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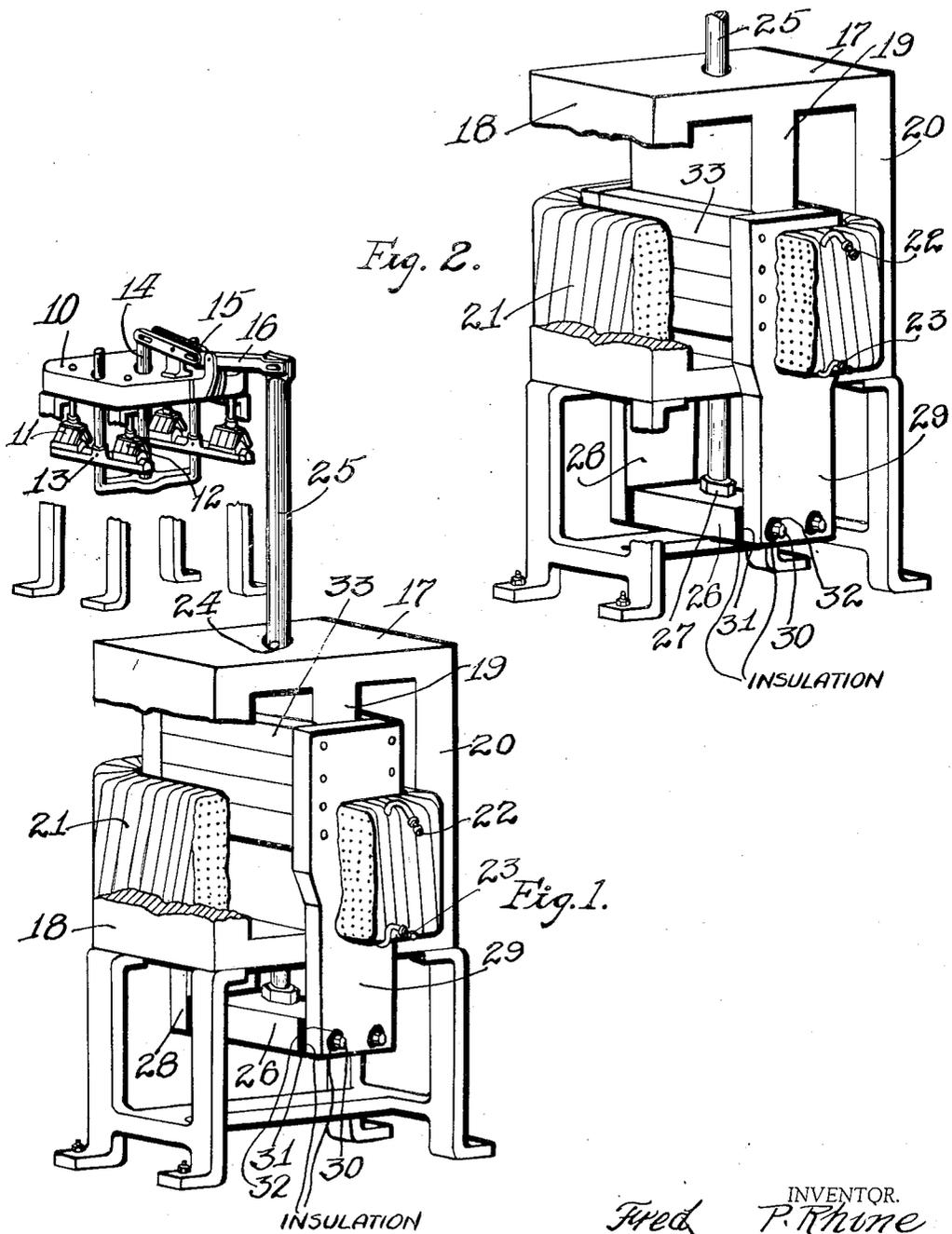
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1,993,946

