Jan. 17, 1967 J. SCHEIB, JR 3,299,378

ELECTROMAGNETICALLY ACTUATED CONTACTOR HAVING A LINEARLY MOVABLE CONTACT CARRIER

Filed March 25, 1965 5 Sheets-Sheet 1

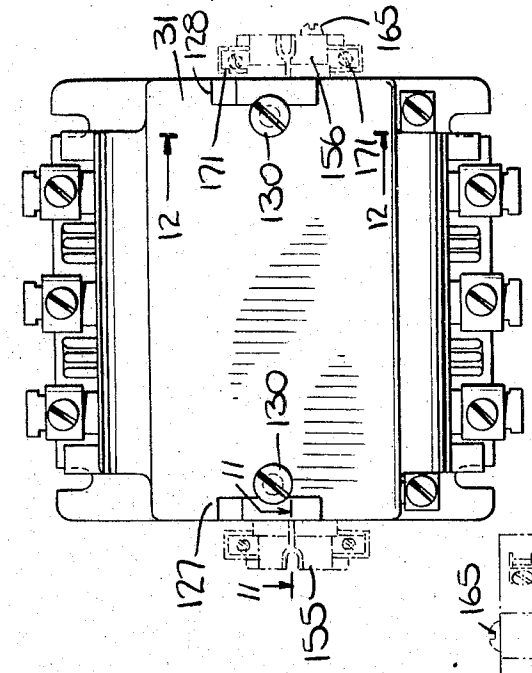


Fig. 2.

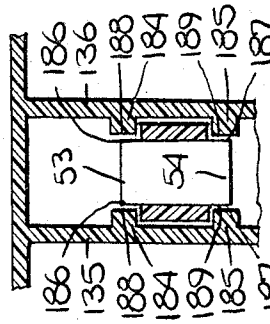


Fig. 2a.

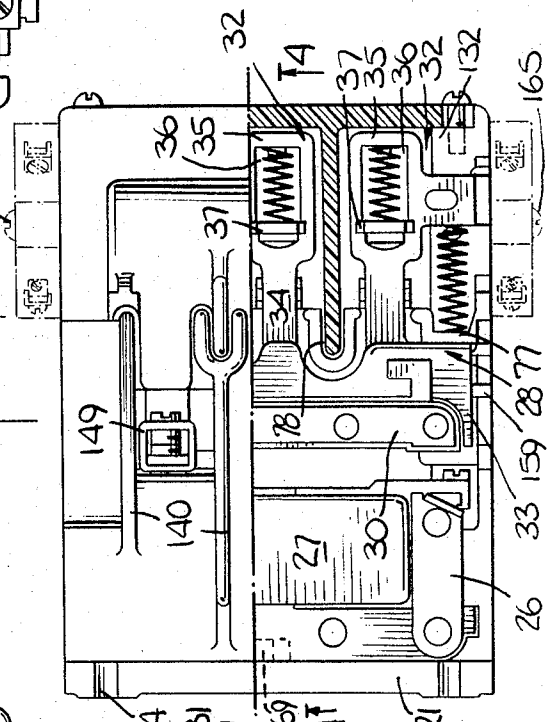


Fig. 3.

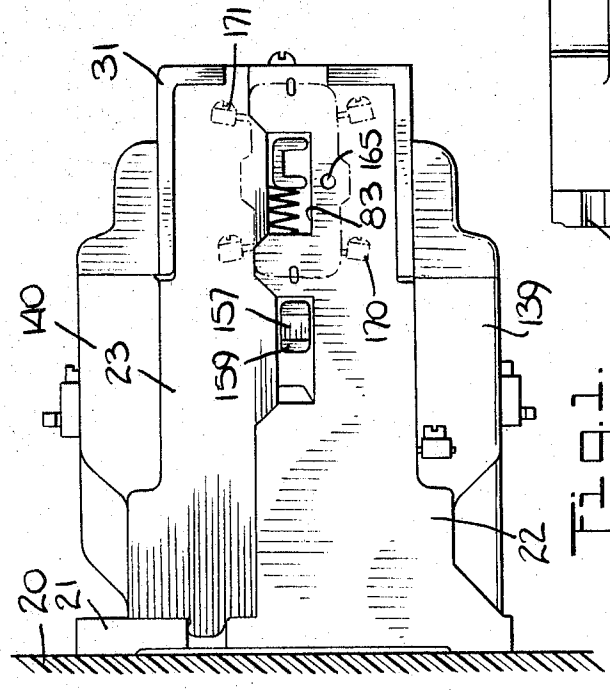


Fig. 1.

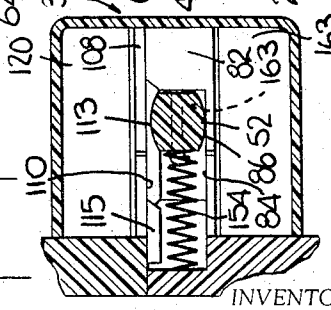


Fig. 12.

