subclasses specified in the Notes thereto, for motor systems having variable length field windings.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 93 for generator systems having a tapped or sectionalized armature winding.

503 Frequency or pulsation control:
This subclass is indented under subclass 494. Subject matter in which means are provided for controlling the frequency, or the rate of pulsations, of the current supplied to the armature or primary circuit of the motor.

(1) Note. Where means are provided for merely repeatedly making and braking the armature or primary circuit, see subclass 519, below.

SEE OR SEARCH THIS CLASS, SUBCLASS:
49, for plural motor systems having cascaded or tandem connected motors in which the frequency of the current supplied to the second motor depends on the slip of the first or preceding motor (i.e., the motor having its primary circuit connected to the AC supply circuit).
129, for oscillating or reciprocating motor systems in which the speed of operation of the motors is controlled by controlling the frequency of the current or current pulses supplied to the motors.
148, for generator-fed motor systems which have an alternating current generator, the speed or frequency output of the generator being controlled.
807, for induction motor systems wherein the frequency of the current to the primary circuit is varied.

SEE OR SEARCH CLASS:
290, Prime-Mover Dynamo Plants, appropriate subclasses for means for controlling the speed and frequency of alternators by controlling the speed of a nonelectric prime mover which drives the alternator.
322, Electricity: Single Generator Systems, appropriate subclasses for generating systems in which the frequency of the generated current is controlled.
331, Oscillators, subclass 36 for oscillators for supplying alternating current of variable or fixed frequency to circuits of general application.
363, Electric Power Conversion Systems, subclass 157 for frequency conversion systems for controlling the frequency applied to load circuits in general.

504 Voltage control:
This subclass is indented under subclass 494. Subject matter in which means are provided for controlling the magnitude of the voltage supplied to the armature or primary circuit of the motor being controlled.

(1) Note. When the voltage is controlled by means of impedance means (such as space-discharge devices, resistors, inductors and capacitors merely connected in series or in parallel, but not in series and in parallel simultaneously-,) which do not form a voltage divider with respect to the motor armature, classification is not herein, but in some other subclass herein below. Note subclasses 505 and 508.

(2) Note. Where voltage is controlled only by means of circuit making and breaking of the armature or primary circuit, classification is not herein but is in subclass 519 below.

SEE OR SEARCH THIS CLASS, SUBCLASS:
49, for plural motor systems having cascade or tandem connected motors in which the voltage supplied to the second motor depends on the speed or slip of the first motor.
139, for motor systems in which primary or secondary-batteries are employed to supply to armature current.
140, for generator-fed motor systems wherein the generator is controlled to control the current supplied to the motor armature.
500, and the subclasses specified in the Notes thereto for this subject matter where the voltage control is effected by a plurality of sources of supply for the armature circuit.
505, see Note 1 above with respect to space-discharge devices in the primary circuit.

508, see Note 1 above with respect to impedances in the primary circuit.
519, see Note 2 above.
812, for primary circuit voltage control in induction motor systems.

SEE OR SEARCH CLASS:
290, Prime-Mover Dynamo Plants, appropriate subclasses for variable voltage generating systems having nonelectric prime mover control.
310, Electrical Generator or Motor Structure, subclass 129 for variable voltage rotary converters, per se.
320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclass for a variable voltage supply for a battery or condenser charging or discharging system.
322, Electricity: Single Generator Systems, appropriate subclasses, for variable voltage generating system, per se.
323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for variable voltage supply systems, per se.
363, Electric Power Conversion Systems, subclasses 13+ and the subclasses mentioned in the notes thereto for variable voltage current conversion systems.

505 By means to space-discharge devices:
This subclass is indented under subclass 494. Subject matter in which a space-discharge device is connected in series or in parallel with the armature or primary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
132, for reciprocating or oscillating motor systems having space-discharge devices in the input circuit thereto.
400.1, through 400.42, for synchronous motor commutation control systems.
504, for this subject matter where one or more space-discharge devices is a part of or forms a voltage converter (divider).
508, and the subclasses specified in the Notes thereto, for other motor systems having an impedance device in the armature or primary circuit of the electric motor.
786, 800, and 807, for this subject matter where the motor is an induction motor.

SEE OR SEARCH CLASS:
315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses, for miscellaneous systems for controlling gas or vapor filled space-discharge devices.
323, Electricity: Power Supply or Regulation Systems, subclasses 227 and 291 for electric space discharge device systems for voltage magnitude control.
327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, appropriate subclasses for miscellaneous space discharge device circuits.

506 Plural, diverse or diversely connected or controlled space-discharge devices:
This subclass is indented under subclass 505. Subject matter in which a plurality of space-discharge devices are provided, the principal electrodes of at least one of which devices are connected to the armature or primary circuit of the motor, and in which one of the space-discharge devices is structurally different or is connected or arranged or controlled differently than the other of the space-discharge devices.

SEE OR SEARCH THIS CLASS, SUBCLASS:
504, for this subject matter where the space-discharge devices are a part of or form a voltage converter (divider).

SEE OR SEARCH CLASS:
323, Electricity: Power Supply or Regulation Systems, subclasses 227 and 291 for electric space discharge device systems for voltage magnitude control involving plural space discharge devices.

507 Having discharge-control means (e.g., grids):
This subclass is indented under subclass 505. Subject matter in which the space-discharge device includes a cathode, and anode, and (a) an electrostatic element (e.g., a control grid)

which is adapted to have an electric potential established between it and the cathode, or (b) a magnetic-field producing means; wherein the elements (a), (b) are positioned relative to the cathode and anode so as to control the space-current flow between the cathode and the anode.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 227 and 291, for electric space discharge device systems for voltage magnitude control having discharge controlled device (e.g., grid) control.

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, appropriate subclasses for miscellaneous electric space discharge device circuits having a control electrode and subclasses 510+ for such circuits which are magnetically effected.

508 Impedance-controlled:

This subclass is indented under subclass 494. Subject matter in which means are provided for connecting one or more impedance devices (e.g., resistors, reactors, capacitors) in series and/or in parallel to the armature or primary circuit of an electric motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

96, for this subject matter in acceleration control systems for plural motors.

133, for this subject matter in reciprocating and oscillating motor systems.

249, for this subject matter in series motors systems.

380, for this subject matter in motor systems for dynamic braking.

505, and subclasses specified in the Notes thereto, for motor systems having space-discharge devices in the armature or primary circuit of the motor.

751, 784, 785, and 794, for impedance-type phase converter or dephasing means for adapting an induction motor for operation from a single phase source of supply.

784, 794, 804, and 814, for this subject matter in induction motor systems.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclass 364 for circuit control in general by means of impedances.

509 Plural, diverse or diversely controlled impedances:

This subclass is indented under subclass 508. Subject matter in which there are provided a plurality of impedance devices each of which is directly connected in the armature or primary circuit of the motor and in which one of the impedance devices is structurally different, differently controlled or connected than another of the impedances.

SEE OR SEARCH THIS CLASS, SUBCLASS:

504, and the subclasses specified in the Notes thereto, for voltage conversion (e.g., voltage dividers, etc.) in motor systems.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclass 364 for plural impedance networks, per se.

510 Including both reactor and condenser:

This subclass is indented under subclass 509. Subject matter in which the impedances comprise a reactor and a capacitor.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 355 through 363 for circuit impedance systems including both a reactor and a capacitor.

334, Tuners, appropriate subclasses for tuned networks for use in wave energy apparatus and comprising inductance and capacitance elements in circuit arrangement to form a resonant circuit and in which structure is provided for adjusting one or both of these elements for changing the mean resonant frequency of the circuit.

511 Inherently or self-variable impedance:
This subclass is indented under subclass 508. Subject matter in which the impedance device is of the type in which the impedance of the device inherently changes appreciably in magnitude (e.g., with mere lapse of time, change in potential applied thereto or current flowing therethrough, change in temperature or physical pressure applied thereto, etc.).

(1) Note. Impedances such as reactors and condensers whose value of impedance changes in consequence merely of a change in the frequency of the electric energy supplied thereto are not included herein. Should the impedance of these devices change inherently, however, with the frequency remaining constant, classification is herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:
767, for motor systems having inherently variable impedance devices in the primary circuit of an induction motor. See particularly subclasses 788, 796, 797, 804, 815, and 892.
821, for motor systems having a inherently variable impedance device in the secondary circuit of an induction motor.

SEE OR SEARCH CLASS:
323, Electricity: Power Supply or Regulation Systems, subclass 364 for miscellaneous impedance systems.
336, Inductor Devices, subclass 30 for adjustable induction apparatus designed to have its impedance automatically controlled in response to a condition, and subclass 155 for the structure of inductive regulators (of the saturable or high leakage reactance type) having no movable adjustable feature.
338, Electrical Resistors, subclass 2 for strain gauge type electrical resistors, and subclass 13 for electrical resistors whose value changes in response to a condition.

512 Inductive reactor controlled:
This subclass is indented under subclass 508. Subject matter in which the impedance device comprises a reactor or choke coil.

SEE OR SEARCH CLASS:
323, Electricity: Power Supply or Regulation Systems, subclass 355 for impedance networks including reactors.
336, Inductor Devices, appropriate subclasses for the structure of inductive reactors and transformers.

513 Having auxiliary means for saturating reactor core:
This subclass is indented under subclass 512. Subject matter in which auxiliary means are provided for saturating the magnetic core or a part thereof of the reactor.

(1) Note. For example, an auxiliary winding on the reactor combined with means for supplying either AC or DC current thereto sufficiently to magnetically saturate the core, would be included herein. Merely increasing the current through the usual winding on the reactor until the core becomes saturated, is not included herein.

SEE OR SEARCH CLASS:
323, Electricity: Power Supply or Regulation Systems, subclasses 206, 249, 302, 310, and 329 for systems wherein saturable reactors are used for control purposes.
336, Inductor Devices, subclass 155 for the structure of inductive regulators of the saturable or high reactance type, which have no movable adjustable feature.

514 Resistor-controlled:
This subclass is indented under subclass 508. Subject matter in which the impedance device comprises a resistor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
509, and the subclasses specified in the notes thereto, for this subject matter where the impedances comprise a plurality of resistors.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 295 through 298 for control systems in general which include resistors as the controlling element.

338, Electrical Resistors, appropriate subclasses, for electrical resistors, per se.

515 Having short-circuiting means:

This subclass is indented under subclass 514. Subject matter in which means are provided for short circuiting the resistor in whole or in substantial part by a conductor of negligible resistance.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 83, for generation systems in which means are provided for short-circuiting the field circuit resistors.

323, Electricity: Power Supply or Regulation Systems, subclasses 295 through 298 , for control systems in general which include short circuited resistors as the controlling element.

516 Short-circuited step-by-step:

This subclass is indented under subclass 515. Subject matter in which means are provided for short circuiting different sections or portions of the resistor at different times (i.e., without going through all intermediate and infinitesimal values of resistance).

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 85 for generator field circuit control by means of resistors with means to short circuit the resistors step by step.

323, Electricity: Power Supply or Regulation Systems, subclass 297 for control systems in general which include resistors which are short circuited step by step as the controlling element.

519 By armature or primary circuit-making and/or breaking:

This subclass is indented under subclass 494. Subject matter in which means are provided for making and/or breaking the armature or primary circuit of the motor.

(1) Note. See Circuit Making and/or Breaking Device of the class definition for the definition of "circuit making and/or breaking" as used in this class.

SEE OR SEARCH THIS CLASS, SUBCLASS:

101, for plural motor systems having starting and or stopping means for the motor which comprise mainly circuit making and or breaking of the armature or primary circuit of the motor.

134, for reciprocating or oscillating motor systems having means for making and or breaking the line or supply circuit to the motor.

264, for automatic starting and or stopping of a motor combined with some other motor operation control, wherein the starting and stopping is generally effected by armature or primary circuit making and or breaking.

272, see the reference to subclass 264, above.

275, see the reference to subclass 264, above.

277, see the reference to subclass 264, above.

374, for motor braking systems by means of "plugging" (i.e., application of reverse power to a forwardly running motor) in which the armature or primary circuit is opened substantially at the moment that the motor reaches zero speed.

443, for periodically or repetitiously starting an electric motor by opening and closing the motor circuit.

SEE OR SEARCH CLASS:

200, Electricity: Circuit Makers and Breakers, all subclasses for the structure of circuit makers and breakers.

307, Electrical Transmission or Interconnection Systems, subclass 96 for intermittent regulatory interruption of

an electrical system, and subclass 112 for switching systems.

314, Electric Lamp and Discharge Devices: Consumable Electrodes, subclasses 72 through 74 for switch controlled motor circuits in electric motor feeding mechanisms for discharge electrodes.

320, Electricity: Battery or Capacitor Charging or Discharging, appropriate subclass for a battery or condenser charging or discharging system that includes circuit making or breaking.

322, Electricity: Single Generator Systems, subclass 69 for means for making and/or breaking the field circuit of an electric generator.

361, Electricity: Electrical Systems and Devices, subclasses 139+ for relay circuits in which an electric circuit is generally made and/or broken and for electron magnetic switching systems in general.

520 Electromagnetically actuated:

This subclass is indented under subclass 519. Subject matter in which the circuit making and/or breaking means are provided with electromagnetically operating means for operating the circuit making and/or breaking means.

SEE OR SEARCH CLASS:

335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclass 2 for the structure of electromagnetic switches.

521 FIELD OR SECONDARY CIRCUIT CONTROL:

This subclass is indented under the class definition. Subject matter in which means are provided for controlling (1) the electric circuit which is connected to the magnetic-flux producing means of the motor, or (2) the electric circuit which is connected to the secondary (i.e., induced) member of an alternating current motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

81, for plural motor systems having means for controlling the speed of one or more electric motors relative to the speed of one or more other electric motors by controlling the field or secondary circuit of one or more of the motors.

84, for plural motor systems having means for controlling the speed of two or more electric motors by controlling the field or secondary circuits of the motors.

89, for braking systems in plural motor systems in which one or more of the motors are converted into exciters for supplying field excitation to the remaining motors during the braking period.

97, for plural motor systems having means for controlling the field or secondary circuit of one or more electric motors for controlling the acceleration of two or more motors.

100, for plural motor systems having field or secondary circuit control of the motors to effect a fixed or predetermined ratio of load or current division between the motors.

153, for generator-fed motor systems having combined control of generator field circuit and of the field circuit of the motor supplied by the generator.

190, and the subclasses specified in the Notes to the definition of those subclasses for synchronous motor systems in which means are provided for controlling the field circuit of the motor.

232, for induction motor systems having secondary circuit control of the motor.

246, for motor systems in which the motor is connected to run as a series motor and in which substantially all circuit control affects the field excitation.

296, for this subject matter in motor reversing systems.

381, for dynamic braking motor systems in which there is field circuit control when the armature circuit is locally closed (e.g., short circuited).

493, and the subclasses specified in the Notes thereto, for motor systems having field circuit control combined with armature or primary circuit control.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 59 for field circuit control of electric generators.

388, Electricity: Motor Control Systems, subclasses 801+ and 826+ for single motor running-speed control systems; and subclasses 843 and 849+ for single motor acceleration control systems; wherein the energization of a field winding, or of both a field winding and an armature winding, is controlled.

523 Plural, diverse or diversely connected or controlled field windings:

This subclass is indented under subclass 521. Subject matter in which the motor is provided with two or more field-producing windings one or more of which are different structurally, connected differently, or controlled differently or by different means, than one or more others of the motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

252, for this subject matter in series-motor systems.

297, for this subject matter in motor reversing systems.

495, and the subclasses specified in the Notes thereto, for motor systems where the motor has plural armature or primary windings.

700, for this subject matter in synchronous motors systems.

818, for this subject matter in induction motors systems.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 63 for generator systems where the generator has plural field windings.

524 Convertible number-of-poles type (e.g., 4-pole or 6-pole):

This subclass is indented under subclass 523. Subject matter in which means are provided for establishing one number of field poles at one time and another number at another time (e.g., 4-pole and 6-poles).

SEE OR SEARCH THIS CLASS, SUBCLASS:

704, for this subject matter in synchronous motor systems.

773, for this subject matter in induction motor systems.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 62 for generator systems, having a generator having a convertible number of sets of poles.

525 Differentially wound or energized windings:

This subclass is indented under subclass 523. Subject matter in which means are provided for energizing one or more field producing windings, turns, or conductors, so as to produce a magnetic field in one direction in a magnetic path, and for energizing one or more other windings, turns, or conductors so as to produce a magnetic field in the opposite direction in the same magnetic path either at the same time or at different times.

SEE OR SEARCH THIS CLASS, SUBCLASS:

499, and subclasses specified in the Notes thereto, for motor systems having a motor with plural armature or primary windings wound in magnetic opposition.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 64, for generator systems having a generator with plural, differentially related, field windings.

526 Series-parallel:

This subclass is indented under subclass 523. Subject matter in which means are provided for connecting the several field windings or conductors in series-circuit relationship with respect to each other at one time and in parallel-circuit relationship with respect to each other at another time, or for connecting two or more of the windings in series circuit relationship and two or more windings in parallel circuit relationship with respect to each other all at the same time.

SEE OR SEARCH THIS CLASS, SUBCLASS:

111, for systems having means for connecting two or more motors in series-parallel circuit relationships.

497, and the subclasses specified in the Notes thereto, for motor systems having means for connecting plural armature or primary circuit windings of a motor in series-parallel circuit relationships.

527 Series field winding:

This subclass is indented under subclass 523. Subject matter in which means are provided for connecting one or more of the field windings in series with the armature or primary circuit of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

244, for alternating-current commutating motors wherein it is common to have a field winding connected in series with the armature or primary circuit of the motor.

246, for series motors, in general, in which a field winding is connected in series with the armature or primary circuit of the motor.

493, for motor systems having both field circuit control and armature circuit control.

528 With means to short circuit a field winding:

This subclass is indented under subclass 523. Subject matter in which means are provided for short circuiting a field winding in whole or in part with a conductor of substantially negligible resistance.

SEE OR SEARCH THIS CLASS, SUBCLASS:

299, for this subject matter in motor reversing system.

501, and the subclasses specified in the Notes thereto, for motor systems having means for short-circuiting an armature or primary winding in whole or in part.

700, for synchronous motor systems having means for short-circuiting the field winding during the starting period of motor operation.

818, for means for short-circuiting the secondary winding of an induction motor for short-circuiting impedances in the secondary circuit of the motor.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 68 for generator systems having means for short circuiting a field winding.

529 Selectively energized:

This subclass is indented under subclass 523. Subject matter in which means are provided for energizing one or more of the field windings or conductors without energizing one or more others.

(1) Note. The means may be operative at times to also energize all of the windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:

524, for this subject matter where the motor is of the convertible number of poles type (e.g., convertible from 4 to 6 pole).

528, for this subject matter where the system includes means to short-circuit a field winding.

819, for induction motor systems in which means are provided for varying the effective number of conductors or turns in the secondary of the motor.

530 Plural, diverse or diversely connected or controlled sources of field circuit voltage:

This subclass is indented under subclass 521. Subject matter in which there are provided two or more sources of voltage for the motor field circuit, one or more of such sources being different structurally, differently connected or differently controlled than one or more others of the sources.

SEE OR SEARCH THIS CLASS, SUBCLASS:

500, and the subclasses specified in the Notes thereto, for motor systems, in which the armature or primary circuit

of the motor is provided with two or more sources of supply.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 86 for generator systems wherein two or more voltage sources are provided for the field circuit of the generator.

531 Variable length or tapped field winding:

This subclass is indented under subclass 521. Subject matter in which means are provided for tapping or otherwise varying the active length of a field winding.

SEE OR SEARCH THIS CLASS, SUBCLASS:

523, for motor systems having plural field windings where the windings are selectively or partially energized.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 71 for generator control systems in which means are provided for tapping or otherwise varying the effective length of the generator field winding.

532 By means of space-discharge device in field circuit:

This subclass is indented under subclass 521. Subject matter in which the principal electrodes (e.g., cathode and anode) of a space-discharge device is connected to the field winding circuit of an electric motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

505, and the subclasses specified in the Notes thereto, for motor systems having space-discharge devices in the armature or primary circuit of the electric motor.

818, for space-discharge devices in the secondary circuit of an induction motor.

