Dec. 6, 1966 R. L. McGARY 3,290,628

CONTACTOR WITH NOVEL CONTACT HOUSING

Filed March 23, 1965 4 Sheets-Sheet 1

Fig. 1.

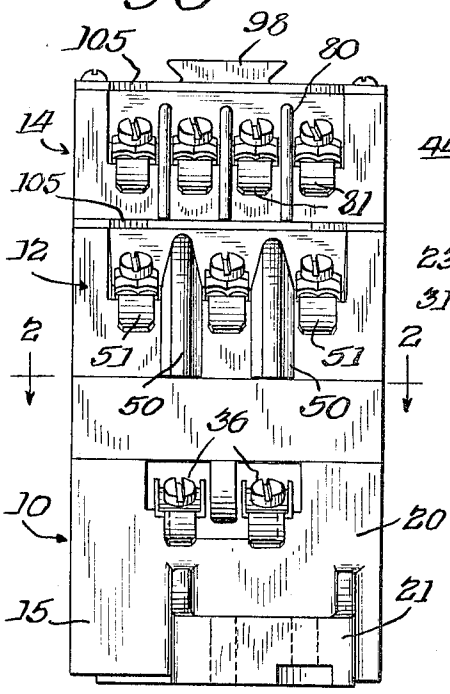


Fig. 3.

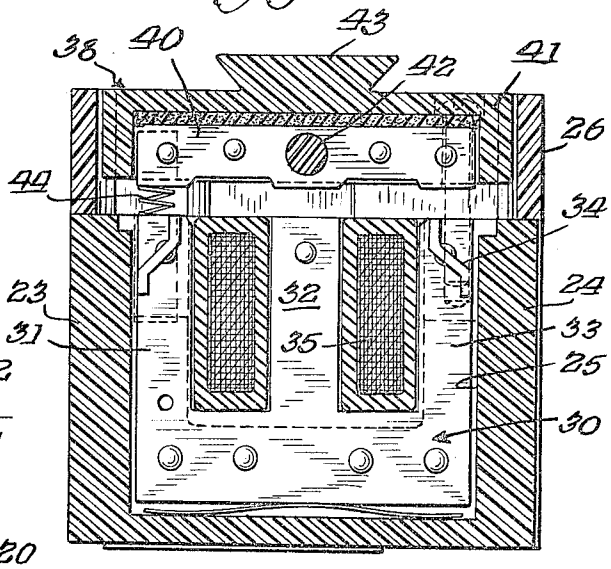


Fig. 2.

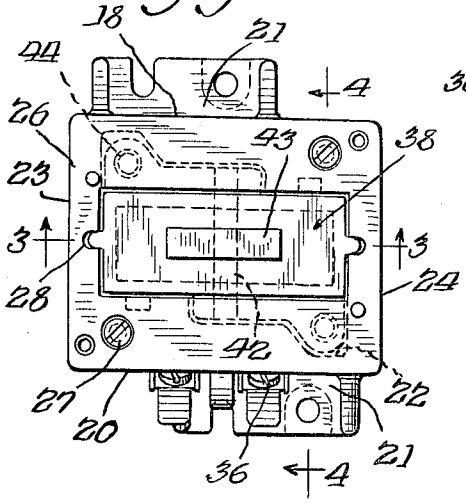
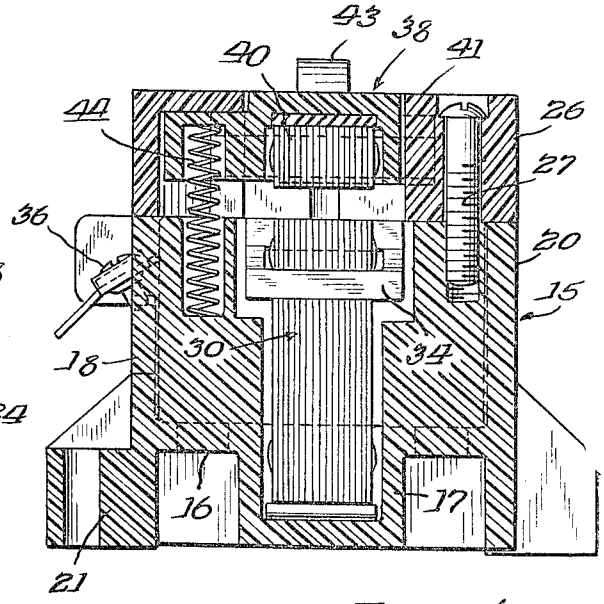


Fig. 4.



