June 10, 1930. H. E. WHITE 1,763,116

MAGNETIC CONTACTOR

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Fig. 1.

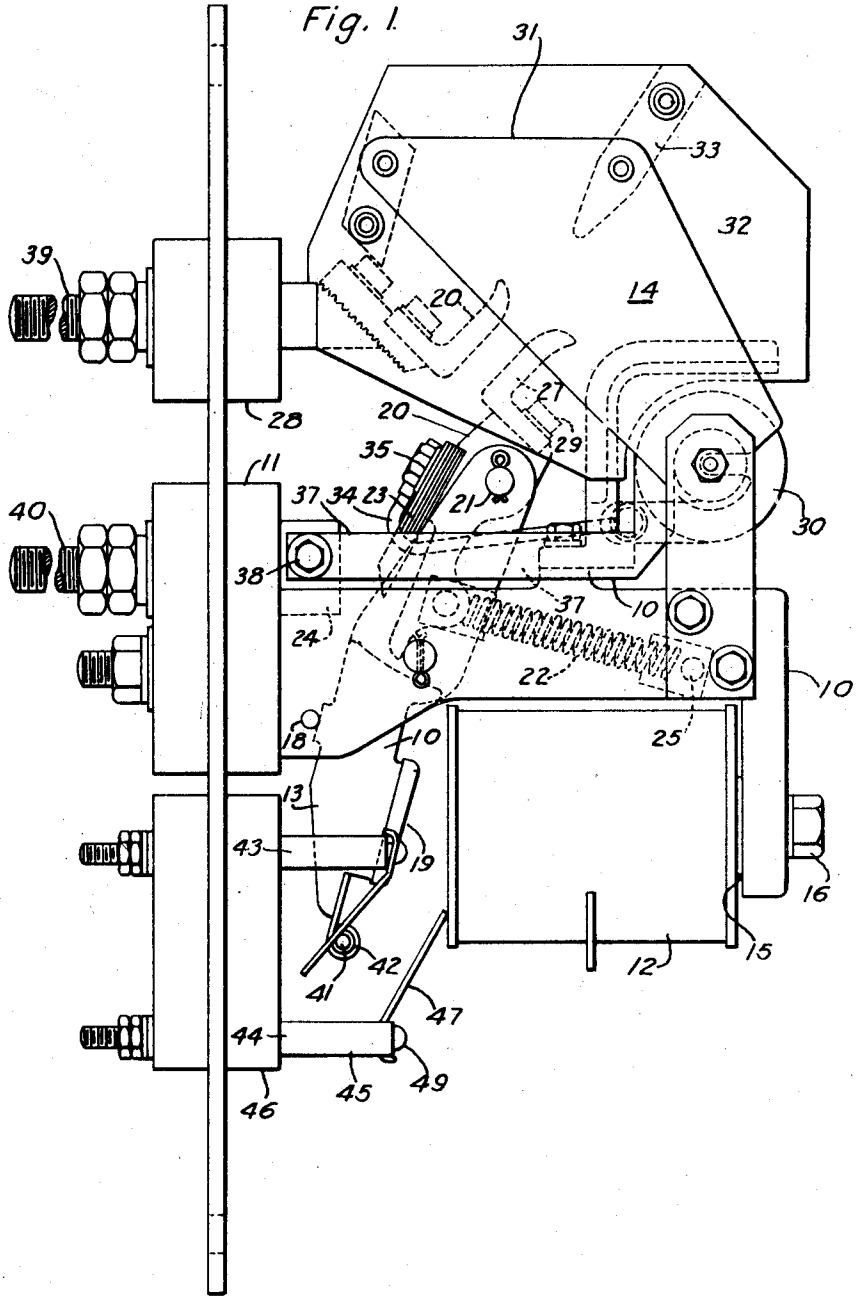

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Fig. 2.

