

R. H. CONRAD.  
ELECTRIC SWITCH.  
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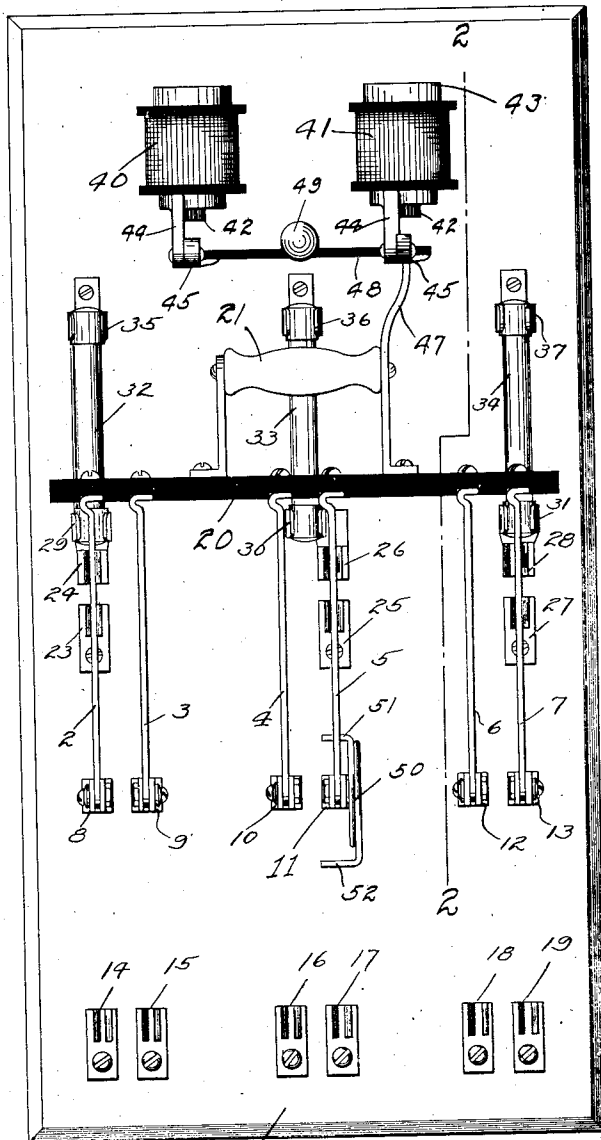


Fig. 1

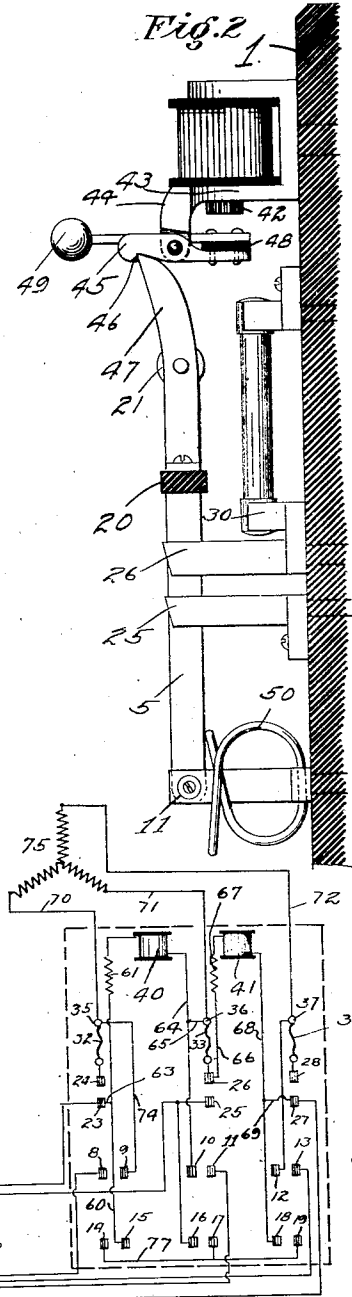


Fig. 2

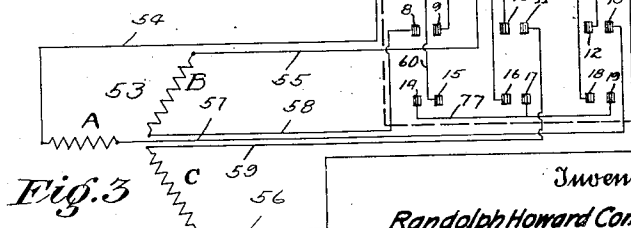


Fig. 3

Witnesses

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# UNITED STATES PATENT OFFICE.

