Feb. 10, 1953 H. MILLARD 2,627,754

OVERCENTER SNAP DEVICE

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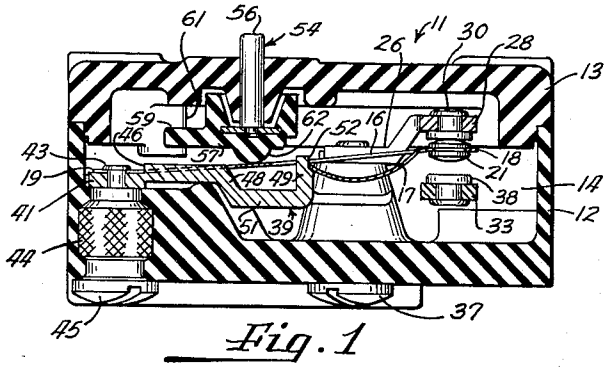


Fig. 1

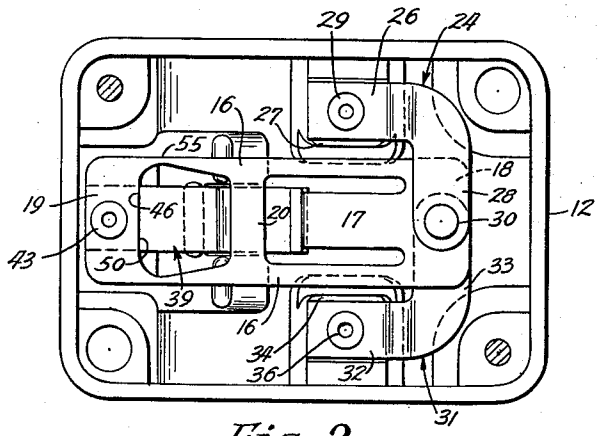


Fig. 2

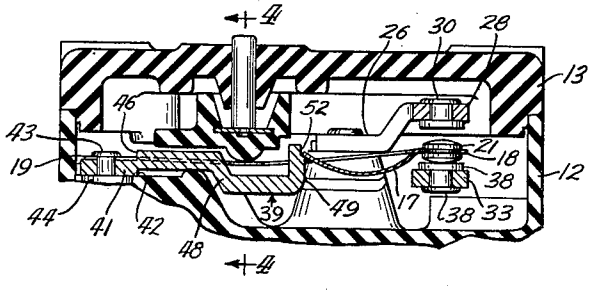


Fig. 3

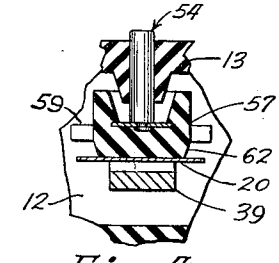


Fig. 4

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OVERCENTER SNAP DEVICE

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12 Claims. (Cl. 74—100)

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This invention relates to snap acting devices and more particularly to a snap acting spring system for an electric switch.

An object of this invention is the provision of a snap acting spring system of the above character having improved operating characteristics as compared to existing comparable systems.

Another object of the invention is the provision of a snap acting spring system having greater stability and better balance characteristics during operation of the spring system than comparable existing systems.

Another object of the invention is the provision of a snap acting spring system having novel means for mounting the stressed members of the system.

Another object of the invention is the provision of a snap acting spring system of the above character employing spaced stressed members having novel means for simultaneously moving the spaced stressed members through an axis of maximum stress to actuate the spring system.

Another object of the invention is the provision of a snap acting spring system of the above character that is simple to construct, that is positive in its action, and that is relatively inexpensive to produce.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which—

Figure 1 is a sectional view taken along the longitudinal axis of a snap acting switch, embodying the present invention, with the movable contact in an upper position;

Fig. 2 is a plan view of the switch shown in Figure 1 with the plunger and cover removed;

Fig. 3 is a sectional view similar to Figure 1 showing the movable contact in its lower position; and

Fig. 4 is a transverse sectional view of the switch taken along the section line 4—4 of Fig. 3.

Referring now to the drawings, the invention is shown embodied in a snap acting spring system for an electric switch. As shown in this embodiment the spring system is mounted in a housing 11 of suitable insulating material and comprising a bottom or base 12 for supporting the spring system and a cover 13 detachably secured to the bottom 12 and defining therewith a chamber 14 for receiving the spring system.

