Dec. 30, 1930. G. R. TOWNSEND 1,787,292

CIRCUIT CONTROLLING DEVICE

Filed Nov. 3, 1928

Fig. 1.

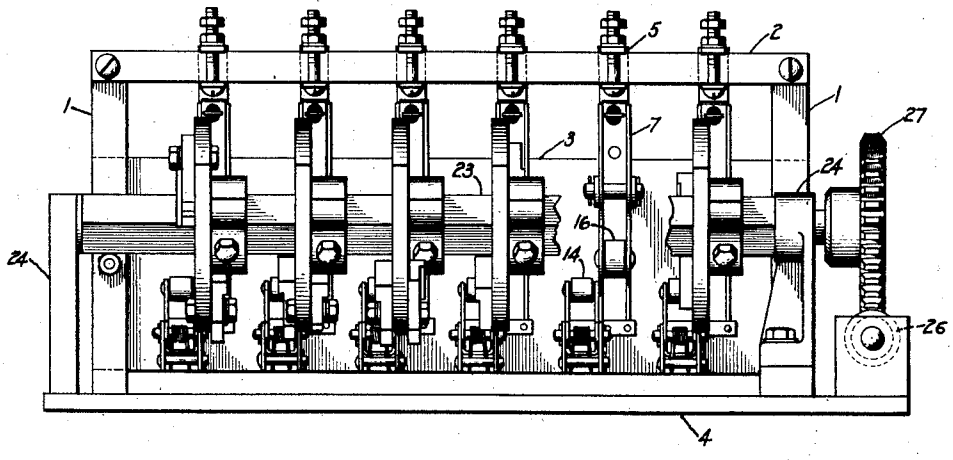


Fig. 2.

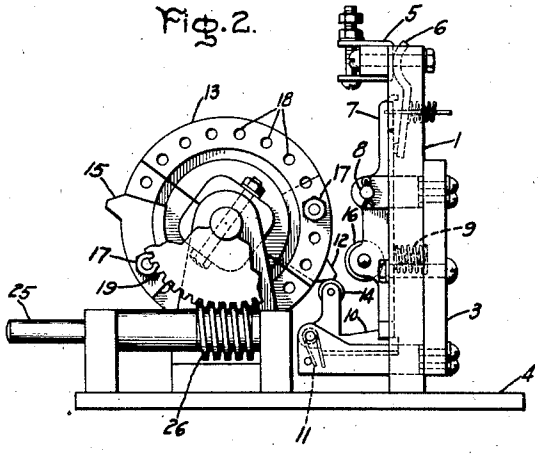


Fig. 3.

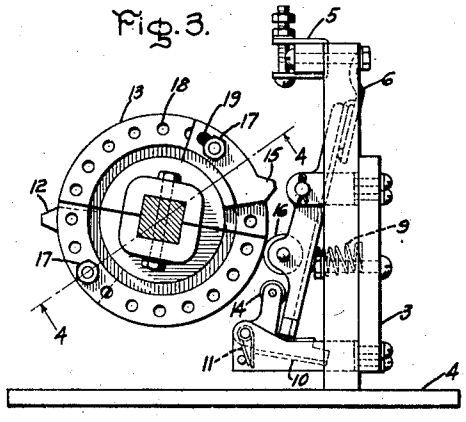
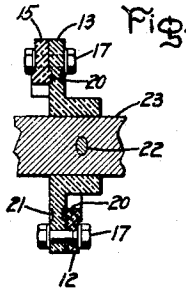


Fig. 4.



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UNITED STATES PATENT OFFICE

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CIRCUIT-CONTROLLING DEVICE

Application filed November 3, 1928. Serial No. 317,095.

My invention relates to circuit controlling devices, particularly of the cam-operated type, and has for its object the provision of an improved form of latched type switch mechanism having cam-operated operating means and separate cam operated releasing means.

While not necessarily limited thereto, the present invention is particularly advantageous in a cam switch mechanism arranged to complete and interrupt a plurality of electric circuits in a predetermined sequence, especially where the operating cam is to be operated in both directions of rotation. Such a switch mechanism is readily adapted for use as a limit switch in connection with automatic magnetic controllers for reversible motor driven machines having a fixed sequence of operation such as accelerating, slowing down and stopping in each direction of rotation as, for example, motor driven rolling mills, hoists, or the like. In addition my improved cam-operated switch mechanism is adapted for continuous rotation in either direction, a requirement which the ordinary limit switch of the traveling nut type does not meet.

Briefly, in my improved form of cam-operated switch mechanism, a rotatable cam member is arranged to operate the movable switch member to one of its circuit controlling positions upon rotation of the cam shaft in either direction to the required angular position. A latch mechanism is provided for maintaining the switch member in a circuit controlling position to which it is operated independently of the operating cam. A second cam is provided on the cam shaft for operating the latch mechanism to release the switch member upon further rotation of the cam shaft in either the same or the reverse direction. In this way the switch member may be closed by operation of the cam shaft in one direction corresponding to operation of the motor driven apparatus in a corresponding direction, for example, the forward direction, and released upon a predetermined operation of the cam member in the other direction corresponding to operation of the motor driven apparatus in the reverse direction. The same considerations hold true even when a plurality of switches are operated from a common cam shaft. Both the operating cams and the releasing cams may be adjustably mounted on the operating cam shaft in accordance with my present invention so that any desired sequence of closing or of opening the switch members may be obtained. Moreover, the construction is such that the cam shaft may be rotated continuously in either direction and the switch members will be successfully opened and closed in a predetermined sequence.

