PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in or relating to Electric Switchgear and Fuses

We, EGA ELECTRIC LIMITED, a British Company, of Holyhead Road, Wednesbury, in the County of Stafford (formerly Electrical and General Accessories (Leicester) Limited), and GEORGE KILMINSTER, a British Subject, of the Company's address, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to electric switch gear of the low tension and relatively low rupturing type ~~to which~~ whether the purpose of clearly defining the scope of the invention will be defined as switch gear suitable for use on voltages up to 600 volts and for rupturing currents up to 100 amperes.

In constructions hitherto employed there is provided in such units one or more removable fuse holders which are provided with projecting connectors for plugging into suitable sockets or equivalent elements on the base of the unit, one or one set of such sockets or equivalent elements being permanently connected to one or a corresponding set of fixed contacts in the switch. Further, separate holders are employed for each fuse.

The object of the present invention is to provide a new or improved construction.

According to the present invention we provide a combined switch and fuse unit of the kind in which the or each fuse comprises a body portion removable from and replacable in the unit, an expendable fuse element replacably mounted in the body portion and connectors attached to the body portion each connector being in electrical contact with the fuse element, characterised in that in the assembled position of the fuse holder or holders a connector of the or each fuse holder co-acts directly with a movable make and break conductor element of the switch so as to form one of the fixed contacts thereof, the contact between the or each connector and the corresponding conductor element being maintained by the innate resilience of one of these members.

Preferably, according to a further aspect of the invention a combined switch and fuse unit is provided with a single removable fuse holder adapted to carry a plurality of expendable fuse elements and having a set of connectors for some or all of its respective fuse elements which connectors are secured to the fuse holder body and form a permanent part thereof, and in the assembled position of the fuse holder body co-act directly with respective movable make and break conductor elements of the switch so as to form one set of fixed contacts thereof, the contact between each conductor element and the corresponding connector being maintained by the inate resilience of one of these members.

The invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a view in front elevation of one construction of combined switch and fuse unit in accordance with the present invention and suitable for use as the main isolating switch for a domestic electric lighting circuit.

Figure 2 is a view in front elevation of the same construction with the fuse holder and cover removed.

Figure 3 is an enlarged view of the same construction in cross section on the line 3—3 of Figure 1.

Figure 4 is a view of the same construction in cross section on the line 4—4 of Figure 1.

Figure 5 is a view in front elevation of another construction of combined switch and fuse unit in accordance with the present invention.

Figure 6 is a view of the construction

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shown in cross section on the line 6—6 thereof.

Figure 7 is a similar view but taken on the line 7—7 of Figure 5.

Figure 8 is a view in front elevation of a combined switch and fuse unit adapted for use on three phase A.C. mains and housed in a metal cover.

Figure 9 is a view of the construction shown in Figure 8 in cross section on the line 9—9 thereof and

Figure 10 is an end view of the spindle employed in the construction shown in Figure 8 showing the engagement of the switch operating member therewith and the manner in which this retains the cover against removal whilst the switch is in the made position.

Referring firstly to the construction illustrated in Figures 1 to 4, the combined switch and fuse unit comprises a body or base member 10, which is recessed to accommodate the working parts of the switch and also the projecting portions of a removable fuse holder 11, which, when in position, covers the upper part of the body or base member 10, the lower portion of which is covered by a cover plate 12.

The body or base member 10 is formed of suitable insulating material, for example, a ceramic, and is of generally rectangular formation. One face of the block has recessed portions located in the view shown in Figures 1 and 2 in the upper part of the block for the accommodation of the projecting portion 15 of the removable fuse holder 11, and for the connectors 13 co-operating with projecting blade-like projectors 14 extending from the fuse holder.

An adjacent portion of the aforesaid face of the block is recessed to accommodate a rotary spindle 16 carrying resilient clipped-on conductor elements or movable contacts 17 and also to accommodate fixed contacts 18 connected electrically to switch terminals 19 to which the incoming mains may be connected.

