

[54] HIGH WATTAGE CONTACTOR

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335/257, 258, 192, 200, 262

[56] **References Cited**

UNITED STATES PATENTS

3,284,742	11/1966	Pettit et al.	335/257
2,523,660	9/1950	Hulstein	335/258
2,521,969	9/1950	Dugan.....	335/161

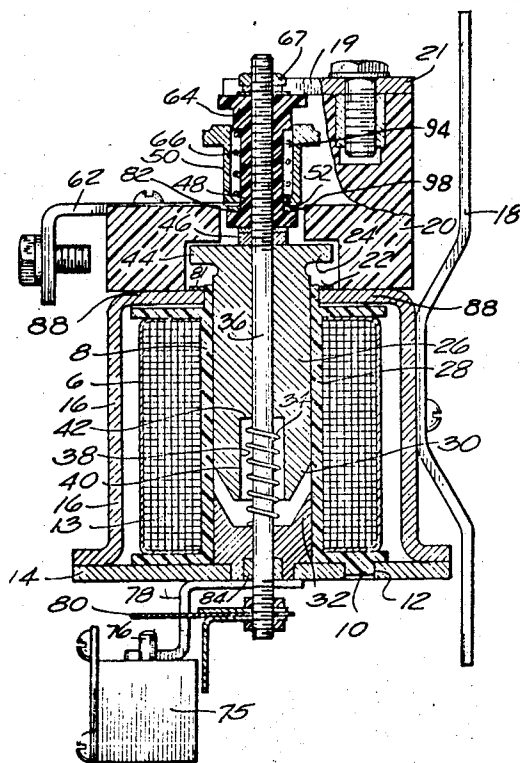
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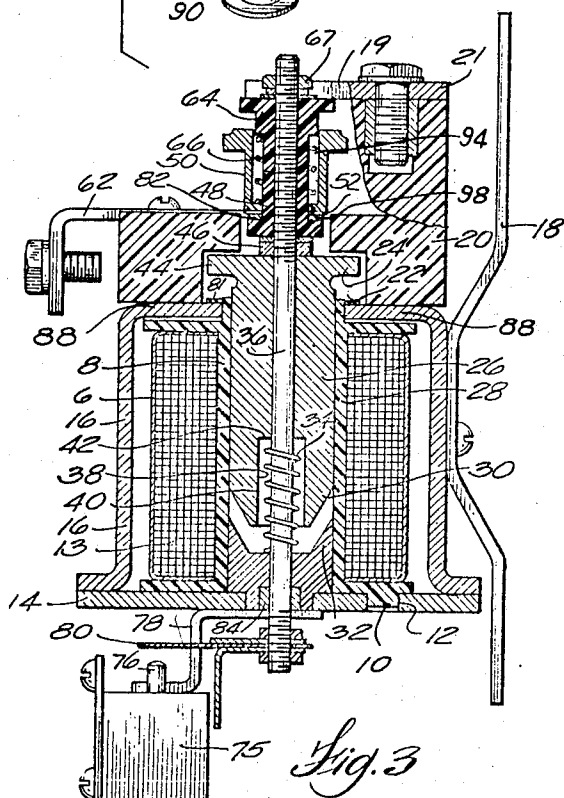
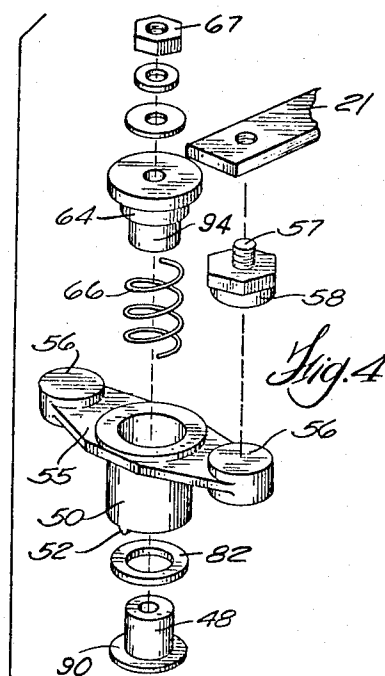
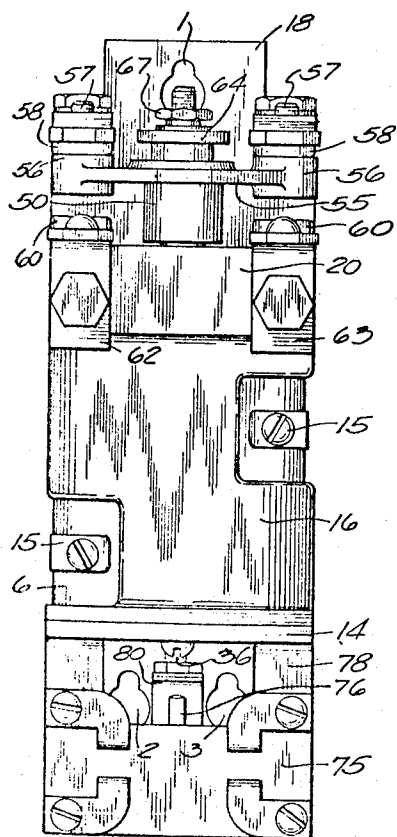
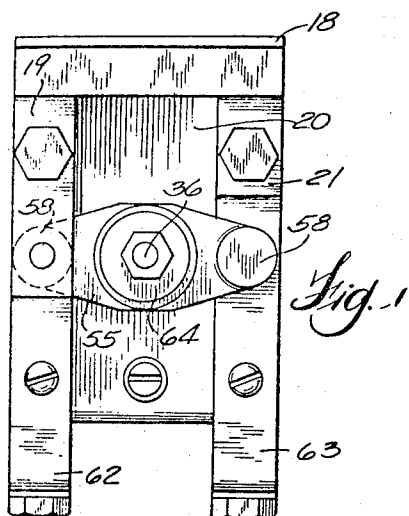
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[57] **ABSTRACT**

