Aug. 7, 1956 R. H. JORDAN 2,758,170

SNAP SWITCH

Filed Dec. 10, 1951

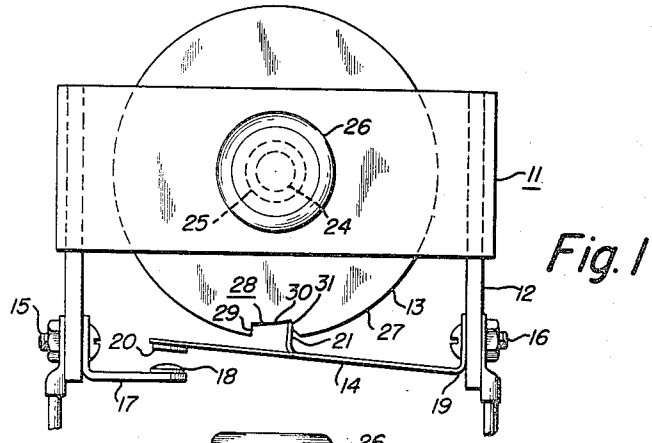


Fig. 1

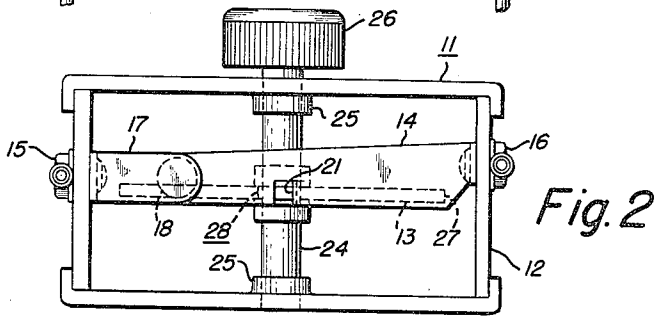


Fig. 2

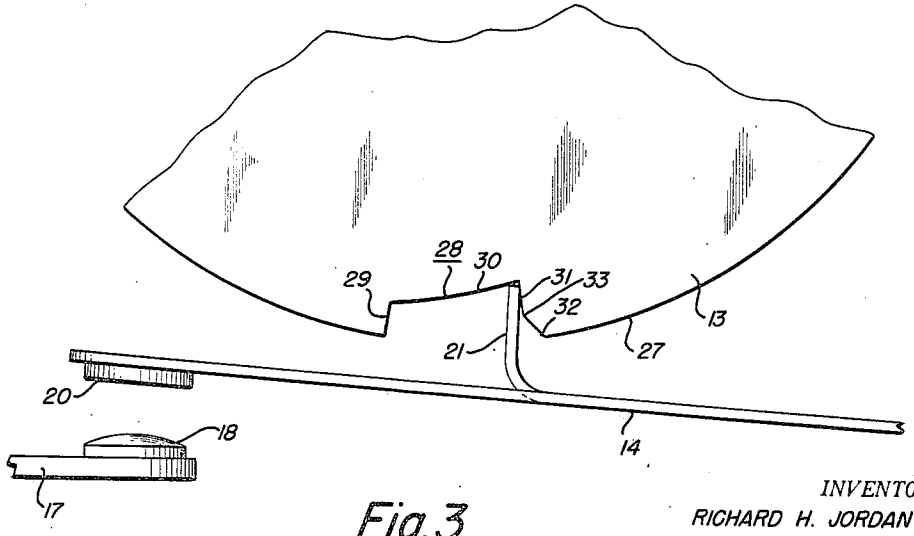


Fig. 3

INVENTOR.
RICHARD H. JORDAN
BY
Woodling and Knoth,
attys.

United States Patent Office 2,758,170 Patented Aug. 7, 1956

2,758,170

SNAP SWITCH

Richard H. Jordan, Mansfield, Ohio

Application December 10, 1951, Serial No. 260,832

12 Claims. (Cl. 200—67)

The invention relates in general to mechanism having a snap action; and more particularly to a device such as a switch in which one member alone is caused to move to two opposing positions with a snap action.

