

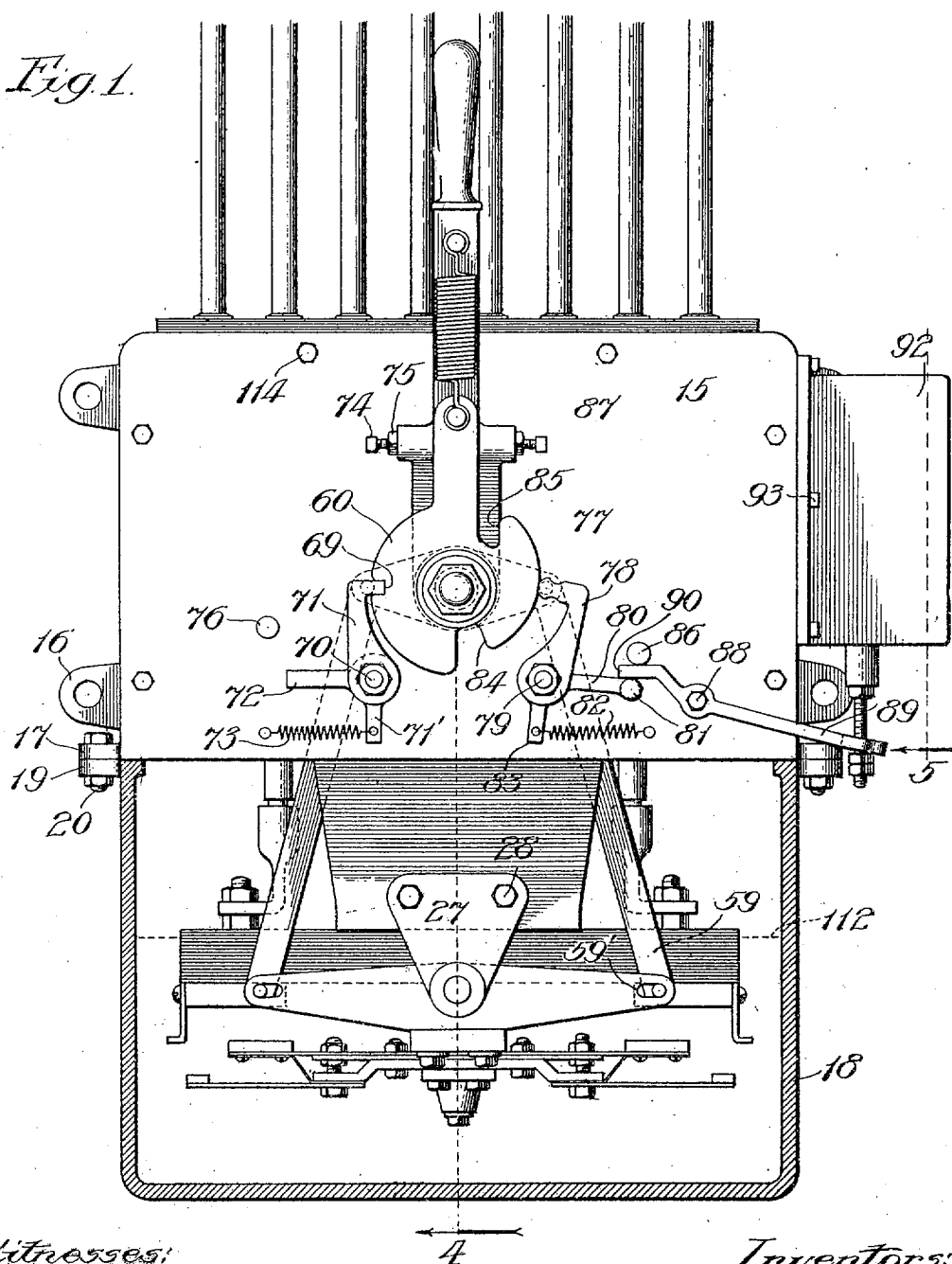
F. L. COLLINS & E. A. HULTS.
ELECTRIC SWITCH.
APPLICATION FILED JUNE 3, 1909.

958,598.

Patented May 17, 1910.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

John Enders
Chas. A. Bull.

Inventors:

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Eugene A. Hults.
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4 SHEETS—SHEET 2.

Fig. 2.