A better understanding of the improved cam-operated switch mechanism of the present invention may be had from a consideration of the accompanying drawing and the following detailed description thereof.

In the drawing Fig. 1 is a front elevation of a preferred form of my improved cam operated switch mechanism suitable for controlling a plurality of circuits with a portion of the camshaft cut away in order to reveal the details of construction of one of the several switch units employed therein.

Fig. 2 is an end view of the switch unit with the movable contact latched in closed position;

Fig. 3 is an end view of the switch unit, partly in section, with the operating mechanism removed showing the contacts in open position; and

Fig. 4 is a sectional view of a portion of the camshaft taken on line 4—4 of Fig. 3 showing the detailed construction of the operating cams.

The switch mechanism of Fig. 1 comprises uprights 1, horizontal member 2 upon which a plurality of stationary contacts 5 are mounted in spaced alinement and panel 3, which are mounted upon base 4. Referring to Figs. 2 and 3 of the drawing, which show a single switch element of the combined switch illustrated in Fig. 1, the stationary contact 5 mounted on the horizontal member 2 has a cooperating contact 6 carried by the movable switch member 7 which is pivotally supported intermediate its ends at 8 and biased to open position by the spring 9. The

pivoted latch 10 under bias of the spring 11 serves to hold the switch member 7 in closed position when operated thereto. The cam 12 carried on the cam disk 13 serves to engage the roller 14 to release the latch 10 permitting the spring 9 to open the contacts 5 and 6. A second cam 15 mounted upon the opposite side of the cam disk 13 is arranged to engage the roller 16 to reclose the switch. It will be noted that as shown in Fig. 1 the roller 16 is mounted out of alinement with the roller 14 so that each of the cams 12 and 15 are in cooperating relation with only the corresponding one of the rollers, thus rendering the closing and opening operations entirely independent of each other. The cams 12 and 15 are mounted at any desired positions on opposite sides of the cam disk 13 by means of the bolts 17 which are placed through any one of the circular row of 18 near the circumference of the cam disk 13. Thus cams 12 and 15 rotate in axially spaced apart paths to engage respectively with rollers 14 and 16 and may be independently adjusted to vary the closing or opening position of the cam disk. The slot 19 in the cams 12 and 15 through which the bolts 17 pass make possible a fine adjustment. The tongues 20 adapted to mesh with the circular grooves 21 in the cam disk 13 insure proper alinement of the cams 12 and 15. The cam disk 13 is split along a diameter so as to be made up of two separable halves to permit easy removal and the two halves are held together by the bolt 22 which secures the cam disk to the camshaft 23. This camshaft preferably is provided with a non-circular cross section over the portion upon which the disks 13 are to be mounted and is carried by bearings 24 suitably mounted on the base 4 and is driven by shaft 25 through the worm 26 and the gear 27. The disks 13 are provided with non-circular hubs as shown which fit in snug engagement with the non-circular portion of the shaft 23, thus relieving the bolts 22 which hold the separable halves of the disks together of substantially all shearing stress when the cam shaft is rotated. The shaft 25 is driven by the machine which is to be controlled.

As thus constructed and arranged the operation of my improved controller mechanism is as follows: With the switch in the position shown in Fig. 3 the contacts are held open by the biasing spring 9. When the camshaft is rotated in either direction the cam 15 engages with the roller 16 to close the switch. As soon as the lower extremity of the switch passes the detent in the latch 10 the spring 11 elevates the detent which holds the switch in closed position. Further rotation of the camshaft in either direction brings the cam 12 into engagement with the roller 14 which depresses the latch and the switch is opened by spring 9.

In case the rotation of the cam shaft 23 should be stopped after closure of the switch and before the cam 12 is brought into engagement with the roller 14 and the cam shaft should then be rotated in the reverse direction, the cam 15 passes by the roller 16 since the switch is already in the closed position. Upon continued rotation of the cam shaft in the reverse direction the cam 12 is carried into engagement with the roller 14 to release the switch member 7 for operation to the open position in accordance with its bias in substantially the same manner as previously described. In case the rotation of the cam shaft 23 in the reverse direction is further continued, the cam 15 again is carried into engagement with the roller 16 to effect the reclosure of the switch in a similar manner to that previously described. Thus it will be seen that my improved form of cam-operated switch mechanism permits the switch member to be both opened and closed upon rotation of the operating cam shaft in each direction. Moreover, it will be evident that the cam shaft 23 may be rotated continuously in either direction or arranged to make a predetermined rotation in one direction to either close or open the switch and then rotate in the opposite direction as first described to effect the reverse operation of the switch. This latter feature is of particular advantage where the cam switch is employed in reversible motor control service.