The snap device may be constructed in the form of a switch mechanism having relatively fixed contact and a movable contact supported on a spring blade. The spring blade is urged by its own resiliency or some auxiliary means in a given direction. A cam or operating member cooperates with the spring blade holding it against the resilient urging means, hence when this cam releases the spring blade, it will move with a snap action in a given direction relative to the fixed contact. The spring blade will have some form of cam follower and the cam follower and the cam have relative resiliency along a direction transverse to the direction of movement of the spring blade. The cam has an abutment edge which abuts the cam follower and upon continued movement of the cam, the relative resiliency will be stressed so that there will be stored in this resilient means energy along a direction transverse to the direction of movement of the spring blade. This transverse direction has a component parallel to the direction of movement of the spring blade and hence when the component of force along this latter direction overcomes the force urging the spring blade toward the cam, then the spring blade will spring away with a snap action against the force of the first resilient means. This of course moves the spring blade in a direction opposite to its first direction of movement.

Consequently an object of the invention is to provide a single member in a snap action device which has resilient means continually urging same in a single direction, yet which will snap in a direction opposite to that in which urged.

Another object of the invention is to provide in a snap acting device a single member having natural resilience urging it in a given direction to move quickly in that direction upon being released and also to move quickly in the opposite direction upon being stressed in a transverse direction which has a component opposite to the direction in which urged.

Another object of the invention is to provide a spring member which is urged by a first resilient means in a first direction and controlled by a cam so that when the cam releases it, it will move with a snap action in this first direction; and wherein a second resilient means urges the spring member in a second direction transverse to the first direction which transverse direction has a component of force opposite to the first direction so that when this component of force exceeds the force of the first resilient means, the spring member will move with a snap action in a direction opposite to the first direction.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing in which:

Figure 1 shows an embodiment of the invention in a switch device having a rotary cam operating a spring blade;

Figure 2 is a side view of the switch shown in Figure 1; and

Figure 3 is an enlarged view of the cam surfaces which actuate the spring blade.

The Figure 1 shows the general arrangement of a switch 11 which has a snap acting feature. The switch includes generally a frame 12 on which is journaled a rotatable cam 13 and which operates upon a movable switch blade 14. The switch 11 has first and second terminals 15 and 16. A fixed contact blade 17 is insulated from and carried by the frame 12 and is electrically connected to the first terminal 15. A fixed contact 18 is carried by the blade 17. The movable switch blade 14 is made of a spring material and has one end 19 carried by the frame 12 and insulated therefrom. The unsupported end of the blade 14 carries a movable contact 20 positioned to abut the fixed contact 18. About mid-way on the spring blade 14 is a cam follower 21 which is a tongue cut and bent from the spring blade itself. This cam follower 21 extends generally perpendicular to the longitudinal dimension of the spring blade 14.

