March 14, 1950 H. J. HAMMERLY 2,500,635

ELECTROMAGNETICALLY ACTUATED SWITCH

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Fig. 2

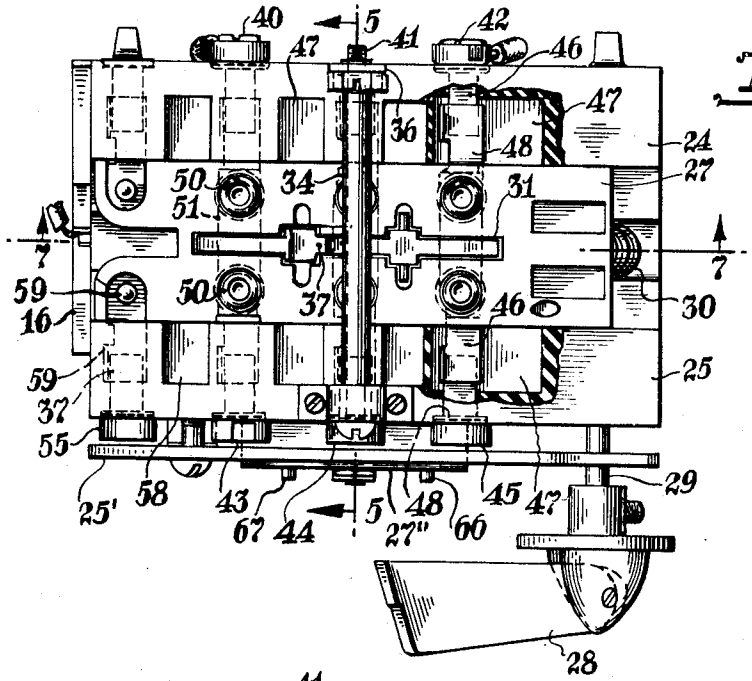


Fig. 1

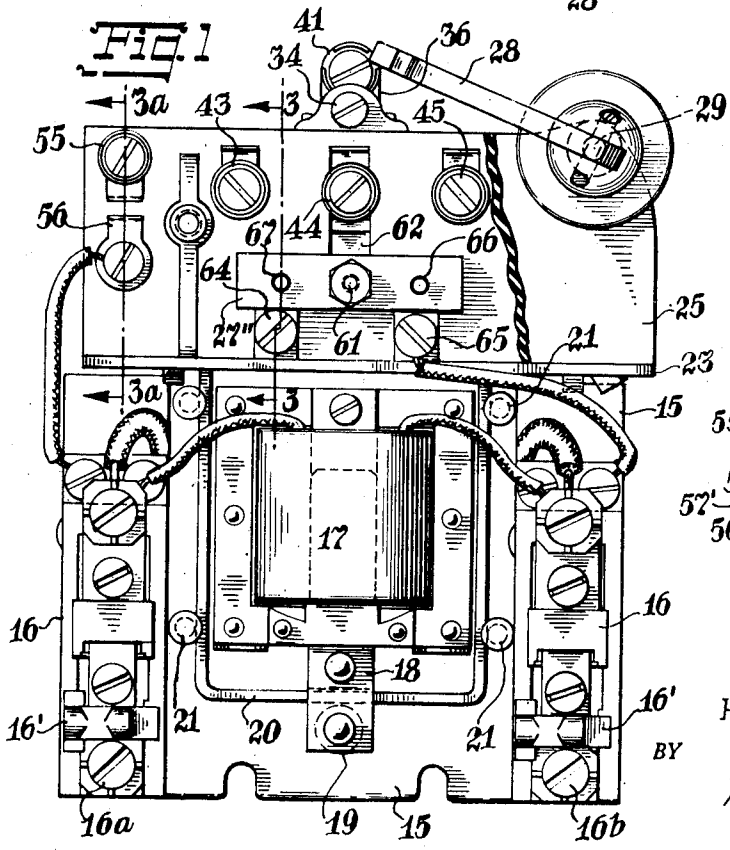


Fig. 3

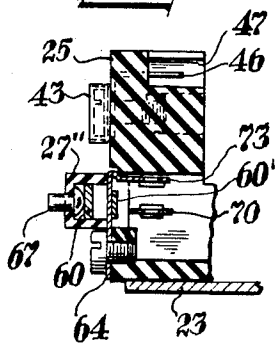
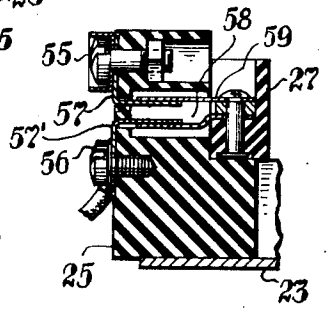