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Jan. 17, 1967 J. SCHEIB, JR 3,299,378

ELECTROMAGNETICALLY ACTUATED CONTACTOR HAVING A LINEARLY MOVABLE CONTACT CARRIER

Filed March 25, 1965 5 Sheets-Sheet 2

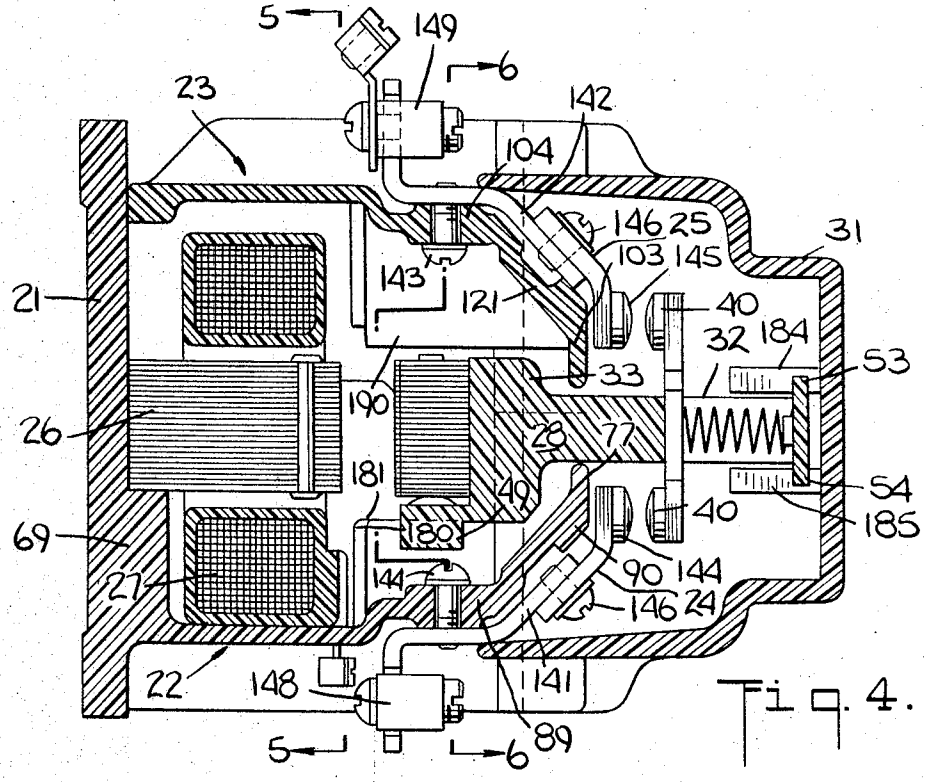


Fig. 4.

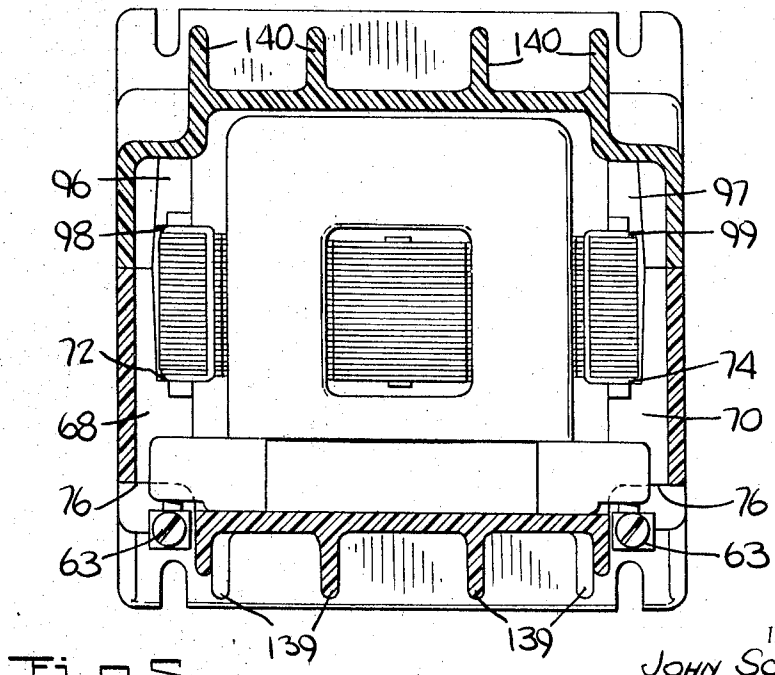


Fig. 5.

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Jan. 17, 1967 J. SCHEIB, JR 3,299,378
ELECTROMAGNETICALLY ACTUATED CONTACTOR HAVING A LINEARLY MOVABLE CONTACT CARRIER
Filed March 25, 1965 5 Sheets-Sheet 3

Fig. 6.

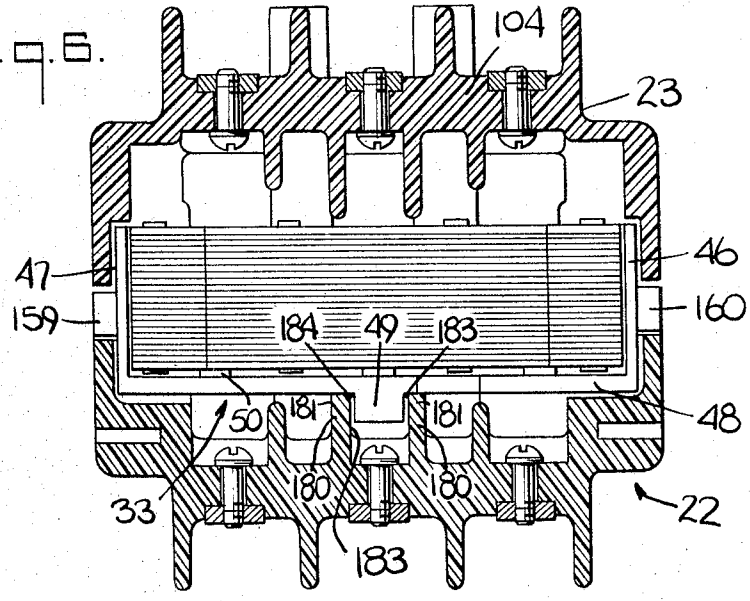


Fig. 9.

