United States Patent

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Hartford, Conn.

[54] ELECTROMAGNETIC CONTACTOR WITH SUPPLEMENTARY SWITCHING DEVICES AND MOUNTING THEREFOR

6 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **335/132,** 335/202
[51] **Int. Cl.** **H01h 45/02**
[50] **Field of Search** ..... 335/132, 197, 202; 200/166 B, 166 S; 337/7

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Attorney—Davis, Hoie, Faithful & Hapgood

ABSTRACT: An electromagnetic switching device made of insulation bodies on which are supported fixed contacts, a movable contact carrier, and electromagnetic operating means.

Provision is made on the bodies for the attachment and annexation of supplementary poles and/or auxiliary smaller switches by interengagement and interlocking of the casings with formations that are provided on the main device so that when the bodies of the main device are assembled together they hold the supplementary or auxiliary devices.

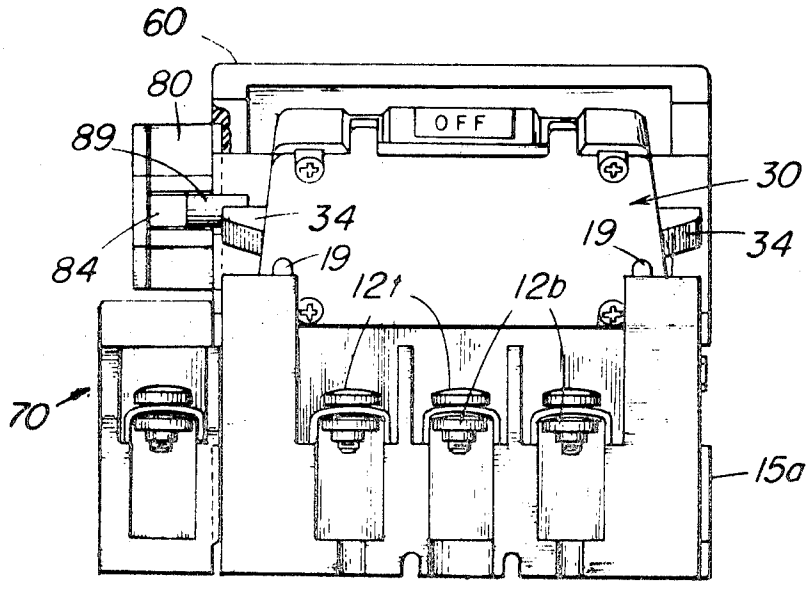


FIG. 1

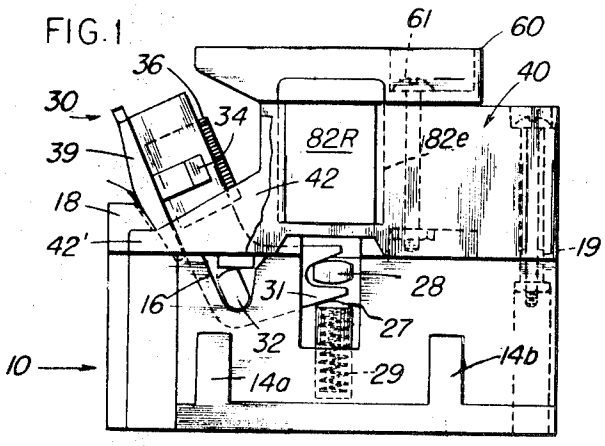


FIG. 4

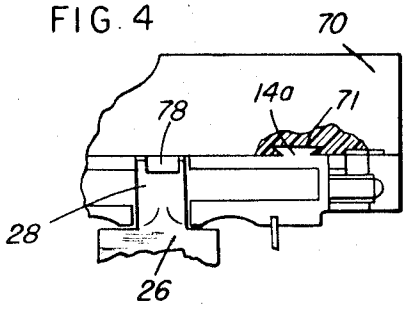


FIG. 7

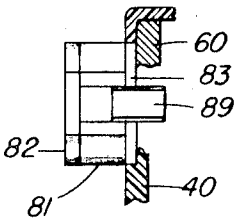


FIG. 2

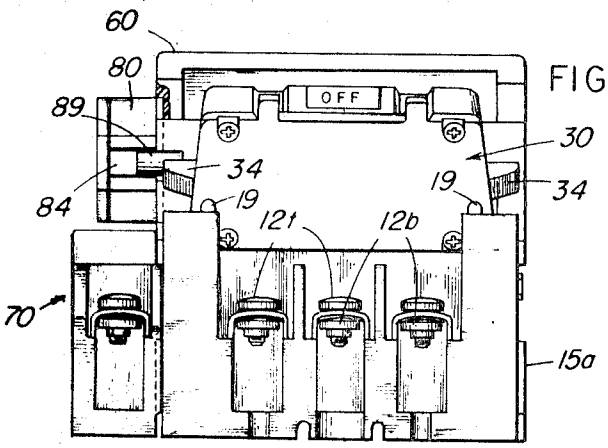


FIG. 6

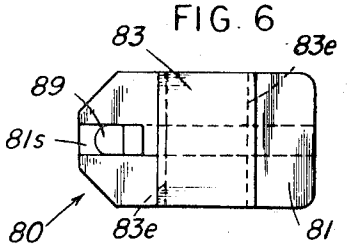


FIG. 3

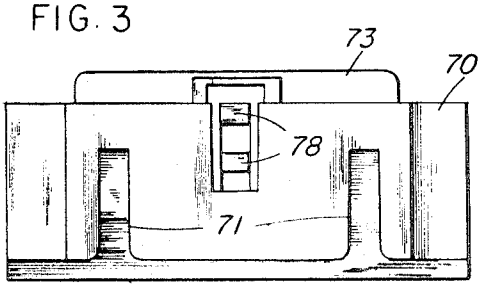


FIG. 8

