

May 26, 1931.

H. J. HAMMERLY

1,807,526

ELECTRIC SWITCH

Filed Sept. 19, 1929

3 Sheets-Sheet 1

Fig. 1.

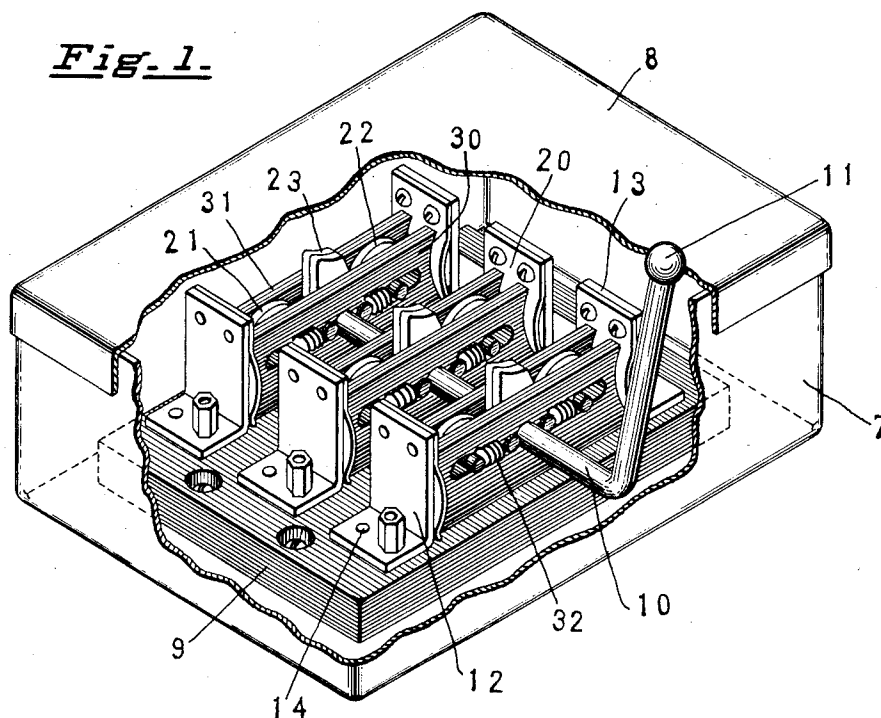
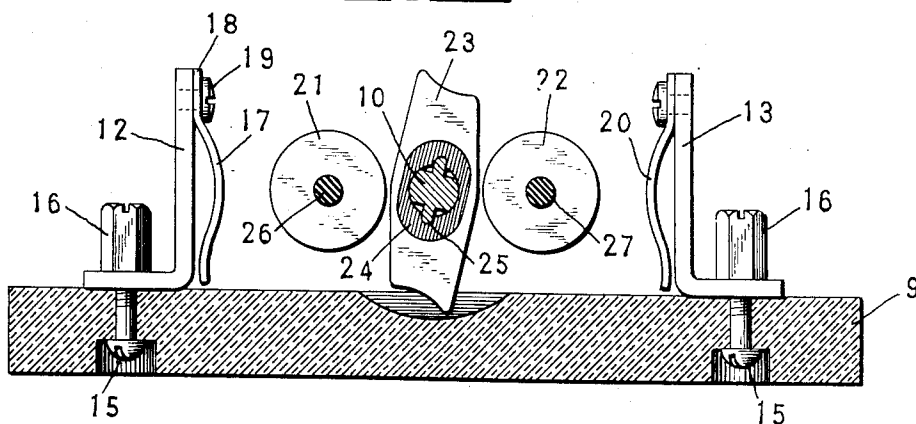


Fig. 2.



