This invention relates generally to an electrical switch construction, and it relates more particularly to switches provided with a load interrupter for an electrical circuit carrying between 2,300 and 5,000 volts at high amperage.

The principal object of the present invention is to provide an improved load interrupter switch which is relatively inexpensive to manufacture, which is extremely compact, which is rugged and dependable in operation, and which may be used to open electric circuits carrying a load as high as 35,000 volts.

Another object of the invention is to provide a switch construction in which an interrupter apparatus has a casing which extends diagonally in a plane parallel to the plane of movement of a switch blade and along a chord of a circle described by the free end of the switch blade as it moves between closed and open positions.

Another object of the invention is to provide a load interrupter switch in which one of the switch contacts is provided with an annular socket to receive a mounting base of an interrupter assembly which is readily mounted or removed by rotating it with respect to the socket.

Yet another object of the invention is to provide an improved load current interrupter unit constituting a separate sub-assembly which is so constructed as to substantially eliminate re-strikes within the interrupter unit.

Still another object of the invention is to provide an interrupter in which an arc-extinguishing gas generated within the interrupter unit is closely confined in the interrupter unit casing and cooperates with spring means to drive the interrupter plunger toward circuit breaking position and retain it in said position.

Still another object of the invention is to provide a circuit interrupter unit having improved operating mechanism for the interrupter plunger.

The invention is illustrated in the accompanying drawings in a first embodiment which is adequate for breaking a circuit carrying not more than about 15,000 volts, and in a second embodiment which is adequate for interrupting electrical circuits above 15,000 volts and up to about 35,000 volts.

In the accompanying drawings:

FIG. 1 is a side elevational view, with a part broken away, of the low voltage embodiment of the invention;

FIG. 2 is a bottom plan view of the switch construction of FIG. 1;

FIG. 3 is a fragmentary section on an enlarged scale taken substantially as illustrated along the line 3—3 of FIG. 2;

FIG. 4 is a longitudinal central sectional view of an interrupter apparatus for the switch construction of FIG. 1;

FIG. 5 is a fragmentary section on an enlarged scale taken substantially as illustrated along the line 5—5 of FIG. 2;

FIG. 6 is a longitudinal central sectional view of the socket for receiving the interrupter assembly, taken substantially as illustrated along the line 6—6 of FIG. 8;

FIG. 7 is a longitudinal central sectional view of the socket engaging base of the interrupter assembly;

FIG. 8 is a top plan view of the interrupter socket of FIG. 6;

FIG. 9 is a top plan view of the interrupter mounting base of FIG. 7;

FIG. 10 is a transverse sectional view on an enlarged scale taken substantially as illustrated along the line 10—10 of FIG. 4;

FIG. 11 is a fragmentary view on an enlarged scale, partly in section, taken substantially as illustrated along line 11—11 of FIG. 4;

FIG. 12 is a fragmentary section on an enlarged scale illustrating the switch construction of FIG. 1 with the switch blade in full lines in its fully open position; and in broken lines in an intermediate position which it occupies in moving from fully open position toward the closed position of FIG. 1;

FIG. 13 is a side elevational view of the high voltage construction with the switch blade in full lines in its closed position and in broken lines in a first intermediate position;

FIG. 15 is a view similar to view 14 but illustrating the switch blade in a second intermediate position in full lines and in its fully open position in broken lines;

FIG. 16 is a fragmentary longitudinal central sectional view of the high voltage interrupter unit;

FIG. 17 is a fragmentary section on an enlarged scale taken substantially as illustrated along the line 17—17 of FIG. 16;

FIG. 18 is a sectional view on an enlarged scale taken substantially as illustrated along the line 18—18 of FIG. 16;

and FIG. 19 is a sectional view on an enlarged scale taken substantially as illustrated along the line 19—19 of FIG. 16.

Referring to the drawings in greater detail, and referring first to FIGS. 1 and 2, a support bar 20 carries insulators 21 and 22 at the lower ends of which are switch contacts 23 and 24, respectively, supplied with line connectors 23a and 24a, respectively, to receive connections from a high voltage electric line. On the switch contact 23 is a pair of depending pivot ears 25 which support a pivot 26 on which a switch blade 27 is mounted for pivotal movement between the closed position of FIG. 1 in which its free end 28 engages switch contact 24, and an open position illustrated in FIG. 13. As best seen in FIG. 2, the switch blade 27 has a pair of parallel switch arms 29 and 30 connected by intermediate bracing means 31, and at the free end 28 of the switch blade is a latch mechanism, indicated generally at 32.

