Jan. 9, 1962 H. E. HAGBERG 3,016,439

MOMENTARY SWITCHES

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Fig. 3.

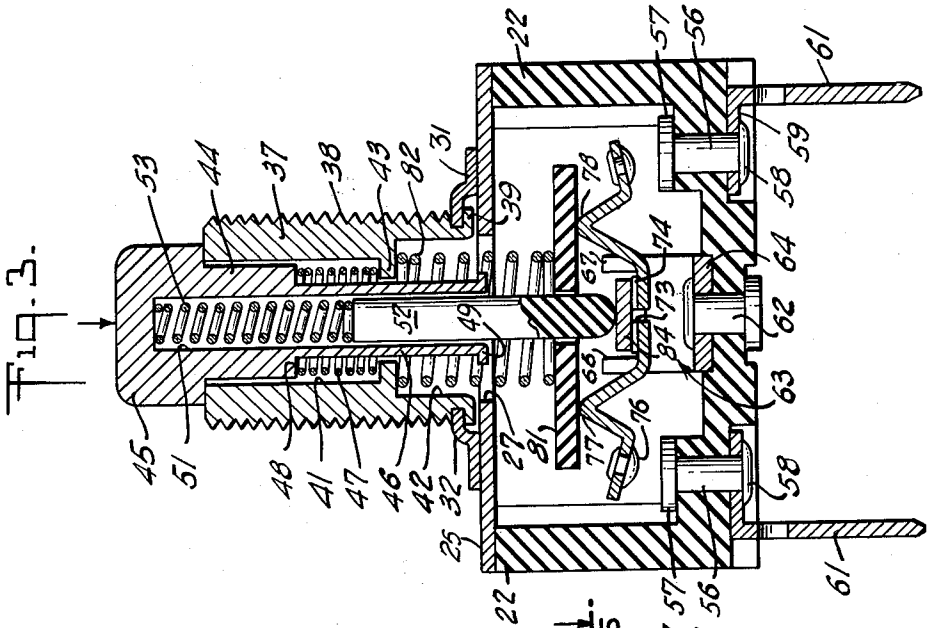

Fig. 2.

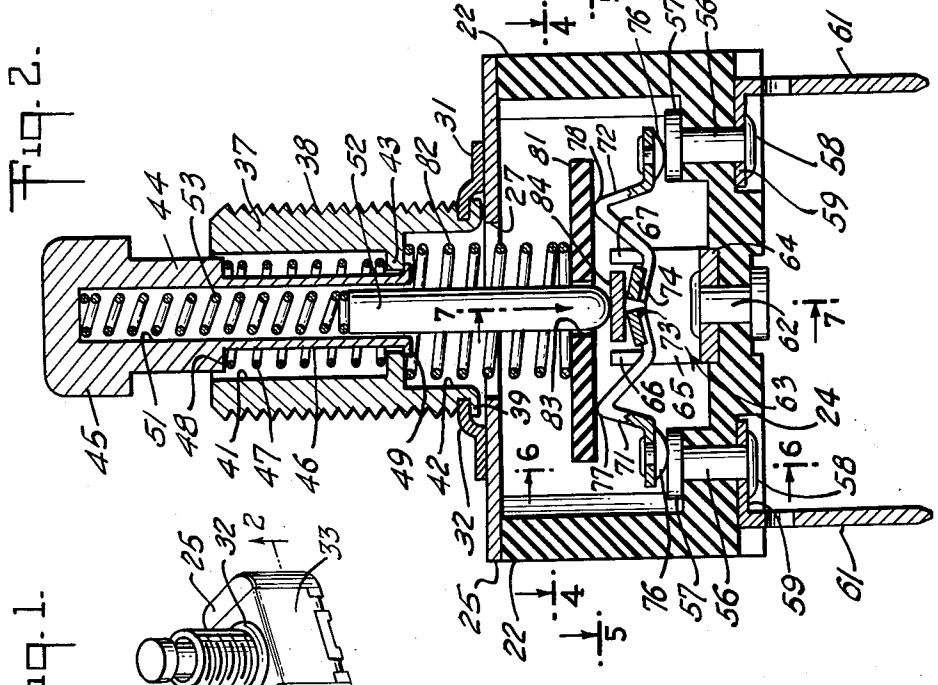

Fig. 1.