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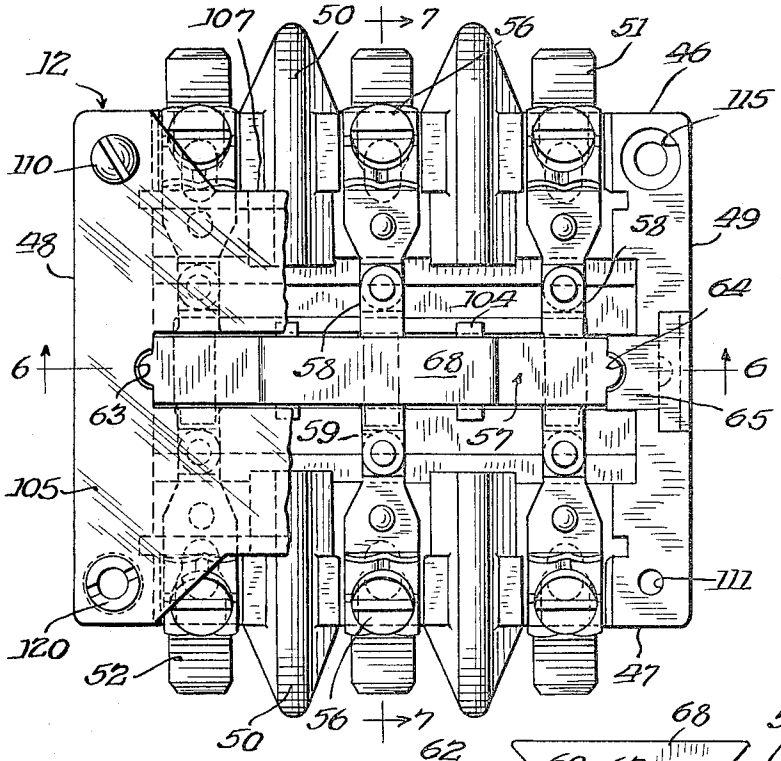


Fig. 5.

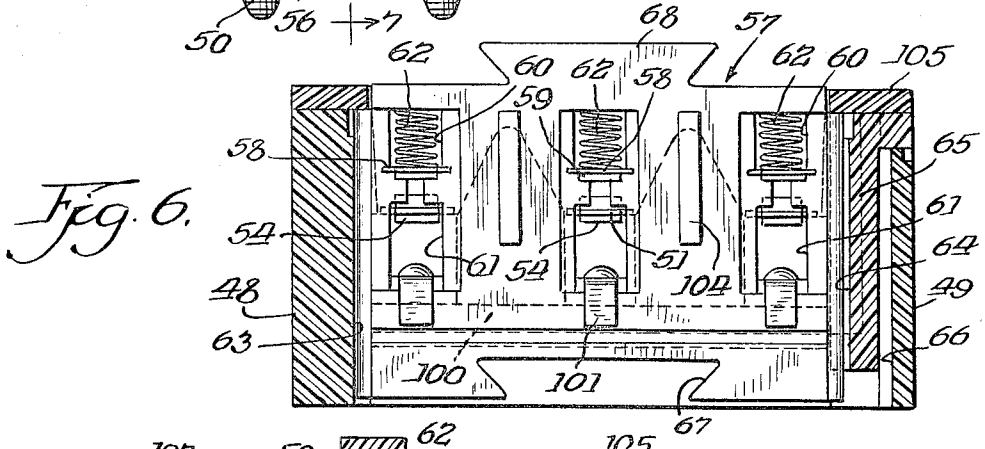


Fig. 6.

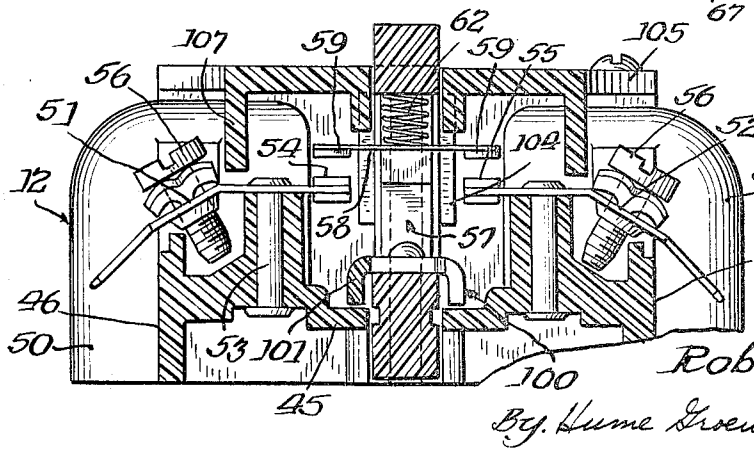


Fig. 7.

