May 10, 1938. H. E. METCALF 2,116,842

BUTT CONTACT ROTARY SWITCH

Filed Sept. 7, 1937

Fig. 1.

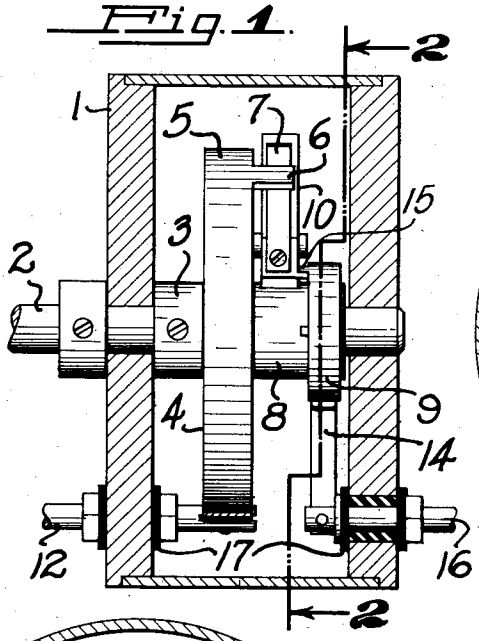
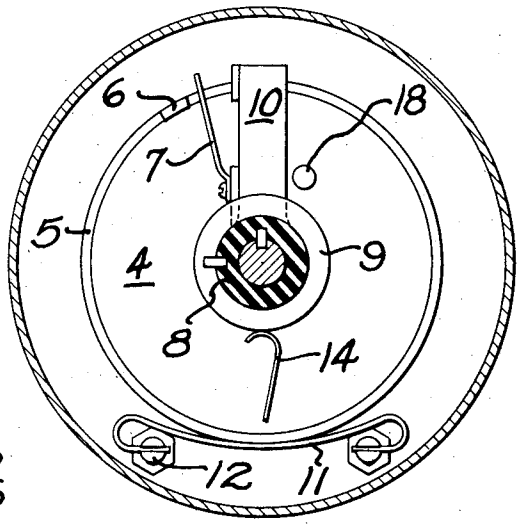


Fig. 2.



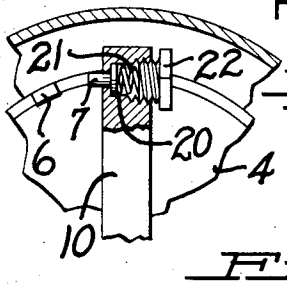


Fig. 3.

Fig. 4.

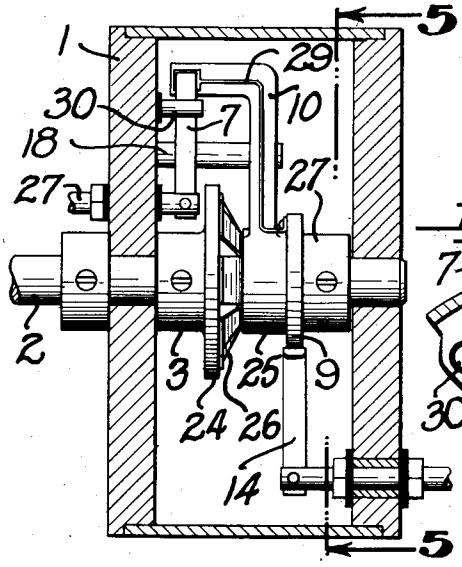


Fig. 5.

