

Sept. 29, 1953

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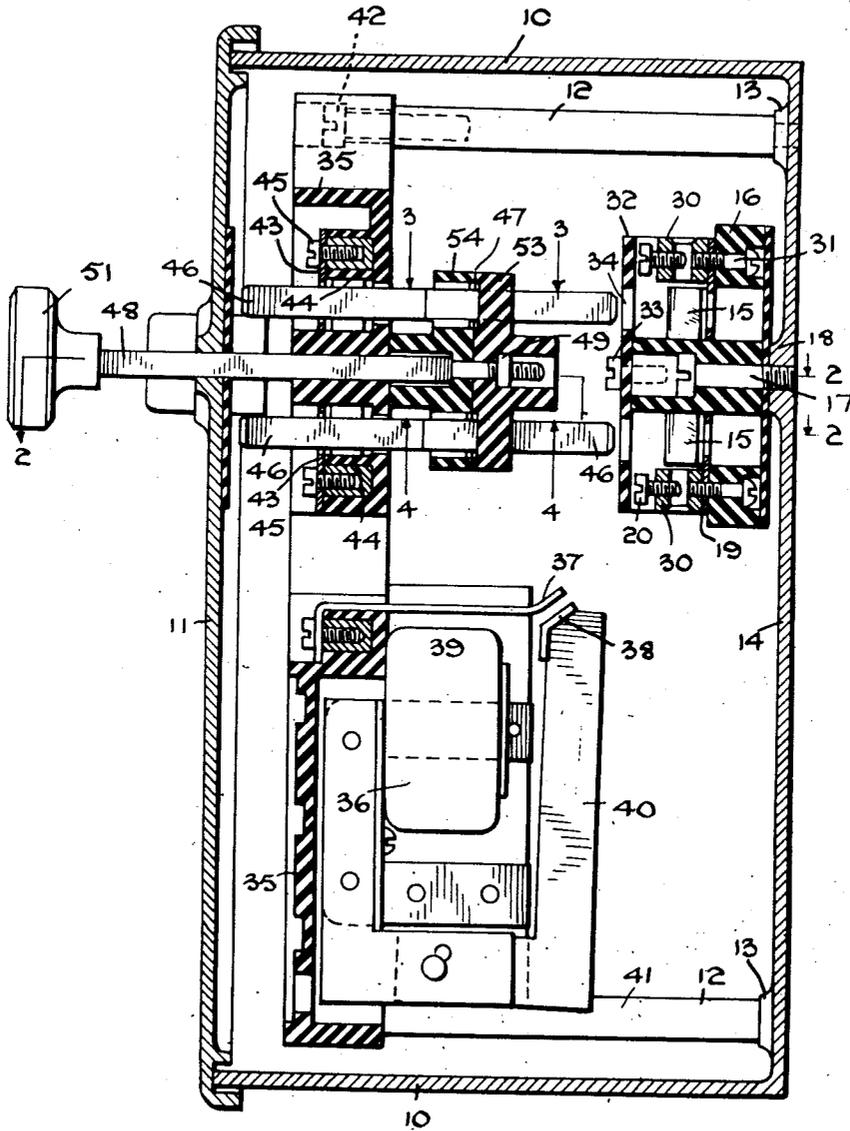
2,654,055

LOW TENSION ELECTRIC SWITCHGEAR

Filed Dec. 29, 1948

3 Sheets-Sheet 1

FIG. 1.



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3 Sheets-Sheet 2

FIG. 2.