As best seen in FIGS. 3 and 5, the latch mechanism 32 includes a cross-pin 33 which extends between the switch blade arms 29 and 30; a latch dog 34 pivotally mounted on the cross-pin 33; a torsion spring 35 wound around the pin 33 and having one end anchored against a spring stop 36 and the other end bearing upon the underside of latch dog 34; and a latch operating arm 37 at the outer end of which is a pull-ring 38 which may be engaged by a hook-stick to disengage the latch dog 34 from a latch bar 39 which is positioned between depending jaws 40 and 41 of the switch contact 24.

An inclined web 42 of switch contact 24 carries an interrupter socket 43 which is best seen in FIGS. 6 and 8 to have a cylindrical side wall 44 and an inturned bottom flange 45 in which there are three slots 46 adjacent each of which is an inclined cam face 47 communicating with an arcuate seat 48. As best seen in FIG. 1, the socket 43 receives a load current interrupter unit, indicated generally at 49, and best seen in FIG. 4.

Referring now to FIGS. 4, 7 and 9, the interrupter unit 49 is seen to include a mounting base member 50 which seats within the cylindrical socket wall 44 and has a circumferential shoulder 51 which separates the wall 50 from a reduced neck 52 which is of slightly less diameter than the flange 45 of the socket and has three radially
extending latch lugs 53 that are adapted to project into the slots 46 of the socket flange so that the interrupter mounting base 50 may be seated in the socket 45, and by rotating the interrupter unit 49 to ride the lugs 53 over the inclined cam surfaces 47 the lugs may be seated in the latch grooves 48 to firmly retain the interrupter unit 49 in its socket. To assure a tight fit between the interrupter base member 50 and the socket member 43, a resilient member 54, preferably in the form of a rubber washer, overlies the shoulder 51 so as to be compressed against the socket flange 45.

The structure of interrupter assembly 49 is best seen in FIGS. 4, 10 and 11; and referring first to FIG. 4, it is seen that a plunger spring housing 55 has a flange 56 which is seated upon an internal shoulder 57 in the interrupter plug base 50, and a rear electrical contact ring 58 which surmounts the flange 56 is held in place by a rear dielectric sleeve 59 that is mounted in the plug base 50 by means of a ring of epoxy resin 60. FIG. 7 shows that the plug base 50 has radial recesses 60a into which the epoxy is keyed. The opposite end of the dielectric sleeve 59 extends into a latch ferrule assembly, indicated generally at 61, to which it is bonded by a ring of epoxy resin 62. A forward dielectric sleeve 63 is bonded into the front of ferrule assembly 61 by means of an epoxy ring 64, and intermediate the ends of the forward sleeve 63 is a vent-hole 65. FIG. 11 shows that the forward margin of the ferrule 61 has radial slots into which the epoxy 64 is keyed; and similar slots at the rear of the ferrule key in the epoxy ring 62. A plastic guide 66 is set in the end of forward sleeve 63 by means of an epoxy mass 67, with the rear face immediately adjacent the vent hole 65, and the epoxy is keyed into opposed holes 68 immediately adjacent the outer end of forward sleeve 63 so as to bond the plastic guide 66 in place. Rear sleeve 59 and forward sleeve 63 may be fabricated from fiber glass reinforced epoxy resin within a vulcanized fiber tubing.

As is well known in the art, the tubes are lined with braid grade fiber, conveniently in the form of fiber washers 59a and 63a, respectively, which generate an arc extinguishing gas when the interrupter unit is operated.

The interrupter unit 49 also includes an interrupter plunger 69 indicated generally at 69, which has a brass core rod 70 embedded throughout most of its length in a Lucite trailer 71 and a Lucite body 72. A rear tautener, bronze plunger contact 73 embraces the brass rod 70 between a pair of fiber washers 74, and a forward interrupter contact 75, which provides a radially enlarged forward head for the plunger having almost no clearance from the forward sleeve wall, fractionally fits on the front end of the brass core rod and is separated from the Lucite body 72 by a fiber washer 76. The interrupter plunger 69 has a normal position in which the rear plunger contact 73 is embraced by the rear electrical contact 58 in the interrupter plug base 50, while the forward plunger contact 75 is embraced by a latch ferrule contact 77 which is mounted in the ferrule 61. The ferrule contact 77 is an annular member with a longitudinal slot in the bottom to accommodate a portion of a latch assembly, indicated generally at 78.