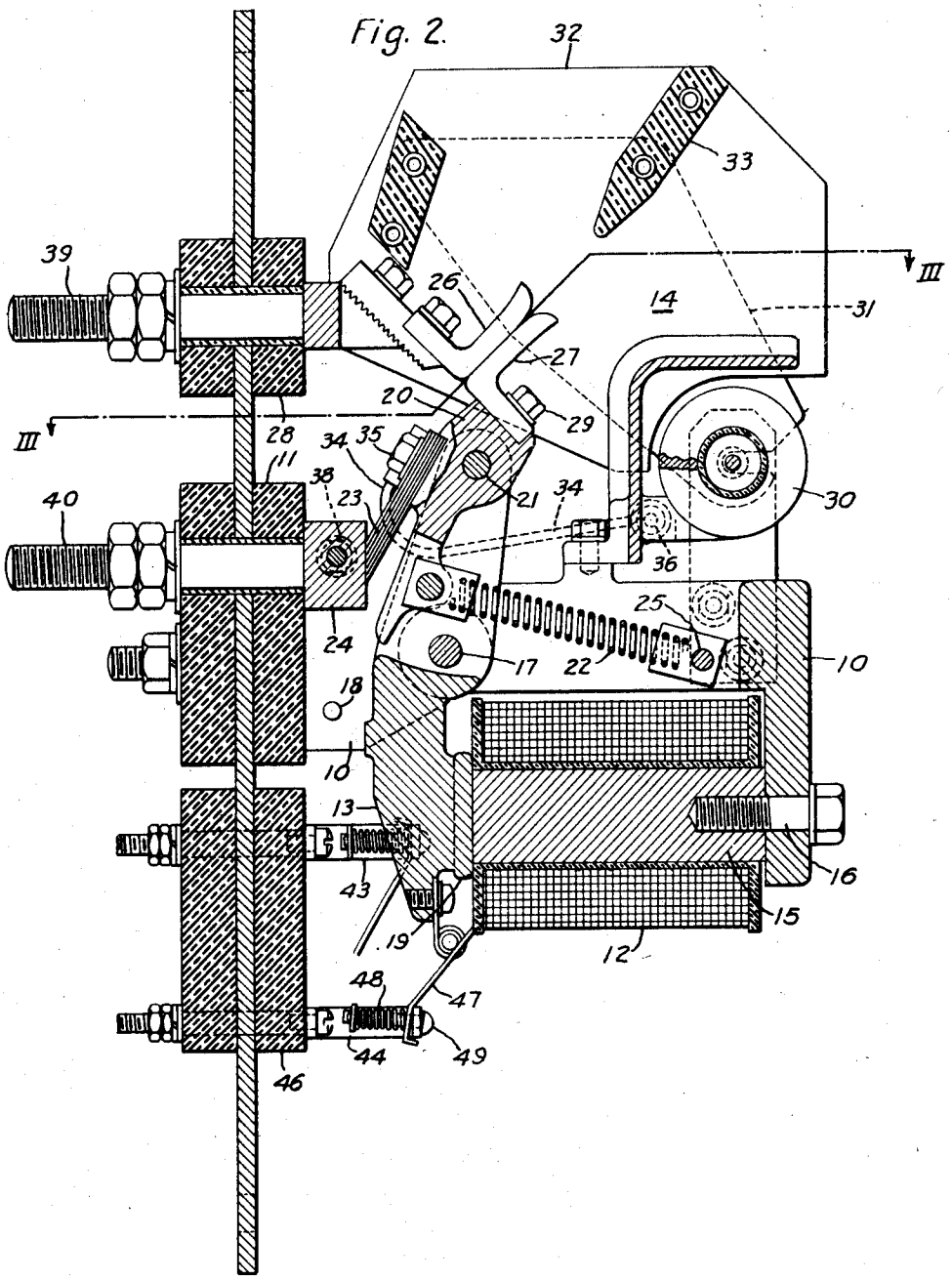

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Fig. 3.

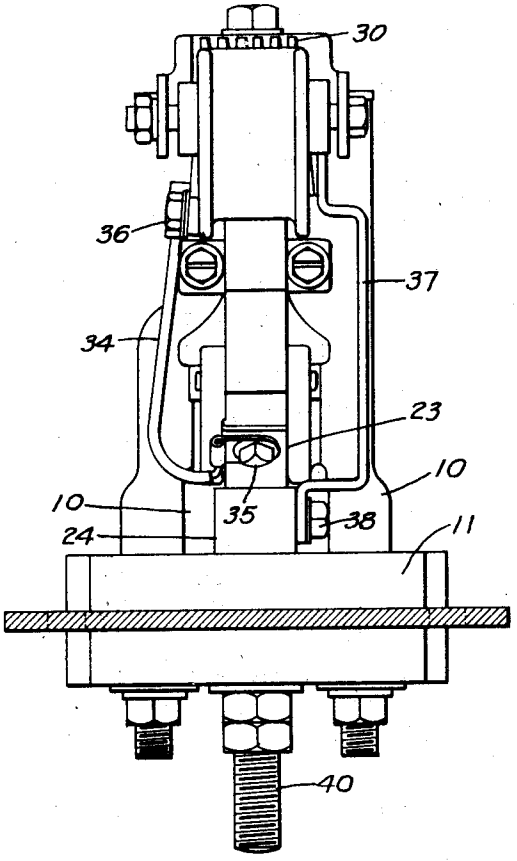
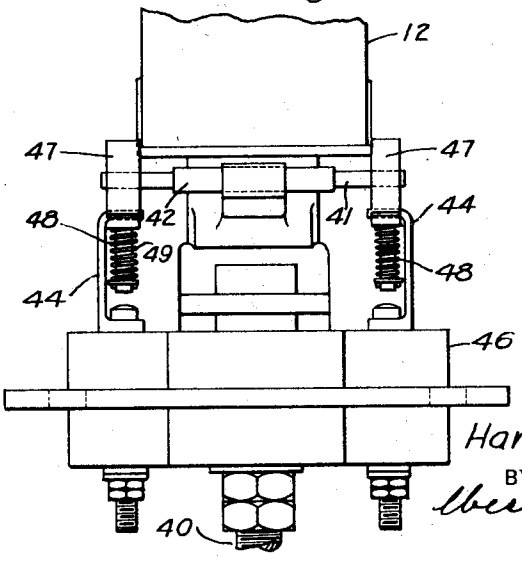