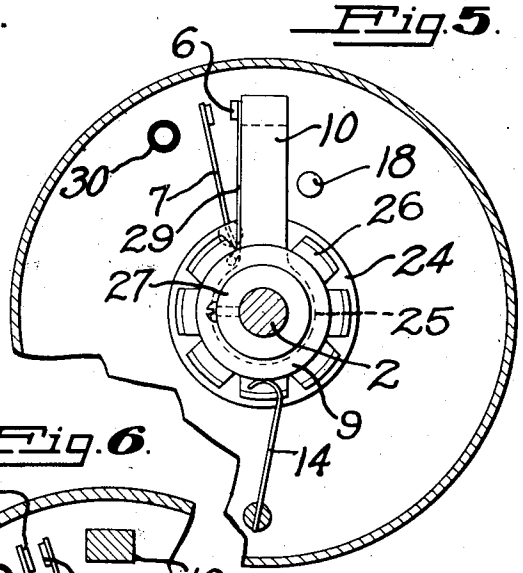
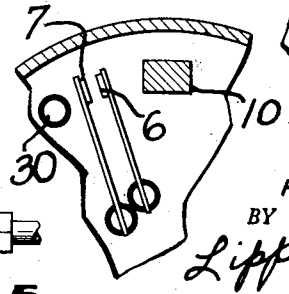


Fig. 6.



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Patented May 10, 1938 2,116,842

UNITED STATES PATENT OFFICE

2,116,842

BUTT CONTACT ROTARY SWITCH

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Application September 7, 1937, Serial No. 162,636

3 Claims. (Cl. 200—59)

My invention relates to rotary switches, and more particularly to a rotary switch which will indicate by making and breaking an electrical circuit, the direction of rotation of a shaft.

In the Clarence B. Howard United States Patent No. 2,096,745, issued October 26, 1937, the inventor has described certain forms of rotary switches operating signalling systems upon reversal of direction of rotation of a shaft, and the switches embodied therein all utilize sliding contacts, inasmuch as butt contacts have hitherto been impractical when used in conjunction with rotary switches of this type, as will be seen hereinafter.

My present invention has, for its main object, the provision of a switch wherein butt contacts may be used and supported in such a manner that the electrical circuits, when made and broken, are definitely controlled, and not subject to the irregularities, arcing, imperfect contacts, etc. of the usual type of butt contact switch.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

In the more common form of shaft reversal indicating switch, a friction driven arm is mounted on the shaft to be rotated and the end of this arm carries a contact point. A second contact point is fixedly positioned in the path of rotation of the first contact so that as the shaft is rotated in one direction, these contacts will be forced together in face-to-face relationship, the pressure of contact being derived wholly from the frictional connection with the shaft.

Such a device is only satisfactory where the shaft is rotating at relatively high speeds, because when the shaft speed is reduced the frictional forces holding the contact points together decrease, and when the shaft stops, without reversal of rotation, there is no force holding the opposing faces of the contact points together. The slightest jolt or other motion causes arcing of the contact faces, and minute rotations of the shaft cause a continual making and breaking of the electrical contact. Under these conditions the contacts are very easily destroyed, and the indication obtained cannot be relied upon because of the imperfect contact. Furthermore, there is no way possible with such switches to allow contact during a short path of reversal of the shaft to allow for minor variations in rotation without changing the indication.

I have therefore provided a switch, several modifications of which are illustrated herein, where butt contacts are used and where at least one of these contacts is resiliently supported so that when shaft rotation stops the resiliency of the support maintains the contact, irrespective of the stopping, and even of minor reversals of direction of rotation of the shaft.

Other broad objects of my invention may be more fully understood by direct reference to the drawing, wherein

Fig. 1 is a view partly in section and partly in elevation of a butt contact switch of the character described, wherein a friction controlled disc is utilized.

Fig. 2 is a view partly in section and partly in plan, taken as indicated by the line 2—2 in Fig. 1.

Fig. 3 is a view partly in section and partly in elevation of an optional method of resiliently supporting one of the contacts.

Fig. 4 is a view partly in section and partly in elevation of a modification utilizing a friction driven arm for operating the shaft.

Fig. 5 is a view partly in section and partly in elevation, taken as indicated by the line 5—5 in Fig. 4.

Fig. 6 is a view partly in section and partly in elevation of an optional arrangement of contacts.

The switch shown in detail in Figs. 1, 2, and 3 utilizes a friction controlled disc. In this type of switch a case 1 provides spaced bearings for an operating shaft 2. Inside the case there is a collar 3 fixed to the shaft, and against this collar is positioned a contact disc 4, preferably of insulating material, and having a metal periphery 5. The periphery carries a contact point 6 extending out therefrom, in the path of a resiliently supported contact 7 projecting from an insulating sleeve 8 pinned to the shaft, this sleeve being provided with a raised slip ring 9. Backing up the resiliently supported contact 7 is a rotating arm 10.