Fig. 3a



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Fig. 4

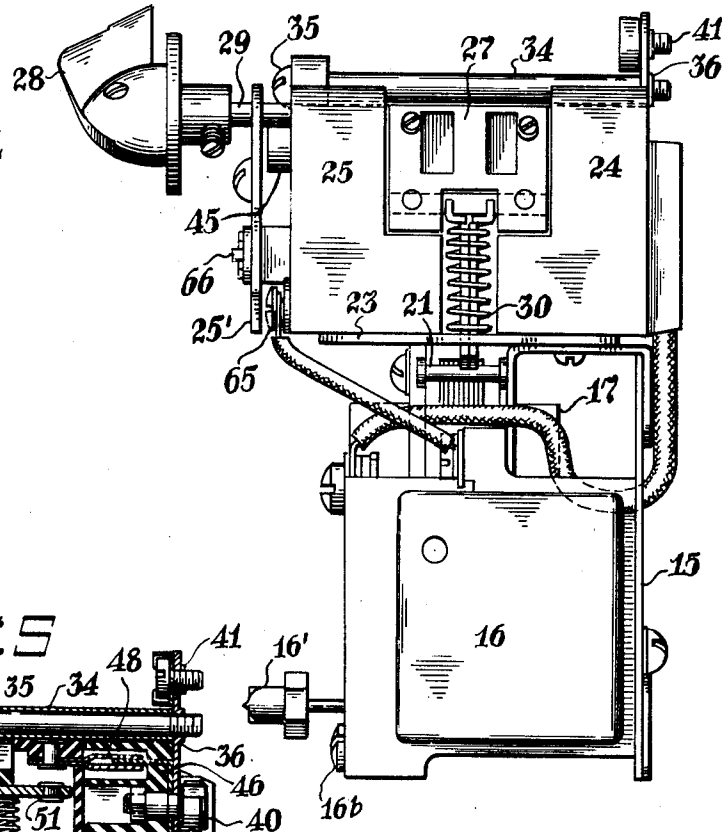


Fig. 5

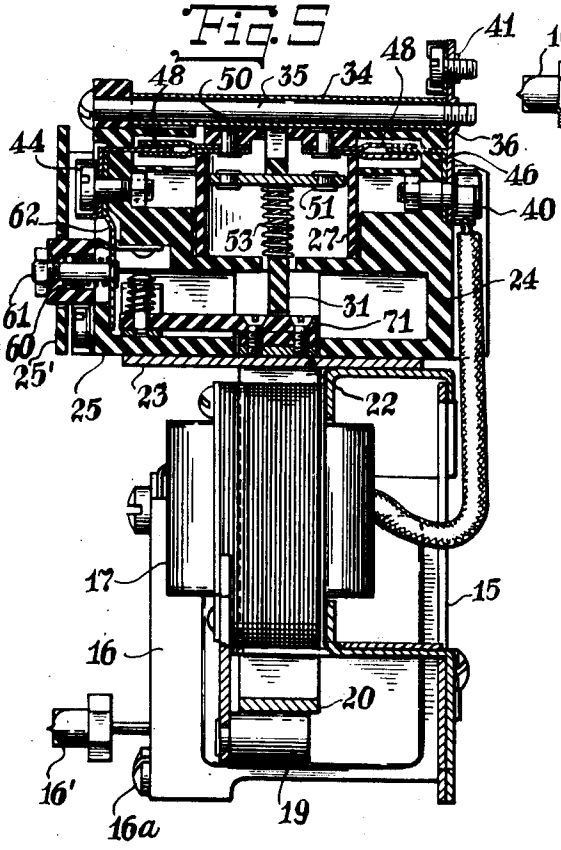
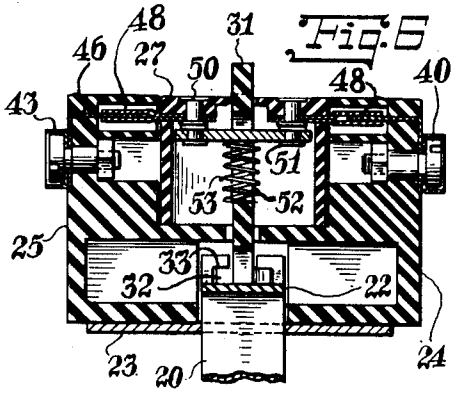


