

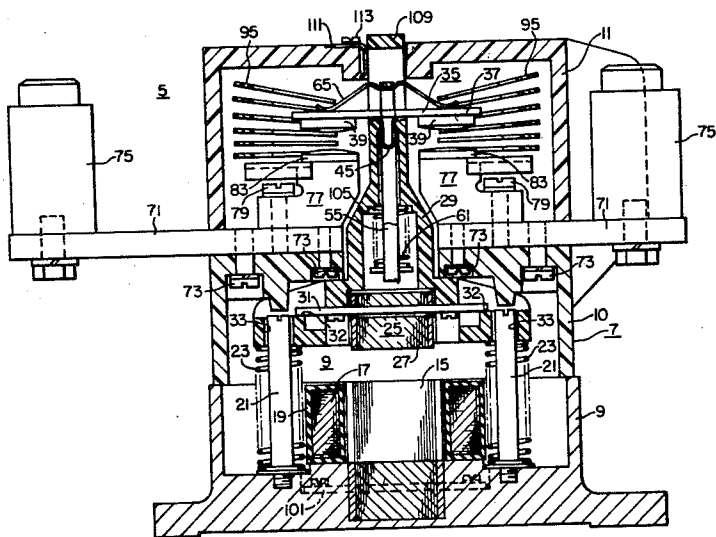
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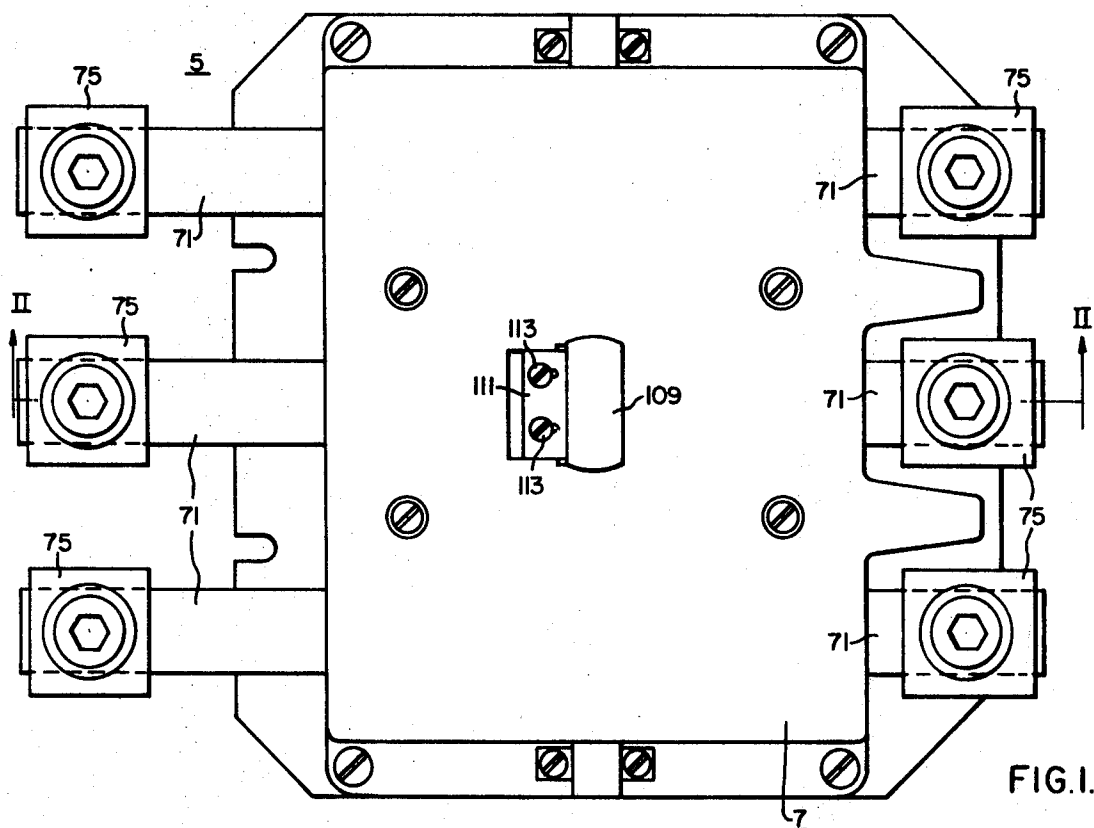
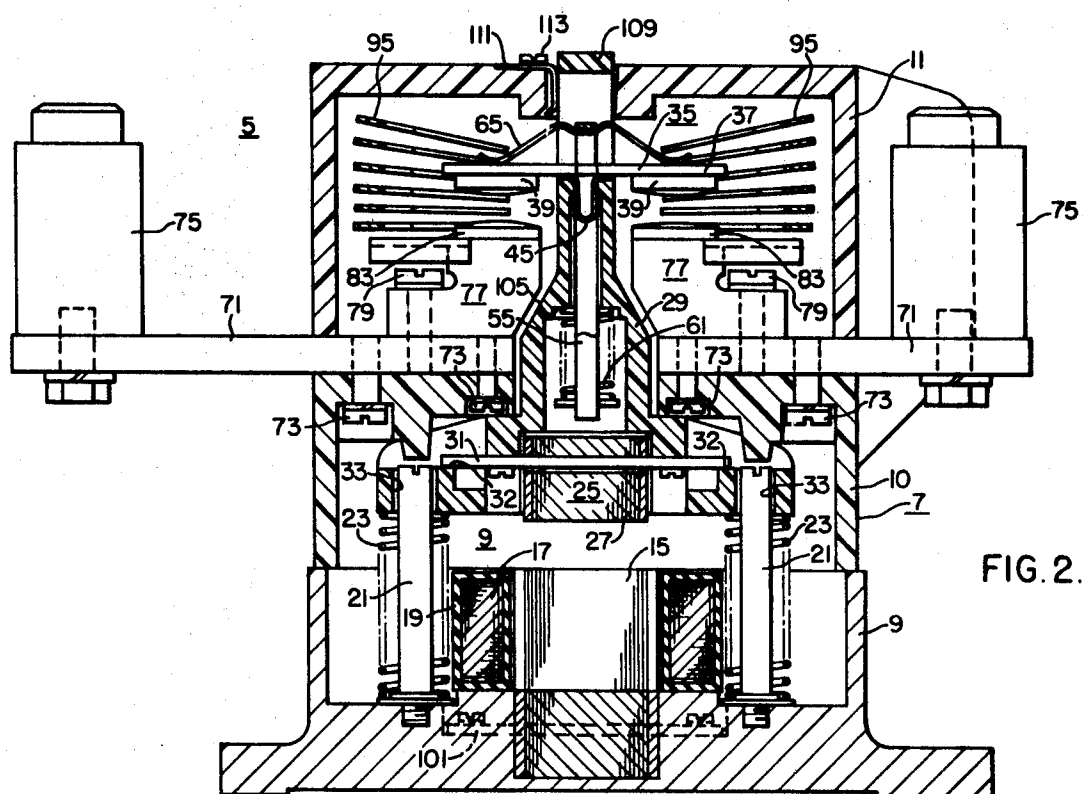
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[54] CONTACTOR WITH IMPROVED CONTACT
SUPPORT MEANS AND GUIDE MEANS
8 Claims, 6 Drawing Figs.
[52] U.S. Cl. 335/133
[51] Int. Cl. H01h 63/00
[50] Field of Search 335/133,
132, 193, 262; 200/166 H, 166 B, 16.1; 308/3