The friction brush 11, supported by brush studs 12 from the case, bears against the metal periphery 5 of the disc 4, and a circuit brush 14 bears against slip ring 9. The resiliently supported contact 7 is connected to the slip ring 9 through a metal link 15. Thus, when the resilient contact 7 touches peripheral contact 6 on disc 4, electrical connection will be made between friction brush stud 12 and slip ring brush stud 16, both of these studs being insulated from the case by bushings 17.

The operation of the switch to indicate direction of rotation by making and breaking elec-

trical contact is as follows: When shaft 2 is rotated so that the resiliently supported contact 7 approaches peripheral contact 6, nothing will happen in the switch until contact 7 touches contact 6 to establish electrical circuit through the switch. Pressure will then be exerted by the resiliently supported contact 7 against peripheral contact 6 to cause rotation of disc 4. I prefer, however, to prevent such rotation by adjusting the pressure of friction brush 11 against periphery 5, so that instead of the disc rotating, contact 7 will flex and continue to flex until the rigid arm 10 touches and backs up contact 7, thus limiting the flexure by preventing further flexure, and positively rotating the disc against the friction developed between periphery 5 and brush 11. Thus, all during the rotation in the original direction electrical contact will be made through the switch.

When the shaft 2 stops rotating, arm 10 will no longer exert a pressure against resilient contact 7 and peripheral contact 6, and in the ordinary butt switch using no resiliently supported contact, the electrical connection through the switch at this particular position would be poor, arcing would take place, and imperfect connection would be inevitable. However, under these circumstances, and in the switch just described, the resilient support of contact 7 continues to press against contact 6 and the electrical connection is maintained firm. At the same time, arm 10 may move in the reverse direction over a distance equal to the normal divergence of contact 7 from arm 10 before the electrical connection will be broken. If, however, arm 10 moves in the reverse direction a greater distance, contact 7 will then break connection with contact 6 and this break will be maintained until the direction of rotation of the shaft is again reversed.

In order that the arm 10 and contact 7 may not travel too far away from contact point 6, a stop pin 18 is provided on disc 4, so that upon rotation in the reverse direction the arm 10 will hit the stop pin 18 and the arm and disc will rotate together. It is obvious that the distance the two contacts may diverge from each other, and the distance over which they will remain in contact with each other before being backed up by arm 10, may be readily adjusted by the position of pin 18 in one instance and the divergence of contact 7 from the arm 10 in the other instance.

While in Figs. 1 and 2 I have shown the contact point 7 supported by a resilient arm extending substantially radially from shaft 2, it is obvious that this contact may also be resiliently supported directly in the end of arm 10, as shown in Fig. 3. Here, the contact 7 is free to move in a recess 20 in the end of arm 10, and the contact 7 is backed up by a coil spring 21 whose travel is regulated by spring adjustment screw 22. In this case, contact 7 may be connected to slip ring 9 in any convenient manner. The operation of the coil spring supported contact is simple, in that after the first touching of contacts 6 and 7 spring 21 compresses until it can compress no further, and thereafter the arm 10 operates to drive disc 4.

The switch shown in Figs. 4, 5, and 6 is the reciprocal of the switch shown in Figs. 1, 2, and 3. Here, the sleeve 3 is provided with a flange 24. Arm 10 is mounted on an arm sleeve 25, free to rotate on shaft 2, and a clutch spring 26 is solidly attached to sleeve 25 and bears, under pressure, against flange 24. The pressure is determined by adjustment of pressure sleeve 27 mounted on the shaft and holding the arm sleeve 25 against the push of the clutch spring.

The base of the resilient contact 7 is now mounted on the case 1 through contact stud 27, and the resilient contact 7 extends upwardly in the path of contact 6 which is now carried directly on the end of arm 10. Contact 6 is connected by link 29 to slip ring 9, which is contacted, as in the formerly described switch, by slip ring brush 14.