Fig. 6



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Fig. 8

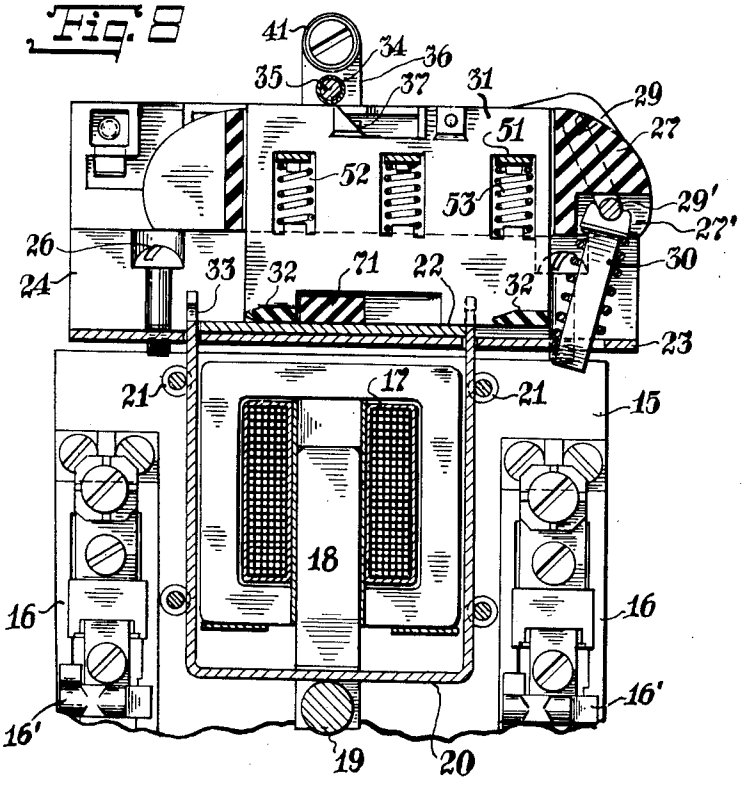
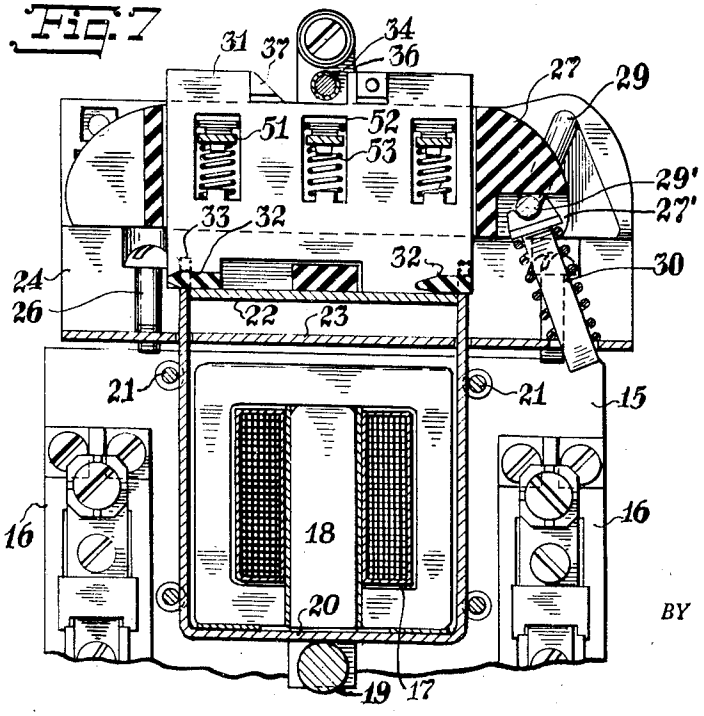


