May 22, 1956 G. V. JEFFERSON 2,747,056

CIRCUIT CONTROLLER

Filed April 20, 1953 2 Sheets-Sheet 1

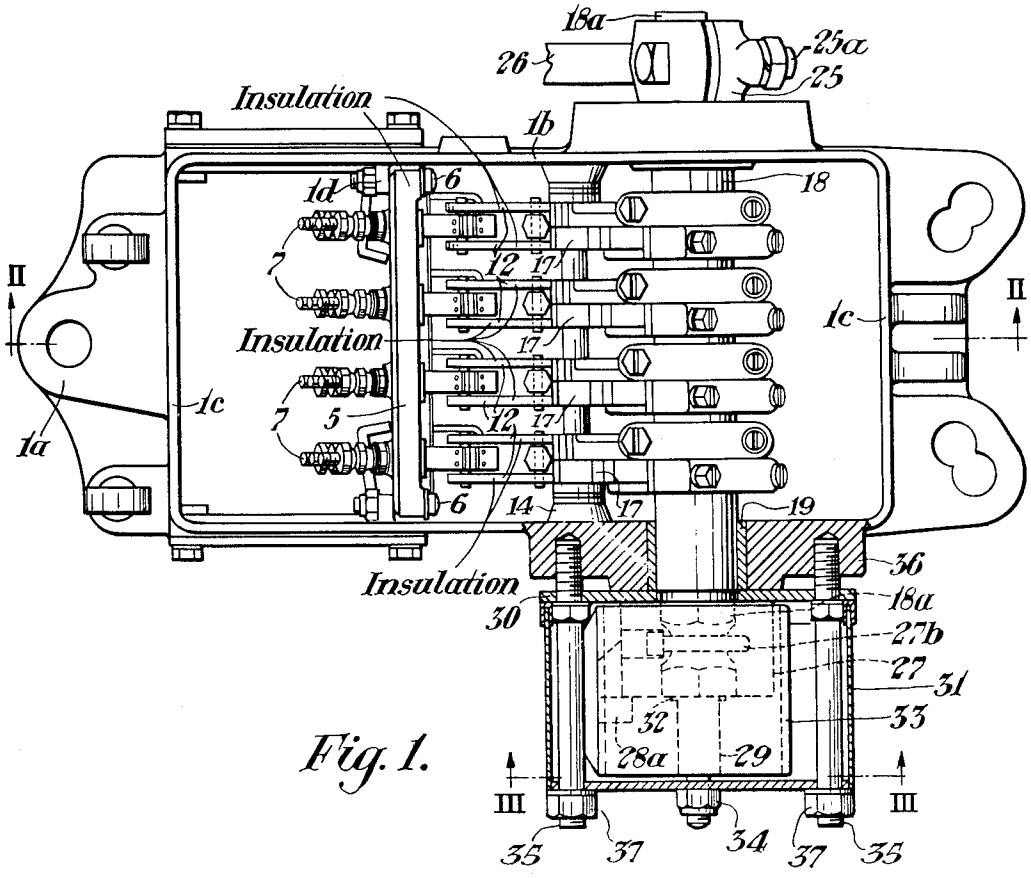


Fig. 1.