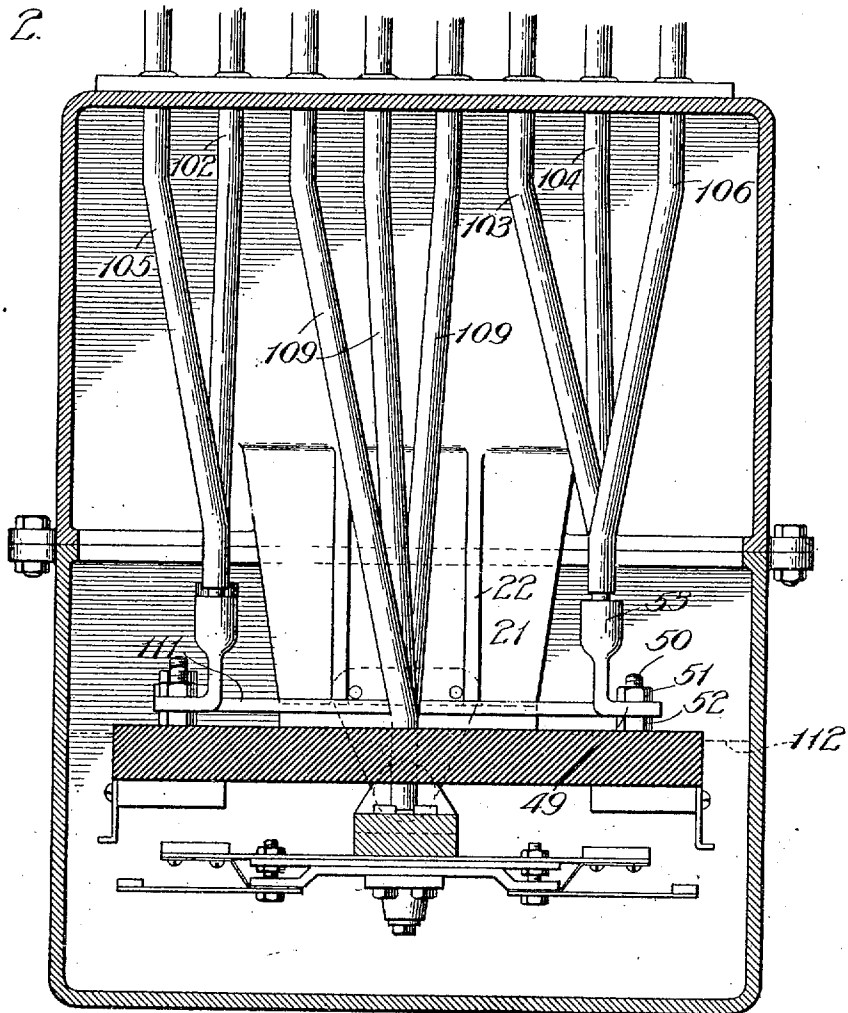
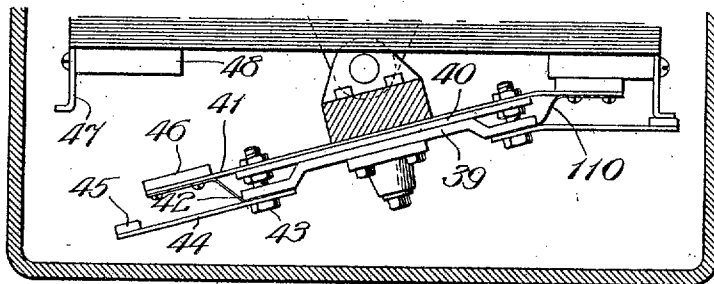


Fig. 3.