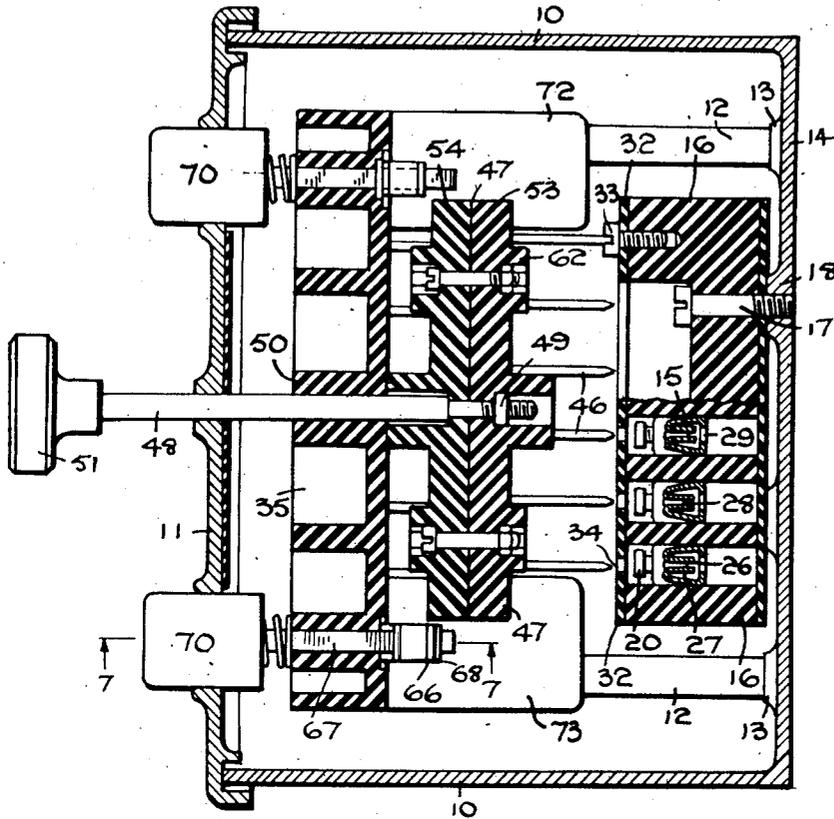


FIG. 3.

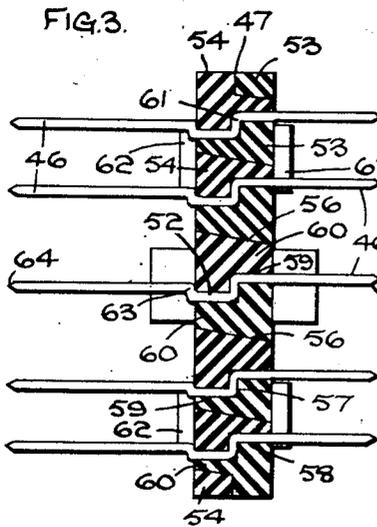
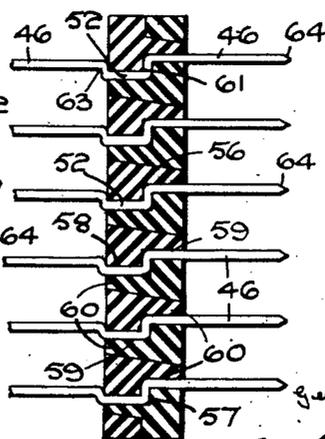


FIG. 4.



