Dec. 28, 1926. 1,612,711

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ELECTRICAL SWITCH

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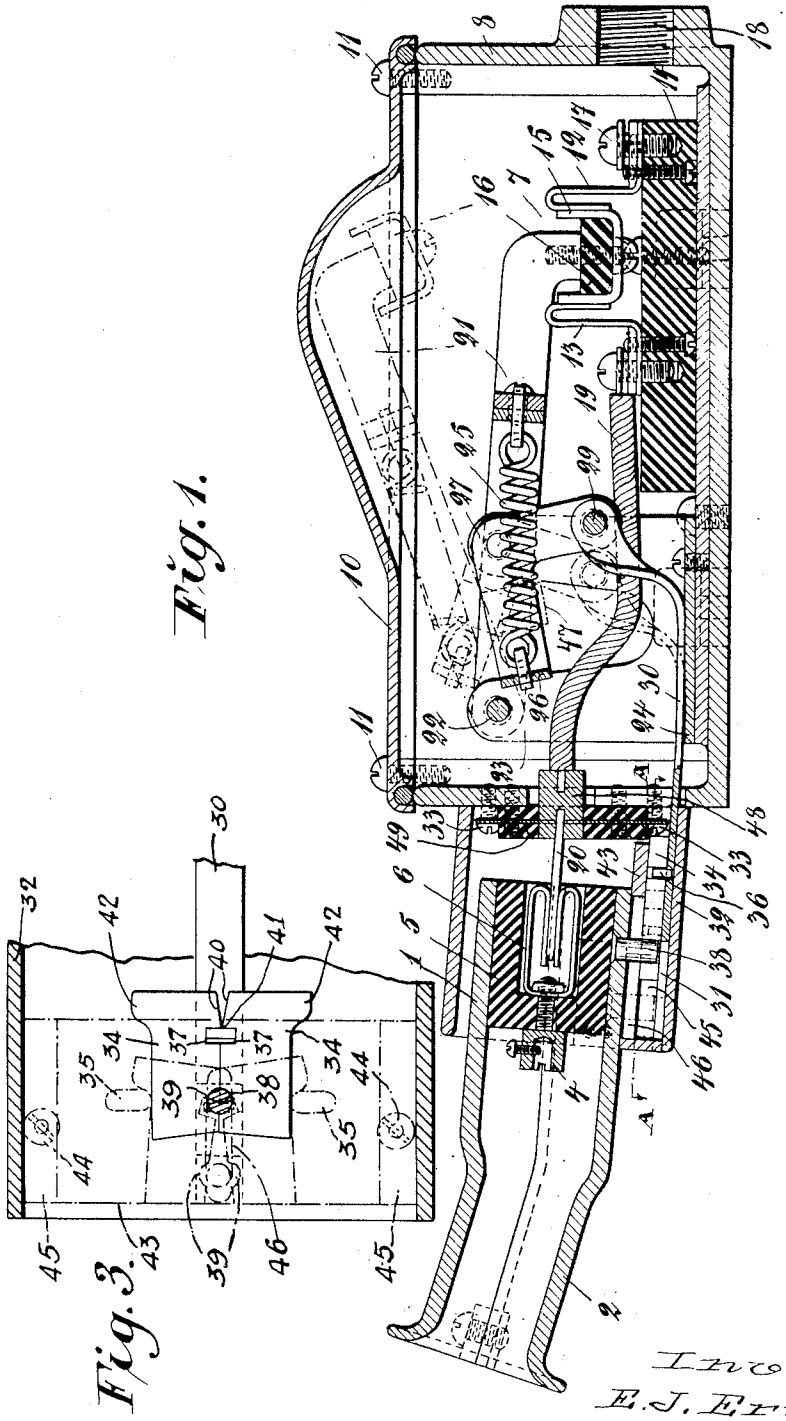


Fig. 1.

Fig. 3.