The rotatable cam 13 is mounted on a shaft 24 journaled in bearings 25 on the frame 12. A manual knob 26 is provided for rotation of the shaft 24 and cam 13. The Figure 3 shows to an enlarged scale a portion of the cam 13 and the spring blade 14. The cam has a circular edge 27 with a notch 28 therein. The notch is formed by four edges serially connected between separated points on the periphery of the cam, with these edges being termed a break edge 29, an inner edge 30, a tension edge 31 and a make edge 32. The cam follower 21 is shown in the drawings as being in contact with the inner edge 30 and this establishes a first condition of the switch wherein the contacts 18 and 20 are in spaced relationship. This spaced relationship is caused by the natural resiliency of the spring blade 14 which is biased upwardly as seen in the Figures 1 and 3. When the cam follower 21 is in contact with the circular edge 27, then the contacts 18 and 20 are in physical contact to establish a second condition of the switch 11. The cam 13 is rotatable manually in a clockwise direction as seen in Figures 1 and 3 and hence when the cam follower 21 is in contact with the circular edge 27, the switch is closed. When the cam 13 is rotated clockwise, the break edge 29 will come into cooperation with the cam follower 21, hence the natural resiliency of the spring blade 14 will urge it upwardly to separate the contacts 18 and 20 and the cam follower 21 will be in contact with the inner edge 30. Continued clockwise rotation of the cam 13 will bring the tension edge 31 into abutment with the cam follower 21. This will flex or stress this cam follower toward the left as viewed in the Figures 1 and 3. The force with which the cam is turned will be resisted by the resilient nature of the cam follower 21 and energy will be stored in this cam follower as it is stressed. Gradually as the cam 13 is continued to be turned, a point will be reached where the end of the cam follower 21 will slip off the shoulder 33 which is between the tension edge 31 and the make edge 32. Since the make edge 32 is disposed at about a 45 degree angle to both the tension edge 31 and the circular edge 27, the stored energy in the cam follower 21 will cause a component of force opposite to and greater than the natural resiliency of the spring blade so that the spring blade rapidly moves downwardly to close the contacts 18 and 20.

The break edge 29 and the tension edge 31 are generally radially disposed on the cam 13. The break edge 29 could of course be undercut, however as long as it is at least radial, the break action will be rapid and in effect

be a snap action. The tension edge 31 is preferably radially disposed, and preferably a perpendicular to this tension edge passes through the effective hinge point 19 of the spring blade 14. This assures that the cam follower 21 will be flexed or stressed for a small rotational arc of the cam 13 to thus store sufficient energy in this cam follower to give a quick make action of the contacts 18 and 20. Since the cam is manually turned by an operator, the resistance to turning, as the cam follower 21 abuts the tension edge 31, will increase, and hence when this resistance is suddenly decreased as the shoulder 33 is reached, the operator will thus find that he is rapidly turning this knob and this further will assure that a rapid closing of the contacts is achieved.

The spring blade 14 having natural resiliency is that which provides a relative urging between the cam and the cam follower in a first direction; namely, radially of the cam. The natural resiliency of the cam follower 21 is that which provides a force relatively urging the cam and the cam follower along a direction transverse to the first-mentioned resilient force. This second force initially is about perpendicular to the first force, however at least at the shoulder 33 it has a component of force which is parallel to and in the opposite direction relative to the first force. Further at the shoulder 33, this component of force must exceed the first force so that the spring blade 14 rapidly moves downwardly against the natural resiliency thereof.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A snap acting device comprising a base, a cam and a cam follower carried on said base, first surface means on said cam for producing a first condition in cooperation with said cam follower, said cam and cam follower being relatively movable along a first path generally parallel to said first surface means, said cam and cam follower being relatively movable along a second path transverse to said first path, first means for establishing relative resilience between said cam and said cam follower along said second path to relatively urge at least said cam first surface means and said cam follower toward each other, an abutment edge on said cam joining said first surface means, second means for establishing resilience in said cam follower along a path transverse to said second path, whereby relative movement along said first path of said cam follower and said cam first surface means bringing said abutment edge and said cam follower into engagement stresses said second resilient means until the component of force thereof along said second path exceeds the force of said first resilient means to relatively move said cam and cam follower along said second path into a condition other than said first condition.

2. A snap acting device comprising a base, a cam and a cam follower carried on said base, first and second surface means on said cam for producing first and second conditions, respectively, in cooperation with said cam follower, said cam and cam follower being relatively movable along a first path generally parallel to said first and second surface means, said cam and cam follower being relatively movable along a second path transverse to said first path, first means for establishing relative resilience between said cam and said cam follower along said second path to relatively urge said cam and cam follower toward each other, an abutment edge on said cam joining said first and second surface means, second means for establishing resilience in said cam follower along a path transverse to said second path, whereby relative movement along said first path of said cam follower and said cam first surface means bringing said abutment edge and said cam follower into engagement stresses said second resilient means until the component of force thereof along said second path exceeds the force of said first resilient means to relatively move said cam and cam follower along said second path into said second condition.

