June 28, 1966 W. T. STOI 3,258,549

LINEARLY OPERATED, LOST MOTION SWITCH CONSTRUCTION

Filed June 24, 1964 2 Sheets-Sheet 1

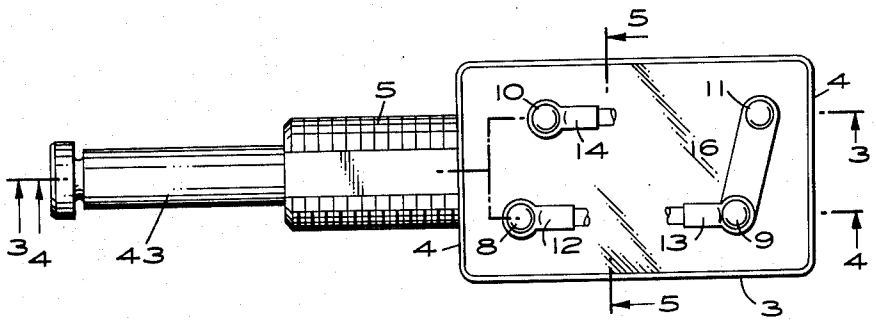


FIG. 1

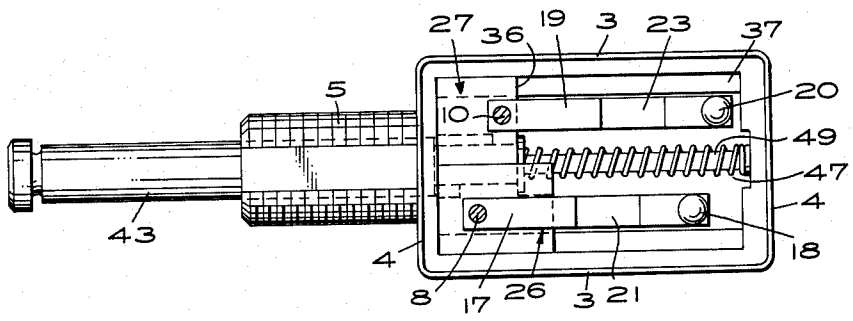


FIG. 2

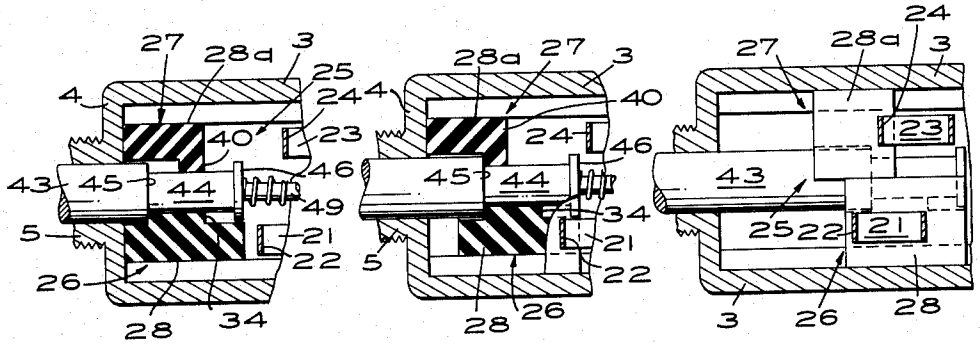


FIG. 6 FIG. 7 FIG. 8

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LINEARLY OPERATED, LOST MOTION SWITCH CONSTRUCTION

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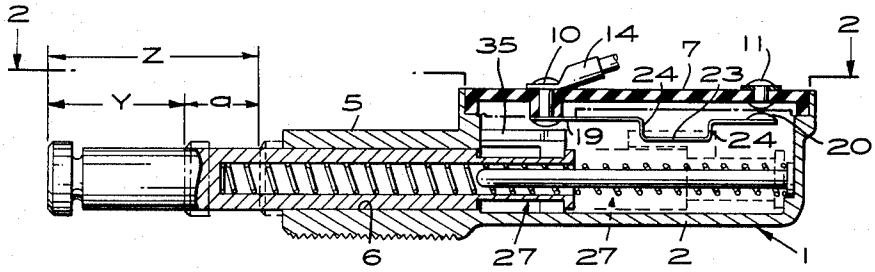