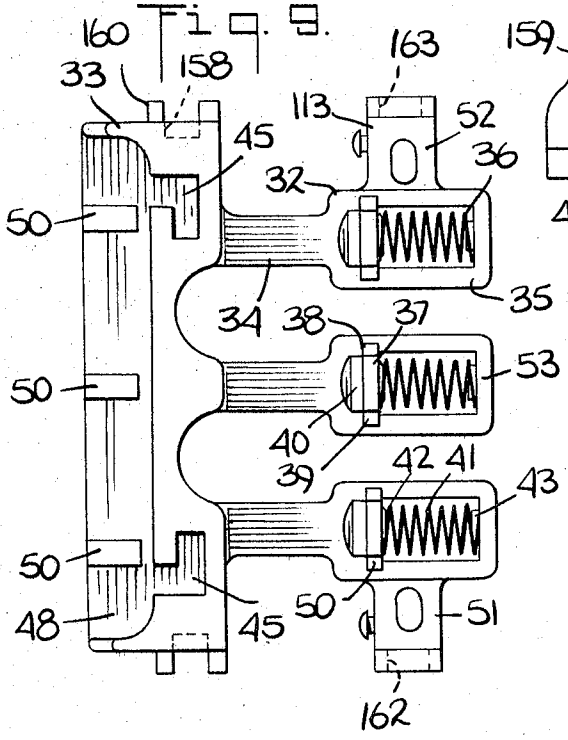
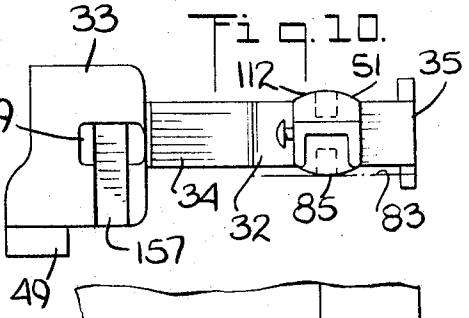


Fig. 10.



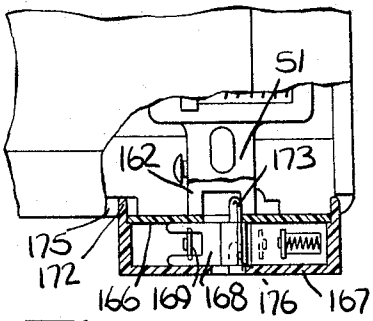


Fig. 11.

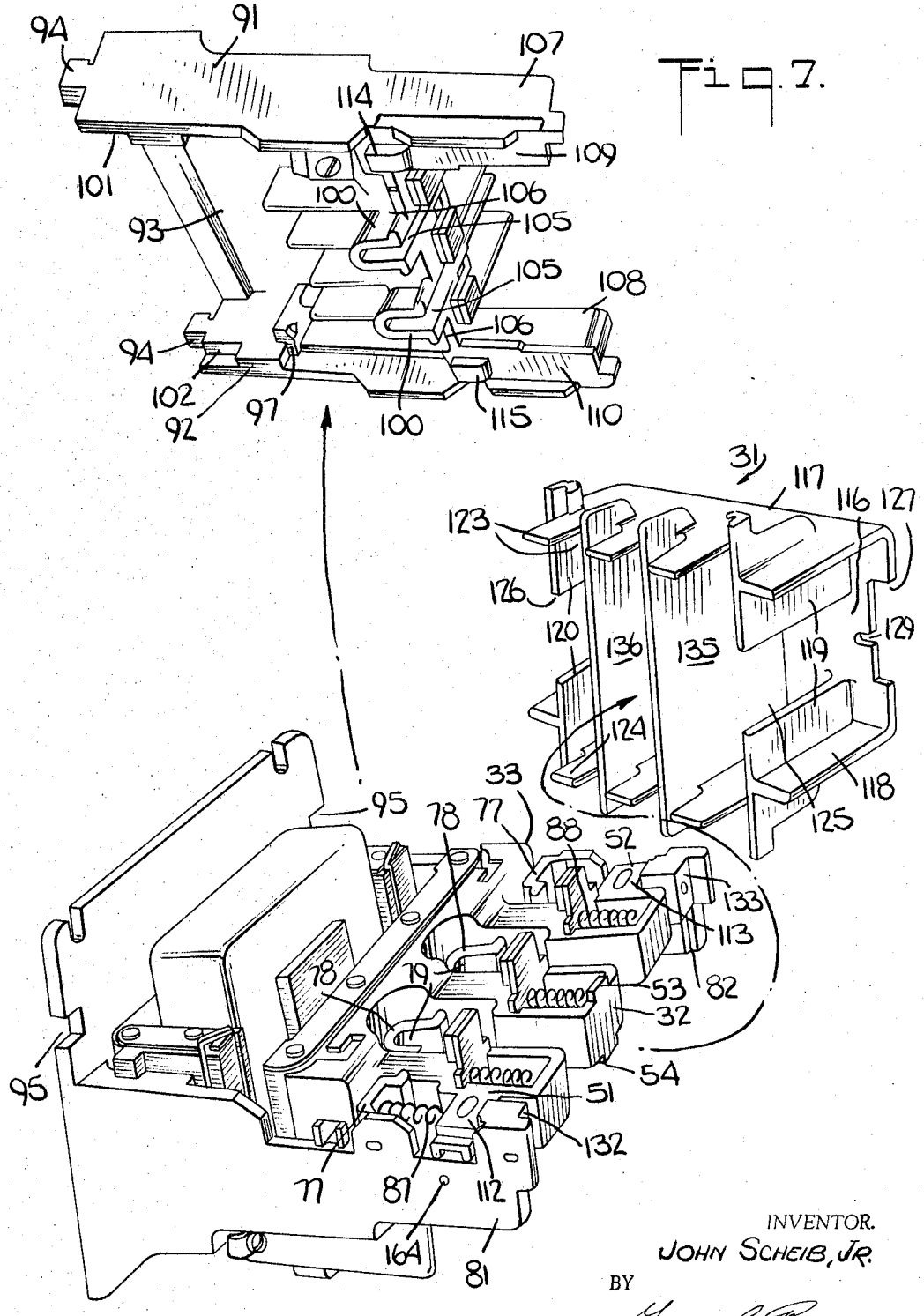
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Jan. 17, 1967 J. SCHEIB, JR 3,299,378