A single fuse holder 11 is employed comprising a main base or body portion 20 from which projects inwardly towards the base or body portion of the switch a pair of projections 15 whose upper and lower edges 21 and 22 taper towards each other and are connected by a short portion 23 at their extremity. This portion is grooved as indicated at 24 to form a seating or cradle for a length of fuse wire extending over the edges 21, 22 and 23 of the projections 15.

The upper connectors 14, the bases of which 25 incorporate terminals by which one end of each length of fuse wire may be secured, are of blade-like form and lie in a vertical plane, as viewed in Figures 2 and 3, of the drawings, whilst the lower connectors 26, which also incorporate corresponding terminals 27 for the other ends of the fuse wire, lie in a horizontal plane, as viewed in Figures 2 and 3, so that their lower faces may conveniently form one set of fixed contacts for co-operation with the conductor elements or movable contacts on the rotary spindle of the switch.

The recessing in the upper part of the block forming the base or body member of the switch is in fact in the form of a plurality of individual recesses comprising recesses of more or less rectangular cross section, as seen at 28, for the accommodation of the connectors 13 of the switch which co-operate with the projecting connectors 14 of the fuse holder and which serve also to accommodate terminals 29 of the outgoing leads to the outgoing circuits which terminals are connected electrically to the connectors 13, inwardly tapering recesses 30 for accommodating the tapered projections 15 and forming an enclosure or fusing compartment, thus preventing high temperatures or molten or vapourised metal which is present, when a fuse blows from reaching or having an adverse effect on the other parts of the switch, and an upper recess 31 having in its base an opening 32 through which may be passed a fixing screw, the head of which is accommodated in the recess 31.

It will be observed that the lower blade-like connectors 26 of the fuse-holder will, when the latter is in position, on the base or body of the switch, be supported by the backing or wall 33, defining the lower extremity of each of the recesses 30, so that the connector 26 need not itself possess the necessary strength to resist upward stress imposed upon it when engaged by one of the resilient movable contacts or conductor elements on the spindle.

There is thus no need for the connectors 26, although forming one set of fixed contacts, to be constructed of expensive resilient material, such as phosphor-bronze, since they will be held rigidly in place by the backing or wall 33, and consequently, these connectors may be formed of ordinary copper strip, as also may the connectors 14.

As a matter of manufacturing convenience, the connectors 14 and 26 may be of identical form and during assembly onto the base 20 of the fuse holder are merely disposed in planes at right angles to each other.

The recessing in the lower portion of the base or body member of the switch

as viewed in Figures 2 and 3 comprises three main compartments, two of which 34, are for the accommodation of those portions of the spindle carrying the clipped-on conductor elements or movable contacts 17 and their associated fixed contacts 18 and terminals 19 and the third of which 35, serves to accommodate a square or rectangular section 36 on the spindle, and co-operating blade springs 37 secured to the body or base member of the switch by a screw and nut 38, 39, for ensuring that the spindle, when rotated, is brought to rest in one of four positions spaced angularly apart at 90°.

In two of these ~~postions~~ positions which are 180° apart, the movable contacts or conductor elements 17 bridge or connect their respectively fixed contacts 18 and connectors 26, whilst in the other two positions which are also 180° apart, the movable contacts or conductor elements are out of engagement with both their respectively associated fixed contacts, so that these are isolated from the connectors 26.

The lower portion of the body of the fuse holder overlaps the upper part of the recess in the body or base member of the switch in which the spindle is accommodated and by bearing against the cover plate 12 serves to secure this in position. The fuse holder itself is secured to the body or base member of the switch by means of a screwed socket 78 (Figure 4) having a slotted head 79 accessible from the outside of the fuse holder which socket engages over the projecting shank of a screw 38 extending through an opening formed in the body of the member of the switch and itself secured in position by means of a nut 39.

The recesses 34 and 35 communicate with each other through open ended slots 40, in the dividing partition portions 41, the bases 42 of these slots being of semi- or part circular formation to form journal bearings for portions of the spindle seated therein, the spindle being retained against withdrawal either as shown in the drawings by the presence of the blade spring 37, or, if desired, by some other retaining means such as co-operating inward projections (not illustrated) on the cover 12.