SWITCH CLOSING MECHANISM

Filed June 20, 1932

2 Sheets-Sheet 1



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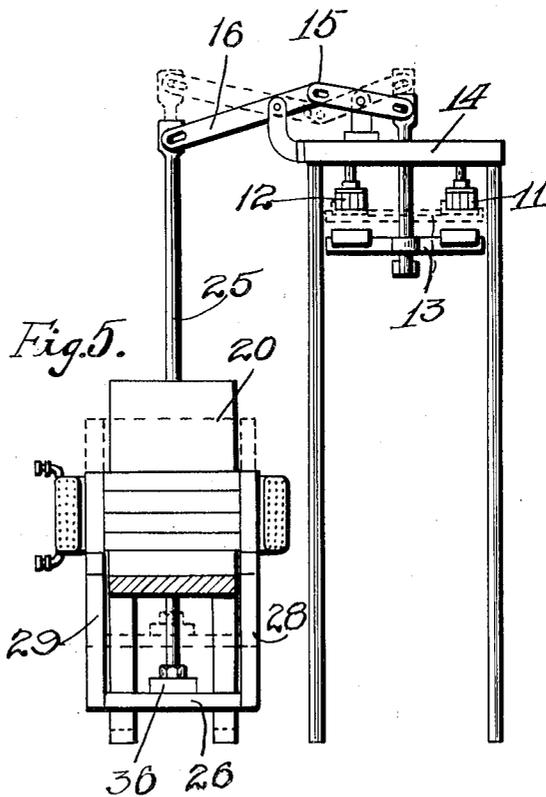
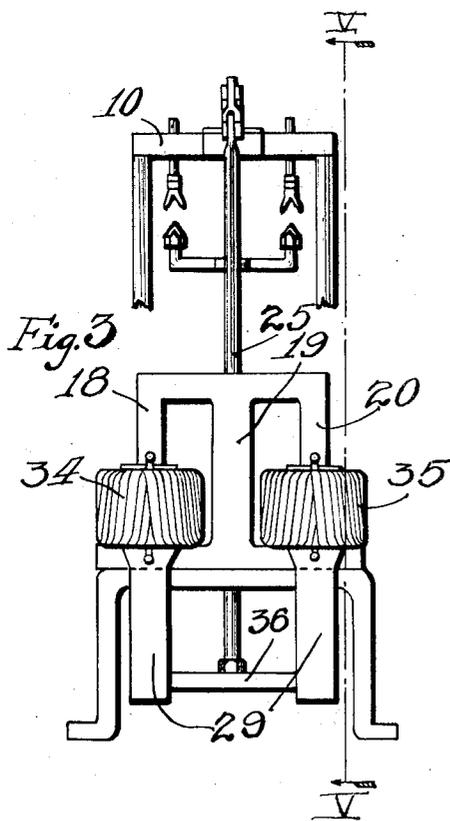
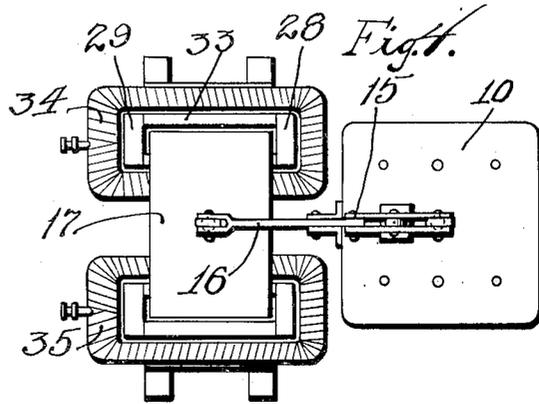
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SWITCH CLOSING MECHANISM

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5 Claims. (Cl. 200—91)

This invention relates in general to a mechanism for operating electrical devices such as circuit breakers, reclosing equipments and the like and is more particularly concerned with the design and construction of a mechanism of this character, which is adapted to be energized from an alternating current source of supply.

In the past, mechanisms of this character, which are operable on alternating current, have been in the main of one of two types. One of these types embraces what is commonly termed a clapper solenoid and is constructed much like the conventional type of contactor which comprises a U-shaped core having a magnetizing coil and an armature operatively associated with the ends of the core so as to be attracted when the magnetizing coil is energized. Suitable links are connected to the armature, whereby its movement may be transmitted to the movable contacts of a circuit breaker or the like.

Although this type of mechanism may be economically constructed, it inherently possesses electrical characteristics which are objectionable, especially when constructed of sufficient size to operate a large circuit breaker which may require an operating force of 200 lbs. or more. Principal among these is the high in-rush current required, this being due to the high reluctance of the magnetic circuit, which results from the large air-gap therein, when the armature is in open position. This type of mechanism is satisfactory for operating small devices, but, when used with large circuit breakers, the high inrush current of this mechanism sets up line fluctuations of such magnitude as to make the mechanism commercially impracticable. This type of mechanism is further objectionable in that its operation is materially affected by the voltage of the supply circuit, especially a condition of low voltage.

The other type is a motor driven centrifugal mechanism, which is so constructed that when the motor circuit is closed, two flyweights are revolved. The centrifugal force developed by the revolving flyweights is utilized thru suitable links to close the contacts of the circuit breaker. This type of mechanism, while possessing desirable electrical characteristics, as compared to the first type described above, is objectionable in that it is more complicated and more expensive to manufacture.

It will therefore be apparent that a mechanism of this character having the mechanical advantages of the first type and the electrical

characteristics of the last mentioned type would be highly desirable.