3. A snap acting device comprising a base, a cam and a cam follower carried on said base, first and second surface means on said cam for producing first and second conditions, respectively, in cooperation with said cam follower, said cam and cam follower being relatively movable along a first path generally parallel to said first and second surface means, said cam and cam follower being relatively movable along a second path generally perpendicular to said first path, first means for establishing relative resilience between said cam and said cam follower along said second path transverse to said first path to relatively urge said cam and cam follower into said first condition, an abutment edge joining said first and second surface means, second means for establishing resilience in said cam follower along a path generally parallel to said first path, whereby relative movement along said first path of said cam follower and said cam first surface means bringing said abutment edge and said cam follower into engagement stresses said second resilient means until the component of force thereof along said second path exceeds and is in opposition to the force of said first resilient means to relatively move said cam and cam follower along said second path into said second condition.

4. A snap acting device comprising a base, first and second relatively movable members carried by said base, a cam follower on said first member, said cam follower extending substantially parallel to the direction of relative movement of said members and being resilient in a direction substantially perpendicular to said direction of relative movement, a cam adapted to cooperate with said cam follower, means urging said cam follower toward said cam, a notch in the surface of said cam adapted to cooperate with said cam follower, said cam follower in cooperating with said cam surface establishing said members in a first condition and said cam follower in cooperating with said notch establishing said members in a second condition, said notch being defined by first, second and third edges serially connected between separated points on said surface, said first and third edges being disposed on said cam surface adjoining same and at an angle thereto, said second edge being spaced from said cam surface, the movement of said cam in a given direction permitting said cam follower to drop off said first edge and in accordance with said urging means to establish said members in said second condition, further movement of said cam in said given direction moving said third edge into engagement with said cam follower to stress said resilient cam follower to a point whereat the resistance to movement of the cam is greatly reduced so that due to the stored energy in the stressed cam follower the cam moves rapidly and the members are established in said first condition with a snap action.

5. A switch comprising a base, a relatively fixed contact on said base, a blade carrying a movable contact for cooperation with said fixed contact and being carried by said base, a cam follower on said blade, one of said cam follower and said blade being resilient in a direction parallel to said spring blade, a manually rotatable cam having a surface adapted to cooperate with said cam follower, means urging said cam follower toward said cam, a notch in said surface adapted to cooperate with said cam follower, said cam follower in cooperating with said surface establishing said contacts in a first condition and said cam follower in cooperating with said notch establishing said contacts in a second condition, said notch being defined by first, second, third and fourth edges serially connected between separated points on said

surface, said second edge being closer to the center of said cam than said cam surface, said fourth edge defining substantially a 45 degree angle with both said third edge and said cam surface, the rotation of said cam in a given direction permitting said cam follower to drop off said first edge and in accordance with said urging means to establish said contacts in said second condition by moving said movable contact inwardly, further rotation of said cam in said given direction moving said third edge into engagement with said cam follower to stress the resilient one of said blade and said cam follower and cam the cam follower outwardly into engagement with said fourth edge whereupon the resistance to turning of the cam is greatly reduced so that due to the stored energy in the stressed resilient one of said blade and cam follower the cam turns rapidly and the contacts are established in said first condition with a snap action.

6. A snap acting device comprising a base, first and second relatively movable members carried by said base, a cam follower attached to said second member, said cam follower extending substantially parallel to the direction of relative movement of said members, and being resilient in a direction substantially perpendicular to said direction of relative movement, a rotatable cam having a substantially circular edge adapted to cooperate with said cam follower, means urging said cam follower toward said cam, a notch in said circular edge adapted to cooperate with said cam follower, said cam follower in cooperating with said circular edge establishing said members in a first condition and said cam follower in cooperating with said notch establishing said members in a second condition, said notch being defined by first, second, third and fourth edges serially connected between separated points on said circular edge, said first and third edges being disposed on said cam substantially radially inwardly from said circular edge, said second edge being closer to the center of said cam than said circular edge, said fourth edge defining substantially a 45 degree angle with both said third edge and said circular edge, the rotation of said cam in a given direction permitting said cam follower to drop off said first edge and in accordance with said urging means to establish said members in said second condition by moving said movable contact inwardly, further rotation of said cam in said given direction moving said third edge into engagement with said cam follower to stress said resilient cam follower and cam it outwardly into engagement with said fourth edge whereupon the resistance to turning of the cam is greatly reduced so that due to the stored energy in the stressed cam follower the cam turns rapidly and the members are established in said first condition with a snap action.