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CONTACTOR WITH NOVEL CONTACT HOUSING

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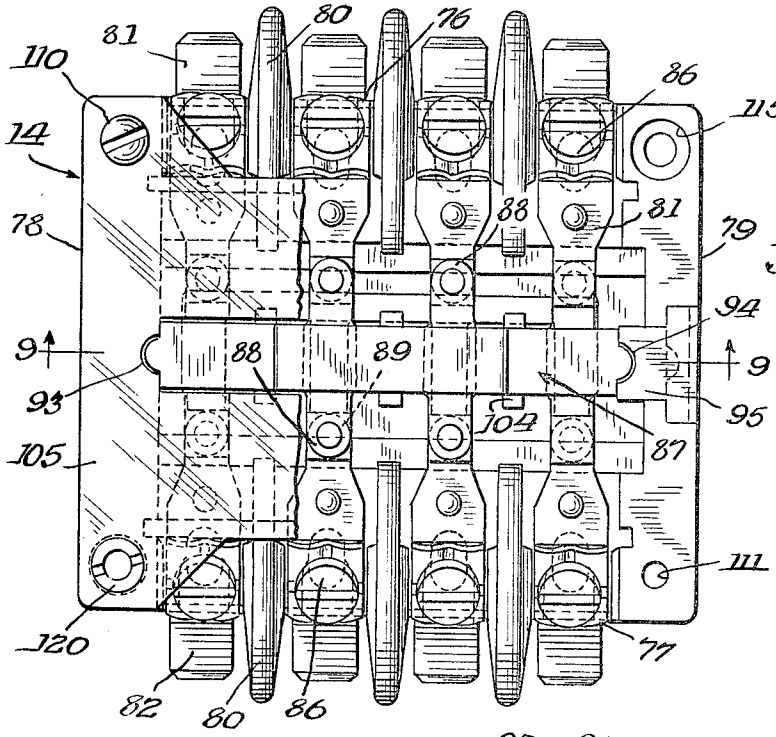


Fig. 8.

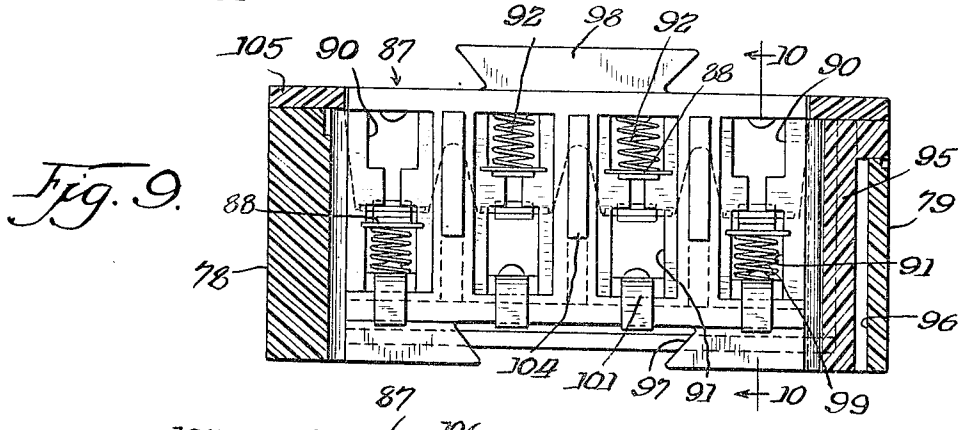


Fig. 9.