One hundred amps. or more is switched with limited space requirements and easy access to parts. A coil bobbin of phenolic or the like serves as a guide for a magnetically responsive armature or plunger. The taper and mushroom head on this armature allows the magnetic attraction of the coil to be used more than would be the case if the head were cut off at right angles. The armature is actually guided by the bobbin and operates therein with dashpot action. The contacts are preferably plated with silver cadmium oxide designed with double break so that no pigtails are required. There is high capacity for overload with little or no corrosion, the springs being stainless steel and the frames plated. An interlock switch is separately fabricated and attached in position for use, all terminals, springs, nuts and other parts being readily accessible from the front of the device.

15 Claims, 4 Drawing Figures





HIGH WATTAGE CONTACTOR

BACKGROUND OF INVENTION

The foregoing advantages are achieved by the disclosed construction in which a contactor in the nature of a relay has magnetic coils wound on a dielectric tube which serves both as a guide and as a dashpot for an armature having a mushroom head. The armature is supported on a stainless steel spring. An interlock or other auxiliary switch may optionally be used with ready access.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a plan view of a heavy duty switch embodying the invention.

FIG. 2 is a front elevational view thereof with an auxiliary interlock switch.

FIG. 3 is a view in side elevation of the assembly shown in FIG. 2 partially broken away to vertical cross section.

FIG. 4 is a view in relatively separated positions of parts of the assembly as such parts appear in FIG. 3.

DETAILED DESCRIPTION

It is one of the features of the disclosed device that it may be mounted in various positions without rendering nuts or bolts inaccessible. High thermal-capacity coils 6 are carried on a bobbin 8 which may conveniently be made of phenolic material with an integral dowel 10 received in the hole 12 of a plate 14 which is fastened to the frame member 16. Closure 32 and bearing 84 are permanently attached to plate 14. The frame 16 may be mounted in a variety of positions, being screwed to a mounting plate 18 as shown in FIG. 3. The plate 18 has keyhole slots 1, 2 and 3 as best shown in FIG. 2. Regardless of the way in which the plate is mounted, the dowel maintains proper orientation of the terminals 15 of the coil or coils 6.

Attached to that portion of the frame which is uppermost in FIG. 1 is a phenolic mounting block 20 which has a socket 22 for the mushroom head 24 of the armature 26. This armature is guided for reciprocation in the core 28 of the bobbin. The fit is close enough so that the core provides dashpot action for the armature 26. The smoothness of such action is enhanced by the provision of a head 30 which, instead of being square cut, has the form of a truncated cone for which the closure has a complementary seat 32 (FIG. 3). The form is such that the head 30 approaches the closure 32 with graduated electromagnetic response. The electromagnetic response is enhanced initially by the truncated cone head 30 and then by mushroom head 24 as the head 24 approaches the magnetizable frame portions 88.

The stainless steel armature spring 34 is guided on a rod 36 which extends and is threaded through the armature and is housed in opening 40 in the lower part of the armature. The rod 36 is guided by bearing 84.