Fig. 4.



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UNITED STATES PATENT OFFICE

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MAGNETIC CONTACTOR

Application filed March 24, 1928. Serial No. 264,357.

My invention relates generally to switching devices and particularly to electro-magnetically operated switches.

In the design of switching devices for maritime service, it is necessary to employ a means unaffected by rolling and pitching of the vessel, or by the shock of battle, for retaining a switch in its open position.

It is further necessary, on account of the limited space and ventilation, that switches used on shipboard be operated at relatively low temperatures. Therefore, such switches should have all necessary heat generating elements arranged so that effective ventilation may be easily accomplished. Switches of this type are equally applicable to railway work where they are subjected to vibration or enclosed in boxes difficult to ventilate.

The object of my invention is to provide a magnetically operated switch which will be suitable for marine purposes as well as for various other applications.

A further object of my invention is to provide for retaining an electro-magnetically operated switch open independently of the force of gravity.

Another object of my invention is to provide an electro-magnetically operated switch whose operating coil and other current carrying elements are designed to produce minimum heat under load and operate at a low temperature.

A more specific object of my invention is to provide a method of removing the blow-out coil of a switch from the path of the main current while the switch is seated in its closed position, and provide for connecting the blow-out coil in the main circuit during the opening operation of the switch and before the contact members have separated.

Other objects of the invention will become apparent to those skilled in the art as the description proceeds.

For a complete understanding of the structure of the invention and the operation of its parts, reference may be had to the following description which should be read in conjunction with the accompanying drawings, in which

Figure 1 is a view in side elevation of a magnetically-operated switch constructed in accordance with my invention and shown in its open position,

Fig. 2 is a view in longitudinal section of a magnetically-operated switch constructed in accordance with my invention and shown with its contact members in their closed positions,

Fig. 3 is a view in section, of the switch taken along the line III—III in Fig. 2, and

Fig. 4 is a view in end elevation of the switch, as shown in Fig. 2 and illustrating the construction of the interlock contact members.

Referring now to Figs. 1 and 2, the frame member 10 is mounted on an insulating base 11 to serve as a support for the operating coil 12, the armature member 13 and the magnetic blow-out device 14. The frame member 10 also constitutes a path for the lines of magnetic force established upon the energization of the operating coil 12.

The operating coil 12 comprises a number of turns of wire wound about a core 15 and mounted on the frame member 10 by means of the screw 16. The operating coil 12 may be energized from any suitable source of power supply and when energized, a flux is set up which follows a path through the core 15, the mounting screw 16, the frame member 10, and the armature 13 so that the armature attracted to and retained in its closed position, as shown in Fig. 2.

The armature member 13 is pivotally mounted on the frame 10 by means of the pin 17. The armature 13 is free to oscillate on the pin 17, its movement being limited by the core 15 of the coil 12 and the stop 18. On one end of the armature member 13, a seat 19 is provided and disposed to engage the core 15 when the coil 12 is energized so that a magnetic flux is established through the coil 12 and armature member 13. The end of the armature member 13 opposite the seat 19 is bifurcated to receive the contact-carrying member 20. As shown the contact-carrying member 20 is pivotally mounted between the prongs of the armature 13 and is free to oscillate about pin 21. The contact-carrying member 20 is provided with a tail piece to

which is attached a tension spring 22 that continuously biases it counterclockwise about the pin 21. The counterclockwise movement of the contact carrier 20 about its pivot pin 21 is limited by the engagement of the tail piece with the pin 17, which supports the armature 13, and the clockwise movement is limited by the engagement of the brush 23 with the contact block 24.