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Filed March 25, 1965 5 Sheets-Sheet 4

Fig. 7.



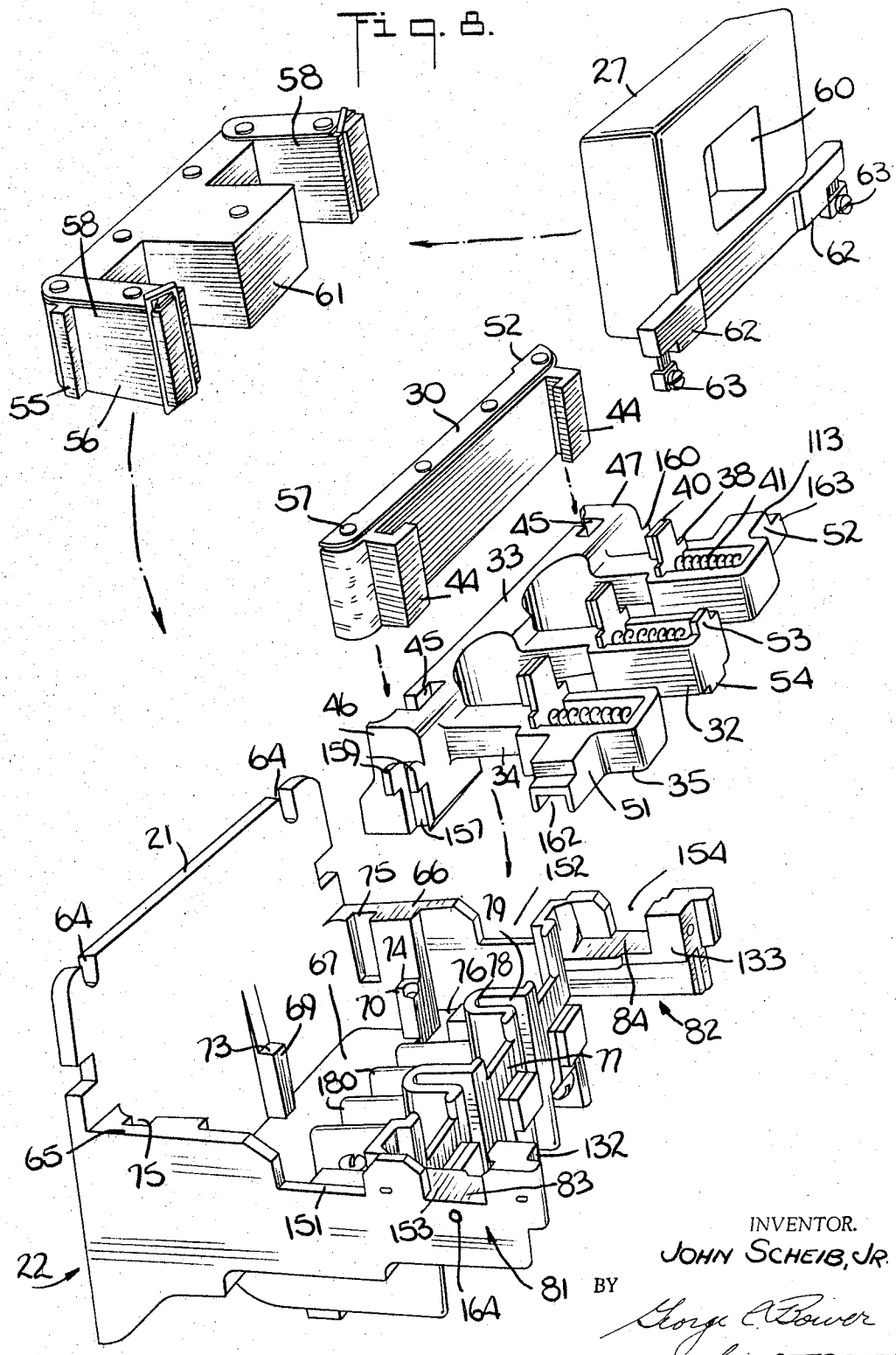
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Filed March 25, 1965 5 Sheets-Sheet 5

Fig. 8.



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ELECTROMAGNETICALLY ACTUATED CONTACTOR HAVING A LINEARLY MOVABLE CONTACT CARRIER

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Filed Mar. 25, 1965, Ser. No. 442,658
7 Claims. (Cl. 335—131)

This invention relates to electrical contactors and is directed particularly to electrical contactors of the type that extend horizontally from a vertical supporting board with the movement of the dynamic parts in a horizontal plane.