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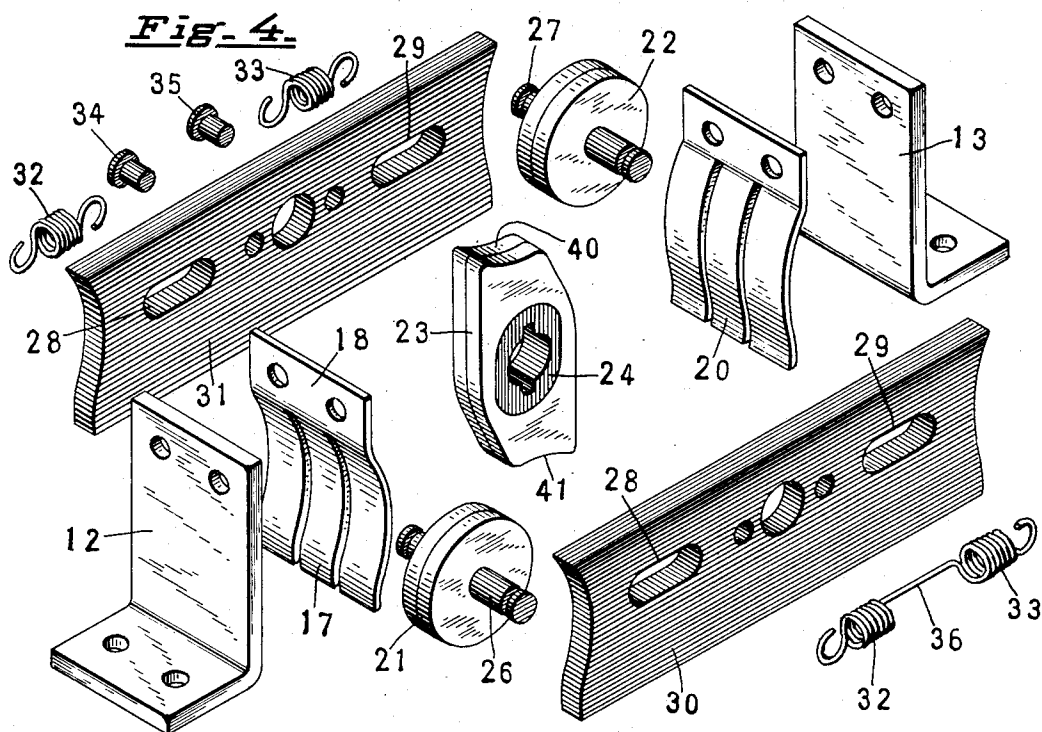
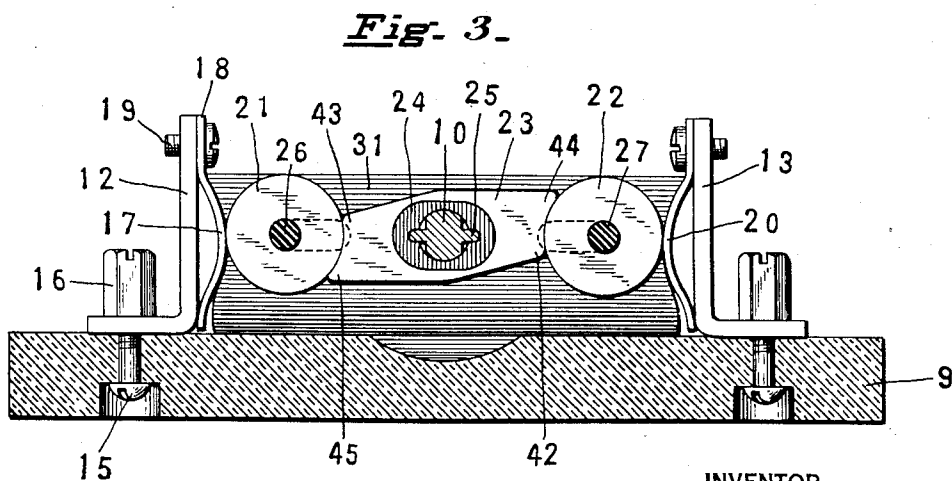
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