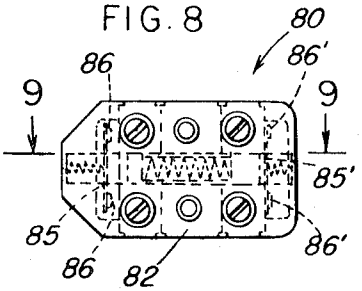


FIG. 5

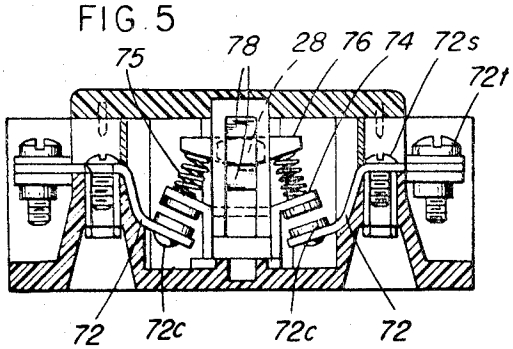
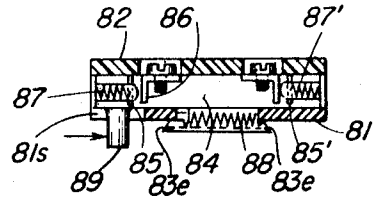


FIG. 9



ELECTROMAGNETIC CONTACTOR WITH SUPPLEMENTARY SWITCHING DEVICES AND MOUNTING THEREFOR

This application is a division of my application, Ser. No. 704,363, filed Feb. 9, 1968, patented on Dec. 29, 1970, No. 3,551,859.

This invention relates to electromagnetically operated switching devices, commonly referred to as electromagnetic contactors, and to supplementary or auxiliary poles or smaller switches and to the means for mounting the latter on the former in a way that the latter is secured to the former by the assembling of the parts of the contactor after the supplementary device is mounted on the contactor.

In electromagnetic contactors as heretofore known, movable contacts have bridged pairs of fixed contacts to open and close the circuits through each line that is connected to the device. These movable contacts were mounted on a carrier which was caused to move by energization of a solenoid coil, creating an electromagnetic field to attract the armature against a bias of springs or gravity or both.

On some occasions and for some usages, it has been desirable or necessary to have the energization of the electromagnet cause actuation of one or more additional units by closing movement of the armature assembly.