In my co-pending application Serial No. 377,333 filed June 13, 1964 and entitled, Electrical Contactor, now Patent No. 3,194,920, a contactor of the foregoing type is described in which the fixed and movable contacts are enclosed by the upper and lower holding members supporting the electrical and magnet elements. This contactor is quite satisfactory. However, under higher ratings it is desirable and more convenient to have the fixed contacts and the movable contacts more easily accessible. Also for higher currents, it is desirable to further isolate the phases or contact pairs.

An object of the invention is to provide an electrical contactor of the horizontally extending type that has a minimum number of parts to be assembled and is easy to inspect and to change the fixed and movable contacts.

Other objects and advantages will be apparent from the following description taken in connection with the drawings in which

FIG. 1 is a side view of the assembled contactor;

FIG. 2 is a front view of the assembled contactor;

FIG. 3 is a top view of the assembled contactor with half of the upper holding member removed to illustrate the coil and core assembly, armature and contact carrier in the lower holding member;

FIG. 4 is a sectional view of the assembled contactor taken along lines 4—4 of FIG. 3;

FIG. 5 is a sectional view of the assembled contactor taken along lines 5—5 of FIG. 4;

FIG. 6 is a sectional view of the assembled contactor taken along lines 6—6 of FIG. 4;

FIG. 7 is a partially exploded view of the contactor with the upper holding member and the fastening member separated from the lower holding member;

FIG. 8 is an exploded view of the lower holding member, coil, core, armature, and contact carrier;

FIG. 9 is a top view of the contact carrier;

FIG. 10 is a side view of the contact carrier;

FIG. 11 is a fragmentary top view of a front corner of the contactor with the auxiliary contactor shown in section taken along lines 11—11 of FIG. 2;

FIG. 12 is a fragmentary sectional view of a front corner of the contactor taken along lines 12—12 of FIG. 2; and

FIG. 13 is a fragmentary rear view of the fastening means with a portion of the contactor fragmentarily shown to illustrate the guide relationship.

Illustrated in the drawings is an embodiment of an electrical contactor of the type that extends horizontally from a vertical supporting board 20. The contactor comprises in general a vertical mounting base 21, lower and upper holding members 22 and 23 with lower and upper sets of fixed contacts 24, 25, a core 26, a coil 27, a contact carrier 28 with an armature 30 actuated by the core and coil assembly and an arc hood and fastening member 31 mounted on the front of the contactor.

The contact carrier 28 is supported by the holding

members 22, 23 for actuation by the core and coil assembly generally in a plane parallel to the holding members and normal to the vertical mounting base 21 (FIG. 4). The contact carrier 28 has three movable contact supporting fingers 32 extending longitudinal to this plane and the movement of the contact carrier 28, and has an armature supporting member 33 extending normal to the plane of movement of the contact carrier, all of which is preferably molded as a single piece (FIGS. 7, 8 and 9). The movable contact carrier fingers 32 have shaft portions 34 and movable contact supporting portions 35 with rectangular-shaped openings 36 in which movable contacts 37 extend normal to the plane of movement of the contact carrier 28. Each movable contact 37 is of a generally rectangular shape and made of metal with side stubs 38 in the plane of the contact for holding the contacts 37 in the openings 36 and with contact buttons 40 on opposite sides of the carrier (FIGS. 4, 7 and 8). The movable contacts 37 are resiliently urged in a direction towards the vertical mounting base 21 and fixed contacts by resilient means such as helical springs 41 seated in projections 42 in the center of the movable contacts and projections 43 in the openings 36 on the movable contact supporting portions 35. As illustrated in FIG. 8 the armature is made of laminated steel and is of a generally rectangular shape. The laminations are shaped to provide L-shaped hooks 44 on the back of the armature for fitting in L-shaped slots 45 in the armature supporting portion of the contact carrier forming an interlocking means to move the armature and carrier in unison. The armature supporting portion has sides 46, 47 and a bottom 48 to receive the main portion of the armature 30. The bottom 48 is provided with rounded stubs 50 for supporting the armature in the carrier (FIGS. 6 and 9). The armature 30 fits loosely in the support and in the L-shaped slots 45 to permit the armature to rock and move on the stubs for seating firmly against the core. For guiding the contact carrier on movement, guide projections 51, 52 are provided extending laterally or sidewise from the two side fingers in the plane of the fingers, and for sidewise guide stubs 53, 54 are provided on the front portion of the middle finger and a guide post 49 is provided on the bottom of the contact carrier (FIGS. 4, 6, 7 and 8).

As best illustrated in FIG. 8, the core 26 is of a laminated E-shaped construction with ribs 55 on the outer side surfaces 56 for holding the core longitudinally in position. The core is otherwise of a standard construction with the raised ends 57 of the armature seated against the outer legs 58 of the core on actuation. The coil 27 has a generally rectangular shape with a rectangular opening 60 for fitting over the center leg 61 of the core. Leads 62 extend from opposite sides of the coil and have terminals 63 for connection to a source of controlled power.

The vertical mounting base 21 is rectangular in shape and has slots 64 for fastening the mounting base to a supporting board 20. The lower holding member 22 is formed as a single piece with the vertical mounting base 21 and extends normal thereto (FIG. 1). The holding member has two opposite sides 65, 66 extending lateral to the mounting base and a horizontal panel 67 therebetween (FIG. 8).