The spring system comprises spaced tension members 16 interconnected at opposite ends by suitable cross-pieces 18 and 19, a compression member 17, and a bridging member 20. The com-

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pression member is connected at one end with the crosspiece 18 to define an end carrying a movable contact 21 free to move between opposed positions, defined by upper and lower stops. The upper stop is formed by an L-shaped member 24 having a stem 26 supported on an upwardly facing shoulder 27 formed in the chamber 14 adjacent one side of the housing and an arm 28 offset with respect to the stem 26 and overlying the crosspiece 18 interconnecting the tension members 16. The stem 26 is secured on the shoulder 27 by connecting members including a tubular portion 29 of an insert (not shown) molded in the bottom 12. The insert is shaped to receive a screw (not shown) providing a terminal at the bottom of the housing accessible for connection to an external circuit. A rivet 30 extending through the arm 28 defines a contact positioned to be engaged by the movable contact 21 when the latter is in its upper position as shown in Figure 1. The lower stop is formed in a similar manner by a generally L-shaped member 31 having an arm 33 carrying a stationary lower contact 38 and a stem 32 secured to an upwardly facing shoulder 34 formed in the chamber 14 on the side thereof opposite to the shoulder 27. The stem 32 is likewise secured in place by connecting means 36 including a metal insert passing through the base and receiving a terminal screw 37 to define a terminal at the bottom of the housing for connection to an external circuit.

One phase of the invention is concerned with novel means for mounting the tension members 16 and compression member 17. In this embodiment of the invention a single anchor bracket 39 forms the mounting for both the tension members 16 and the compression member 17. The bracket includes a pad 41 at one end shaped to seat upon a shoulder 42 formed at one end of the chamber 14. The pad 41 is secured to the shoulder 42 by deforming the end of the tubular portion 43 of an insert 44 molded in the bottom 12, a screw 45 threaded into the insert defining a terminal for connection to an external circuit. Mounting the pad 41 in the above manner in effect provides a cantilever mounting for the bracket 39 in the chamber 14 so that the bracket extends inwardly toward the center of the chamber. The crosspiece 19 interconnecting the tension members 16 rests on the pad 41 in face to face relation therewith and is secured in place by the tubular portion 43. Adjacent the pad 41 is a shoulder 46 shaped and positioned for engagement by the inwardly facing edge 50 of the crosspiece 19, the shoulder 46 in this instance being formed by

offsetting the bracket adjacent its end to produce the pad 41 as best seen in Figs. 1 and 3.

The free or unsupported end of the bracket 39 has an upstanding leg 49 formed by bending the bracket downwardly in spaced relation to its free end as shown at 48 and upwardly directly adjacent its end with the legs 48 and 49 in spaced relation as shown at 51. The leg 49 is provided with a groove 52 for pivotal reception of the free end of the compression member 17. The distance between the recess 52 and the shoulder 46 is somewhat greater than the distance between the end of the compression member 17 and the edge 50 when the spring is disposed flat and consequently when the spring is mounted the member 17 is stressed in compression and the members 16 are stressed in tension. The recess 52 is also located below a line joining the free end 18 when in its upper position, as shown in Figure 1, and the pad 41 so that a portion of the tension members may be depressed to a position below the recess and thereby effect snap movement of the mobile contact.

The bridging member 20 is connected at opposite ends with the tension members 16 (in this instance being integral therewith) at a position between the shoulder 46 and the pivotal recess 52. In general the dimensions of the bridging member 20 are such as to provide a relatively rigid member between the tension members 16; however, the width of the bridging member is such that it may be received between the legs 48 and 49 formed on the bracket 39 when the tension members 16 are moved to actuate the spring system.

The plunger 54 comprises a stem 56 and a head 57. The stem 56 is slidably received in the cover 13 and the head 57 is formed with a skirt 59 having a surface on one edge shaped to conform to the surface of a shoulder 61 formed on the cover 13 so as to prevent rotation of the plunger during reciprocation. The head is formed with a rounded projection 62 extending transversely of the tension members 16 and shaped to engage the bridging member 20. The projection 62 is shaped so that the contact between the bridging member and the plunger is a line contact that extends over a considerable length of the bridging member as shown in Fig. 4.

To actuate the switch the plunger 54 is moved downwardly causing the projection 62 on the plunger 54 to urge the bridging member 20 and the tension members 16 downwardly until the line of action or stress line of the tension members moves across or past the compression pivot point defined by recess 52. Thereupon the contact 21 snaps from engagement with the contact 30 to engagement with the contact 38. The position of the parts when the contact 21 engages the contact 38 is shown in Fig. 3. As the plunger moves downwardly the bridging member 20 is received between the legs 48 and 49 to permit the required relative movement of the tension members necessary to effect snap action of the spring system. Preferably the tension and compression members are biased so that they return to the position shown in Figure 1 upon release of the actuating force. In so doing the tension stress line is moved through the axis of maximum stress and the contact 21 is moved with a snap action from engagement with the contact 38 to engagement with the contact 30. Where desired portions of the tension members 16 adjacent the crosspiece 19 may be removed to provide the tension members with relatively narrow portions 55 adjacent their mounted ends. The above construction is for the purpose of distributing stresses in the tension members 16 in a preselected manner to control the flexure thereof as described more fully and claimed in an application of Robert M. Readeker, Serial No. 156,439, filed April 17, 1950.