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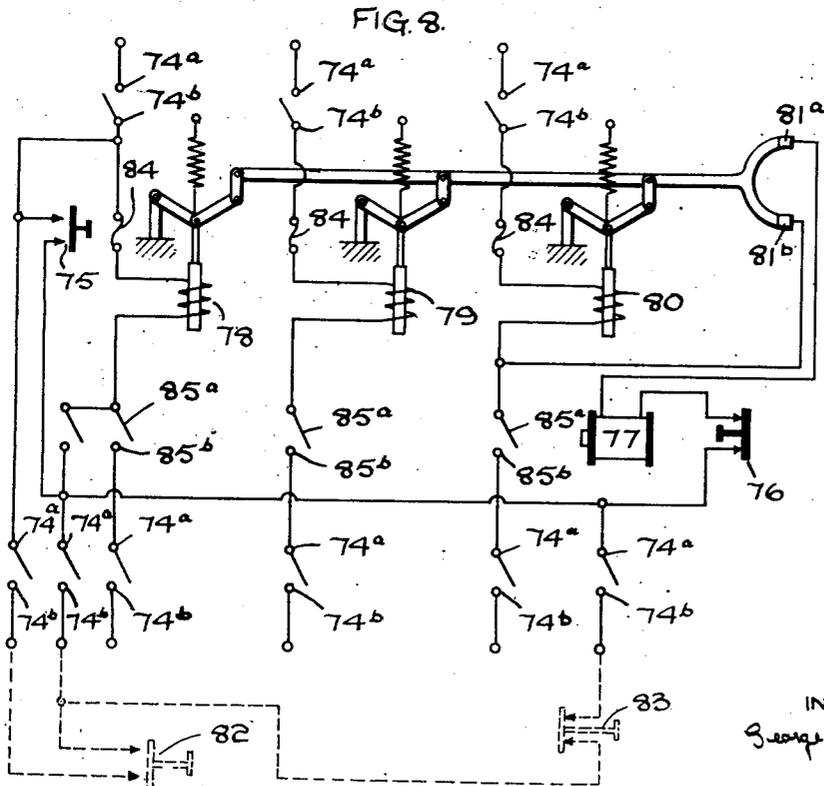
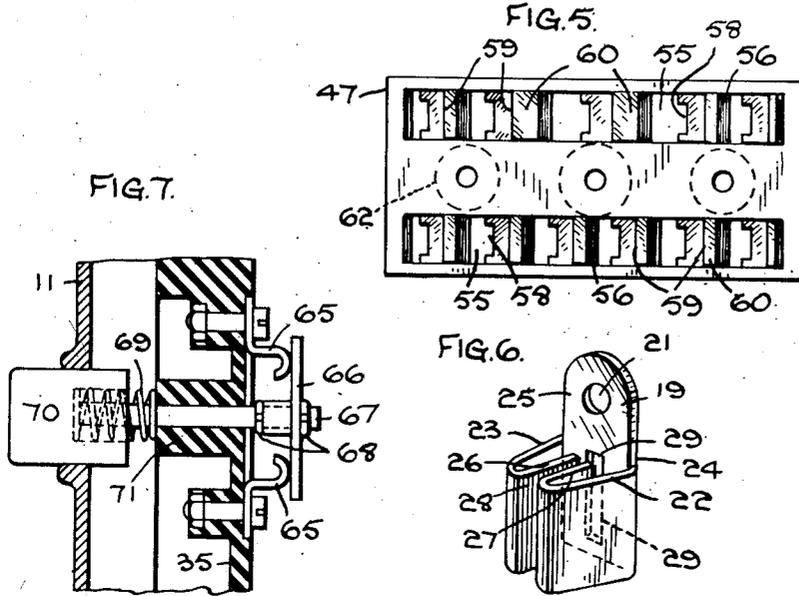
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LOW TENSION ELECTRIC SWITCHGEAR

Filed Dec. 29, 1948.

3 Sheets-Sheet 3



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2,654,055

LOW TENSION ELECTRIC SWITCHGEAR

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Application December 29, 1948, Serial No. 67,819
In Great Britain January 7, 1948

4 Claims. (Cl. 317-112)

1

This invention relates to electric switch gear and refers to switch gear which is of the low tension type.

In my copending application Serial No. 41,322, filed on July 29, 1948, and granted under Number 2,544,761, there is described a low tension electric switch which includes a contactor assembly having fixed and moving contacts carried upon a supporting member which is provided with projecting contact members slidably engaging fixed contact elements in the switch casing to which the mains and other external leads are connected, so that in the event of failure of the contactor assembly the supporting member can be slid out of the casing as a single unit and replaced by a further similar unit without the necessity of effecting isolation of the contactor assembly from the mains.

The object of the present invention is to provide means whereby the electrically conducting parts carried by the supporting member can be isolated from the mains or other external live circuit prior to the withdrawal of the supporting member from the casing.

With this object in view there are provided in accordance with the present invention conductor members supported in a movable carrier and having electrical contact with fixed contact elements in the case of the switch, hereinafter referred to for convenience as "primary contact elements," and also having electrical contact with contact elements fixed to the supporting member, these being hereinafter designated "secondary contact elements," the carrier being movable between an operative position in which the conductor members each bridge a primary contact element and an associated secondary contact element, and an isolating position in which each conductor member is disconnected from its associated primary contact element. The secondary contact elements have electrical connection with the contactor assembly carried by the supporting member, and the primary contact elements are connected electrically to suitable terminal devices adapted to receive mains, leads and connections to an external circuit, in which the switch is required to operate.

A further object of the present invention is the provision of a construction of carrier especially suited to the function which it performs and which is at the same time convenient and inexpensive to manufacture.