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MOMENTARY SWITCHES

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Fig. 4.

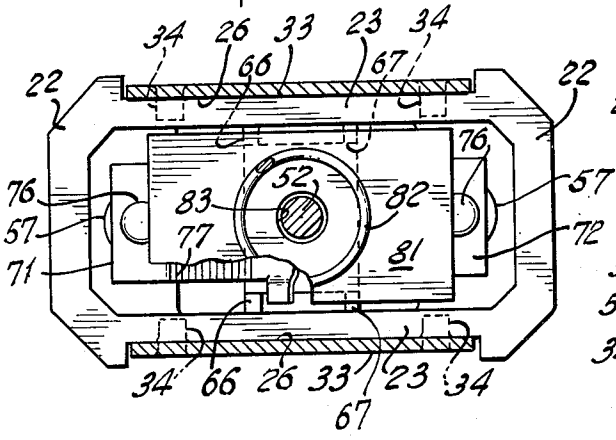


Fig. 6.

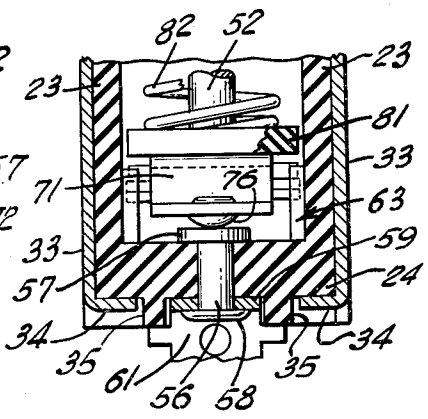


Fig. 5.

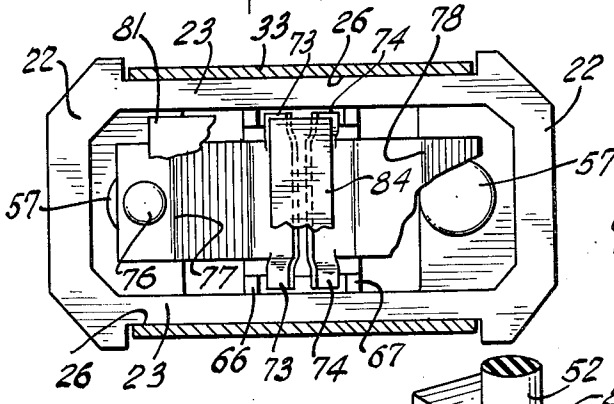


Fig. 7.

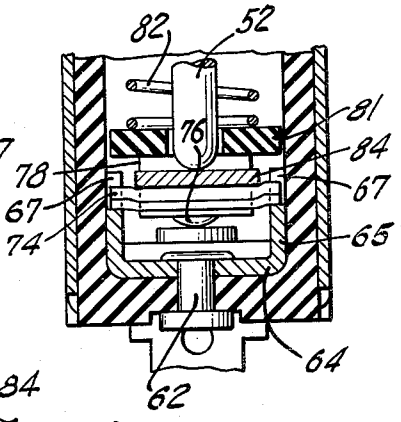
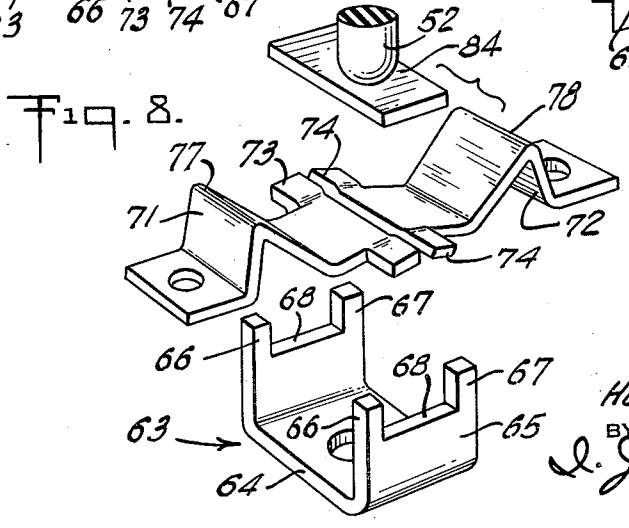


Fig. 8.