Fig. 7



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Fig. 9

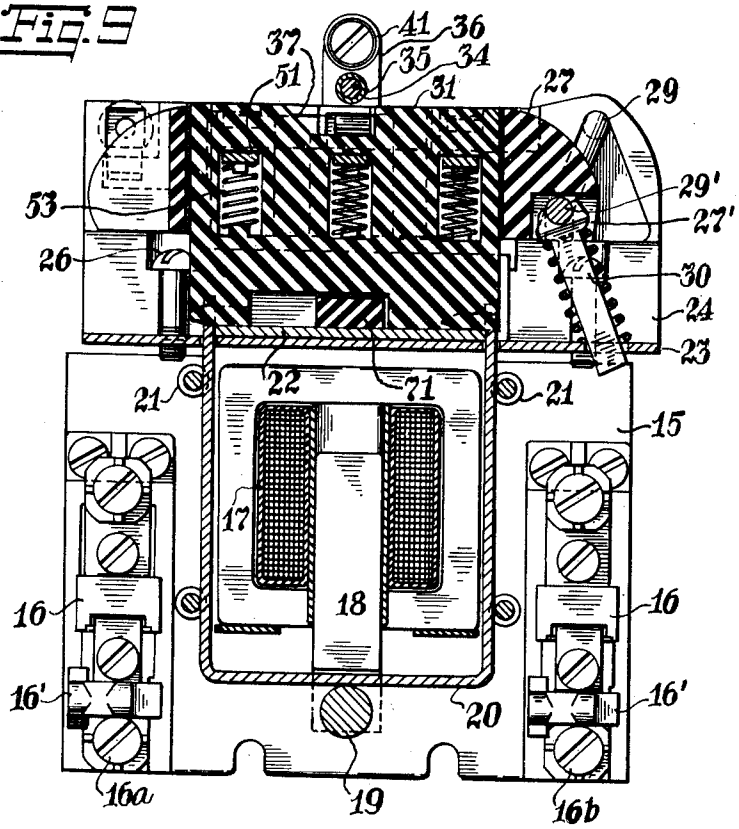


Fig. 10

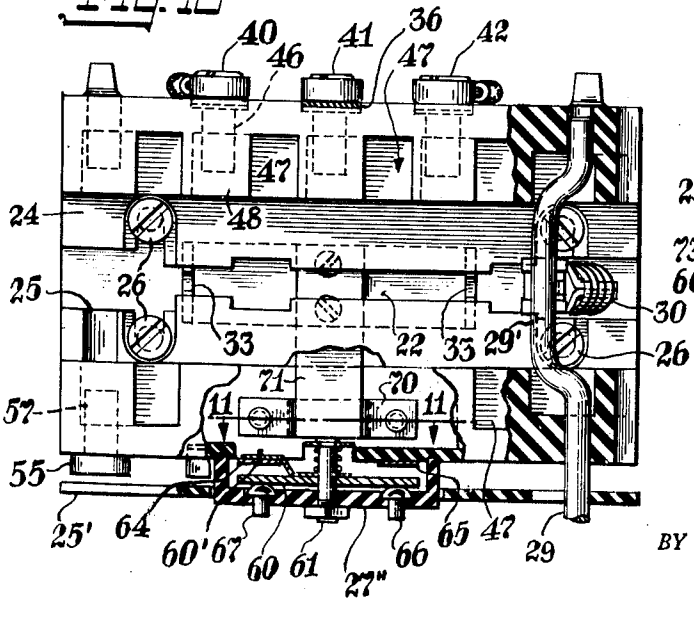
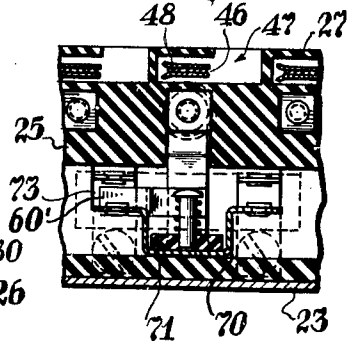