It is thus an object of the invention to provide the carrier in multi-part form, for example two parts each of which are identical, and can

2

hence be produced by moulding in the same mould and which are capable of being fitted together so as to clamp the conductor members fixedly in position in the assembled carrier.

A further object of the present invention is to guard against the exposure of parts of the switch which remain "live" after the carrier has been moved to the isolating position and the interior of the switch is exposed by withdrawal of the supporting member.

A further object of the invention is the elimination of the necessity for providing flexible conductors to provide electrical connection between the conductor members of the carrier and fixed electrical contact elements on the supporting member.

A further object of the invention is the provision of a single replaceable unit on which there is carried a solenoid-operated contactor assembly controlling pushbutton switches therefor and an overload release device and fuses.

Other objects and advantages of the invention will be pointed out or will be apparent from the description which follows and from the claims.

One embodiment of the present invention is illustrated in the accompanying drawings, wherein:

Figure 1 shows in side elevation a sectional view of an electric switch constructed in accordance with the present invention;

Figure 2 is a plan view of the same construction shown in section on the line 2-2 of Figure 1;

Figure 3 is a fragmentary view showing in plan and in section on the line 3-3 of Figure 1 the movable carrier with the conductor members fixed in position therein;

Figure 4 is a view similar to that shown in Figure 3 but sectioned on the line 4-4 of Figure 1;

Figure 5 is a view of one of two like parts constituting the body of the carrier and viewed in end elevation from the front of the switch, the part illustrated being the rearmost part of the carrier with the conductor elements removed;

Figure 6 is a perspective view showing the construction of one of the primary or secondary contact elements;

Figure 7 is a fragmentary view in side elevation and in section on the line 7-7 of Figure 2 showing one of the pushbuttons controlling the operation of the contact assembly; and

Figure 8 is a circuit diagram showing how a switch of the type illustrated is applied to the

control of an appliance fed from three-phase A. C. mains.

In the construction shown in the drawings the outer case 10 of the switch is of box formation and is provided with a removable cover 11 which may be secured to the remainder of the casing in any suitable manner.

In the interior of the case there is provided a plurality of guide bars 12, for example four in number, in the form of rods secured in bosses 13 in the wall 14 of the case, which lies opposite the cover. The rods extend outwardly from the wall 14 of the case and lie adjacent the remaining walls of the case, preferably in the corners thereof.

Primary contact elements 15, Figure 2, are carried upon a mounting member 16 of insulating material secured by means of screws 17 passing into threaded bosses 18 on the internal face of the wall 14 of the case.

The primary contact elements 15, seen in detail in Figure 6, are each provided with at least one contact face lying in a plane approximately at right angles to the plane of the wall 14 and the removable cover 11, this contact face being yieldable to pressure against it so as to provide spring-pressed wiping contact with a cooperating conductor member adapted to be moved across said face in contact with it from the direction of the cover, as when the carrier is advanced towards the primary contact elements.

Preferably each primary contact element comprises an attachment plate adapted to be secured to the mounting member 16 by means of a screw passing through the opening 21 in the attachment plate. The primary contact element further comprises a pair of contact portions formed integrally with the attachment plate comprising a pair of lugs 22 and 23 extending at right angles or approximately so to the plane of the attachment plate from opposite edges 24 and 25 thereof and having contact faces 26 and 27, Figure 2, lying closely adjacent and directed towards each other formed by folding the ends of the lugs over so that their inner free ends lie near the central portion of the attachment plate.

A passage way 28, Figure 2, exists between the contact faces 26 and 27, and in the attachment plate there is provided an opening 29 in register with this passageway to permit a conductor member to be passed through the passageway, thus making contact with the faces 26 and 27, the leading end of the conductor member extending through the opening 29 if necessary.

Each of the primary contact elements is connected electrically to a suitable terminal block 30 having a set screw 20 for securing a mains lead or lead to another external circuit, the terminal block itself being secured to the mounting member by a screw 31 with the attachment plate 19 of an associated primary contact element clamped between the terminal block and the mounting member. The terminal blocks, together with the primary contact elements, are housed in recesses in the mounting member, as seen in Figure 1, and a cover plate 32 is secured detachably by means of screws, such as that seen at 33, to the face of the mounting member which is exposed when the remaining parts of the switch are removed, this cover plate serving to prevent access to the terminal block and the primary contact elements, some of which may remain "live" after the removal of the remaining parts of the switch.