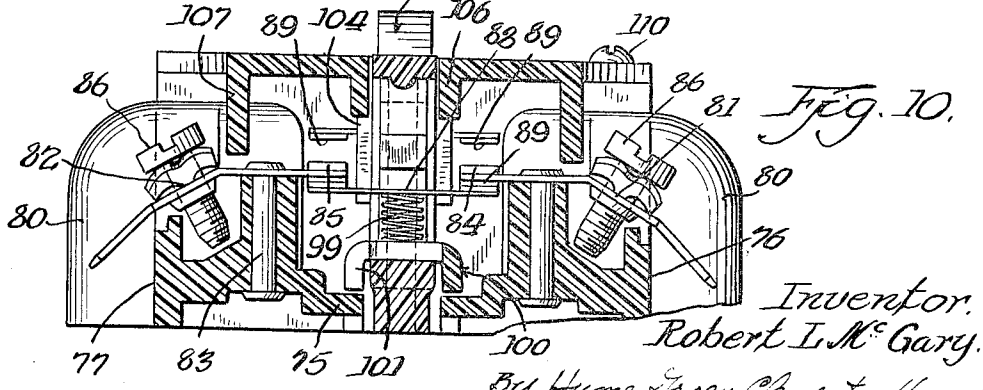


Fig. 10.

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CONTACTOR WITH NOVEL CONTACT HOUSING

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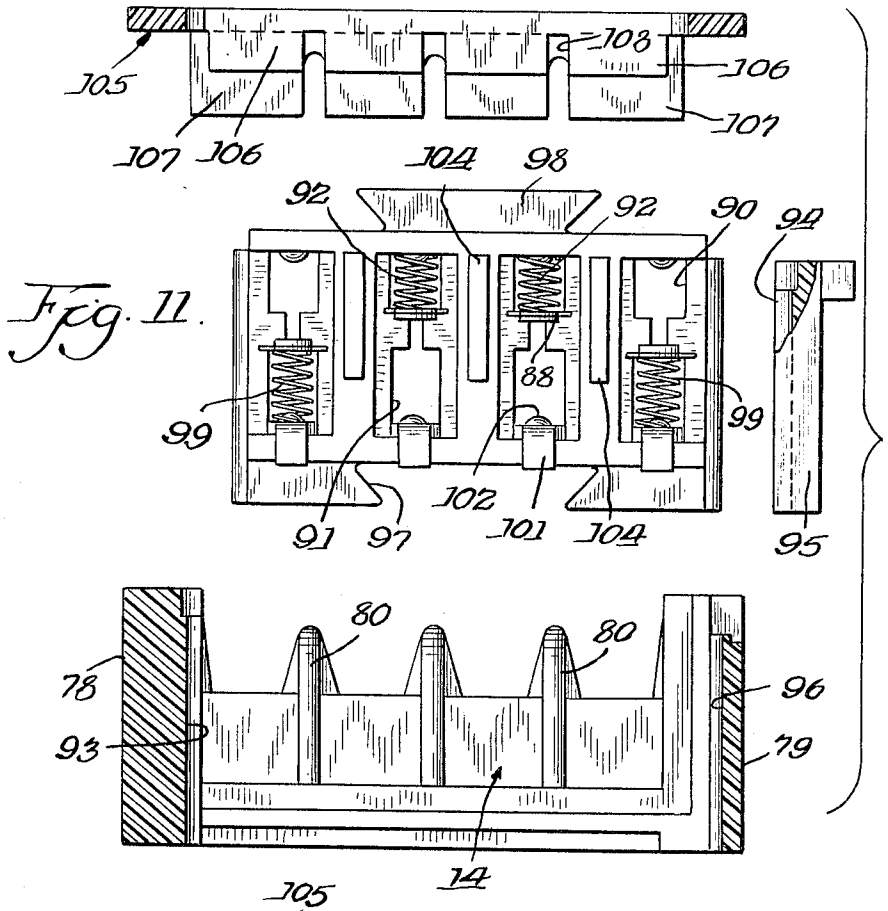


Fig. 11.

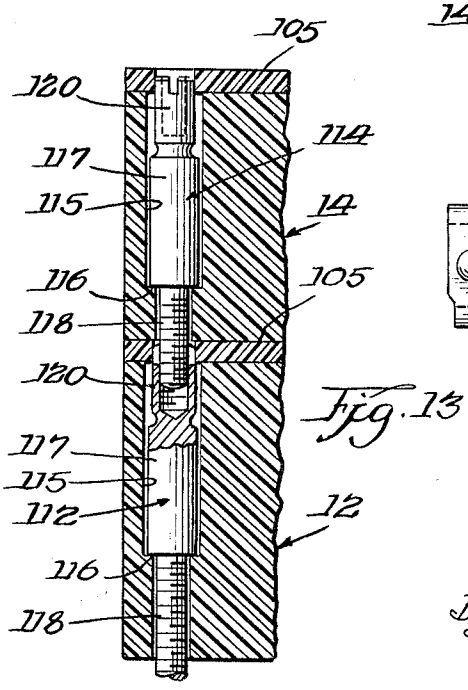


Fig. 13

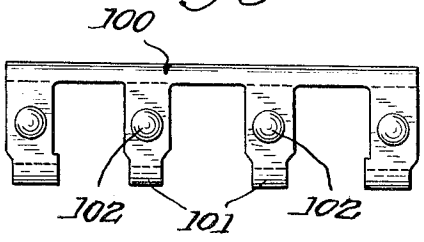


Fig. 12.