As best seen in FIGS. 4 and 11, the latch assembly includes a latch level shaft 79 which extends transversely, latch ferrule 61 and has opposite ends projecting outwardly therefrom to receive mounting bosses 80 of a latch level 81 which is secured to the shaft 79 by pins 82. An interrupter latch 83 is pivotally mounted on shaft 79, and an a spring 84 which is wound around the shaft and has an end 83a bearing on the wall of the shaft member 63a, and an end 84b turned beneath the latch 83 so that a latch dog 83a is normally urged upwardly as viewed in FIG. 4 to latch the interrupter plunger 69 in the current carrying position which is illustrated in FIG. 4. As best seen in FIG. 11, a pin 85 projects radially from the shaft 79 and a pin 86 projects transversely from the latch 83 so that counterclockwise motion of the lever 81 and pin 79 may bring the pin 85 into contact with the pin 86, rocking the latch 83 downwardly and disengaging the latch dog 83a from the forward end of the plunger assembly 69. When this occurs a plunger drive spring 87 which is confined between plunger trailer 71 and the bottom of the spring well 85 drives the plunger to very rapidly break the electrical contact between the plunger contact 73 and base plug contact 58, and between the plunger 75 and the ferrule contact 77.

Return of the plunger assembly 69 to the position of FIG. 4 is accomplished by means of a plunger return assembly, indicated generally at 88. The assembly 88 includes a return rod 89 which is slidably in the guide 66 and has its outer end bonded in a connector 90 which is pivotally mounted by means of a pin 91 in a connector yoke 92. The yoke 92 has a socket 93 to receive a fiberglass-polyester connecting rod 94 the opposite end of which is seated in a socket 95 of an operating lever yoke 96 which is pivotally connected by a pin 97 to the operating lever 81. The push rod 89 is not connected to the interrupter plunger 69, and accordingly, movement of the lever 81 in a counterclockwise direction prior to contact of pin 85 with pin 86 serves to withdraw the push rod 89 far enough that its free end 89a is at the inner end of the guide member 66, so that when the interrupter plunger is released the spring 87 drives it against the inner end of the guide member where the lever 81 is aligned with the vent hole 65 of the forward sleeve 63.

Return of the lever 81 in a clockwise direction causes the push rod 89 to return the interrupter plunger 69 to the position of FIG. 4 where the latch dog 83a of the latch 83 snaps into place ahead of the forward contact 75 so as to retain the interrupter plunger in the position of FIG. 4.

Referring again to FIGS. 1 and 2, and also to FIG. 12, it is seen that when the interrupter unit 49 is mounted in the socket 45, and the switch blade 27 is in its closed position, the interrupter lever 81 has its outer end portion 81a gripped between a pair of spring actuating contacts 98 which are mounted on a pin 99 and spacer sleeve 100 between the switch blade arms 29 and 30.

When the switch blade 27 and interrupter assembly 49 in the closed position of FIGS. 1 and 2, the high voltage current circuit is through the contact element 23a and 24a is closed through the switch blade 27 and also through the interrupter socket 43, the interrupter base plug 50, the base plug contact 58, the rear plunger contact 73, the front plunger contact 75, the latch ferrule contact 77, the latch ferrule 61, the lever shaft 79, the lever 81, and the actuating contacts 98.

When it is necessary to open knife switch 27 a long hook stick is engaged with the pull ring 38 and the hook stick is given a vigorous jerk to release the latch 34 and swing the switch blade 27 downwardly about its pivot 26. As seen in FIG. 13, as the blade 27 moves from the closed circuit position of FIG. 1 to the fully open position of FIG. 13, the spring actuating contacts 98 slide in contact with the lever 81 so that the circuit remains closed through the interrupter unit until the free end 28 of the switch blade 27 has sufficient clearance from the switch contact jaws 41 that no arc can be pulled between 41 and 28 when the interrupter plunger is released. The spacer 100 abuts the lever 81 and swings it counterclockwise.