ABSTRACT: A contactor comprises improved contact means. Spring support means, comprising a contact-pressure spring and a damping spring, supports a bridging contact structure on an insulating contact carrier. Externally adjustable guide means is provided to enable external adjustment of the alignment between the armature and stationary magnetic member.





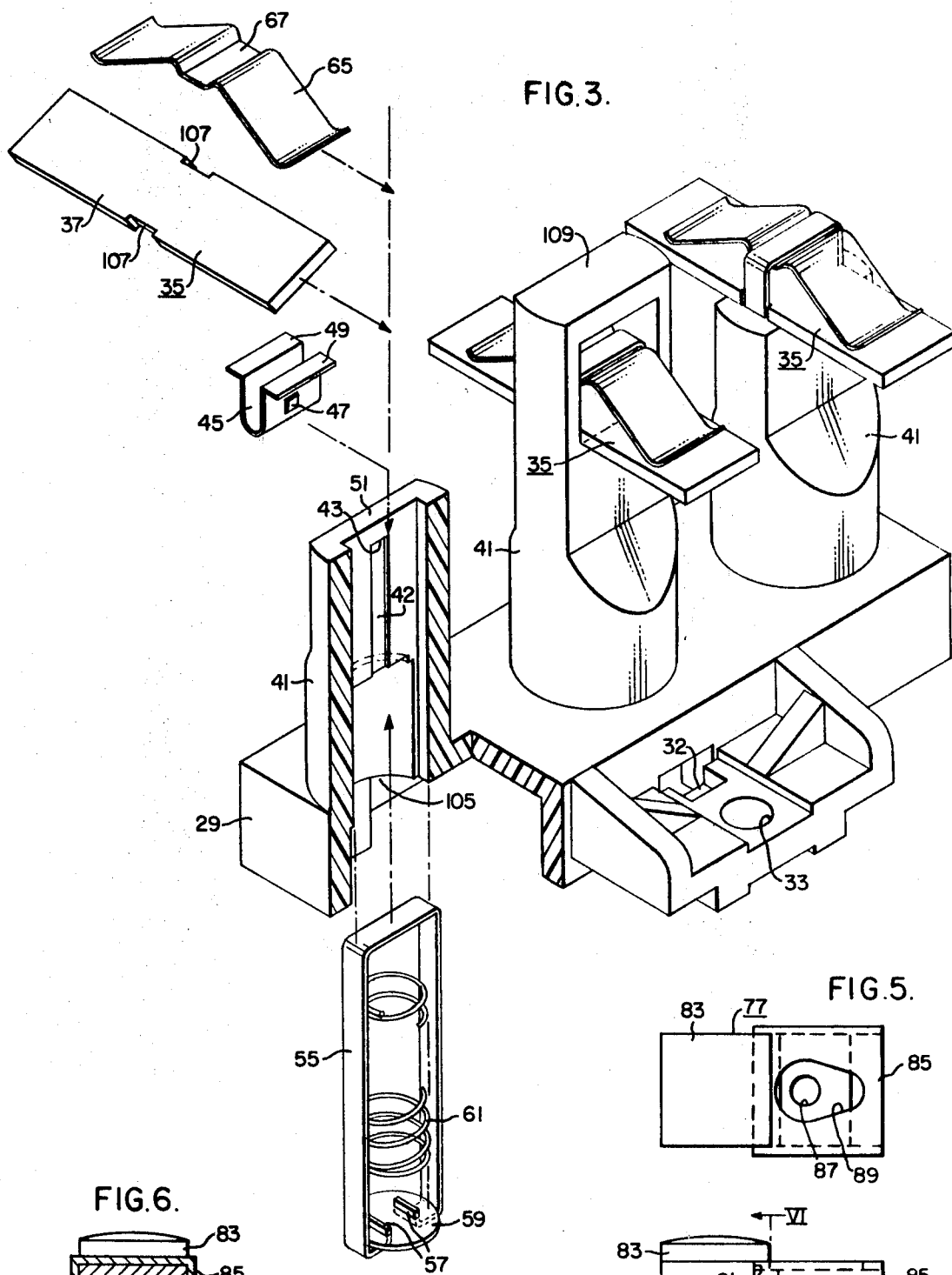


FIG. 3.

FIG. 5.

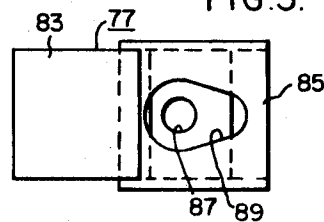


FIG. 6.

