July 5, 1966 L. A. BURTON ET AL 3,259,702

MULTIPLE CONTACT SWITCH WITH REMOVABLE COVER

Filed March 2, 1964 3 Sheets-Sheet 1

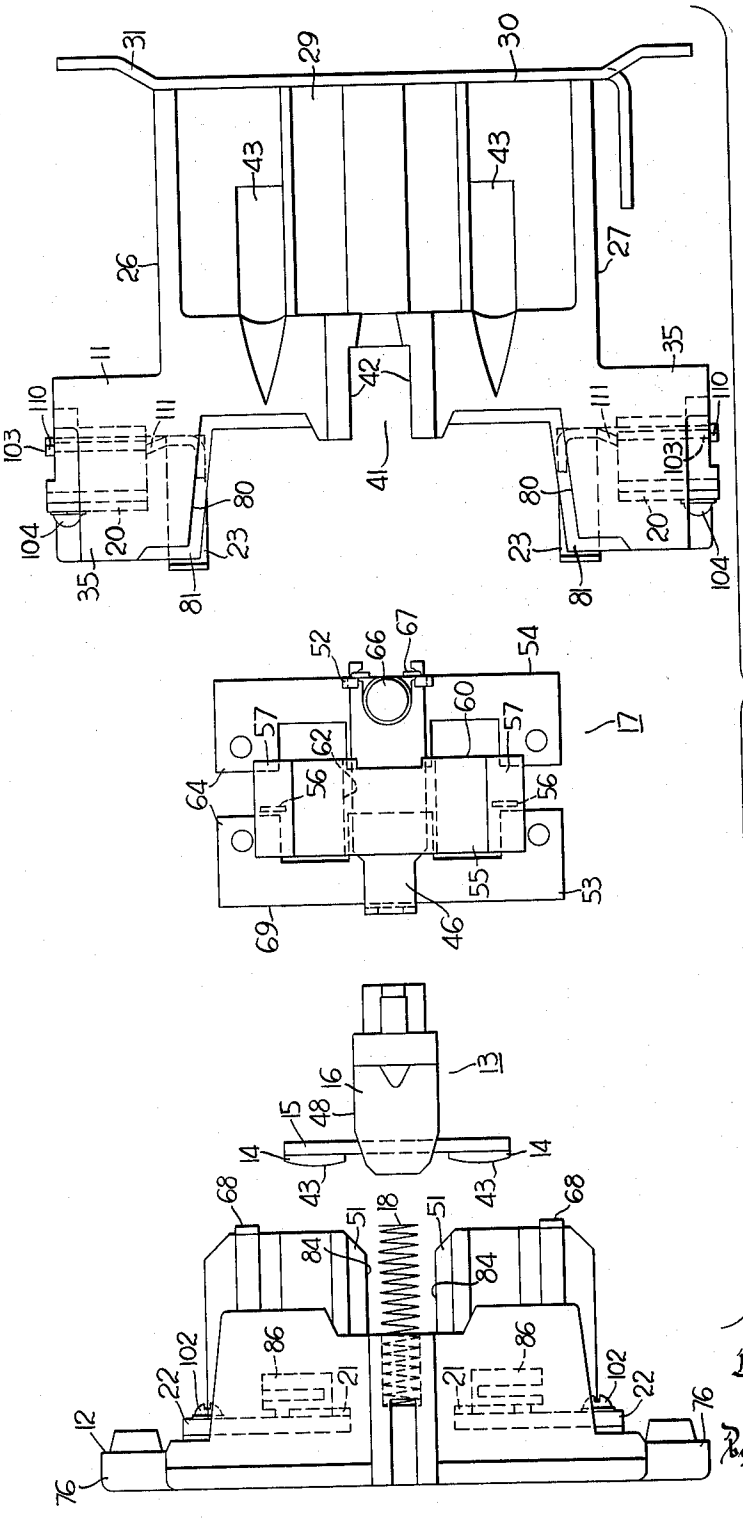


Fig. 1

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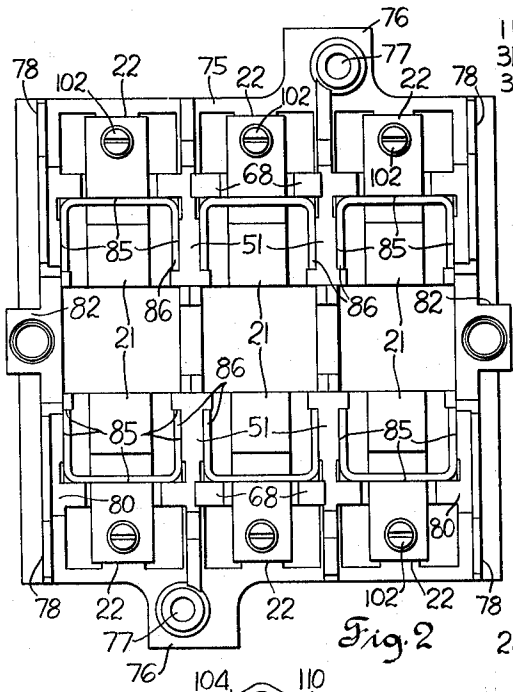