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United States Patent Office

3,290,628

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CONTACTOR WITH NOVEL CONTACT HOUSING

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Filed Mar. 23, 1965, Ser. No. 441,964
3 Claims. (Cl. 335—131)

The invention relates to electric switches having contacts which may be normally open or normally closed and has reference in particular to an industrial type relay consisting of a solenoid type actuator and one or more contact blocks operatively assembled on the solenoid actuator, the actuator thus providing the base for the combination.

The relay of the present invention has been especially designed for industrial use since it is possible to mount on a single actuator a plurality of contact blocks for various voltages such as a four pole three hundred volt block, or a three pole six hundred volt block. Since one or more contact blocks can be assembled on a single base the operator in the field can produce a relay for either a three hundred volt application or a six hundred volt application, or a combination of the two.

An additional object of the invention resides in the provision of a relay combination as described wherein the blocks can be easily assembled for various combinations of normally open or normally closed contacts and wherein the contacts of each block are visible by means of a clear plastic cover which also serves as a dust shield.

Another object of the present invention is to provide contact blocks which can be operatively connected to each other by means of a special dovetail formation on the moveable contact carrier of each block and wherein adjacent blocks can be fixedly secured together by means of special securing screws held captive in the contact blocks, respectively.

Another object is to provide contact blocks for the purposes described wherein the carrier for the moveable contacts is releasably retained in place within its contact block by a releasable slide, the slide, in turn, being retained in its passageway by the plastic cover for the block.

With these and various other objects in view the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts

FIGURE 1 is a front elevational view of an industrial type relay coming within the invention and which includes a three pole six hundred volt contact block and a four pole three hundred volt contact block;

FIGURE 2 is a view taken substantially on line 2—2 of FIGURE 1 and showing in top plan the solenoid type actuator which provides the base for the relay combination;

FIGURE 3 is a sectional view taken substantially along line 3—3 of FIGURE 2, the said view being on a somewhat larger scale than FIGURE 2;

FIGURE 4 is a sectional view taken substantially along line 4—4 of FIGURE 2, the scale being the same as FIGURE 3;

FIGURE 5 is a top plan view of the three pole six hundred volt contact block on a scale twice that as shown in FIGURE 1;

FIGURE 6 is a transverse sectional view taken substantially along line 6—6 of FIGURE 5;

FIGURE 7 is a transverse sectional view taken substantially along line 7—7 of FIGURE 5;

FIGURE 8 is a top plan view of the four pole three hundred volt contact block on a scale twice that as shown in FIGURE 1;

FIGURE 9 is a transverse sectional view taken substantially along line 9—9 of FIGURE 8;

FIGURE 10 is a transverse sectional view taken substantially along line 10—10 of FIGURE 8;

FIGURE 11 is an exploded view showing the various parts, which when operatively assembled, comprise a contact block;

FIGURE 12 is a view in plan of a releasable base element which is retained by each of the contact blocks; and

FIGURE 13 is a fragmentary sectional view showing the manner of fixedly securing adjacent contact blocks by means of captive screws retained by the blocks, respectively.

The relay selected for illustrating the invention includes a solenoid actuator designated in its entirety by numeral 10, FIGURE 1, and which provides a base member for the industrial type relay. A first contact block 12 having three poles for a three-phase circuit is shown as mounted on the base member. A second contact block 14 having four poles for two single phase circuits is shown as mounted on these contact block 12. Referring again to the solenoid-type base actuator it will be observed from FIGURES 2, 3 and 4 that the housing 15 for the same is substantially rectangular in both top plan and side elevation. The housing 15 is formed of plastic, hard rubber and other suitable material having insulating qualities. The bottom wall 16 is recessed at 17 longitudinally of the member and both side walls 18 and 20 have integral therewith an exterior flange 21 which is employed for securing and anchoring the base member to a support. The walls 18 and 20 have varying thickness as best shown in FIGURE 2, the area of minimum thickness forming an inside cavity 22 for each wall. The end walls 23 and 24 are integral with the side walls and each end wall on its inside surface is grooved vertically at 25. The housing 15 is closed on its top side by a cover 26, also of plastic, hard rubber or the like, and which is secured to the housing by the screws 27, FIGURES 1 and 4. The cover is apertured centrally for receiving the armature to be presently described and the end walls of the cover are grooved vertically at 28 with the grooves communicating with the central aperture.