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MOMENTARY SWITCHES

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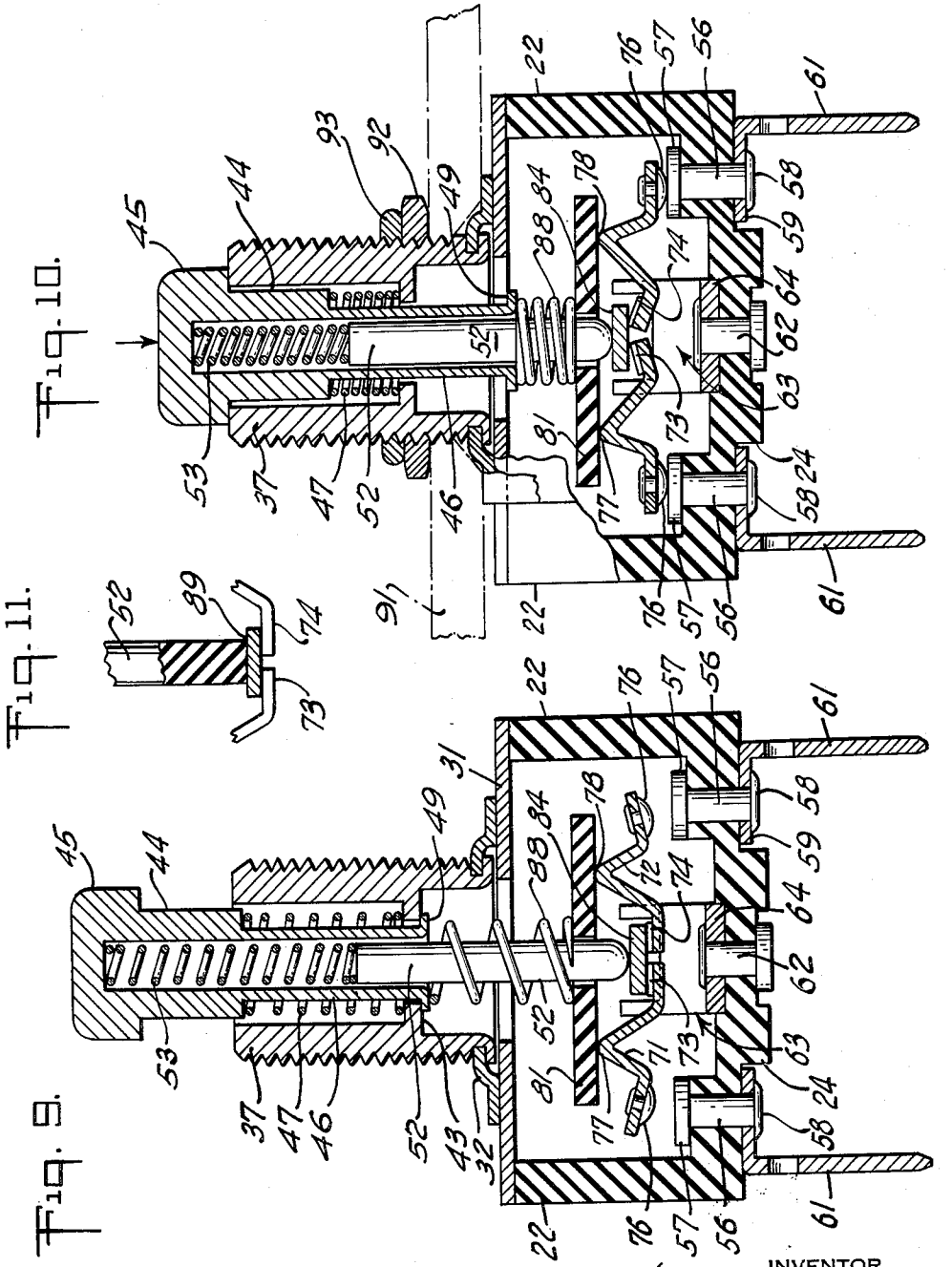

Fig. 9.

Fig. 10.

Fig. 11.