Fig. 2

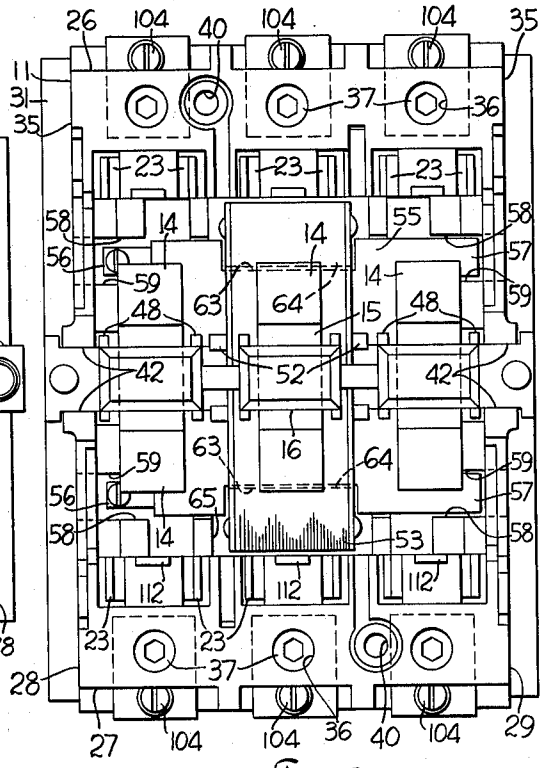


Fig. 3

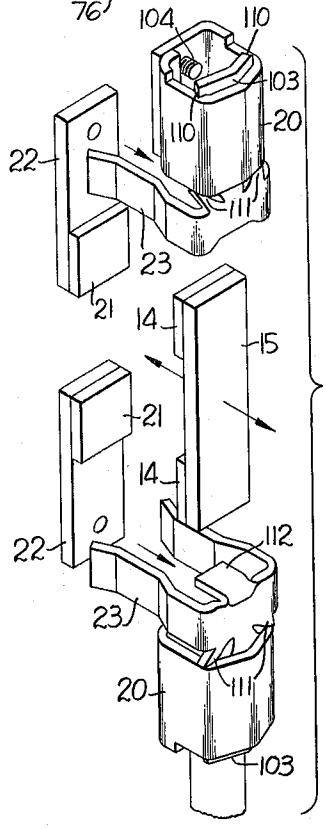


Fig. 4

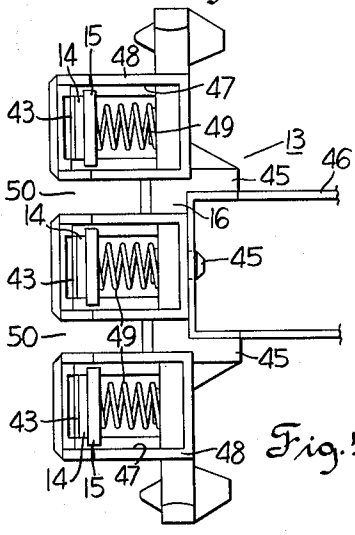


Fig. 5