The flange 44 at the upper end of the armature carries a nut 46 and supports a headed fitting insulator 48 and steel pivot washer 82. A rockable sleeve 50 on a transverse fulcrum rib 52 (FIG. 4) rests against washer 82. The bridge 55 carries contacts 56 which are preferably made of silver cadmium oxide or the like to insure continuity, resist corrosion and have strong anti-weld characteristics. The design is such that these contacts

are fully exposed for inspection and this is true regardless of the position in which the contactor is mounted. The rib 52 permits the contact arms and contacts to adjust themselves to a good seat.

Considerable importance is attached to details of the construction shown in FIGS. 3 and 4 which is intended to eliminate or minimize adjustments which might otherwise be required following replacement of parts. Already described is the rod 36 which extends centrally through the core 28 of the bobbin. Together the rod and bobbin core guide the armature 26 for which compression spring 34 provides resilient support. The head 30 of armature 26 is tapered, having the form of a truncated cone, for which the bottom closure 32 has a complementary taper such that the head approaches the closure with graduated electromagnetic response.

The guidance of the cone for the armature 26 is sufficiently close to provide substantial dashpot control enhanced in the final movement of the core as the mushroom head 24 approaches the non-magnetic stainless steel washer 81 in the bottom of the cavity 22 in which the mushroom head 24 operates.

On top of the frame 16 is the block of insulating material 20 which may be phenolic or the like and which may be made up of several sections, the total being generally L-shaped in vertical cross section (FIG. 3). Forwardly projecting from this block at its rear are contact carrying arms 19 and 21, respectively provided with contact bolts 57 for the contacts 58. Assuming that the switch is normally closed as in the species herein illustrated, a contact carrying bridge 55 is mounted on sleeve 50 (FIG. 4).

The electric terminals 19 and 21 spaced from each other behind the armature, register with the contacts 56 at the end of bridge 55. Also spaced to register with contacts 56 are the contacts 60 on terminals 62, 63, which lie below the level of the bridge (FIG. 2).

As indicated, the bridge 55 is supported to project laterally from sleeve 50 having an upturned shoulder 98. Within the sleeve there is a compression spring 66 (FIG. 4). One end of spring 66 bears against the bottom of the sleeve 50 and within that end is the reduced neck of the insulator 48 having an outturned flange 90. Another insulator 64 has a neck portion extending into the upper end of spring 66 and fitted into the top of sleeve 50 (FIG. 3). When the nut 67 threaded to the upper end of shaft 36 is tightened to draw the ends of insulators 48 and 64 together as shown in FIG. 3, the adjustment becomes proper and the downward pressure from arm 21 to the bridge 55 is correct. When the contacts 56 engage the contacts 60, the spring seat 94 on the insulator 64 moves within the sleeve 50 until the mushroom head or outwardly extending annular flange 44 engages the washer 81. The predetermined travel thus afforded of the rod 36 and armature 26 after engagement of the contacts 56 and 60 determines the normally open contact wear allowance and contact pressure for contacts 56 and 60. Moreover, when the bridge contacts 56 are replaced, the insulating elements 48 and 60 establish the proper travel without any adjustments.

Underneath the flange or mushroom head 24 of the armature 26 is a non-magnetic stainless steel washer 81 against which the mushroom head 22 stops in its downward movement.

Reference has been made to the insulator 64 but without fully describing its function. In addition to seat-

ing against insulator 48, the insulator 64 assists in guiding the threaded rod 36 and in establishing the proper spring pressure to which the armature is subject when the nut 67 is adjusted. It also, of course, insulates the armature rod 36.

Mention has been made of the fact that the assembly of parts described eliminates the need for the individual adjustment for such parts, since the adjustment is automatically achieved during assembly. Thus, when the nut 67 at the top of rod 36 is tightened, the insulator spring seat 64 compresses spring 66 to the correct contact spring pressure to which contacts 60 should be subject. Thus, when the bridge assembly 55 is replaced in service and the parts are re-assembled, the correct pressures are automatically achieved and need for adjustment is eliminated.

The insulating rod 36 and the assembly of coil 6 thereon automatically insulates the coil from the frame member 16 and results in the fact that the mounting plate 18 is electrically dead so that the device can be mounted to steel or any other surface without the use of insulating materials other than those already present in the assembly.

The contactor as shown is a double throw switch, one side being normally open and one normally closed. The contacts 58, which provide the normally closed circuit, may be replaced with normally open contacts, and the contacts 60 can be replaced with normally closed contacts, whereby the switch is changed from normally closed to normally open. When re-assembled, it will function as desired without requiring other adjustment.