When the air gap between the jaws 41 and the free end 28 is adequate, the interrupter plunger 69 is released to break the circuit. This pulls an arc within the interrupter unit which generates an arc extinguishing gas from the fiber washers 59a and 63a, the wall of the latch member 63a, and because of the structure of the interrupter unit and including the close fit between the plunger head 75, the plunger, and the casing wall, this gas is very closely confined and most of it expands into the spring cup 55 behind the trailer 71, so as to assist the spring 87 in moving the plunger 69 to its extreme forward position.
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does the restricted space in the interrupter unit cause the gas to assist movement of the interrupter plunger, but it also prevents any possible resurgence of ionized gases which, in certain prior art interrupter units, has been known to cause a "restrike," or arcing between the open contacts 58 and 77. The generated gas passes rapidly out through the hole 55 in the forward sleeve 63, which thus serves as a gas vent port.

When the switch blade 27 is to be returned to its closed circuit position, the hook stick is again used to manipulate the switch blade by engaging the pull ring 38. As the blade is swung towards its closed position, the actuating contact 98 and spacer 100 engage the free end 81a of the interrupter level 81 and swing it in a clockwise direction so that the return assembly 88 moves the interrupter plunger 69 back to the position of FIG. 4 where it is engaged by the latch 83. The circuit is thus re-established through the interrupter unit and momentarily thereafter the free end 28 of the switch blade engages the switch contact jaws 41, and the blade 27 is latched in place by engagement of the latch 34 with the latch bar 39. Movement of the switch blade 27 from closed position to open position or vice versa is so rapid that the full current load is carried by the interrupter unit only for a fraction of a second and the current does not damage the interrupter unit in such a brief period of time.

Ordinarily the interrupter unit will need to be replaced without opening the switch blade 27, and for this purpose the latch ferrule 61 is provided with an eye 61a which may be engaged by a suitable insulated tool to rotate the interrupter unit in its socket 43 so as to remove one interrupter unit and replace it with a new one. High voltage circuits of the type in which the present interrupter unit is used are rarely opened, and an interrupter unit of the type here disclosed may be used for about 50 current interrupter operations before it needs to be replaced. Thus, in ordinary service, a single interrupter unit will remain in use for months or even years.

The second form of the device, illustrated in FIGS. 14 to 19, contains such modifications of the switch blade assembly and of the interrupter unit as to make them suitable for voltages up to 54.5 kv. (34,500 volts). This requires three basic changes:

(1) The space between insulators 121 and 122 must be increased, so as to increase the space between switch elements 123 and 124; and this requires that a switch blade 127 be substantially longer than the switch blade 27.

(2) To avoid the free end 128 of the switch blade 127 to move a substantially greater distance from a switch jaw 141 before the circuit is broken through the interrupter unit, because the current can arc across a much greater air gap with the high voltage circuit than with a lower voltage circuit. In order to accomplish this, an interrupter unit 149 is elongated, and the manner in which this is accomplished will be described in detail in connection with Figs. 16 to 19.

(3) A pair of arcing horns 110 and 111 are secured, respectively, to a line connector 124a and to the switch blade 127, and the circuit is temporarily maintained through the arcing horns during a period in operation of the switch blade 127 when there is no completed circuit through the interrupter unit 149. Dimensional problems make it impractical to maintain a normally closed circuit from the switch blade through the interrupter unit, and accordingly, the arcing horns provide a temporary bridging circuit during the first part of the movement of the switch blade 127 from closed circuit position and during the last part of movement toward closed circuit position.

Referring now to FIGS. 16 to 19, and particularly to FIG. 16, interrupter unit 127 is seen to have the same basic components as the unit 27. Thus, there is a plug base 188 as in all respects with the interrupter unit 27, and a latch ferrule 161 which is also identical with the ferrule 61. The latch mechanism 178 is like the latch mechanism 78, except that the lever 181 is substantially longer than the lever 81 so as to adapt it to the longer working radius of the switch blade 127 as compared with that of the switch blade 27. Likewise a return mechanism 188 is identical with the return mechanism 88.

The elongation of the interrupter unit 27 is accomplished by splitting the dielectric tube between the plug base 150 and the latch ferrule 169 into three parts which are designated, respectively, 158, 258 and 358. In addition to a base contact 158 in the base plug 150 there are intermediate contacts 258 and 358 at opposite ends of the sleeve 259, and a cast aluminum tubular bridging member 160 forms an electric circuit between the contacts 258 and 358, around the sleeve 259. The entire span between the base plug 150 and the latch ferrule 161 is then encased in an outer insulating jacket 162.