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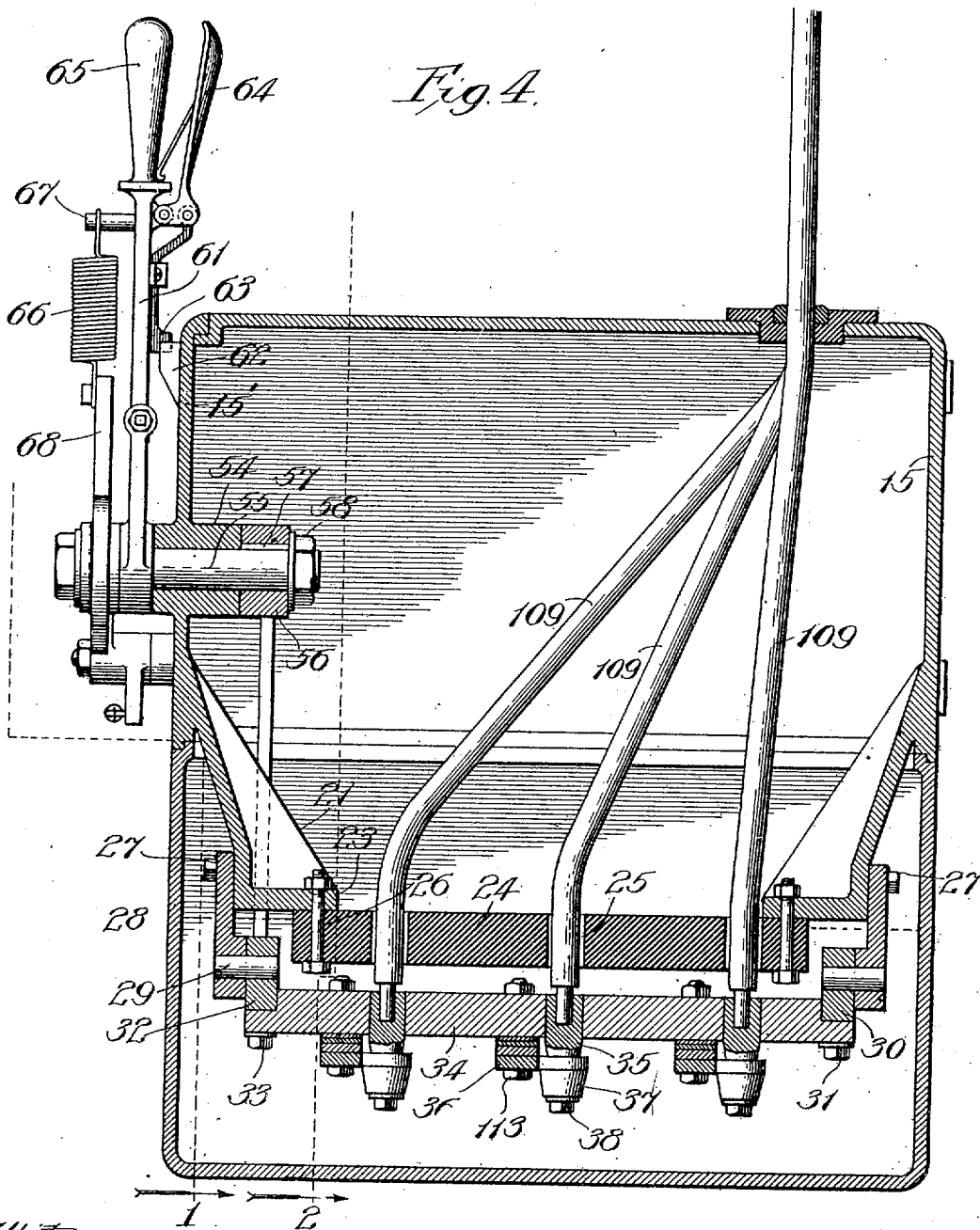
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

Fig. 5.

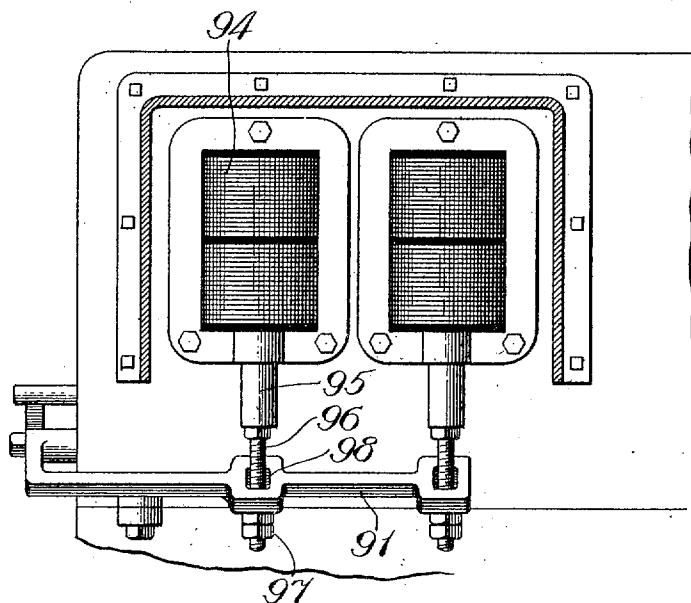
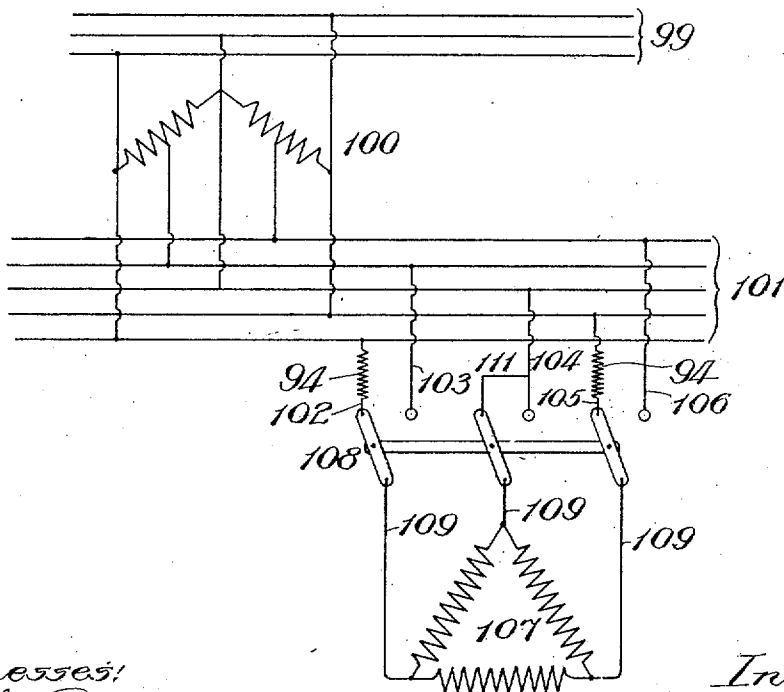


Fig. 6.