SEE OR SEARCH CLASS:

315, Electric Lamp and Discharge Devices: Systems, appropriate subclasses for means for controlling and supplying electric energy to gas-filled space-discharge devices, per se.

322, Electricity: Single Generator Systems, subclass 72 for generator systems having the generator field circuit controlled by means of space discharge devices.

323, Electricity: Power Supply or Regulation Systems, subclasses 227 and 291 for electric space discharge device systems for voltage magnitude control.

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, appropriate subclasses for miscellaneous control circuits wherein a space discharge device is the controlling element.

533 Impedance-controlled:

This subclass is indented under subclass 521. Subject matter in which impedance devices are provided in the field circuit of a motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

249, for series motor systems having impedance devices either in series or in parallel to the series field winding.

532, and the subclasses specified in the Notes thereto, for field control by means of space-discharge devices.

700, for this subject matter in synchronous motor systems.

821, for induction motor systems having impedance devices in the secondary circuit thereof.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 75 for generation systems having impedance devices in the field circuit of the generator.

323, Electricity: Power Supply or Regulation Systems, subclass 364 for miscellaneous circuit control by means of impedances.

534 Plural, diverse or diversely connected or controlled field circuit impedances:

This subclass is indented under subclass 533. Subject matter in which two or more impedances are provided in the field circuit; one or more of which are structurally different or are differently controlled or controlled by means

which are different with respect to each other, than one or more others of the impedances.

SEE OR SEARCH THIS CLASS, SUBCLASS:

509, and the subclasses specified in Notes thereto, for motor systems having the armature or primary circuit controlled by means of plural impedance devices.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 76 for generator systems having the generator field circuit controlled by means of plural impedances.

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for miscellaneous load control by means of impedance devices including plural impedances.

535 Wheatstone bridge:

This subclass is indented under subclass 534. Subject matter in which the several impedances are connected in a Wheatstone bridge (i.e., four-arm) arrangement with respect to each other.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 77 for Wheatstone bridge arrangements of impedances in the field circuit of generators.

323, Electricity: Power Supply or Regulation Systems, subclass 365 for Wheatstone bridge arrangements of impedances in general.

333, Wave Transmission Lines and Networks, subclass 169 for wave filters of the Wheatstone bridge or lattice type.

536 By field circuit making and/or breaking:

This subclass is indented under subclass 521. Subject matter in which means are provided for physically making and/or breaking the field circuit of the motor.

(1) Note. See Circuit Making and/or Breaking Device, of the class definition for a definition of “Circuit making and breaking”.

SEE OR SEARCH THIS CLASS, SUBCLASS:

519, and the subclasses specified in the Notes thereto, for motor systems having means for making and/or breaking the armature or primary circuit of the electric motor.

529, for motor systems where the motor has a plurality of field windings and means are provided for selectively energizing the field windings thereby generally necessitating the making and/or breaking of the circuit to one or more of the windings.

705, for synchronous motors starting as repulsion or induction motors wherein means are provided for connecting or disconnecting the field exciting means.

716, for this subject matter in synchronous motors systems.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 69 for generator systems having means for making and/or breaking the field circuit of an electric generator.

537 Intermittently operated:

This subclass is indented under subclass 536. Subject matter in which means are provided for making and breaking the circuit intermittently or repetitiously.

SEE OR SEARCH CLASS:

200, Electricity: Circuit Makers and Breakers, subclasses 19.01 through 19.4 for structure of periodic switches, per se.

307, Electrical Transmission or Interconnection Systems, subclass 96 for intermittent regulatory interruption of an electrical system, and subclass 132 for periodically or repetitiously making and breaking an electric circuit.

322, Electricity: Single Generator Systems, subclass 70 for generator systems having periodic or repetitious circuit making and/or breaking of the field circuit of an electric generator.

335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclass 87 for electromagnetically operated periodic switches.

538 MOTOR STRUCTURE ADJUSTMENT OR CONTROL:

This subclass is indented under the class definition. Subject matter in which means are provided for relatively moving one or more structural elements of a motor relative to one or more other structural elements of an electric motor.

(1) Note. Mere motion of the working element of the motor relative to other parts of the motor as a result of normal excitation of the motor during the normal working cycle thereof are not included herein.

(2) Note. Where a motor having one type of normal working motion (e.g., rotary) also has another type of motion (e.g., axial movement) for producing some useful external work (e.g., operating a clutch lever to clutch the motor to some work load, but wherein the clutch is not claimed, but the several types of motions of the motor are claimed), classification is not herein but in some other appropriate subclass. See subclass 115. However, where a motor having one type of useful work motion, also has another type of movement of the working element for regulatory or control purposes for the motor, classification is in this subclass (538).

SEE OR SEARCH THIS CLASS, SUBCLASS:

115, for motor systems having a motor having plural, diverse types of motion of the working element of the motor. See (2) Note above.

136, for motor systems having auxiliary means for producing mechanical torque on the working element of a motor during the starting or accelerating period.

159, and the subclasses specified in the Notes to the definition of that subclass for motor systems having means for biassing the rotary working element of the motor against angular movement.

437, for phasing, or angular or linear position control of a motor wherein a motor element may be moved without energizing the motor.

491, and the subclasses specified in the Notes thereto, for this subject matter where the system also includes means for controlling the motor circuits.

830, for this subject matter in induction motors systems.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, appropriate subclasses for structure of the motor, per se.

322, Electricity: Single Generator Systems, subclass 49 for generator systems which are controlled by adjusting or varying the magnetic structure of the generator; see subclass 54 for generator systems wherein the generator control involves the current collecting mechanism.

388, Electricity: Motor Control Systems, subclasses 835+ for single motor running-speed control systems having combined control of motor structure and motor circuit.

539 Both armature and field structures rotatable or adjustable:

This subclass is indented under subclass 538. Subject matter in which means are provided for moving or permitting to move, both the armature or primary member of the motor and the field or secondary member of the motor.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 115 for structure of a motor in which both the field and armature are incorporated in separate rotary elements.

540 Rotor element movable axially:

This subclass is indented under subclass 538. Subject matter in which means are provided for relatively moving the rotor element axially (i.e., along the axis about which the motor revolves) with respect to the remainder of the motor structure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

115, for motor systems having a motor having plural, diverse types of motion which commonly include axial movement. See (2) Note to the definition of subclass 538 for the distinction between the subclass and subclass 115.

SEE OR SEARCH CLASS:

322, Electricity: Single Generator Systems, subclass 51 for generator systems wherein the generator is controlled by moving or adjusting the rotor element axially.

541 Brush or other current-collector control:

This subclass is indented under subclass 538. Subject matter in which means are provided for moving or adjusting the brushes or other current-collector or current-transfer means of the motor.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 229 for dynamoelectric devices in which a current collecting brush is caused to traverse across the surface of the cooperating collector element transverse to the direction of motion therebetween; subclass 230 for current collecting brushes which are circumferentially adjusted upon the reversal of direction of motion of a dynamoelectric device; subclass 241 for means for circumferentially adjusting normally fixed brush holders.

322, Electricity: Single Generator Systems, subclass 54 for generator systems having generator control by means of movable or adjustable brushes particularly subclass 55 wherein the brushes are movable or adjustable circumferentially.

542 Having movement toward or from cooperating part (e.g., brush lifted from commutator):

This subclass is indented under subclass 541. Subject matter in which means are provided for moving the brush or other current-collector or current-transfer means toward or away from its cooperating part.

(1) Note. This subclass includes means for completely separating the brushes, etc., from the cooperating part and means for merely varying or changing the contact pressure therebetween.

543 THREE-OR-MORE-POSITIONS MOTOR CONTROLLER SYSTEMS:

This subclass is indented under the class definition. Subject matter in which the electric motor is controlled or regulated by a controller having three or more definite positions of control in which the degree or magnitude or kind of control at any one position differs substantially from that which is obtained when the controller is in either of at least two of the other positions.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 469 for miscellaneous control lever and linkage systems.

200, Electricity: Circuit Makers and Breakers, subclasses 1 through 18, 19.06+ for multiple contact circuit makers and breakers.

307, Electrical Transmission or Interconnection Systems, subclass 112 for miscellaneous switching systems.

335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclass 106 for electromagnetically operated switches of the plural contact type.

338, Electrical Resistors, subclass 68 for mechanically variable electrical resistors, and especially subclass 185 for mechanically variable electrical resistors having intervening connectors between the contact and resistance element (e.g., taps) so that the resistance value changes in steps.

361, Electricity: Electrical Systems and Devices, subclass 139 for miscellaneous relay circuits.

544 With other motor control device:

This subclass is indented under subclass 543. Subject matter in which a three-or-more-position controller is combined with some other motor control device between which there is

some particular inter-relationship; such as, for example, a predetermined sequence of operation, a mechanical or electrical interlock, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

53, and 255, for plural diverse motor operations control systems in which it is common to have a three-or-more-position controller combined with some other controller wherein each controller effects a different motor operation, see subclass 53 for plural motor systems and subclass 255 for miscellaneous motor systems.

255, see the reference to subclass 53 above.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclasses 471 and 479.01 for miscellaneous control lever and linkage systems having plural controlled elements or plural controlling elements, respectively.

545 Main line switch:

This subclass is indented under subclass 544. Subject matter in which the three-or-more-position controller is combined with a main line or armature or primary circuit switch.

SEE OR SEARCH THIS CLASS, SUBCLASS:

62, 264, 272, 275, and 277 for plural diverse motor operations control systems which include automatic starting and/or stopping which is usually effected by circuit maker and breaker in the main line circuit to the motor, see subclass

62, for plural motor systems,

264, 272, 275, and 277 for miscellaneous motor systems having plural diverse motor operations.

546 Plural, diverse or diversely controlled controllers:

This subclass is indented under subclass 543. Subject matter in which two or more three-or-more-position controllers are provided for controlling one or more motors, one of the controllers being different structurally or being differently controlled than another of the controllers.

547 Plural control stations:

This subclass is indented under subclass 546. Subject matter in which a plurality of means are provided for controlling the motor controllers, which means are positioned physically apart so as to constitute two stations or locations from which the operation of the controllers may be controlled.

548 Plural control stations:

This subclass is indented under subclass 543. Subject matter in which a plurality of means are provided for controlling the operation of a three-or-more-position motor controller, which means are positioned physically apart so as to constitute a plurality of stations or locations from which the operation of the controllers may be controlled.

SEE OR SEARCH THIS CLASS, SUBCLASS:

547, for this subject matter where the systems include plural controllers.

549 Return to "off", "starting" or "neutral" positions:

This subclass is indented under subclass 543. Subject matter in which means are provided for returning the controller, or which make it necessary that the controller be returned, substantially completely or fully to the “off”, “starting”, or “neutral” position after having been operated or started from such positions in a previous operation before it can become effective in controlling a subsequent motor operation.

550 Power-operated controllers:

This subclass is indented under subclass 549. Subject matter in which motive power means are provided for operating the three-or-more-position controller through part or all of its path of travel.

SEE OR SEARCH THIS CLASS, SUBCLASS:

552, and the subclasses specified in the search notes thereto, for other motor systems having power-operated motor controllers.

551 Knee- or foot-operated controllers:
This subclass is indented under subclass 543. Subject matter in which means are provided for operating the three-or-more-position controllers by knee or by foot of the operator.

SEE OR SEARCH CLASS:
74, Machine Element or Mechanism, subclasses 512 and 515 and the subclasses specified in the notes thereto, for miscellaneous foot-and-knee-operated control levers and linkages.

552 Power-actuated controllers:
This subclass is indented under subclass 543. Subject matter in which motive power means are provided for operating the three-or-more-position motor controller through all or part of its path of travel.

SEE OR SEARCH THIS CLASS, SUBCLASS:
550, for this subject matter where the power operated controller is provided with means for returning or necessitating that the controller be returned to its "off", "starting", or "neutral" position.

SEE OR SEARCH CLASS:
60, Power Plants, and the classes and subclasses specified in the notes to this class, for the structure of the power actuating means, per se.
185, Motors: Spring, Weight, or Animal Powered, and the classes and subclasses specified in the notes to this class, for the structure of the power actuating means, per se.

553 Separately actuated controller contacts:
This subclass is indented under subclass 552. Subject matter in which the three-or-more-position controller is provided with two or more sets or pairs of electrical contacts with separate or individual actuators for each set or pair of contacts.

554 Electromagnetic actuated:
This subclass is indented under subclass 553. Subject matter in which one or more of the actuating means for the sets or pairs of contacts are electromagnets (including electric motors).

SEE OR SEARCH THIS CLASS, SUBCLASS:
555, and the subclasses specified in the notes thereto, for other motor systems having electromagnetic actuating means for three-or-more-position motor controllers.

555 Electromagnetic actuated:
This subclass is indented under subclass 552. Subject matter in which one or more of the actuators are electromagnets (including electric motors).

SEE OR SEARCH THIS CLASS, SUBCLASS:
554, for this subject matter where there is electromagnetic actuating means for separately or individually actuated controller contacts.

SEE OR SEARCH CLASS:
335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, appropriate subclasses for electromagnetically operated switches, per se.
361, Electricity: Electrical Systems and Devices, subclass 139 for miscellaneous relay and electromagnet circuits.

556 Reciprocating or oscillating electromagnetic means:
This subclass is indented under subclass 555. Subject matter in which the electromagnetic actuating means comprise an electromagnetic means having a reciprocating or oscillating type of motor for its operating or working member.

SEE OR SEARCH THIS CLASS, SUBCLASS:
119, for miscellaneous motor systems in which the motor, which is the load device in the system, is a reciprocating or oscillating type of motor.
557, for motor systems having other means for operating a three-or-more-position motor controller intermittently or step-by-step.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 15 for reciprocating motors, and subclass 36 for oscillating motors.

557 Intermittent or step-by-step operation:

This subclass is indented under subclass 555. Subject matter in which the electromagnetic actuating means is a motor having an intermittent or step-by-step movement in a single direction of operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

135, for miscellaneous motor systems in which the motor, which is the load device in the system, is a linear-movement motor.

556, for this subject matter where the motor for actuating the controller is a reciprocating or oscillating electromagnetic means (including electric motors).

558 MISCELLANEOUS:

This subclass is indented under the class definition. Subject matter not classifiable in any of the preceding subclasses.

560 POSITIONAL SERVO SYSTEMS (E.G., SERVOMECHANISMS):

This subclass is indented under the class definition. Subject matter comprising a system which maintains a prescribed relationship between the position of a member or a function of the position and the value of a arbitrarily varied command signal by detecting an error between the actual position of the member or the actual value of the function of the position and the position or value commanded by the signal and controlling a motor of the servo system in response to the detected error.

(1) Note. From the definition set forth above, it is obvious the systems classified hereinunder are feedback control systems in which the directly controlled variable is mechanical position and the terminology employed will generally be that encountered in the feedback control art. Such feedback controlled mechanically positioning systems are also known as servo control or servomechanisms.

(2) Note. Since Class 318 takes, under the class definition only electric motor control systems, then a search, in order to be complete, must in appropriate situations extend to Class 33, Class 77, Class 91, Class 235, Class 244, Class 250, Class 307, Class 310, Class 327, Class 329, Class 330, Class 340, Class 346, Class 361, and Class 409.

(3) Note. If a servo system is presented which only discloses fluid motors and the claims are broad enough to cover either fluid or electric motors, the appropriate fluid motor class accepts the application. If the same type system is presented in which it is disclosed that the motor may be either fluid or electric, Class 318 accepts the application.

SEE OR SEARCH THIS CLASS, SUBCLASS:

690, for self-synchronous motor systems.

SEE OR SEARCH CLASS:

700, Data Processing: Generic Control Systems or Specific Applications, subclasses 1 through 89 for generic data processing control systems, subclasses 90-306 for control systems which are limited by the claims to a particular process or have a specific utility, and subclasses 245-264 for robot control. See the search class note in the class definition of this class (318).

901, Robots, subcollection 9 for positional servo systems for robots.

561 Adaptive or optimizing systems including "bang-bang" servos:

This subclass is indented under subclass 560. Subject matter in which the system may include means to measure or evaluate its own performance and automatically adjust one or more of its parameters in response to a change in internal or external environmental conditions, or where the system has been initially designed for optimum performance such as a bang-bang servo.

(1) Note. For example, an output from the system may be compared with the output from a desired response model or computer and the error produced employed to adjust the system gain.

SEE OR SEARCH CLASS:
- 244, Aeronautics and Astronautics, subclasses 175+ for autopilots with adaptive or optimizing features.
- 700, Data Processing: Generic Control Systems or Specific Applications, subclasses 28 through 55 for data processing adaptive or optimizing control systems.

562 Time-sharing or multiplexing systems:
This subclass is indented under subclass 560. Subject matter in which the system includes at least one element or one data-transmission link common to two or more servo loops and include in each of the loop on either a time sharing or multiplexing basis.

(1) Note. Included herein are systems in which a single computer provides command signals for two or more servo systems on a time sharing basis.

SEE OR SEARCH CLASS:
- 340, Communications: Electrical, subclasses 1.1 through 16.1 for communications systems in which a lesser number of communication lines control plural remote devices and subclasses 870.13 and 870.14 for time division telemetering of plural transmitters.
- 370, Multiplex Communications, appropriate subclasses for multiplex systems.

563 With protective or reliability increasing features (e.g., "fail-safe" systems):
This subclass is indented under subclass 560. System in which the system includes means to protect or guard against system failure.

SEE OR SEARCH CLASS:
- 91, Motors: Expansible Chamber Type, subclass 360 for fluid motor systems with fail safe features.
- 244, Aeronautics and Astronautics, subclasses 175+ for fail safe circuitry used in conjunction with autopilots.
- 307, Electrical Transmission or Interconnection Systems, subclasses 326+ for electrical transmission or interconnection systems with fail safe or protection features.
- 361, Electricity: Electrical Systems and Devices, subclasses 1+ for electrical systems with fail safe features.
- 700, Data Processing: Generic Control Systems or Specific Applications, subclasses 79 through 82 for protective or reliability features in combination with a data processing control system.
- 713, Electrical Computers and Digital Processing Systems: Support, subclasses 300+ for computer power control.
- 714, Error Detection/Correction and Fault Detection/Recovery, subclasses 1+ for reliability and availability, fault recovery, locating, and avoidance in digital data processing systems.

564 "Redundant" operating channels:
This subclass is indented under subclass 563. Subject matter in which the system includes a plurality of channels arranged such that should a failure occur in one channel, operation of the system is maintained by the remaining channel or channels.

SEE OR SEARCH CLASS:
- 244, Aeronautics and Astronautics, subclasses 175+ for redundant controls in autopilots.
- 327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 407+ for miscellaneous gating circuits having plural inputs and a single output and subclasses 415+ for miscellaneous gating circuits having a single input and plural outputs.
- 333, Wave Transmission Lines and Networks, subclass 3 for wave transmission lines and networks with automatic control for lines substitution.
- 361, Electricity: Electrical Systems and Devices, subclasses 62+ for plural parallel interconnected feeders for electrical systems.

565 Monitoring systems:
This subclass is indented under subclass 563. Subject matter in which the system includes one or more elements whose sole function is to test or monitor the performance of similar elements in the servo loop and to disable the servo upon a failure of one of the similar elements.

(1) Note. For example, a system operating in response to the amplified output of a first gyro may be provided with a second gyro and amplifier, which first gyro system is disabled when the output from the second amplifier differs substantially from the system output.

SEE OR SEARCH CLASS:
244, Aeronautics and Astronautics, subclass 77, for autopilots with monitoring control.
340, Communications: Electrical, subclass 648 for motor condition responsive indicating systems.

566 Maneuver, force, or load-limiting:
This subclass is indented under subclass 563. Subject matter in which means are provided for limiting the response of the system to excessive or large error signals.

SEE OR SEARCH THIS CLASS, SUBCLASS:
445+, for open loop systems which include automatic starting or stopping of a motor under various conditions.
635, for servo systems which include signal, voltage or current limitation.

SEE OR SEARCH CLASS:
91, Motors: Expansible Chamber Type, subclass 371 for fluid motor systems with pressure limitation.
244, Aeronautics and Astronautics, subclasses 175+ for autopilots with maneuver, force or load limiting.

567 Program- or pattern-controlled systems:
This subclass is indented under subclass 560. Subject matter having means whereby the command signal for the system is varied in response to a predetermined program or pattern thereby establishing a predetermined pattern or schedule for the positions of the controlled member.