FIG. 3

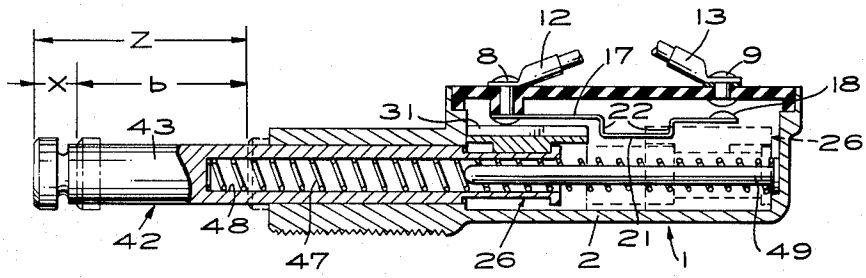


FIG. 4

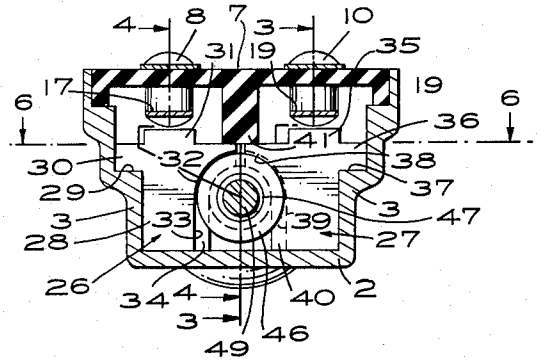


FIG. 5

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LINEARLY OPERATED, LOST MOTION SWITCH CONSTRUCTION

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9 Claims. (Cl. 200—16)

This invention relates to an electric switch construction and more particularly to a switch which is especially adapted for use as a so-called kick-down switch in automotive vehicle transmission systems.

An object of this invention is to provide a switch having one or more switching elements that may be shifted between circuit making and breaking positions in response to movement of an operator, and wherein the operator is capable of substantial movement relative to the switch elements when the latter are in either position and without effecting a change in their position.

Another object of the invention is to provide a switch construction of the kind described and wherein the movement of the switch elements between their circuit making and breaking positions is effected with a snap action so as to minimize sparking and other undesirable characteristics.

Another object of the invention is to provide a switch construction of the kind having switch elements movable between circuit making and breaking positions in response to linear movements of an operator, and wherein dimensional control over the actuation of the switch elements is positively maintained.

A further object of the invention is to provide a switch construction of the class referred to and wherein the construction is such that engagement and disengagement of the switch contacts may be felt.

A further object of the invention is to provide a switch construction which utilizes inexpensive, easily fabricated parts which may be assembled simply and rapidly to form a switch having the characteristics of ruggedness and durability.

Other objects and advantages of the invention will be pointed out specifically, or will become apparent from the following description when it is considered in conjunction with the appended claims, and the accompanying drawings in which:

FIGURE 1 is a plan view of a switch constructed and assembled in accordance with the invention;

FIGURE 2 is a view similar to FIGURE 1, but with the cover removed and with certain parts being shown in section, the section being taken on the line 2—2 of FIGURE 3;

FIGURE 3 is a longitudinal sectional view taken on the lines 3—3 of FIGURE 1 and FIGURE 5;

FIGURE 4 is a transverse sectional view taken on the lines 4—4 of FIGURE 1 and FIGURE 5;

FIGURE 5 is a transverse sectional view taken on the line 5—5 of FIGURE 1;

FIGURE 6 is a sectional view taken on the line 6—6 of FIGURE 5, and illustrating certain parts of the switch in one position of relative adjustment;

FIGURE 7 is a view similar to FIGURE 6, but illustrating the switch parts in another position of relative adjustment; and

FIGURE 8 is a view similar to FIGURE 7, but illustrating the parts in still another position of relative adjustment.