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UNITED STATES PATENT OFFICE.

FRED L. COLLINS AND EUGENE A. HULTS, OF CHICAGO, ILLINOIS.

ELECTRIC SWITCH.

958,598.

Specification of Letters Patent.

Patented May 17, 1910.

Application filed June 3, 1909. Serial No. 500,008.

To all whom it may concern:

Be it known that we, FRED L. COLLINS and EUGENE A. HULTS, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Switches, of which the following is a specification.

The object of our invention is to provide a new and improved switch for changing electric circuit connections. In certain of its aspects, our invention is especially adapted for circuits carrying heavy currents of electricity.

In the accompanying drawings, we have illustrated one specific embodiment of our invention which is especially adapted to have the switch terminals immersed in oil and in which for illustrative purposes, the switch is shown in a form adapted for the starting and running positions of an induction motor, as will be more fully explained hereinafter.

The more specific objects of our invention and its advantages will become apparent on perusal of the following specification and claims, taken in connection with the drawings, in which—

Figure 1 is a front elevation of the device taken partly in section on the line 1 in Fig. 4 looking in the direction of the arrow. Fig. 2 is a vertical section taken on the line 2 in Fig. 4 looking in the direction of the arrow. Fig. 3 is a partial view corresponding to Fig. 2, showing certain movable parts in a changed relative position. Fig. 4 is a vertical section taken on the line 4 in Fig. 1, looking in the direction of the arrow. Fig. 5 is an elevation of an auxiliary device taken partly in section on the line 5 of Fig. 1. Fig. 6 is a diagram illustrating suitable circuit connections for the particular switch which we have chosen to show in the drawings.

The device comprises an upper cast iron shell 15 adapted to be bolted to a wall by means of the lugs 16, and a lower cast iron shell 18 adapted to be secured to the upper shell 15 by means of the opposed lugs 17 and 19 and the bolts 20. These two shells form a complete box like housing for the parts within. We make the upper shell 15 with its front end 15' detachable, as shown in Fig. 4, the two parts 15 and 15' being secured together by means of the stud bolts 114, as shown in Fig. 1. Two opposite

brackets or hangers 21, reinforced by ribs 22, project downwardly and inwardly from the wall of the shell 15, their lower ends carrying the horizontal flanges 23 to which the slate slab 24 is secured by means of the bolts 26. This slab 24 has three holes 25 through which pass the conductors 109. Attached to the brackets 21, by means of the stud bolts 28, are the extension pieces 27 which carry projecting trunnions 29. These trunnions 29 are rotatably mounted in the respective members 27 and pinned to the respective members 30 and 32. The hard maple bar 34 is secured to the member 30 and the walking beam 32 by means of the respective stud bolts 31 and 33. This bar 34 carries copper sockets 35 in alinement with the respective holes 25 in the slate slab 24. The conductors 109 are soldered or sweated into the sockets 35. Each socket 35 has its lower end tapered and adapted to receive a correspondingly tapered sleeve 37, which may be secured tightly there by means of the stud bolt 38. Each sleeve 37 has an offset position 36, between which and the maple bar 34, are the copper bars 39, the steel spring 41 and the intermediate spring reinforcing bar 40, all these parts being secured to the maple bar 34 by means of the bolts 113.

The ends of the copper bars 39 are offset as indicated by the reference numeral 42, bolts 43 passing through the parts, as shown in Figs. 2 and 3. By means of the three nuts on each of these bolts the contact terminals 46 can be adjusted so that all three of them on one side will act simultaneously. The steel spring 41 carries copper contact terminals 46 adapted to coact with the fixed terminals 48. Copper ribbon strips 110 are provided connecting the copper bar 49 conductively to the contact terminals 46. Extension springs 44 are secured under the bolts 43 and carry supplementary steel contact terminal pieces 45, adapted to coact with the fixed steel supplementary terminals 47.

The fixed contact terminal pieces 48 are connected by bolts 50 and nuts 51, 52 to the copper members 49, each of which is bent upwardly, as shown in Fig. 2, and carries a cup 53 to receive the end of the respective conductor leading thereto.

The upper shell front 15' has a boss 54 which carries a rotatable shaft 55, to the inner end of which the walking beam 56 is

secured by means of the key 57 and nut 58. The ends of the two walking beams 57 and 32 are connected together by means of the links 59; these connections comprising the slots 59' in the walking beam 32, so as to facilitate movement of the parts.