These supplementary units include (a) an extra pole having contacts capable of handling current and voltage requirements equal to the poles of the contactor itself, or (b) an auxiliary switch having normally open or normally closed switch contacts or combinations thereof for one or more auxiliary or supplementary circuits, or (c) both another pole and an additional switching unit.

It is an object of this invention to provide units and contactors as aforesaid with improved and novel means for the units to be annexed or attached to the contactor without separate screws or similar securing means but held in engagement when the parts of the contactor are assembled.

It is also an object to avoid the need for separate screws and similar securing means when attaching units, as aforesaid, to the contactor in interlocked, fixed relationship. A related object is to accomplish said attachment by use of interior and exterior formations of the units and contactor. Other objects and advantages of the invention will become apparent as it is described in connection with the drawing.

FIG. **1** is a side elevation view of an electromagnetically actuated switch or contactor embodying the invention, before attachment of a supplementary unit.

FIG. **2** is an end elevation view of the invention looking at the left end of FIG. **1**, with an auxiliary unit attached.

FIG. **3** is a side elevation view of a supplementary pole switch unit, designed for use with the contactor of FIG. **1**, and shown assembled on the contactor in FIG. **2**.

FIG. **4** is a fragmentary view, partly broken away, showing the mounting of a supplementary pole unit as seen in FIG. **2**.

FIG. **5** is a longitudinal midsection view of the unit of FIG. **3**.

FIG. **6** is a side elevation view of a supplementary pushbutton type of switch unit designed for use with the contactor of FIG. **1**, and shown assembled on the contactor in FIG. **2**.

FIG. **7** is a fragmentary view, partly broken away, showing the mounting of a supplementary switch unit which is shown in mounted position in FIG. **2**.

FIG. **8** is a side elevation view of the supplementary pushbutton type switch unit of FIG. **6**, but of the other side.

FIG. **9** is a longitudinal switch view transversely through the unit of FIG. **7** and FIG. **8**, with the section being along line **9—9** of FIG. **8**.

The invention as illustrated in the drawings is made up of several interconnected assemblies each having a number of parts.

The assemblies are mounted on a base **10** made of molded insulating material. These assemblies are:

1. A base assembly comprising an insulation base member on which are mounted fixed contacts and terminal members.

2. A movable contact assembly which is mounted in the base and includes an insulation contact carrier on which is mounted a plurality of bridging contacts, each adapted to engage and disengage a pair of fixed contacts.
3. An actuating assembly for moving the movable contact carrier including a pivoted U-shaped bellcrank lever member carrying an electromagnet armature.
4. A field assembly for an electromagnet including an insulating body on which is mounted a subassembly consisting of a solenoid coil embedded in insulation and a laminated U-shaped field piece passing through the coil.
5. A cover made of insulation for the electromagnet field assembly mounted on the same.
6. Supplemental switching assemblies or units for annexation or attachment to the assembled combination of the assemblies described above.

One supplemental assembly or unit may be an extra pole unit comprising an insulating body having a pair of fixed contacts and a movable bridging contact, and an actuating member positioned to be moved by the actuating assembly when the electromagnetic operating means is energized.

Another supplementary assembly or unit may be a pushbutton-actuated switch having a pair or pairs of normally open or a pair or pairs of normally closed contact sets or combinations thereof in which a bridging contact or contacts are moved into engagement with a pair of fixed contacts or out of engagement with a pair of fixed contacts, or both, by and simultaneously with attraction and release of the armature.

The assemblies comprising the basic combination may be so formed and configured with tongue-and-groove or dovetail formations as to enable attachment, without screws or the like, of the supplementary units and to hold them in such position of interengagement with the basic units of the combination that, after the securing screws which secure the main component assemblies together are screwed tight, the supplemental unit or units are firmly attached.

The details of the electromagnetic contactor are fully described and claimed in parent application Ser. No. 704,363, to which reference may be had for details. Hence, the contactor is only briefly and in summation described herein.

THE BASEPLATE MEMBER

Referring more particularly to the individual components or assemblies which make up the contactor, the base **10** is a molded insulating body of a generally rectangular shape and is hollowed out with three parallel similar cavities for the reception of pairs of aligned fixed contact and terminal members such as **12***b*.