SEE OR SEARCH THIS CLASS, SUBCLASS:
162+, for open loop pattern control systems.

SEE OR SEARCH CLASS:
29, Metal Working, subclass 64 for automatic machines which perform a cycle or operations in response to some mechanism.
66, Textiles: Knitting, subclasses 215+ and 231+ for automatic knitting machines which perform a sequence of operations.
91, Motors: Expansible Chamber Type, subclasses 36 and 37 for fluid motor systems responsive to a pattern or program.
409, Gear Cutting, Milling, or Planing, subclasses 2+, 79+, 245+, and 289+ for a gear cutting, milling, or planning machine adapted to operate in response to a pattern or program.
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 56 through 66 and 159-195, respectively, for generic digital positioning control or machining data processing; see the search class note in the class definition of this Class 318.

568.1 With program recording or composing means:
This subclass is indented under subclass 567. Subject matter including means for initially producing the program of control instructions to which the system subsequently responds.

568.11 Multifunction manipulator (i.e., Robot):
This subclass is indented under subclass 568.1. Subject matter wherein the system is a reprogrammable multifunction manipulator designed to move devices through variable programmed motions for the performance of changeable tasks on a repetitive basis without human intervention.

(1) Note. A robot usually has an arm (elongated appendage) which normally has three or more degrees of freedom.

(2) Note. A robot must be reprogrammable to perform a variety of different tasks. Thus, a numerically controlled machine tool, which may have an arm, but which is designed to perform only a fixed set of tasks, is not a robot.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 245 through 264 for robot control.
901, Robots, appropriate subclasses for cross-reference art collections of robot motion controls.

568.12 Mobile robot:
This subclass is indented under subclass 568.11. Subject matter in which the robot includes a base which is moveable without restraint under the control of a programmable guidance system.

(1) Note. A robot with a base which is guided for movement along a track so that the base must follow the track is not considered to be a mobile robot.

SEE OR SEARCH CLASS:
409, Gear Cutting, Milling, or Planing, subclasses 2+, 79+, 245+, and 289+ for a gear cutting, milling, or planning machine adapted to operate in response to a pattern or program.
701, Data Processing: Vehicles, Navigation, and Relative Location, subclasses 23+ for mobile robot control systems.
901, Robots, subclass 1 for an art collection of mobile robots.

568.13 With particular program teaching method:
This subclass is indented under subclass 568.11. Subject matter including methods of instructing or programming the robot to perform the steps of a desired sequence of manipulations.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 245 through 264 for robot control.
901, Robots, subclasses 3+ for program teaching methods for robots.

568.14 Manual lead through:
This subclass is indented under subclass 568.13. Subject matter wherein the robot is "taught" the steps of a desired sequence of manipulations by actual performance of the steps while the robot"s control system is in a memory mode, with the robot subsequently performing the memorized sequence without human intervention.

(1) Note. This subclass includes stepping the robot through a desired sequence of motions under keyboard control while the outputs of detectors associated with the joints of the robot"s arm are recorded.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 245 through 264 for robot control.
901, Robots, subclass 4 for manual lead through teaching of robots.

568.15 With particular interpolation means:
This subclass is indented under subclass 568.11. Subject matter in which the motion of the robot is defined by a plurality of discrete points along the path to be followed and a means is provided for generating continuous motion between the points.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclass 252 for robot control with interpolation.

568.16 With particular sensing device:
This subclass is indented under subclass 568.11. Subject matter in which a particular sensing device is used in monitoring or control of the robot.

(1) Note. Sensing devices include: video camera, force sensor, "absolute" position detector, etc.

SEE OR SEARCH CLASS:

700, Data Processing: Generic Control Systems or Specific Applications, subclasses 258 through 259 for robot control with particular sensor.

901, Robots, subclass 46 for robot sensing devices.

568.17 With multimode control (e.g., course-fine, position-force, etc.):

This subclass is indented under subclass 568.11. Subject matter in which more than one mode of control is provided.

(1) Note. Modes of control include: course positioning, fine positioning, velocity, acceleration, and force.

(2) Note. Inclusion of a compliance means on the robot is considered to constitute a position-force multimode control.

568.18 Including velocity control:

This subclass is indented under subclass 568.17. Subject matter wherein one of the modes of control is control of velocity (including acceleration and deceleration).

SEE OR SEARCH CLASS:

901, Robots, subclass 20 for speed altering provisions in a robot.

568.19 With particular coordinate transformation means:

This subclass is indented under subclass 568.11. Subject matter in which a transformation is made either (a), from one coordinate system to another (e.g., spherical polar coordinates to cartesian coordinates), or (b) from one reference frame to another (e.g., a reference frame associated with an “end effector” to a reference frame associated with the base of the robot).

SEE OR SEARCH CLASS:

700, Data Processing: Generic Control Systems or Specific Applications, subclass 251 for robot control with coordinate transformation.

568.2 With plural control systems (e.g., the interaction of plural processors to control the plural joints of a single robot:

This subclass is indented under subclass 568.11. Subject matter in which (a) plural robots interact, (b) a robot interacts with a numerically controlled machine tool or conveyor, or (c) plural computers interact in the control of a single robot.

SEE OR SEARCH CLASS:

700, Data Processing: Generic Control Systems or Specific Applications, subclass 249 for robot control with plural processors.

901, Robots, subclasses 6+ for communication between a robot and another machine including another robot.

568.21 Including end effector (e.g., gripping jaw, micromanipulator, etc.):

This subclass is indented under subclass 568.2. Subject matter including a device, usually attached to the robot arm, which extends the capability of the robot by one or more degrees of freedom.

SEE OR SEARCH CLASS:

700, Data Processing: Generic Control Systems or Specific Applications, subclasses 245 through 264 for robot control.

901, Robots, subclasses 30+ for robot end effectors.

568.22 With particular compensation (e.g., gain, offset, etc.):

This subclass is indented under subclass 568.11. Subject matter in which provision is made for improving the performance of a robot by applying a correction to a control instruction to compensate for a predictable inaccuracy in the positioning of the robot.

SEE OR SEARCH CLASS:

700, Data Processing: Generic Control Systems or Specific Applications, subclass 254 for robot control with compensation.

568.23 Including program modification:
This subclass is indented under subclass 568.22. Subject matter wherein the correction is applied by modifying the control program so that future repetitions of the robot"s actions are precompensated.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 250 through 257 for robot control with program modification.

568.24 With reliability enhancement means (e.g., monitoring, redundant circuits, etc.):
This subclass is indented under subclass 568.11. Subject matter in which means are provided for monitoring the performance of the robot and appropriate actions are taken in the event a fault is detected.

(1) Note. Fault response reactions include: (a) sounding an alarm, or otherwise alerting a human operator, (b) interrupting the action of the robot (shut down), or (c) selecting an alternate program path or device to circumvent the fault producing program step or device (redundant system).

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 250 through 257 for robot control with enhancing techniques.

568.25 Including display device:
This subclass is indented under subclass 568.24. Subject matter including means for displaying information relevant to locating and diagnosing faults in the robot or its control system.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclass 264 for robot control with particular operator interface.

569 Digital or numerical systems:
This subclass is indented under subclass 560. Subject matter including digital or numerical systems wherein the control system programming means utilizes numerical values, digital signals or coded pulses corresponding to desired positions of the control. Usually these numerical or digital signals are recorded on punched cards, punched tapes, magnetic tapes, or optical tapes.

SEE OR SEARCH THIS CLASS, SUBCLASS:
600+, for digital servo systems, per se, where the input command is not necessarily from a program.

570 Contouring systems:
This subclass is indented under subclass 569. Subject matter in which motion of a member along two or more axes is controlled simultaneously to provide a continuous predetermined path along which the member is directed.

571 With "feed-rate" control:
This subclass is indented under subclass 570. Subject matter in which means are provided for controlling the tangential velocity of the member along the path.

572 With "zero-offset" or tool radius correction:
This subclass is indented under subclass 570. Subject matter in which means are provided for (1) varying the reference points from which the coordinates of the system are measured or (2) compensating the system for variation in the diameter of the tool, such compensation being precalculated.

573 With interpolating means:
This subclass is indented under subclass 570. Subject matter in which the input data is represented by a plurality of discrete points along the path to be followed and the system includes means to interpolate between the points so that the ultimate servo command is a smoothly varying function.

574 Multiple axes point to point systems:
This subclass is indented under subclass 569. Subject matter in which the system programming means directs a member to move from a first point having a first set or coordinates to a second point having a second set of coordinates and in which the path taken by the member between points is not a material consideration.

575 Multiple axes analog systems:
This subclass is indented under subclass 560. Subject matter wherein the program input is a pattern in analog form, and means responsive thereto being used to position a member along one or more axes.

576 Nonmechanical line, seam or edge followers:
This subclass is indented under subclass 575. Subject matter in which the pattern to be followed is provided by a line, seam, or edge and the pattern follower is non-mechanical.

SEE OR SEARCH THIS CLASS, SUBCLASS:
162, for open-loop analog pattern controls.
653, for servo systems in which the position measuring instrument is a magnetic transducer.

SEE OR SEARCH CLASS:
219, Electric Heating, subclasses 124.01+, for systems which automatically position a welding machine over a seam.
409, Gear Cutting, Milling, or Planing, subclasses 290+ for a planning machine controlled by a line follower.

577 Optical or photoelectric line followers:
This subclass is indented under subclass 576. Subject matter in which the means to sense the line, seam or edge is a photoelectric means.

SEE OR SEARCH THIS CLASS, SUBCLASS:
640, for photoelectric or optical measuring instruments as an error detector in a servo system.

SEE OR SEARCH CLASS:
226, Advancing Material of Indeterminate Length, subclass 20 for systems wherein the material advanced is maintained in a predetermined path by photoelectric control.
250, Radiant Energy, subclass 202 for photoelectric line followers wherein the novelty lies in the photoelectric portion of the circuit.

578 Cam or template followers:
This subclass is indented under subclass 575. Subject matter in which the pattern to be followed is provided by a cam or template.

SEE OR SEARCH THIS CLASS, SUBCLASS:
162+, for open-loop, analog pattern control systems.

SEE OR SEARCH CLASS:
74, Machine Element or Mechanism, subclass 567 where a machine follows a groove or predetermined contour.
82, Turning, subclasses 19 and 55 for automatic turning machines which follows a cam or template.
409, Gear Cutting, Milling, or Planing, subclasses 79+ for a pattern controlled milling machine.

579 Multiple pass systems:
This subclass is indented under subclass 575. Subject matter in which the system controlled makes a plurality of passes of ever increasing precision.

(1) Note. For example, a patterned controlled machine tool which make a rough cut and ultimately a finish cut with as many intermediate cuts as are necessary.

SEE OR SEARCH CLASS:
409, Gear Cutting, Milling, or Planing, subclasses 288+ for a planning machine which functions in the manner of the device of this subclass.

580 Vehicular guidance systems with single axis control:
This subclass is indented under subclass 560. Subject matter in which the servomechanism guides a vehicle about a single axis, wherein the novelty is chiefly in the servomechanism and not in the guidance system.

(1) Note. The systems classified hereunder specifically exclude multiple axes vehicle guidance systems, which systems are classified in Class 244, Aeronautics, subclass 77, which subclass is the generic place for steering of dirigible craft in two or three dimensions by elec-

trical means. See particularly (2) Note of Class 244, subclass 77, as to the line between subclass 77 and the other motor and vehicle classes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

575+, for analogous pattern controlled systems in which a controlled member follows a path.

SEE OR SEARCH CLASS:

33, Geometrical Instruments, subclasses 204+ for direction indicator means, per se.

74, Machine Element or Mechanism, subclass 5 for structure of gyroscopes, per se.

102, Ammunition and Explosives, subclass 384 for drop bombs having direction controlling devices which may be automatic.

114, Ships, subclass 144 for steering mechanisms for ships which may be automatic.

180, Motor Vehicles, subclasses 167+ for a motor vehicle provided with means for controlling its operation responsive to electromagnetic radiation, magnetic force, or sound waves received from a source, or reflected from an object or surface, which is located apart from the vehicle; and subclass 79.1 for a motor vehicle having a steering gear of the electric power assist type.

244, Aeronautics and Astronautics, subclasses 76+, see (1) Note above.

340, Communications: Electrical, subclasses 907+, 945+, and 984+ for traffic and vehicle communication systems including aircraft and nautical controls.

701, Data Processing: Vehicles, Navigation, and Relative Location, subclasses 1+ for data processing systems in the application of vehicle control.

581 Radio-controlled:

This subclass is indented under subclass 580. Subject matter in which the steering control signal is obtained by radio.

SEE OR SEARCH THIS CLASS, SUBCLASS:

16, for open-loop remote controls including space transmitted electromagnetic or electrostatic energy (e.g., radio) control means.

SEE OR SEARCH CLASS:

244, Aeronautics and Astronautics, subclasses 3.13, 3.14, and 3.19 for electromagnetic wave or radio guidance.

340, Communications: Electrical, subclasses 12.5, 12.51, 13.25, and 13.26 are the generic subclasses for the control of apparatus and devices at a distance by means of radio wave energy.

342, Communications: Directive Radio Wave Systems and Devices (e.g., Radar, Radio Navigation), subclasses 385+ for directive beacons used in radio guidance.

455, Telecommunications, subclass 68 for remotely controlled modulated carrier wave communication systems.

582 Celestial navigation:

This subclass is indented under subclass 580. Subject matter in which the steering control is obtained by celestial means.

SEE OR SEARCH CLASS:

244, Aeronautics and Astronautics, subclass 3.18 for guidance systems employing a celestial body.

250, Radiant Energy, subclass 203.1, for photoelectric systems responsive to a point of illumination such as a star, etc.

583 Landing systems:

This subclass is indented under subclass 580. Subject matter in which the steering control is a landing system.

SEE OR SEARCH CLASS:

244, Aeronautics and Astronautics, subclasses 63 and 81 for guidance system including landing assists.

342, Communications: Directive Radio Wave Systems and Devices (e.g., Radar, Radio Navigation), subclasses 410+ for radio wave beacons which provide a glide path.

701, Data Processing: Vehicles, Navigation, and Relative Location, subclasses 15 and 16 respectively, for vehicle control of take-off or landing.

584 Altitude or pitch control:
This subclass is indented under subclass 580. Subject matter in which the steering control is an altitude or pitch control.

SEE OR SEARCH CLASS:
244, Aeronautics and Astronautics, subclasses 175+ for aircraft guidance.

585 Roll control:
This subclass is indented under subclass 580. Subject matter in which the steering control is a "Roll" control.

SEE OR SEARCH CLASS:
244, Aeronautics and Astronautics, subclasses 175+ for aircraft guidance.

586 Yaw control:
This subclass is indented under subclass 580. Subject matter in which the steering control is a "Yaw" control.

SEE OR SEARCH CLASS:
244, Aeronautics and Astronautics, subclasses 175+ for aircraft guidance systems.

587 Land vehicles:
This subclass is indented under subclass 580. Subject matter in which the steering control is for a land vehicle.

SEE OR SEARCH CLASS:
180, Motor Vehicles, subclasses 167+ and 79.1 as explained in the reference to Class 180 appearing in subclass 580 above.
340, Communications: Electrical, subclasses 901+ for traffic control of vehicles.

588 Marine vehicles:
This subclass is indented under subclass 580. Subject matter in which the steering control is for a marine vehicle.

SEE OR SEARCH THIS CLASS, SUBCLASS:
589, for steering controls for submarines or torpedoes.

SEE OR SEARCH CLASS:
114, Ships, subclass 144 for steering mechanisms for ships which may be automatic.
340, Communications: Electrical, subclasses 984+ for control of nautical vehicles.

589 Submarine and torpedo systems:
This subclass is indented under subclass 588. Subject matter in which the marine vehicle is a submarine or torpedo.

SEE OR SEARCH THIS CLASS, SUBCLASS:
588, for steering systems for marine vehicles.

590 Multiple mode systems:
This subclass is indented under subclass 580. Subject matter in which the servomechanism may operate or be operated in a plurality of different modes.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 75 through 77 for data processing control systems which include multiple modes.

591 With mode-engagement features (e.g., manual to automatic):
This subclass is indented under subclass 590. Subject matter in which the servomechanism includes features to provided for smooth transition from one operating mode to the next.

(1) Note. For example, a servo control system for shifting from manual control to automatic control or vice-versa which includes means to prevent the changeover until the servo error signal shaft would be negligible.

SEE OR SEARCH THIS CLASS, SUBCLASS:

591, and 649, for inertial or inclination devices which also include an erecting control.

609, and 610, for "reset" systems (P I and P I D controllers) with manual to automatic features.

SEE OR SEARCH CLASS:

74, Machine Element or Mechanism, subclass 5 for erecting gyroscopes.

244, Aeronautics and Astronautics, subclasses 175+ for aircraft guidance systems with manual to automatic and vice-versa features.

307, Electrical Transmission or Interconnection Systems, subclasses 64+, 85+, and 125+ for electrical interconnection systems with means to connect or disconnect responsive to various electrical conditions.

592 Fine and coarse systems:

This subclass is indented under subclass 590. Subject matter in which a plurality of position error detectors, one for each operating mode, are provided. The first of these position error detectors provides a coarse signal which is indicative of the rough or approximate final position. When the "coarse" position is approached, the "fine" position error detectors successively take over and precisely direct the servo to it final position. Complete servo control is thus realized at all time.

(1) Note. The servo systems classified herein differ from the "slewing" systems in subclass 597, in that the error signal maintains full control of the servo during the "coarse" positioning mode; whereas in the "slewing" control mode, control by the error signal is lost.

593 Separate fine and coarse motors:

This subclass is indented under subclass 592. Subject matter in which separate servo motors are provided for each of the operating modes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

625, for systems which include plural servomotors.

594 Digital systems:

This subclass is indented under subclass 592. Subject matter in which the system in at least one operating mode is controlled by digital means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

569+, for digital servo systems responsive to a program or pattern.

600+, for digital servo systems, per se.

595 Multiple speed synchro systems:

This subclass is indented under subclass 592. Subject matter in which the position error detectors for each mode are synchros. A synchro is a rotary position sensing transformer. The different speeds are usually obtained by use of a gear train.

SEE OR SEARCH THIS CLASS, SUBCLASS:

654+, for synchro systems, per se.

660, for systems in which one of the synchros may be an "Inductosyn". An "Inductosyn" is a planar two phase synchro.

661, for resolver systems, per se. A resolver is merely a two phase synchro.

692, for "self-synchronous" motor controls in which the receivers are selsyn motors. A selsyn motor is a device similar to a synchro but which produces torque.

596 Combined "on-off" and proportional control:

This subclass is indented under subclass 590. Subject matter in which the servo system includes means responsive to the error signal to operate the servo full on or completely off until a desires position operating range is attained at which point a proportional control means assumes control to bring the servo to a predetermined final position.

(1) Note. This subclass also includes systems in which during the "on-off" mode, the power may be periodically switched on and off.

(2) Note. The servo systems classified herein differ from the "slewing" systems elsewhere (see search notes below) in that the error signal maintains full control of the servo during both "on-off" and proportional control modes, whereas in a slewing control system control by the error signal is lost.

SEE OR SEARCH THIS CLASS, SUBCLASS:
597+, for slewing motor controls.
672+, for "on-off" motor controls.

597 Slewing systems:
This subclass is indented under subclass 590. Subject matter in which the servo system, includes means which, in response to a predetermined type of error signal saturates and applies maximum power to the servo motor. During this mode of operation, the error signal loses control of the servo motor which runs at maximum rate toward its ultimate position. This mode is defined as the "slewing" mode. Means are provided whereby the error signal regains control under the proper conditions.

SEE OR SEARCH THIS CLASS, SUBCLASS:
561, for "band-bang" servos which are somewhat similar to slewing systems except that the end position is continuously predicted and thus the error signal does not lose control.

598 With a separate slewing motor:
This subclass is indented under subclass 597. Subject matter in which a separate "slewing" motor is provided when the system operates in the "slewing" mode.

599 Pulse-width modulated power input to motor (e.g., "duty cycle" systems):
This subclass is indented under subclass 580. Subject matter in which electric power pulses of fixed magnitude and variable width are periodically applied and removed from the servo motor. The variation in width is in accordance with the servo error signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:
341, and 345, for similar type systems for motor speed control.