FIGURE 4 shows the housing 15 as retaining a field magnet 30 consisting of soft iron laminations and having three upstanding leg portions identified by numerals 31, 32 and 33. The outer leg portions 31 and 33 are each provided with a shading coil 34 of copper and an energizing coil 35 is disposed in surrounding relation with the center leg 32. The coil is encased in a plastic shell and the solenoid thus formed is surrounded on all sides by the iron of the field magnet. The terminals 36 for the energizing coil 35 are located exteriorly of the housing for convenient access by the operator.

The armature 38 for the base actuator 15 is located within the central aperture of the cover as shown in FIGURE 2, and said armature includes a metal part 40 consisting of metal laminations similar to the field magnet and a plastic cover part 41 which retains the metal part, since the latter is pivoted to the plastic cover by the pin 42. The top exposed surface of the plastic cover part 41 is formed into a projection of dovetail shape 43 as shown in FIGURE 3, and which makes it possible for a contact block to be operatively connected to the armature of the base actuator all in a manner to be presently described. The armature 38 is guided in its reciprocating movements by vertical projections which ride in the grooves 28. At least two coil springs 44 are provided for yieldingly biasing the armature 38 in an upward direction

so that upon energization of the coil **35** the metal part **40** and thus the armature **38** is pulled down against the coil springs to compress them.

The details of the contact block **12** are shown in FIGURES 5, 6 and 7. The plastic housing for the block **12** is substantially rectangular in top plan, including a bottom wall **45**, side walls **46** and **47**, and end walls **48** and **49**. The side walls **46** and **47** are formed with outwardly extending ribs **50** which provide compartments for the stationary contacts **51** associated with wall **46** and for the stationary contacts **52** associated with wall **47**. Each contact is fixedly secured to the block by a rivet **53** and the inwardly extending ends of the contacts **51** and **52**, respectively, are provided with silver contacts **54** and **55** on both top and bottom surfaces. Each of the stationary contacts is also provided with a terminal screw such as **56** for fastening a conductor or a wire to the said stationary terminals.

The contact block **12** retains a carrier **57** for the movable bridging contacts **58**, the said contacts **58** carrying at their respective ends the silver contacts **59**. The contacts **59** on the left, FIGURE 7, are adapted to coact with the contacts **54** of the stationary terminal **51** and the silver contacts **59** on the right are adapted to coact with the contacts **55** of the stationary terminal **52**. The carrier **57** is similar in most respects to the carrier shown in FIGURE 11. Three movable bridging contacts **58** are carried by the carrier **57** and for this purpose three openings are formed in the carrier, each opening having an upper half **60** and a lower half **61**. When the contacts are normally open the movable contacts **58** are located against the bottom ledge of the upper opening **60** as best shown in FIGURE 6. However, when the contacts are normally closed, the movable contacts **58** are located against the top edge of the lower opening **61**. However, with respect to carrier **57** all of the movable contacts are shown in a position for normally open operation. Coil springs are associated with the movable contacts for maintaining the said contacts in either their normally open or normally closed positions. For FIGURES 5, 6 and 7 the coil springs **62** are located above the movable contacts **58** and the said springs thus yieldingly bias the movable contacts in a downward direction to hold them against the bottom ledge, respectively, of the upper openings **60**.

The carrier **57** is retained by the contact block in a manner permitting reciprocating movements and it will be observed that the carrier is guided by end projections which ride in the grooves **63** and **64**. The groove **63** is formed in end wall **48**, and groove **64** is formed in the releasable slide **65**. The slide is in turn provided with a vertical end projection which rides in a groove **66** in side wall **49**. By means of a top ledge portion integral with the slide, the same can be lifted from or inserted in the side wall **49**. When the slide **65** is lifted and removed, then the carrier **57** can be moved laterally in a direction to the right and with the carrier thus released it can be lifted from the contact block. It is necessary for the carrier **57** to be first moved laterally to the right in order to locate the movable contacts **58** out of alignment with the stationary contacts. This is particularly the case when one or more of the movable contacts are located for normally closed operation. When re-inserting the movable carrier a reverse of the above operations is followed.