A switch constructed in accordance with the invention comprises a generally rectangular, metallic casing 1 having a base 2 surrounded by side walls 3 and end walls 4, one of the latter of which is provided with a tubular extension 5 in which is a through-bore 6. A cover plate 7 formed of insulating material and parallel to the base 2

is removably secured to the casing 1 in any suitable manner such as by crimping the walls 3 and 4. Supported on the cover 7 is a first pair of longitudinally spaced apart electrical contacts 8 and 9. Parallel to the contacts 8 and 9, but staggered longitudinally thereof, is a second pair of contacts 10 and 11. To the contacts 8, 9 and 10 may be secured the ends of conductors 12, 13 and 14, respectively, and the contacts 9 and 11 may be connected to one another by a conductive jumper 16.

Spanning the distance between the contacts 8 and 9 is an electrically conductive, spring switching element 17, one end of which is anchored to the contact 8 and the other end of which is provided with an electrically conductive button 18 that is adapted to engage and disengage the contact 9. A similar switching member 19 spans the distance between the contacts 10 and 11 and is anchored at one end to the contact 10. The other end of the member 19 has an electrically conductive button 20 adapted to engage and disengage the contact 11. Between the ends of the member 17 is a laterally deflected linear run or part 21 terminating at its opposite ends in substantially right angular portions or abutments 22. The switching member 19 is provided with a similar run 23 having right angular portions or abutments 24 at its opposite ends.

Actuating means 25 is provided for effecting movements of the switching members 17 and 19 into and out of engagement with their respective contacts 9 and 11. The actuating means comprises a pair of independent blocks 26 and 27 formed of insulating material and being slidably mounted in the casing 1 for movements longitudinally thereof along paths paralleling the switching members 17 and 19. The block 26 has a body 28 which rests upon the base 2 of the casing and has its outer side shaped to conform to the adjacent side wall 3 of the casing, the casing having a shoulder 29 cooperating with a flange 30 on the body 28 to guide the latter in its movements. The upper surface of the body 28 is provided with a longitudinally extending, upstanding rib 31 which, as is best indicated in FIGURE 4, extends above the base 2 a distance greater than the distance between the base and the offset portion 21 of the switch element 17. The other or inner side of the block 28 is cut away along an arcuate surface 32 that merges with a vertical surface 33 adjacent the casing base 2. Between its ends, however, the inner side of the block 28 is provided with a rib or abutment 34 which follows the contours of the surfaces 32 and 33 and which forms part of lost motion connecting means which will be referred to hereinafter.

The block 27 is similar to the block 26 in that it has a body 28*a* that rides upon the base 2 and has an upper rib or projection 35 that is so positioned as to engage the portion 23 of the switch element 19. (See FIGURE 3.) The outer side of the block 27 has a flange 36 which cooperates with a shoulder 37 formed on the adjacent side wall 3, and the other or inner side of the block 27 is cut away on an arcuate surface 38 which merges with a vertical surface 39. The block 27 is provided at one end with a rib or abutment 40 which projects toward the other block 26 and follows the contours of the surfaces 38 and 39. The rib 40 also forms part of the lost motion connecting means previously referred to.

Operating means designated generally by the reference character 42 is provided for effecting movements of the actuator means 25 along a linear path parallel to the switch elements 17 and 19. The actuating means comprises a plunger stem 43 slidably extending through the bore 6 of the extension 5. Adjacent its inner end the stem 43 is recessed or reduced as at 44, thereby providing a shoulder 45 and a terminal flange 46 spaced from the shoulder. The reduced portion 44 of the stem 43 slidably fits between the ribs 34 and 40 of the body members 26

and 27, respectively, so as to position the ribs between the shoulder 45 and the flange 46, but the length of the reduced portion 44 is substantially greater than the length of either of the ribs 34 and 40. The arrangement is such that relative movement between the plunger 43 and each of the blocks 26 and 27 is possible, as will be pointed out in greater detail hereinafter.