Fig. 11



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Fig. 12

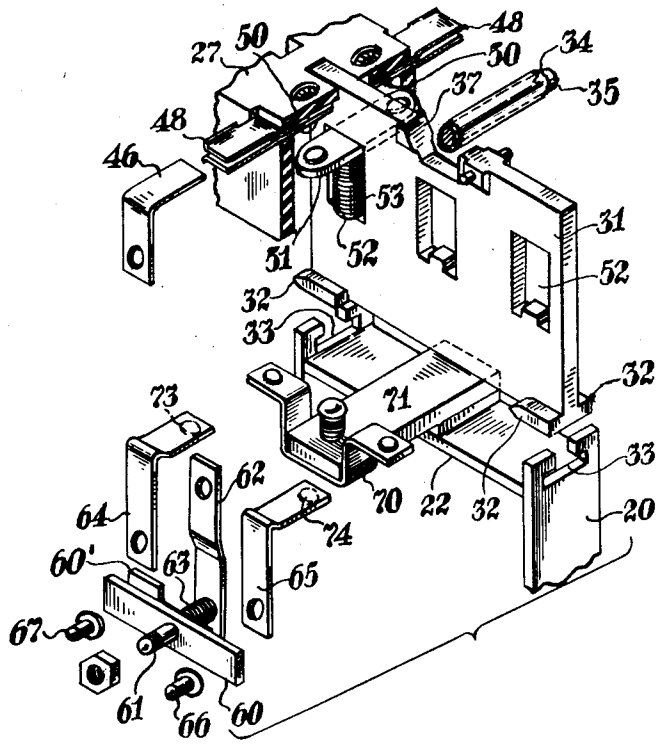


Fig. 13

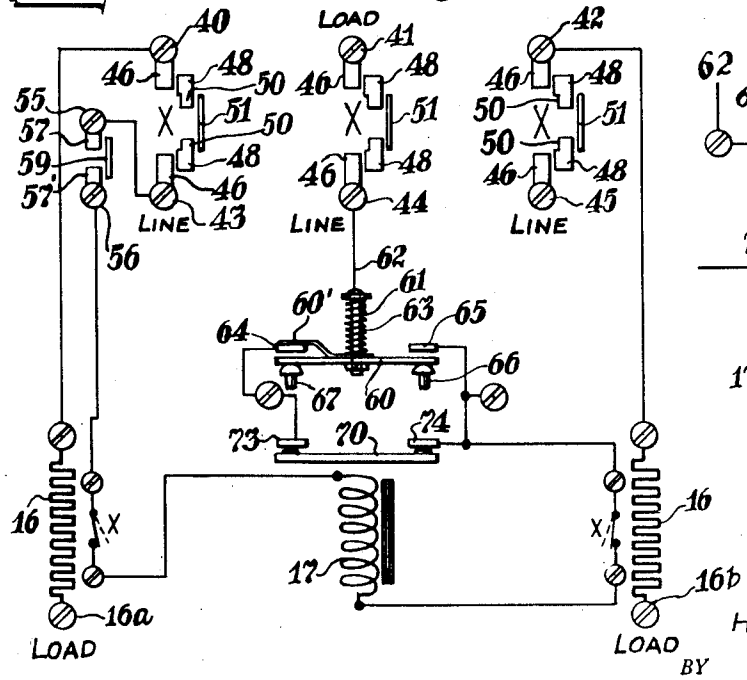
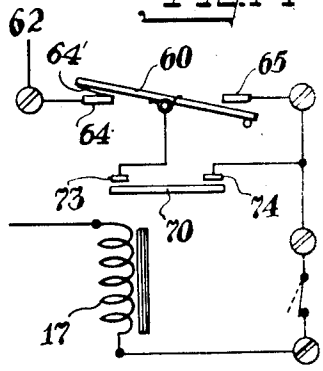


Fig. 14



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Patented Mar. 14, 1950

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UNITED STATES PATENT OFFICE

2,500,635

ELECTROMAGNETICALLY ACTUATED SWITCH

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Application August 2, 1947, Serial No. 765,697

13 Claims. (Cl. 200—5)

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My invention relates to switches of the type of my application #463,215, filed October 24, 1942 now Patent 2,449,221.

One object is to provide in a single device the functions of a contactor and a disconnect switch.

Another object is to provide a switch which can be electromagnetically controlled and manually disabled.

Another object is to provide a mechanism which will successively break, first the control circuit and then the main circuit.

Another object is to provide an electromagnetically controlled switch in which the main circuit contacts can be forcibly separated even if the magnetic release fails to act, i. e., in case the contacts stick.

Another object is to provide for physically and electrically disabling a switch in one operation.

Another object is to provide a switch in which it is impossible to attempt to obtain access to the main switch contacts until the circuit is broken.

Another object is to provide for more effectively housing the various switch contacts.

Another object is to combine in a single unit an electromagnetic contactor, a hold-in switch, a thermostatic overload release, a start and stop device and a disabling switch.

In carrying out my invention in its complete form, I provide a support having line and load terminals, an electromagnetically actuated main switch with a start-and-stop control, overload relays, a hold-in switch and a manually operable switch for de-energizing the coil of the electromagnet and for disabling and disconnecting the main switch.

Details of the invention will be understood from the accompanying drawings and the following specification.

Fig. 1 is a front elevation of switch mechanism embodying one form of my invention, the disabling switch being in the "on" position, parts being broken away and parts being omitted.

Fig. 2 is a plan view of the same, parts being broken away.

Fig. 3 is a fragmentary sectional view on the plane of the line 3—3 of Fig. 1 showing the start-and-stop switch.

Fig. 3a is a fragmentary section on the plane of line 3a, 3a, of Fig. 1.

Fig. 4 is a side elevation viewed from the right side of Fig. 1.

Fig. 5 is a side elevation and section on the plane of the line 5—5 of Fig. 2 showing the disabling switch contacts in the closed circuit position and the magnetically actuated switch member in the open circuit position.

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Fig. 6 is a vertical sectional view showing a magnetically actuated switch member in the closed circuit position.

Fig. 7 is a vertical sectional view on the plane of line 7—7 of Fig. 2, with the parts of the main switch and disabling switch in closed circuit positions.

Fig. 8 is a similar sectional view showing the parts in the open circuit position.

Fig. 9 is a sectional view taken on the central plane of Fig. 2.