Further similar slots, the bases of which are of like formation and form bearings for the spindle are formed in the walls of the base or body at the lateral extremities of of the recess system accommodating the spindle.

The details of the spindle itself and the clipped-on moving contacts or isolating and bridging conductor elements will not be specifically described in detail since such description is included in our co-pending application 10684/49, dated 22nd April, 1949 (Serial No. 699,403) from which the present application is divided.

In the construction shown in Figures 5 to 7, the invention is applied to a combined switch and fuse unit commonly known as a splitter, in which it is required to connect two circuits which are also required to be separately fused to a single pair of incoming A.C. mains of which one is a neutral and the other a phase-line.

In this construction the incoming leads from the mains are connected to terminals 6 and 61, the neutral being connected to the latter, whilst the outgoing circuits are connected respectively across the terminals 62 and 63 and 62 and 64.

The fuse holder has two projections 15 for fuse wire for the lines associated with terminals 63 and 64 as well as a permanent strap or connector 65 in the neutral line which is unfused.

Other modifications as compared with the construction already described include, of course, a parallel connection or strap between the inwardly projecting connector 26 of the fuse holder forming the other fixed contact registering with that associated with the incoming terminal 6, this strap joining the aforesaid connector 26 with the corresponding lower terminal for the fuse in the line which is joined to terminal 64.

A further modification is the substitution of an upper fixed contact 66 in the neutral line of a form similar to that illustrated at 18, in the previously described construction, or of J-formation as previously described in place of the inwardly projecting connector 26, which can, of course, be omitted in respect of the neutral line when no fuse is required.

In the construction illustrated in Figures 8 to 10, the invention is shown applied to a combined switch and fuse unit for use on three phase mains.

Such switches are normally employed industrially and thus iron clad or provided with a cover of other suitable metal.

In the construction illustrated the base or body member of the switch is somewhat modified as compared with that described in connection with Figures 1 to 4, in as much as the recesses 67 and 68 which accommodate the switch terminals are open-sided, since the whole base is enveloped by a metal casing 69, 70, whilst a set of three fuses, three movable contacts or conductor elements and three co-operating fixed contacts are provided in place of the two used in the

construction of Figures 1 to 4.

The portion 70 of the metal cover is hinged by means of screws 71 to the lower forward portion of the part 69 and is retained against removal whilst the switch is in the "on" position by the provision of a pivoted **U**-shaped member 72 for the switch.

The ends of the limbs 73 of this member are turned inwardly towards each other, one end 74 entering an opening in the casing forming a bearing for it and the other end 75 as shown especially in Figure 10 being flattened as at 76, and engaging in an open-ended axially extended slot in the corresponding end of the spindle.

The spindle is, of course, provided with the requisite square portion and corresponding blade spring to ensure that it is brought to rest in one of four positions separated angularly by 90°, the disposition of the flattened portion 76 and wall in the spindle in which it engages being related to the square portion of the spindle in such a manner that in the "on" positon of the switch the connecting limb 77 of the operating member bears against the outer face of the hinged portion of the casing 70 to retain this in position.

Since to release the hinged portion of the cover necessitates deflection of the operating member through an angle of more than 90°, a certain degree of lost motion is provided between the flattened portion 76 and the slot in the end of the spindle so that the spindle may drop to a nearly vertical position when the switch is in the "off" position, thus permitting the cover to hinge downwardly to the requisite extent.

What we claim is:—

1. A combined switch and fuse unit of the kind in which the or each fuse comprises a body portion removable from and replacable in the unit, an expendable fuse element replacably mounted in the body portion and connectors attached to the body portion each connector being in electrical contact with the fuse element, characterised in that in the assembled position of the fuse holder or holders a connector of the or each fuse holder co-acts directly with a movable make and break conductor element of the switch so as to form one of the fixed contacts thereof, the contact between the or each connector and the corresponding conductor element being maintained by the inate resilience of one of these members.