To this end the present invention embraces a mechanism which utilizes the latent mechanical energy existing between the primary and secondary coils of a transformer. It is well known to those skilled in the art that a transformer under load has a magnetizing power or magnetomotive force in its primary coil, which is equal to the product of the amperes flowing through the coil and the number of turns of the coil. Similarly, the secondary coil also has a magnetomotive force depending upon its ampere-turns. However, since the fluxes produced by virtue of the primary and secondary magnetomotive forces are in opposition, their repelling action may be mechanically utilized by mounting one of the coils so that it is free to move relative to the other.

It is a further object of this invention to provide a mechanism of this character having such design and construction that its principles of operation may be readily utilized for either single phase or polyphase operation.

Other objects of this invention will more fully appear from the following detailed description taken in connection with the accompanying drawings which illustrate several embodiments thereof, and in which

Figure 1 is a perspective view showing a conventional circuit breaker and a novel closing mechanism embodying the features of this invention applied thereto, portions being cut away to disclose details of the operative instrumentalities of the mechanism, the circuit breaker being in closed position;

Figure 2 is a fragmentary perspective view of the circuit breaker closing mechanism, portions being cut away to show the relationship of its parts when the circuit breaker is in open position;

Figure 3 is a fragmentary view in elevation showing a modified form of the closing mechanism of this invention adapted for three-phase operation;

Figure 4 is a plan view of the same; and
Figure 5 is a sectional view showing the operative relationship of the various parts of the closing mechanism, taken substantially on line V—V of Figure 3.

As shown on the drawings

In Figure 1 there is illustrated an embodiment of the present invention which is adapted for operation on single phase alternating current. The closing mechanism is disclosed as being connect-

ed to a conventional type of circuit breaker which broadly comprises a frame structure 10 which supports a plurality of stationary contact members 11 and 12, these contact members being arranged in pairs and disposed in the path of movement of a bridging contact 13. The bridging contact is carried by a reciprocably mounted rod 14 adapted to be actuated by means of a toggle structure generally indicated at 15 mounted on the frame 10. This toggle includes an arm 16 which is connected by an operating rod to the switch operating mechanism or motor. The toggle is so arranged that when the arm 16 is moved upwardly, the switch contacts are moved to closed position, and when moved downwardly the switch contacts are moved to open position.

The switch closing mechanism embodying the features of this invention is illustrated as comprising a core structure 17 which, in this instance, is rectangular in shape and of conventional construction. The core may be constructed of punchings or laminations which are assembled to form a core having three spaced parallel leg portions 18, 19 and 20, the leg 19 being centrally disposed between the legs 18 and 20.

Surrounding the central leg 19 is a primary coil 21 which is preferably provided with a suitable cover of insulating material and secured against movement. The inner surface of the primary coil is spaced from the central leg in order to provide sufficient clearance for a movably mounted secondary coil structure. The primary coil is provided with terminals 22 and 23 having suitable nuts by means of which connections may be made to an electrical source of supply.

Extending through central leg 19 of the core is a central aperture 24 through which extends a rod member 25 which is connected at its upper end to the arm 16 of the circuit breaker toggle described above. The lower end of the rod 25 is threaded into a transverse head member 26 and locked in place by means of a lock nut 27 which may be tightened against the surface of the head member. Secured to the ends of the head member 26 are a pair of uprights 28 and 29 which are preferably of current conducting material such as copper. Each upright is secured to the head member by means of bolts indicated at 30. The bolts 30 and uprights are insulated from the head member 26 by means of a spacer 31 of insulating material placed between each upright and an end of the head member, and washers 32 which are also of insulating material.

The uprights 28 and 29 extend upwardly between the primary coil and the central leg 19 of the core. The lateral margins of the uprights adjacent their upper ends are interconnected by a plurality of spaced copper bar members 33 which are disposed on either side of the leg 19. It will be observed that since the bars 33 and uprights 28 and 29 are of copper, a secondary coil of a single turn is formed surrounding the central leg 19 of the core.

It will be obvious to those skilled in the art that, since the secondary coil comprises a single turn, the large amount of current flowing therein will manifest itself in the form of thermal energy to increase the temperature of the copper in the secondary coil. The construction of the secondary coil and the manner in which it is supported admirably lends itself to the dissipation of the thermal energy. The upright members 28 and 29 provide large radiating surfaces which serve to

keep the temperature of the secondary coil within suitable limits.