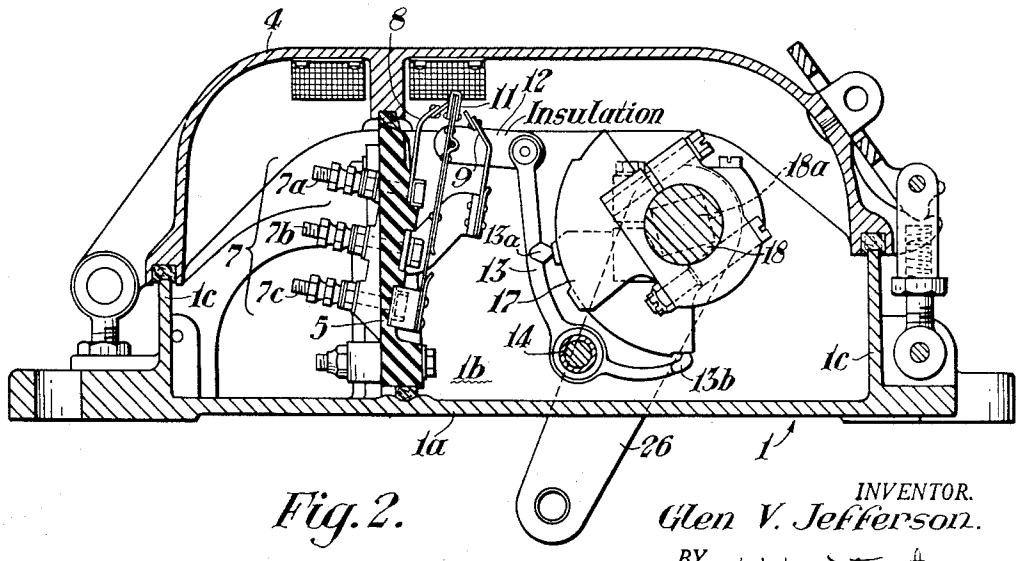


Fig. 2.

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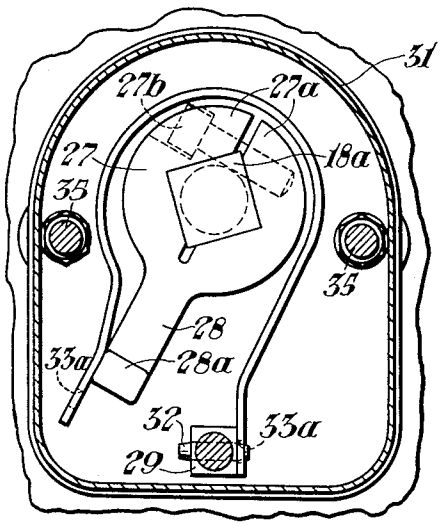


Fig. 3.

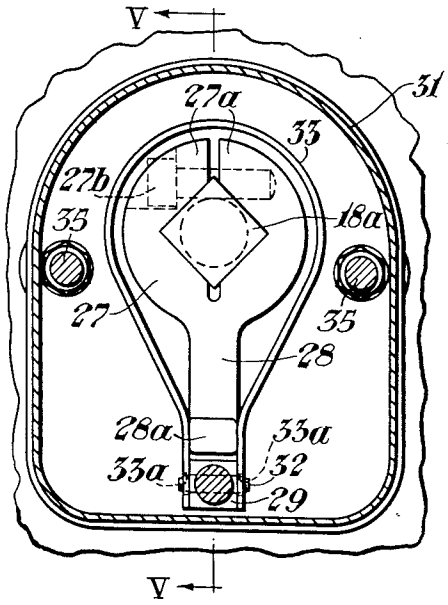


Fig. 4.

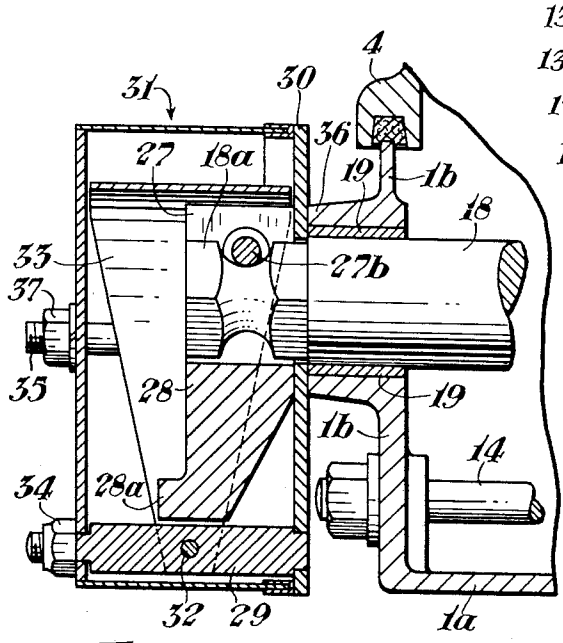


Fig. 5.

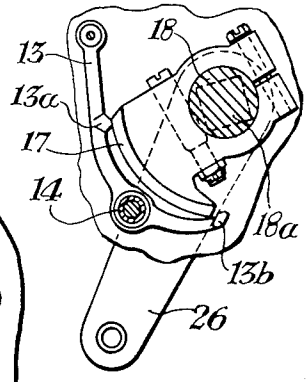


Fig. 6.

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2,747,056

CIRCUIT CONTROLLER

Glen V. Jefferson, Edgewood, Pa., assignor to Westinghouse Air Brake Company, Wilmerding, Pa., a corporation of Pennsylvania

Application April 20, 1953, Serial No. 349,799

4 Claims. (Cl. 200—153)

My invention relates to circuit controllers, and particularly to circuit controllers having a cam shaft operable between an intermediate position and two extreme positions.