Three posts 68, 69, 70 extending normal to the panel are provided in the lower holding member with two of the posts 68, 70 on opposite sides of the holding member and formed as part of the sides 65, 66 and the third post 69 intermediately positioned adjacent to and as part of the vertical mounting base 21 (FIGS. 4, 5 and 8). The posts have horizontal seating surfaces 72, 73, 74 for receiving and supporting the core 26. The sides have notches 75 into which the ribs 55 on the core fit, thereby

locking the core in a longitudinal position. The coil 27 rests on the panel and openings 76 are provided at the sides of the panel through which the terminals 63 extend for access exterior to the contactor. Forward of the panel is a front wall 77 extending normal to the sides and panel. The front wall 77 is spaced from the core 26 and the armature 30 and the armature supporting member 33 are positioned between the front wall and core. Three notches are provided in the front wall through which the shaft portions 34 of the fingers 32 of the contact carrier extend. As illustrated in FIG. 4, the front wall separates the core, coil and armature supporting portion of the contact carrier from the movable contact supporting portion 35 of the carrier positioned exterior to the front wall. The front wall is provided with U-shaped portions 78 extending normal to the panel and between the fixed contacts. The U-shaped portions have forwardly facing grooves 79 for receiving barriers located between the fixed contacts. A fixed contact mounting portion 89 is provided on the panel between the front wall 77 and the core and coil assembly. A part 90 is sloped to accommodate the terminal attached to the fixed contact mounting portion.

On each side of the lower holding member are projecting members or portions 81, 82 extending longitudinally to the contactor and having guide surfaces 83, 84 extending longitudinally and parallel to the plane of movement of the contact carrier (FIGS. 7 and 8). The guide projections 51, 52 on the contact carrier have lower curved surfaces 85, 86 for engaging the guide surfaces 83, 84 respectively. Resilient means, such as helical springs 87, 88 are positioned between the front wall 77 and the guide projections 51, 52 for biasing the armature 30 and movable contacts 37 away from the coil 27 and fixed contacts 24, respectively.

The upper holding member 23 is complementary to the lower holding member 22 and is detachably mounted to the vertical mounting base 21 and the lower holding member 22 (FIGS. 4, 5, 6 and 7). The upper holding member 23 has longitudinally extending sides 91, 92 and a horizontal panel 93 thereacross. Knobs 94 on the ends of the walls fit into the notches 95 in the vertical base 21. The sides 91, 92 of the upper holding member mate with the sides 65, 66 of the lower holding member 22 to form an enclosing member for housing the core 26, coil 27, armature 30 and armature supporting member 33 of the contact carrier. Two posts 96, 97 (FIGS. 5 and 7) are provided on each side of the upper holding member 23 extending normal to the panel 93 and forming surfaces 98, 99 engaging the core to cooperate with the posts 67–69 in the lower holding member for retaining the core in a vertical position. Cutouts 101, 102 (FIG. 7) are provided at the rear lower portion of the sides to interfit with the ribs 55 on the core and cooperate with the lower member in holding the core in longitudinal or horizontal position.

The panel 93 has between the core and coil assembly and the front wall 103 a fixed contact mounting portion 104 (FIG. 4) which extends between the sides 91, 92. The front wall 103 extends generally normal to the panel and across the holding member to separate the fixed contacts from the electromagnet components. The front wall is provided with U-shaped portions 100 having grooves 105 complementary to the U-shaped portions 78 and grooves 79 of the lower holding member. The shaft portions 34 of the carrier extend through the notches 106 in the front wall 103 to position the movable contact supporting portion 35 of the carrier on the other side of the wall from the armature 30. The walls 77 and 103 mate to form a chamber enclosing the electromagnetic components.

The projecting members or portions 107, 108 extending forwardly and longitudinally are provided on the upper holding member 23 and are complementary to the projecting members 81, 82 on the lower holding member 22. Said projecting members or portions 81 and 107 are on one side of the contact carrier and the projecting members or portions 82 and 108 are on the other side. Guide surfaces 109, 110 extending parallel and longitudinally to the contact carrier face the guide surfaces 83, 84 on the lower projecting portions. The guide projections 51, 52 on the contact carrier 28 have upper curved guide surfaces 112, 113 on the opposite side to the curved surfaces 85, 86 (FIG. 7). These surfaces are normally spaced from the upper guide surfaces due to the tolerances and play provided in the contactor. Raised portions 114, 115 are provided on the upper projecting members 107, 108 which overlap the lower front wall 77 and fit into the recess containing the helical biasing springs 87, 88.

An arc hood and fastening means 31 slides on the front of the upper and lower holding members for holding these members together and enclosing the fixed and movable contacts (FIG. 7). This means comprises a front panel 116, upper and lower panels 117, 118 and two side panels 119, 120 for housing the fixed contacts and their terminals. The upper and lower panels are curved and have guards 123, 124 extending over the terminals of the fixed contacts 24, 25 (FIG. 4). The side panels 119, 120 have large slots 125, 126 for receiving the projecting members 81, 82, 107, 108 of the lower and upper panels. The front panel 116 also has notches 127, 128 to interlock with these members for locking the upper and lower holding members together. Slots 129 are provided for screws 130 which are threaded into blocks 132, 133 provided on the projecting members 81, 82 of the lower holding member 22.