One end of each member extends toward the outside of the base and has a terminal screw **12***t* threaded through it.

The fixed contact and terminal members are secured to the base by conventional means.

On each of the opposite sides of the base that are parallel to the contacts, two parallel spaced ribs **14***a*, **14***b*, and **15***a*, **15***b*, are formed with their parallel edges undercut or dovetailed (see FIGS. **1**, **2** and **7** for the dovetailing). These dovetail ribs provide means to secure additional units to the sides of the base, as will subsequently more fully appear.

For moving the contact carrier there is an endwise extension **28** from each end thereof, embraced by the forked ends of the arm **31** of an armature assembly **30**, as hereinafter described.

To bias the contact carrier **20** and the armature assembly, spring pressed plungers **27** (see FIG. **1**) are mounted in two symmetrically located wells, on in each of the walls of the base beneath each end of the contact carrier. Each of these plungers is pressed upwardly against the bottom tyne of the forked end of the arms **31** of the armature assembly **30**, as in FIG. **1** by a coiled compression spring **29** seated in the well and received in the hollow head of its plunger **27**.

ELECTROMAGNETIC CONTACT-ACTUATING MEANS

This means consists of two assemblies: (1) an electromagnet field assembly consisting of (a) a supporting member or body **40** and (b) a solenoid coil and field piece; and (2) an armature assembly. They may be assembled with ease on the base **10** as individual self-contained units; and equally they may be diassembled from the base.

The field assembly consists of an insulating support member or body **40** formed from molded insulation material into the form best observed in FIGS. **1** and **2**. The body is of irregular shape but symmetrical about its longitudinal centerline. Viewed from the side(as in FIG. **1**) it has generally rectangular sides with generally triangular platelike extensions **42** at the upper end of each of its sides. The extensions taper to tips **42'**, which, when the body **40** is assembled upon the base end, extend under overhanging projections **18**, which extend up from the base at two opposite corners thereof. The width of the body **40** approximates that of the base; and the surfaces of the bottom body lie in a plane and on the top surface of the base **10**. The body **40** is located in proper position on top of the base by conical collars **19** extending up around screwbolt passages through the base from the top surface of the base at those corners of the base which are opposite to the tips **42'**. These conical collars are in register with and are received in conical recesses in the bottom of the body **40** when the body **40** is placed upon the base. Then screwbolts may be inserted through the registering holes in the body **40** and through the collars to secure the base **10** and body **40** together.

On the inside of each of the projections **18** on the body **40** there is a vertical wall closing the inner side of the overhang. This prevents sidewise movement of the tips **42'** when they are engaged under the overhang.

The bottom of the body **40** overlies the trunnion recesses **16** in the base **10** and the trunnions **32** of the hereinafter described armature assembly thus holding the trunnions in the recesses.

The solenoid coil and field piece (not shown) are mounted in the insulating support body **40**, as described in said parent application and are designed to attract (when energized) the hereinafter described armature assembly in known fashion.

To hold the field unit in the body **40**, a shallow, flat-topped cover **60** of molded insulation material is secured over the field units by bolts **61** which pass downwardly through holes in the cover into the body **40** near neighboring corners. The cover is hollowed in its under surface to receive in close-fitting embrace the upper part of the coil casing.

To actuate the movable contact carrier, a bellcrank-type electromagnet armature assembly **30** is mounted in the base **10** pivotally in open-V-shape recesses **16** (see FIG. **1**) that are provided in the sidewalls of the base in opposite aligned positions.

The body of the assembly is made of molded insulation and is generally speaking of U-shape, with its arms formed identically in the shape of parallel belicrank levers **31**. Trunnions **32** extend from the outer side surfaces of the arms **31**, for seating in the V-recesses **16** in the sides of the base. The ends of the arms **31** are forked to embrace the extending ends **28** of the contact carrier, as previously mentioned, to cause the carrier and bridging contacts to move toward and away from the fixed contacts. The armature assembly is biased toward inactive position, as shown in FIG. **1**, by the spring-pressed plungers **27** pressing against the bottom side of the forked ends of the arms **31**, all as previously mentioned.