Circuit controllers of the type described are often used in railway signaling systems in conjunction with railway switches and/or signals and at drawbridge locations as well as at miscellaneous other locations where it is desired to control circuits in response to the position of the device with which the circuit controller is associated. In such applications, there are two major types of circuit controllers which are used, a three position controller and a two position controller.

Both types of circuit controllers are provided with a rotatable shaft which rotates in response to movement of the associated device. In the three position controller, a first contact is closed when the shaft is in one extreme position, a second contact is closed when the shaft is in a second extreme position and both contacts are open when the shaft is in an intermediate position. In the two position controller, there may be several arrangements. A contact may be closed in a first extreme position and open in all other positions, or a contact may be open in a first position and closed in all other positions, or there may be a combination of these two arrangements.

In either type of circuit controller it is often desirable to have the shaft biased toward its intermediate position so that in case the linkage connecting the circuit controller with the associated device should break or become disconnected, the shaft will be moved to its intermediate position wherein a circuit will be established for displaying a restrictive warning indication, thereby insuring a so-called safe failure.

A common application for the type of circuit controller described herein is in conjunction with a railway switch. In such an application, the circuit controller is usually mounted on the ties adjacent the associated switch. The shaft of the controller is operatively connected to the switch points by suitable linkage so that when the switch points are in their normal position, the shaft is in a first position and when the switch points are in their reverse position, the shaft is in a second position. Operatively connected to the shaft are contacts which usually control a wayside signal governing train movements over the switch. If the circuit controller is a three position controller, circuits usually will be established for permitting the signal to display a proceed indication when the switch points are in their normal or reverse position and when the points are in any position in between these two extreme positions, the signal will be set to stop. The signal may be controlled directly by contacts of the circuit controller or the circuit controller may control a repeater relay which in turn controls the signal. If a repeater relay is used, the energizing circuit for the repeater relay will usually be shunted by the controller contacts when the controller contacts are in their intermediate positions

to thereby set the signal to stop. If the circuit controller is a two position controller, the controlled signal will be clear when and only when the switch points are in their normal position, and the signal will be at stop when the switch points are in any other position.

Regardless of the type of circuit controller and the type of circuitry associated therewith, because of the extreme conditions of vibration to which a circuit controller is subjected, it is desirable for reasons of safety to make provision for the possibility of a mechanical failure, in which case the circuit controller would not indicate the true position of the switch points. A simple method of accomplishing this is to bias the shaft to its intermediate position so that if the operating linkage breaks or becomes disconnected, the shaft will be moved to its intermediate position to stop train movements.

It is therefore an object of my invention to provide improved spring biasing means for use in a circuit controller of the type described to bias the shaft of the controller to its intermediate position in the event of breakage of the linkage connecting the controller to the associated device.

A further object of my invention is to provide a biasing means for the operating shaft of circuit controllers of the type described wherein the biasing means does not take up any space in the circuit controller housing but can be readily mounted on the outside of the main housing.

A further object of my invention is to provide an improved circuit controller which is readily adaptable to either left-hand or right-hand operation.

According to my invention, I provide a circuit controller having a shaft which is rotatable between a first and a second extreme position, and an intermediate position. Mounted on one end of the shaft is a crank and fixedly mounted below the crank is a stud. A pin is securely mounted in the stud and has its ends extending beyond the sides of the stud. I further provide a U-shaped spring having arms so tapered that when the spring is loaded, the unit stress is substantially uniform throughout. Each of the spring arms has an opening in it which fits around the pin extensions, and the arms are biased into engagement with the sides of the stud. This initial bias and the arm openings fitting around the pin extensions are sufficient to hold the spring in its normal position when the circuit controller shaft is in its intermediate position.

Upon the shaft being rotated to its first or second extreme position, the crank will move one of the spring arms away from the stud. Accordingly, the spring will exert a force against the crank tending to rotate the shaft so that the shaft will be restored to its intermediate position. If the means for rotating the shaft to its first or second extreme position becomes broken or disconnected, the spring will be effective for returning the shaft to its intermediate position.

Other objects of my invention will become apparent hereinafter as the characteristic features of construction and mode of operation of my invention are described in detail.

I shall describe two forms of circuit controllers embodying my invention and shall then point out the novel features thereof in claims.