Two contact barriers 135, 136 are provided extending normal to the plane of movement of the contact carrier and fitting into the grooves 79, 105 formed by the U-shaped portions 100, 78 on the front sides of the upper and lower holding members (FIG. 7). Slots 137, 138 are provided between the guards 123, 124 for accommodating the U-shaped portions 100, 78 on the front side of the holding members. The contact barriers 135, 136 extend above the upper and lower panels 117, 118 so as to be of the same height as the U-shaped portions. The lower and upper holding members 22, 23 have terminal barriers 139, 140 extending normal to the panels and longitudinally to the contactor. These terminal barriers are of the same height as the U-shaped portions. The side walls 119, 120 of the arc hood and fastening means also extend so as to be of the same height as the terminal barriers, and are grooved to recess with the ends thereof.

As best illustrated in FIG. 4, the fixed contacts 24 and 25 are mounted on the fixed contact supporting portions 89, 104 by means of the terminals 141 and 142. These terminals are secured by screws 143, 144 extending through the lower and upper fixed contact mounting portions respectively. As illustrated, the terminals are contoured to follow the sloped parts 90 and 121 of the lower and upper members respectively. The fixed contacts are also contoured to present the buttons 144, 145 in a facing relation to the movable contact buttons 40. The fixed contacts may be secured to the terminals by the screws 146. Thus the fixed contacts are to be positioned on the fixed contact mounting portions and front walls opposite to the vertical mounting base 21.

Lug means 148, 149 are provided on the fixed contact terminals for securing leads to the terminals. The lugs are mounted on the portions of the terminals extending normal to the holding members and face outwardly for access from the front of the contactor. Similarly, the bolts on the terminals 63 connected to the coil 27 face toward the front of the contactor for ready access.

As illustrated in FIGS. 1 to 3 and 10 of the drawings, openings or slots 151, 152 and 153, 154 are provided in the sides 65, 66 of the lower contact member 22 and the projecting members 81, 82 to permit connection of the contact carrier to auxiliary contactors 155,

156. Slots 157, 158 are provided on the sides of the armature supporting portion of the contact carrier with stubs 159, 160 extending therefrom on each side of the slots. The stubs extend through the openings in the sides 65, 66 of the lower holding member. Thus connecting means may fit through the openings 151, 152 into the slots 157, 158 for interconnection of the contact carrier with other contactors. Similarly, the guide projections 51, 52 have U-shaped portions 162, 163 having openings facing the guide surfaces 83, 84 on the projecting members 81, 82 of the lower holding member. Threaded holes 164 are provided below the openings 153, 154 for receiving bolts 165 passing through the auxiliary contactors 155, 156. The auxiliary contactors each have a base plate 166, a casing 167 mounted on the base plate and a contact carrier 168 with a movable contact 169 for engaging the fixed poles 170, 171 mounted in the casing 167. The contact carriers have projections 173 fitting in the U-shaped portions 162, 163. The casing has fingers 174 forming a snap fit onto the base 166 and extending to recess in keying slots 175 on the side of the projecting members 81, 82. The auxiliary contact carrier 168 correspondingly has a mating hole 176 so that a plurality of auxiliary contactors 155, 156 may be mounted for actuation by the contact carrier 28.

The contact carrier 28 rests in the lower holding member 22. The lower holding member has partitions 180 extending normal to the fixed contact mounting portion 89 of the horizontal panel 67. The partitions are laterally spaced apart and have narrow longitudinally extending surfaces 181 on which the armature supporting member 33 rests. The curved surfaces 85, 86 of the guide projections 51, 52 rest on flat surfaces 83, 84 of the projecting members 81, 82. Due to the large tolerances and play the laterally spaced upper partitions 190 extending normal to the fixed contact mounting means 104 of the panel 93 of the upper holding member 23 have a substantial clearance with the armature supporting member 33. Also the surfaces on the projecting members 107, 108 are similarly spaced from the upper curved surfaces 112, 113 of the guide projections 51, 52. The contact carrier is thus guided in a plane extending normal to the vertical mounting base essentially by the guide surfaces of the lower holding member. The contact carrier 28 is guided to move longitudinally by a guide post 49 projecting from the bottom of the armature supporting member (FIG. 6). This post 49 projects between the partitions 180 in the lower holding member and the facing side surfaces 182 of the partitions with the side surfaces 183 of the post engaging and guided by the side surfaces 182. At the forward end of the contact carrier the guide stubs 53, 54 on the middle finger 32 fit between bosses 184, 185 formed as part of the barriers 135, 136 of the arc hood and fastening means 31 (FIG. 13). These bosses 184, 185 are on the facing surfaces of the barriers and positioned above and below the middle finger so that the side surfaces 186, 187 of the stubs 53, 54 engage the facing surfaces 188, 189 of the bosses 184, 185. However, substantial play or tolerance is provided between these surfaces.

The lower and upper holding members, the contact carrier and the arc hood or fastening means are each molded as a single piece from plastic material of the phenolic type. The upper and lower holding members have the fixed contact mounting means formed so as to support the fixed contacts exterior to the chamber housing the electromagnetic components. Thus the fixed contacts are readily accessible by removing the arc hood 31. The arc hood 31 has the guards 123, 124 extending over the fixed contacts and terminals and has the contact barriers extending between and overlapping the fixed contacts and terminals to isolate each pair of fixed contacts and the connecting movable contact associated therewith. This overlapping is accomplished by the

U-shaped portions 78 and 100 with grooves 79 and 105, respectively.