RANDOLPH HOWARD CONRAD, OF OAKLAND, CALIFORNIA.

## ELECTRIC SWITCH.

1,094,534.

Specification of Letters Patent.

Patented Apr. 28, 1914.

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*To all whom it may concern:*

Be it known that I, RANDOLPH HOWARD CONRAD, a citizen of the United States, residing at Oakland, in the county of Alameda and State of California, have invented certain new and useful Improvements in Electric Switches, of which the following is a specification.

The invention relates to switches for three-phase alternating currents and more particularly for a switch for use in connection with alternating current motors.

One of the objects of my invention is to provide a double acting switch having a plurality of blades by means of which the motor is started with its windings in star relation and when running is switched over to the delta arrangement.

Another object of the invention is to provide a solenoid operated trip device by which the switch is opened whenever the current stops in any phase, the said trip device being so connected as to operate by two coils.

The manner in which these objects are accomplished and the advantages obtained thereby will be fully described and illustrated in the following specification and the accompanying drawing forming a part thereof.

In the drawing: Figure 1 is a front elevation of the trip mechanism. Fig. 2 is a section on line 2—2 of Fig. 1. Fig. 3 is a diagrammatic view of the switch circuit.

Similar letters of reference indicate corresponding parts throughout the drawing and specification.

1 represents an insulating base on which is mounted the three-pole switch, for each pole of which there is provided a double blade represented by the sets 2, 3, 4, 5, 6 and 7, respectively. These blades are pivotally mounted in suitable bearings 8 to 13 inclusive and contact clips 14 to 19 inclusive are provided in spaced relation to said bearings and in alinement thereof.

The various blades are connected to an insulating strip 20 having attached thereto a handle 21. In alinement with and parallel to blade 2 are provided contacts 23 and 24,

with blade 5 contacts 25 and 26, and with 50 blade 7 contacts 27 and 28.

The contacts 24 and 26 and 28 are provided with clips 29, 30 and 31, respectively, for the reception of fuses 32, 33 and 34 the other ends of which engage similar clips 35, 36 and 37, respectively. Mounted on the same base above the switch are two solenoids 40 and 41, each having a free moving laminated core 42.

The solenoid support 43 is provided with 60 a forwardly projecting arm 44 on which is pivotally mounted a two-armed lever 45. One of these lever arms is provided with a notch 46 which engages an arm 47 which may be conveniently made a part of the 65 handle support. The two levers 45 are connected by an insulating strip 48 carrying in its center a counterweight 49. Mounted in one of the bearings as for instance in 11 is a coiled spring 50 having projecting ends 51 70 and 52, the former resting under blade 5 in a state of tension while the latter projects across the path of the blade when it is swung to the lower row of contacts.

53 represents a three-phase motor having 75 conductor wires 54, 55 and 56 connecting one end of the winding of each phase with contacts 23, 25 and 27, respectively. The other terminals of these coils are connected by conductors 57, 58 and 59 with contacts 13, 8 80 and 11, respectively. From contact 15 a conductor wire 60 leads to the solenoids 40 and in this conductor is a non-conductive resistance 61. Contact 23 is connected to conductor 60 by the short connection 63. The 85 other terminal of the solenoid 40 is connected by a conductor 64 with a terminal clip 10. a short lead 65 connecting 64 with clip 36. From contact 26 a conductor 66 leads to the solenoid 41 with a resistance 67 in series. 90 The other terminal of this solenoid is connected by lead 68 with the contact 18 having a branch lead 69 to contact 27.