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MULTIPLE CONTACT SWITCH WITH REMOVABLE COVER

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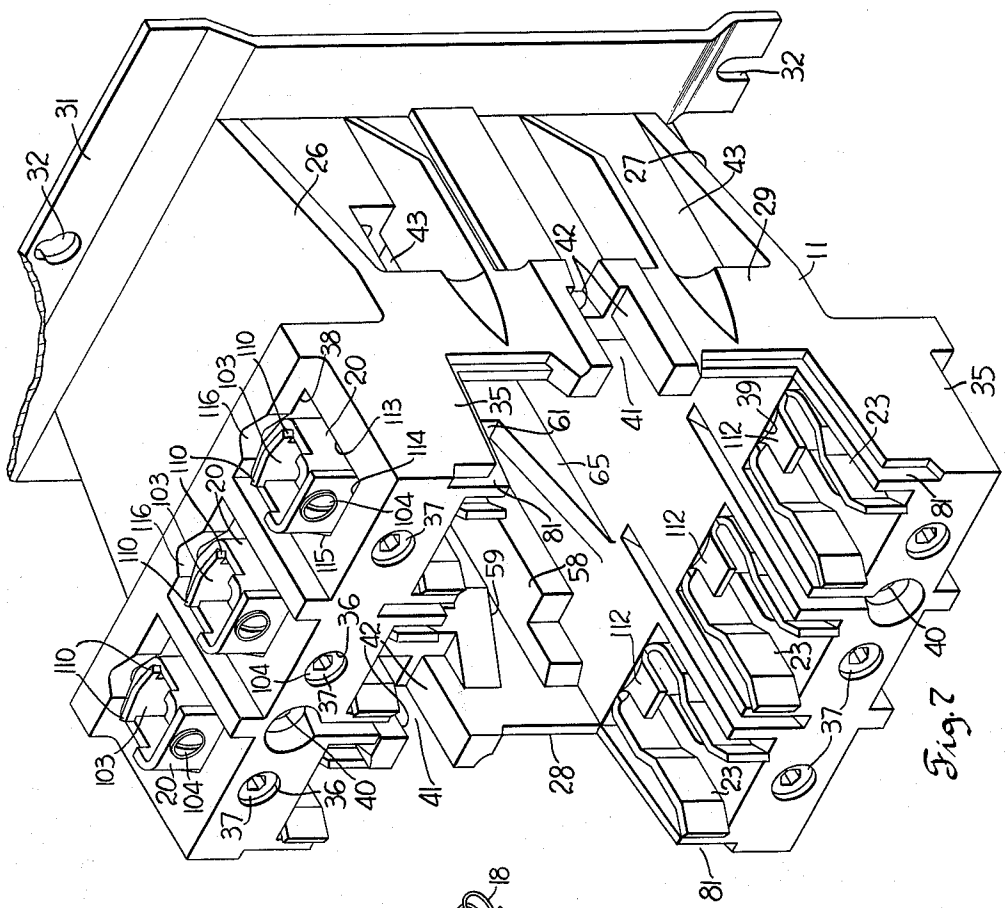