The high voltage interrupter member 127 has an elongated plunger, indicated generally at 169, which is illustrated in FIG. 16 in its released, or circuit breaking position. The movement of the interrupter plunger 169 is no greater than that of the plunger 69 in the low voltage unit, and the plunger 169 may conveniently be regarded as being two current carrying plungers connected together by a dielectric rod. Thus, there is a rear brass core 170 carrying a trailer 171 and a sleeve 172. A rear plunger contact 173 is between the trailer and the rear sleeve, while a rear interrupter plunger contact 175 is at the front of the sleeve 172. A forward brass core rod 270 has its rear end bonded in a Lucite connector 271 which is also bonded to the forward end of the rear core rod 170. Between the connector 271 and a forward sleeve 272 is a front intermediate electrical contact 273, and at the front of the forward core rod 270 is a front electrical contact 275.

When the interrupter unit 27 is in closed circuit position, the interrupter plunger 169 is so positioned that the rear plunger contact 173 is against the base plug contact 158 and the front plunger contact 175 is against a latch ferrule contact 177 which is identical with the contact 77 in the low voltage unit. In this position the rear interrupter plunger contact 175 is embraced by the rear sleeve contact 258, and the front interrupter plunger contact 273 is embraced by the front sleeve contact 358. Accordingly, the circuit is closed through the contact 158, the contact 173, the rear core rod 170, the rear intermediate plunger contact 175, the rear sleeve contact 258, the aluminum bridging sleeve 160, the forward sleeve contact 358, the front intermediate plunger contact 273, the forward core rod 270, the front plunger contact 275, the latch ferrule contact 177, and the latch lever 181.

As seen in FIG. 14, when switch blade 27 is in closed circuit position, a parallel circuit is closed through the arcing horns 110 and 111 and there is a substantial gap between the interrupter unit operating lever 181 and actuating contacts 198 on the switch blade 127. As the switch blade moves toward open position, as shown by the broken lines in FIG. 14, the arcing horn 111 slides along the arcing horn 110, thus maintaining a temporary closed circuit until the operating contacts 198 on the switch blade 127 embrace the operating lever 181 of the interrupter unit 149. At this point there are again parallel circuits, this time through the arcing horns and through the interrupter unit as previously described, and shortly after the operating contact 198 closes the parallel circuit through the interrupter unit the arcing horn 111 slides off the arcing horn 110 and the circuit is closed solely through the interrupter unit.

Referring now to FIG. 15, the actuating contacts 198 slide in contact with lever 181, while the arc strikes the operating lever in a counterclockwise direction, thus backing the return mechanism 188 away from the interrupter plunger 169. The plunger is not released by the interrupter latch mechanism 178 until the air gap between arcing horns 110 and 111 are sufficiently large to assure that no arc will strike across the gap between the horns.
Release of the interrupter plunger breaks the circuit in precisely the manner previously described for the operation of the interrupter unit 49.

During return of the switch blade 127 from fully open position which is illustrated in broken lines in FIG. 15, the operating contacts 198 and spacer 206, which have overridden the operating lever 181, pick up the lever and move it in a clockwise direction to move the plunger return mechanism 188 and return the plunger 169 to its closed circuit position. This closes the circuit through the interrupter unit, and almost immediately thereafter the arcing horn 111 contacts the arcing horn 110 so as to close the parallel circuit through the arcing horns and take the heavy current load off the interrupter unit. Continued movement of the switch blade 127 breaks the circuit between the operating contacts 198 and the operating lever 181 so that the entire load is carried by the arcing horns, but this condition continues for a very brief period until the free end 128 of the switch blade moves into electrical contact with the switch element 124.

As in the low voltage form of the device, the interrupter unit is carrying the full circuit load for such a brief interval of time in any one operation that the unit is not damaged by it. Similarly, the arcing horns, which are not large enough to carry the full circuit load for a long period of time, are perfectly satisfactory during the short intervals that the horns alone are carrying the full circuit load.