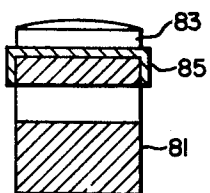
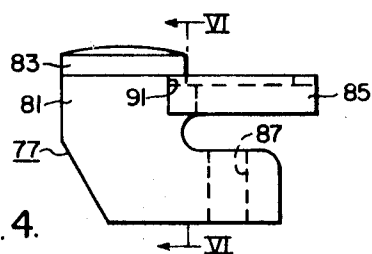


FIG. 4.



CONTACTOR WITH IMPROVED CONTACT SUPPORT MEANS AND GUIDE MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

Electric contactors of the type comprising an insulating support and a bridging contact structure resiliently supported on the insulating support.

2. Description of the Prior Art

It is old in the art to provide contactors of the type comprising an insulating support and a bridging contact structure supported on the insulating support by resilient means that provides contact pressure in the closed position of the contacts. This invention provides an improved combination contact-pressure spring means and damping spring means for supporting the bridging contact structure on the insulating support. It is also old in the art to mount an arc-runner on a conductor adjacent a stationary contact that is supported on the conductor. This invention provides an improved means for supporting a contact and arc-runner on a conductor such that the arcs leaving the stationary contact more directly onto the arc-runner with the unitary contact structure being constructed to facilitate removable mounting thereof on a conductor.

SUMMARY OF THE INVENTION

An improved contactor comprises an insulating contact carrier comprising a tubular part. An elongated bridging contact structure is supported at one end of the tubular part by spring support means which comprises a saddle member that extends into the tubular part with the bridging contact structure being positioned within the saddle member. A coil spring, contained within the tubular part for protection from the arcs, engages a ledge portion of the contact carrier and one end of the saddle member to bias the saddle member into the tubular part. A damping spring is supported at the outer end of the saddle member between the saddle member and the bridging contact structure whereby the contact-pressure spring operates against the saddle member which operates against the damping spring to bias the bridging contact structure toward the opening of the tubular part into engagement with ledge means of the insulating contact carrier. An externally adjustable guide means is provided to enable external adjustment of the alignment between the armature and the stationary magnetic member seating the pole faces for noise (audible) reduction and input power reduction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a three-pole contactor constructed in accordance with principles of this invention;

FIG. 2 is a side sectional view taken generally along the line II—II of FIG. 1;

FIG. 3 is a perspective view, partly exploded, and with parts broken away, of the contact carrier and movable contact structures of the contactor of FIGS. 1 and 2;

FIG. 4 is a side view of one of the stationary contact structures seen in FIG. 2;

FIG. 5 is a top plan view of the contact structure seen in FIG. 4; and

FIG. 6 is a sectional view taken generally along the line VI—VI of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, there is shown, in FIGS. 1 and 2, a three-pole contactor 5 comprising a housing structure 7 and a contactor-structure 9 supported on the housing structure 7. The housing structure 7 comprises a die cast aluminum base 9, a molded insulating intermediate housing part 10 suitably secured to the base 9, and a molded insulating cover 11 suitably secured to the intermediate housing part 10.

The contactor-structure 9 comprises a generally U-shaped stationary magnetic member 15 supported on the base 9 and a

conducting coil 17, encapsulated in an insulating shell 19, supported on the base to energize the contactor. A pair of guide pins 21 are secured to the base 9, and a separate coil kickout spring 23 is supported on each of the guide pins 21. A movable structure 25 is provided to cooperate with the stationary magnetic member 15 in a manner to be hereinafter described. The movable structure 25 comprises an inverted generally U-shaped magnetic armature 27 and an insulating contact carrier 29 connected to the armature 27 by means of a connecting rod 31 that rests on ledges 32 of the insulating carrier 29 and passes through an opening in the armature 27. The insulating contact carrier 29 is provided with a pair of openings 33 that receive the guide pins 21. The guide means 21, 33 guide the movable structure 25 for rectilinear reciprocal movement. As can be seen in FIG. 2, the springs 23 bias the movable contact carrier 29 to thereby bias the movable structure 25 outward to the unactuated or deenergized position.