The transverse part of the armature assembly has a rectangular opening through it and extending longitudinally along it. In the opening is inserted a rectangular laminated bar armature **36** which is attracted by the field piece when its solenoid coil is energized.

For the purposes of actuating auxiliary or supplementary units when they are attached to the contactor, two lugs **34** may be formed on the armature assembly on opposite sides, one extending from each side of the molded bell crank member to engage a cooperating stud on the auxiliary switch, as will subsequently be described.

To enable supplementary units to be attached to or annexed to the contactor without separate screws or similar securing means, the base, body and cover members **10**, **40** and **60**, respectively, are formed exteriorly to cooperate and engage with exterior formations on the casings of the units, for mutual interengagement and interlocking when the components or assemblies of the contactor are fitted and secured together. The manner and means for accomplishing this will appear from the following description:

Extra Pole Addition

Referring to FIG. **3–5**, the supplementary unit comprises a molded insulation casing **70** having substantially plane sidewalls in which are parallel channels **71**, the parallel edges of which are undercut at an acute angle forming the channel into dove formation as viewed in transverse section (see FIG. **4**). The casing is molded with a cavity for reception, mounting and movement of the switch elements as hereinafter described. A cover **73** fits over and covers the open top of the casing. The channels are dimensioned and positioned to receive snugly the dovetail ribs **14*a***, **14*b*** on the base member **10** as the unit **70** is placed against the side of the base **10** above the ribs and is slid down with the channels **71** in register with the ribs.

The channels and ribs are so dimensioned and positioned that when the unit **70** is connected to the base **10** with the unit slid on the ribs as far as possible, the top of the unit will be flush with the top of base **10**. In order to hold the unit **70** in that position, the side wall of the field supporting body **40** overhangs the cover **73** of the unit **70** at least as much much as the ribs protrude from base **10**. Thus while the body **40** remains secured on the base **10**, the unit **70** cannot be removed and no other means is required to hold the unit in that assembled position.

The switching contacts are within the casing **70** and may be of various different forms, sizes and capacities, but when the unit is to be usable as a fourth pole, it is preferable that its contact carrier **76** support backing springs **75** pressing against bridging contact **74** for engagement with fixed contact buttons **72*c*** on terminal members **72** secured to the casing **70** by screw bolts **72*s***, all of like form and in a like manner to equivalent parts in the contactor itself. The carrier **76**, however, need only be one-third the length of carrier in the main contactor.

To enable the contact carrier **76** of the extra pole to be actuated by and simultaneously with the carrier **26** of the contactor itself, a pair of parallel spaced lugs **78** extend one above the other from the carrier **76** through a wide slot in the casing **70** toward the base **10** in position to overlie and underlie and to be in constant engagement with the extension **28** from the carrier of the contactor. The location of the extension **28** is shown in dotted lines in FIG. **5**. Hence, the bridging contact **74** of the added pole is actuated at the same time and partakes the same movement as the bridging contacts inside the contactor.

AUXILIARY SWITCH ADDITION

Referring to FIGS. **6–9**, and auxiliary switch has its switching parts housed within a molded insulation casing (designated generally by numeral **80**) having a hollow base part **81** covered over by a cover part **82** to hold the switching parts in properly assembled position therein. The casing may be of any desired shape, the shape shown in FIGS. **6** and **8** illustrating only one convenient form. The cover part **82** is flat, while the base part is recessed in various places to receive the several switch parts and wire connection terminals.

For mounting the auxiliary switch on the contactor, a wide, rectangular, flat, platelike rib **83** is molded integrally with the base part **81**. Its longer edges are undercut or dovetailed as at **83*e***, toward the surface of the base part, as may be seen in FIG. **9**. These dovetailed edges **83*e*** are adapted to fit in op-

posite parallel undercut dovetailed edges **82***e* of a recess **82R** in the side wall of the body **40**, as may be seen in FIG. **1**.