One end of the tension spring 22 is attached to the frame member 10 through the pin 25 and, as stated above, the other end is attached to the tail piece of the contact carrying member 20. When the coil 12 is deenergized and the armature 13 released, the armature member 13 is retained in its open position by the tension spring 22 acting through the contact carrier 20. A further function of the tension spring 22 is to provide an increased contact pressure between the contact members 26 and 27 when the armature 13 is in its closed position, as shown in Fig. 2.

The stationary contact member 26 is mounted on an insulating base 28 and is disposed to receive the movable contact member 27 which is attached by screw 29 to the contact-carrying member 20 and actuated by the armature member 13 and the operating coil 12.

When the operating coil 12 becomes energized, a magnetic flux is set up which attracts the armature member 13 and the seat 19 is retained in engagement with the core 15. During the closing operation of the armature member 13, the contact members 26 and 27 first engage each other at the curved surfaces near their tips and as the closing operation continues, the contact member 27 is rotated about the axis 21 on which the contact-carrying member 20 is pivoted so that when the closing operation is completed, the flat portions of the contact members 26 and 27 are engaged as shown in Fig. 2. During the closing operation, the first engagement of the contact members 26 and 27 occurs near the tips and the contact members roll upon one another as they approach their final positions. There is a change of contact surface during the closing operation and the surfaces which conduct the current continuously through the switch jaws are never affected by the arcs which are drawn upon opening and closing the contact members. The rolling and wiping action of the contact members upon one another occurs similarly during the opening operation of the contact members and the arcs which are drawn and broken at the tips of the contact members 26 and 27 can never injure or burn the surfaces through which the current is continuously conducted when the switch is in its fully closed position.

A magnetic blow-out device 14 is provided on the switch and comprises a coil 30, a pair of magnetic plates or pole-pieces 31 which are disposed to concentrate the flux set up by the coil 30 and produce a magnetic field within the arc chute 32 which functions to project arcs drawn onto the wedge-shaped splitter 33. When an arc is drawn at the tips of the contact members 26 and 27 and subjected to the influence of the magnetic field within the arc chute, it is stretched and broken about the wedge-shaped arc splitter 33. The blow-out coil 30 is connected to the contact members through the conductor 34 which is attached to the contact-carrying member 20 through the screw 35. An extension 37 of the copper strap which comprises the blow-out coil 30 is connected through the screw 38 to the contact block 24 and the blow-out coil is connected in circuit between the brush 23 and the contact block 24. When the switch has completed its closing operation and is in its fully closed position so that the brush 23 is in engagement with the contact block 24, the brush 23 shunts the blow-out coil 30 and no current traverses the blow-out coil. In this manner, the heating of a switch having magnetic blow-out devices is reduced to a minimum and the heating caused by the energization of the coil occurs only during the closing and opening operations of the switch.

Upon the initial engagement of the contact members 26 and 27, the circuit established through the switch may be traced from the terminal 39 through the contact member 26, contact member 27, the contact carrying member 20, screw 35, conductor 34, blow-out coil 30, conductor 37, screw 38, contact block 24 to the terminal 40. As the contact members 26 and 27 roll into their fully closed positions, the circuit is changed and may be traced from the contact-carrying member 20, through the brush 23 to the contact block 24 and this circuit is maintained as long as the switch is entirely closed.

An interlocking device is mounted upon the armature 13 on the end opposite the contact member 27 and this interlocking device comprises a conductor bar 41 insulated from the armature member 13 by the tube 42 and actuated by the armature to make contact with either of two sets of interlocking fingers 43 and 44. The sets of contact fingers 43 and 44 each comprise two fingers and each set is disposed to engage the opposite ends of the conductor bar 41 so that a circuit will be completed between the individual members of the set of interlocking fingers. From the drawing, it will be seen that the set of interlocking fingers 43 is engaged by the conductor bar 41 when the contact members are in their open position and the set 44 is engaged by the conducting bar 41 when the armature is in its closed position.

From Figs. 2 and 4, the construction of the mounting structure of the interlock fingers may be readily understood. Each of the interlock fingers is mounted upon a supporting member as 45, which in turn is mounted upon

the insulating base member 46. The contacting portion of the interlock fingers is composed of a metal strip 47 bent into the shape shown in Figs. 1, 2 and 4 and resiliently mounted upon the supporting member 45. A coil spring 48 is mounted on a pin 49 which engages the interlocked contact member 47 and the support 46 so that through the action of the spring a resilient mounting of the interlock contact member is obtained.