The contactor 5 is a three-pole contactor with three bridging contact structures 35 supported on the insulating contact carrier 29 for simultaneous movement. Each of the bridging contact structures 35 comprises an elongated flat conductor 37 having a pair of contacts 39 fixedly secured thereto in a spaced relationship. As will be best understood with reference to FIG. 3, the insulating contact carrier 29 is formed with three tubular projections 41 for carrying the three bridging contact structures 35. A pair of slots 42 (only one slot being shown in FIG. 3) is provided in each of the openings of each tubular projection 41 to provide a pair of ledges 43. A separate spring generally U-shaped steel heat sink or shield member 45 (FIGS. 2 and 3), having a pair of tangs 47 and a pair of flange portions 49 formed thereon, is snapped down into each of the openings with the tangs 47 engaging the ledges 43 to secure the shield in place. The flange portions 49 rest on opposite front surfaces 51 of the associated projection 41 to receive the impacts of the associated bridging contact structure 35 during operation and to serve as a heat sink protecting the molded material of the insulating contact carrier 29 from the heat of the bridging contact structure 25. In each pole unit, a stainless steel saddle member 55 is provided for carrying the associated bridging contact structure 35. Each of the saddle members 55 is provided with a pair of bent over end portions 57 that protrude through suitable openings in a fiber disk 59 that supports one end of a coil contact-pressure spring 61. A sheet-metal damping spring 65, formed with a depression 67 at the center thereof for receiving the front end of the associated saddle 55, is provided in each pole unit. The construction of the movable contact structure 25 will be best understood with reference to the assembly and operation of the contactor as will be hereinafter described.

As can be understood with reference to FIG. 2, in each pole unit two rigid flat conductors 71 are supported on the intermediate housing member 10 by bolts 73. Solderless terminal connectors 75 are secured to the outer ends of the conductors 71 to enable connection of each pole unit in an electric circuit. A separate stationary contact structure 77 is secured to the inner end of each of the conductors 71 by means of a separate bolt 79. As can be understood with reference to FIGS. 4, 5 and 6, each of the stationary contact structures 77 is a three-piece unitary structure comprising a conducting support 81, a contact member 83 and an arc-runner 85. The conducting support 81 is a copper member comprising an extension or mounting part having an opening 87 therein for receiving the associated mounting bolt 79 (FIG. 2). The contact member 83 is a silver cadmium oxide alloy of silver tungsten alloy member that is brazed to the front of the contact support 81. The arc-runner 85 is an inverted generally U-shaped sheet-metal magnetic steel member having an opening 89 thereon. The conducting support 81 is formed with a notch 91 (FIG. 4) therein. As can be seen in FIG. 4, the contact 83 comprises an overhanging part that overhangs the notch 91. The arc-runner 85 extends into the notch 91 where it is fixedly brazed to the support. The part of the arc-runner 85 that extends into the notch 91 is a support part and the part that extends away from

the contact is an arc-runner part. As can be seen in FIG. 6, parts of the downwardly extending legs of the arc-runner 85 engage side surfaces of the support 81 to provide additional support of the arc-runner 85 on the support 81. As the arcs leave the contact member 83 they travel directly onto the arc-runner 85. The opening 89 permits an operator to insert a screwdriver therethrough in order to removably mount the stationary contact structure 77 (FIG. 2) on the associated conductor 71 by means of the bolt 79. During circuit interruption the arc travels over the arc-runner along the edge provided at the periphery of the opening 89. As can be understood with reference to FIG. 2, a plurality of slotted magnetic steel plate members 95 are supported on the insulating cover 11 in a stacked spaced relationship in proximity to each of the stationary contact structures 77 with each of the stacks 95 being supported with the slots thereof in vertical (FIG. 2) alignment and with the associated contact 39 moving within the outer ends of the aligned slots.