Fig. 7

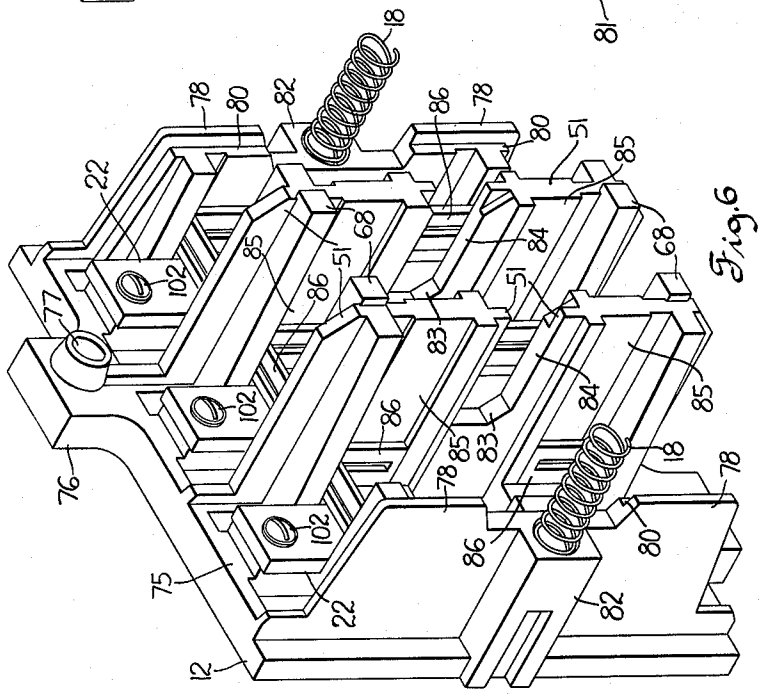


Fig. 6

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3,259,702

MULTIPLE CONTACT SWITCH WITH REMOVABLE COVER

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Filed Mar. 2, 1964, Ser. No. 348,651
12 Claims. (Cl. 200—16)

This invention relates generally to electrical switches, more specifically to a general use magnetic contactor.

A contactor is a switch designed for jobs such as motor control where its contacts are opened and closed many times, and a contactor can be expected to wear out many sets of contacts in its life. Maintenance people inspect the contacts periodically and replace them when they have worn out. One object of this invention is to provide a new and improved contactor that has both its fixed and movable contacts mounted where they are easily accessible for inspection and replacement. This goal is made difficult by the fact that the fixed and movable contacts are positioned to face opposite directions so that they can come together to make contact; consequently, with most contactor designs, maintenance people cannot see all the contact making surfaces without first disassembling part of the contactor. A more specific object of this invention is to provide a new and improved contactor that separates into two parts for inspection and replacement of the contacts.

The contactor of this invention is enclosed in a housing having an open faced stationary part and an easily removable cover part. The stationary part carries the movable contacts and the associated magnetic actuator, and the cover carries the fixed contacts. When the cover has been removed, both the movable and the stationary contacts are readily accessible for inspection and replacement.

Mounting the fixed contacts on the removable cover raises the question of how to connect them electrically and mechanically to the fixed terminals that the conductors of the external circuit are attached to. An object of this invention is to locate the terminals on the stationary housing part so that the cover can be removed without interference from the conductors attached to these terminals. Another object is to mount the terminals where electricians installing the contactor can reach each terminal easily to attach the conductors. In the contactor of this invention pairs of terminals are mounted toward the front of the stationary housing along two opposite sides. This makes each terminal accessible from the front and from its associated side without interference from the other terminals or from the wiring or from other parts of the contactor. Connectors are provided on the cover and on the stationary housing part for plugging in the fixed contacts to the terminals when the removable cover is attached to the stationary housing part.

These features make the contactor of this invention very compact and give the housing and the associated wiring a neat appearance.

The drawing and the detailed description of the preferred embodiment of the invention will suggest other objects and features of the invention.

In the drawing:

FIG. 1 is an exploded side view of the contactor of this invention;

FIG. 2 shows the inside of the housing cover;

FIG. 3 is a front view of the housing with the cover removed;

FIG. 4 is an isometric view of the current carrying elements of one phase of the contactor in an open position;

FIG. 5 is a top view of the movable contact assembly;

FIG. 6 is an isometric view of the housing cover; and

FIG. 7 is an isometric view of the stationary part of the housing.

Introduction.—The contactor comprises the following groups of elements:

A housing including a stationary part **11** and a removable cover **12**;

a movable contact assembly **13** including a pair of movable contacts **14** mounted on a conductive bar **15** for each pair of external conductors and a movable contact carrier **16**;

contact operating means including a magnetic actuator **17** for driving the movable contact carrier to its closed position and a spring **18** for returning the contact carrier to its open position;

an assembly including for each external wire a terminal **20** mounted on stationary part **11**, a fixed contact **21** mounted on cover **12**, and a plug in connector having a cover part **22** that also forms a support for an associated fixed contact **21** and having a part **23** mounted on stationary housing part **11** and electrically connected to an associated terminal **20**.

The housing stationary part.—As FIGS. 1, 3 and 7 show, the housing stationary part **11** is generally box shaped with top and bottom walls **26, 27**, two side walls **28, 29**, a back wall **30**, and an open front. A plate **31** is attached along the outside surface of back wall **30** by suitable means such as screws and is provided with holes **32** for mounting against a surface such as the flat vertical wall of a switch enclosure. Within its walls **26, 27, 28, 29, 30** housing part **11** is generally open to receive movable contact assembly **13**, magnetic actuator **17**, and parts of cover **12**. Preferably, back wall **30** is partly open for ventilation. Aside from its generally boxlike shape, stationary housing part **11** is shaped to have surfaces for supporting other parts of the contactor; these elements of stationary part **11** will be described briefly in this section and will be described further in the description of the associated components.