Fixed on the shaft 55 is the cam plate 60 and loosely mounted on the shaft 55 adjacent to the cam plate 60 is the lever 61 with the handle 65. The shell member 15' has a notched lug 62 adapted to be engaged by the dog 63 controlled by the hand hold 64. The helical tension spring 66 connects the arm 68 of the cam plate 60 to the stud 67 on the lever 61. The cam plate 60 has the notch 69 on its periphery normally engaged by the dog 71 pivoted on the casing at 70. This dog 71 carries an arm 72 adapted to be engaged by the adjustable stud 74 on the lever 61. This stud can be fixed at any desired adjustment by means of the lock nut 75. The dog 71 also carries another arm 71' which is engaged by a tension spring 73 tending to hold the dog 71 against the cam plate 60. A stud 76 projecting from the casing member 15' acts as a stop for the lever 61. On its opposite side, the cam plate 60 has the contour 77 with decreasing radius going around the cam plate in a clockwise direction. The dog 78, pivoted at 79, is held against this cam 77 by means of the tension spring 82, engaging the arm 83. The dog 78 also carries another arm 80 with a hold 81 on the end thereof. This arm 80 is adapted to be engaged by the adjustable stud 87 on the lever 61. At the ends of the cam 77 are the notches 84 and 85. The stud 86 in the casing plate 15 acts as a stop for the lever 61.

Pivoted on the bolt 88 is the L-shaped lever 89, one end 90 thereof, resting on the arm 80 of the dog 78, and the other end 91 being bent around the side of the casing 15 below the solenoids 94. These solenoids 94 are within a hood 92 attached to the casing shell 15 by means of the stud bolts 93. Each solenoid 94 has a core 95 with a stem 96 passing through a hole 98 in the arm 91. Nuts 97 have screw threaded engagement with this stem 96, and thus provide for adjustment. These solenoids 94 and the associated parts constitute an overload circuit breaker, whose operation will be explained later.

In Fig. 6, the three conductors of a three phase transmission circuit are indicated by the reference numeral 99; and 100 is an open delta starting transformer from which taps are taken off to the five conductors 101 as shown. From these taps branch conductors 102, 103, 104, 105 and 106 may be taken off to supply any three phase induction motor 107. The reference numeral 108 designates generally the particular switch which we have described as an illustrative embodiment of

our invention. As shown in the diagram, it will readily be perceived that the switch is in a running position, but that by throwing it on the contact terminals of the conductors 103, 104 and 106, the motor 107 will then be connected to the half voltage taps of the starting transformer 100. 111 is a cross connector from the conductor 104, which is clearly shown in Fig. 6.

It will be noted that the shell 18 is in the form of a cup adapted to hold insulating oil, a suitable approximate level for which is indicated by the reference numeral 112. It will be observed that by removing the bolts 20, this cup 18 can be lowered with its contained oil and set aside, thus making the contact members of the switch readily accessible for inspection or repairs.

The switch is shown in Figs. 1 and 2 in neutral open position, and it will readily be observed on comparing Fig. 2 with Fig. 3 that in closing the switches on either side, the terminals 45 and 47 will meet first and then the terminals 46 and 48 will meet, and in all cases, there will be a sliding movement between the pair of terminals, thus keeping them bright and more effectively excluding oil from between them. The terminals 45-47 meeting first, and breaking last, will always carry the arc, thus protecting the main terminals 46 and 48. If for any reason it is necessary to remove the contact terminals for repairs this can very readily be done by withdrawing the bolts 28 and 38 and disconnecting the links 59 from the walking beam 32; and thus the maple bar 34 can be directly removed.

We will now describe the mode of operation; first closing the switch to start an induction motor; then shifting it to running position, and then restoring it to normal; this will sufficiently illustrate its applicability for other uses. To start, the operator seizes the handle 65-64 withdrawing the dog 63 and pulls the lever 61 over to the left as viewed in Fig. 1 until the stud 74 strikes the arm 72 and withdraws the dog 71. This movement of the lever having extended the spring 66, it follows that as soon as the dog 71 is withdrawn from the cam plate 60, the tension of the spring 66 will instantly jerk the cam plate 60 around to the left, as viewed in Fig. 1. Thereupon the dog 78, influenced by the spring 82, will drop into the notch 84 and the circuit contacts will be closed, as indicated by Fig. 3. The motor will thus start supplied from the half voltage taps of the open delta auto-transformer 100. As soon as the motor gets to going fast enough, the operator will throw the lever clear over to the right until the stud 87 strikes the arm 80 of the dog 78, thus withdrawing it from the notch 84, and permitting the spring 66 to jerk the cam plate 60 around to the right until the dog 78

drops into the notch 85. This movement of the cam plate 60 will take place very quickly, and by means of the connecting links 59, the movable switch member will be quickly reversed from the position shown in Fig. 3, thus changing to full running position for the motor. This clock wise movement of the cam plate 60 will cause the cam 77 to engage the dog 78 and push it back farther until it drops into the notch 85, the lever 61 meanwhile resting against the stop 86. When the dog 78 has locked into the notch 85, the operator returns the lever 61 to normal position locking it there by means of the dog 63, and thus leaving the spring 66 on a tension. Whenever it is desired to stop the motor, this can be accomplished by tripping the dog 78 by means of the handle 81, thus permitting the spring 66 to jerk the cam plate 60 in counter clockwise direction back to the normal position, shown in Fig. 1.