The assembly of the contactor 5 will be best understood with reference to FIGS. 2 and 3. As can be seen in FIG. 2, the stationary magnetic member 15 is mounted on the aluminum base 9 by means of a rod 101 that extends through an opening in the member 15 and is secured to the base 9. The coil 19 is supported on the base 9, and the guide pins 21 are screwed into tapped openings in the base 9. The springs 23 are placed over the guide pins 21. The stationary contact structures 77 are secured to the associated terminal conductors 71 by means of the bolts 79 and each conductor 71, with the terminal 75 secured thereto, is secured to the intermediate housing member 10 by means of the associated bolt 73. Each saddle member 55 of each movable contact structure, with the spring 61 and spring support 59 mounted thereon, is moved up through the associated opening in the insulating contact carrier 29 with each of the springs 61 engaging a ledge 105 of the contact carrier 29. After the saddles 59 are in position protruding out past the surfaces 51 (FIG. 3), the shield members 45 are moved into position in the associated openings. Each of the shield members 45 is moved down into position with the associated tangs 47 engaging the associated ledges 43 to retain each shield 45 in place. With the saddles 55 and shields 45 in position, the armature 27 is secured to the contact carrier 29 by means of the bar 31 that it passes through the opening in the armature 25 and engages the ledges 32 on the contact carrier 29 at the opposite ends thereof. The contact carrier 29, with the armature 25 secured thereto, is then moved up through an opening in the intermediate housing member 10 and thereafter the bridging contact structures 35 are mounted in position. As can be seen in FIG. 3, each of the bridging conductors 37 is formed with a pair of notches 107 at the opposite sides thereof. Each saddle member 55 is forced upward against the bias of the associated spring 61 and each of the conductors 37 is then tilted at an angle and moved into position through the opening in the associated saddle 55 and then moved so that the notches 107 receive the side legs of the associated saddle 55. Each saddle 55 is forced upwardly to provide sufficient clearance or the damping spring steel member 65 to be moved into the position seen in FIG. 2 with the depressed portion 67 mating with the top portion of the associated saddle 55. Thereafter, upon release of the saddle 55, the associated contact pressure spring 61 will operate against the associated saddle 55 and damping spring 65 to bias the associated bridging conductor 37 downward until the bridging conductor 37 engages the associated flange portions 49 of the associated shield 45. With the movable structure 25 and stationary conductors 71 and stationary contact structures 77 secured to the intermediate housing member 10, the intermediate housing member 10 is moved into the position seen in FIG. 2 and secured to the housing base 9. As can be seen in FIG. 2, the openings 33 in the movable contact carrier 29 are positioned over the guide pins 21 and over the knockout coil springs 23. Thereafter, the housing cover 11, with the arc plates 95 secured thereto, is then moved into position and suitably secured to the intermediate housing member 10. The

center pole projection 41 of the insulating contact carrier 29 comprises a front protruding part 109 that protrudes through a suitable opening in the cover 11 to permit manual operation of the contactor and to serve as a guide for the movable structure. A metallic adjustable guide member 111 having a pair of slots therein is secured to the cover 11 by means of a pair of bolts 113 which pass through the slots and are screwed into the cover member 11. The slots in the adjustable guide member 111 permit adjusting movement (left-to-right and right-to-left FIG. 2) of the member 111 when the screws 113 are loosened. The adjustable guide member 111 comprises a planar surface that engages the side of the part 109 of the contact carrier 29 to provide a front bearing surface, and by adjusting the position of the member 111 the front bearing surface engagement between the part 109 and the member 111 is adjusted to adjust the alignment between the armature 27 and the stationary magnetic member 15. As was hereinbefore set forth, the internal guide means 21, 33 guides the movable structure 25 for rectilinear reciprocal movement between the unactuated and actuated positions. At the large majority of installations the contactor is mounted with the left-hand (FIG. 2) side thereof facing downward so that the part 109 of the contact carrier rests against the member 111 with the engagement between the member 111 and part 109 serving as an externally adjustable guide means enabling a worker to externally adjust the member 111 to thereby adjust the alignment between the armature 27, of the movable structure 25, and the stationary magnetic member 15.