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United States Patent Office 3,016,439 Patented Jan. 9, 1962

3,016,439
MOMENTARY SWITCHES

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Filed July 9, 1959, Ser. No. 825,969
23 Claims. (Cl. 200—159)

This invention relates to switches, and particularly to improvements in momentary switches.

A salient feature of the present invention is the provision of a simple momentary switch assembly which is operative to maintain either a normally closed circuit or a normally open circuit by the use of substantially identical parts except for the alternative use of either of two springs having somewhat different characteristics and being placed in slightly different positions in the assembly relative to the other parts.

Another important feature of the present invention is the provision of momentary switches of improved structure wherein opposing spring forces are utilized to obtain positive circuit closing contact action and positive circuit opening contact release, while at the same time excessive contact pressures are obviated by overtravel arrangements for the actuating elements thereof.

Still other objects and advantages of the invention will be apparent from the specification.

The features of novelty which are believed to be characteristic of the invention are set forth herein and will best be understood, both as to their fundamental principles and as to their particular embodiments, by reference to the specification and accompanying drawings, in which:

FIGURE 1 is a perspective view of a typical switch assembly embodying the present invention;

FIG. 2 is a greatly enlarged vertical section view taken on line 2—2 of FIG. 1, some parts being shown in section and some parts being shown in elevation, and showing the contacting elements normally closed;

FIG. 3 is similar to FIG. 2, showing the arrangement of the elements after the plunger has been depressed momentarily to open the contact elements;

FIG. 4 is a view taken on line 4—4 of FIG. 2, some parts being broken away and some parts in section;

FIG. 5 is a view taken on line 5—5 of FIG. 2, some parts in section and some parts broken away;

FIG. 6 is a view taken on line 6—6 of FIG. 2, some parts being shown in phantom outline, some in section, and some parts being shown in elevation;

FIG. 7 is a view taken on line 7—7 of FIG. 2, some parts being shown in elevation and some in section;

FIG. 8 is a greatly enlarged exploded view of the contact levers and their relationship to their supporting yoke, to the plunger rod and the contact bar;

FIG. 9 is a view similar to FIG. 2, showing an embodiment wherein the contacting elements of the switch are normally open;

FIG. 10 is a view similar to FIG. 3, showing the normally open switch of FIG. 9 having been closed momentarily by the depression of the plunger; and

FIG. 11 is a greatly enlarged, partial section, fragmentary view of one of the actuating elements for the contact levers.

Referring now to the drawings in detail, wherein similar parts are designated by the same reference numerals throughout, the switches of the present invention comprise the box like molded base, generally designated **21**, made of a suitable synthetic thermosetting resin such as Bakelite, or the like, and having a pair of opposing end walls **22** and a pair of side walls **23**. The bottom of base **21** is enclosed by a floor **24**.

The top of base **21** is covered by a top plate **25** made of a suitable material such as sheet metal or the like,

and whose ends are coextensive with the outer surfaces of respective end walls **22**. The sides of top plate **25** are recessed to coincide with recesses **26** in the outer surfaces of side walls **23** of base **21**. FIGS. 4, 5. Top plate **25** has a central aperture **27** through which various switch elements project as will be described hereinbelow.

Positioned over top plate **25** is a bracket **31** of sheet metal having a central circular aperture positioned substantially coaxially in respect of aperture **27** of top plate **25**, and surrounded by an upset circular collar **32**. Bracket **31** has a pair of downwardly extending leaves **33** which fit within the recesses **26** of side walls **23**. The lower end of each leaf **33** is provided with a pair of spaced apart lugs **34** which extend into respective recesses **35** in the bottom floor **24** of base **21**. FIGS. 4, 6. Lugs **34** fit snugly into recesses **35** whereby bracket **31** secures top plate **25** firmly to the top of base **21**.

A suitable bushing **37** having peripheral threading **38** is provided at its lower end with an annular lip **39** forming an interlocking connection with collar **32** of bracket **31** whereby said bushing is secured firmly to base **21**. Bushing **37** has a pair of coaxially aligned central apertures **41** and **42**, the latter being of somewhat greater diameter than the former. Said apertures are separated from each other by means of an annular collar **43** intermediate the ends of said bushing. Bushing **37** and base **21** together form a frame or closure for the operative elements of the switches described herein.