Since it will be possible to modify the embodiment of my invention hereinbefore set forth and adapt it to a number of applications without departing from the spirit and scope of the invention, it is desired that the foregoing description be construed as entirely illustrative and not in a limiting sense.

I claim as my invention:

1. In a magnetically operated switching device, the combination of a pivotally mounted armature member, a contact carrying member pivotally mounted on the armature, a movable contact member mounted on the contact carrying member, a stationary contact member disposed to be engaged by the movable contact member, a tension spring attached to the contact carrying member and disposed to bias the armature to its open position and rotate the contact carrying member about its pivot point, a blow-out coil disposed to be energized by the current traversing the contact members, a contact brush mounted on the contact-carrying member, a stationary contact block disposed to be engaged by the brush in response to the rotation of the contact carrying member, said brush and contact block being disposed to short-circuit the blow-out coil subsequent to the engagement of the contact members, and a magnetizing coil disposed to actuate the armature.

2. In a magnetically operated switch, the combination of a centrally pivoted armature member, a stationary contact member, a movable contact member, a contact-carrying member pivotally mounted on one end of the armature for carrying the movable contact member, said contact-carrying member being provided with a tail piece, means cooperative with the tail piece to limit the movement of the contact-carrying member about its pivot point, a tension spring attached to the tail piece of the contact carrying member, said tension spring being disposed to bias the armature towards its open position and to permit the movable contact member to rotate into engagement with the stationary contact member, a blow-out coil disposed to be energized by the current traversing the switch, a brush mounted on the contact-carrying member, a stationary contact block disposed to be engaged by the brush when the contact members are in their closed position, said brush and contact block being disposed to short-circuit the blow-out coil when in engagement, and an externally mounted magnet coil for actuating the armature.

3. In a magnetically operated switch, in combination, a movably mounted armature member, a stationary contact member, a movable contact member pivotally mounted on the armature for engaging the stationary contact member to establish a circuit, means disposed to permit rotation of the movable contact member on the armature, a blow-out coil for developing an arc-rupturing field about the contact members, said blow-out coil being connected in series circuit relation with the contact members, and means carried by the movable contact member for establishing a circuit to shunt the blow-out coil in response to the rotation of the movable contact member when the contact members are in engagement, and a magnetic coil for actuating the armature.

4. In a magnetically operated switch, in combination, a movably mounted armature member, a stationary contact member, a movable contact member for engaging the stationary contact member to establish a circuit a carrier for the movable contact member pivotally mounted on the armature, a blow-out coil for developing an arc-rupturing field about the contact members, said blow-out coil being connected in series circuit relation with the contact members, an auxiliary contact member carried by and electrically connected to the movable contact member and carrier, means cooperative with the auxiliary contact member to establish a shunt circuit around said blow-out coil, and a magnet coil for actuating the armature.

5. In a magnetically operated switch, in combination, a pivotally mounted armature member, a stationary contact member, a movable contact member for engaging the stationary contact member to establish a circuit, said armature having a pivotally mounted carrier for the movable contact member, a blow-out coil for developing an arc-rupturing field about the contact members, said blow-out coil being connected in series circuit relation with the contact members, an auxiliary contact member carried by and electrically connected to the movable contact member and carrier, means cooperative with the auxiliary contact member and carrier to establish a shunt circuit around said blow-out coil, said auxiliary contact member being disposed to interrupt the shunt circuit before the contact members are separated, and means for actuating the armature to effect the operation of the auxiliary contact member.

6. In a switch, in combination, a movably mounted armature, a contact carrier pivotally mounted on the armature, a movable contact member mounted on the contact carrier, a contact member disposed to receive the movable contact member, a spring disposed to

bias the contact carrier in a predetermined direction about its pivot point, said spring being disposed to cause a wiping action between the contact members when the armature is actuated, an auxiliary contact member mounted on the contact carrier, said auxiliary contact member being disposed to be actuated upon the rotation of the contact carrier about its pivot point caused by the operation of the armature, and means for actuating the armature.

7. In an electric switch, in combination, a stationary contact member and a cooperative movable contact member, an armature for actuating the movable contact member, a contact carrier pivotally mounted on one end of the armature disposed to carry the movable contact member, a biasing spring connected to one end of the contact carrier to retain the armature in the open position, a blowout coil for extinguishing the arc between the contact members, said coil being connected in series circuit relation with the contact members through the contact carrier, a brush provided on the contact carrier disposed to bridge the blowout coil connections in response to the closure of the armature and the movement of the contact carrier about its pivot point under the control of the biasing spring, and a coil for actuating the armature against the force of the biasing spring.

In testimony whereof, I have hereunto subscribed my name this 20th day of March, 1928.

HAROLD E. WHITE.