Nov. 17, 1953 W. A. MARTIN 2,659,238

SNAP ACTING MECHANISM

Filed Oct. 15, 1949

Fig. 1

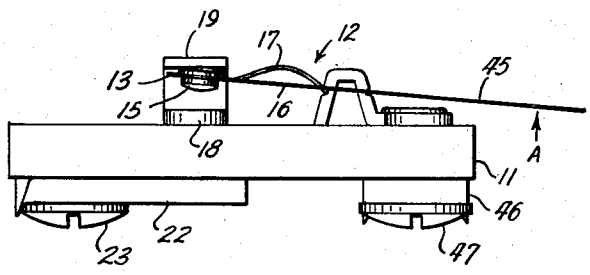


Fig. 3

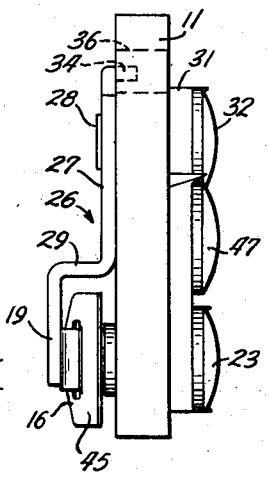


Fig. 2

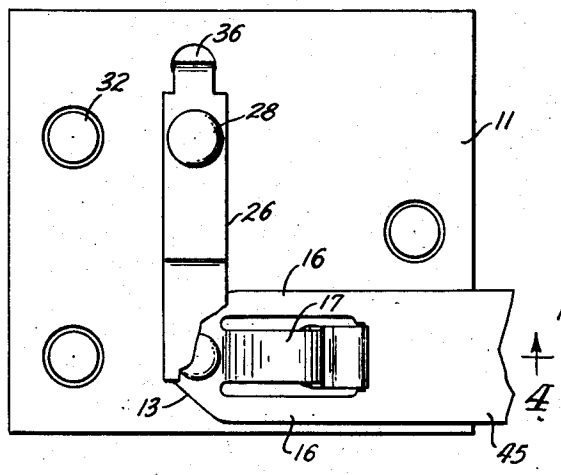


Fig. 4

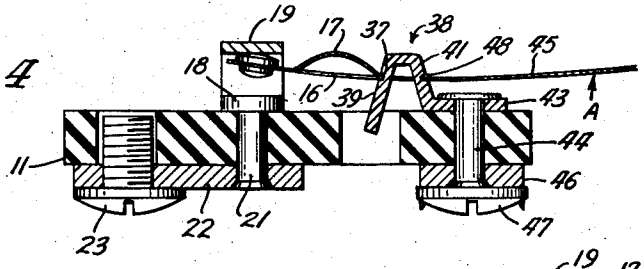


Fig. 5

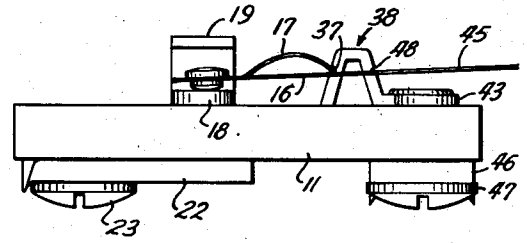
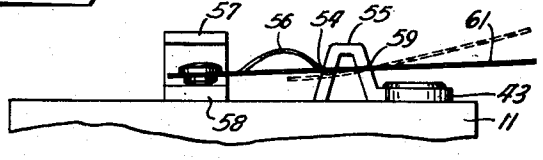


Fig. 6



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SNAP ACTING MECHANISM

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Application October 15, 1949, Serial No. 121,597

13 Claims. (Cl. 74—100)

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This invention relates to a snap acting device and more particularly to a snap acting switch.

An important object of the invention is the provision of a snap acting device comprising a minimum number of parts and easily adjusted so as to provide a precision type switch at a minimum cost.

Another object of the invention is the provision of a snap acting device of the above character having a novel construction wherein the pretravel and the overtravel movements may be made to vary between wide limits by simple and inexpensive changes.

Another object of the invention is the provision of a snap acting device of the above character having novel means for mounting the spring system wherein the device may be readily changed from a manually reset type spring system to a self-return type and vice versa by simple adjustments.

Another object of the invention is the provision of a snap acting device of the above character that is positive in its action and that is of a relatively simple construction.