7. A snap acting device comprising a base, a relatively fixed member on said base, a spring member carried on said base for cooperation with said fixed member, a cam follower attached midway on said spring member, said cam follower extending transversely to said spring member and being resilient in a direction parallel to said spring blade, a rotatable cam having a substantially circular edge adapted to cooperate with said cam follower, means urging together said cam and cam follower, said cam being manually operable and hence operable at a slow rotational speed, a notch in said circular edge adapted to cooperate with said cam follower, said cam follower in cooperating with said circular edge establishing said spring member in a first condition and said cam follower in cooperating with said notch establishing said spring member in a second condition, said notch being defined by first, second, third and fourth edges serially connected between separated points on said circular edge, said first and third edges being disposed on said cam substantially radially inwardly from said circular edge, said second edge being closer to the center of said cam than said circular edge, said fourth edge defining substantially a 45 degree angle with both said third edge and said circular edge, the rotation of said cam in a given direction permitting said cam follower to drop off said first edge and in accordance with said urging means to establish said spring member in said second condition by moving said spring member inwardly, further rotation of said cam in said given direction moving said third edge into engagement with said cam follower to stress said resilient cam follower and cam it outwardly into engagement with said fourth edge whereupon the resistance to turning of the cam is greatly reduced so that due to the stored energy in the stressed cam follower the cam turns rapidly and the spring member moves outwardly with a snap action to said first condition.

8. A switch comprising a base, a relatively fixed contact on said base, a blade carrying a movable contact at one end thereof for cooperation with said fixed contact, the other end of said blade being carried by said base, a cam follower attached midway on said blade, said cam follower extending transversely to said blade and being resilient in a direction parallel to said spring blade, a manually rotatable cam having a substantially circular edge adapted to cooperate with said cam follower, means urging said cam follower toward said cam, a notch in said circular edge adapted to cooperate with said cam follower, said cam follower in cooperating with said circular edge establishing said contacts in a first condition and said cam follower in cooperating with said notch establishing said contacts in a second condition, said notch being defined by first, second, third and fourth edges serially connected between separated points on said circular edge, said first and third edges being disposed on said cam substantially radially inwardly from said circular edge, said second edge being generally arcuate on a radius less than the radius of said circular edge, said fourth edge defining substantially a 45 degree angle with both said third edge and said circular edge, the rotation of said cam in a given direction permitting said cam follower to drop off said first edge and in accordance with said urging means to establish said contacts in said second condition by moving said movable contact inwardly, further rotation of said cam in said given direction moving said third edge into engagement with said cam follower to stress said resilient cam follower and cam it outwardly into engagement with said fourth edge whereupon the resistance to turning of the cam is greatly reduced so that due to the stored energy in the stressed cam follower the cam turns rapidly and the contacts are established in said first condition with a snap action.