A series of small openings 34 are provided in the cover plate in register with the passageways 28 between the contact faces of the primary contact elements, so that conductor members can pass through these openings into the passageways. The openings are however not sufficiently large for there to be any appreciable danger of making accidental contact with "live" contact elements when removing or replacing parts of the switch.

Within the case of the switch there is provided a supporting member comprising a plate 35 of insulating material which carries a contactor assembly, indicated generally at 36, including cooperating fixed, 37, and moving, 38, contacts actuated by means of a solenoid 39 and cooperating armature 40, all of conventional construction.

The supporting member 35 is detachable from the case and is mounted on the guide bars 12 and positioned with the contactor assembly housed within the case, the inner face of the supporting member abutting against means provided within the case for this purpose in the form of distance pieces 41 or sleeves mounted on the guide bars.

When it is desired to remove the supporting member for replacement or maintenance purposes the carrier is moved to the isolating position, the cover is removed, and the screws 42 are removed to release the supporting member comprising the plate 35.

The plate 35 has fixed thereto secondary contact elements, as seen at 43, Figure 1, positioned opposite the primary contact element 15, a secondary contact element being in register with each primary contact element, and being constructed in a like form. The secondary contact elements are housed in recesses 44 in the plate 35 and are secured thereto by means of screws 45 screwing into metallic inserts inserted into the plate 35 during moulding of the latter.

The conductor members already referred to comprise bars 46 fixedly supported in a carrier 47, and arranged parallel to each other, mounted within the case and adapted to be moved between operative and isolating positions. In the operative position the conductor members 46 each bridge electrically a primary and a secondary contact element, and in the isolating position each conductor member 46 being disconnected from its associated primary contact element whilst remaining continuously in contact with its associated secondary contact element.

In the arrangement shown the carrier 47 is guided for rectilinear movement towards and away from the primary contact element in a direction perpendicular to the cover by means of a stem 48 one end of which is secured to the carrier by means of a nut 49 screwing onto a threaded end portion passing through an opening in the carrier, the stem engaging with the walls of a guide opening 50 in the supporting member or plate 35, movement of the carrier being effected between its operative and isolating positions by means such as a handle or knob 51 secured to the part of the stem which projects externally of the case through an opening in the cover.

Each of the conductor members 46 is in the form of a bar constructed of strip metal and is provided with abutment means in the form of a stepped portion 52 at the position in which the bar is secured in the carrier, each of the con-

5

ductor bars projecting from the carrier on both sides thereof, as seen in Figures 3 and 4.

In the construction shown two banks of conductor bars 46 are provided, an upper and a lower, the former being utilised, for example, to effect connection from the mains to the contact assembly, and the latter to effect connection from the contact assembly to the circuit of an external device, such as an electric motor for which the switch serves as a controller or starter.

The abutment means on the conductor bars 46 coact with shouldered clamping means in the carrier so that in the backward and forward rectilinear movement of the carrier the conductor bars are held positively and are prevented from any sliding movement in relation to the carrier.

Preferably, and as shown in the drawings, the carrier comprises a two-part structure in which each part has openings and projections so that the two parts may be fitted together with the projections of one part engaging in the openings of the other part so as to define a stepped passageway between the two parts for receiving the stepped portion of the conductor bars.

Referring particularly to Figures 3 and 4, one of the parts of the carrier is seen at 53 and the other part at 54. Referring in detail to one of the parts, as seen in end elevation in Figure 5, the openings 55 extending through it have one side wall inclined, as seen at 56, Figures 3 and 4, to the general longitudinal direction of the conductor bars, and an oppositely-disposed side wall of stepped formation having an abutment shoulder 57 lying in a plane at right angles to the length of the conductor bars and positioned midway along the opening. The shape of the opening within the main body of the carrier part, as seen at 58, is recessed in the stepped side wall to a depth equal to the thickness of the conductor bar, so that along this portion of the stepped side wall the conductor bar lies flush with the walls of the opening. On the shouldered portion 57 of the stepped side wall the recess is continued but is here of a depth equal to half the thickness of the conductor bar, and for the remaining part of the opening along the stepped side wall at 58 of the projecting part 53 there is no recess so that the conductor bar stands out from this part of the side wall.