As both the cams 12 and 15 are adjustably mounted upon the camwheel 13, their relative angular positions may be varied at will. Consequently the switch 7 may be closed or opened at any desired point in the rotation of the camshaft 23. Thus it will be seen that with a series of switches, as shown in Fig. 1, any desired sequence of opening and closing thereof may be obtained with rotation of the cam shaft continuously in either direction or partly in one direction and partly in the other direction.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination of a movable switch member biased to one position, means for holding the switch member in another position against its bias to said one position, and a movable member for operating the switch member to said one position upon a predetermined movement of the operating member in one direction and for controlling said holding means to release the switch member for operation in accordance with its bias upon movement of the operating member in the other direction.

2. The combination of a movable switch member, a rotatable member for operating the switch member to a predetermined position, latch mechanism for maintaining the switch member in said position independently of the operating member and means associated with the operating member for

controlling said latch mechanism to release the switch member upon reverse rotation of the operating member.

3. The combination of a movable switch member operable between two positions and biased to one of said positions, a rotatable member having a cam for operating the switch member to the other of said positions upon rotation of the cam in one direction, latch mechanism for maintaining the switch member in said other position independently of the operating cam, and a second cam associated with said rotatable member for controlling said latch mechanism to release the switch member for operation in accordance with its bias upon rotation of the rotatable element in the reverse direction.

4. The combination of a movable switch member operable between two positions and biased to one of said positions, a rotatable element having a cam for operating the switch member to the other of said positions upon rotation of the member in each direction, latch mechanism for maintaining the switch member in said other position independently of the operating cam, and a second cam associated with said rotatable member for controlling said latch mechanism to release the switch member for operation in accordance with its bias upon rotation of the rotatable member in each direction.

5. The combination of a movable switch member biased to one position, latch mechanism for holding the switch member in another position upon operation thereto, a rotatable member having a pair of cam elements adjustably mounted thereon, one for operating the switch member to said other position upon rotation of the rotatable member in each direction to a predetermined angular position and the other for operating the said latch mechanism to release the switch member for operation to said one position in accordance with its bias upon rotation of the rotatable element in each direction to a different angular position.

6. The combination of a movable switch member biased to one position, latch mechanism for holding the switch member in another position upon operation thereto, a rotatable disk, a double-acting cam element adjustably secured to one side of the disk for operating the switch member to said other position upon rotation of the disk in each direction, and a second double-acting cam element adjustably secured to the other side of the disk for controlling said latch mechanism to release the switch member for operation to said one position in accordance with its bias upon rotation of the disk in each direction.

7. The combination of a movable switch member biased to one position, latch mechanism for holding the switch member in another position upon operation thereto, a rotatable disk having a circular groove in each side thereof, a circular row of openings adjacent the groove, a cam element having a portion arranged to nest within the groove on one side of said disk, a fastening element arranged to fit into any selected one of the holes in the disk for securing the cam element in position to operate said switch member to said other position upon rotation of the disk and a second cam element having a portion arranged to nest within the groove on the other side of the disk and a fastening element arranged to fit into any selected one of the remaining holes in the disk to maintain the cam element in position to operate said latch mechanism to release the switch member for operation to said one position in accordance with its bias upon rotation of the disk.

8. In combination, a stationary contact, a movable member pivoted intermediate its ends and having a contact mounted at one end thereof in cooperating relation with the stationary contact, biasing means associated with the other end of the movable member for biasing the same to operate the contact to the open position, a spring actuated latch cooperating with said other end of the movable member for holding the contact in the closed position, a rotatable disk having double acting cam elements adjustably mounted on opposite sides thereof for rotation in axially spaced apart paths, and means associated with said one end of the movable member and disposed in the path of one of said cams to be engaged thereby for operation of the movable member to effect movement of the contact to the closed position upon rotation of the disk in each direction, and means associated with said latch and disposed in the path of the other cam element to be engaged thereby for effecting release of the latch to permit movement of the relatively movable contact to the open position upon rotation of said disk in each direction.

9. A multiple contact cam switch comprising a plurality of stationary switch members mounted in spaced alinement, a plurality of cooperating movable switch members each biased to one position and having an independently movable latch for maintaining the same in another position, a rotatable shaft, and a plurality of two part disks removably mounted on the shaft and each having cams adjustably mounted thereon in cooperating relation respectively with a corresponding movable switch member and latch to effect operation of the switch members upon rotation of said cam shaft in a sequence dependent upon the adjustment of said cam elements.

10. In a circuit controller, a rotatable shaft, a plurality of units removably mounted thereon, each comprising a disk formed of separable semi-circular halves and having

independently adjustable cams mounted on opposite sides thereof, a plurality of stationary contact members, a plurality of cooperating movable contact members pivoted intermediate their ends and biased to open position, one of said cams on each disk being adapted to close a corresponding one of said movable contact members, spring actuated latching means for holding the contacts closed, the other of said cams on each camwheel being adapted to release said latching means to permit, the contacts to open, and means for rotating the shaft.

In witness whereof I have hereunto set my hand this 2nd day of November, 1928.

GEORGE R. TOWNSEND.