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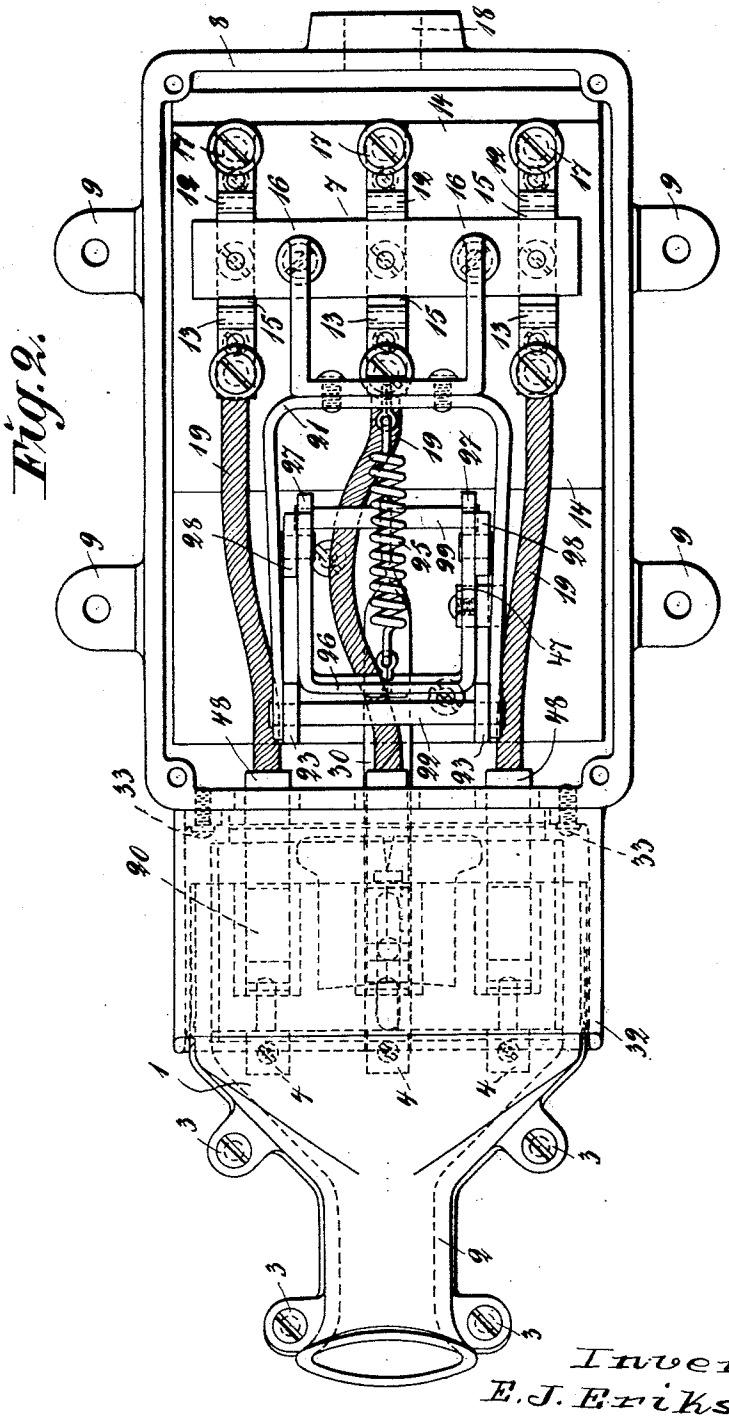
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Fig. 2.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL SWITCH.

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The invention relates to electrical switching apparatus of the kind which consists of a plug switch or a similar hand operated switch and a quick-break switch connected in series therewith. Switches of this type are generally used for connecting up portable electric motors or other current consumption apparatus for heavy currents, in order to avoid live terminals at the plug switch and to prevent interruption of current at the contacts of the plug switch. In switches of this kind hitherto known the plug switch and the quick-break switch are adapted to be operated separately by hand so that two consecutive manipulations are required for switching on as well as for switching off. The present invention is distinguished from the said switches by the switching on and the switching off operations being effected each by a single switching manipulation, viz by the insertion of the contact plug into the contact sleeve or by withdrawing the plug from the sleeve respectively. For this purpose the plug switch and the quick-break switch are connected with one another by means of a mechanism which is so devised that the quick-break switch will be positively closed by the insertion of the contact plug and opened by the withdrawing of the plug, the closure of the quick-break switch taking place after the closure of the plug switch, whereas the opening of the quick-break switch will take place before the plug switch has been opened.

The invention will be more closely described with reference to the accompanying drawings, in which Fig. 1 shows a longitudinal section of a switch for a relatively heavy current supply cable for instance that of an electrical motor. Fig. 2 is a plan view of the switch the cover of the casing of the quick-break switch being removed. Fig. 3 is a section on the line A—A in Fig. 1 showing a detail on a larger scale.