SEE OR SEARCH CLASS:
329, Demodulators, subclass 106 for pulse width demodulators, per se.
363, Electric Power Conversion Systems, subclasses 26 and 41 for conversion systems which may include pulse width modulation.

600 Digital or numerical systems:
This subclass is indented under subclass 560. Subject matter in which the command signal is digital or numerical. A digital or numerical command is one which is composed of one or more discrete symbols which may form a code. These symbols may take the form of any of the following examples: (1) The presence or absence of a discrete value of electrical voltage or current; (2) The presence or absence of a perforated hole in a tape or card; (3) The presence or absence of a discrete mechanical movement; (4) The making or breaking of an electrical switch. The above examples are not exclusive but merely representative.

SEE OR SEARCH THIS CLASS, SUBCLASS:
569+, for programmed controlled digital servo systems.
594, for digital fine and coarse systems.

SEE OR SEARCH CLASS:
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 1 through 89 for generic data processing control systems, subclasses 90-306 for control systems which are limited by the claims to a particular process or have a specific utility, and subclasses 245-264 for robot control. See the search class note in the class definition of this class (318).

601 Digital comparison:
This subclass is indented under subclass 600. Subject matter in which the system error signal is obtained by comparison of the digital command signal with a position feedback signal

which is also in digital form. Included herein are systems in which the position feedback includes an analog to digital converter for generating the feedback in digital form.

SEE OR SEARCH CLASS:
341, Coded Data Generation or Conversion, for code converters, generators or transmitters.

602 Commutating switch-type encoder:
This subclass is indented under subclass 601. Subject matter in which the digital position feedback is obtained from a commutating switch encoder, which encoder usually converts position information of analogue to digital form.

SEE OR SEARCH CLASS:
341, Coded Data Generation or Conversion, for encoders, per se.

603 Pulse-counting systems:
This subclass is indented under subclass 600. Subject matter in which a counting means acts as the comparator between the command signal and the position signal.

(1) Note. For example: If the member is to be positioned a certain increment from its present position, the command signal introduces a count into the counting means which is proportional to the distance to be moved, an error signal is generated which causes the member to move toward its final position, a feedback position indicator causes the counting-means to count back toward zero; and upon reaching zero the member is properly positioned, the error signal is no longer generated and the system waits for the next command.

SEE OR SEARCH CLASS:
377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, for pulse counting circuits.

604 Analogue comparison:
This subclass is indented under subclass 600. Subject matter in which the digital command signal is converted to an analog signal which is compared with an analog position signal to form the system error signal.

(1) Note. Included herein are systems which feature specific digital to analog converters.

SEE OR SEARCH CLASS:
341, Coded Data Generation or Conversion, subclasses 126+ for digital to or from analog converters.

605 Synchro or resolver (e.g., transmitter simulators):
This subclass is indented under subclass 604. Subject matter in which the analog comparison is by means of a synchro or resolver system. A synchro is a rotary transformer used for the instantaneous electrical transmission or reception of the angular position data of rotating parts. A resolver is a rotary transformer for resolving a vector into two mutually perpendicular components, such as translating error angle into electrical information corresponding to sine and cosine of rotor angle.

(1) Note. Included herein are systems in which the synchro or resolver transmitter is simulated by the digital to analog converter.

SEE OR SEARCH THIS CLASS, SUBCLASS:
569, and especially subclass 573, for programmed controlled digital systems in which a synchro or resolver transmitter simulation may be employed.

SEE OR SEARCH CLASS:
708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 1+ for electric hybrid computers, and subclasses 270+ for digital function generation.

606 Frequency- or phase-modulated systems:
This subclass is indented under subclass 560. Subject matter in which modulator means are provided wherein the command signal or feedback signal either frequency modulates, or phase modulates a system carrier. The system carrier is a wave suitable for being modulated to transmit intelligence. The modulation represents the information, and the original wave is

used only as the carrier of the modulation. Combinations of phase and frequency modulation are commonly referred to as frequency modulation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

684, for servo systems in which the novelty lies in the modulator which may be a frequency or phase modulator.

SEE OR SEARCH CLASS:

332, Modulators, subclasses 117+ for a frequency modulator and subclasses 144+ for a phase modulator, per se.

340, Communications: Electrical, subclasses 870.18, 870.25, and 870.26 for frequency or phase modulated telemetering systems and subclass 351, for code transmitters in which the frequency of the carrier is modulated in accordance with the code.

342, Communications: Directive Radio Wave Systems and Devices (e.g., Radar, Radio Navigation), subclasses 128+, 134+, 200+, and 202 for radio wave communications.

455, Telecommunications, subclasses 42+ for frequency or phase modulated carrier systems, per se.

607 Frequency comparison:

This subclass is indented under subclass 606. Subject matter in which the system includes a reference signal of the same frequency as the carrier frequency which is used with means to compare it with the modulated signal to obtain the modulating wave.

SEE OR SEARCH THIS CLASS, SUBCLASS:

684, for servo systems in which the novelty lies in the detector which may be an F M detector. Also subclass 318, for motor speed control by electrical frequency difference type detector.

SEE OR SEARCH CLASS:

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclass 42 for miscellaneous frequency comparison between a fixed frequency signal and a variable frequency signal.

329, Demodulators, subclasses 103 and 110+ for frequency demodulation, per se.

340, Communications: Electrical, subclasses 13.2 through 13.36 for frequency responsive remote control systems.

608 Phase comparison:

This subclass is indented under subclass 606. Subject matter in which the system includes a reference signal of the same frequency as the carrier frequency and of a fixed phase which is used with means to compare it with the phase modulated signal to obtain the modulating wave.

SEE OR SEARCH THIS CLASS, SUBCLASS:

683, for servo systems with particular phase sensitive discriminators. Also, subclass 314, for motor speed control with electrical phase difference type detectors.

SEE OR SEARCH CLASS:

324, Electricity: Measuring and Testing, subclasses 76.52+ and 76.77+ for measuring and testing systems which include phase comparison.

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 3+ for phase comparison of plural inputs.

329, Demodulators, subclasses 103 and 110 for phase demodulation, per se.

340, Communications: Electrical, subclass 13.1 for phase responsive remote control systems.

609 'Reset' systems (P.I.):

This subclass is indented under subclass 560. Subject matter in which two error detectors are provided: One which detects the instantaneous positional errors and attempts to immediately correct for them. This detector contributes what is termed “proportional” control to the system. The second error detector senses the instantaneous position with respect to the long term average position. This detector contributes what is a termed “reset” or “integral” control to the system. The two signals are summed to provide a composite system error signal.

(1) Note. In the systems classified herein, the "reset" or "integral" control is provided to increase long term system stability and it is really a special form of "lag" circuit. A "lag" circuit is any electrical circuit which integrates.

(2) Note. Systems of this nature may control any type or process such as temperature control, fluid flow, a chemical condition, mixtures, etc., as a result the art is widely scattered.

SEE OR SEARCH THIS CLASS, SUBCLASS:

621, for systems which include lead and/or lag compensation.

SEE OR SEARCH CLASS:

219, Electrical Heating, subclass 497 for electric heating systems which may include reset control features.

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 518+ for miscellaneous control circuits which may include reset features.

700, Data Processing: Generic Control Systems or Specific Applications, subclasses 1 through 89 for computer controlled manufacturing process controllers which may include reset features.

610 With rate (P. I. D.) (e.g., reset windup prevention):

This subclass is indented under subclass 609. Subject matter in which a third error detector is provided which detects the rate of change of the position and contributes what is termed a "rate" or "differential" control to the system. This rate signal is also summed with the two previous signal to provided a composite system error signal.

(1) Note. In the systems classified herein, the "rate" or "differential" control is provided to increase short system stability and is really a special form or a "leaf" circuit. A "lead" circuit is any electrical circuit which differentiates.

(2) Note. In the systems classified herein, the "rate" or "differential" control is often provided to prevent "reset windup". "Reset windup" is an art term which means that the system is unstable when subjected to quickly changing error signals.

SEE OR SEARCH THIS CLASS, SUBCLASS:

621, for systems which include lead and/or lag compensation.

611 With stabilizing features (e.g., anti-hunting, damping):

This subclass is indented under subclass 560. Subject matter in which the system includes stabilizing means which prevents hunting and minimizes overshooting of the commanded position.

(1) Note. Hunting is a condition of instability in a feedback control device which is essentially an uncontrolled oscillation due to insufficient feedback, improper phase shift or underdamping. The oscillations cause the positioned element to swing about its commanded position without stopping at the position.

(2) Note. Overshooting is a damped oscillation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

448, for automatic starting or stopping motor controls which include anti-hunt control.

612 Electric braking near balance (e.g., dynamic):

This subclass is indented under subclass 611. Subject matter in which the stabilizing means is by electrical means such as dynamic braking of the servo motors as the system approaches balance. Dynamic braking is forcing the motor to act as a generator which thus absorbs its rotational energy.

SEE OR SEARCH THIS CLASS, SUBCLASS:

211, for induction motor braking systems using dynamic braking. Also sub-

classes 371 and 375, for motor braking systems using dynamic braking.

613 D.C. in A.C. windings:
This subclass is indented under subclass 612. Subject matter in which dynamic braking is achieved by introducing DC into the windings of an AC servo motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
211, for induction motor dynamic braking by DC in AC windings.

614 Friction-braking near balance including magnetic or eddy current brakes:
This subclass is indented under subclass 611. Subject matter in which the stabilizing means is by friction braking as the system approaches balance.

SEE OR SEARCH THIS CLASS, SUBCLASS:
371, and 372, for motor control systems with friction braking.

615 By auxiliary feedback loop:
This subclass is indented under subclass 611. Subject matter in which the stabilizing means employees a separate auxiliary feedback loop in addition to the positional feedback loop.

616 Rate feedback:
This subclass is indented under subclass 615. Subject matter in which the auxiliary feedback loop senses the rate of positioning and introduces a signal proportional to the rate into the servo loop to reduce the magnitude of the servo error signal as the final position is approached.

(1) Note. For example, the counter E. M. F. of the servo motor can be measured to obtain the rate signal.

SEE OR SEARCH CLASS:
91, Motors: Expansible Chamber Type, subclass 364 for fluid motor control systems which include rate feedback.

617 Variable rate feedback:
This subclass is indented under subclass 616. Subject matter in which the rate sensing circuit is made variable to further enhance the stabilizing effect.

SEE OR SEARCH THIS CLASS, SUBCLASS:
651, for position servos which include an error detector responsive to acceleration.

SEE OR SEARCH CLASS:
91, Motors: Expansible Chamber Type, subclass 364 for fluid motor control systems which include variable rate feedback.

618 Tachometer feedback:
This subclass is indented under subclass 616. Subject matter in which the means to sense the rate is an electrical tachometer.

SEE OR SEARCH THIS CLASS, SUBCLASS:
312, and 326, for electric motor speed control which employ electrical tachometers or equivalent devices for speed control.

619 Variable gain bandwidth:
This subclass is indented under subclass 611. Subject matter in which the stabilizing means is a means for changing the gain of the servo loop of its bandwidth. The bandwidth is the upper and lower limit of frequencies to which the servo will respond.

(1) Note. For example, the variable gain element in the loop may be used to make the loop less sensitive to large error signals with means to increase the gain as balance is achieved.

(2) Note. For example, the bandwidth may be made variable so the loop is made more or less sensitive to certain frequency components which are present in the command signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:
561, for adaptive or optionizing controls which may utilize variable gain elements.

SEE OR SEARCH CLASS:

244, Aeronautics and Astronautics, subclasses 175+ aircraft controls which include variable gain or bandwidth systems.

620 Nonlinear circuits:

This subclass is indented under subclass 611. Subject matter in which the stabilizing means is a nonlinear circuit.

(1) Note. For example, the circuit may include a nonlinear resistor which changes its effective value in response to the applied voltage.

SEE OR SEARCH CLASS:

91, Motors: Expansible Chamber Type, subclass 379 for nonlinear fluid motor systems.

324, Electricity: Measuring and Testing, subclass 132 for measuring and testing devices which use nonlinear elements (e.g., thyrite).

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, appropriate subclasses for miscellaneous nonlinear circuits and particularly subclasses 334+ for an output signal which is a nonlinear mathematical function of an input signal.

330, Amplifiers, subclass 110 for nonlinear impedance in the feedback path of an amplifier. Also subclass 183 for nonlinear devices as interstage coupling.

621 Lead or lag networks:

This subclass is indented under subclass 611. Subject matter in which the stabilizing means is a lead or lag circuit or a combination of both. A “lead” circuit is defined as a circuit whose output voltage leads the input voltage over a certain range of frequencies. Sometimes it may be referred to as an “integrating” circuit.

SEE OR SEARCH THIS CLASS, SUBCLASS:

609, for “reset” servomechanisms which use integral and differential compensation.

SEE OR SEARCH CLASS:

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclass 335 for miscellaneous differentiating circuits and subclasses 336+ for miscellaneous integrating circuits.

622 A.C. networks:

This subclass is indented under subclass 621. Subject matter in which the lead and lag circuit is adapted for use in an AC servo loop.

(1) Note. Since many lead and lag circuits will only operate on DC Voltages, the systems classified herein may include: Means to demodulate the AC signals in an AC servo loop, passing the demodulated signal through the lead or lag circuit, and then remodulating the resultant signal.

623 Load stabilization (e.g., viscous, magnetic or friction dampers):

This subclass is indented under subclass 611. Subject matter in which the stabilizing means is a load stabilizer where the positioned load may have appreciable inertia.

(1) Note. For example, the load stabilizer may be a viscous, magnetic or friction damper.

SEE OR SEARCH CLASS:

324, Electricity: Measuring and Testing, subclass 125 for measuring and testing devices which include damping of this type.

624 By deadband at null (e.g., threshold circuits):

This subclass is indented under subclass 611. Subject matter in which the stabilizing means is a deadband in the servo loop which requires the servo error signal to be of a predetermined threshold magnitude before any control takes place.

SEE OR SEARCH CLASS:

244, Aeronautics and Astronautics, subclasses 175+ for aircraft control systems which include deadband devices for control purposes.

625 Plural servomotors:
This subclass is indented under subclass 560. Subject matter in which the system includes more than one motor.

626 Limit or end-stop control:
This subclass is indented under subclass 560. Subject matter in which means are provided to prevent the servo loop from driving the positioned member beyond predetermined limits.

(1) Note. Included herein are synchro systems which include means to prevent a synchro from locking onto a balance point which is 180° out of phase with the proper balance point.

627 Secto-scanning systems:
This subclass is indented under subclass 560. Subject matter in which the servo system scans the sector between the limit stops.

628 'Feelback' systems:
This subclass is indented under subclass 560. Subject matter in which the servo system is a "Feelback" system. "Feelback" is that characteristic of a servo system in which the servo system does not apply all the force required in positioning the member, but is a manual assist device.

SEE OR SEARCH THIS CLASS, SUBCLASS:
2, for motor controls including manual driving means.

SEE OR SEARCH CLASS:
91, Motors: Expansible Chamber Type, subclass 434, for fluid servomechanisms including "Feelback" is included.

629 Unwanted harmonic or voltage component elimination quadrature rejection systems:
This subclass is indented under subclass 560. Subject matter in which means are provided to eliminate from any of the servo loop signals an unwanted harmonic, an undesirable voltage component, or a quadrature component.

(1) Note. For example, an unwanted harmonic may be eliminated by the use of filtering.

(2) Note. For example, an undesirable voltage or quadrature signal may be bucked out of the system by introducing a signal of equal but opposite magnitude.

SEE OR SEARCH CLASS:
327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclass 549 for miscellaneous circuits with hum or interaction prevention and subclasses 551+ for miscellaneous unwanted signal elimination.
363, Electric Power Conversion Systems, subclasses 39+ for electrical conversion systems including means to eliminate an unwanted harmonic.

630 Antibacklash systems (e.g., with unidirectional approach to balance):
This subclass is indented under subclass 560. Subject matter in which some means to prevent "backlash" is provided to increase the accuracy of the positioned member. "Backlash" is an inherent inaccuracy more or less present in ever mechanical device caused by the "give" between parts. Backlash is also present in electrical components. Included herein are systems which do not specifically recite the term "backlash" but effectively compensate for it by always approaching balance from the same direction.

SEE OR SEARCH CLASS:
74, Machine Element or Mechanism, subclasses 409 and 440+, machine elements, for means to eliminate backlash from gearing.
408, Cutting by Use of Rotating Axially Moving Tool, subclasses 124+ for a boring or drilling machine with provision to compensate for backlash.
409, Gear Cutting, Milling or Planing, subclass 146 for a gear cutting machine with backlash compensation.

631 Antistatic friction features (e.g., 'dither' voltage):
This subclass is indented under subclass 560. Subject matter in which means are provided to eliminate static friction. Static friction is usually higher than running friction and has a deleterious effect on servo performance.

(1) Note. For example, by applying a low magnitude AC signal to the motor at all times, the rotor of the motor continuously vibrates at null to eliminate the static friction. The application of an AC signal is termed using a “Dither” voltage.

632 With compensating features:
This subclass is indented under subclass 560. Subject matter in which a compensating means is provided to improve servo performance.

(1) Note. For example, velocity compensation may be introduced into the servo loop to decrease the magnitude of the servo error signal and thus increase the ability of the servomechanism to correctly follow the command signal.

SEE OR SEARCH THIS CLASS, SUBCLASS:
655, for synchro differential systems in which various compensation signals are added by means of the differential synchro.

633 'Two-cycle error' compensation:
This subclass is indented under subclass 560. Subject matter in which the compensating means compensates for “Two cycle error”. “Two cycle error” is that characteristic of a position sensing device, usually caused by finite mechanical tolerances, which causes the device to exhibit a non-random error during each cycle of operation which repeats itself twice.

(1) Note. For example, the rotor of a synchro, because of mechanical limitation, will wobble minutely back and forth during 360 of rotation and cause a “Two cycle error”.

SEE OR SEARCH THIS CLASS, SUBCLASS:
654+, and 661, for synchro or resolver systems, per se, which may include such features.

634 Temperature compensation:
This subclass is indented under subclass 632. Subject matter in which the compensating means compensates for temperature effects on the servo.

SEE OR SEARCH CLASS:
324, Electricity: Measuring and Testing, subclasses 105+ for electrical measuring and testing instruments including thermal compensation.

635 With signal-, voltage-, or current-limiting:
This subclass is indented under subclass 560. Subject matter in which means are provided to limit the magnitude of a servo signal, or some voltage or current in the servo system.

SEE OR SEARCH CLASS:
327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 306+ for miscellaneous amplitude limiting circuits.

636 'Sampling' systems including miscellaneous 'sampled data' control systems:
This subclass is indented under subclass 560. Subject matter in which a servo signal is not continuously measured, but is periodically sampled at a rate high enough so that there are no deleterious effects on servo performance. Also included herein are that class of servomechanisms termed “sample data” control systems.

(1) Note. Not included herein are systems in which the DC signal is converted into an equivalent AC signal by means of a “chopper” or a modulator.

SEE OR SEARCH THIS CLASS, SUBCLASS:
331, and 341, for motor speed control systems which may include similar techniques.

637 Analog computation:
This subclass is indented under subclass 560. Subject matter in which included in the system is same form of analog computation. In other words, a mathematical problem solving servomechanism.

SEE OR SEARCH THIS CLASS, SUBCLASS:

661, for resolver systems which, for example, solve vector problems.

SEE OR SEARCH CLASS:

708, Electrical Computers: Arithmetic Processing and Calculating, subclasses 1+ and 800+, respectively, for electric hybrid computers or analog computers which may include analog circuits employing servomechanisms.

638 With particular 'error-detecting' means:

This subclass is indented under subclass 560. Subject matter in which a particular error detecting means is provided. An error detector is a device which compares the command signal with the feedback signal and produces an error signal related to the difference between these signals.

639 Plural, diverse conditions:

This subclass is indented under subclass 638. Subject matter in which the error detector is responsive to plural, diverse conditions.

SEE OR SEARCH THIS CLASS, SUBCLASS:

452+, for open-loop automatic motor controls responsive to plural, diverse conditions.