70, 71, and 72 are connections which are connected to a source of a three-phase current as for instance the generator 75. Now 95 when the motor is to be started the switch is thrown downward until the blades enter

contacts 14 to 19. In this position it will be seen that the windings are connected in star relation, the common point being the strap 77 which connects the terminals 14, 17 and 19. A circuit is now established through conductor 70, conductor 74, contact 9, switch blade 3, contact 15, conductors 60 and 63, contact 23, conductor 54, through winding A, conductor 57, contact 13, blade 7, and contact 19, through the common point 77. In the same manner a circuit is established from each of the other conductors to the central point. During this operation for starting the engine the fuses are not in circuit nor are the solenoid coils connected in operative relation. When the motor speeds up the switch is thrown to its upper position against the action of a spring 50. The end of arm 47 catches in the notch 46 and thus the switch is held close against the action of the spring 50. A circuit is now established from conductor 70 through fuse 32, contact 24, switch blade 2 to contacts 23 and 8, conductor 54 to one end of coil A, and conductor 58 to the opposite of coil 23. This in effect connects these coils in delta relation and in a similar manner the opposite terminals of coils B and C and of C and A are connected to the switch blades 5 and 7, respectively. It will also be seen that the coil 40 is gripped across one phase, coil 41 across the other and both coils in series across the third phase. With the normal voltage across phases these coils take sufficient current to hold up their respective cores, but if the current in any phase stops due to the blowing out of a fuse or to an open circuit in the line, then that core falls and strikes the insulated strip 48 which raises the opposite end of lever 45 disengaging the arm 47 from notch 46 and allowing spring 50 to open the switch. In falling downward the back of the blades strike the arm 52 on the spring and they are thus prevented from engaging the lower contacts.

I claim:

1. An electric switch of the character described comprising a base provided with bearings, a plurality of pairs of switch blades pivotally mounted in said bearings, the blades of each pair being insulated from each other and also from the remaining pairs, contact clips upon said base in alignment with said blades, electrically controlled means for holding said blades in electrical connection with said contacts, and means for closing the switch in its opposite position upon failure of current, substantially as described.

2. A three-pole electric switch of the character described comprising a base provided with bearings, a double blade for each pole of said switch pivotally mounted in

said bearings, contact clips in spaced relation to said bearings and in alinement therewith, an insulated strip having a handle to which said blades are connected, two contacts in alinement with and parallel to each of three of said blades (2, 5 and 7), clips connected to three of said contacts (24, 26, and 28), adapted to receive fuses, clips for the engagement of the free ends of said fuses, two solenoids each having a freely moving laminated core above the switch upon said base, means for operatively connecting said solenoids with the second group of three contacts (23, 25 and 27), and means for operating said switch, substantially as described.

3. The combination of a three phase motor having leads brought out from both ends of each coil, means whereby said coils are connected in delta during the normal operation of the motor, and means for automatically connecting said coils in star or Y upon failure of current.

4. An electric switch of the character described comprising in combination, an insulating base, spaced conducting blades, conducting bearings mounted on said base on which said blades are pivoted, fixed contact clips carried by said base and adapted to cooperate with said blades one to each when the switch is in one position, three pairs of clips carried by said base on the opposite side of said bearings from said first mentioned clips, each pair of said second mentioned clips being adapted to cooperate with a single one of said blades when the switch is in a second position, and means for simultaneously operating said blades.

5. An electric switch of the character described comprising in combination, an insulating base, spaced conducting blades, conducting bearings mounted on said base on which said blades are pivoted, fixed contact clips carried by said base and adapted to cooperate with said blades one to each when the switch is in one position, three pairs of clips carried by said base on the opposite side of said bearings from said first mentioned clips, and each pair of said second mentioned clips being adapted to cooperate with a single one of said blades when the switch is in a second position.

6. An electric switch of the character described comprising in combination, an insulating base, spaced conducting blades, conducting bearings mounted on said base on which said blades are pivoted, fixed contact clips carried by said base and adapted to cooperate with said blades one to each when the switch is in one position, three pairs of clips carried by said base on the opposite side of said bearings from said first mentioned clips, each pair of said sec-

ond mentioned clips being adapted to co-operate with a single one of said blades when the switch is in a second position, means for simultaneously operating said blades, a latch for holding said switch in the second mentioned position, electrically controlled means adapted to release said latch upon failure of current, and means

for reversing said switch when said latch is released.

In testimony whereof I affix my signature  
in presence of two witnesses.

RANDOLPH HOWARD CONRAD.

Witnesses:

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F. P. SCHROEDER.