Means is provided for urging the plunger 43 to its projected position as shown in FIGURE 1 and comprises a compression spring 47 that is received in and projects to the right beyond a bore 48 formed in the main stem 43. One end of the spring acts against the base of the bore and the other end of the spring acts against the end wall 4 of the casing. The spring 47 is guided by a post 49 that projects from the casing wall 4 toward and into the stem 43. The stem 43 is prevented from being ejected from the casing by the engagement of the flange 46 with the ribs 34 and 40 on the blocks 26 and 27, respectively.

When the parts of the switch construction are in the positions indicated in full line in FIGURES 3 and 4, both of the blocks 26 and 27 will be in abutting relation with the left hand end wall 4 (as is indicated in FIGURE 6), and the terminal end flange 46 of the plunger 43 will be in engagement with the ribs 34 and 40 of the respective blocks, as is shown in full lines in FIGURES 3 and 4. When the plunger 43 is moved inwardly of the casing 1 a distance corresponding to the dimension X, the plunger first will move relatively to the blocks 26 and 27 to the position indicated in FIGURE 6 in which the shoulder 45 on the plunger is in engagement with the adjacent end of the rib 34 of the block 26, but the shoulder 45 still will be spaced from the adjacent end of the rib 40 of the block 27.

Continued inward movement of the plunger 43 from the position indicated in FIGURE 6 the full distance of the dimension Y will cause corresponding movement of the block 26 so as to effect engagement between the leading end of the block 26 and the right angular portion or abutment 22 of the switch element 17. These positions of the parts are shown in FIGURE 7. As is shown in FIGURE 4, the leading edge of the rib 31 is rounded, but only slightly, so that forceable engagement between it and the abutment 22 will, upon the application of sufficient force, effect movement of the switching element 17 in a direction to cause engagement between the contact button 18 and the contact 9. The movement of the switching element 17 to its contact bridging position is effected with a snap action due to the abruptness of the confronting surfaces of the parts 22 and 31.

The abruptness of the confronting surfaces of the members 22 and 31 enables precise control to be maintained over the actuation of the switch. That is, the length of movement of the block 26 between its circuit making and breaking positions can be determined quite accurately and maintained in mass production. Moreover, the snap action of the switch element, due to such abruptness, enables one to feel the making and breaking of the circuits.

Movement of the plunger 43 the distance X does not effect movement of the block 27, but inward movement of the plunger 43 following deflection of the switching element 17 into its contact engaging position will effect engagement between the plunger shoulder 45 and the rib 40 of the block 27 so as to effect movement of the latter longitudinally of the casing and conjointly with the block 26. Conjoint movement of the plunger stem 43 and the two blocks 26 and 27 the distance represented by Y in FIGURE 3 will locate the block 27 in such position that the leading end of the rib 35 will engage the abutment 24 of the switch element 19 and deflect the latter with a snap action into engagement with the contact 11 in the same manner described earlier in connection with the switch element 17.

The engagement of the switch elements 17 and 19 with their respective contacts 9 and 11 is sequential. The timing of the engagement of the switch elements and their respective contacts is determined partly by the lengths of the respective ribs 34 and 40 on the actuator blocks, and partly by the longitudinal staggering of the offset portions 21 and 23 of the switch elements.

When both switch elements have been moved into their contact engaging positions, the plunger may be moved fully inwardly of the casing, the total distance of movement of the plunger being indicated by the letter Z in FIGURES 3 and 4. Upon such movement of the plunger, the actuator blocks 26 and 27 will be moved toward the end wall 4 so as to occupy the positions shown in dotted lines in FIGURES 3 and 4. The relative lengths of the blocks 26 and 27 are such that the switch elements 17 and 19 are maintained in their contact engaging positions during the full movement of the plunger stem from the Y position to the Z position, this distance being designated by *a* in FIGURE 3.