A stop pin 30 is now positioned back of resiliently supported contact 7 so that it can flex only a definite amount. In the operation of this switch, when the shaft 2 is rotated in one direction to cause contact 6 to approach contact 7, arm 10 being frictionally driven by the shaft, the first thing that occurs is that contact 6 touches contact 7, but inasmuch as I prefer to adjust the clutch friction to be sufficient to overcome the resiliency of the support for contact 7, contact 7 will flex and continue to flex, with contacts 6 and 7 touching, until contact 7 hits stop pin 30. A firm resistance is then offered to any continued rotation of arm 10, and the clutch spring 26 will slip on flange 24 and continue to slip during further rotation of the shaft in the same direction. When, however, the shaft is stopped and the frictional pressure removed, the resiliency of the resilient contact 7 still causes firm contact between contacts 6 and 7. Arm 10 may reverse its direction over small arcs of the shaft and contact 7 will follow contact 6 until contact 7 reaches its normal position, where it ceases to exert pressure, and with further rotation arm 10 draws away and the circuit through the switch will be broken.

Here, as in the first switch, in order to prevent contact 6 from departing too far from contact 7, a stop pin 18 is positioned on the case 1 so that when arm 10, upon reversal of rotation, reached stop pin 18, it can travel no further and the shaft 2 may continue to rotate in that direction. Upon reversal of rotation, contacts 6 and 7 will again touch and establish electrical connection through the switch.

In Fig. 6, both contacts 6 and 7 are resiliently supported, and contact 7 is backed up by stop pin 30. Here, arm 10 first touches contact 6, picks it up and carries it to touch contact 7, which is also picked up and carried until stop pin 30 is reached. Here, a firm opposition is offered to further rotation of arm 10, and the clutch slips with the electrical connection made. When the shaft stops, the resiliently supported contact 7 exerts pressure against contact 6 backed by arm 10 until contact 7 straightens out, whereupon contact 6 will leave it. The connection is broken, and contact 6 straightens out as the arm 10 proceeds in its reverse direction until it brings up against stop 18.

It is clear from the above description that the switches herein described utilize a butt contact. However, these butt contacts differ from the usual butt contacts in that at least one of the contact points is resiliently supported, so that when a second contact pushes against it the two contacts move as a unit over a predetermined path until a stop is reached, the frictional forces operating to keep the contacts in making position when the shaft is rotated in one direction and in breaking position when the shaft is rotated in the other direction. The resilient support of at least one of the contacts assures that when the shaft is stopped in contact making position there is

a firm pressure maintained between the contacts, and that when there are only slight reversals of direction of rotation of the shaft thereafter, the contacts will still touch, and then will separate cleanly when the making and breaking forces acting on them are removed.

I claim:

1. In combination, a single shaft, a driving member positively mounted on said shaft, a contact mounted on said driving member, a driven member comprising a disc mounted for free rotation on and insulated from said shaft and movable only by force communicated from said driving member, a contact on the driven member, said contacts adapted to form a butt connection and at least one of the contacts being resiliently mounted in spaced relation to its support along the arc of rotation of said driving member, said driven member being driven by the driving member when the two contacts have met and the motion of the driving member has taken up all the distance allowed by the resilient mounting of the resiliently mounted contact, a casing surrounding said members and having means therein for supporting said shaft, frictional means mounted on said casing adapted to cooperate with said driven disc member in torque creating relationship thereto at a point at a substantial radial distance from said shaft and operating to keep said contacts in contact making position when said shaft is rotating in one direction, and in contact breaking position when the shaft is rotating in the other direction, said frictional means being insulated from said shaft and also serving as an electrical connection to the driven member, and stop means mounted on said driven member for limiting the separation of the contacts.

2. A combination as defined in claim 1, characterized in that the resilient contact is mounted on the driving member.

3. A combination as defined in claim 1, characterized in that the resilient contact comprises a movable element adapted to move relatively to the driving member, and a cooperating spring, both the movable element and the spring being mounted on said driving member.

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