In case of an overload, the solenoids 94 will be energized excessively and will pull up on their cores 95, thus causing the end 90 of the lever 89 to trip the dog 78 and stop the motor.

It will be seen that we have provided mechanism by which a circuit can be closed instantly, can be changed as quickly from one arrangement to another, and can be quickly broken. The mechanism is comparatively simple and is sure in its mode of operation.

The device is automatic in its action; it will be noted that when the switch is in its normal open position, it cannot be thrown directly to full running position, but must first be thrown to the starting position. It is further automatic in that quick action is inevitable; it is impossible for an attendant to break or make the contacts slowly, even if he tries. This quick action does away with the formation of injurious arcs and thus preserves the contact terminals. For motors of several hundred kilowatts supplied with current at several hundred volts, there would be very destructive arcs formed at the terminals, unless they were made or broken almost instantaneously as is the case in our device. Another point of advantage is that the contact terminals when made are pressed tightly and firmly together by the springs on which they are mounted.

By means of the nuts on the bolt 43, the spring 41 can be adjusted relatively to the ends 42 of the bar 39, so as to make the three contact terminals 46 on one side touch their respective coacting fixed terminals 48 at the same instant. In this way, the three circuits are made and broken exactly simultaneously.

All movable and wearing parts are so arranged that every one can be gotten at easily and replaced when necessary with very little trouble and time.

All the contact terminals are safely inclosed in a suitable housing which is absolutely dust proof. The device can be operated by comparatively unskilled laborers, and hence the control of large induction motors can be safely entrusted to them. Many other advantages will be apparent to those skilled in the art to which this invention relates.

In the following claims, we employ the term "cam-plate" in a broad sense to refer to the member 60 or its equivalent.

We claim—

1. An electric switch comprising an upper shell adapted to be supported in a suitable manner, the front wall of said shell being removable, a lower shell adapted to be secured to the upper shell, contact terminals within the lower shell supported by inside hangers depending from the upper shell, and mechanism secured to the front wall of the upper shell for operating and controlling said contact terminals, said mechanism remaining mounted on said front wall when the latter is removed from the rest of the shell.

2. An electric switch comprising a casing adapted to be supported in a suitable manner, contact terminals within the casing, mechanism secured to one outside face of the casing for operating and controlling said contact terminals, a handle for actuating said mechanism, an overload circuit breaker mounted on another outside face of the casing and having connections around the corner of the casing to also actuate said mechanism, and a hood attached to the casing to protect said overload circuit breaker.

3. An electric switch comprising an upper shell, a lower shell adapted to be secured thereto, extension brackets hanging down from the upper shell within the lower shell, a horizontal slab of insulation attached to the lower ends of said brackets, stationary contact terminals mounted on the under face of said slab, trunnions also attached to said brackets, and a member carrying movable contacts mounted on said trunnions.

4. An electric switch comprising an upper shell, a lower shell secured thereto, brackets hanging down from the upper shell within the lower shell, fixed contact terminals supported by said brackets, trunnions also supported by said brackets, and a movable member mounted on said trunnions carrying contacts adapted to engage the fixed contacts, said member being adjustably supported on the lower ends of said brackets.

5. An electric switch comprising an upper shell, a lower shell secured thereto, brackets depending from the upper shell within the lower shell, fixed contact terminals supported by said brackets, trunnions carried by the lower ends of said brackets, a bar pivotally mounted on said trunnions,

flexible contact strips fixed on said bar and adapted to engage the said fixed contact terminals, and mechanism to operate said bar.

5 6. An electric switch comprising an insulating slab, fixed opposite contact terminals on said slab, an oscillatory bar between said fixed terminals adjacent to the slab, and flexible contact terminals extending across the bar and adapted to engage the fixed contact terminals alternatively according to which way the bar is oscillated.

10 7. An electric switch comprising a horizontal insulating slab with opposed fixed contact terminals on its lower face, a horizontal bar beneath the said slab mounted to oscillate on its axis, said slab having holes therethrough above said bar, transverse flexible contact terminals carried by said bar and adapted to engage the said fixed terminals, and conductors passing through said holes in the slab and connected to said transverse contact terminals.