Fig. 10 is a plan view and partial sectional view showing the start-and-stop switch and omitting the movable member of the disabling switch.

Fig. 11 is a fragmentary sectional view taken on the plane of the line 11—11 of Fig. 10 showing the hold-in switch.

Fig. 12 is an exploded perspective view showing parts of the various switch contacts.

Fig. 13 is a diagram of the circuits.

Fig. 14 is a fragment of a modified circuit.

A support 15 has a conventional resettable overload relay 16 on each side and an electromagnet coil 17 between them. The armature core 18 is movable up and down within the coil and carries a cross piece 19 beneath the lower bar of a yoke 20 which slides between guides 21, 21. A plate 22 forms the upper part of yoke 20 and the side arms of the yoke are slidable through the bottom plate 23 of the main support.

An insulating body is mounted on plate 23 and comprises two parts 24 and 25 which are secured in place by screws 26. In the passageway between these parts, an insulating block 27 is slidable horizontally by means of a handle 28 on the crank shaft 29. This shaft has its ends supported in parts 24 and 25 and has an offset portion 29' which engages in a recess 27' in the block 27. A throwing spring and bar 30 holds the crank shaft and the block 27 in the "off" or "on" position at the right or left as the case may be.

An insulating carrier 31 is slidable vertically in a guideway in the block 27 and has lugs 32, 32 projecting from its lower edge to interlock or engage in slots 33 in the side arms of the yoke 20 when in one position. A tubular cross bar 34 is mounted on a screw 35 which passes through the front part 25 and is screwed into a bracket 36 on the rear part 24. The carrier 31 has a cam-like portion 37 at the left adapted to engage the cross bar 34 of the carrier when the block

27 and the carrier 31 are moved manually to the right as viewed in Fig. 1 to disable the switch. Such action forces the carrier downwardly regardless of the action of the coil 17.

At the back of the body are the terminals 40, 41 and 42 and at the front are the main line terminals 43, 44 and 45. Each of these terminals has a contact member 46 which projects into an undercut recess 47 in one of the insulating parts of the body such as 25 (see Fig. 11). The block 27 has a corresponding number of outwardly extending contacts 48, 48. These contacts 48 are so located that they are all exposed to view when the block is at the right and are concealed when the block is at the left as viewed in Fig. 2. Front main line terminals 43, 44 and 45 may be protected by a cover plate 25' removably mounted on shaft 29 in front of body part 25. Contacts 46 and 48 are the contacts of the disabling switch. Terminals 43, 44, 45 are the main line terminals and terminals 16a, 16b and 41 are the load terminals.

At the inner end of each contact 48 is a contact 50 of the main switch. The carrier 31 has a number of switch members 51, 51 the ends of which engage the respective contacts 50, 50 and each is mounted in a recess 52 in the carrier and pressed upwardly by a spring 53 so that when the carrier is raised the main circuit switches will be closed provided the block 27 is at the left hand or "on" position.

A safety switch in the coil circuit has two terminals 55 and 56 with contacts 57, 57' which are concealed in an L-shaped recess 58 in the part 25 (see Figs. 2 and 3a). The block 27 has a contact 59 which connects the contacts 57, 57' when the disabling switch block is in the closed circuit position. When the block is moved toward the right as viewed in Fig. 1, this safety switch immediately opens the coil circuit and de-energizes the magnet.

A start-and-stop switch (Figs. 1, 2, 5, 10, 11, 12 and 13) has a contact bar 60 with an offset member 60' loosely mounted on a stud 61 in a hollow insulating housing 27'. Bar 60 is connected to terminal 44 by a strap 62 and pressed outwardly by spring 63. The offset 60' and the opposite end of bar 60 coact with contact members 64 and 65 respectively supported by body part 25. The spring 63 normally presses the right hand end of said bar 60 away from contact member 65 and presses the left hand end 60' against contact member 64. This bar 60 is manually actuated by pressing the "start" button 66 or the "stop" button 67 as the case may require. Button 66 has a limited motion in the block 27'' so that it can not push the bar 60 far enough to cause the left end of 60 to engage contact 64. This left end of 60 of course may be insulated in any suitable manner from contact 64.

The hold-in switch (see Figs. 5, 10, 11, 12 and 13) includes a switch member 70 which is resiliently mounted on one end of an insulating bar 71. The other end of bar 71 is carried by the cross piece 22 of the armature yoke or frame 20 so that switch member 70 moves up and down with the armature core 18 of the magnet. When the coil 17 is energized the switch member 70 contacts and electrically connects the extensions 73 and 74 of the stop-and-start contacts 64 and 65 respectively.