Along its top front edge and its bottom front edge, stationary part **11** has a region **35** that is shaped to support and insulate terminal **20** and plug in connector **23**. For each terminal **20**, housing part **11** has three communicating openings, a front facing opening **36** adapted to receive a screw **37** for retaining a terminal **20**, an outside facing opening **38** adapted to receive fixed terminal **20**, and an inwardly facing opening **39** for plug in connector part **23**.

In each terminal region **35**, stationary housing part **11** has a threaded opening **40** that receives a screw (not shown) for attaching the cover to part **11** of the housing.

Along side walls **28, 29** between the terminal regions **35** housing **11** is cut back to about the frontwardmost point of travel of movable contact carrier **16**. In this region the housing has a cut out portion **41** that defines parallel guide surfaces **42** that the outer ends of movable contact carrier **16** ride in.

Each side wall **28, 29** is also provided with two openings **43** located to provide access for control wiring (not shown) to magnetic actuator **17**.

The movable contact assembly.—As FIG. 5 shows, the contactor has three movable contacts **14** that are mounted on bar **15** to electrically bridge an associated pair of fixed contacts **21**. Movable contact carrier **16** is adapted to hold the three movable contacts and to be driven frontwards by actuator **17** and backwards by spring **18**. Carrier **16** extends from side to side **28, 29** and has its ends shaped to ride along guide surfaces **42** of stationary housing part **11**; it has means **45** that center carrier **16** on a movable bracket **46** of magnetic actuator **17**. (Spring

18 holds carrier 16 against bracket 46.) Carrier 16 is shaped to have for each movable contact 14 a window 47 defined by a frame 48 in which a movable contact is retained by means of a spring 49. The window structure provides lost motion for movable contacts 14 to seat properly against fixed contacts 21 when the contactor is closed. Individual frames 48 are separated by a space 50 into which an insulating barrier 51 extends from cover 12.

The actuator.—Magnetic actuator 17 (FIGS. 1 and 3) comprises a stationary laminated core element 53, a movable laminated core element 54, and a coil 55 that is positioned to excite the core to move the movable element 54 frontwards toward the stationary element. Coil 55 is generally rectangular as seen in the front view of FIG. 3. It has two terminals 56 positioned on one side to be aligned with openings 43 in side walls 28, 29 so that the external control wiring can be attached to coil 55 from either side of the contactor housing. The opposite side of coil 55 has projections 57 that fit between surfaces 58 and 59 formed on housing stationary part 11 that cooperate with other elements described later to hold coil 55 aligned. The back surface 60 of coil 55 rests against vertically extending surfaces 61 formed in housing stationary part 11. As FIG. 1 shows, coil 55 is provided with a window 62 and top and bottom cut out portions 63 for receiving legs 64 of core elements 53, 54. Stationary core element 53 is positionable in housing part 11 with its side surfaces partly adjacent surfaces 65 found in housing part 11.

Movable core element 54 is positioned to ride between surfaces 65 of housing part 11, and it is connected by means of bracket 46 to transmit its frontward motion to movable carrier 15. Bracket 46 is generally U-shaped and is positioned with its sides extending along the center leg of core parts 53, 54 and its bight frontwards and located between centering and locating means 45 of movable contact carrier 16. The backwardly extending open ends of bracket 46 are positioned between hooks 52 formed on core part 54 and connected to movable core part 54 by means of a pin 66 extending from side to side through movable core element 55 and a removable clip 67 locking bracket 46 to pin 66. The back surface of coil 55 has a cut out portion shown in FIG. 1 that part of pin 66 extends frontwards into when the contactor is closed.

When the contactor is assembled, surfaces 68 on removable cover 12 bear against the front surface 69 of stationary core element 53 to hold the stationary core element and the coil 55 in their assembled position. When cover 12 is removed, magnetic actuator 17 and movable contact assembly 13 can be lifted out of the housing stationary part 11.