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 side elevational view of a reset type switch embodying the present invention and showing the movable contact in engagement with one of the fixed contacts;

Fig. 2 is a plan view of the switch shown in Figure 1;

Fig. 3 is an end view of the switch shown in Fig. 2;

Fig. 4 is a sectional view taken substantially along the line 4—4 of Fig. 2 showing the relation of the parts with an actuating force applied to the spring system;

Fig. 5 is a side elevation view similar to Figure 1 showing the movable contact in engagement with the other fixed contact, and

Fig. 6 shows the invention embodied in a self-return spring system.

Referring now to the drawings, the invention is shown embodied in a snap acting switch. In general the latter includes a base or support 11, a spring system 12 mounted on the base 11 and having an end 13 movable between opposed positions with a snap action. The base 11 in the embodiment shown is in the form of a generally rectangular base formed from any suitable insulating material.

The spring system 12 includes spaced resilient

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tension members 16 and a resilient compression member 17. At one of their ends the tension members 16 are interconnected with one end of the compression member 17 to form the free end 13. The latter is, in the embodiment shown, shaped to carry a mobile contact 15 movable between spaced stationary contacts or stops 18 and 19 defining the opposed positions between which the free end 13 moves. As best seen in Fig. 4 the contact 18 is formed by a head of a rivet 21 extending through the base 11 and interconnected with a terminal 22. The terminal 22 carries a screw 23 for securing electric lead wires of an external circuit to the terminal. The contact 19 is formed by a Z-shaped element 26 as shown in Fig. 3 having a mounting portion 27 secured to the base 11 as by a rivet 28 or the like and a portion, defining the contact 19, held in spaced relation to the contact 18 by a bridging portion 29. The rivet 28 extends through the base 11 and is connected with a terminal 31 on the opposite side of the base which likewise carries a screw 32 threadably mounted on the terminal for securing electric lead wires of an external circuit to the terminal 31. At its outer end 34, the mounting portion 27 is inclined at an angle and is shaped to be received in an aperture 36 formed in the base to positively hold the Z-shaped member in fixed relation on the base 11.

The opposite end of the compression member 17 is supported in a pivotal recess 37 formed on a leg 39 of a bracket 38. The latter may be in the form of an inverted U-shaped member having spaced legs 39 and 41. The bracket is mounted on the base 11 by a pad 43 integral with the lower end of the leg 41 and inclined at an angle thereto as shown in Fig. 4. The pad 43 is shaped to be attached to the base 11 by a rivet 44 passing through the pad, the base and a terminal 46 on the opposite side of the base. A screw 47 is carried by the terminal 46 for connecting the terminal with the wire of an external circuit. Preferably the bracket 38 is formed from material which positively maintains a pre-adjusted shape but which may be manually deformed to vary the position of the recess 37 for a purpose presently to appear.

A resilient tang 45 in spaced relation with the opposite end of the compression member 17 interconnects the ends of the tension members 16 opposite the end carrying the contact 15. The forward edge of the tang 45 is shaped to be received in a pivotal recess 48 formed in the outwardly disposed surface of the leg 41 of the bracket 38 and the rearward edge extends outwardly from

the recess. In this instance the pivotal recess 48 and the pivotal recess 37 are disposed in a plane passing between the stops 18 and 19. The length of the tang 45 may vary, depending upon the particular application for which the device is being used as will be apparent hereinafter.

Figure 1 shows the components of the spring system in one of its normal positions; that is, the movable contact 15 engages the fixed contact 19 and the spring system 12 is biased so that the resultant force of the compression and tension members urges the contact 15 into positive engagement with the contact 19. To actuate the switch shown in Figure 1 a force is applied at some point A on the bottom of the tang 45. As force is applied at point A, the free end of the tang moves. In so moving the forces in the spring system are such that the tang 45 and the tension members 16 flex and store energy. Thus with sufficient force applied at the point A portions of the tension members 16 are carried or flexed downwardly across the pivotal groove or recess 37 for the end of the compression member 17. As soon as the tension members pass the pivotal support for the compression members the stored energy in the tension member and the tang is operative to move the contact 15 between the contacts 19 and 18 with a very rapid motion. In other words when the tension members 16 are flexed downwardly moving the tension centerline across the compression centerline or through the axis of maximum stress, the movable contact 15 moves from the contact 19 into engagement with the contact 18 with a snap action and the resultant force of the compression and tension members is reversed. The relative position of the parts at the instant of actuation of the spring system is shown in Fig. 4.

Fig. 5 shows the relation of the parts after the movement of the contact 15 from engagement with the contact 19 into engagement with the contact 18. The tension members 16 are disposed below the pivotal recess 37 for the compression member 17 and the contact 15 is positively urged into engagement with the contact 18. The actuating force has been removed from the tang 45 and the latter and the tension members tend to assume a position in which they are coplanar. Where desired the tang 45 may be initially inclined at an angle with respect to the plane of the tension member 16. In the latter case when the force A is removed, tension members 16 and the tang 45 will assume their initial position.