In the accompanying drawings,

Fig. 1 is a plan view, with the cover removed and certain of the parts in section showing a three position electrical circuit controller embodying my invention.

Fig. 2 is a cross sectional view taken along the line II—II of Fig. 1, with the cover of the circuit controller in place.

Fig. 3 is an enlarged sectional view taken along the line III—III of Fig. 1.

Fig. 4 is a sectional view taken along the line III—III

of Fig. 1, with the circuit controller shaft in its intermediate position.

Fig. 5 is a sectional view taken along the line V—V of Fig. 4.

Fig. 6 is a cross sectional view of a cam construction which may replace the cam construction shown in Fig. 1 in order to convert the circuit controller shown in Fig. 1 to a two position circuit controller.

Similar reference characters refer to similar parts in each of the several views.

Referring now to the drawings, there is shown a housing comprising a casing 1 and a hinged cover 4. The casing 1 consists of a bottom 1*a*, sides 1*b* and ends 1*c*. The housing may be of any suitable design. For instance, it may be similar to the housing shown and described in Letters Patent of the United States No. 2,575,994, issued on November 20, 1951, to Herbert L. Bone and Glen V. Jefferson for Control Apparatus.

A terminal board 5, of insulating material, is mounted on ribs 1*d* formed on the sides 1*b* of casing 1. The terminal board 5 is mounted on the ribs 1*d* by mounting bolts 6, and carries four sets of terminals 7. Each set comprises three terminals 7*a*, 7*b* and 7*c*. These terminals extend through the terminal board 5, and on one side are attached respectively to a stationary contact finger 8, a stationary contact finger 9, and a movable contact finger 11. These contact fingers are of the leaf spring type, and are supported at one end on the terminal board 5 by the associated terminal. The free end of the movable contact finger 11 lies between the free ends of stationary contact fingers 8 and 9, and is connected by a link 12 to a rocker arm 13 pivotally mounted on a rockshaft 14. The rocker arm 13 carries a pair of hardened steel cam followers 13*a* and 13*b*, which cooperate with cams 17 mounted by suitable means on a cam shaft 18 which rotates in bushings 19 in the opposite sides 1*b* of casing 1.

The portion of the circuit controller thus far described is all well known, and if a more detailed description is desired, reference may be had to the aforementioned Bone and Jefferson patent.

Cam shaft 18 extends outside the casing 1 substantially equal amounts on the opposite sides of the casing. The outer ends of the shaft 18 are squared, as indicated at 18*a*. Clamped on one of the squared portions 18*a* by means of a threaded bolt 25*a* is a split hub 25, to which is attached a crank arm 26. When installed, crank arm 26 will be connected to the points of a railway switch or to the movable portion of some other associated device by means not shown and crank 26 will be rotated in response to the motion of the associated device to rotate shaft 18.

Mounted on the other squared end 18*a* of shaft 18 is another split hub 27 which is securely fastened thereon by means of a bolt 27*b* which is received in a threaded hole of the split hub 27. Fixedly attached to hub 27 is a crank arm 28. Although hub 27 and crank arm 28 may be two separate members, they are shown in the drawings as one continuous member, which is the preferred embodiment. At the lower end of crank arm 28 is a foot 28*a* which extends from crank arm 28 in a direction substantially perpendicular to the vertical axis of the crank arm.

Mounted below foot 28*a* of crank arm 28 is a stud 29 which has a threaded end and has its other end mounted on a plate 30 which is attached to one of the sides 1*b* of casing 1. Plate 30 forms a part of an auxiliary housing 31, the remainder of which is removable. The removable portion of the auxiliary housing is held in place by a nut 34 mounted on the threaded end of stud 29 and by a pair of nuts 37 mounted on studs 35 secured to a boss 36. Firmly mounted in the stud 29 is a pin 32 having its ends extending beyond the sides of stud 29 on each side.

Also provided in the auxiliary housing 31 is a U-shaped return spring 33. The return spring 33 is formed from a strip of spring metal and has its ends tapered so as to produce substantially uniform unit stresses in the spring for loads applied to the ends of the spring. Preferably the edges of the spring are rounded so as to reduce concentration of stresses as the spring is deflected. After the spring is tapered and the edges are rounded, it is bent into substantially the shape shown in Fig. 4, that is, with a rounded central portion and the two arms being biased so as to contact each other at their ends if the stud were not positioned in between them. Each of the arms is provided with an opening 33*a* which is preferably chamfered and which fits over an extending end of pin 32 so as to position spring 33. The extending ends of pin 32 are preferably provided with a slight taper to more easily position openings 33*a* thereon. The arms of spring 33 are provided with an initial bias toward each other in order to aid the spring in remaining in its proper position by securely clamping on stud 29, thereby preventing chattering of the spring when spring 33 is in the position shown in Fig. 4. The initial bias also insures that spring 33 will always be under tension which is desirable for reasons to be explained hereinafter.