The barriers 135 and 136 may be of a Fiberglas type to further reduce the arcing effect of the contacts. The contact carrier is supported to move in a planar direction normal to the vertical mounting base 21 by the longitudinal extending surfaces 181 on the partitions 180 and by the horizontal surfaces 83, 84 on the projection members 81 and 82. However, the partitions 190 and the surfaces 109, 110 also function as guide surfaces in case the contact carrier is forced against the upper holding member. However, due to the molding of the parts, there is a substantial clearance between the contact carrier and these latter surfaces.

The sidewise guiding is provided by the guide post 49 at the center of the armature supporting member 33 engaging the surfaces 182 of the partitions 180 and by the posts 53 and 54 engaging the bosses 184 and 185. Thus in addition to providing an arc barrier, enclosing the contacts and forming a fastening means for locking the holding members together, the arc hood 31 also functions so as to guide or limit the sidewise movement of the contact carrier.

Various modifications and changes may be made in the contactor without departing from the invention as set forth in the appended claims.

I claim:

1. An electrical contactor comprising a coil and core assembly including a movable armature actuated by said core and coil assembly, a movable contact carrier having supporting means at one end for holding said armature to actuate said carrier and having movable contact mounting means at the other end, a mounting base with two holding members supportably attached thereto and extending normal thereto for enclosing said core and coil assembly, each of said holding members having fixed contact holding means extending laterally across said holding members on the opposite side of said coil and core assembly from said base and having projecting portions extending in a direction perpendicular to said mounting base and laterally separated forming a space for said carrier, each of said fixed contact holding means having a set of fixed contacts supported to form pairs of contacts exterior to said holding members, said contact carrier reciprocally mounted in said holding members with said armature supporting means positioned between said fixed contacts and said coil and core assembly and with said movable contact mounting means positioned between said projecting portions on the other side of said fixed contact holding means from said base, said movable contact mounting means having movable contacts in facing relation with said fixed contacts and exteriorly accessible to said holding members, and fastening cover means removably mounted on said projecting portions to secure said holding members together and for enclosing said exteriorly accessible fixed and movable contacts.

2. An electrical contactor as set forth in claim 1 wherein said holding members have surfaces extending longitudinally and parallel to the movement of said contact carrier for guiding said contact carrier in planar movement on actuation.

3. An electrical contactor as set forth in claim 1 wherein said holding members comprise a lower member and an upper member, and said lower holding member has surfaces extending longitudinally and parallel to the plane of movement of said contact carrier for guiding said contact carrier.

4. An electrical contactor as set forth in claim 1 wherein said projecting portions of said holding members have facing surfaces extending longitudinally and parallel to the movement of said contact carrier, and said holding members have supporting walls extending perpendicular to the fixed contact mounting means and extending inwardly with longitudinally extending parallel facing

surfaces for guiding said contact carrier in co-operation with the surfaces on said projecting portions.

5. An electrical contactor as set forth in claim 4 wherein one of said holding members has longitudinally extending parallel facing surfaces normal to the plane of movement of said contact carrier, and said fastening means has longitudinally extending parallel facing surfaces normal to the plane of movement of said contact carrier, and said contact carrier has surfaces overlapping with said guide surfaces for laterally guiding said contact carrier.

6. An electrical contactor comprising a coil and core assembly including a movable armature actuated by said coil and core assembly, a contact carrier having means for supporting movable contacts and extending in the plane of movement of the contact carrier and having armature supporting means extending normal to the plane of movement for holding said armature, a mounting base with upper and lower holding members supportably attached and extending normal thereto enclosing said core and coil assembly, each of said holding members having fixed contact holding means extending laterally across said holding member intermediate thereof on the opposite side of said coil and core assembly and walls extending normal to said holding members and to said mounting base on the opposite side of said core and coil assembly from said base, said holding members having projecting portions extending in a direction perpendicular to said mounting base and laterally separated to form a space for said means for supporting movable contacts, said projecting portions and said walls having longitudinally extending surfaces extending parallel to the plane of movement of the contact carrier with the surfaces of said lower holding member facing the surfaces of said upper holding member for guiding said contact carrier, said contact carrier mounted in said holding members with said armature supporting means between said fixed contacts and said coil and core assembly and normally engaging said surfaces on said walls of said lower holding member, said movable contact supporting means positioned between said projecting portions and normally engaging said guide surfaces on the projecting portions of said lower holding members, each of said fixed contact holding means exteriorly supporting a set of fixed contacts on opposite sides of said contact carrier and said movable contact supporting means having movable contacts accessible exteriorly to said holding members for engaging said fixed contacts, and cover means mounted on said projecting portions for enclosing said fixed and movable contacts.

7. An electrical contactor comprising a core and coil assembly including a movable armature actuated by said core and coil assembly, a contact carrier having means for connecting said armature to said carrier to actuate said carrier and having movable contact supporting means, a casing formed by two upper and lower holding members enclosing and supporting said core and coil assembly, one of said holding members having means slidably supporting and guiding said armature and contact carrier in a given direction and plane of movement, each of said holding members having a fixed contact holding means above and below said contact carrier and plane of movement, sets of fixed contacts exteriorly mounted on said fixed contact holding means and extending towards said contact carrier, said contact carrier extending exteriorly to said holding members in the direction of movement of said carrier to position said movable contact supporting means exteriorly to said holding members, movable contacts mounted on said movable contact supporting means in facing relation to said fixed contacts in a make and break relation therewith, projecting portions on said holding members and extending exteriorly therefrom at opposite sides of said contact carrier in a direction parallel to the movement of said contact carrier, and cover and partition means removably mounted on said projecting portions and extending to cover and isolate said exteriorly positioned fixed and movable contacts.

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R. N. ENVALL, *Assistant Examiner.*