640 Photoelectric or optical-type measuring instruments:

This subclass is indented under subclass 638. Subject matter in which the error detector is a radiant energy photoelectric or optical measuring instrument.

SEE OR SEARCH THIS CLASS, SUBCLASS:

480, for open-loop automatic motor controls responsive radiant energy.

577, for photoeclectric line followers.

SEE OR SEARCH CLASS:

250, Radiant Energy, subclasses 200+ for radiant energy devices and systems employing photocells.

641 With particular temperature measuring instrument:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is a temperature measuring instrument.

SEE OR SEARCH THIS CLASS, SUBCLASS:

471+, for open-loop automatic motor controls responsive to thermal conditions.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 497+, electric heating, for automatic regulating or control for electric heating means responsive to temperature.

340, Communications: Electrical, subclasses 584+, electrical communication systems automatically responsive to temperature.

374, Thermal Measuring and Testing, subclass 168 for a self-rebalancing electrical thermometer.

642 With liquid level measuring instruments:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is a liquid level measuring instrument.

SEE OR SEARCH THIS CLASS, SUBCLASS:

482, for open-loop automatic motor controls responsive to liquid level or level of a granular material.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclasses 290+ for measuring and testing devices which measure liquid level.

340, Communications: Electrical, subclasses 612+ for electrical communication systems automatically responsive to the level of a fluent or pulverized material.

643 With moisture content or wetness measuring instruments:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is a moisture content or wetness measuring instrument.

SEE OR SEARCH THIS CLASS, SUBCLASS:

483, for open-loop automatic motor control responsive to moisture content or wetness.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclasses 29.02+ for measuring and testing devices employing hygrometers.

340, Communications: Electrical, subclass 602 for electrical communications systems automatically responsive to moisture or humidity.

644 With flow measuring instruments:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is a flow measuring instrument.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclasses 861+ for measuring and testing devices employing flow measuring instruments.

340, Communications: Electrical, subclasses 606+ for electrical communication systems automatically responsive to flow of fluent or pulverized material.

645 With fluid pressure measuring instruments:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is a fluid pressure measuring instrument.

SEE OR SEARCH THIS CLASS, SUBCLASS:

481, for open-loop automatic motor controls responsive to pressure in a fluid or granular material.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclasses 37+ for measuring and testing devices with pressure measuring instruments.

340, Communications: Electrical, subclass 626 for electrical communication systems automatically responsive to pressure.

646 With force or weight measuring instruments:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is a force or weight measuring instrument.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclasses 769+ for specific circuit structure in apparatus for measuring stress or strain.

340, Communications: Electrical, subclass 666 for electrical communication systems automatically responsive to weight.

346, Recorders, subclasses 9+ for weight responsive recorders.

647 With magnetic field measuring instruments:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is a magnetic field measuring instrument.

SEE OR SEARCH CLASS:

33, Geometrical Instruments, subclasses 355+ for geometrical instruments which measure magnetic fields.

324, Electricity: Measuring and Testing, subclass 244 for electrical measuring and testing instruments which measure a magnetic field.

648 With inertial, direction or inclination measuring instrument:

This subclass is indented under subclass 638. Subject matter in which the error detecting means is an inertial, direction, or inclination measuring instrument.

SEE OR SEARCH CLASS:

33, Geometrical Instruments, subclasses 340+ for geometric instruments which measure direction, inclination or inertia.

244, Aeronautics and Astronautics, subclasses 79 and 80 for automatic control of aircraft responsive to gyroscopes or pendulums.

649 Stable platforms:
This subclass is indented under subclass 648. Subject matter in which the measuring instrument includes a stable platform.

SEE OR SEARCH THIS CLASS, SUBCLASS:
591, for multiple mode servomechanisms with mode engagement features such as the erection of gyroscopes.

SEE OR SEARCH CLASS:
33, Geometrical Instruments, subclasses 321+ for geometrical instruments which include one or more gyroscopic elements that may form a stable platform.
74, Machine Element or Mechanism, subclasses 5+ for gyroscopes, per se, and other related features.

650 With current, voltage or electrical power measuring instruments:
This subclass is indented under subclass 638. Subject matter in which the error detecting means is a current, voltage or electrical power measuring instrument.

SEE OR SEARCH THIS CLASS, SUBCLASS:
453+, and 474+, for open-loop automatic motor control systems responsive to current, voltage, or power.

SEE OR SEARCH CLASS:
324, Electricity: Measuring and Testing, subclasses 76.11+ for electrical measuring and testing which is responsive to electricity, per se.

651 With acceleration measuring instruments:
This subclass is indented under subclass 638. Subject matter in which the error detecting means is an acceleration measuring instrument.

SEE OR SEARCH THIS CLASS, SUBCLASS:
617, for servomechanisms with variable rate compensation. Also, subclass 648, for servomechanisms with inertia measuring instruments.

SEE OR SEARCH CLASS:
73, Measuring and Testing, subclasses 488+ for measuring and testing devices responsive to acceleration.
244, Aeronautics and Astronautics, subclass 3.2 for missile guidance systems in which the control is responsive to acceleration.

652 With particular position measuring instruments:
This subclass is indented under subclass 638. Subject matter in which the system includes a particular position measuring instrument.

653 Magnetic transducers:
This subclass is indented under subclass 652. Subject matter in which the position measuring instrument is a magnetic transducer.

SEE OR SEARCH CLASS:
336, Inductor Devices, subclasses 115+ for inductor devices of the relatively movable coil or core type.

654 Synchro control transmitter-transformer systems:
This subclass is indented under subclass 652. Subject matter in which the particular position measuring instrument is a synchro. A synchro is a rotary transformer used for the instantaneous electrical transmission or reception of angular position data of rotating parts. Included herein are systems in which both the command signal and the feedback position signal are obtained from synchros.

SEE OR SEARCH CLASS:
336, Inductor Devices, subclasses 115+, especially subclasses 122+, for inductor devices of the relatively movable core and coil type.

655 With synchro differential:
This subclass is indented under subclass 654. Subject matter in which a differential synchro circuit is used. A differential synchro is a synchro in which both the stator and the rotor are relatively rotatable with respect to fixed reference, and the angular positional data obtained from such a device in the sum or difference of the two rotations.

656 Differential transformer systems:
Subject matter under subclasses 652 in which the particular position measuring instrument is a differential transformer. A differential transformer is a position indicating transformer with at least one primary winding and a plurality of secondary windings, the secondary windings are in bucking or aiding relationship. Some portion of the magnetic circuit of the transformer will affect the coupling of the secondary windings in responses to position and the secondary windings will give a voltage indication of the position sensed.

SEE OR SEARCH CLASS:
336, Inductor Devices, subclasses 115+ for inductor devices of the relatively movable core and coil type.

657 Linear differential transformer:
This subclass is indented under subclass 656. Subject matter in which the differential transformer is the linear type. Included herein are relatively movable core and coil type linear differential transformers. A linear differential transformer is one in which the coils and core are physically arranged on line.

658 'E' type transformer:
This subclass is indented under subclass 656. Subject matter in which the differential transformer is of the "E" type. An "E" type differential transformer is one in which the magnetic structure takes the form of an E.

659 'Microsyn' type:
This subclass is indented under subclass 656. Subject matter in which the differential transformer is a "Microsyn" type. A microsyn is a rotary type differential transformer in which the coils and core are relatively angularly movable.

660 'Inductosyn' systems:
This subclass is indented under subclass 652. Subject matter in which the particular position measuring instrument is an "Inductosyn". An "Inductosyn" is a rotary or linear synchro-like device in which the rotor and stator windings move relative to each other in parallel planes. Included herein are devices in which the rotor and stator windings are printed circuits.

SEE OR SEARCH THIS CLASS, SUBCLASS:
654+, and 661, for synchro or resolver type systems which are directly analogous in function to "Inductosyns".

661 Resolver systems:
This subclass is indented under subclass 652. Subject matter in which the particular position measuring instrument is a resolver. A resolver is a rotary transformer which has two phase windings on either or both the rotor and stator and may be used for resolving a vector into two mutually perpendicular components, such as translating rotor angle into electrical information corresponding to the sine and cosine of rotor angle. A resolver may also be considered as a two phase synchro.

SEE OR SEARCH THIS CLASS, SUBCLASS:
654+, for synchro systems, per se.

662 Variable capacitor systems:
This subclass is indented under subclass 652. Subject matter in which the particular position measuring instrument is a variable capacitor.

SEE OR SEARCH CLASS:
361, Electricity: Electrical Systems and Devices, subclasses 277+ for variable capacitors, per se.

663 Potentiometer systems including autotransformers and Wheatstone bridges:
This subclass is indented under subclass 652. Subject matter in which the particular position measuring instrument is a potentiometer. A potentiometer is any voltage dividing circuit. Included herein are systems using autotransformers as A C potentiometers. Also included herein are systems in which the command signal is introduced by one half of a Wheatstone bridge and the feedback potentiometer forms the other half of the bridge.

SEE OR SEARCH CLASS:
338, Electrical Resistors, subclasses 68+ for mechanically variable resistors.

664 Minor arc seeking:
This subclass is indented under subclass 663. Subject matter in which the position measuring potentiometer is circular and means are provided to sense the minor arc to be travelled in reaching the commanded position whereby positioning will be achieved in minimum time.

665 Continuous rotation, unlimited range:
This subclass is indented under subclass 663. Subject matter in which the position measuring potentiometer is circular and means are provided to allow continuous rotation of the wiper beyond 360°.

666 Controlled tap and slidewire:
This subclass is indented under subclass 663. Subject matter in which both the mechanical length of the potentiometer and the tap are both controllable.

667 With a bridge in the feedback circuit:
This subclass is indented under subclass 663. Subject matter in which the feedback loop contains a bridge circuit which does not necessarily null out when the servo loop is balanced.

(1) Note. Excluded from this subclass are potentiometer systems in which the feedback potentiometer forms one half of a Wheatstone bridge. See definition of 663, supra.

668 Recalibrating systems:
This subclass is indented under subclass 667. Subject matter in which the bridge circuit includes means for recalibration.

669 Standing wave:
This subclass is indented under subclass 652. Subject matter in which the particular position measuring instrument is a means for measuring the length of a standing wave. This means may take the form of a resonator, mechanical or electrical, dependent upon the type of wave being measured.

670 Contact resistance:
This subclass is indented under subclass 652. Subject matter in which the particular position measuring instrument is a means for measuring contact resistance.

671 With particular motor control system responsive to the 'actuating signal':
This subclass is indented under subclass 560. Subject matter in which the servo system includes a particular motor control responsive to the actuating signal.

672 Discontinuous or 'on-off' control:
This subclass is indented under subclass 671. Subject matter in which the particular motor control is the discontinuous or “on-off” type.

SEE OR SEARCH THIS CLASS, SUBCLASS:
599, for “on-off” and proportional control systems.

673 Seeking switch type:
This subclass is indented under subclass 672. Subject matter in which the discontinuous or “on-off” motor control is part of a “seeking” switch system. A “seeking” switch system is one in which the motor moves the wiper of a multiposition noncoded switch until a circuit which includes the motor and the switch is found which deenergizes the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
602, for analogous digital systems in which the motor drives a commutating switch type digital encoder.

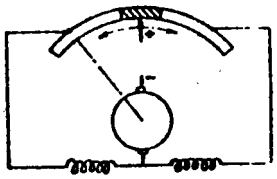
674 Wheatstone bridge type:
This subclass is indented under subclass 672. Subject matter in which the discontinuous or “on-off” motor control is controlled by a Wheatstone bridge circuit.

SEE OR SEARCH THIS CLASS, SUBCLASS:
663, for potentiometer systems which may be of the Wheatstone type.

675 One transmitter or controller element follows another:
This subclass is indented under subclass 671. Subject matter in which the transmitter or initiating controller comprises at least two relatively movable parts one of which is moved to effect starting of the follow-up motor and the other of which is actuated by the motor or

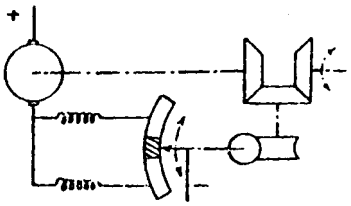
devices driven thereby in a direction so as to follow the said one part.

(1) Note. The following is an illustrative example.



676 Transmitter or controller element returned (e.g., force balance systems):
This subclass is indented under subclass 671. Subject matter in which means are provided for causing the follow-up motor to return the transmitter to its normal or original position at which position the motor is not adapted to run or operate.

(1) Note. An example of a transmitter returned follow-up arrangement comprises a differential gearing where in one element is driven by a control shaft, another element is driven by a controlled motor and the third element devices a circuit controlling means such as a switch. When the switch is in the neutral position, the arrangement is at rest. If the control shaft turns, the third element of the gearing drives the switch to an operating position to initiate operation of the motor to drive the second gearing element to drive the third gearing element to return the switch to neutral. The following is an illustrative example.



677 With particular servoamplifier:
This subclass is indented under subclass 671. Subject matter in which the particular motor control system includes a particular servoamplifier.

SEE OR SEARCH CLASS:
330, Amplifiers, subclasses 1+ for amplifiers, per se.

678 Differential amplifier:
This subclass is indented under subclass 677. Subject matter in which the particular servoamplifier includes a differential amplifier. A differential amplifier consists of two amplifying devices in parallel with a one common path (e.g., common cathode or common emitter), which senses the difference between a signal on the control electrode of the first amplifying device with the signal on the control electrode of the second amplifying device.

SEE OR SEARCH CLASS:
330, Amplifiers, subclass 69 for sum and difference amplifiers and subclass 116 for balanced to unbalanced amplifiers. See the notes thereunder.

679 Diverse types of amplifiers in different stage:
This subclass is indented under subclass 677. Subject matter in which the particular servoamplifier includes diverse types of amplifiers in the various stages.

SEE OR SEARCH CLASS:
330, Amplifiers, subclass 3 for amplifiers with plural diverse type amplifying devices.

680 Magnetic servoamplifiers:
This subclass is indented under subclass 677. Subject matter in which the particular servoamplifier is a magnetic amplifier.

SEE OR SEARCH CLASS:
330, Amplifiers, subclass 8 for saturable reactor type amplifiers and subclass 63, for magnetic amplifiers.

681 Solid-state servoamplifiers:
This subclass is indented under subclass 671. Subject matter in which the particular servoamplifier is a solid-state amplifier.

SEE OR SEARCH CLASS:
330, Amplifiers, subclasses 250+ for solid-state amplifiers.

682 Rotating amplifier (e.g., 'Ward Leonard' control):
This subclass is indented under subclass 677. Subject matter in which the particular servoamplifier is a rotating amplifier. For example, a generator with plural field winding which control current, voltage or power output. Included herein are "Ward-Leonard" control systems.

SEE OR SEARCH THIS CLASS, SUBCLASS:
140+, for generator-fed motor speed control systems.

SEE OR SEARCH CLASS:
322, Electricity: Single Generator Systems, for single generator systems in which the generator is connected as an amplifier.
330, Amplifiers, subclass 58 for rotating amplifiers, per se.

683 With particular phase discriminator:
This subclass is indented under subclass 671. Subject matter in which the particular motor control includes a particular phase discriminator.

SEE OR SEARCH THIS CLASS, SUBCLASS:
608, for position servomechanisms using phase comparison.

SEE OR SEARCH CLASS:
329, Demodulators, subclasses 103 and 110+, for particular phase demodulators or detectors.

684 With particular modulator or detector (e.g., choppers):
This subclass is indented under subclass 671. Subject matter in which the particular motor control includes a particular modulator or detector. Included herein are "chopper" systems.

SEE OR SEARCH CLASS:
330, Amplifiers, subclasses 9 and 10 for chopper or modulated amplifying systems.
335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclasses 87+ for magnetically operated periodic switches (e.g., vibrators).

685 'Step-by-step' motors in closed-loop servos:
This subclass is indented under subclass 671. Subject matter in which the particular motor control is used to control a "Step-by-step" or stepping motor; and the servo loop is closed by feeding back a position signal from the motor shaft back to the servo input.

SEE OR SEARCH THIS CLASS, SUBCLASS:
696, for "open-loop" stepping motor control systems.

SEE OR SEARCH CLASS:
310, Electrical Generator or Motor Structure, subclass 12.05 for a linear motor structure designed as an X-Y positioner; subclass 12.17 for a linear stepping motor; and subclasses 49.01-49.55 for a rotary stepping motor, per se.

686 Reciprocating or oscillating motors:
This subclass is indented under subclass 671. Subject matter in which the particular motor control is used to control a reciprocating or oscillating motor.

(1) Note. For the definition of a "reciprocating" or "oscillating" motor, see the class definition.

SEE OR SEARCH CLASS:
310, Electrical Generator or Motor Structure, subclasses 15+ for reciprocating electric motors and subclasses 36+ for oscillating electric motors.

687 Linear movement motors:
This subclass is indented under subclass 671. Subject matter in which the particular motor control is used to control a linear movement motor.

(1) Note. For a definition of "linear-movement" motor, see Linear Movement Motors of the class definition.

SEE OR SEARCH THIS CLASS, SUBCLASS:
135, and the subclasses specified in the Notes to the definition of that subclass for other linear-movement motor systems.
686, for reciprocating or oscillating motor systems under subclass 671.

SEE OR SEARCH CLASS:
310, Electrical Generator or Motor Structure, subclasses 12.01 through 12.33 for a linear motor, per se.

688 Shaded pole motors:
This subclass is indented under subclass 671. Subject matter in which the particular motor control is used to control a shaded pole motor. A shaded pole motor is a single phase induction or hysterysis motor where field shifting or distortion means is provided to determine direction of rotation.

689 TORQUING MOTORS:
This subclass is indented under subclass 671. Subject matter in which the particular motor control is used to control a torque motor. A torque motor is any motor which may operate in an energized but non-rotating mode primarily, to provide torsional force to the positioned load.

690 SELF-SYNCHRONOUS TYPE OF MOTOR:
This subclass is indented under the class definition. Subject matter in which a motor acts as a receiver or slave device with respect to a master or transmitter device. The receiver motor is termed "self-synchronous" in that it has the ability to produce torque in direct response to a command from the transmitter and to position itself in response to the command. No additional feedback loop or servomotors are included in these systems.

(1) Note. In the systems in this and the indented subclasses, the position or movement of the receiver motor is always substantially synchronized with the transmitter command.

691 With means to amplify transmitter signals:
This subclass is indented under subclass 690. Subject matter which means are provided for receiving a signal or control energy from the transmitter and delivering to the receiver motor a signal or control energy, the magnitude or energy content of which is appreciably greater than that received from the transmitter.

(1) Note. This subclass excludes mere voltage or current transformer systems where the magnitude of either the voltage or current output is greater than the input voltage or current, but the energy content at the output is the same or less than the input energy.

SEE OR SEARCH THIS CLASS, SUBCLASS:
505+, for motor armature or primary circuit control by space discharge devices.
727+, for induction motor control by space discharge devices in the primary circuit.
818+, for induction motor control by space discharge devices in the field or secondary circuit.

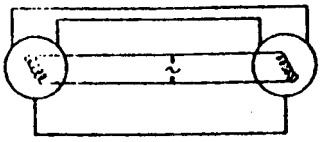
SEE OR SEARCH CLASS:
323, Electricity: Power Supply or Regulation Systems, appropriate subclasses for miscellaneous systems for controlling the output of electrical energy by means of a smaller quantity of electrical energy.
330, Amplifiers, appropriate subclasses for amplifiers generally (where the output signal wave shape is a substantial replica of the input wave shape).

692 Having induction or 'selsyn' type transmitter:
This subclass is indented under subclass 690. Subject matter in which the transmitter is of the same or similar structure as its self-synchronous receiver motor.

(1) Note. Systems classified herein are not to be confused with synchro transformer systems found in subclass 654, supra. A synchro transformer is an angular position pickoff device which cannot develop torque as can self-synchronous motor systems.

(2) Note. The transmitter and receiver windings of the systems in this subclass are some times called “selsyn” devices.

(3) Note. The following is an illustrative example:



SEE OR SEARCH THIS CLASS, SUBCLASS:
654+, for synchro-transformer systems, see (1) Note above.

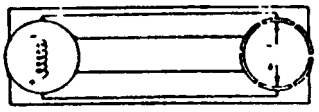
SEE OR SEARCH CLASS:
336, Inductor Devices, appropriate subclasses for the structure of transformers and inductive reactors.