2. A combined switch and fuse unit in which there is provided a single removable fuse holder body adapted to carry a plurality of expendable fuse elements and having a set of connectors for some or all of its respective fuse elements which connectors are secured to the fuse holder body and form a permanent part thereof, and in the assembled position of the fuse holder body coact directly with respective movable make and break conductor elements of the switch so as to form one set of fixed contacts thereof, the contact between each conductor element and the corresponding connector being maintained by the inate resilience of one of these members.

3. A combined switch and fuse unit according to either of claims 1 and 2 in which the or each connector is in the form of a strip metal blade which in the assembled position projects into the switch body and is supported at one side thereby.

4. A combined switch and fuse unit according to any of the preceding claims comprising a body or base member of insulating material, one face of which is formed with a recess for accommodating a rotary switch spindle carrying one or more conductor elements forming the movable contacts of the switch, and for accommodating one or a set of side by side fixed contacts, joined electrically to switch terminals and a removable fuse holder having for the or each fuse a pair of connectors secured to the holder one of which connectors projects into said recess to form the other or other set of fixed contacts with which said movable contacts co-act directly, and the other of which connectors is adapted to engage with a co-operating connector or set thereof joined electrically to switch terminals.

5. A combined switch and fuse unit according to Claim 4 in which the fuse holder overlaps said recess.

6. A combined switch and fuse unit according to Claim 4 in which the fuse holder serves to retain in position a removable cover extending over any portions of said recess not masked by the fuse holder itself.

7. A combined switch and fuse unit according to any of the preceding claims in which the fuse holder comprises a body of insulating material formed on one face with one or a set of fuse seating projecting portions arranged side by side, and at the ends of the or each projection, connectors projecting in the same direction as said seating portion or portions, and in which the switch has a body or base member of insulating material which is formed with a recess into which one or one set of such connectors projects this recess also accommodating one or a set of moving contacts co-acting directly with the connector or connectors project-

construction of Figures 1 to 4.

The portion 70 of the metal cover is hinged by means of screws 71 to the lower forward portion of the part 69 and is retained against removal whilst the switch is in the "on" position by the provision of a pivoted U-shaped member 72 for the switch.

The ends of the limbs 73 of this member are turned inwardly towards each other, one end 74 entering an opening in the casing forming a bearing for it and the other end 75 as shown especially in Figure 10 being flattened as at 76, and engaging in an open-ended axially extended slot in the corresponding end of the spindle.

The spindle is, of course, provided with the requisite square portion and corresponding blade spring to ensure that it is brought to rest in one of four positions separated angularly by 90°, the disposition of the flattened portion 76 and wall in the spindle in which it engages being related to the square portion of the spindle in such a manner that in the "on" positon of the switch the connecting limb 77 of the operating member bears against the outer face of the hinged portion of the casing 70 to retain this in position.

Since to release the hinged portion of the cover necessitates deflection of the operating member through an angle of more than 90°, a certain degree of lost motion is provided between the flattened portion 76 and the slot in the end of the spindle so that the spindle may drop to a nearly vertical position when the switch is in the "off" position, thus permitting the cover to hinge downwardly to the requisite extent.

What we claim is:—

1. A combined switch and fuse unit of the kind in which the or each fuse comprises a body portion removable from and replacable in the unit, an expendable fuse element replacably mounted in the body portion and connectors attached to the body portion each connector being in electrical contact with the fuse element, characterised in that in the assembled position of the fuse holder or holders a connector of the or each fuse holder co-acts directly with a movable make and break conductor element of the switch so as to form one of the fixed contacts thereof, the contact between the or each connector and the corresponding conductor element being maintained by the inate resilience of one of these members.

2. A combined switch and fuse unit in which there is provided a single removable fuse holder body adapted to carry a plurality of expendable fuse elements and having a set of connectors for some or all of its respective fuse elements which connectors are secured to the fuse holder body and form a permanent part thereof, and in the assembled position of the fuse holder body coact directly with respective movable make and break conductor elements of the switch so as to form one set of fixed contacts thereof, the contact between each conductor element and the corresponding connector being maintained by the inate resilience of one of these members.