15 8. An electric switch comprising a shell adapted to contain oil, a horizontal insulating slab supported in the oil, fixed contact terminals on the under face of the slab, a movable member pivotally supported beneath the slab, and coating movable contact terminals carried by said member.

20 9. An electric switch comprising a fixed contact terminal, a movable member carrying a coating terminal, a movable cam plate operatively connected to said movable member, a dog on a fixed pivot adapted to positively interlock with said cam plate, an independently movable hand lever, a spring connecting the said hand lever to the said cam plate, means to positively withdraw the dog from the cam plate in a certain definite position of the hand lever, and means to lock the hand lever in a position to put the said spring on a tension when the dog interlocks with said cam plate.

25 10. An electric switch comprising a fixed contact terminal, a movable member carrying a contact terminal adapted to coact therewith, a notched cam plate operatively connected to said movable member, two dogs adapted to lock positively into the notches of said cam plate, an independently movable hand lever, a spring connection between the cam plate and the hand lever, and means to lock the lever in a position to put the spring on a tension when one of the dogs locks into said cam plate.

30 11. An electric switch comprising an upper and a lower shell adapted to be secured together, a fixed contact terminal supported in the lower shell, an oscillatory beam mounted in the lower shell and carrying a coating contact terminal, a walking beam secured to said oscillatory beam, another walking beam in the upper shell, links connecting the respective ends of the two walk-

ing beams, and mechanism outside of the upper shell to operate the upper beam.

12. An electric switch comprising an oscillatory shaft adapted to actuate the movable contact terminal of the switch, a cam plate fixed on said shaft, a hand lever loosely mounted on the same shaft, a dog adapted to positively interlock with the cam plate, a spring connecting the said hand lever and cam plate, means to positively withdraw the dog from the cam plate in a certain definite position of the hand lever, and means to lock the hand lever in a position to put the said spring on a tension when the dog interlocks with said cam plate.

13. An electric switch comprising an oscillatory shaft adapted to actuate the movable contact terminal of the switch, a cam plate fixed on said shaft, a hand lever loosely mounted on the same shaft, a dog on a fixed pivot adapted to coact with the cam plate, a spring connecting the said hand lever and cam plate, said hand lever being adapted in one position to engage the dog thus releasing the cam plate and permitting the spring to actuate the same, and means to lock the hand lever in a position to extend the spring when the dog engages the cam plate.

14. An electric switch comprising an oscillatory shaft adapted to actuate the movable contact member of the switch, a notched cam plate fixed on said shaft, two dogs adapted to coact therewith, a hand lever loosely mounted on the same shaft and adapted in certain positions to engage the dogs and release the same, a spring connecting the hand lever to the cam plate, and means to lock the hand lever in a position to extend the spring when one of the dogs engages the cam plate.

15. An electric switch comprising an oscillatory shaft adapted to actuate the movable contact terminal of the switch, a notched cam plate fixed on the shaft, a dog engaging a notch in the cam plate when the switch is in open position, a hand lever loosely mounted on the same shaft, a spring connecting the hand lever to the cam plate, said lever being adapted to disengage the dog from its notch in the cam plate and thus permit the spring to oscillate the same, and means to lock the hand lever in a position to put the spring under tension when the dog engages the cam plate.

16. An electric switch comprising two alternative fixed contact terminals, a movable contact terminal member adapted to engage either one of the fixed terminals, an oscillatory shaft controlling said movable member, a notched cam plate fixed on the oscillatory shaft, a dog engaging a notch in said cam plate when the switch is in neutral position, and another dog engaging either of two notches in the cam plate when the

switch is in its corresponding closed positions.

17. An electric switch comprising two alternative fixed contact terminals, a movable contact terminal member adapted to engage either one of the fixed terminals, an oscillatory shaft controlling said movable member, a notched cam plate fixed on the oscillatory shaft, a dog engaging a notch in said cam plate when the switch is in neutral position, another dog engaging either of two notches in the cam plate when the switch is in its corresponding closed positions, a hand lever loosely mounted on the oscillatory shaft, and a spring connecting the same to the cam plate.

18. An electric switch comprising two alternative fixed contact terminals, a movable contact terminal member adapted to engage either one of the fixed terminals, an oscillatory shaft controlling said movable member, a notched cam plate fixed on the oscillatory shaft, a dog engaging a notch in said cam plate when the switch is in neutral position, another dog engaging either of two notches in the cam plate when the switch is in its corresponding closed positions, a hand lever loosely mounted on the oscillatory shaft, and a spring connecting the same to the cam plate, said lever being adapted to strike against said dogs thus releasing the same and permitting the spring to act upon the cam plate.

19. An electric switch comprising two alternative fixed contact terminals, a movable contact terminal member adapted to engage either one of the fixed terminals, an oscillatory shaft controlling said movable member, a notched cam plate fixed on the oscillatory shaft, a dog engaging a notch in said cam plate when the switch is in neutral position, and another dog engaging either of two notches in the cam plate when the switch is in its corresponding closed positions, the radius of said cam plate increasing progressively from one of said last two notches to the other.