The operation of the contactor 5 will be best understood with reference to FIG. 2. The contactor is shown in FIG. 2 in the deenergized or unactuated position. The coil 17, which is suitably connected in a controlling circuit in a manner well known in the art, is energized to actuate the contactor. Upon energization of the coil 17 the armature 27 is magnetically attracted to the stationary magnetic member 15 to thereby move the movable structure 25 downward which downward movement is guided by the guide pins 21 and the front part 109. The movable structure 25 moves down against the bias of the knockout springs 23. Downward movement of the movable structure 25 closes the contacts 39, 83 for all three pole units. After the contacts 39, 83 engage the armature 27 and contact carrier 29 move downward an additional distance until the armature 27 engages the stationary magnetic member 15 during which additional movement the contact-pressure spring 61 is charged as the ledge portion 105 of the contact carrier 29 biases the contact-pressure spring 61 downward with the spring seat 59 and saddle 55 being restrained from downward movement by the relatively stiff damping spring 65 which operates against the bridging contact structure 35 that is in the closed position. Although the damping spring 65 is stiff enough, relative to the contact-pressure spring 61, that the damping spring 65 will not flatten out as the spring 61 is charged, the damping spring 65 will tend to flatten out the portions thereof that engage the bridging contact structure 35 moving laterally (FIG. 2) to thereby provide a damping action against contact bounce when the contacts 39, 83 are operated to the closed position. As the contact carrier 29 moves downward the additional distance after the contacts 39, 83 engage, a space is provided between the bridging conductor 37 and the flange portions 49 of the shield 45. Upon deenergization of the coil 17 the knockout springs 23 will return the movable structure 25 to the deactuated or open position seen in FIG. 2. During the initial part of this movement, the charged contact pressure springs 61 aid in moving the movable structure 25 toward the open position until the bridging conductor 37 engages the flange portions 49 of the shield 45, and thereafter the knockout springs 23 alone serve to move the movable structure 25 as a unit to the open position seen in FIG. 2. By interposing the shield 45 between the bridging conductor 37 and the molded material of the contact carrier 29 the molded material of the contact carrier 29 is protected from the impacts and heat of the bridging conductor 37.

During opening operations, the arcs that are drawn between each movable contact 39 and the associated stationary contact 83 are drawn magnetically toward the bight portions of the associated U-shaped magnetic steel plates 95. These arcs move off of the stationary contact button 83 directly onto the arc-runner 85 and along the periphery of the opening 89 (FIG. 5) of the arc-runner 85 toward the bight portions of the plates 95 where the arcs are extinguished in a manner well known in the art. By positioning the magnetic steel arc-runner 85 in the slot 91 (FIG. 4) under a port of the contact button 83, the arcs move directly onto the arc-runner 85 thereby protecting the conducting support 81 and the brazed joint between the contact button 83 and the conducting support 81. The opening 89 (FIG. 5) in the arc-runner 85 can receive a screwdriver type tool to facilitate removable mounting of the three-piece unitary contact structure 77 on the associated conductor 71 by means of the associated bolt or screw 79.

I claim:

1. A contactor comprising a stationary magnetic member, an armature movable toward said stationary magnetic member to an actuated position and away from said stationary magnetic member to an unactuated position, an insulating contact carrier operatively connected to said armature for movement upon movement of said armature, a pair of spaced stationary contacts, a bridging contact structure, contact support means comprising a spring support a contact-pressure spring and a damping spring, said damping spring being an elongated leaf spring, said contact-pressure spring being disposed on one side of said bridging contact structure to bias said spring support against said damping spring intermediate the ends of said damping spring to bias said damping spring on the opposite side of said bridging contact structure against said bridging contact structure to bias said bridging contact structure against said contact carrier to thereby support said bridging contact structure on said contact carrier, upon movement of said armature and contact carrier to the actuated position said contact carrier carrying said bridging contact structure therewith until said bridging contact structure engages said spaced stationary contacts and said contact carrier moving an additional distance as said contact pressure spring is charged to operate through said spring support and damping spring to provide contact pressure between said bridging contact structure and said spaced stationary contacts.

2. A contactor according to claim 1, kickout spring means biasing said armature and contact carrier to said unactuated position, said armature and contact carrier moving to said actuated position against the bias of said kickout spring means, upon movement of said armature and contact carrier to said unactuated position said armature and contact carrier moving under the bias of said contact-pressure spring and kickout spring means until said bridging contact structure is engaged by said contact carrier and thereafter said armature said contact carrier and said bridging contact structure moving to said unactuated position under the bias of said kickout spring means.