The foregoing detailed description is given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

I claim:

1. An electrical circuit interrupter switch for opening and closing a high voltage current carrying circuit comprising, in combination: a pair of switch contacts in insulated spaced relation; a switch blade pivoted on a first of said contacts and having a free end which is movable upon pivoting of the blade between a position engaged with the second of said contacts and a fully open position; a load current interrupter apparatus having a casing mounted on said second switch contact and extending diagonally in a plane parallel to the plane of movement of said switch blade and along a chord of a circle described by said free end of the switch blade as it moves between engaged and fully open positions, interrupter contacts in said casing electrically connected to said second switch contact, means for electrically connecting the second interrupter contact to the switch blade, a movable interrupter member in the casing for selectively closing or opening a circuit through said interrupter contacts, holding means urging said interrupter member toward open circuit position, and operating means to release said interrupter member for movement to open circuit position and to return said interrupter member to closed circuit position, said operating means including an external member movably mounted on the interrupter casing and extending toward the switch blade; and actuating means on the switch blade engageable with said external member to move said member during movement of the switch blade between engaged and fully open positions, said actuating means cooperating with said member and said operating means to release the interrupter member after there is an adequate air gap between the switch blade and the second switch contact and to return said interrupter member to closed circuit position.

2. The apparatus of claim 1 in which the means for electrically connecting the second interrupter contact to the switch blade includes the external member and the actuating means on said blade.

3. The apparatus of claim 2 in which the external member and the actuating means are in engagement when the switch blade is engaged with the second switch contact.

4. The apparatus of claim 2 which includes an upstanding auxiliary circuit extension on the second switch contact alongside the switch blade, an auxiliary circuit arm on the switch blade which bears on said extension to maintain a circuit therethrough when the switch blade first disengages said second contact, in which the external member and the actuating means are in engagement only after said arm has moved a substantial distance along said extension, and in which the plunger is released only after there is an adequate air gap between the arm and the extension.

5. The apparatus of claim 1 in which the actuating contact means disengages from the external member after release of the plunger as the switch blade pivots toward fully open position, and re-engages with the external member as the switch blade pivots toward engaged position.

6. The apparatus of claim 1 in which the external member is a lever pivoted on the interrupter, and the means for electrically connecting the second interrupter contact to the switch blade includes said lever and the actuating means on the switch blade.

7. The apparatus of claim 1 in which the switch blade has two parallel arms, the interrupter contact being between the arms, and the free end of the switch blade passes over the outer end of the interrupter in moving between engaged and fully open positions.

8. The apparatus of claim 1 in which the interrupter occupies an angle of about 50° with respect to the engaged position of the switch blade.

9. In an electrical circuit interrupter for opening and closing a high voltage current carrying circuit, in combination: a first switch contact; a switch blade pivoted on said first contact; a second switch contact spaced from said first contact with which a free end of the switch blade selectively engages to close said circuit; an annular socket member on said second contact and electrically connected therewith, said socket member having longitudinal slots therein and shoulders between said slots; a load current interrupter having a dielectric casing and a metal plug base, said plug base having lugs which pass through said slots and engage with the shoulders by rotation of the interrupter in the socket; a pair of interrupter contacts in said interrupter, one of said interrupter contacts being electrically connected with the plug base; means for electrically connecting the second interrupter contact with the switch blade; a movable interrupter member within the casing for selectively closing or opening a circuit through said interrupter contacts; and annular resilient means surrounding said plug base and butting against the bottom of the casing to provide a tight rotating fit between the interrupter and the socket.

10. The apparatus of claim 9 in which the socket member has its axis in a plane parallel to that of the switch blade and inclined toward the first switch contact so that an interrupter mounted therein extends parallel to the switch blade along a chord of a circle described by the free end of the blade as the blade pivots.

11. The apparatus of claim 10 in which the interrupter casing is elongated, and a pivoted lever is mounted thereon for moving the interrupter member, said lever extending toward the switch blade so as to be moved thereby as the blade pivots.

12. The apparatus of claim 9 in which the socket member has an interrupted bottom flange in which the longitudinal slots are formed, and integral circumferential bosses on the outer face of the flange with which the lugs engage upon rotation of the interrupter.