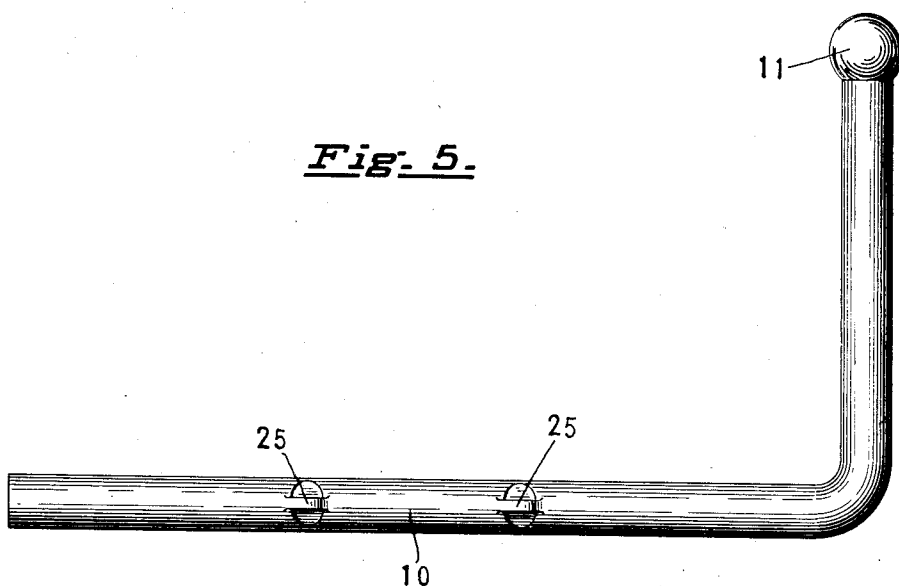
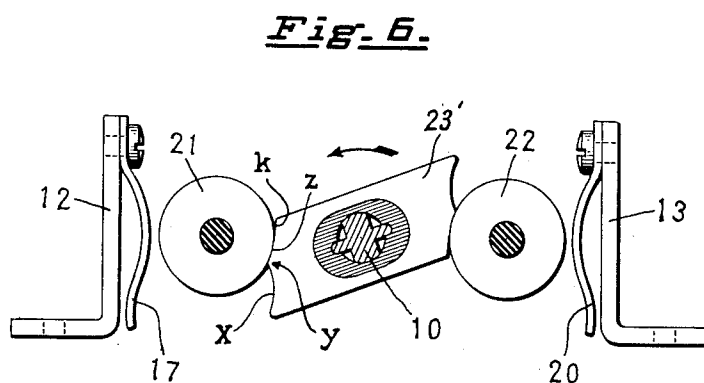
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ELECTRIC SWITCH