693 Having impedance-type transmitter:
This subclass is indented under subclass 690. Subject matter in which the transmitter comprises an impedance device which is effective to vary the characteristics of the voltage or current supplied to the receiver device.

694 Having commutated dynamoelectric machine transmitter:
This subclass is indented under subclass 690. Subject matter in which the transmitter comprises a dynamo-electric machine in which the field producing means and the brushes are angularly adjustable relative to each other and the electrical circuits extending from the transmitter are connected at the transmitter end thereof to the commutator brushes.

695 Having commutating switch-type transmitter:
This subclass is indented under subclass 690. Subject matter in which the transmitter comprises a multiple contact switch with control circuits extending from the several contacts and a distributing contactor relatively movable into and out of contact with the said several contacts.

(1) Note. The following is an illustrative example.



SEE OR SEARCH THIS CLASS, SUBCLASS:
693, for impedance-type transmitters having relatively movable commutator and brush.

696 OPEN-LOOP STEPPING MOTOR CONTROL SYSTEMS:
This subclass is indented under the class definition. Subject matter in which a rotary electric motor; of the type in which the rotary element tends to assume a predetermined angular position when the motor is continuously energized; indexes in discrete angular increments of essentially uniform magnitude as a function of pulse inputs derived from outside the motor.

(1) Note. The pulses supplied to the motors used in these systems are not responsive to rotor movement or position.

(2) Note. Nonstepping space discharge commutated motors are classified elsewhere.

SEE OR SEARCH THIS CLASS, SUBCLASS:
400.42, for open-loop commutated motors.
685, for closed-loop servomechanisms which employ stepping motors.

SEE OR SEARCH CLASS:
310, Electrical Generator or Motor structure, subclasses 49.01 through 49 .55 for a rotary stepping motor, per se.

700 SYNCHRONOUS MOTOR SYSTEMS:
This subclass is indented under the class definition. Subject matter wherein the system of supply and/or control is for a synchronous motor.

(1) Note. See Synchronous motor of the class definition for the definition of a "synchronous motor" as used in this subclass and the subclasses indented hereunder.

(2) Note. Where the frequency or the periodicity of the armature or primary circuit currents is determined solely by means actuated by the motor itself, classification is not herein but in some other appropriate subclass.

(3) Note. In synchronous motors an energized alternating current winding produces a rotating electromagnetic field on a first member, and a fixed polarity magnetic field on a second member is rotatively movable with respect to the first member. The interaction of the two magnetic fields produces the rotation of the motor. The alternating current winding is referred to as the armature or the primary winding, and when the fixed field is produced by an energized winding, the energized winding is called the field winding.

(4) Note. Since synchronous motors are frequently used for phase or power-factor control purposes either (a) solely for such purposes by merely being connected to a power circuit with no load device being connected to the motor and generally, but not necessarily, having field excitation control means, or (b) for the combined purposes of phase or power-factor control and for driving useful load devices, it has been deemed advisable to classify the patents relating to synchronous motor systems in accordance with the function or functions performed thereby. Accordingly, synchronous "motor" systems will be classified on the basis of phase or power-factor control when the claimed subject matter is limited to such functions and all other synchronous motor systems will be classified on the basis of synchronous motors regardless of the disclosure in the respective specifications. Thus, for example, synchronous "motor" systems will be classified on the basis of:

A. Phase or Power-Factor Control. When the claimed subject matter: (1) refers to, or designates, the synchronous motor as: a. "phase adjusting means", b."phase modifier", c. "synchronous phase modifier", d. "synchronous condenser", e. "or any other means, the title of which definitely signifies that its function is to control phase or power factor such as, for example, as a f. "synchronous machine for correcting or modifying the power factor", or g. "synchronous motor for varying the power factor" which synchronous motor or machine is not limited to driving or actuating a useful load device and is connected to an electric circuit or system which is capable of supplying driving energy to the machine and which system is susceptible to having its phase or power factor affected by the machine; (2) refers to, or designates, the synchronous motor as a."synchronous machine", or b. "synchronous motor" and limits the motor or machine to being unloaded and is connected to an appropriate source of energy which is capable of supplying driving energy thereto which source is susceptible to having its phase or power factor affected by the machine; (3) refers to, or designates, the synchronous motor as a."synchronous machine", or a b.

"synchronous motor" and is connected to an electrical system to which other load or translating devices or circuits are also connected, none of which other loads, however, being electric motors or otherwise limited to a particular art device or load such as, for example, a "lamp", "secondary battery", "space-discharge device", etc., and which synchronous machine or motor is not limited to driving or actuating a useful mechanical load device, regardless of whether excitation control means are claimed or not.

B. Synchronous Motor Systems. When the claimed subject matter: (1) refers to, or designates, the synchronous "motor" as (a) "synchronous machine", or a (b) "synchronous motor", and (2) is not included under part "A", immediately preceding, and (3) is not disclosed solely as a source of electric energy.

(5) Note. In this subclass and those indented hereunder, where the synchronous motor has at least one stationary member and at least one rotating member movable relative to the stationary member, the fixed member is called the "stator" and the rotating member is called the "rotor".

(6) Note. Methods consistent with the apparatus in this group of subclasses will be placed with the appropriate apparatus.

(7) Note. In this subclass are synchronous motor systems which include both an armature or primary circuit and a direct current field excitation circuit where changeover from subsynchronous operation to synchronous operation or vice versa is involved. Also here are motor systems which do not require a DC field excitation circuit for synchronous operation but are double fed alternating current motor systems which operate at one or more synchronous speeds.

SEE OR SEARCH THIS CLASS, SUBCLASS:

47, for motor systems which include a synchronous and a nonsynchronous motor mechanically interconnected in a fixed or predetermined ratio of movement.

119+, for motor systems having a reciprocating or oscillating motor that operates synchronously with the periodicity of the source which supplies the electric energy thereto.

148, for generator-fed synchronous motor wherein the motor is controlled by controlling the generator.

254.1, and 254.2, see (2) Note above.

560+, for follow-up electric motor systems in which the motor controlled is a synchronous motor or operates, if at all, at a speed substantially synchronously with the motion of the transmitter.

731, for doubly fed induction motors which can run at synchronous speeds.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 201 through 204 for phase control systems including synchronous dynamoelectric machines.

701 Hysteresis or reluctance motor systems:

This subclass is indented under subclass 700. Subject matter wherein the motor includes a motor winding energized with alternating current by the system of supply and/or control to form a rotating magnetic field and (a) a rotor member of high magnetic retentivity which acquires a fixed magnetic field by induction from the energized winding and is thus attracted to the rotating field to rotate at the speed of the rotating field or (b) a rotor member which assumes a position of minimum magnetic reluctance with respect to the rotating magnetic field and, as a result of the magnetic field's rotation, rotates at the speed of the rotating magnetic field.

SEE OR SEARCH THIS CLASS, SUBCLASS:

254.1, and 254.2, for motor systems having a self-commutated motor in which the rotor tends to assume positions of minimum magnetic reluctance when energized.

702 Antihunting or damping:
This subclass is indented under subclass 700. Subject matter which includes means to reduce or eliminate variations in the speed of the energized synchronous motor from the synchronous speed.

(1) Note. Braking to maintain the synchronous motor speed constant is considered to be "running speed control", see Motor Braking Control of the general class notes.

SEE OR SEARCH THIS CLASS, SUBCLASS:
161, for motors having flywheels or other massive rotary member which may act to reduce hunting.
448, and the subclasses specified in the notes thereto for automatic motor systems which include antihunting means.
704+, for synchronous motor synchronization systems which includes squirrel cage or other short circuited windings which may act as antihunting or damping means during running speed operation.

703 Braking:
This subclass is indented under subclass 700. Subject matter which includes means to slow down or stop the rotation of the energized synchronous motor.

(1) Note. See the general class notes, Acceleration Control, for the distinction between braking and deceleration.

SEE OR SEARCH THIS CLASS, SUBCLASS:
362+, and the subclasses specified in the notes thereto for other motor systems having means for braking action types of electric motors.
757+, for the braking of induction motors by power reversal and mechanical and dynamic braking means.

704 Pole changing motor winding circuits:
This subclass is indented under subclass 700. Subject matter which includes an alternating current motor winding connected to an electric circuit, or a field winding connected to an electric circuit, or both an alternating current winding and a field winding each connected to an electric circuit wherein the electric circuit in each instance includes switching means to change the number of magnetic poles of the motor winding or windings.

(1) Note. Subject matter of this subclass type includes motors or subcombinations of motors capable of running at more than one speed.

SEE OR SEARCH THIS CLASS, SUBCLASS:
352, for field or secondary control circuits for changing the number of poles in field windings or secondary motor windings in running speed control circuits.
524, for field or secondary control circuits for changing the number of poles in field windings generally.

SEE OR SEARCH CLASS:
322, Electricity: Single Generator Systems, subclass 62 for generators having a convertible number of poles.

705 Synchronization systems:
This subclass is indented under subclass 700. Subject matter wherein the motor includes an alternating current winding and a field winding and the system includes an alternating current circuit connected to the alternating current winding of the motor to generate a rotating electromagnetic field, means to rotate the motor near synchronous speed and a circuit connected to the field winding of the motor to form a direct current magnetic field when the motor is rotating at near-synchronous speed so that the direct current field being attracted to the rotating magnetic field of the motor will rotate the motor at the speed of the rotating field.

(1) Note. As used in this subclass group, the term "synchronization" refers to the changing over of the operation of the synchronous motor from mechanical rotation by any means to rotation by the rotating magnetic field of the motor at the speed of the rotating field.

SEE OR SEARCH THIS CLASS, SUBCLASS:

700, for synchronous motor systems which may include the primary or armature motor circuit and the field excitation circuit where synchronization is not claimed.

716+, for synchronous motor field circuits where no armature or alternating current circuits are also claimed.

720+, for synchronous motor armature or primary circuits where no field circuit is also claimed.

706 With armature power removal upon failure to synchronize or loss of synchronism:

This subclass is indented under subclass 705. Subject matter wherein the system includes an alternating current circuit having a switching means to apply ac power to the AC winding of the motor and means responsive to some condition of the energized motor related to the operation of the motor at subsynchronous speed to control the switching means to de-energize the ac winding of the motor upon failure of the motor to achieve or maintain rotation at the speed of the rotating magnetic field.

SEE OR SEARCH THIS CLASS, SUBCLASS:

445, and the subclasses specified in the notes thereto for automatic control of other electric motors including automatic starting and/or stopping of electric motors.

519, for armature circuit control of electric motor system generally by the making and/or braking of the motor armature circuit.

707 Upon failure to resynchronize:

This subclass is indented under subclass 706. Subject matter which includes a second switching means in the circuit connected to the field winding, the means responsive to a condition of the energized motor detecting the failure of the motor to synchronize and controlling the second switching means to remove the DC power from the field and to reapply power to the field a predetermined number of times and controlling the first switching means to remove power from the AC winding of the motor if the motor still does not synchronize.

SEE OR SEARCH THIS CLASS, SUBCLASS:

437, and the subclasses specified in the notes thereto, for motor systems having means for phasing nonsynchronous motors.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 85+ for systems of interconnecting plural supply circuits or plural generators for synchronous operation.

708 Responsive to thermal electrical element in system:

This subclass is indented under subclass 706. Subject matter wherein the means responsive to some condition includes a heat sensitive electrical element to control the switching means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

471+, for motor control means responsive to thermal conditions of the motor circuit or in or about the motor.

511, for inherently or self-variable impedance for motor armature circuits generally which include an impedance whose value changes as a result of temperature changes.

709 Having different armature voltage prior to synchronism:

This subclass is indented under subclass 705. Subject matter wherein the alternating current winding circuit includes electrical means to apply one alternating voltage to the alternating currore synchronous operation and another value of voltage to the motor for synchronous motor operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

504, for voltage motor armature circuit control generally.

710 With D.C. field removal:

This subclass is indented under subclass 705. Subject matter which includes means responsive to the loss of synchronism in the motor to control the circuit connected to the field wind-

ing of the motor to cut the DC power to the field winding of the motor.

(1) Note. Subject matter of this subclass type not only removes the DC power from the field winding but can also reapply the DC power to the field winding.

SEE OR SEARCH THIS CLASS, SUBCLASS:

536+, and the subclasses specified in the notes thereto for other motor control systems in which the field circuit is made and/or broken.

712, for synchronous motor synchronization systems to apply the DC field to a synchronous motor.

716, for field circuits of synchronous motor systems where the power to the circuit may be switched on or off.

711 With electronic control element in system:

This subclass is indented under subclass 710. Subject matter wherein the means to control the circuit includes an electronic element to regulate the removal of DC power from the DC field winding.

SEE OR SEARCH THIS CLASS, SUBCLASS:

532, for general motor field or secondary circuit control by means of a space discharge device in the field circuit.

716+, for the control of power to the field winding of the synchronous motor.

712 With field excitation application:

This subclass is indented under subclass 705. Subject matter wherein the circuit connected to the field winding includes switching means to connect a direct current source of power to the field winding of the motor.

(1) Note. Subject matter of this subclass type includes electromagnetic and electronic switches.

SEE OR SEARCH THIS CLASS, SUBCLASS:

536+, for general motor field or secondary circuit control by making or braking the circuit.

710+, for synchronous motor synchronization systems including means to remove the direct current excitation of the field circuitry.

716+, for synchronous motor field excitation circuits only with means to apply or remove the excitation from the circuits.

713 Responsive to slip voltage frequency in DC field winding:

This subclass is indented under subclass 712. Subject matter wherein the rotating magnetic field and the speed of the rotating motor induce an AC voltage in the field winding and which includes means responsive to the frequency of the induced voltage to control the switching means to apply the direct current power to the field winding.

SEE OR SEARCH THIS CLASS, SUBCLASS:

521+, for motor field or secondary circuit control generally.

717, for synchronous motor field excitation application circuits controlled by the frequency of the voltage induced in the field winding circuits.

827, for induction motor secondary circuit control responsive to the frequency of the secondary circuit.

714 Responsive to armature current:

This subclass is indented under subclass 712. Subject matter having means sensing the current in the alternating current circuit to control the switching means to connect a source of direct current to the direct current winding of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

521, for motor field or secondary circuit control generally.

717, for synchronous motor field circuits responsive to a motor condition.

715 Responsive to rotor speed or rotor driven member:

This subclass is indented under subclass 712. Subject matter wherein the switching means is actuated by means responsive to the angular velocity of the rotor or to movement of a member driven by the rotor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

461+, for speed or rate of movement including tachometer-type detectors for controlling motor circuits generally.

717+, for synchronous motor field circuits, particularly subclass 719 for synchronous motor speed responsive field power sources.

716 Field winding circuits:

This subclass is indented under subclass 700. Subject matter which includes a field winding of a synchronous motor and an electric circuit connected to the winding.

(1) Note. The circuits of this subclass type include those which energize or control the field winding as by the adjustment, change, or regulation of the direct current winding of the synchronous motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

521+, for motor field secondary circuit control generally.

700+, for synchronous motor systems including both an armature circuit and a field circuit where synchronization of the motor is not claimed.

710+, for synchronous motor synchronization systems which include field winding excitation removal.

712, for synchronous motor synchronization systems which include field winding excitation applications.

717 Responsive to a motor condition:

This subclass is indented under subclass 716. Subject matter wherein the field winding circuit is controlled by some condition of the motor.

(1) Note. Motor conditions of this subclass type include, for example, current in the motor, power factor in the motor, the power taken by the motor, and the speed of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

453+, for generally controlling a motor in response to plural conditions one of which may be an electrical condition.

459, for generally controlling a motor in response to terminal voltage or counterelectromotive force of controlled motor.

471, for generally controlling a motor in response to thermal conditions of the motor control means or in or about the motor.

474+, for generally controlling motor in response to armature or secondary circuit current in the motor.

708, for synchronous motor synchronization systems responsive to a thermal electric element in the system to control the armature power removal upon failure to synchronize or loss of synchronization.

713, for synchronous motor synchronizing systems responsive to slip voltage frequency in the DC field winding to control excitation of field winding.

714, for synchronous motor synchronization systems responsive to motor armature current to control excitation of motor field winding.

715, for synchronous motor synchronization systems responsive to motor rotor speed or driven member to control excitation of the motor field winding.

718 Induced voltage in field winding:

This subclass is indented under subclass 717. Subject matter wherein a rotating magnetic field from an alternating current winding and rotating rotor induce a voltage in the field winding includes a switching circuit under the control of the induced voltage to control direct current to the field winding.

(1) Note. Subject matter of this subclass type includes, for example, relay and electronic switching circuits.

(2) Note. Subject matter classified in this subclass may include a armature or alternating current winding, but will not include circuits connected to the armature winding. See subclass 700 for syn-

chronous motors with circuits connected to the field and the alternating current winding when the energized motor is in the running mode but not being started.

(3) Note. Subject matter of this subclass type includes, for example, brushless motor solid-state switching device circuits to control the application of direct current to the field winding after the motor is near synchronous speed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

459, for general motor control means responsive to terminal voltage or counterelectromotive force of the controlled motor.

719 Speed responsive field power sources:
This subclass is indented under subclass 717. Subject matter wherein the electric circuit connected to the field winding includes direct current power sources whose power is dependent upon the speed of the synchronous motor rotor.

(1) Note. The direct current sources of this subclass type include, for example, DC generators and AC to DC converters.

SEE OR SEARCH THIS CLASS, SUBCLASS:

464, for motor control generally responsive to an electric generator tachometer responsive to the speed of the motor.

720 Armature winding circuits:
This subclass is indented under subclass 700. Subject matter which includes an alternating current winding of the motor.

(1) Note. Subject matter of this subclass type includes, for example, circuits to energize or control the alternating current winding of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

494+, for armature circuit control of motor generally.

704, for synchronous motor pole changing motor winding circuits.

706+, for synchronous motor synchronization systems which remove power form motor armature upon failure to synchronize or upon loss of synchronization.

719, for synchronous motor synchronization systems wherein the motor armature winding is different prior to synchronism.

767+, for induction motor circuit control circuits.

721 Responsive to rotor shape position or speed:
This subclass is indented under subclass 720. Subject matter wherein the electric circuit includes means to regulate the energization of the alternating current winding of the motor under the control of the rotor rotation.

(1) Note. The regulating means may be controlled by, for example, the speed of the rotor and the position of the rotor shape with respect to the location of the rotating alternating electromagnetic field or with respect to the position of a direct current electromagnetic field or permanent magnet field.

SEE OR SEARCH THIS CLASS, SUBCLASS:

461+, for speed or rate of movement control of a motor generally.

722 Having electronic power conversion circuit:
This subclass is indented under subclass 720. Subject matter wherein the electric circuit includes a static type of power converter which generates an electric wave-form which can be used by the alternating current winding of the motor.

(1) Note. Subject matter of this subclass types includes, for example, cycloconverters, rectifier inverters, and controlled and free-running oscillators and vibrators which can generate electricity having a waveform useable by the motor.

(2) Note. The power converter of this subclass type can include vacuum tubes or solid-state devices which must be electrically powered to operate as a generator.

(3) Note. The frequency of the converters of this subclass type can be varied or

switched between two different frequencies, and generally with a change in frequency the voltage of the waveform is changed accordingly.

SEE OR SEARCH THIS CLASS, SUBCLASS:

400.1, through 400.42, for synchronous motor commutation control systems.

768, for three phase induction motors operated from a single phase source.

800+, for induction motor primary circuits including controlled power conversion during motor starting.

807+, for induction motor primary circuits involving frequency control of the circuit.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 151 for conversion systems and subclass 154 for miscellaneous systems with a specifically recited load device.

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 365+ for miscellaneous gating circuits and subclasses 100+ for miscellaneous signal shaping, converting, or generating.

363, Electric Power Conversion Systems, subclasses 13+ for current conversions, subclasses 148+ for phase conversions; and subclasses 157+ for frequency conversions.

723 Having variable frequency supply:

This subclass is indented under subclass 720. Subject matter wherein the electric circuit has means to vary the rate of cyclic variations of the electrical energy supplied to the alternating current winding of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

110+, for plural diverse or diversely controlled electric motors having plural diverse or diversely controlled sources for armature circuits having different frequencies.