Positioned within the upper aperture **41** and movable longitudinally therein is a tubular plunger **44** having a head **45** of enlarged diameter which limits the downward movement of said plunger into said aperture when said head bears upon the top end of bushing **37**. The lower portion **46** of plunger **44** is reduced in outside diameter to accommodate coil spring **47**, the lower end of which bears against the top of collar **43** and the upper end of which bears against shoulder **48** in order normally to urge plunger **44** upwardly into a non-operating condition. The lower end of plunger **44** is provided with an annular flange **49** which engages the lower surface of collar **43** to limit the upward movement of said plunger under the action of spring **47**.

Plunger **44** has a longitudinal central aperture **51** which is enclosed at the top and open at the bottom. Aperture **51** accommodates an elongated pin **52** that is movable longitudinally therein. Aperture **51** also accommodates a coaxial spring **53**, the lower end of which bears yieldably up on the top of pin **52** normally urging the latter downwardly out of said aperture. Pin **52** is made of a suitable plastic, rubber or other insulating material which is sufficiently rigid and strong to withstand a great number of actuations.

Positioned in floor **24** of base **21** is a pair of spaced apart, electrically conducting studs **56** which extend through said floor and are incorporated securely therein by means of molding or otherwise. Each stationary stud **56** has a contact head **57** which extends into the interior of base **21**. The lower ends of studs **56** extend downwardly to the exterior of base **21** and each has a rivet head **58** which firmly secures an electrically conductive bracket **59** to the bottom of said base. Each bracket **59** has a downwardly extending lug which serves as a terminal **61** to which electrical circuitry is connectible.

Secured firmly to the central portion of floor **24** on the interior of base **21** by means of rivet **62** is a contact lever support yoke, generally designated **63**. Yoke **63** comprises a laterally extending horizontal base **64** having integrally formed at each end thereof an upwardly extending bracket **65** which terminates in a pair of spaced apart upwardly extending ears **66** and **67**. FIGS. 2, 3, 7, 8. Ears **66** and **67** bound horizontal support

ridges 68 on top of brackets 65. Coacting with yoke 63 is a pair of oppositely extending identical electrically conducting contact levers 71 and 72. Contact levers 71 and 72, which are separate and independent from each other, have respective pairs of oppositely extending lugs 73 and 74 which rest upon ridges 68 of brackets 65 between ears 66 and 67. The lower inner edges of lugs 73 and 74 serve as fulcrums, intermediate the ends of the levers, coacting with ridges 68 to provide pivoting action for the respective contact levers 71 and 72.

The outer end of each contact lever 71 and 72 is provided with an electrically conductive contact button 76 secured therein by riveting or otherwise, each contact button being adapted to establish electrical connection with a respective head 57 of contact studs 56.

Intermediate their respective ends, levers 71 and 72 are bent into acute angle bights 77 and 78, respectively. Coacting simultaneously with both bights 77 and 78 is a horizontal actuator bar 81 made of a suitable insulating material, such as resin impregnated fiberboard, Bakelite, or the like. Actuator bar 81 is normally urged yieldably upon bights 77 and 78 by the lower end of spring 82, the upper end of which bears against the bottom of collar 43 of bushing 37. It will be noted that spring 82, which surrounds pin 52 and is coaxially aligned with spring 53, extends into aperture 42 of bushing 37 and extends freely through aperture 27 in top plate 25.

Actuator bar 81 has a central aperture 83 which permits the free vertical movement of actuator pin 52 therethrough. The lower end of pin 52 bears upon the top of a laterally extending electrically conducting center contact bar 84, the bottom of which in turn bears upon the tops of both pairs of lugs 73 and 74 of levers 71 and 72, respectively.

It will be observed in FIG. 2, that the switch is in a normally closed position by reason of contact buttons 76 having established electrical connection with respective contact heads 57 under the action of spring 82 bearing down upon contact bar 81 which in turn bears down on bights 77 and 78. Electrical connection between contact levers 71 and 72 is established through contact bar 81. In this embodiment, the respective characteristics of springs 53 and 82 are predetermined whereby the force exerted by spring 81 is normally greater than that of spring 53 so that in the non-operative position of plunger 44 (FIG. 2), the switch is in the normally closed electrically conducting condition.