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3 Sheets-Sheet 3



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ELECTRIC SWITCH

Application filed September 19, 1929. Serial No. 393,695.

My invention relates to electric switches such as are in general use in the industrial arts.

One object of my invention is to provide a switch construction which will more safely and more positively break the circuit controlled by the switch.

Another object is to provide a switch which will break the circuit at a multiple number of points simultaneously or which may be arranged to first open the circuit between two points just sufficiently to actually interrupt the circuit and which will then proceed to open the circuit at two or more additional points so that any arcing between the separating points of contact will be split up or distributed through a number of contact points.

Another object is to provide a switch having rolling contacts which will engage with the co-operating stationary contacts in such a manner that any arcing that may occur will not be confined to any one spot on the respective contacts but which will travel from the point at which the arcing first starts to the point at which the contacts actually separate.

Another object is to provide a switch having rotatable contact making rollers so arranged, with respect to a cooperating cam member, that the rollers will be rotated or spun as the cam moves away from contact with the rollers in the circuit opening movement of the switch.

Another object is to provide a switch having contacts of the "butt" type and in which the contacts are engaged and are held in both open and closed positions under ample spring pressure so as to insure that the contact will positively be maintained while the switch is closed and will be surely broken when the switch is open.

Another object is to provide a switch construction which may be built up to any reasonable number of poles and in which each pole of the circuit is provided with a separate switch unit, each unit having characteristics of construction which permit of variable and interchangeable combinations.

Another object is to provide a switch unit of built-up construction of such a character that switches of different capacities may be

constructed of standardized parts by varying the number of some of the parts which are common to all of the switches of a given range of capacities.

Another object is to provide a built up type of switch unit especially adapted for enclosing in the usual switch boxes and in which the flexibility of construction is so great that it permits for the manufacturing of lines of switches having a wide range of capacities with a minimum number of parts and a minimum number of sizes of boxes.

Another object is to provide a switch construction which is comparatively so extremely compact that the enclosing box or casing may be made comparatively very small for a switch of any given capacity.

Another object is to provide a construction in which a number of switch units are operated by a common shaft of a character which is readily adapted for operation by a separate quick-make or quick-break means.

The invention resides in the construction of the switch unit any number of which may be used in a given construction. Each unit is composed of two relatively stationary contacts which are preferably resilient, two sets of roller contacts for engaging these stationary contacts and a cam member mounted between the roller contacts. This cam member also constitutes a current carrying switch member. Details of the preferred construction will be understood from the following specification and the accompanying drawings in which—

Fig. 1 is a perspective view of the construction embodying my invention and having three switch units mounted in a box, the walls of which are broken away to show the interior construction.

Fig. 2 is a side elevation of one of the switch units with the insulating side plates removed and showing the switch parts in the open circuit position.

Fig. 3 is a longitudinal sectional view and side elevation showing the parts of the switch unit in closed circuit position.

Fig. 4 is an exploded perspective view showing the parts of one of the switch units.

Fig. 5 is a detail of one form of operating

crank or handle and showing one form of integral projections for positively engaging the crank with the movable switch parts.

Fig. 6 is a side elevation of one of the switch units with the insulating side plates removed and showing a form of cam member which is especially adapted for use in breaking or disrupting an alternating current circuit, the movable cam or switch member being shown in a partially opened position.

Although the invention resides in the switch construction per se, I have shown it in Fig. 1 mounted in a box so as to show the relative proportions of one form of switch and in which the box body 7 has a cover 8 which may be mounted in any suitable manner and provided with any suitable form of interlocking mechanism.

The base 9 of the switch may be of any suitable construction preferably of insulating material and secured in the box in any suitable manner.

The operating crank 10 is preferably pivoted in the side walls of the box in any suitable manner and provided with a suitable form of external operating handle 11.

The operating crank or shaft 10 may be made of round, square or polygonal rod and may or may not have an integral portion bent at right angles to form an external operating handle 11.

I have shown three switch units in Fig. 1 but as the invention resides in the individual units it will be necessary to describe only one.

Each unit has two stationary end brackets 12 and 13 suitably secured to the base 9, for instance by screws such as 14 and 15. Binding nuts such as 16 may be provided for connecting the circuit wires. It will be obvious that any suitable form of fuse or circuit protection device may be employed but as the invention is independent of such devices I have not thought it necessary to illustrate them.

A spring contact is secured to each of the brackets 12 and 13. The exact form is immaterial to the invention. In the form shown the contact spring may be formed as a finger-like extension of the plate 18, which may be secured to the bracket 12 in any suitable manner, as for instance by one or more rivets or screws 19.

Opposite the spring contact 17 is another similar contact 20 electrically connected to the bracket 13. Between the contacts 17 and 20 are located sliding contacts in the form of rollers 21 and 22 which are actuated by cam 23. This cam is actuated by the operating crank 10, which may be insulated from the cam by an insulating member 24 which is interlocked with the shaft 10 by the lugs 25. The contact rollers 21 and 22 are mounted to freely rotate on shafts 26 and 27 which slide in and are guided by slots 28 and 29 respectively in the insulating side bars 30 and 31.