The mushroom head 24 stops against the non-magnetic washer 81 to allow the armature to drop out without residual magnetism when the coil is de-energized.

The contactor which includes the bridge 55 interrupts the electrical circuit in two places, providing a double break instead of a single break such as would be provided but for the construction shown. This greatly enhances the electrical life by disrupting the arcing ability which the moving contactor would otherwise have. Moreover, the contacts are clearly visible from the front, thus facilitating visual inspection. The coil 6 operates at a much lower temperature than otherwise because the heat generated is conducted physically away from the coil through the plate 14 into frame member 16 to the mounting plate 18, which thus provides a heat sink.

Above and below each of the contacts 56 there are contacts 58 and 60. In the illustrated embodiments, the electromagnetically operated contacts 56 are normally seated under the bias of spring 34 against fixed contacts 58. Subject to the magnetic response of the armature 26, contact 56 may engage the normally open contacts 60. To absorb shock, the assembly 50 is not fixed solidly to the rod 36 but is supported by means of compression spring 66 on an insulator 64.

It is particularly to be observed that all of the nuts and screws used to assemble the described parts are readily accessible from the front, as shown in FIGS. 1 and 2. All terminals and mounting holes are accessible from the front.

If desired, an accessory device such as an electrical interlock switch 75 may be hung on the frame. This switch per se forms no part of the present invention and consequently is not illustrated in detail. It is a conven-

tional commercial switch having an actuator or contact button 76, a mounting bracket 78 and a spring arm 80 which may be attached, as best shown in FIG. 3, to the reciprocable rod 36 to project over the switch actuator 76 for engagement therewith when the armature 26 and its central rod 36 are displaced in a direction which is downward, as viewed in FIG. 3.

It will be understood in this connection that the design of the apparatus is such that it will function either vertically or horizontally or otherwise. It is not, therefore, to be regarded as requiring a mounting in the position shown.

In order to provide maximum disclosure of the most desirable construction and material known to me, I have specified many details of construction and materials which, for some purposes, may not be required. I do not, therefore, wish to limit my definition of the invention except by reference to the accompanying claims. Long wear is assured by the use of non-corrosive contacts, absence of pigtailed, the ability of the switch to handle heavy overloads without injury, making the springs of stainless steel, and plating the frame. The specific embodiment as shown and described has been tested for a mechanical life of five million operations within an electrical life of three million operations. Notwithstanding its heavy duty construction, it requires smaller paneled area than any commercial device for this purpose which is known to me. In practice, it requires less than twelve square inches per mounting. It uses a minimum number of major parts in its construction.

I claim:

1. A contactor comprising a coil bobbin having a tubular core and a winding thereon supported on a frame, a fixed electrical contact on said frame, an armature guided for axial reciprocation in said core and provided with a mushroom head at one end and a truncated cone at the other end, an electrical contact movable with said armature, and means providing a complementary closure for the bobbin and with which said armature coacts, and magnetizable frame portions in the path of travel of said mushroom head for magnetically attracting said mushroom head when said coil is energized, said mushroom head providing increased magnetic attraction of said armature with said coil and said magnetizable frame portions as said head approaches said magnetizable frame portions and said armature contact engages said fixed contact to complete an electric circuit.

2. A contactor according to claim 1 including a non-magnetic washer between said frame portions and said mushroom head to prevent contact of said head and said frame portions to isolate said head from said frame portions and prevent residual magnetism developing in said mushroom head.

3. A contactor according to claim 1 including a frame having means for engaging and supporting said bobbin, said bobbin having a closure element complementary to said armature and toward which said armature is magnetically attracted when the coil of the bobbin is energized, said armature interfitting in the bobbin core to provide a dashpot action and, additionally, to provide a graduated electromagnetic response.

4. A contactor according to claim 1 in which a mounting frame supports a bobbin and has a socket for which the bobbin provides an integral dowel, said wind-

ing having terminal means maintained in orientation by engagement of the dowel with the socket.

5. A contactor according to claim 1 in which the frame has a dielectric mounting block, a rod extending therethrough axially of the bobbin, the armature being mounted on the rod and fitted within the core of the bobbin, means supporting the rod for yielding resilient movement with respect to the mounting block, and a spring of relatively non-magnetic metal disposed interiorly of the armature and engaged with the armature and supported on a closure with which the bobbin is provided.

6. A contactor according to claim 5 in which the armature has its said mushroom head at the end away from which it is electromagnetically urged when the coil is energized, the armature being made fast to said rod and having contact means movable with the armature and for which said frame provides coacting contacts.