20. An electric switch comprising an oscillatory shaft controlling the movable contact terminal of the switch, a notched cam plate fixed on said shaft, a hand lever loosely mounted on said shaft, fixed stops to limit the movement of the hand lever, and a dog to coact with the notched cam plate.

21. An electric switch comprising an oscillatory shaft controlling the movable contact terminal of the switch, a notched cam plate fixed on said shaft, a hand lever loosely mounted on said shaft, fixed stops to limit the movement of the hand lever, and a dog to coact with the notched cam plate, said lever being adapted to disengage the dog just before it strikes against its fixed stop.

22. An electric switch comprising an oscillatory shaft controlling the movable contact

terminal of the switch, a cam plate fixed on said shaft, a hand lever loosely mounted on said shaft, means to lock the hand lever in an intermediate position, and means to lock the cam plate in a certain position.

23. An electric switch comprising an oscillatory member controlling the movable contact terminal of the switch, a dog to lock this oscillatory member in certain definite positions, a spring acting upon the oscillatory member, hand operated means to withdraw the dog, and an overload circuit breaker also acting on the same dog to release it.

24. An electric switch comprising a casing, control mechanism mounted on the front of the casing, a hand lever to actuate said control mechanism, an overload circuit breaker mounted on the side of the casing, and operating connections extending from said overload circuit breaker around the corner of the casing to actuate the same mechanism.

25. An electric switch for starting an induction motor comprising a movable member carrying contact terminals adapted to be locked in any one of three positions, one position being full open, the next position being that for starting from half voltage taps, and the third position that for running at full voltage, and mechanism to constrain the operation of the switch in cyclic order from one position to the next as named.

26. An electric switch comprising an upper shell, a lower shell secured thereto, integral brackets hanging down from the upper shell within the lower shell, fixed contact terminals supported by said brackets, detachable extension brackets attached to the lower ends of said integral brackets, said detachable brackets carrying trunnions, and a member pivoted on said trunnions carrying contacts adapted to engage the said fixed contacts.

27. An electric switch for starting a polyphase induction motor comprising a support, a hanger depending therefrom, a horizontal slab of insulating material attached to said hanger, a member pivotally mounted beneath the slab, contact terminals carried by said movable member conductively connected to the motor, and fixed contact terminals mounted on the under face of the slab to co-operate with the movable terminals, said fixed terminals being supplied with different voltages, and an oil receptacle inclosing all said contact terminals.

28. An electric switch comprising a fixed contact terminal, a movable member carrying a coacting terminal, a movable cam plate operatively connected to said movable member, a dog on a fixed pivot, said cam plate being abruptly notched to receive said dog, an independently movable hand lever, a spring connecting said cam plate and hand

lever, means to withdraw the dog from the abrupt notch in the cam plate in a certain definite position of the hand lever, and means to lock the hand lever in another definite position.

29. An electric switch comprising a fixed contact terminal, a movable member carrying a contact terminal adapted to coact therewith, a cam plate operatively connected to said movable member, said cam plate having a plurality of abrupt notches therein, two dogs adapted to lock into said abrupt notches in the cam plate, an independently movable hand lever, a spring connection between the cam plate and the hand lever, and means to lock the hand lever in a position to put the spring under tension when one of the dogs locks into a notch of the cam plate.

30. An electric switch comprising a fixed contact terminal, a movable member carrying a contact terminal adapted to coact therewith, a cam plate operatively connected to said movable member, an abrupt notch in said cam plate, a dog adapted to lock positively into said abrupt notch in the cam plate, an independently movable hand lever, a spring connection between the cam plate and the hand lever, and means to lock the hand lever in a position to put the spring under tension when one of the dogs locks into a notch of the cam plate.

31. An electric switch comprising a fixed contact terminal, a movable member carry-

ing a coacting terminal, means to lock the movable member with the terminals in engaging position, an independent hand lever, a spring connecting the hand lever to the said movable member, and means to lock the hand lever in a position to put said spring on a tension when the contact terminals are locked in engaging position.

32. An electric switch comprising opposite fixed contact terminals, a movable member carrying coacting terminals adapted to engage said fixed terminals alternatively, mechanism to lock said movable member in either position, an independent hand lever, a spring from said hand lever to said movable member, and means to lock said hand lever in an intermediate position.

33. An electric switch comprising an oscillatory member controlling the movable contact terminal of the switch, mechanism to lock this oscillatory member in certain definite positions, a spring acting upon the oscillatory member, hand operated means to unlock the said mechanism, and an overload circuit breaker also adapted to unlock said mechanism.

In testimony whereof, we have subscribed our names.

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EUGENE A. HULTS.

Witnesses:

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F. C. COLLINS.