The roller shafts 26 and 27 may be of metal or of insulating material according to the capacity of the switch and according to the necessity of more completely insulating these members from the metal parts of an adjacent switch unit or other metal parts.

These rollers 21 and 22 are normally under tension of springs 32 and 33 which tend to draw the rollers away from the stationary contacts 17 and 20 respectively. The outer ends of these springs are secured to the shafts 26 and 27 and the inner ends may be connected to stationary abutments 34 and 35 as shown in Fig. 1 or the two springs may be combined as a unit and connected to each other by an integral portion 36 as shown in Fig. 4.

The ends of the cam member 23 are provided with arc-shaped contact portions 40 and 41 for engaging the periphery of contact rollers 22 and 21 respectively. These arc-shaped surfaces are so constructed that they are interposed between the contact rollers as shown in Fig. 3 when the switch is closed. The shoulders 42 and 43 pass beyond the plane which includes the axes of the rollers 21 and 22 and the axis of the shaft 10, so that the springs 32 and 33 exert pressure of the rollers against the arc-shaped surfaces 40 and 41 to hold the switch cam 23 in the closed circuit position.

The ends 44 and 45 of the cam 23 project so as to serve as abutments to limit the circuit closing movement of the switch.

The rollers 21 and 22 as well as the switch cam 23 are preferably cut or stamped from sheet metal suitable for switch contacts and in fact I have shown each of these members as formed of two plates or stampings of metal of suitable thickness. Obviously any number of these plates may be employed so that by using a different number of plates the carrying capacity of the switch may be varied as required.

The cam plates 23 and the roller plates 21 are preferably stamped from the same thickness of metal so that the total thickness of any given number of roller plates may be matched by an equal number of cam plates.

When the switch is in the open circuit position the parts are in the position shown in Figs. 1 and 2 with the contact rollers retracted. To close the switch, the operating handle 11 is actuated and the cam shoulders 42 and 43 of the switch member 23 engage the roller contacts 21 and 22 and cause them to roll into engagement with the stationary contacts 17 and 20, thus closing the circuit. To open the circuit the handle 11 is actuated in the reverse direction and as soon as the shoulders 42 and 43 of the cam move beyond the central plane of the axes of the rollers, the springs 17 and 20 will follow the rollers 21 and 22 inwardly as far as their inherent

spring force will permit, after which the spring contacts will remain relatively stationary and, as the circuit opening movement of the cam continues, a break in the circuit will occur between each of roller and its respective spring contact and, simultaneously with these breaks in the circuit the rollers will have been brought to the limit of their inward lineal movement by the springs 32 and 33, and the continued circuit opening movement of the cam member will cause its opposite ends to move away from the respective rollers thus causing two more breaks in the circuit making a total of four breaks which may be simultaneous or two of which breaks may be delayed for certain reasons which will be explained hereinafter.

As the cam shoulders 43 and 44 leave the rollers 21 and 22 the pull of the springs 32 and 33 tends to move the rollers with a snap action so that both rollers spin clockwise as viewed in Fig. 3.

During this circuit opening movement, the rollers are caused to rotate in a direction reverse to that of the switch closing movement. This rolling movement of the contacts 21 and 22 is of great importance in that it keeps the contact making surfaces clean and bright and it also causes the points of contact to move along in such a manner that the actual breaking or separating point is a considerable distance away from the point at which the arcing tendency first starts and, further, this rolling movement causes a constantly changing and relatively cooler mass of metal to be brought into the arcing area as the movement takes place.

The spring contacts 17 and 20 tend to move the respective parts to the open circuit position but their range is limited and additional means is preferably provided for moving the cam member to the fully opened position so as to provide for the more positive breaking of the circuit at all points. I have not shown any separate means for causing the full movement of the cam member because it is not a necessary or specific part of my invention since this movement may be caused by the simple normal operation of the switch crank or by any form of an additional quick break mechanism which will operate independently of the operator after the circuit opening movement is initiated manually.