The removable cover.—Removable cover 12 is shaped to fit over the open front of stationary housing part 11 and to form a seal between the adjoining surfaces of the two parts 11, 12. It includes a generally flat rectangular front part 75 that has projections 76 at its top and bottom provided with holes 77 through which the cover is screwed to the stationary housing part. Removable cover 12 has sides 78 that extend into the cut out regions of the sides 28, 29 of stationary part 11. Cover sides 78 are provided with ledges 80 that fit into grooves 81 of stationary part 11 to form a seal.

Sides 78 also carry a part 82 provided with a frontwardly extending hole for holding return spring 18.

Cover 12 is also shaped to cooperate with stationary part 11 to form a barrier between each of the three phases. It has two parts 51 that extend into stationary part 11 to a point just forward of the front surface 69 of stationary core part 53. As has already been explained, a projection 68 on part 51 bears against stationary core part 53 to hold magnetic actuator 17 in position. Barriers 51 have cut out portions 83 shown in FIG. 1 and FIG. 6 that movable contact carrier 16 moves within. Inwardly facing surfaces 84 of barriers 51 fit closely alongside movable contact carrier 15.

Sides 78 and barriers 51 are also shaped to have surfaces 85 that define a four cornered frontwardly extending slot that U-shaped arc chutes 86 (described later) fit into.

The terminal and fixed contact assembly.—FIG. 4 shows the terminal and fixed contact assembly and the movable contacts 14 with all the other parts of the contactor removed. Some of the elements of the terminal and fixed contact assembly have already been described in the introduction and in the description of other parts of the contactor: stationary contact 21 and its associated part 22 of the plug in device are mounted on removable cover 12, and the terminal 20 and its associated part 23 of the plug in connector are mounted in the openings formed in region 35 of housing stationary part 11. Each cover plug in part 22 is provided with a hole for receiving a screw 102 (FIGS. 1, 2 and 6) that secures contact 21 and plug in part 22 to removable cover 12.

Fixed terminals 20 are generally tubular and has the appropriate inside cross sectional area to receive external wires and to receive a connecting fastening part 103 of plug in part 23. Preferably, as FIG. 4 shows, fixed terminal 20 is formed by bending a strip of conductive metal into an overlapped shape that is generally rectangular except that it is somewhat rounded along one side to correspond to the shape of the external wires. Terminal 20 is provided with a threaded opening for receiving screw 37 (FIGS. 3 and 7); screw 37 secures the external wire inside the terminal, secures the terminal to attaching part 103 of the plug in device, and secures fixed terminal 20 to stationary housing part 11. Terminal 20 may be provided with a second threaded opening for receiving a screw 104 for attaching smaller auxiliary wiring to the fixed terminal.

The stationary part 23 of the connector is made integral with the part 103 already mentioned and it is shaped with two contact making parts that are like well known fuse clips.

Part 103 is made long enough to extend through terminal 20 and slightly outward from terminal 20 where it is provided with two outer projecting lugs 110 that engage the outer edge of terminal 20 when the assembly is in place. Corresponding inner lugs 111 are located on part 103 to engage the inner edges of terminal 20. Thus, when parts 20 and 23 are assembled in the position of FIG. 4, the force of screw 37 on the external wire holds parts 20, 23 securely together; the screw 37 also prevents the assembly from rotating about the axis of terminal 20.

Connector part 103 is provided with a stop 112 located to prevent an external wire from being pushed into terminal 20 beyond about its inner end.

The housing part 11 is shaped so that fastening part 103 and terminal 20 can be fit together with terminal 20 locked between the inner and outer lugs 110, 111 as FIG. 4 shows. As FIG. 7 shows, opening 38 is shaped to permit fixed terminal part 20 to be rotated slightly so it can be slipped over part 103 past the outer projecting lugs 110. Opening 38 has surfaces 113, 114 with which the terminal 20 is aligned loosely by screw 37 as FIG. 7 shows. Opening 38 also has surfaces 115, 116 that permit part 20 to be rotated (clockwise as shown in FIG. 7) and then positioned in opening 38.

As FIGS. 1, 2 and 6 show, metal U-shaped arc chutes 86 are positioned in cover 12. Arc chutes 86 help to propel the arc outwards from contacts 14, 21 and help to cool and deionize the arc medium.