13. Load current interrupter apparatus for a high voltage current carrying circuit, comprising: an elongated hollow casing of dielectric material, the interior wall of said casing including material which generates an arc extinguishing gas in the presence of an electric arc; spaced internal interrupter contacts in said casing; means extending through the casing for electrically con-
necting said interrupter contacts into a high voltage current carrying circuit; an interrupter plunger longitudinally moveable in said casing for selectively closing or opening a circuit through said interrupter contacts, there being only a small clearance between the side of said plunger and said interior wall; a hollow extension tube at one end of said casing; a compression spring in said extension tube and bearing on the plunger to urge the latter toward open circuit position; means normally retaining the plunger in closed circuit position against the urging of said spring; and operating means mounted in the casing for releasing the plunger for movement toward open circuit position and for returning the plunger to closed circuit position.

14. Load current interrupter apparatus for a high voltage current carrying circuit, comprising: an elongated hollow casing of dielectric material, the interior wall of said casing including material which generates an arc extinguishing gas in the presence of an electric arc; spaced internal interrupter contacts in said casing; means extending through the casing for electrically connecting said interrupter contacts into a high voltage current carrying circuit; an interrupter plunger longitudinally moveable in said casing for selectively closing or opening a circuit through said interrupter contacts, there being only a small clearance between the side of said plunger and said interior wall; a hollow extension tube of small diameter at one end of said casing; a compression spring in said extension tube and bearing on the plunger to urge the latter toward open circuit position; operating means mounted in the casing for releasing the plunger for movement toward open circuit position and for returning the plunger to closed circuit position, said operating means comprising an external lever pivoted intermediate the ends of the casing, a slidable push rod bearing on the plunger and extending from the end of the casing opposite the compressing spring, and a link connecting said lever to the push rod so that pivotal movement of the lever slides and said push rod to move the plunger toward closed circuit position.

15. The apparatus of claim 14 which includes a latch lug in the casing which engages the plunger to maintain the latter in closed circuit position, and means for disengaging said latch lug from the plunger by movement of the lever.

16. The apparatus of claim 15 which includes a lever pivot in the casing and in which the latch lug is disengaged from said pivot.

17. The apparatus of claim 14 in which the lever is part of an electrical circuit to one of the interrupter contacts, said circuit also including the lever pivot, and in which the link connecting the lever to the push rod is of dielectric material.

18. The apparatus of claim 13 in which the retaining means comprises a latch lug in the casing which engages the plunger to maintain the latter in closed circuit position, and in which the operating means includes means extending outwardly of the casing for disengaging said latch lug from the plunger.

19. Loading current interrupter apparatus for a high voltage current carrying circuit, comprising: an elongated hollow casing of dielectric material, the interior wall of said casing including material which generates an arc extinguishing gas in the presence of an electric arc; a hollow extension tube of small diameter at one end of said casing; two spaced internal interrupter contacts in said casing adjacent the extension tube; a second pair of longitudinally spaced interrupter contacts remote from said first pair, a first one of each of said pairs of contacts being adapted to be electrically connected to the current carrying circuit; a metal insert in the casing electrically connecting the second of each of said pairs of contacts to the interrupter plunger longitudinally moveable in said casing for selectively closing or opening a circuit through said interrupter contacts, there being only a small clearance between the side of said plunger and said interior wall; said plunger having a first pair of electrically connected interrupter contacts engaging the first pair of interrupter contacts in closed circuit position, a second pair of electrically connected interrupter contacts engaging the second pair of interrupter contacts in said position, and a dielectric portion isolating said two pairs of interrupter contacts from one another; a compression spring in the extension tube and bearing on the plunger to urge the latter toward open circuit position; and operating means mounted in the casing for releasing the plunger for movement toward open circuit position and for returning the plunger to closed circuit position.

20. In an electrical circuit interrupter switch for opening and closing a high voltage current carrying circuit, in combination: a first switch contact; a switch blade pivoted on said first contact; a second switch contact spaced from said first contact with which a free end of the switch blade selectively engages to close said circuit; and a socket member fixedly mounted on said second contact and electrically connected therewith, said socket member having an annular wall and an open end to receive the base of a removable interrupter unit, there being bayonet slot type retaining means on said socket spaced from said open end, said retaining means comprising an internal flange having a plurality of longitudinal slots therein so as to divide said flange into a plurality of circumferentially spaced elements, all said elements having circumferentially extending and circumferentially inclined faces facing away from said open end, all said faces being inclined in the same direction spaced from said open end, said socket being positioned with its longitudinal axis on a chord of a circuit that is described by the free end of the switch blade as it pivots on the first contact.