503, for armature circuit control of motors, generally, which includes controlling the frequency or pulsations of current supplied to the armature circuit.

700+, for synchronous motors having doubly fed circuits where synchronization or resynchronization is not involved.

704+, for synchronous motor synchronization systems.

807+, for induction motor primary circuit frequency control.

724 Having a plurality of windings or winding portions:

This subclass is indented under subclass 720. Subject matter wherein the alternating current winding of the motor consists of more than one winding or wherein such winding is formed of sections which are connected together.

SEE OR SEARCH THIS CLASS, SUBCLASS:

495+, for armature motor circuits, generally, having plural diverse or diversely controlled armature windings.

502, for armature motor circuits, generally, having a variable length or tapped armature winding.

700+, for synchronous motors with armature and field circuits.

705+, for synchronous motor synchronization and resynchronization systems.

767+, for induction motor primary circuits which require plural windings out of phase to start the motor.

725 REPULSION MOTOR SYSTEMS:

This subclass is indented under the class definition. Subject matter where the system of supply and/or control is connected to a repulsion motor.

(1) Note. See the class definition for the meaning of “repulsion motor” as used in the titles and definitions of this subclass and the subclasses indented hereunder. Such motors as are described in this section but having closed circuits between the brushes (rather than merely “short” circuits) are also classifiable in this subclass or in the subclasses indented hereunder provided that these motors function as repulsion motors.

SEE OR SEARCH THIS CLASS, SUBCLASS:

244+, for alternating current commutating motor systems which do not require

short-circuited brushes or close-circuited brushes in the operation of the motor.

728, for repulsion motor start, induction motor run systems.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclasses 173+ for commutated alternating current motors.

726 With added motor winding or convertible to series motor:

This subclass is indented under subclass 725. Subject matter wherein (a) the motor includes more than one winding forming the inducing electromagnetic field, (b) the motor armature has an added winding in addition to the commutated induced winding, or (c) the system has circuitry to place the field or inducing winding in series with the commutated winding of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

244+, for alternating current series motor circuits.

727 INDUCTION MOTOR SYSTEMS:

This subclass is indented under the class definition. Subject matter wherein the system of supply and/or control is for an induction motor.

(1) Note. See Induction motors of the class definition for the definition of "induction motor" as used in the titles and definition of this subclass and of the subclasses indented hereunder.

(2) Note. In this subclass and those indented hereunder, where only one of the two conductors [see Class Definition, Glossary, "Induction Motors"] rotates relative to the motor supporting structure, that conductor and the motor structure rotating with it is referred to in the title and definitions as the "rotor", and the fixed part of the motor is referred to as the "stator".

(3) Note. Nominal recitation of an induction motor (i.e., by name only) is an insufficient basis for classification in this subclass or the subclasses indented hereunder. For classification in this subclass or in the subclasses indented hereunder, some electrical or structural characteristic of induction motors (e.g., "secondary winding", "induced current winding") must be recited.

(4) Note. The induction motors included in the systems classifiable in this subclass or in the subclasses indented hereunder must be of the type which rotate continuously for at least one complete revolution (360°). For motors which rotate continuously for less than one complete revolution ("stepping motors") see the note to subclass 696 of this class in the search notes below.

SEE OR SEARCH THIS CLASS, SUBCLASS:

44, for motor systems having two or more induction motors with synchronizing interconnections between the induction motor secondaries.

49+, for electrically cascaded motors one or more of which are induction motors.

121, for motor systems having reciprocating motors which operate on the principle of the induction motor.

135, for motor systems having linear movement motors which operate on the principle of the induction motor.

148, for induction motors which are supplied by alternating current generators, the generators being provided with generator control means.

696, for stepping motors.

700+, for synchronous motor systems where the motor is provided with means for starting and/or accelerating the motor as an induction motor.

725+, for repulsion motors.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclasses 166+ for the structure of induction motors.

728 Repulsion start:

This subclass is indented under subclass 727. Subject matter having a switching means in the secondary circuit of the motor arranged so that, when starting, the current induced in the sec-

ondary member creates an electromagnetic field which reacts with the electromagnetic field formed by the primary member to cause the motor to accelerate and having means to run the motor as an induction motor after starting.

(1) Note. The switching means of this subclass type includes, for example, a commutator and brushes.

(2) Note. Subject matter of this subclass type includes, for example, repulsion-induction motors.

(3) Note. The means to run the motor as an induction motor may or may not include the switching means.

(4) Note. See the general class notes for the definition of a “repulsion motor”.

SEE OR SEARCH THIS CLASS, SUBCLASS:
725, for repulsion motor systems generally.

SEE OR SEARCH CLASS:
310, Electrical Generator or Motor Structure, subclass 173 for alternating current commutating motors.

729 Power-factor control:
This subclass is indented under subclass 727. Subject matter wherein the system includes means connected to the primary member, the secondary member, or to both to change the electrical angle between the voltage and the current in one or both of the members.

(1) Note. Means for adapting an induction motor for operation from a source of supply having a number of phases different from that for which the motor is wound are not included here even though the power factor may be affected by such means, particularly when condensers are employed in a phase splitting arrangement. See Search Notes below.

(2) Note. The change of phase may be for starting or running the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
438, for miscellaneous motor systems having power-factor control means.
781+, for induction motors operating from a single phase source, particularly subclasses 794+. See (1) Note above.
809, for voltage phase angle control of the primary motor circuit.
816, for split phase motor primary circuit voltage control.

730 With plural separately movable rotors:
This subclass is indented under subclass 727. Subject matter wherein the induction motor includes two rotors rotatable with respect to each other.

(1) Note. One rotor may support the primary member and the other rotor may support the secondary member, or one primary member may be on a stator and the secondary may be supported on one rotor with a second primary member on the other rotor, and the system to supply or control may be connected to the primary members, the secondary members, or to both.

(2) Note. The rotation of the motor may be reversed in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:
731+, for induction motors of the double fed type.
737, for self-cascaded, double fed induction motors.

731 With voltage source connected to motor secondary:
This subclass is indented under subclass 727. Subject matter wherein the secondary member is connected to a system which supplies it with a voltage in addition to the voltage electromagnetically induced by the primary member.

(1) Note. The systems of this subclass type, for example, control the speed or the torque of the energized motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

49+, for cascaded electrical motors which include induction motors having other motors connected in series with the secondary circuit thereof.

730, for plural rotor induction motor systems.

737, for self-cascaded induction motor systems.

732 Electronic device controls current in secondary circuit:

This subclass is indented under subclass 731. Subject matter wherein the system includes a three terminal electronic device having two terminals connected in circuit with the motor secondary and having the third terminal control the passage of current between the other two terminals to or from the secondary member of the motor.

(1) Note. The controlled electronic device of this subclass type is an electric valve which can control the amount of electrons or holes passing through the device. These devices include solid-state switches, thyratrons, and controlled vacuum and gas tubes. Saturable reactors are not included.

SEE OR SEARCH CLASS:

327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 365+ for miscellaneous gating circuits.

733 Commutator connected to secondary winding:

This subclass is indented under subclass 731. Subject matter wherein the secondary member is energized through a rotary switch at least one contact of which is stationary with respect to the secondary member and another contact of which rotates relative thereto with another part of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

738, for the definition of a “rotary switch”.

734 Slip rings connected to secondary winding:

This subclass is indented under subclass 731. Subject matter wherein the secondary member is energized continuously through at least two sliding contacts at least one of which is stationary with respect to the secondary winding.

(1) Note. Slip rings are a rotary electrical interconnection device to join two conductive members and consists usually of a resilient electrical member in contact with a circular electrically conductive member.

735 Rotor shaft coupled to dynamoelectric machine:

This subclass is indented under subclass 734. Subject matter wherein the secondary member and the sliding contact stationary with respect thereto are mounted on the induction motor shaft and the shaft is mechanically coupled to another dynamoelectric device.

736 Slip rings connected to dynamoelectric machine winding:

This subclass is indented under subclass 735. Subject matter wherein the dynamoelectric device has windings and the secondary winding of the induction motor is connected through the sliding contacts to a winding of the dynamoelectric device.

737 Self-cascaded motor windings:

This subclass is indented under subclass 727. Subject matter wherein the relatively movable members consist of plural windings on each separate member, a first winding on one member being in inductive relation with a second winding on the other member, a third winding on the other member being connected to the second winding, and a fourth winding on the one member being connected to the third winding.

(1) Note. The winding arrangements of this subclass type are in one induction motor rather than in cascaded machines.

(2) Note. The term “connected” includes an electrical or an inductive connection between windings.

SEE OR SEARCH THIS CLASS, SUBCLASS:

49+, for cascaded plural induction motors.
734+, for doubly fed induction motor systems.
738, for induction motor systems with a commutated winding generally.

738 With commutated winding:

This subclass is indented under subclass 727. Subject matter wherein the primary winding, secondary winding, or some other winding of the motor is energized through a rotary switch at least one contact of which is stationary with respect to the energized winding and another contact rotates relative thereto with some other part of the motor.

(1) Note. The rotary switch of this subclass type is usually a rotary electrical interconnection device which has a ring or disc of individual electrically insulated conducting sections around the periphery of the ring or disc and has brushes contacting the sections serially by the motion of the brushes or ring or disc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

244, for AC, current-commutating motor systems.
400.1, through 400.42, for synchronous motor commutation control systems.
725, for repulsion motor supply or control circuits.
728, for circuits to supply or control repulsion start-induction run motors and repulsion-induction motors.
733, for induction motor circuits having a commutator connected directly to the secondary winding of the motor which has a voltage source also connected to it.
734, for induction motor circuits whose secondary winding has slip rings directly connected thereto, a voltage supplied to it, and has a separate dynamoelectric machine with a commutator forming part of the electrical system.
737, for self-cascaded double fed induction motor systems using a commutated auxiliary winding in the motor to supply a voltage to the induction motor secondary.

739 Reversing:

This subclass is indented under subclass 727. Subject matter wherein the system connected to the primary winding of the motor includes means to change the direction of the rotation of the motor.

(1) Note. See Reversing Control class notes for the distinction between reversing and braking.

SEE OR SEARCH THIS CLASS, SUBCLASS:

65, for the reversing of plural motors.
256+, for plural diverse motor controls, generally, which include motor reversing.
280+, for more reversing generally.

740 With diverse motor operation:

This subclass is indented under subclass 739. Subject matter wherein the system includes means to perform some additional motor operation.

(1) Note. See Diverse Motor Operations of the Class Definition Glossary as to what is included as a motor operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

256+, and the search notes thereto for motor systems having a plurality of unlike motor operations.

741 With braking:

This subclass is indented under subclass 740. Subject matter wherein the additional operation is braking.

(1) Note. See Motor Braking Control of the Class Definition Glossary for the definition of “motor braking”.

SEE OR SEARCH THIS CLASS, SUBCLASS:

258, for general motor systems which include reversing, running speed control, and braking.
261+, and the notes thereto for motor systems having both reversing and braking functions.

362+, for motor braking systems generally.
757+, for braking of induction motors.

742 Electromagnetic brakes:
This subclass is indented under subclass 741. Subject matter wherein the braking action is a result of electromagnetic force.

(1) Note. The force of this subclass type may be within the motor or external to the motor and physically transmitted to it.

(2) Note. Electromagnetic brakes of this subclass type include, for example, eddy current brakes.

SEE OR SEARCH THIS CLASS, SUBCLASS:
362+, for motors braking, particularly subclass 373 for plugging and subclass 375 for dynamic braking.
759+, for electromagnetic dynamic braking of induction motors.
765, for eddy current braking of induction motors.

743 Generator action:
This subclass is indented under subclass 742. Subject matter wherein the braking is a result of electromagnetic energy created within the motor as a result of the rotation of the motor.

(1) Note. Subject matter of this subclass type includes, for example, regenerative braking.

SEE OR SEARCH THIS CLASS, SUBCLASS:
375+, for dynamic braking of motors generally.
759+, for dynamic braking of induction motors.

744 Plugging:
This subclass is indented under subclass 742. Subject matter wherein the electromagnetic action is a result of reversal of current or phase reversal within the primary member of the energized motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
373+, for miscellaneous dynamic braking systems for motors.
763+, for systems to plug induction motors.

745 With controlled saturable reactor in primary circuit:
This subclass is indented under subclass 739. Subject matter wherein the system includes a controlled saturable magnetic device having a control winding and a power winding, the power winding being connected between a power source and the primary winding of the motor, and the control winding being energizable to vary the impedance and the phase of the power winding to reverse the rotation of the motor.

746 Two phase motor:
This subclass is indented under subclass 745. Subject matter wherein the motor reversed is a two phase motor.

747 Two phase motor:
This subclass is indented under subclass 739. Subject matter wherein the motor reversed is a two phase motor.

748 With plural primary windings or winding portions having common connection:
This subclass is indented under subclass 747. Subject matter wherein the primary motor member includes two windings each having an end connected to form a common terminal or a single winding having a center tap.

749 Operating from a single phase source:
This subclass is indented under subclass 739. Subject matter wherein the energized motor is powered by a single phase source.

(1) Note. Subject matter of this subclass type includes single phase power source which can be converted to a two or three phase power source to run the induction motor.

750 Shaded pole motor:
This subclass is indented under subclass 749. Subject matter wherein the energized motor has a main magnetic field and the reversing means includes auxiliary motor windings

which develop a magnetic field out of phase with the main field to change the direction of the resultant field to reverse the motor.

(1) Note. Subject matter of this subclass type includes selectively short-circuited and close-circuited auxiliary windings and auxiliary windings which, when receiving properly phased voltages, act in the same manner as short-circuited or close-circuited windings.

751 Split phase motor with capacitor interchangeably connected in series with either primary winding:
This subclass is indented under subclass 749. Subject matter wherein the primary member includes two windings, a capacitor, and means to connect either winding with the capacitor so that the motor can selectively rotate in either direction.

752 With controlled electronic device to provide the series connection:
This subclass is indented under subclass 751. Subject matter wherein the means to connect either winding with the capacitor includes a three terminal electronic device where two of the terminals pass current through the device under the control of the third terminal which thereby determines which winding is in circuit with the capacitor or permits current to flow through the windings and the capacitor.

753 With de-energizable start winding:
This subclass is indented under subclass 749. Subject matter wherein the primary member includes a run and a start winding and the reversing means includes means to apply power to both of the windings and to cut out the start winding after the motor has come up to speed.

(1) Note. In this subclass and in the subclasses indented hereunder are manual, relay, and solid-state type switching to reverse the phase of the start winding with respect to the run winding of the motor so that the rotation of the motor rotor can be reversed.

(2) Note. The means to remove the start winding includes manual, centrifugal, and electromagnetic means.

754 With separate winding or winding portion energized for each direction of rotation:
This subclass is indented under subclass 753. Subject matter wherein the run or the start winding has more than one winding or has tapped portions and the reversing means has a switch means connecting the one or the other winding or both winding or a portion of the windings to reverse the direction of the motor.

755 Automatic current reversal on start winding:
This subclass is indented under subclass 753. Subject matter wherein the reversing means includes a self-acting switch which reverses the direction of the current through the start winding after the start and the run windings are energized so that when the start winding is de-energized and subsequently reenergized the motor will rotate in the other direction.

(1) Note. The switch of this subclass type is self-acting in the sense that it is actuated as a result of the operation.

(2) Note. The reversal can be as a result of (a) a centrifugal switch, (b) a thermal switch, or (c) an electromagnetic relay or some other means.

756 With controlled electronic switch for phase reversal:
This subclass is indented under subclass 739. Subject matter wherein the means to change direction of the motor includes an on-off electronic device with a control terminal which operates to determine when to permit or stop the transfer of power through the device itself from a power source to the motor or through a relay actuated by the on-off device.

(1) Note. Included in this subclass for example are three phase-reversing circuits with cycloconverters or rectifier inverters.

757 Braking:
This subclass is indented under subclass 727. Subject matter wherein the system includes means or devices for applying a torque or force to the motor in a direction opposite to the torque or force of the motor for the purpose of

slowing down or stopping the rotation of the motor.

(1) Note. See Acceleration Control, Motor Braking Control, and Reversing Control of the general notes to this class for what constitutes braking, reversing, and deceleration of a motor.

758 With diverse operation:
This subclass is indented under subclass 757. Subject matter wherein there is included means to perform an additional motor operation.

(1) Note. See Diverse Motor Operations of the general class notes as to what constitutes plural diverse motor operations.

759 Dynamic braking:
This subclass is indented under subclass 757. Subject matter wherein the means for applying a torque or force to the motor includes the primary and secondary members of the motor which when rotating relative to each other interact to form a generator action which produces a force opposite to the motor rotation to slow down or stop the motor.

(1) Note. Subject matter of this subclass type includes regenerative type braking systems.

760 Direct current primary winding braking circuit:
This subclass is indented under subclass 759. Subject matter wherein the means for applying a torque or force to the motor includes circuitry to apply direct current to the primary member so that the rotation of the motor causes the primary member to develop an induced voltage which causes a force in a direction opposite to the motor rotation to slow down or stop the motor.

761 Rotating rotor controls braking current in primary winding:
This subclass is indented under subclass 760. Subject matter wherein the rotating part of the motor controls the primary circuitry so as to apply direct current to the primary member.

762 With A.C. to D.C. conversion circuit:
This subclass is indented under subclass 760. Subject matter wherein the circuitry includes an electrical device which transforms an alternating current into direct current for the primary member of the motor.

763 Reversal of power to primary winding:
This subclass is indented under subclass 757. Subject matter wherein the means for applying a torque or force to the motor includes circuitry to change the direction of current or the phase through the primary winding of the motor to create an electromagnetic force in the secondary winding of the motor in a direction opposite to the direction of rotation of the motor to slow down or stop the motor.

(1) Note. The method of reversing the motor connections to apply braking action is known as “plugging”.

764 Three phase power reversal:
This subclass is indented under subclass 763. Subject matter wherein the circuitry to change the direction of current or the phase is in a three phase motor circuit.

765 Eddy current braking circuits:
This subclass is indented under subclass 757. Subject matter wherein the motor rotor has an electrical conducting member connected thereto and an electrical winding associated with the conducting member such that current passing through the winding creates a changing electromagnetic field within the conducting member which induces eddy currents which create an electromagnetic force in a direction which opposes rotation of the motor to slow or stop the motor.

766 Primary and secondary circuits:
This subclass is indented under subclass 727. Subject matter wherein the system to supply and or control connected to the motor includes an electric circuit connected to both the primary and to the secondary winding of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:
493, for miscellaneous motor systems having combined armature or primary

control and field or secondary control of the motor.

725, for repulsion motors having primary and secondary circuits.

731, for induction motors which have a primary circuit and a secondary circuit with a voltage source in addition to the secondary induced voltage.

739, for induction motor reversing circuits with a secondary speed control circuit.

757, for induction motor braking circuits having a primary and a secondary circuit.

767 Primary circuit control:

This subclass is indented under subclass 727. Subject matter wherein the system to supply and or control the motor includes a circuit connected to the primary winding of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

494, for miscellaneous motor systems for controlling the armature or primary circuits of the electric motor.

766, for primary and secondary induction motor circuits.

768 Three phase motor operated from single phase source:

This subclass is indented under subclass 767. Subject matter wherein the circuit includes means to transform power from a single phase source into three phase power to energize a three phase motor.

769 With dynamoelectric converter:

This subclass is indented under subclass 768. Subject matter wherein the means to transform power from a single phase source into three phase power includes a rotary dynamoelectric machine.

770 Dual voltage motors:

This subclass is indented under subclass 767. Subject matter wherein the motor is adapted to operate from either of two possible alternating voltages and the circuit connects the primary member of the motor to one of the two alternating voltages.

771 Delta-wye, plural wye, or plural delta connected primary windings:

This subclass is indented under subclass 767. Subject matter wherein the primary member comprises a plurality of windings and the circuit connected to the windings permits (a) a star-delta connection of the windings, (b) two or more star connections of the windings, (c) two or more delta connections of the windings.

(1) Note. A star connection is a polyphase circuit in which all circuit paths from each point of power connection go to a common point.

(2) Note. A delta connection is a polyphase circuit in which all circuit paths form a triangle with the apex of each path intersection being connected to a power source.