It will thus be seen that the central transverse portions 61 of the conductor bar lie partly in a recess in the part 53 of the carrier and partly in a recess in the part 54 of the carrier. On one side of this transverse portion the conductor bar lies wholly within a recess in the part 53 and on the other side wholly within a recess in the part 54, the two parts of the carrier being clamped together by screws passing through openings in the bosses 62, the cooperating inclined side walls 56 of the two parts ensuring that tightening of the clamping screws holds the conductor bars rigidly in the body of the carrier.

Each conductor bar is provided with a further smaller transverse portion 63 the face of which abuts against the outer face of the carrier nearest the secondary contact elements, and it will be apparent that since these transverse portions 63 and 61 are of different lengths the stepped portion 61 is longer than the stepped portion 63 so that the correct stepped portion can readily be identified for placing between the two clamped parts of the carrier when assembling.

Both ends of the conductor members 46 are preferably somewhat chamfered along their

6

lateral faces, as seen at 64, to permit these ends to pass readily into the passageway between the contact faces of the contact elements whilst forcing these faces apart and maintaining good electrical contact between the contact elements and the conductor bars due to the resilient nature of the metal from which the contact elements are constructed.

In Figure 7 there is shown the details of construction of one of the pushbutton switches by means of which the solenoid actuating the contactor assembly can be energised and de-energised to close and open respectively the contacts of the contactor assembly. The pushbutton switch comprises a pair of terminal contacts 65 fixed to the plate 35, which in the case of the pushbutton switch illustrated are bridged by a conducting plate 66 secured in position on the pushbutton stem 67 by means of circular clips 68.

A coiled compression spring 69 acting between the underside of the pushbutton 70 and the forward face of a mounting boss 71 in the plate 35 ensures that the plate 66 remains in contact with the contact 65 except when the pushbutton is depressed. The pushbutton stem 67 is of non-circular, for example rectangular, cross section to prevent rotation of the plate 66 out of engagement with the associated contact 65, and the pushbutton 70 projects through a suitable opening in the cover 11 so as to be accessible from outside the case.

On one side of the contactor assembly 36, and also carried from the supporting member or plate 35, are provided suitable fuses in the leads connecting the contactor assembly to the secondary contact elements, these fuses being housed under a cover shown at 72, and on the other side another cover 73 houses an overload release device of any suitable type, preferably of the type described in my pending patent application Serial No. 41,321, filed July 29, 1948, and granted under Number 2,532,172.

For the sake of clarity in the drawings the leads connecting the secondary contact elements on the supporting member or plate 35 with the contactor assembly have been omitted, but in Figure 8 there is shown a circuit diagram illustrating a suitable arrangement for such connections when the switch is applied to the control of a device such as a three-phase induction motor supplied with power from three-phase A. C. mains.

In this diagram the primary contact elements and the associated ends of the conductor bars are designated by the reference numerals 74a and 74b. The "on" and "off" pushbuttons are shown at 75 and 76, the latter being the pushbutton shown in detail in Figure 7, the contactor solenoid at 77, and the overload release device being indicated by current-responsive means in each of the mains leads within the switch at 78, 79 and 80, any of which serve to break overload contacts 81a and 81b.

If instead of pushbutton switches 75 and 76 it is required to actuate the switch at remote points, a plurality of sets of remote control pushbutton switches may be provided in addition to the pushbutton switches 75 and 76, each arranged as indicated by the dotted lines, Figure 8, wherein a single set of such remote pushbutton switches is indicated at 82 and 83.

Since connection between the conductor bars and the secondary contact elements is continuous except when the switch is taken apart and

the carrier removed from the supporting member, the sliding connection between the conductor bars and the secondary contact elements is not indicated in any way on the circuit diagram.

It will however be understood that on the circuit diagram these points of sliding connection would occur between the conductor bars, indicated at 74b in the upper part of the diagram, and the fuses 84 on the one hand, and also between the contacts 85b of the contactor assembly and the conductor bars 74a in the lower part of the diagram.

In describing the nature of the invention and in the claims which follow it is to be understood that the term "low tension" as used in relation to switch gear means switch gear suitable for use up to a maximum voltage of 600 volts.