If we assume that the overload relays are set for operation and that the manually operable slide 27 with its safety switch contacts 59, 57, 57', are in the "on" position at the left, as shown in

Figs. 1 and 2, the load circuits may be completed by pressing on the "start" button 66. This connects switch member 60 to contact 65 and completes a circuit from line terminal 44 through the thermal cut-out of the right hand relay 16, through the coil 17 of the electromagnet, through the thermal cut-out of the left hand relay 16 to the terminal 56, through the safety switch contact 57', 59, 57 and terminal 55 to the line terminal 43. The magnet is thus energized and raises its armature which lifts the main switch contact carrier 31 and closes the main switch and the hold-in switch. The starting switch button 66 is then released. The switch bar 60 when released tilts against contact 64 and thus closes a circuit through contact 73, and switch member 70 so that the coil circuit remains closed until opened by an overload, an underload or manual operation.

It will be noted that the switch bar 60 normally engages contact 64 and remains in contact even while the start button 66 is pressed in. As a matter of fact the piece 60 with 60' actually pivots about the contact 64 when the start button 66 is actuated. The result is that when button 66 is compressed it completes the circuit between member 60 and the contact 65 and thus closes the circuit through 73 and 74 and these circuits remain closed even after piece 60 leaves the contact 65, and until piece 60' leaves contact 64.

In the case of an overload, the circuit is opened by one of the conventional relays 16 which may be reset by a push button 16'.

In case of an underload, the magnet is de-energized and its armature with the carrier 31 and the main switch contacts 51, 51 drop from contacts 48, 48 and breaks the main circuits. To open the circuit in the usual manner without disabling it the "stop" switch button 67 is pressed. This opens the circuit through the hold-in switch and thus breaks the coil circuit.

If it is desired to disable the switch so that it can not be started automatically, or if it is desired to obtain access to the main switch contacts, the block 27 carrying the main contacts is moved to the right as viewed in Fig. 1 by turning the handle 28. This breaks the coil circuit through the safety switch member 59 and opens the main load lines and in fact bar 34 forces the carrier with the main contacts downward to ensure separation of the main switch contact.

Figure 14 is a diagram showing a simplified arrangement of the start and stop and hold-in switch members. In this figure the "start" contact 64 has a resilient spring portion 64' with which member 60 normally contacts. Moving the member 60 into engagement with contact 65 completes the circuit through the coil 17 and thus closes the circuit through contacts 73 and 74 as in the other arrangement. To open the circuit, member 60 is moved away from the resilient contact 64' which breaks the coil circuit and de-energizes the switch. In such an arrangement if the start button (not shown) should become stuck or welded the circuit can be opened by the stop button.

The electromagnetically operated switch having hold-in contacts and a start and stop switch herein shown and described is claimed in my copending application 51,976, filed September 30, 1948.

I claim:

1. An insulating body having a passage, switch terminal contacts carried by said body, an in-

sulating block slidable in said passage and having a guideway, outer switch contacts carried by said block coacting with the contacts of the body, inner contacts carried by said block on opposite sides of said guideway, a carrier slidable in said guideway and having switch contact coacting with the inner contacts of said block, an electromagnetically operable member for moving said carrier in said guideway and means for retracting said carrier independently of the action of said electromagnetically operable member.

2. An insulating body having two parts with a passage between them, switch terminal contacts carried by said body, an insulating block slidable in said passage and having a guideway, outer switch contacts carried by said block coacting with the contacts of the body, inner contacts carried by said block on opposite sides of said guideway, a carrier slidable in said guideway and having switch contacts coacting with the inner contacts of said block and an electromagnetically operable member for moving said carrier in said guideway.

3. An insulating body having a passage, switch contacts carried by said body, an insulating block slidable in said passage and having a guideway, outer switch contacts carried by said block coacting with the contacts of the body, inner contacts carried by said block on opposite sides of said guideway, a carrier slidable in said guideway and having switch contacts coacting with the inner contacts of said block, a hold-in switch member carried by said carrier and an electromagnetically operable member for moving said carrier in said guideway.

4. In a switch, a body having stationary contacts concealed in pockets, a sliding block having second contacts coacting therewith, said second contacts being exposed to view when disconnected from the first mentioned contacts, other contacts connected to said second contacts, a carrier movable in said block having contacts coacting with said other contacts and means coacting with said carrier for moving it and its contacts at right angles to said block and separating the contacts of the carrier from the other contacts of the block when said block is moved to separate the second contacts from the first contacts.