It will be understood that the carrier **57** is held in its elevated position, in which position the movable contacts are normally open. This holding of the carrier in its elevated position is effected by the armature **38** of the base actuator **10**. Thus when the field magnet **30** is magnetized to pull down the armature the carrier **57** is reciprocated downwardly and the normally open contacts **54**, **59** and **55**, **59** are closed to close the electrical circuits controlled by this particular contact block. For operatively connecting the armature with the carrier the said carrier is provided with a recess **67** in its bottom surface and which

is of dovetail shape for receiving the projection **43** of the armature. A projection **68** also of dovetail shape is formed on the top surface of the carrier for operatively connecting the same to the carrier of the contact block **14** or to the carrier of another contact block similar to **12**. As previously explained the contact block **12** has three poles and is designed for three-phase circuits of approximately six hundred volts, whereas the contact block **14** has four poles and is designed for handling two single phase circuits of approximately three hundred volts each.

Referring to FIGURES 8, 9 and 10, the contact block **14** essentially consists of a housing substantially rectangular in top plan and which includes a bottom wall **75**, side walls **76** and **77**, and end walls **78** and **79**. The side walls **76** and **77** are formed with three outwardly extending ribs **80** which provide compartments for the stationary contacts or terminals **81** for wall **76** and the stationary contacts or terminals **82** for wall **77**. Each stationary contact is fixedly secured to the block by a rivet **83** and the inwardly extending end of each stationary contact is provided with silver contacts on both top and bottom surfaces. The silver contacts **84** are located on the end of the stationary terminals **81** and the silver contacts **85** are located on the end of stationary terminals **82**. Also, each stationary terminal is provided with a screw such as **86** for fastening a conductor or wire to the said stationary terminal.

The contact block **14** retains a carrier **87** for the movable bridging contacts **88** and which at their terminal ends carry the silver contacts **89**. The contacts **89** on the left, FIGURE 10, are adapted to coact with contacts **84** of the stationary terminals **81** and the silver contacts **89** on the right are adapted to coact with the contacts **85** on the stationary terminals **82**. Four movable bridging contacts **88** are carried by the carrier **87** and for the purpose four openings are formed in the carrier, each opening having an upper half **90** and a lower half **91**. When the contacts are normally open the movable contacts **88** are located against the bottom ledge of the upper openings **90** as shown in FIGURES 9 and 11. However, when the contacts are normally closed, the movable contacts **88** are located against the top ledge of the lower openings **91**. FIGURES 9 and 11 show the two inner bridging contacts as located for normally open operation whereas the two end bridging contacts are located for normally closed operation. Coil springs are associated with the movable contacts in both their normally open and normally closed positions. In FIGURES 8 to 11, inclusive, the coil springs **92** are located above the two centrally located movable contacts and thus said springs yieldingly bias the contacts in a downward direction to hold them against the bottom ledge of the upper openings **90**. For the two end movable contacts the coil springs **99** are located below the said contacts within the lower openings **91** and these springs yieldingly bias the contacts in an upward direction to hold them against the top ledge of the bottom openings **91**.

The carrier **87** is retained by the contact block **14** in a manner permitting reciprocating movement, for which purpose the carrier is guided by end projections which ride in grooves **93** and **94**. The groove **93** is formed in end wall **78** and the groove **94** is formed in the releasable slide **95** as clearly shown in FIGURES 8 and 9. The slide in turn is provided with a vertical end projection which rides in a groove **96** in side wall **79** and by means of a top ledge portion integral with the slide the same can be lifted from or inserted in the side wall **79** all in a manner identical to that as described in connection with the slide **57** for contact block **12**.

The carrier **87** is provided with a recess **97** of dovetail shape for receiving a projection of similar shape so as to operatively connect the carrier with the armature of a base actuator or with the carrier of another contact block. Also, for this purpose, the top surface of the carrier is provided with a dovetail projection **98**.