The recess **82R** is generally speaking of the same size and shape as the wide rib **83**, so that the rib **83** may be fitted in the top end of recess **82R** with its bevelled edges in dovetail engagement therewith. Thus the rib will slide into the recess as the auxiliary switch is pressed toward the base **10** of the contactor.

One or more auxiliary switches **80** may thus be attached or annexed to and flush against the side walls of the body **40** without the use of screws, rivets, or like fasteners. To make that annexation and attachment the cover **60** is removed, while the rib **83** is inserted in and slid along the recess **82R**. The cover **60** is then placed on the body **40** with the cover engaging the top edge of the rib **83**. When the cover is secured on the body **40** by bolts **61** the auxiliary switch will be firmly and permanently secured to the body **40** of the contactor.

The interior parts of the switch **80** may be varied to suit varying demands and requirements. One particularly useful form includes a bar **84** of insulation material extending lengthwise centrally of the casing in a channel **81***s* in the base part **81**.

Mounted slidably on the bar **84** within passages through it at opposite ends are spaced bridging contact bars **85**, **85'**, which extend through the passages and are adapted to bridge and to disengage pairs of fixed contacts **86** and **86'** as the bar is moved axially to and fro. The fixed contacts are mounted on the cover part **82** of the switch casing. A coiled compression spring **87**, **87'**, positioned within each passage presses against each bridging contact to resiliently mount it.

To bias the contact carrying bar **84**, a coiled compression spring **88** is mounted under it (as viewed in FIG. **9**) pressing at one end against the base part **81** of the casing and at its other end against a lateral projection from the bar **84**.

In order to actuate the auxiliary switch as the contactor operates, a stud **89** extends laterally from the bar through a longitudinally extending slot **81***s* in the end of the base part. The stud extends toward the contactor into the path of the lug **34** on the armature assembly.

Thus, as the electromagnet is energized and the armature assembly is actuated, the auxiliary switch will be operated when the lug **34** of the armature assembly engages the stud **89** on the movable contact-carrying bar **84**.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the specific embodiment illustrated and described.

What is claimed is:

1. A main switching device comprising, housing means made of molded insulation and having at least two parts, fixed and movable contact means mounted within said housing means, means moving said movable contacts, means mounted within said housing means operating said contact-moving means, a supplemental switching device including engageable and disengageable contact means and an insulating casing, means formed integrally with the housing means of the main device interlocking with means formed integrally with the casing of said supplementary device for mounting said supplementary device on the outside of said housing means, and means formed as an integral part of one of said parts of said main device to prevent detachment of the supplementary device from the main device while said housing parts of the main device remain assembled, regardless of the presence or absence of any back or mounting plate.

2. The combination as claimed in claim **1** wherein the interlocking means on the housing means is on one part thereof and another part of said housing means is in overhanging relation to said supplementary device preventing disconnection of the latter from the main device while the parts of the main device remain assembled.

3. The combination as claimed in claim **1** wherein the interlocking means comprise a rib and a channel receiving the rib, and wherein a second part of said housing means is in overhanging relation to said supplementary device preventing disconnection of the latter from the main device while the parts of the main device remain assembled.

4. The combination as claimed in claim **1** wherein the interlocking means comprise a depression in at least one of part of said housing means and a protrusion on the casing of the supplementary device, and means on said housing and on said casing preventing disconnection of the supplementary device from the main device while the latter remains assembled.

5. The combination claimed in claim **1** wherein said supplementary switching device also includes contacting means in said casing, interengaging means on said contacting means which is movable to cause engagement and disengagement of said contacting means, said interengaging means interconnecting with said contact-moving means of the main device to cause simultaneous movement of said movable contact means and said contacting means of said supplementary device.

6. The combination as claimed in claim **1** wherein the interlocking means comprises a depression and a protrusion fitting in said depression, the depression being formed in one device and the protrusion being formed integrally with the other, and means on said devices preventing their disconnection while the main device remains assembled; and wherein said supplementary switching device also includes interengaging means on said contacting means which is movable to cause engagement and disengagement of said contacting means; said interengaging means interconnecting with said contact moving means of the main device to cause simultaneous movement of said movable contact means and said contacting means of said supplementary device.