3. A contactor according to claim 2, and a metallic shield supported on said insulating contact carrier between said insulating contact carrier and said bridging contact structure to protect said insulating contact carrier from the impacts and heat of said bridging contact structure.

4. A contactor according to claim 2, said insulating contact carrier comprising a tubular part, said bridging contact structure comprising an elongated bridging conductor and a pair of movable contacts supported on said elongated conductor in a spaced relationship, said spring support being positioned within said tubular part under said bridging conductor and extending along opposite sides of bridging conductor to a position over said bridging conductor, said contact-pressure spring comprising a coil spring positioned under said bridging conductor within said tubular part biased between a ledge portion on said tubular part and one end of said spring support, and said damping spring being positioned above said bridging conductor between said bridging conductor and the opposite end

of said spring support whereby said coil spring biases said spring support to operate against said spring support and said damping spring to bias said bridging conductor against said contact carrier at one end of the said tubular part.

5. A contactor comprising a housing structure, a contactor-mechanism supported on said housing structure,

said contactor-mechanism comprising a stationary magnetic member, a movable structure supported for movement relative to said stationary magnetic member, a pair of spaced stationary contacts,

said movement structure comprising an armature and an insulating contact carrier operatively connected to said armature, said insulating contact carrier comprising a tubular part, a saddle support inserted into said tubular part from a first end of said tubular part, a spring support ledge in said tubular part on said insulating contact carrier, a coil spring supported between said spring support ledge and a first end of said saddle support, an elongated bridging contact structure extending across said tubular part at one end of said tubular part and extending through said saddle support, a damping spring at the opposite end of said saddle support between said opposite end of said saddle support and said bridging contact structure, said coil spring biasing said saddle support to operate through said saddle support and said damping spring to bias said bridging contact structure toward said one end of said tubular part to thereby resiliently mount said bridging contact structure on said contact carrier,

conducting coil means energizable to effect movement of said movable structure from an unactuated position toward said stationary magnetic member to an actuated position, upon movement of said movable structure to said actuated position said contact carrier carrying said bridging contact structure therewith until said bridging contact structure engages said stationary contacts and thereafter said contact carrier moving an additional distance as said contact pressure spring is charged to operate through said saddle support and damping spring to provide contact pressure between said bridging contact structure and said stationary contacts.

6. A contactor according to claim 5, kickout spring means biasing said movable structure to said unactuated position, said movable structure moving to said actuated position against the bias of said kickout spring means, upon deenergization of said coil said movable structure being movable to said unactuated position under the bias of said kickout spring means during which movement said contact carrier moves to engage said bridging contact structure and carries said bridging contact structure to said unactuated position.

7. A contactor comprising an insulating housing, a contactor structure supported in said insulating housing, said contactor structure comprising a stationary contact structure, a stationary magnetic member, a movable structure,

said movable structure comprising a movable contact structure cooperable with said stationary contact structure, a movable magnetic armature, an insulating contact carrier connected to move with said movable magnetic armature and carrying said movable contact structure thereon,

internal guide means in said insulating housing structure guiding said movable structure for movement between actuated and unactuated positions,

said insulating housing having an opening therein, said movable structure comprising a protruding part protruding through said opening, externally adjustable guide means comprising a guide plate and externally adjustable mounting means mounting said guide plate on said housing in proximity to said protruding part, said guide plate comprising a guide surface that engages said protruding part to guide movement of said protruding part of said movable structure, and said externally adjustable mounting means permitting adjustment of said guide plate to selected adjusted stationary positions on said housing to vary the guiding action of said guide plate on said

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protruding part to thereby enable adjustment of the alignment of said movable magnetic armature with said stationary magnetic member.

8. A contactor according to claim 7, said guide plate comprising a first leg extending into said opening and a mounting

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leg positioned on the outside of said housing, said mounting leg having a pair of spaced slots therein, a separate mounting screw extending through each of said slots, said mounting screws securing said mounting plate to said housing.

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