For normally open operation the downward movement of the carrier is limited by the movable contacts which engage the stationary contacts followed by limited compression of the coil springs such as **62** and **92**. For normally closed operation the up movement of the carrier is also limited by the engagement of the movable contacts with the stationary contacts and which is followed by compression of the coil springs **99**, to a limited extent. However, downward movement of the carrier is additionally limited by a releasable base member **100** shown in top plan in FIGURE 12. The base element is carried by each carrier with the fingers **101** of the element extending through the lower openings **61** or **91**, the fingers having supporting contact on the bottom ledge of these openings. The body portion of the base element will thus extend along one side of the carrier and the fingers will be disposed on the opposite side, such structure being clearly apparent from FIGURES 7 and 10. Since the base element is supported on its carrier, the element in turn provides a support for the coil springs **99** which are positioned by the base element within the lower openings **61** and **91**. For this positioning purpose the base element has upward extending projections **102**. From FIGURES 7 and 10 it will be observed that the body portion of the base element **100** and the fingers **101** thereof overlie the bottom wall **45** for the contact block **12**, and the bottom wall **75** for the contact block **14**. Thus when the carrier is actuated in a down direction the base element will engage the bottom wall on respective sides of the carrier and the coil springs **99** will thus be compressed, and the normally closed movable contacts will be withdrawn from their respective stationary contacts to open the electrical circuit controlled thereby. It will be understood, of course, that this down movement of the carrier is sufficient to move the normally open movable contacts into a closed position with their respective stationary contacts.

An additional limiting stop is provided for the carriers to limit their movement in an upward direction. The structure is the same for both carriers and consists of stop projections **104** which extend vertically and outwardly on both sides of the carrier. Each contact block includes a cover of clear plastic which provides a window in addition to forming a dust cover. The cover is substantially the same for both contact blocks and is identified by numeral **105**. Inside partition walls **106** and outside partition walls **107** depend from the undersurface of the cover and each group of partition walls includes a number corresponding to the compartments of the contact block. Thus the cover for the contact block **12** has three partition walls **106** on both sides of the carrier and three partition walls **107** which are located inwardly from each edge of the cover. The cover for the contact block **14** has four of both groups of partition walls as clearly shown in FIGURE 11. The spaces between the partition walls **106** form slots **108** which are wide enough to receive the stop projections **104**. Since the slots extend to the top wall of the cover, this structure forms a stop limiting upward movement of the carriers.

Each cover **105** is releasably secured to its contact block by two corner screws **110** and which are received in the threaded recesses **111**, FIGURES 5 and 8. Each contact block also carries a captive screw, FIGURE 13, identified by numeral **112** for the contact block **12** and **114** for the contact block **14**. Each screw is located in a vertical bore **115** extending completely through its block, the bore providing a shoulder **116**. Each screw includes a body portion **117**, a lower threaded extension **118** and an internally threaded head **120**. The body portion **117** of the screw is held captive within its block by the shoulder **116** and by the cover **105**. As shown in FIGURE 13 the lower exteriorly threaded extension **118** of screw **114** is threaded in the head **120** of the screw **112**. Captive screws such as shown in FIGURE 13 are located in each block at diagonal corners opposite the securing screws **110**, and the structure makes possible the securing or fixing of the base actuator and the contact blocks in a stacked relation.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will, of course, be apparent to those skilled in the are without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In an industrial type relay, in combination, a base actuator including a housing containing a field magnet, a solenoid in close surrounding relation with the field magnet for magnetizing the same when the solenoid is energized, an armature retained by the housing and which is reciprocated in one direction when the field magnet is magnetized, a contact block in stacked relation on the base actuator and removable as a unit from the base actuator, a plurality of stationary contacts retained by the block and which are disposed in pairs of spaced but aligned relation as regards each pair, a plurality of bridging contacts for engaging the pairs of stationary contacts, respectively, to electrically close the circuits controlled thereby, a carrier for the bridging contacts mounted in the contact block for limited reciprocating movement to thus effect similar movement of the bridging contacts, and said armature and movable carrier being releasably interconnected by releasable interconnecting means, said carrier and said contact block removable as a unit from said armature and base actuator.

2. An industrial type relay as defined by claim **1**, wherein the movable carrier has releasable interconnecting relation with the armature by means of a dovetail shaped projection and a dovetail shaped recess provided by the parts respectively.

3. An industrial type relay as defined by claim **1**, additionally including a cover of clear plastic for the contact block and which provides a dust shield for the stationary and also the bridging contacts, and means for releasably securing the contact block in stacked relation on the base actuator with the armature and movable carrier in connected relation, said means including a securing screw located within a bore extending from the top to the bottom surface of the block, said screw being held captive within the bore by a shoulder provided by the bore and by said cover, said captive screw having an exteriorly threaded extension projecting below the bottom surface, and said captive screw having an interiorly threaded head and which is accessible from the top surface of the block.

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