In Figure 2 the relationship of the primary and secondary coils is shown for the circuit breaker when its contacts are in open position. It will be observed that the upper edge of the secondary coil is disposed substantially in the same plane as the upper edge of the primary coil. When the primary coil is energized, current will be induced in the secondary coil and the current flowing in the respective coils will produce opposing electromotive forces which will cause the secondary coil to be propelled upwardly relative to the primary coil, as shown in Figure 1. Movement of the primary coil is transmitted through the rod 25 to the toggle 15 of the circuit breaker, whereby the contacts thereof are moved to closed position.

In Figures 3, 4 and 5 there is illustrated a form of my invention which operates on the same principles as the form previously described, this form, however, being arranged for operation on three phase current rather than single phase as in the previous arrangement. In the modified form, corresponding parts have been indicated with the same numerals as in the previous form of my invention. Instead of using a single primary and secondary coil as embodied in the single phase switch closing mechanism, the modified form for operation on three phase current employs two primary coils 34 and 35 which are respectively mounted on the outermost legs 18 and 20 of the core. The rod 25 extends through a passage in the central leg 19 as before. As in the previous case, a secondary coil structure is disposed within each of the primary coils, each secondary coil being supported on uprights 28 and 29 which are connected in the manner previously described to a head member 26. In this case, however, the head member of each supporting structure is connected to one end of a bridging member 36 which is in turn connected to the rod 25 in the same manner as the head member was connected in the first form of my invention. Each primary coil is provided with two terminals, thus enabling the two coils to be connected in open delta to a three phase alternating current supply source. Since the principles of operation of the three phase circuit breaker closing mechanism is the same as for the single phase embodiment, it is not thought that it will be necessary to describe the operation of this form of my invention.

The three phase embodiment is advantageous in that the power output of the closing mechanism is increased and the initial or inrush current is decreased. It is also important to note that in the three phase application the power is so distributed that the electrical power demand per phase is decreased.

From the foregoing it will be apparent that this invention provides a closing mechanism for use with switches, reclosing equipments and the like, which is simple in construction and has electrical characteristics of a highly desirable nature; and which embodies principles of operation such that the mechanism may be constructed for polyphase operation without sacrificing its mechanical simplicity.

Now, it is of course to be understood that although I have described in detail the several embodiments of my invention, the invention is not to be thus limited but only in so far as defined by the scope and spirit of the appended claims.

I claim as my invention:

1. A motor for closing a circuit breaker, said motor comprising a closed core having three par-

allel spaced legs, a stationary primary coil surrounding the middle leg and having its interior surface spaced therefrom, a pair of arms of current conducting material respectively disposed on opposite sides of the middle leg between the primary coil and the middle leg, spaced current conducting members connecting the lateral margins of said arms at their upper ends to form a closed secondary around said middle leg, and means interconnecting the lower ends of said arms, said means being insulated from the arms and adapted for connection to a circuit breaker, whereby movement of the secondary coil, when the primary coil is energized, may be transmitted to the circuit breaker.

2. A motor adapted to operate, a circuit breaker having cooperable stationary and movable contacts, said motor comprising a three-legged closed core structure having a vertical central leg with a longitudinal passage therethrough, a rod reciprocable in said passage, the upper end of the rod being connected to the movable contacts of the circuit breaker, a transverse head secured to the lower end of the rod for movement therewith, a single turn secondary coil positioned surrounding said central leg and rigidly supported on said head, the coil being insulated from the head and movable axially of and guided by the central leg, and a primary coil surrounding the secondary coil and central leg with its inner surface spaced from the secondary coil, said primary coil being adapted for connection to an alternating current source of supply.

3. In a switch closing mechanism, an induction motor comprising a closed core of three connected legs, a primary coil encircling the middle leg

of said core and in spaced relation thereto, and a movable secondary member encircling said middle leg and being arranged movable between said middle leg and said primary coil, said secondary member comprising a first row of spaced conducting bars, a second row of spaced conducting bars in spaced parallel relation to said first row, and conducting means of high heat emissivity connecting the said first and second rows of bars to form a conducting loop.

4. In a switch closing mechanism, an induction motor comprising a closed core of three connected and spaced parallel and vertical legs, a secondary member of a single turn encircling one of said legs and arranged for movement along the vertical axis thereof, said secondary member comprising a first row of spaced horizontal conducting bars, a second row of spaced conducting bars in spaced parallel relation to said first row, and vertical conducting members of high heat emissivity connecting the ends of said conducting bars to form a conducting loop, a primary coil positioned encircling said secondary member and arranged stationary on said core.

5. In a switch closing mechanism, an induction motor comprising a closed core of three connected and spaced parallel and vertical legs, a secondary member of a single turn encircling one of said legs and arranged for movement along the vertical axis thereof, a primary coil encircling said secondary member and arranged stationary on said core, one of said legs being apertured to define a central and vertical duct therein, and an operating rod connected to said secondary member and extending in said duct for guided movement therein.

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