The operation of the switch in the reverse direction in which the contact 15 moves from engagement with the contact 18 into engagement with the contact 19, is substantially the same as that described above except that the force is applied to the top of the tang 45 and the movements are made in the reverse direction to that described above.

From the above it is apparent that the point A at which the operating pressure is applied to the tang may be at any position from a point adjacent the pivotal recess 48 to the extreme outer end of the tang. It will also be apparent that less movement of the member, applying the force to the tang, is required to effect actuation of the snap spring system when the point A is adjacent the pivotal recess 48 than when the point A is adjacent the end of the tang. It is therefore apparent that this construction can be used for applications having widely varying pretravel movements. It should also be noted as the distance between the pivotal recess 48 and the point of application of the actuating force increases the force required to actuate the spring system decreases.

As soon as the spring system is actuated; that is, as soon as the tang 45 has been moved a sufficient distance to effect actuation of the spring system any additional movement of the tang 45 thereafter is overtravel movement. The resiliency of the tang 45 permits considerable overtravel movement depending on how far the point A at which force is applied is from the pivotal recess 48. Thus, this switch may be used in applications where the overtravel movement varies over wide ranges. The movement differential also increases as the point of application of force is moved outwardly from the pivotal recess 48. Because the operating characteristics of this switch change considerably depending on the location of the point A, it is evident that this spring system has many applications and can be operated by widely varying forces.

In Fig. 6 there is shown another embodiment of the invention. This embodiment of the invention differs from the construction shown in Figs. 1–5 in that the pivotal recess in a bracket 55 for supporting the end of the compression member 56 and the pivotal recess 59 supporting the tang 61 lie in a plane passing below the contact carrying end of the spring in all positions thereof. In other words, in Fig. 6 the arrangement of the pivotal recess 54 is such as to provide a self-return spring. The dotted line showing of the spring system in Fig. 6 illustrates the position of tang 61 when displaced upwardly by the operating force to urge the mobile contact against the lower stationary contact 58. In the full line position of Fig. 6 the spring system 12 is in a momentary position of unstable equilibrium immediately after the upward operating force on tang 61 has been removed and just before the mobile contact 16 returns under the self-return action of the spring system to its normal position in engagement with upper stationary contact 57.

The above described constructions are simple. The component parts may be formed as stampings. Thus, the tension members, the compression member and the tang may be formed as a single metal stamping from suitable resilient material. This construction is easy to assemble, disassemble and service.

I claim:

1. In a snap acting device, the combination of opposed stops, spaced resilient tension members interconnected at one end to form an end free to move between said stops with a snap action, a compression member having one end connected with said free end, means for pivotally supporting the opposite end of the compression member, a tang pivotally supported in fixed spaced relation to the pivotal support for the compression member to form a snap spring system having an axis of maximum stress, said tang interconnecting the opposite end of the tension members and being movable between opposed positions, movement of the tang between said positions effecting storage of energy in the tension members and flexing them through the axis of maximum stress to move said free end between said stops with a snap action.

2. 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 interconnected at one end with said free end, means

supporting the opposite end of the compression member, an elongated tang interconnecting opposite ends of the tension members and extending in a direction away from the compression member, and fixed means supporting said tang in spaced relation to said support for said compression member to stress said tension and compression members to define a snap spring system having an axis of maximum stress, said tang being movable to move the tension members to move the tension centerline through the axis of maximum stress to actuate the snap spring system.

3. In a snap acting device, the combination of a base, spaced stops mounted on said base, an inverted U-shaped bracket mounted on said base in spaced relation to said stops comprising spaced legs and a bridging portion interconnecting said legs, each of said legs having a recess formed on its outer facing surface, a compression member having an end free to move between limits defined by said stops with a snap action and an end pivotally received in one of said recesses, spaced tension members disposed on opposite sides of said bracket and movable between opposed positions, one end of said tension members being interconnected with said free end of the compression member, and an elongated resilient tang interconnecting the opposite end of the tension members and pivotally received in the other recess to stress the tension members and compression members to define a snap spring system having an axis of maximum stress, said tang being movable about its pivotal mounting to store energy in itself and the tension members to move the tension centerline about a fixed point and through the axis of maximum stress to actuate the spring system with a snap motion.