At any position of the actuating blocks 26 and 27 and in which they engage their respective switch elements 17 and 19, the reversal of movement of the plunger from one direction of travel to the other will permit relative movement between the plunger and the blocks, and without effecting any change in position of the blocks in the casing. During such relative movement between the plunger and the blocks, the latter are maintained in fixed position relative to the casing by the spring tension exerted on the blocks by the switch elements 17 and 19. That is, the actuating blocks are frictionally and yieldably clamped between the bottom wall 2 of the casing and the offset portions 21 and 23 of the respective switch elements. Although the frictional clamping of the blocks is sufficient to prevent their inadvertent movement, it is not so great as to require the expenditure of undue force to effect movement of the blocks in response to movement of the plunger.

As will be apparent from FIGURES 3 and 4, the plunger 43 is capable of substantial axial movement without effecting disengagement of the switching elements 17 and 19 from their respective contacts. For example, the plunger 43 may move the distance *a* (FIGURE 3) without effecting disengagement between the element 19 and the contact 11, and the plunger 43 may move the distance *b* (FIGURE 4) without effecting disengagement of the switch element 17 and the contact 9.

The disclosed embodiment is representative of the presently preferred form of the invention, but is intended to be illustrative rather than definitive thereof. The invention is defined in the claims.

I claim:

1. An electric switch construction comprising a casing; a pair of spaced contacts supported on said casing; a switch element; means mounting said switch element on said casing for movement to and from positions in and out of engagement with said contacts; an actuator member mounted in said casing for back-and-forth movements along a linear path, said switch element having a linear part located in and substantially parallel to said path of movement of said actuator member for engagement thereby, engagement between said actuator member and said part effecting movement of said switch element from one of its said positions to the other; operating means; and lost motion means interconnecting said operating means and said actuator member for effecting movement of the latter in either direction along its path, said operating means comprising a reciprocable plunger member and said lost motion means comprising an enlargement on one of said members and a pair of spaced abutments on the other of said members, each of which is successively engageable with said enlargement in response to movement of said plunger member in opposite directions.

2. The construction set forth in claim 1 wherein the means mounting said switch element biases the latter in

a direction to frictionally clamp said actuator member between said part and said casing, thereby enabling relative movement between said operating means and said actuator member as permitted by said lost motion means.

3. The construction set forth in claim 2 wherein said switch element is formed of resilient material and wherein said part forms a substantially abrupt abutment in the path of said actuator member, whereby engagement and disengagement between said part and said actuator member effects snap action of said switch element in its movements.

4. An electric switch construction comprising a casing; a plurality of spaced contacts supported on said casing; a pair of switch elements; means mounting said switch elements on said casing for movements to and from positions in and out of engagement with selected ones of said contacts; a pair of independent actuator blocks mounted in said casing for back-and-forth movements along a linear path into and out of engagement with said switch elements in response to said movements of said blocks, thereby to move said switch elements into and out of engagement with said selected ones of said contacts; first abutment means on each of said blocks; operating means; means mounting said operating means for back-and-forth linear movements along said path; and second abutment means on said operating means and having a lost motion connection with the abutment means on each of said blocks for effecting movement of the latter in either directions along said path.

5. The construction set forth in claim 4 wherein said lost motion connection is such that the movements of said blocks are initiated sequentially.

6. The construction set forth in claim 4 wherein said switch elements are staggered longitudinally of said path so as to be moved to and from said positions sequentially by said blocks.

7. The construction set forth in claim 4 wherein each of said switch elements has a linearly extending part forming a substantially abrupt abutment located in the path of movement of its associated block, whereby engagement and disengagement between said parts and the respective blocks effects snap action of said switch elements in their movements.

8. The construction set forth in claim 4 wherein said operating means comprises a reciprocable plunger interposed between said blocks, and wherein said first abutment means comprises an enlargement on each of said blocks accommodated in a recess in said plunger, said recess being greater in length than the length of either of said enlargements, whereby said plunger is movable relatively to said blocks.

9. The construction set forth in claim 8 wherein said enlargements are different in length, whereby one of said blocks is movable prior to the other.

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