In Fig. 6 I have shown my invention as applied to a switch particularly intended for controlling an alternating current circuit. The construction is similar to that which I have already described. The portion X of the cam 23' is adapted to coact with and fit the roller 21 when the circuit is closed. The projection Y is the shoulder which holds the cam closed. The portion Z is cut back to permit the initial opening movement or separation of the roller 21 from contact 17. The surface K is preferably the arc of a circle

whose center is in the center of the cam and thus momentarily maintains a relatively short breaking distance between the respective roller members and stationary contacts. From the drawings it will readily be seen that this relatively short break will be retained momentarily even if the central cam member 23' is being moved rapidly from its initial starting movement to its full off or full break position. It has been found in practice that an alternating current has far less tendency to arc if the contacts are first separated a relatively short distance and held in that position momentarily, after which the full switch throwing movement may be completed, without any arcing whatever, the reason being that a short break is great enough to interrupt the circuit but not great enough to draw an arc large enough to generate any appreciable heat or to throw off gas enough to possess any degree of arc-carrying characteristic. If this short break position could positively be maintained, it would suffice for circuit interrupting purposes, but, for the sake of greater safety, the movable switch member is preferably moved to the usual full off position after the surface K leaves the roller.

In my construction I have provided for this interrupted circuit opening and have further provided another arc-preventing means in the roller contacts which continue to roll during the circuit interrupting period so as to present a constantly changing and relatively cool contact surface and the combination of these two features makes it practically impossible for any harmful arc to form under normal circumstances.

Additional limited movement rollers may be provided and positioned between the first roller and the cam member or between the first roller and the spring contact.

I have shown the invention in a simple form but it is obvious that it is applicable to various types of switches, enclosed or otherwise. It should also be understood that the invention is subject to embodiment in other forms and modifications of details without departing from the spirit or scope of the accompanying claims.

Although I have shown a quadruple break, it should be understood that certain advantages of the invention may be attained even though the circuit may be required to be broken only between the rollers and the resilient contacts. It should also be understood that certain advantages of the invention might be attained by the use of a single stationary contact, a single roller and an actuating cam or it could be made as a six or eight break or more by addition of pairs of rolls to correspond.

I claim:

1. A switch construction including a stationary contact, a freely rotatable roller con-

tact for engagement with said stationary contact, a rotarily movable cam member for moving said roller contact towards said stationary contact said cam member having a concave recess to hold said roller contact in closed circuit position and spring means for moving said roller contact away from said stationary contact, said cam member having an abrupt shoulder for imparting an initial extra compression of the spring just before opening the circuit, the spring action tending to rotate the roller when opening the circuit.

2. In a switch, a stationary contact, a pair of insulating side bars, a sliding contact member guided in said side bars and adapted to engage said contact, a spring for pulling said member away from said stationary contact and an oscillating conducting cam coacting with said member for pressing it into engagement with said contact.

3. In a switch, a pair of side bars having guide slots, roller contacts guided in said slots, stationary contacts adapted to be engaged by said roller contacts and an oscillating cam member mounted between said bars and coacting with said roller contacts for pressing the latter into engagement with said stationary contacts.

4. A switch unit including a base, oppositely disposed resilient stationary contact members thereon, spaced insulated side bars formed with slots, pairs of oppositely disposed contact members slidably and rotatably mounted on said side bars, a cam member disposed between each pair of said sliding contacts and rockingly mounted for sliding said latter contacts, means for rocking said cam, a spring between each pair of said sliding contacts for moving the latter contacts away from the stationary contacts and pivots on said sliding contacts adapted to engage the ends of the slots in said side bars to limit the movement of the sliding contacts away from the stationary contacts.

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