4. In a snap acting device, the combination of a base, opposed stops, a bracket including spaced legs and a bridging portion interconnecting said legs, each of said legs having a recess formed on its outer facing surface, and one of said legs having a pad in side by side relation with the base for securing the bracket thereon, a compression member having an end free to move between said stops and an end pivotally received in one of said recesses, spaced tension members disposed on opposite sides of said bracket and movable between opposed positions, said tension members being interconnected with said free end of the compression member, and an elongated resilient tang interconnected at an end adjacent the compression member with the opposite end of the tension members and pivotally received thereat in the other recess to stress said tension and compression members to have a resultant force urging said free end into engagement with one of said stops, said tang being movable about its pivotal mounting to move the tension members to effect a reversal of said resultant force acting on said free end to move the latter out of engagement with one stop into engagement with the other with a snap action.

5. The combination recited in claim 3 in which said recesses are disposed in a plane passing between the limits.

6. The combination recited in claim 3 in which said recesses are disposed in a plane passing to one side of the free end.

7. In a snap acting device, the combination of a base, spaced stops, a bracket having recesses on opposite sides thereof, a compression member having an end free to move between said stops with a snap action and an end pivotally received

in one of said recesses, a resilient tension member movable between opposed positions and interconnected with said free end of the compression member, a resilient tang connected to the opposite end of the tension member and pivotally supported in the other recess on said bracket in fixed spaced relation from the pivotal mounting for the compression member to stress the compression and tension members to define a snap spring system having an axis of maximum stress, said tang being movable about its pivotal mounting to move the tension stress line through the axis of maximum stress and storing energy in the tension member to actuate the spring system.

8. The combination recited in claim 7 in which the bracket is manually deformable to permit moving one of the pivotal recesses with respect to the other.

9. In a snap acting device, the combination of spaced stops, spaced resilient tension members interconnected at one end to form an end free to move between said stops, a compression member interconnected at one end with said free end, means supporting the opposite end of the compression member, an elongated resilient tang interconnecting the opposite ends of the tension members, and means pivotally supporting said tang in fixed spaced relation to said support for said compression member to stress said tension and compression members to define a snap spring system having an axis of maximum stress, said tang being movable in one direction in response to the application of a force thereto to flex the tension members in the opposite direction to move the tension stress line about said fixed pivotal means through the axis of maximum stress to move the free end between said opposed stops with a snap action.

10. In a snap acting device, the combination of opposed stops, spaced tension members interconnected at one end to form an end free to move between said stops, a compression member connected at one end with said free end, means for supporting the opposite end of the compression member, a normally unstressed resilient tang interconnecting opposite ends of the tension members, and means supporting said tang in fixed spaced relation to said support for said compression member to stress said tension and compression member to have a resultant force urging said free end into engagement with one of said stops, said tang being movable to move the tension members to effect a reversal of said resultant force acting on said free end to move the latter out of engagement with said one stop into engagement with the other stop with a snap action.

11. In a snap acting device, the combination of opposed stops, a resilient tension member and a compression member interconnected at one end to form an end free to move between said stops with a snap action, means for pivotally supporting the opposite end of the compression member, a tang connected to the opposite end of the tension member and pivotally supported in fixed spaced relation to the pivotal support for the compression member to form a snap spring system having an axis of maximum stress, said tang being movable between opposed positions, movement of the tank between said positions effecting storage of energy in the tension member and flexing the tension member through the axis of maximum stress to move said free end between said stops with a snap action.

12. In a snap acting device, the combination of opposed stops, a resilient tension member and a compression member interconnected at one end to form an end free to move between said stops with a snap action, means for supporting the opposite end of the compression member, a resilient elongated tang connected to the opposite end of the tension member and pivotally supported thereat in spaced relation to the support for the compression member to form a snap spring system having an axis of maximum stress, said tang extending away from its pivotal support in a direction away from the free end of the tension and compression members and being movable between opposed positions, movement of the tang between said positions effecting storage of energy in the tang and in the tension member and flexing the tension member through the axis of maximum stress to move said free end between said stops with a snap action.

13. In a snap acting device, the combination of spaced stops, a tension member having an end free to move between said stops with a snap action, a compression member having one end

connected with said free end, means for supporting the opposite end of the compression member, one of said members being resilient, an elongated resilient tang in spaced relation to the said one end of the compression member connected to the free end of the tension member, said tang being movable between opposed positions, and means for supporting the tang adjacent its connection to the tension member to form a snap spring system having an axis of maximum stress whereby movement of the tang between said positions moves the tension member around the means supporting the tang through the axis of maximum stress to move said free end from one stop into engagement with the other with a snap action.

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