5. In a switch a body having stationary contacts concealed in pockets of L-shaped cross section, a sliding block having second contacts coating therewith, said second contacts being exposed to view in said pockets when disconnected from the first mentioned contacts, other contacts connected to said second contacts, a carrier movable in said block having contacts coacting with said other contacts and means coacting with said carrier for moving it and its contacts at right angles to said block and separating the contacts of the carrier from the other contacts of the block.

6. In a switch a body having stationary contacts concealed in pockets, a sliding block having second contacts coacting therewith, said second contacts being exposed to view when disconnected from the first mentioned contacts, other contacts connected to said second contacts, a carrier movable in said block having contacts coacting with said other contacts and means coacting with said carrier for moving it and its contacts at right angles to said block and separating the contacts of the carrier from the other contacts of the block.

7. The combination of an insulating body having switch contacts, an insulating block manually movable with respect to said body and having outer switch contacts adapted to coact with the respective contacts on the body, said block having other inner contacts constituting main contacts and respectively connected to the outer contacts of the block, a carrier movable in said block, switch members carried by said carrier for coacting with the respective main inner contacts of said block, a magnet coil and armature having a frame interlocked with said carrier and a switch actuated by moving said block for opening a circuit through said coil before the carrier moves.

8. The combination of an insulating body having terminals with switch contacts connected to the respective terminals, an insulating block manually movable with respect to said body and having outer switch contacts adapted to coact with the respective contacts on the body, said block having other inner contacts constituting main contacts and respectively connected to the outer contacts of the block, a carrier movable in said block, switch members carried by said carrier for coacting with the respective main inner contacts of said block, a magnet coil and armature for actuating said carrier to close circuits through the main contacts when said coil is energized and a switch actuated by moving said block for opening a circuit through said coil.

9. The combination of an insulating body having terminals with switch contacts connected to the respective terminals, a member manually movable with respect to said body and having outer switch contacts adapted to coact with the respective contacts on the body, said member having other inner contacts constituting the main contacts and respectively connected to the outer contacts of the member, a carrier movable in said member, switch members carried by said carrier for coacting with the respective main inner contacts of said member, a magnet coil and armature for actuating said carrier to close circuits through the main contacts when said coil is energized, and means for mechanically retracting said carrier from its closed circuit position when said member is moved to separate the outer contacts of said member from the respective contacts of the body.

10. The combination of an insulating body having switch contacts, an insulating block manually movable with respect to said body and having outer switch contacts adapted to coact with the respective contacts on the body, said block having other inner contacts constituting the main contacts and respectively connected to the outer contacts of the block, a carrier movable in said block, switch members carried by said carrier for coacting with the respective main inner contacts of said block, a magnet coil and armature for actuating said carrier to close circuits through the main contacts when said coil is energized, and means for retracting said carrier from its closed circuit position when said block is moved to separate the outer contacts of the block from the respective contacts of the body.

11. The combination of an insulating body having switch contacts, an insulating block manually movable with respect to said body and having outer switch contacts adapted to coact with the respective contacts on the body to constitute a disabling switch, said block having other inner contacts constituting main switch contacts and respectively connected to the outer contacts of

the block, a carrier movable in said block, switch members carried by said carrier for coacting with the respective main inner switch contacts of said block, electromagnetic means for actuating said carrier to close circuits through the main contacts, a switch actuated by moving said block for de-energizing said means and means for retracting said carrier from its closed circuit position in case the main switch contacts stick when said block is moved to separate the outer contacts of the block from the respective contacts of the body.

12. The combination of an insulating body having switch contacts, an insulating block manually movable with respect to said body and having outer switch contacts adapted to coact with the respective contacts on the body to constitute a disabling switch, said block having other inner contacts constituting main switch contacts and respectively connected to the outer contacts of the block, a carrier movable in said block, switch members carried by said carrier for coacting with the respective main inner switch contacts of said block, a hold-in switch having a switch member carried by said carrier, electromagnetic means for actuating said carrier to close circuits through the main contacts and the hold-in switch, a switch actuated by moving said block for de-energizing said means and means for retracting said carrier and the hold-in switch member from its closed circuit position in case the main switch contacts stick when said block is moved to separate the outer contacts of the block from the respective contacts of the body.

13. The combination of an insulating body having switch contacts, an insulating block manually movable with respect to said body and having outer switch contacts adapted to coact with the respective contacts on the body, said block having other inner contacts constituting main contacts and respectively connected to the outer contacts of the block, a carrier movable in said block, switch members carried by said carrier for coacting with the respective main inner contacts of said block, a hold-in switch having a switch member carried by said carrier, a magnet coil and armature for actuating said carrier to close circuits through the main contacts and the hold-in switch when said coil is energized.

HERMAN J. HAMMERLY.

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