9. A switch comprising a relatively fixed contact, spring blade carrying a movable contact at one end thereof for cooperation with said fixed contact, the other end of said spring blade being relatively fixed, a cam follower attached midway on said spring blade, said cam follower extending substantially perpendicular to said spring blade and being resilient in a direction parallel to said spring blade, a rotatable cam having a substantially circular edge adapted to cooperate with said cam follower, means including said spring blade urging apart said contacts and urging together said cam and cam follower, said cam being manually operable and hence operable at a slow rotational speed, a notch in said circular edge adapted to cooperate with said cam follower, said cam follower in cooperating with said circular edge establishing said contacts in physical contact and said cam follower in cooperating with said notch establishing said contacts in a spaced relationship, said notch being defined by a break edge, an inner edge, a tension edge and a make edge serially connected between separated points on said circular edge, said break and tension edges being disposed on said cam substantially radially inwardly from said circular edge, said inner edge being generally arcuate on a radius less than the radius of said circular edge, said make edge defining substantially a 45 degree angle with both said tension edge and said circular edge, the rotation of said cam in a given direction permitting said cam follower to drop off said break edge and in accordance with said urging means to separate said contacts by moving said

movable contact inwardly, further rotation of said cam in said given direction moving said tension edge into engagement with said cam follower to stress said resilient cam follower and cam it outwardly into engagement with said make edge whereupon the resistance to turning of the cam is greatly reduced so that due to the stored energy in the stressed cam follower the cam turns rapidly and the contacts close with a snap action.

10. A snap acting device comprising, a base, first and second relatively movable members carried by said base, a cam follower on said first member, a cam having a surface adapted to cooperate with said cam follower, first resilient means urging said cam follower toward said cam, said cam surface having first, second and third edges serially connected between separated points, said third edge lying at an acute angle to said second edge, said cam first edge in cooperation with said cam follower establishing said members in a first condition, second means for establishing resilience in said cam follower along a path transverse to said second edge, the movement of said cam in a given direction permitting said cam follower to abut said second edge to stress said second resilient means to a point whereat the cam follower slides off the second edge and engages the third edge whereat the resistance to movement of the cam is greatly reduced so that due to the stored energy in the resilient means the cam follower moves in a direction opposite to that moved upon being stressed, hence the cam moves rapidly and the members are established in a second condition with a snap action.

11. A snap acting device comprising, a base, first and second relatively movable members carried by said base, a cam follower on said first member, a cam having a surface adapted to cooperate with said cam follower, first resilient means urging said cam follower toward said cam, said cam surface having first, second, third and fourth edges serially connected between separated points, said second and fourth edges being generally perpendicular, said third edge lying at an acute angle to both said second and fourth edges, said cam first edge in cooperation with said cam follower establishing said members in a first condition, second means for establishing resilience in said cam follower along a path transverse to said second edge, the movement of said cam in a given direction permitting said cam follower to abut said second edge to stress said second resilient means to a point whereat the cam follower slides off the second edge and engages the third edge whereat the resistance to movement of the cam is greatly reduced so that due to the stored energy in the resilient means the cam follower moves in a direction opposite to that moved upon being stressed, hence the cam moves rapidly into a position whereat the cam follower engages the fourth edge and the members are established in a second condition with a snap action.

12. A snap acting device comprising a base, a cam carried on said base, a relatively straight resilient arm, support means for attaching a first end of said arm on said base, a resilient cam follower arm extending generally perpendicular to and carried by said straight arm, first and second surface means on said cam for producing first and second conditions, respectively, in co-operation with said cam follower, said cam and cam follower being relatively movable along a first path generally parallel to said first and second surface means by movement of said cam and by the resilience of said cam follower arm, said first path lying along a line generally extending through said arm support means, said cam and cam follower being relatively movable along a second path transverse to said first path by the resilience of said straight arm, a perpendicular to said second path generally extending through said arm support means, first means including the resilience of said straight arm for establishing relative resilience between said cam and said cam follower along said second path to relatively urge said cam and cam follower toward each other, an abutment edge on said cam joining said first and second surface means, second means including the resilience of said cam follower arm for establishing relative resilience between said abutment edge and said cam follower along a path transverse to said second path, whereby relative movement along said first path of said cam follower and said cam first surface means bringing said abutment edge and said cam follower into engagement stresses said second resilient means until the component of force thereof along said second path exceeds the force of said first resilient means to relatively move said cam and cam follower along said second path into said second condition.

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