Although a single embodiment of the invention has been described, it will be understood that changes may be made in the construction and arrangement of parts without departing from the scope of the invention which is defined in the claims.

What I claim then is:

1. In a low tension electric switch of the kind in which a contactor assembly carried upon a supporting member detachably secured within the case forms the normal make and break means of the switch but is capable of isolation from terminals on the switch; the provision of means for effecting isolation and establishing electrical continuity between said contactor assembly and said terminals, comprising primary contact elements fixed within said case and connected electrically to said terminals, secondary contact elements on said supporting member, which elements are connected electrically to said contactor assembly, and a carrier of insulating material interposed between said primary contact elements and said secondary contact elements and having fixedly mounted therein a set of conductor members for guiding and supporting said carrier for movement between operative and isolating positions, said means including a member projecting through said supporting member and extending externally of said case to enable said carrier to be moved by manual operation of said member, and said conductor elements coacting with said primary and secondary contact elements to bridge same in the operative position of said carrier and being removed from said primary contact elements in the isolating position of the carrier.

2. In a low tension electric switch of the kind in which a contactor assembly carried upon a supporting member detachably secured within the case forms the normal make and break means of the switch but is capable of isolation from terminals on the switch; the provision of means for effecting isolation and establishing electrical continuity between said contactor assembly and said terminals, comprising primary contact elements fixed within said case and connected electrically to said terminals, secondary contact elements on said supporting member which elements are connected electrically to said contactor assembly, and a carrier of insulating material interposed between said primary contact elements and said secondary contact elements, and having fixedly mounted therein a set of conductor members, said carrier engaging and supporting said conductor elements in fixed

parallel relationship with each other at a location intermediate their ends, a guiding operating member fixed to said carrier parallel to said conductor elements, this member extending slidably through said supporting member and projecting externally of said case to enable said carrier to be moved by manual operation of said member, and said conductor elements coacting with said primary and secondary contact elements to bridge same in the operative position of said carrier and being removed from said primary contact elements in the isolating position of the carrier.

3. In a low tension electric switch of the kind in which a contactor assembly carried upon a supporting member detachably secured within the case forms the normal make and break means of the switch but is capable of isolation from terminals on the switch; the provision of means for effecting isolation and establishing electrical continuity between said contactor assembly and said terminals, comprising primary contact elements fixed within said case and connected electrically to said terminals, secondary contact elements on said supporting member, which elements are connected electrically to said contactor assembly, and a carrier of insulating material interposed between said primary contact elements and said secondary contact elements and having fixedly mounted therein a set of conductor bars in parallel relationship with each other, said carrier comprising a two-part clamping structure including shoulders coacting with abutment means on said conductor bars and engaging and supporting same at a location intermediate their ends, a guiding operating member fixed to said carrier parallel to said bars, this member extending slidably through said supporting member and projecting externally of said case to enable said carrier to be moved by manual operation of said member, and said conductor elements coacting with said primary and secondary contact elements to bridge same in the operative position of said carrier and being removed from said primary contact elements in the isolating position of the carrier.

4. In a low tension electric switch of the kind in which a contactor assembly carried upon a supporting member detachably secured within the case forms the normal make and break means of the switch but is capable of isolation from terminals on the switch; the provision of means for effecting isolation and establishing electrical continuity between said contactor assembly and said terminals, comprising primary contact elements fixed within said case and connected electrically to said terminals, secondary contact elements on said supporting member, which elements are connected electrically to said contactor assembly, and a carrier of insulating material interposed between said primary contact elements and said secondary contact elements, and having fixedly mounted therein a set of conductor bars each formed of strip metal and having a stepped portion intermediate its ends, said carrier comprising a two-part structure of which the separate parts define in cooperation stepped passageways coacting with the stepped portions of said bars to secure same against endwise displacement relative to the carrier and in fixed parallel relation to each other, a guiding operating member fixed to said carrier parallel to said bars, this member extending slidably through said supporting member and projecting externally of said case to enable said carrier to be moved by manual oper-

ation of said member, and said conductor elements coating with said primary and secondary contact elements to bridge same in the operative position of said carrier and being removed from said primary contact elements in the isolating position of the carrier.

Number
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