Other embodiments.—The specific contactor that has been described in detail has its movable contacts and its fixed contacts each positioned in separate housing parts in such a way that all of the contact surfaces can be seen easily when the two parts are separated. The fixed terminals are mounted on the same housing parts as the mova-

ble contacts and they are electrically connected to their associated fixed terminals through a plug in connector. From this standpoint the housing **11, 12** functions primarily as a two part support for the contacts **14, 21** and other elements and only incidently as a housing enclosure. Those skilled in the art will find various arrangements of the contactor supporting structure for achieving this relationship between the movable contacts, the terminals, and the fixed contacts.

The specific contactor housing that has been described provides this relationship very satisfactorily and it provides features of its own that have already been pointed out. Both the contact and terminal structure and the housing and the actuator structure may be modified within the spirit of the invention and the scope of the claims as will be apparent to those skilled in the art.

Having now particularly described and ascertained the nature of our said invention and the manner in which it is to be performed, we declare that what we claim is:

1. A contactor comprising

an insulating support comprising a stationary part and a removable part,

a pair of terminals mounted on said stationary part and adapted to receive external wires,

a pair of fixed contacts mounted on said removable part,

a movable contact assembly positioned within said stationary part of said support,

means mounted on said stationary part for moving said movable contact assembly toward said removable part to conductively connect said pair of fixed contacts and away from said removable part to disconnect said fixed contacts, and

means for conductively connecting each said fixed contact to an associated terminal, said means being mounted on said removable part for disconnection from said terminals when said removable part is separated from said stationary part.

2. A contactor according to claim **1** in which said means for connecting a fixed contact to a terminal comprises a connector having one part mounted on said removable support part and conductively connected to the associated fixed contact and a second part mounted on said stationary part and conductively connected to the associated terminal.

3. A contactor according to claim **2** in which said stationary connector parts are mounted on said stationary support to be on opposite sides of said movable contact assembly and each said removable connector part is mounted on said removable support part outward of its associated fixed contact.

4. A contactor according to claim **2** in which said terminals are mounted on opposite sides of said movable contact assembly whereby the view of the movable contacts when said removable support is removed is not obstructed by the external wiring.

5. A contactor according to claim **2** in which said stationary connector parts and said terminals are mounted on opposite sides of said movable contact assembly whereby the view of said movable contacts when said removable support is removed is not obstructed by the external wiring or by said connector.

6. A contactor according to claim **4** in which said removable support part has a substantially flat portion and said removable connector part comprises a generally rectangular flat conductive bar mounted on said removable support part flat portion to extend in the direction that opposed terminals are spaced apart, and said fixed contact comprises a region of contact making material formed on the inner end of said bar.

7. A contactor according to claim **6** in which each said stationary connector part comprises a clip adapted to engage the outer end of the associated bar when said removable support part is mounted on said stationary support part.

8. A contactor according to claim **1** in which said stationary support comprises a generally box shaped insulating housing with a top wall, a bottom wall, two opposite side walls and an open front and said removable part comprises a cover for said open front.

9. A contactor according to claim **8** in which said stationary housing has oppositely and outwardly facing openings on two opposite of said walls near the front of the contactor, each of said openings being adapted to receive one of said terminals whereby external wires can be attached to said terminals without obstructing removal of said cover or inspection and maintenance of said movable contact assembly.

10. A contactor according to claim **9** in which each said terminal comprises a tubular conductive member adapted to receive a wire and each said terminal has a hole in one wall for receiving a screw, and said housing has screw receiving openings each communicating with an associated terminal receiving opening whereby each said screw retains its associated terminal in its terminal receiving opening.

11. A contactor according to claim **10** in which each said screw is adapted to be tightened against an external wire positioned in its associated terminal.

12. A contactor according to claim **10** in which said stationary housing has inwardly facing openings each communicating with an individual associated terminal receiving opening and each said connector stationary part includes a fastening part adapted to fit inside said tubular terminal closely along the side wall of said terminal opposite said screw and having inner and outer lugs positioned to engage the inner and outer edges of said terminal to retain said terminal in said opening, said outward housing opening being shaped to permit tilting said terminal to fit onto said fastening part over said outer lugs to assemble said terminal and stationary connector part.

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