The contact plug 1 is adapted to be fitted to the end of the cable and is provided with a tubular extension 2 serving as a handle and made in two pieces to be screwed together by means of screws 3 the cable being thereby clamped into the handle so as to relieve the plug contacts of strains caused by the pull of the cable. In the example shown the cable is a three-wire cable, the conductors of which are connected by means of clamps 4 to three contact springs 6 provided in an insulating piece 5 of the plug. The quick-break switch 7 and its operating mechanism are arranged in a casing 8 adapted to be mounted on a vertical wall and provided for this purpose with lugs 9. The quick-break switch and its operating mechanism are accessible through a cover 10 adapted to be screwed to the casing by means of screws 11. The contacts of the quick-break switch consist of three pairs of fixed contact springs 12, 13 screwed to an insulating plate 14, and three contact pieces 15 screwed to a contact carrier 16 of insulating material and adapted to form bridge connections between the springs 12, 13. The outer springs 12 are connected to terminals 17 by means of which the conductors of the live cable are connected to the quick-break switch, said cable being adapted to be introduced through an insulating tube to be screwed into the hole 18 in the rear wall of the casing. The inner contact springs 13 are connected by means of conductors 19 to the fixed contacts 20 of the plug switch. The contact carrier 16 is secured to a pivoted switch arm 21, consisting of two stirrups screwed together, one of which is screwed with its shanks to the contact carrier 16, whereas the other is pivoted by means of a pin 22 to standards 23 forming extensions of a U-shaped plate 24. The switch arm 21 is connected with the operating mechanism by means of a strong helical spring 25 fastened with one end to the transversal part of the switch arm 21 and with the other end to one of an angle lever 26 consisting of a stirrup the shanks 27 of which are bent at right angles. The knees of said shanks are pivoted to standards 28 forming extensions of the plate 24. The ends of the shanks 27 are connected together by means of a pin 29.

The operating mechanism also comprises a push bar 30 and means for coupling said bar with the plug of the plug switch. The fore end of the push bar 30 is bent upwards and pivotally connected with the pin 29 and the straight part of the push bar is slidably disposed in a groove 31 in the bottom of the sleeve 32 of the plug switch. Said sleeve is secured by means of screws 33 to the front wall of the casing 8. The coupling device for connecting the push bar 30 with the plug 1 is seen more clearly in Fig. 3. It consists of two coupling plates 34 loosely placed on

the bottom of the sleeve 32. Said coupling plates 34 are kept in place on the bottom of the sleeve by means of a cover plate 43 which is supposed to be removed in Fig. 3, its position being indicated only by chain lines. The cover plate 43 is provided with two shoulders 35 disposed on opposite sides of the coupling plates 34 so as to guide said plates in their movements. The cover plate 43 is secured to the bottom of the sleeve 32 by means of screws 44, screwed into shoulders 45 on the lower side of the cover plate, said shoulders being adapted to keep the cover plate at the distance required from the bottom of the sleeve 32 so as to allow the coupling plates to move freely between the cover plate and the bottom of the sleeve. The coupling plates 34 are adapted to engage a stud 36 on the push bar 30 by means of notches 37 in the inner edges of the coupling plates. When the contact plug is inserted, said coupling plates will also engage a pin 38 on the lower side of the plug by means of semi-circular notches 39 in the edges of the plates. The inner edges of the coupling plates are further cut obliquely at 40 so as to form an acute angle which will allow the plates to turn about the apex 41 of said angle when the plug is being withdrawn, said turning movement of the plates being caused by the latter extensions 42 of the plates coming into contact with the shoulders 35. The outer ends of the plates are thereby separated from one another so as to release the pin 38 from the notches 39 of the plates. The cover plate 43 is provided with a longitudinal slot 46 through which the pin 38 is inserted.

The fixed contact members 20 of the plug switch consists of three contact stems connected with the conductors 19 by metal bushings 48 projecting through openings in the front wall of the casing 8 and secured to an insulating plate 49 screwed to the said wall.

In the drawings the movable parts of the switching apparatus are shown in full lines in the positions they are taking up when the contact plug 1 is inserted. The positions of the different parts when the plug switch is disconnected, are shown in chain lines. In the former case the coupling plates 34 are locked by the shoulders 35 in such positions that they will engage the stud 36 on the push bar 30 as well as the pin 38 on the plug 1. When the push bar 30 is in its innermost position, the end of the spring 25 fastened to the crank lever 26 is in its lowermost position in which the spring tends to force the switch arm 21 down into its closing position. When the plug 1 is withdrawn, the coupling plates 34 and, as a consequence, the push bar 30 are moved outwards, whereby the angle lever 26 is swung over its unstable position of equilibrium and moved into the position shown in chain lines, in which the pull of the spring 25 is directed upwards and, consequently, the quick-break switch will be switched off suddenly. The course of operation is so adapted as to cause the quick-break switch to be opened before the plug switch is opened, in order to ensure a currentless breaking of the contacts of the plug switch. Owing to the coupling plates being guided against the shoulders 35 the contact plug will be kept in engagement with the coupling plates until the quick-break switch has been opened entirely and the plug has been disconnected from the contact stems 20. The extensions 42 of the coupling plates will then come into engagement with the shoulders 35, whereby the fore ends of the plates are separated so that the pin 38 is disengaged. During the switching operation the contact plug 1 is guided in the sleeve 32 in such a manner as to be positively kept in engagement with the mechanism of the operating quick-break switch, the plug being not released until it has been withdrawn so far as to break the contacts. Moreover, the sleeve 32 is so devised that the plug cannot be pushed in until the pin 38 has been brought in a position to engage the operating mechanism of the quick-break switch. By these arrangements it is ensured that the apparatus will always operate in the right way.