772 Plural speed:

This subclass is indented under subclass 767. Subject matter wherein the primary member comprises a plurality of windings or winding portions and the circuit includes means connected to the windings or winding portions to cause the motor to rotate at several nominal discrete speeds.

(1) Note. The speeds here are not limited to the synchronous speeds of the motor.

(2) Note. Speed of the motor can be controlled by change of frequency of the power supply, change in the number of poles, or a change in the slip of the motor. Only the change in the number of poles is included in this group of subclasses.

(3) Note. Generally, the speed selected is determined by changing the connections between the winding portions or the number of the winding turns energized.

SEE OR SEARCH THIS CLASS, SUBCLASS:

773+, for poles changing systems to change the speed of the motor.

807+, for frequency control systems to change the speed of the motor.

821+, for impedance control of the motor secondary to change the speed of the motor.

773 Pole changing:
This subclass is indented under subclass 772. Subject matter wherein the means connected to the windings provides a predetermined number of primary magnetic poles at one operating speed and a different number of poles for another operating speed.

774 Single phase motor:
This subclass is indented under subclass 773. Subject matter wherein the motor controlled is a single phase motor.

775 Separate primary running winding for each pole number, alternately energized:
This subclass is indented under subclass 774. Subject matter wherein each predetermined number of poles is produced by the energization of a separate primary winding.

776 Entire primary running winding energized for each running speed:
This subclass is indented under subclass 774. Subject matter wherein the means connected to the windings or winding portions electrically rearranged the windings or winding portions to produce a different number of poles and energize all of the windings or winding portions in all running speeds of the motor.

777 Separate primary running winding for each pole number, alternately energized:
This subclass is indented under subclass 773. Subject matter wherein each number of poles is produced by the energization of a separate primary winding.

778 Starting control:
This subclass is indented under subclass 767. Subject matter wherein the circuit provides means to supply electric energy to the motor or to control flow of the current in the primary circuit for initiating motor rotation or controlling the motor during acceleration from rest.

779 With speed control:
This subclass is indented under subclass 778. Subject matter wherein means are provided for controlling motor speed during any mode of motor operation.

(1) Note. Motor Operation Control is defined in the Class Definition Glossary.

780 Three phase motor with variable transformer to initially adjust voltage to motor windings:
This subclass is indented under subclass 778. Subject matter wherein the circuit includes transformer means to enable the application of a voltage value for starting which is different from the voltage applied during running of a three phase motor.

(1) Note. Tapped transformer windings or auto-transformers are included in this subclass.

781 Operating from a single phase source:
This subclass is indented under subclass 778. Subject matter wherein the means to supply electric energy to the motor is a single phase source of electric supply.

(1) Note. Included in this subclass are shaded pole motors.

782 With protective features:
This subclass is indented under subclass 781. Subject matter wherein means are provided to protect the motor from harmful operation.

SEE OR SEARCH CLASS:
361, Electricity: Electrical Systems and Devices, subclasses 24+ for motor protective condition responsive circuits.

783 Thermal starting and thermal overload protection:
This subclass is indented under subclass 782. Subject matter wherein the means to protect the motor includes heat responsive means for controlling the motor starting and for protecting against current overload in the motor.

784 Impedance for reducing current during starting operation:
This subclass is indented under subclass 781. Subject matter wherein the means to control the flow of current in the primary member or a portion thereof during starting includes impedance means.

785 Start winding removed during running operation:
This subclass is indented under subclass 781. Subject matter wherein the primary member consists of a main primary winding and a start winding and the circuit includes means for de-energizing the start winding by removing part or all of the start winding from the circuit which supplies the electrical energy to the start and the run winding.

(1) Note. The main primary winding is the run winding of the motor.

786 By electronic switch:
This subclass is indented under subclass 785. Subject matter wherein the means for removing part or all of the start winding includes an electronic switch means to de-energize the start winding.

SEE OR SEARCH CLASS:
327, Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems, subclasses 365+ for miscellaneous gating or switching systems.

787 With transformer for sensing the run winding current:
This subclass is indented under subclass 786. Subject matter wherein the electronic switch means is controlled in response to the output voltage of a sensing transformer which provides a measure of the current flowing in the main winding circuit.

788 With variable temperature coefficient resistor in switch control circuit:
This subclass is indented under subclass 786. Subject matter wherein the electronic switch means is controlled by a circuit which includes a resistor whose resistance is a function of its temperature.

789 By electromagnetic switch:
This subclass is indented under subclass 785. Subject matter wherein an electromagnetic switch means is provided for de-energizing the start winding.

SEE OR SEARCH CLASS:
335, Electricity: Magnetically Operated Switches, Magnets, and Electromagnets, subclasses 2+ for electromagnetic switches, per se.

790 With relay coil in series with main winding:
This subclass is indented under subclass 789. Subject matter wherein the switch includes an operating coil for the electromagnetic switch in series with the main primary winding.

791 By thermal switch:
This subclass is indented under subclass 785. Subject matter wherein a heat responsive switch means is provided for de-energizing the start winding.

792 With variable temperature coefficient impedance element:
This subclass is indented under subclass 791. Subject matter wherein the heat responsive switch means includes an element whose impedance is a function of its temperature.

793 By centrifugal switch:
This subclass is indented under subclass 785. Subject matter wherein the start winding is de-energized by a switch actuated by centrifugal force developed by the rotating motor.

794 Capacitor run motor with different capacitance at starting:
This subclass is indented under subclass 781. Subject matter wherein the motor is a split phase motor and the primary member has two or more primary windings energized in both the starting and the running modes of operation, at least one winding having in circuit therewith capacitance whose value is different in each operating mode.

795 With plural capacitors:
This subclass is indented under subclass 794. Subject matter wherein there are two or more capacitors to change the effective capacitance in circuit with at least one winding.

796 Saturable winding in capacitor run motor circuit:
This subclass is indented under subclass 781. Subject matter wherein there is a split phase capacitance motor having a saturable winding

in circuit with the capacitor and the primary windings, which has a reactance value in the starting mode different from that of its reactance in the running mode.

797 Phase splitting using stator winding mutual inductance or saturable winding:
This subclass is indented under subclass 781. Subject matter wherein the primary member includes two or more primary windings and the mutual inductance between the windings or a saturable winding is used to cause a phase splitting effect between the windings to create the starting torque to rotate the motor.

798 Responsive to motor condition:
This subclass is indented under subclass 767. Subject matter wherein means is provided to sense a motor condition and the circuit connected to the primary member of the motor is controlled by the sensing means.

(1) Note. The motor condition is some characteristic of the motor which is affected by the operation of the motor. Such characteristics may be electrical or electromagnetic and include speed, slip, current, voltage, or magnetic flux.

SEE OR SEARCH THIS CLASS, SUBCLASS:
806, for motor control means responsive to a condition other than a motor condition.

799 Responsive to speed or rotation phase angle:
This subclass is indented under subclass 798. Subject matter wherein the means to sense is responsive to the speed or the rotational phase angle of the motor being controlled or a device driven by the motor.

800 With controlled power conversion:
This subclass is indented under subclass 799. Subject matter wherein the circuit connected to the primary member of the motor includes a power conversion means controlled by the speed or rotational phase angle responsive means.

801 Including inverter:
This subclass is indented under subclass 800. Subject matter wherein the power conversion means includes one or more inverter circuits.

(1) Note. An inverter circuit changes a direct current source of power into an alternating source of power.

802 Responsive to an additional condition:
This subclass is indented under subclass 801. Subject matter wherein the circuit connected to the primary member of the motor is responsive to another condition as well as being responsive to the speed or the rotational phase angle of the motor.

(1) Note. Subject matter of this subclass type includes feedback sensing of a motor condition or some characteristic of the motor control circuit and may include the sensing of motor current, voltage, or a signal indicative of some characteristic of the control circuit.

803 With controlled AC to DC circuit in inverter supply:
This subclass is indented under subclass 802. Subject matter wherein the one or more inverter circuits includes an AC to DC converter having means to adjust the direct current output voltage of the converter.

(1) Note. A converter is an electrical device that transforms one type of electricity to another type.

804 With controlled magnetic reactance:
This subclass is indented under subclass 799. Subject matter wherein the circuit connected to the primary member of the motor includes a controlled magnetic reactance.

(1) Note. The controlled reactance of this subclass type includes magnetic amplifiers, saturable reactors, and transformers having a winding in circuit with the primary winding of the motor wherein the winding reactance is changed as a result of the mutual inductance between this winding and another winding of the transformer.

805 Responsive to motor voltage:
This subclass is indented under subclass 798. Subject matter wherein the motor condition sensed is the motor voltage.

806 Condition responsive:
This subclass is indented under subclass 767. Subject matter wherein there is means to sense a condition other than a motor condition and the circuit connected to the primary member of the motor is controlled by the means to sense the condition.

(1) Note. A condition is some quantity which is capable of being sensed including, for example, temperature, pressure, voltage delivered to the circuit, or some manifestation of the motor environment.

SEE OR SEARCH THIS CLASS, SUBCLASS:
798, for motor control means responsive to some condition of the motor.

807 Frequency control:
This subclass is indented under subclass 767. Subject matter wherein the circuit connected to the primary member of the motor includes means to regulate the frequency of the current or voltage supplied to the primary member.

(1) Note. Regulation used here means to adjust or fix the rate of the cyclic current or voltage delivered to the primary winding of the motor, and includes control of the frequency to deliver a constant frequency or a variable frequency to the primary winding of the motor.

808 With voltage magnitude control:
This subclass is indented under subclass 807. Subject matter wherein means are also provided to regulate the magnitude of the voltage applied to the primary member of the motor.

(1) Note. The means to regulate this subclass type consists of means to adjust or fix the value of the voltage so that the voltage can be constant or selectively varied.

809 With voltage phase angle control:
This subclass is indented under subclass 807. Subject matter wherein the voltage supplied to the primary member is a repetitious sinusoidal waveform and the means to regulate the frequency of the voltage supplied to the primary member includes means to regulate the phase angle of the waveform at which the remainder of the waveform of each cycle is applied to the primary member.

(1) Note. Phase angle is the angle in electrical degrees of the waveform between the beginning of the waveform at 0° and the end of the waveform at 360° at which the waveform is applied to the motor winding.

(2) Note. Regulation includes the control of the phase angle at a constant angle or a variable angle.

810 With voltage pulse time control:
This subclass is indented under subclass 807. Subject matter wherein the voltage waveforms applied to the primary member of the motor is a pulse waveform having alternating positive and negative polarity portions, and the means to regulate the frequency of the voltage includes means to regulate the time at which the pulses are started and ended.

(1) Note. Regulation includes the starting and ending of the pulses at a constant time or a variable time.

811 Pulse width modulation or chopping:
This subclass is indented under subclass 810. Subject matter wherein each positive and negative polarity portion of the applied waveforms comprises a plurality of pulses of variable width.

812 Voltage control:
This subclass is indented under subclass 767. Subject matter wherein the circuit connected to the primary member of the motor includes means for regulating the voltage applied to the circuit.

(1) Note. Regulation includes a constant or a selectively variable voltage control.

813 With transformer:
This subclass is indented under subclass 812. Subject matter wherein the means for regulating the voltage includes a transformer.

SEE OR SEARCH CLASS:
336, Inductor Devices, appropriate subclasses for transformers, per se.

814 With impedance control:
This subclass is indented under subclass 812. Subject matter wherein the means for regulating the voltage includes a variable impedance.

815 Saturable reactor:
This subclass is indented under subclass 814. Subject matter wherein the variable impedance is a saturable reactor.

816 Single phase, split phase motors:
This subclass is indented under subclass 812. Subject matter wherein the motor is operated from a single phase source as a split phase motor.

817 With capacitor:
This subclass is indented under subclass 816. Subject matter wherein a capacitor is used to effect phase splitting in the motor.

818 Secondary circuit control:
This subclass is indented under subclass 727. Subject matter wherein the system to supply and or control the motor includes a circuit connected to the secondary member of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

44, for plural induction motor systems having synchronizing interconnections between motor secondaries.

49, for an induction motor having an electric motor connected to the secondary circuit (i.e., connected in tandem) of the induction motor.

521+, and the subclasses specified in the search notes thereto for miscellaneous motor systems having secondary circuit control of the motor.

729, for power factor control in the primary or secondary circuit of an induction motor.

731+, for primary and secondary induction motor circuits having a voltage source connected to the motor secondary.

766, for primary and secondary induction motor circuits.

819 Open secondary member or portion thereof with means to open or close the circuit thereto:
This subclass is indented under subclass 818. Subject matter wherein the circuit connected to the secondary member includes switch means to turn off or on the current in the secondary member or a portion thereof.

(1) Note. The secondary member portion may consist of one winding or a plurality of windings and the switch means may control the current through all of the windings or one or more windings.

(2) Note. The switch means includes controlled and uncontrolled electronic devices, mechanical and automatic switches which act only to open or close the secondary motor winding or a part of the secondary motor winding. The electronic devices include thyratrons, silicon-controlled rectifiers, silicon-controlled switches, and four-layered diodes, but amplifier-type tube or solid-state devices which can act as a switch and additionally function as an amplifier are not included.

820 Closed secondary member or member portion with means to change electrical characteristics thereof:
This subclass is indented under subclass 818. Subject matter wherein the secondary member or a portion thereof is always in a closed electrical path with the circuit and the circuit includes means connectable to the member or member portion to change the electrical characteristics thereof.

821 Impedance control of secondary circuit:
This subclass is indented under subclass 818. Subject matter wherein the circuit includes an electrical impedance element of the resistive, inductive, or the capacitive type to control the current in the secondary member of the motor.

(1) Note. Here the voltage induced in the secondary member by the primary member creates a current which is controlled by an impedance element forming part of the circuit.

(2) Note. Means to add, remove, or vary the secondary impedance element is included in this group of subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

533, and the subclasses specified in the notes thereto for miscellaneous motor systems having impedance devices in the field or secondary circuit of the motor.

SEE OR SEARCH CLASS:

323, Electricity: Power Supply or Regulation Systems, subclasses 220 through 354 for impedance voltage magnitude controlled systems.

336, Inductor Devices, appropriate subclasses for inductors, per se.

338, Electrical Resistors, appropriate subclasses for resistors, per se.

361, Electricity: Electrical Systems and Devices, subclass 271 for capacitors, per se.

822 Responsive to motor condition:

This subclass is indented under subclass 821. Subject matter wherein the impedance element of the circuit is controlled by a motor characteristic.

(1) Note. The motor characteristics include secondary motor voltage, the secondary motor current, the primary motor current, and the motor rotor speed.

(2) Note. The term "controlled" includes the addition, removal, the shorting out, or somehow changing the value of the impedance element or elements of the circuit.

823 Rotor speed or position responsive:

This subclass is indented under subclass 822. Subject matter wherein the motor characteristics are the motor rotor speed or the position of the rotor with respect to the inducing magnetic field of the motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclasses 120+ for speed responsive switching systems.

323, Electricity: Power Supply or Regulation Systems, for speed controlled impedance systems.

824 Centrifugal force of rotor controls secondary circuit impedance:

This subclass is indented under subclass 823. Subject matter wherein a mass movable radially of the motor rotor in response to a force caused by the speed rotation of the rotor controls the impedance element of the circuit.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 120 for centrifugal force responsive switching systems.

323, Electricity: Power Supply or Regulation Systems, subclasses 293 through 298 for output responsive impedance systems.

825 Induction motor current:

This subclass is indented under subclass 822. Subject matter wherein the motor characteristic is the current flowing in a member of the motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 131 for current controlled switching systems.

323, Electricity: Power Supply or Regulation Systems, subclasses 293 through 298 for current or current and voltage controlled impedance systems.

826 Primary motor current:

This subclass is indented under subclass 825. Subject matter wherein the current is flowing in a primary member of the motor.

(1) Note. In the subject matter of this subclass type current may flow in the primary and the secondary members of the motor.

827 Frequency of secondary current:

This subclass is indented under subclass 822. Subject matter wherein the motor characteristic is the frequency of the voltage induced in the secondary member or the relative frequencies of the current in the primary and the secondary members of the motor.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 129 for frequency controlled switching systems.

323, Electricity: Power Supply or Regulation Systems, subclasses 293 through 298 for electrical condition controlled impedance systems.

828 Secondary voltage:

This subclass is indented under subclass 822. Subject matter wherein the motor characteristic is the voltage of the secondary circuit of the motor or the voltage across an impedance element of the motor secondary circuit.

SEE OR SEARCH CLASS:

307, Electrical Transmission or Interconnection Systems, subclass 130 for voltage controlled switching systems.

323, Electricity: Power Supply or Regulation Systems, subclasses 293 through 298 for voltage or voltage and current controlled impedance systems.

829 By manual operation:

This subclass is indented under subclass 821. Subject matter wherein the impedance element of the circuit is controlled totally by manual means requiring only human force.

(1) Note. The term "control" as used herein means to add, remove, or somehow change the impedance of a resistive, inductive, or capacitive electrical element.

SEE OR SEARCH THIS CLASS, SUBCLASS:

821, for relay operated switching circuits to control the adding, removal, or the changing of impedance elements in the secondary circuit of the motor.

830 With relatively movable cooperating motor parts to control energized motor:

This subclass is indented under subclass 727. Subject matter wherein the motor includes plural cooperating members which are movable relative to each other physically and means to move the members with respect to each other, this relative movement is in addition to motion caused by the electromagnetic interaction between the rotor and the stator of the motor.

SEE OR SEARCH THIS CLASS, SUBCLASS:

115, for motors with diverse motions.

491, and the notes thereto for miscellaneous motor control systems with both circuit and structure control of the motor.

538+, for miscellaneous motor structure adjustment or control systems wherein the motor structure is controlled.

SEE OR SEARCH CLASS:

310, Electrical Generator or Motor Structure, subclass 191 for field or excitation windings or core structure having adjustable magnetic structure; and subclass 209 for armature or primary windings or core structure with adjustable magnetic structure.

831 Axially movable cooperating parts:

This subclass is indented under subclass 830. Subject matter wherein one of the two relatively movable parts is movable in the direction of an axis.

(1) Note. "Axial" as used herein means situated in the direction of or along an axis.

(2) Note. Included are movable rotary dual motor rotors cooperating with a movable stator and rotary dual, in-line rotors cooperating with a fixed stator.

SEE OR SEARCH THIS CLASS, SUBCLASS:

115, for motors with diverse motions including axial movement of the rotor by the magnetic forces of the motor in addition to the rotary or angular movement of the rotor even though the reverse axial movement is effected by gravity only when the motor energization is reduced.

832 Dual stators, one or both angularly movable:

This subclass is indented under subclass 830. Subject matter wherein the motor includes a double stator and at least one stator is angularly movable with respect to the other stator.

FOREIGN ART COLLECTIONS

The definitions below correspond to abolished subclasses from which these collections were formed. See the Foreign Art Collection schedule of this class for specific correspondences. [Note: The titles and definitions for *indented* art collections include all the details of the one(s) that are hierarchically superior.]

FOR 100 SPACE-DISCHARGE-DEVICE COMMUTATED MOTOR:

Foreign art collection in which space discharge devices are connected in the armature or primary circuit of the motor and are connected so as to effect the commutation of the motor.

(1) Note. The interposition of an induction transformer or other electric converter between the space discharge devices and the armature of the motor does not prevent classification herein.

FOR 101 SELF-COMMUTATED IMPULSE OR RELUCTANCE MOTORS:

Foreign art collection in which a rotary electric motor, of the type in which the rotary element tends to assume a predetermined angular position when the motor is continuously energized, is provided with a commutator or circuit making and breaking means which is actuated by the motor to determine the instants of time at which the field producing winding or windings thereof are energized and de-energized relative to the angular position of the rotary element of the motor.

FOR 102 MOTOR COMMUTATION CONTROL SYSTEMS:

Foreign art collection in which means are provided for facilitating or otherwise controlling commutation in commutator motors.

(1) Note. For example, means for preventing or reducing deleterious effects incident to, or accompanying, commutation in electric motors are included herein; such effects including large intercommutator bar currents, heating of commutator bars and brushes, flashover between bars, arcing and pitting of commutator bars and brushes, etc. Periodically or repeatedly reversing polarity of direct current supplied to commutator motors to reduce pitting, corrosion metal transfer between brush and commutator is included herein. Shifting of brushes to reduce sparking is included.

END