7. A contactor according to claim 6 in which said contact means include at least one fixed contact toward which the said first mentioned contact means moves when the coil is energized and another contact means away from which it moves when the coil is energized.

8. A contactor according to claim 5 in which an auxiliary contactor is mounted on the frame and has a contact actuator in the path of operating means with which said rod is provided.

9. A contactor according to claim 6 in which the contact means is movable with the armature and the said coacting contacts of the frame are normally open and the relatively non-magnetic spring automatically maintains proper contact pressure resistance and wear allowance is automatically accomplished without the need for adjustments.

10. A contactor according to claim 7 in which one of said contacts has a pivotal mounting which is self-alignable when it engages another of the contacts.

11. A contactor in accordance with claim 1 wherein said mushroom head is in the form of an outwardly extending flange.

12. A contactor comprising a mounting plate, arms projecting therefrom, an insulating bobbin supported on said arms forwardly of the plate, a winding on the bobbin, an armature reciprocable through the bobbin and provided with a mushroom head and a terminal truncated cone, the truncated head having a cavity opening into the interior of the armature, a compression spring within the cavity in supporting relation to the armature, means providing a seat for the spring, a rod extending from the cavity through the armature and providing guidance therefor, the armature being closely fitted within the bobbin for dashpot action, a pair of insulating elements arranged on the rod, a spring through which the rod extends and which is confined thereon between said elements, a sleeve enclosing the spring and portions of the elements, said elements being in abutment under compression of a nut with which said rod is provided.

13. A contactor comprising a frame including a mounting plate, arms projecting therefrom, a bobbin supported on said arms forwardly of the plate, a winding on the bobbin, an armature reciprocable through the bobbin, a rod extending through the armature and providing guidance therefor, a compression spring arranged around the rod in supporting relation to the ar-

mature, means providing a seat for the spring, a pair of insulating elements on the rod, a second spring through which the rod extends and which is confined thereon between said elements, a sleeve enclosing the spring and portions of the elements, fulcrum means on said sleeve engaged with one of said elements, said elements being in abutment under compression of a nut with which said rod is provided, a bridge extending laterally from said sleeve and having spaced electrical contacts on said bridge with said bridge electrically connecting said bridge contacts, a pair of fixed contacts supported on said frame and spaced to engage said bridge contacts to provide a double contact and double break in a single conductor, and said spring and said fulcrum means affording angular deflection of said bridge to insure engagement of said bridge contacts with said fixed contacts notwithstanding wear or misalignment of any of said contacts.

14. A contactor in accordance with claim 13 including a second nut threaded on said rod and engaged with said armature to secure the armature to said rod, and one of said insulating elements having a flange with a surface abutting said second nut, and wherein said fulcrum means includes a washer supported on an opposed surface of said nut and a radial rib on said sleeve pivotally supported on said washer and wherein said spring yields to afford a predetermined travel of said rod and said armature relative to said bridge after engagement of said bridge contacts and said fixed contacts to compensate for wear of said contacts and insure engagement of said contacts notwithstanding wear of said contacts.

15. A contactor comprising a coil, a coil bobbin having a tubular core and a winding thereon, an armature guided for axial reciprocation in said core, a frame for supporting said coil bobbin, a rod extending therethrough axially of the bobbin, the armature being mounted on the rod and fitted within the core of the bobbin, a spring disposed interiorly of the armature and engaged with the armature and supported on a closure with which the bobbin is provided, a sleeve arranged around said rod and movable with said armature, an intumed shoulder on said sleeve, a bridge on said sleeve extending laterally in two directions from said sleeve, two electrical contacts on said bridge, fixed contacts on said frame disposed to engage said bridge contacts and connectable to afford a double break in a circuit, means supporting said sleeve to yieldably afford engagement of said bridge contacts and said fixed contacts upon energization of said armature and afford angular displacement of said bridge relative to said rod upon engagement to insure alignment and engagement of said bridge contacts with said fixed contacts notwithstanding wear of any of said contacts, said means supporting said sleeve including a first insulative element having a flange and a hollow shank, said sleeve being supported on said first element flange, a second insulative element having a seat, a flange and a hollow shank, said rod extending through said elements, a nut threaded on the rod clamping said elements in abutting engagement, a spring arranged around said element shanks and located between said intumed shoulder on said sleeve and said seat on said second element, with said spring compressing upon energization of said coil and movement of said armature when said contacts engage as said insulative elements move relative to said sleeve.

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