It will be clear that placing my novel biasing means in an auxiliary housing has decided advantages. With such an arrangement, no space is taken up in the main housing 1. Furthermore, with the biasing means located outside of the main housing, it will be a simple matter to inspect and maintain it. In addition, with the arrangement proposed herein, existing circuit controllers not now provided with a biasing means can be provided with my novel biasing means with relative ease, merely by substituting a suitable cam shaft for the cam shaft in service and affixing the spring and stud arrangement to the outside of the housing in an auxiliary housing.

The circuit controller is shown in Fig. 1, Fig. 2 and Fig. 3 in its normal position. Crank 26 is in its extreme left-hand position. The movable contact fingers 11 are in engagement with the stationary contact fingers 8, thereby completing a first set of electric circuits. The return spring 33 has been bent away from its normal position by crank arm 28 so that it is biasing crank arm 28 and therefore cam shaft 18 for movement in the counterclockwise direction as viewed in Fig. 3.

If crank 26 is operated toward its extreme right-hand position, shaft 18 will be rotated counterclockwise as viewed in Fig. 2. During the initial portion of this rotation, cam 17 cooperates with cam followers 13*a* and 13*b* to rotate the rocker arm 13 clockwise on shaft 14, which causes operating link 12 to move movable contact finger 11 out of engagement with fixed contact finger 8 but not into engagement with fixed contact finger 9. At this time, both sets of contacts 8—11 and 9—11 will be open. Upon continued rotation of crank 26 toward its right-hand position, cam 17 will cooperate with cam followers 13*a* and 13*b* to further rotate rocker arm 13 clockwise on shaft 14. This further rotation of rocker arm 13 will operate link 12 so as to move contact finger 11 into engagement with contact finger 9, thereby closing contact 9—11.

When crank 26 is moved to its reverse extreme position, shaft 18 will rotate in a counterclockwise direction as just described, crank 28 will rotate in a counterclockwise direction, as viewed in Fig. 3, and will be placed in a position similar to that shown in Fig. 3, except that crank 28 will be rotated to its right-hand extreme position, thereby causing the right arm of spring 33 to be moved away from stud 29 and the left arm of spring 33 to engage stud 29.

If, with the circuit controller in its normal or reverse position, the linkage imparting motion to crank 26 should break or there should be some other failure in the operating linkage, then return spring 33 will be effective to rotate cam shaft 18 so that the mechanism will be moved into the position shown in Fig. 4, in which position neither set of contacts will be closed.

It will be seen, therefore, that failure of the circuit controller operating linkage will not produce an unsafe condition. That is, if the connecting link becomes broken so that the controller will no longer indicate the true position of the associated device, circuits will be controlled in a manner to indicate that the crank **26** is not in its normal or reverse position.

As was stated earlier, the novelty in my invention resides in the provision of the U-shaped return spring **33** which is frequently housed outside of the main housing of a circuit controller of the type described. As was already stated, the spring is designed to have substantially uniform strength throughout so that no portion of the spring will be subjected to stress concentrations. It will be obvious that with a return spring of the design shown herein, the circuit controller is especially well adapted for either left or right-hand operation since there is no material difference in the operation of return spring **33** regardless of which type of operation is used. Furthermore, with shaft **18** extending beyond the housing substantially equal amounts on both sides, it will be clear that from right-hand to left-hand operation can be accomplished by merely securing crank **26** on the opposite end of shaft **18** and by placing the biasing assembly and the auxiliary housing on the end originally occupied by crank **26**.

A circuit controller provided with my novel centering spring is well adapted for the three position operation just described. My spring is suitable for this type of operation because regardless of which direction the shaft is rotated, the stress set up in the return spring **33** will always be in the same direction. This is true since, whichever spring arm is being moved by crank **28**, the relative motion of the two arms of spring **33** will remain the same and, therefore, the stress in the spring will always remain in the same direction. Furthermore, with the spring being subject to an initial tension even in the position shown in Fig. 4, the stress in the spring will always be in the same direction, regardless of the position of the spring. With the direction of stress in the spring never reversing, the spring will not be subject to as much fatigue as are springs in which the direction of stress does reverse and, accordingly, the spring may be subjected to relatively high stresses without unduly shortening the life of the spring.