3. A combined switch and fuse unit according to either of claims 1 and 2 in which the or each connector is in the form of a strip metal blade which in the assembled position projects into the switch body and is supported at one side thereby.

4. A combined switch and fuse unit according to any of the preceding claims comprising a body or base member of insulating material, one face of which is formed with a recess for accommodating a rotary switch spindle carrying one or more conductor elements forming the movable contacts of the switch, and for accommodating one or a set of side by side fixed contacts, joined electrically to switch terminals and a removable fuse holder having for the or each fuse a pair of connectors secured to the holder one of which connectors projects into said recess to form the other or other set of fixed contacts with which said movable contacts co-act directly, and the other of which connectors is adapted to engage with a co-operating connector or set thereof joined electrically to switch terminals.

5. A combined switch and fuse unit according to Claim 4 in which the fuse holder overlaps said recess.

6. A combined switch and fuse unit according to Claim 4 in which the fuse holder serves to retain in position a removable cover extending over any portions of said recess not masked by the fuse holder itself.

7. A combined switch and fuse unit according to any of the preceding claims in which the fuse holder comprises a body of insulating material formed on one face with one or a set of fuse seating projecting portions arranged side by side, and at the ends of the or each projection, connectors projecting in the same direction as said seating portion or portions, and in which the switch has a body or base member of insulating material which is formed with a recess into which one or one set of such connectors projects this recess also accommodating one or a set of moving contacts co-acting directly with the connector or connectors project-

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ing into said recess, the body or base member being further recessed to accommodate the or each fuse seating portion and the other or other set of connectors, which engage with a co-operating connector or set thereof in the switch body or base member.

8. A combined switch and fuse unit according to any of the preceding claims in which the moving contacts of the switch are constructed and supported on a spindle as claimed in any of the claims of our co-pending application No. ~~10861/49.~~ 10684/49.

9. A combined switch and fuse unit substantially as hereinbefore described with reference to and as shown in Figures 1, 2, 3 and 4 of the accompanying drawings.

10. A combined switch and fuse unit substantially as hereinbefore described with reference to and as shown in Figures 5, 6 and 7 of the accompanying drawings.

11. A combined switch and fuse unit substantially as hereinbefore described with reference to and as shown in Figures 8, 9 and 10 of the accompanying drawings.

Dated the 1st day of January, 1952.
FORRESTER, KETLEY & CO.,
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PROVISIONAL SPECIFICATION

Improvements in or relating to Electric Switchgear and Fuses

We, EGA ELECTRIC LIMITED, a British Company, of Holyhead Road, Wednesbury, in the County of Stafford (formerly Electrical and General Accessories (Leicester) Limited), and GEORGE KILMINSTER, a British Subject, of the Company's address, do hereby declare the nature of this invention to be as follows:—

The present invention relates to electric switch gear of the low tension and relatively low current rupturing type which for the purpose of clearly defining the scope of the invention will be defined as switch gear suitable for use on voltages up to 250—300 volts and for rupturing of up to 50 amperes.

It is primarily intended that the invention should be applied to the main isolating switches of domestic lighting or similar low power circuits but it may of course also be applied to other switch gear operating within the electrical limits hereinbefore specified.

The first part of the present invention is concerned with combined switch and fuse units. In constructions hitherto employed there is provided in such units one or more removable fuse holders which are provided with projecting connectors for plugging into suitable sockets or equivalent elements on the base of the unit, one or one set of such sockets or equivalent being permanently connected to one or a corresponding set of fixed contacts in the switch.

The object of this part of the present invention is to provide a new or improved construction of units in which manufacturing costs are reduced.

According to this part of the present invention we provide a combined switch and fuse unit in which the fuse holder or holders is or are of the removable kind, said unit being characterised in that in the assembled position of the fuse holder or holders one of the connectors of the or each fuse holder co-acts directly with a movable make and break conductor element of the switch so as to form one of the fixed contacts thereof.