When inserting the contact plug, the switching operation is effected in the reversed order. After the plug switch has been disconnected the coupling plates 34 are retained in the position shown in chain lines by means of the stud 36 of the push bar and the shoulders 35. The pin 38 on the plug may therefore now be introduced between the inner edges of the plates 34. Upon the plug 1 being pushed in the coupling plates are displaced by the pin 38 while being guided by the shoulders 35, so as to hold the pin 38 firmly in engagement with the notches 39. When the plug is moved further, the angle lever 26 is shifted into the position shown in full lines the spring 25 being thereby brought in such a position as to cause the quick-break switch to be closed momentarily. The transmission of movement is so adapted that the quick-break switch will not be closed, until the plug switch has been closed, in order to prevent the current to be closed in the plug switch.

As already mentioned this switch is of the type which is generally used for connecting up portable electrical motors by means of a cable connected to the plug. Such switches are usually adapted to be mounted vertically on a wall and, for the sake of convenience, the plug should be inserted from below. The switch must therefore be so devised as to prevent the plug from being pulled out by the weight of the cable which is rather

heavy. Heretofore special locking means were provided for that purpose which had to be operated separately after the plug had been inserted. According to the present invention said locking devices are done away with by the above described combination of the trip spring 25 and the clutch device 30, 36, 38, 41, 42 inasmuch as this combination will cause the plug to be retained in its inserted position by the inward pull of the spring 25 on the plug, which is sufficient to carry safely the weight of the cable.

In order to ensure the disconnection of the quick-break switch under all circumstances, for instance in case the spring would be brought out of operation, the angle lever 26 is provided with a catch 47 or the like riveted to one shank of the lever and adapted to engage the switch arm 21 when the angle lever is nearly turned over into the position shown in chain lines, so that the switch arm may be positively shifted in case the spring would fail to operate.

I claim:

1. In an electrical switching apparatus the combination of a heavy current lever switch enclosed in a casing, a trip lever for shifting said lever switch, a plug switch disposed on the outside of said casing, a push bar displaceable in its longitudinal direction through the wall of said casing and connected at its inner end with said trip lever, a clutching device for automatically connecting said push bar with the plug upon the insertion of the latter, and a trip spring actuating said trip lever and adapted to exert an inward pull on the plug in its inserted position.

2. In an electrical switching apparatus the combination of a plug switch, a lever switch, enclosed in a casing, a trip lever for shifting said lever switch, a plug switch disposed on the outside of said casing, a push bar displaceable in its longitudinal direction through the wall of said casing and connected at its inner end with said trip lever, a clutching device for automatically connecting said push bar with the plug upon the insertion of the latter, a trip spring forming an elastic connection between the lever switch and the trip lever in both extreme positions of the latter and adapted to exert an inward pull on the plug in its inserted position, and a catch member connected with said trip lever and adapted to engage the lever switch positively before the plug has been withdrawn entirely, so as to ensure the disconnection of the lever switch.

3. In electrical switching apparatus the combination of a plug switch, a lever switch a casing enclosing said lever switch, a trip lever provided in said casing and adapted to be shifted into two extreme positions, a trip spring forming an elastic connection between the lever switch and the trip lever in both extreme positions of the latter, a push bar adapted to be displaced in its longitudinal direction through the wall of the lever switch casing and connected at its inner end with the trip lever, and means for automatically connecting said push bar with the plug upon the insertion of the latter comprising, a locking pin on the plug, two locking plates pivotally connected with the outer end of the push bar, said locking plates having recesses to engage the locking pin on the plug, and fixed guiding means for the locking plates adapted to cause said plates to engage said locking pin positively upon insertion of the plug.

4. An electrical switching apparatus as claimed in claim 3, in which the sleeve of the plug coupling is provided with a false bottom having a slot to receive the locking pin of the plug, the locking plates being loosely disposed between the bottom of the sleeve and said false bottom.

In testimony whereof I affix my signature.

ERIK JOHAN ERIKSON.