Referring now to Fig. 6, it will be seen that my novel return spring will operate effectively with a two position circuit controller. As can be seen in Fig. 6, when the crank **26** is moved away from its extreme left-hand position, shaft **18** will be rotated counterclockwise and almost immediately upon commercement of the motion, cam **17** will cooperate with cam followers **13***a* and **13***b* to rotate rocker arm **13** clockwise on rock shaft **14**. The clockwise rotation of rocker arm **13** will actuate link **12** to move contact finger **11** out of engagement with contact finger **8** and into engagement with contact finger **9**, thereby either establishing or opening associated circuits. The additional motion of the crank **26** as it moves to its extreme right-hand position will merely serve to increase the contact pressure of contact fingers **11** and **9**.

With such an arrangement, regardless of the position of the crank **26**, if the operating linkage for any reason fails, spring **33** will move crank **28** to an intermediate position between the normal and reverse positions, as shown in Fig. 4, wherein contact fingers **9** and **11** will be in engagement. Thus a safe indication may be obtained if such a failure occurs.

Although I have herein shown and described only two forms of apparatus embodying my invention, it is to be understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination with a shaft rotatable from an intermediate position to two extreme positions, a crank secured to said shaft and rotatable therewith, a stud fixedly mounted a distance from said shaft greater than the length of said crank and so positioned that when said shaft is in its intermediate position said stud will be in radial alignment with said crank; a protrusion on opposite sides of the stud, and a U-shaped spring having an aperture at the end of each arm and being positioned around said shaft and crank, said spring being biased to clamp the stud between the spring arms when said shaft is in its intermediate position, the stud protrusions registering in the apertures of the spring arms; said spring arms being disposed on both sides of said crank and in the arc of travel of said crank, the rotation of the shaft from its intermediate position to one of its extreme positions rotating said crank to move one of said spring arms out of engagement with one side of said stud, the other spring arm remaining in engagement with the other side of said stud.

2. In combination with a shaft rotatable to two positions, a crank secured to said shaft and rotatable therewith, a stud fixedly mounted a distance from said shaft greater than the length of said crank and so positioned that when said shaft is in a first of said positions said stud will be in radial alignment with said crank, said stud having a protrusion on each side, and a U-shaped spring having an aperture at the end of each arm and being positioned around said shaft and crank, said spring being biased to clamp the sides of the stud between the spring arms when the shaft is in the first of said positions, the stud protrusions registering in the apertures of the spring arms; said spring arms being disposed in the arc of travel of said crank, the rotation of said shaft to the second of said positions rotating said crank to move one of said spring arms out of engagement with a side of said stud whereas the other spring arm will remain in engagement with the other side of said stud.

3. In a circuit controller having a contact operable to two positions in response to the rotation of a shaft, the combination comprising a crank secured to said shaft and rotatable therewith, a fixedly mounted stud so positioned that when said contact is in a first of said positions, said stud will be in radial alignment with said crank, a pin mounted in said stud and extending beyond the sides of said stud, and a U-shaped spring having an aperture at the end of each arm and being positioned around said shaft and crank, said spring being biased to clamp the sides of said stud between the spring arms when said contact is in said first position, the stud pin registering in the apertures of the spring arms; said spring arms being disposed in the arc of travel of said crank, the operation of said contact to the second of said positions rotating the crank to move one of the spring arms out of engagement with one side of said stud whereas the other spring arm will be in substantially the same position it is in when said contact is in said first position.

4. In a circuit controller having a contact operable to three positions in response to the rotation of a shaft, the combination comprising a crank secured to said shaft and rotatable therewith, a fixedly mounted stud so positioned that when said contact is in a first of said positions said stud will be in radial alignment with said crank, a pin mounted in said stud and extending beyond the sides of said stud, and a U-shaped spring having an aperture at the end of each arm and being positioned around said shaft and crank; said spring being biased to clamp said stud between the spring arms when said contact is in said first position, said stud pin extensions entering said spring arm apertures; said spring arms being disposed in the arc of travel of said crank, the operation of said contact to its second or third position rotating said crank to move one or the other of said spring arms out of engagement with one side of said stud, the unmoved spring arm remaining

in substantially the same position it is in when said contact is in said first position.

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