In one construction of combined switch and fuse unit suitable for employment as the main isolating switch for a domestic electric lighting circuit, said switch being constructed in accordance with the invention, the unit comprises a base member which is formed of a suitable insulating material, for example, a ceramic, one part of which is adapted to receive the working parts of the switch together with those parts of the fuse holder which form part of the switch and another part of which is adapted to receive certain other parts of the fuse holder so as to support same and connect it electrically to the incoming electric supply.

In the following description as a matter of convenience only and not in any limiting sense, it will be assumed that the base member is positioned in a vertical plane with the fuse holder uppermost and switch mechanism housed in the lower portion of the base member, this being a position in which the unit will normally be employed although it will be understood that it may be mounted in any other suitable position.

The ceramic base member may be in the form of a generally rectangularly ceramic block, the upper part of which is provided with a pair of horizontally

spaced openings of rectangular cross section which serve to house suitable spring sockets or equivalent contacts of clip form into which the conventional projecting blade connectors of a fuse holder may be plugged, in the base of each of these openings there being provided the usual terminal block for the reception of incoming leads from the main or other external circuit from which power is supplied, these terminal blocks being connected electrically to the sockets or clip members.

The lower portion of the ceramic block forming the base member is provided with a transverse horizontal recess in which is housed the rotary spindle which carries bridging conductor elements which serve in one position of the spindle to bridge spaced fixed contacts arranged in pairs, one contact of each pair being positioned at the upper limb of the recess and the corresponding contact for each pair being positioned in register therewith at the lower limb of the recess.

In another position of rotation of the spindle each bridging conductor element is spaced away from its associated fixed contacts so that these are isolated electrically.

The fuse holder comprises a body of suitable insulating material, for example, a ceramic, and this body may be of rectangular form of the same width as the base member of the unit with the upper edge of the fuse holder body in register with the upper edge of the base member when the former is in position in the unit.

The fuse holder body is provided with suitable integral projections extending inwardly towards the base member of the unit from that face of the body which is towards the base member when the two parts are assembled together, these projections forming seatings for the fuse wire and preferably being provided with a groove for this purpose.

For instance, in a suitable arrangement where two fuses are required two such projections may be provided, the upper and lower edges of which taper towards each other in the direction in which the projections extend outwardly from the body of the fuse holder, and above and below each of these projections are provided on the body of the fuse holder suitable terminals for fixing the ends of the fuse wire which will extend from one terminal over the inclined edges and the end of the projection and be secured at its other end at the other terminal.

From the two upper terminals in such a construction there will extend inwardly towards the base member blade-like connectors as already described and from the two lower terminals there will also extend inwardly one from each terminal two further connectors in the form of blades, the plane of these latter blades being horizontal so as to lie against the upper surface of the lower recess in the base member which serves to house the switch spindle.

The base member will, of course, be provided with suitable recesses intermediate that provided with the switch spindle and those provided in the upper connectors of the fuses suitably shaped to receive the projections of the body of the fuse holder which form seatings for the fuse wire itself.

When the fuse holder is in position on the base member the under surfaces of the two lower connector blades are so positioned as to be engaged by the projecting and isolating conductor elements of the rotary switch so that these blades form the upper fixed contacts of the switch.

In the lower portion of the lower recess in the base member which houses the spindle of the switch are provided two fixed contacts each in register with the upper fixed contact formed by the projection connectors of the fuse holders. The lower fixed contacts are each formed of a length of resilient strip metal, for example, phosphor-bronze bent into the bowed form. For instance each of these fixed contacts may be of inverted **U**-shape and be supported by embracing the forward and rearward faces of rectangular section terminal block suitably secured in the lower part of the recess.

To retain the spindle of the switch in position in the base member when assembled therein a cover plate is provided, the upper edge portion of which is clamped beneath a wire spring which extends downwardly from the bolt securing the blade spring and the fuse holder body. This cover serves to enclose the lower recess in the base member which houses the above described switch parts even when the fuse holder is removed.

It will, of course, be understood that the lower recess although not described in detail will be of a general shape which conforms to that of the parts of the spindle which it houses and also to the shape of the fixed contact and terminal parts of the switch which it houses.

Dated this 21st day of December, 1951.

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