Pressure applied to the bridging member through the plunger 54 causes both tension members 16 to move simultaneously relative to the compression member. The bridging member also acts somewhat as a strut to prevent excessive flexing of the spring about the longitudinal axis of the spring and thereby serves to retard twisting or turning of the tension members 16 as they are moved to actuate the spring system. Thus one tension member is prevented from going overcenter before the other. This construction therefore produces a spring system which is stable and has good balance characteristics during its operation. The line contact of the plunger 54 with the bridging member 53 tends to distribute the applied force over the length of the bridging member. However, if desired, the plunger may be constructed with two depending points, one located near each end of the line of contact. With the line contact there is less tendency on the part of the bridging member to buckle than would be the case if the force were applied to a single point on the bridging member.

One advantage of the mounting means for the tension and compression members is that the shoulder 46 engages the cross member 19 throughout a substantial portion of its length. The stresses in the cross member are thus distributed and the high stresses in the tension members, such as when a single rivet of conventional construction is utilized to hold the tension member, are avoided. The anchor bracket 39 is extremely simple to form and may be readily made as a single stamping. Consequently it can be made relatively inexpensively. The remaining parts of the spring system are also of very simple construction and can also be readily made as stampings. The shape of the parts is such that the full width of the strip material from which they are formed may be utilized. Consequently there is very little scrap material in the production of this switch. Due to the fact that there is only one anchor groove required for the compression member, alinement problems, are eliminated. Since there is only one compression member to be seated in the anchor groove very little work is required in the assembly of this construction. In view of the above it is apparent that the production cost of this snap acting spring system is relatively low.

I claim:

1. In a snap acting device, the combination of spaced tension members interconnected at one end to form an end free to move between opposed positions, a compression member disposed between said spaced members and interconnected at an end with said free end, means fixedly mounting the opposite end of each tension member in spaced relation to each other, means mounting the opposite end of the compression member to have the line of stress in said tension member movable past the mounted end of the compression member, bridging means interconnecting said spaced tension members intermediate the ends thereof, and an actuator engageable with said bridging means for moving the spaced members to move the tension stress line across the com-

pression stress line to move said free end between said opposed positions with a snap action.

2. In a snap acting device, the combination of spaced tension members interconnected at opposite ends, one of said ends being free to move between preselectd positions with a snap action, a compression member having one end interconnected with said free end, means for mounting the opposite end of said compression member, means defining a stationary mounting for the other end of the tension members in spaced relation to one another, rigid bridging means interconnecting said tension members at a position between said mounting means for the tension and compression members, and a plunger positioned to engage said bridging means to move said tension members for moving said tension stress line across said compression stress line to move said free end between said positions, said plunger being shaped to have line contact with said bridging means to distribute the applied force over a substantial length of the bridging portion.

3. In a snap acting device, the combination of spaced tension members interconnected at opposite ends, one of said ends being free to move between preselected positions with a snap action, a compression member having one end interconnected with said free end, means for mounting the opposite end of said compression member, means defining a stationary mounting for the other end of the tension members in spaced relation to one another to have the line of stress in said tension members movable past the mounted end of the compression member, bridging means interconnecting said tension members at a position between said mounting means for the tension and compression members and a plunger engageable with said bridging means to effect simultaneous movement of said tension members to move the tension stress line across the compression stress line to move said free end between said positions, said plunger having an end portion extending between the tension members and shaped to have line contact with said bridging means to prevent buckling of the bridging means upon application of force to the plunger to move the tension members.

4. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members at opposite ends thereof, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end spaced from the other crosspiece, stationary means for mounting the opposite end of the compression member, stationary means including shoulder means engageable with said other crosspiece and defining a stationary mounting for said spaced tension members, said shoulder means engaging said crosspiece throughout a substantial portion of its length and positioned to have the tension stress line movable through the compression stress line, and an actuator between said mounting means for the compression and tension members for moving said tension members to move the tension stress line through the compression line to move said free end between said opposed positions with a snap action.

5. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end spaced from the other crosspiece, an anchor bracket for said tension and compression members having a fixed shoulder positioned to engage said other crosspiece and defining thereat a mounting for said spaced tension members and having a portion spaced from the shoulder disposed between said tension members and having a recess for pivotally receiving the opposite end of the compression member to stress the latter in compression and to stress said tension, members in tension and means for moving said tension members to move said tension stress line across the compression stress line to move said free end between said opposed positions with a snap action.

6. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members adjacent the ends thereof, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end spaced from the other crosspiece, a mounting bracket for mounting said tension member in tension and said compression member in compression, said mounting bracket defining a stationary mounting for fixedly positioning said tension members in spaced relation at one end thereof, bridging means extending between said spaced tension members intermediate the ends thereof, and a plunger having line contact with said bridging means for moving said tension members to move the tension stress line through the compression stress line to move said free end between opposed positions with a snap action.

7. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members adjacent the ends thereof, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end spaced from the other crosspiece, a stationary bracket including a mounting portion positioned to rigidly mount said spaced tension members at one end thereof and a mounting portion shaped to mount said compression member to form with said tension members a snap spring system having an axis of maximum stress, said bracket having a central portion disposed at one side of the plane of the mounted ends of the tension and compression members, bridging means extending between said spaced tension members intermediate the ends thereof shaped to pass between said mounting portions, and plunger means having line contact with said bridging means for moving said tension members to move the tension stress line through the axis of maximum stress to move said free end between opposed positions with a snap action.

8. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members, a compression member disposed between said tension members and connected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end spaced from the other crosspiece, stationary means for mounting the opposite end of the compression member, sta-

tionary means including shoulder means engageable with the other crosspiece throughout a substantial portion of its length positioned to define a stationary mounting for said spaced tension members, and means between said mounting means for the compression and tension members for moving said tension members to move the tension stress line across the compression line to move said free end between opposed positions with a snap action.

9. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members at the ends thereof, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end terminating short of the other crosspiece, a bracket for mounting said tension members in tension and said compression member in compression, said bracket being formed with a rear shoulder portion engaging the other of said crosspieces throughout a substantial portion of the length thereof and forming a stationary mounting for one end of said spaced tension members, said bracket also being formed with a recess for pivotally receiving said opposite end of the compression member to stress the latter in compression, a bridging member interconnecting said spaced tension members intermediate the lengths thereof, and a plunger having line contact with said bridging member for displacing the tension members to move the tension stress line through the compression stress line to move said free end between opposed positions with a snap action.

10. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members at the ends thereof, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end terminating short of the other crosspiece, a bridging member interconnecting said tension members intermediate the lengths thereof, a plunger contacting said bridging portion for displacing the tension members, and a bracket for mounting the tension and compression members, said bracket being formed with a rearwardly facing shoulder engaging the other of said crosspieces for a substantial portion of the length thereof and forming a stationary mounting for one end of said spaced tension members, said bracket also being formed with a recess for pivotally receiving said opposite end of the compression member to stress the same in compression, said bracket also being formed with a portion intermediate said shoulder and said recess which is offset from the plane of the mounted ends of the tension and compression members to permit passage of said bridging portion upon displacement of the same by the plunger.

11. In a snap acting device, the combination of a pair of spaced, parallel, coplanar tension members, spaced crosspieces interconnecting said tension members at the ends thereof, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end terminating a substantial distance short of the other crosspiece, means forming a pivotal mounting for said opposite end of the compression member, stationary means for mounting said tension members at one end in spaced relation comprising a shoulder positioned between said tension members and engaging the other of said crosspieces throughout a substantial portion of the length thereof, a bridging member interconnecting said tension members and disposed intermediate said shoulder for mounting the tension members and said pivotal mounting for the compression member, and a plunger having line contact with said bridging member transversely of the tension members for displacing said bridging member to pass between said shoulder mounting for the tension members and said pivotal mounting for the compression member.

12. In a snap acting device, the combination of spaced movable tension members, spaced crosspieces interconnecting said tension members, a compression member disposed between said tension members and interconnected at one end with one of said crosspieces to form an end free to move between opposed positions and having its opposite end spaced from the other crosspiece, an anchor bracket for said tension and compression members having a rigid shoulder shaped to engage the other of said crosspieces and defining thereat a mounting for said spaced tension members and having a portion spaced from the shoulder disposed between said tension members and having a recess for pivotally receiving the opposite end of the compression member to stress the latter in compression and to stress said tension members in tension, and means for relatively moving said tension stress line and said compression stress line to move said end between opposed positions with a snap action.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,493,559	Norden	May 13, 1924
2,044,822	Vaughn	June 23, 1936
2,157,156	Abendroth	May 9, 1939
2,349,008	Sauter	May 16, 1944
2,511,526	Bugge	June 13, 1950

FOREIGN PATENTS

Number	Country	Date
119,204	Australia	Nov. 13, 1944
585,972	Great Britain	Mar. 3, 1947