21. In a switch apparatus for opening and closing a high voltage current carrying circuit, in combination: a first switch contact; a switch blade pivoted on said first contact; a second switch contact spaced from said first contact with which a free end of the switch blade selectively engages to close said circuit; and a socket member fixedly mounted on said second contact and electrically connected therewith, said socket member having an annular wall affording an unobstructed socket opening at one end, there being an internal flange spaced from said open end of said wall, said flange having a plurality of radial slots, and a plurality of generally circumferentially extending retaining bosses formed integrally with the outer face of the flange, each said boss including an inclined cam face extending circumferentially from a margin of one of the slots and a groove in communication with the apex of the cam face, said grooves providing retaining recesses.

22. The apparatus of claim 21 in which the socket is positioned with its longitudinal axis inclined toward the switch blade pivot and on a chord of a circle that is described by the free end of the switch blade as it pivots on the first contact.

23. Load current interrupter apparatus for a high voltage current carrying circuit, comprising: an elongated hollow casing of dielectric material, the interior wall of said casing including material which generates an arc extinguishing gas in the presence of an electric arc; a hollow extension tube of small diameter at one end of said casing; a first pair of longitudinally spaced internal interrupter contacts in said casing adjacent the extension tube; a second pair of longitudinally spaced interrupter contacts remote from said first pair, a first one of each of said pairs of contacts being adapted to be electrically connected to the current carrying circuit; a metal insert in the casing electrically connecting the second of each of said pairs of contacts to the interrupter plunger longitudinally moveable in said casing for selectively closing or opening a circuit through said interrupter contacts, said plunger ...
or having a first pair of electrically connected plunger contacts engaging the first pair of interrupter contacts in closed circuit position, a second pair of electrically connected plunger contacts engaging the second pair of interrupter contacts in said position, and a dielectric portion isolating said two pairs of plunger contacts from one another; and means for moving the plunger between a closed circuit position and an open circuit position.

24. Load interrupter apparatus for a high voltage current carrying circuit, comprising: an elongated hollow casing of dielectric material having a hole near its forward end that provides the sole effective vent from the interior of the casing, the interior wall of said casing including material which generates an arc extinguishing gas in the presence of an electric arc; spaced internal interrupter contacts in said casing remote from said hole; means extending through the casing for electrically connecting said interrupter contacts into a high voltage current carrying circuit; an interrupter plunger longitudinally moveable in said casing between a circuit making position toward the rear of the casing and a circuit breaking position toward the hole, said plunger having a radially enlarged forward head which has almost no clearance from the interior wall of the casing, said plunger other than the head having only a small clearance from said interior wall; a fixed extension tube of small diameter at the rear end of the casing; means adapted to drive the plunger rapidly toward the forward end of the casing to break a circuit; and operating means mounted in the casing for controlling movement of the plunger between open circuit and closed circuit positions, the relationship between the vent hole, the internal casing wall, the plunger and the plunger head causing substantially all generated gases to urge the plunger toward the forward end of the casing thereby supplementing the thrust of the driving means on the plunger.

25. The interrupter apparatus of claim 24 in which the enlarged head is substantially opposite the hole in the casing when the plunger is in circuit breaking position, whereby gases must flow forwardly around the plunger and the head to pass through the vent hole.

26. In an electric circuit interrupter switch for opening and closing a high voltage current carrying circuit, in combination: a first switch contact; a switch blade pivot ed on said first contact; a second switch contact spaced from said first contact with which a free end of the switch blade selectively engages to close said circuit; a socket member on said second contact and electrically connected therewith, said socket member having its axis in a plane parallel to that of the switch blade and being inclined toward the first switch contact; a load current interrupter having a dielectric casing and a metal plug base adapted to make a rotating, locking connection in said socket member, so that the interrupter extends parallel to the switch blade along the chord of a circle described by the free end of the blade as the blade pivots; a pair of interrupter contacts in said interrupter, one of said interrupter contacts being electrically connected with the plug base; means for electrically connecting the second interrupter contact with the switch blade; a movable interrupter member within the casing for selectively closing or opening a circuit through said interrupter contacts; and an integral resilient means surrounding said plug base and butting against the bottom of the casing to provide a tight rotating fit between the interrupter and the socket.

27. The apparatus of claim 26 in which the interrupter casing is elongated, and a pivoted lever is mounted thereon for moving the interrupter member, said lever extending toward the switch blade so as to be moved thereby as the blade pivots.

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