When it is desired to open the electrical circuit momentarily, plunger 44 is depressed against the action of spring 47 whereby the compression of spring 53 increases its force upon pin 52 to cause the latter to bear downwardly upon bar 84 which in turn bears downwardly upon lugs 73 and 74 to produce a pivoting action upon respective contact levers 71 and 72, as shown in FIG. 3. This compression of spring 53 produces sufficient force to overcome the force of spring 82 whereby the latter becomes compressed to permit actuating bar 81 to move upwardly so that pivoting contact levers 71 and 72 are enabled to lift contact buttons 76 away from their respective contact heads 57, FIG. 3.

After the momentary opening of the electrical circuit has been accomplished, and it is desired to reclose the circuit, pressure is released from head 45 of plunger 44 which is automatically returned to its original non-operative position by the action of spring 47, thereby diminishing the force exerted by spring 53 so that spring 82 is once again enabled to cause actuator bar 81 to bear down upon bights 77 and 78 and to cause contact levers 71 and 72 to move pivotally back into the contact closing position shown in FIG. 2.

The normally closed switch shown in FIGS. 2 and 3 is readily converted into a normally open switch as illustrated in FIGS. 9 and 10 without making any substantial change in any of the parts except for the substitution of a single spring.

Spring 82 (FIGS. 2, 3) is removed and a coiled spring 88 (FIGS. 9, 10) of somewhat smaller diameter is positioned coaxially around actuator pin 52, the lower end of said spring 88 bearing upon actuator bar 81 and its upper end impinging upon and being engageable by flange 49 of plunger 44. The characteristics of the respective springs 88 and 53 are predetermined whereby the normal biasing force exerted by spring 53 upon pin 52 is greater than that exerted by spring 88 so that contact levers 71 and 72 are maintained in an open circuit position as shown in FIG. 9. When plunger 44 is depressed against the action of spring 47, the compression of spring 88 produces sufficient additional force upon actuating bar 81 to cause contact levers 71 and 72 to move pivotally to close the electrical circuit between each contact button 76 and its corresponding contact head 57 as shown in FIG. 10. The increased force exerted by spring 88 when plunger 44 is depressed is sufficient to overcome the countervailing force of spring 53 so that pin 52 is lifted to permit the pivoting action of contact levers 71 and 72 from their normally open position shown in FIG. 9 to their circuit closing position as shown in FIG. 10.

In both embodiments, FIGS. 2, 3, and FIGS. 9, 10, the opening and closing of the respective switches take place during a partial downward stroke of plunger 44 so that when said plunger is depressed beyond the point where the contacts make or break the circuit, the energy produced by the continuing stroke of the plunger is absorbed by the operative springs whereby excessive pressure either upon the cooperating contacts or upon portions of the contact levers themselves is obviated, thereby conserving as well as prolonging the life of the switch assembly.

In some embodiments, electrically conducting bar 84 may be omitted in which case there may be alternatively connected to the lower end of actuating pin 52 an electrically conducting bar 89 (FIG. 11) which serves to actuate lugs 73 and 74 and at the same time conduct the electrical current therebetween when the respective contact buttons 76 and contact heads 57 are in circuit closing position. In other embodiments, pin 52 may be made of a suitable electrically conducting metal, the lower end of which impinges upon lugs 73 and 74 of contact levers 71 and 72 simultaneously. In such event, suitable means can be readily effected for electrically insulating pin 52' from the other parts of the switch.

It will be noted that in the normally closed switch, FIG. 2, the biasing force of spring 82 upon levers 71 and 72 on one side of their respective fulcrums is normally greater than the biasing force of spring 53, on the other side of said fulcrums. When plunger 44 is depressed, the biasing force of spring 53 is increased to the extent of surpassing that of spring 82 whereby contact levers 71 and 72 are caused to move pivotally and open the circuit, as shown in FIG. 3.

Conversely, in the normally open switch embodiment shown in FIG. 9, the biasing force of spring 53 is normally greater than that of spring 88 whereby the contact levers are maintained in the normally open position. When plunger 44 is depressed, however, the biasing force of spring 88 is increased to the extent of overcoming that of spring 53, even though the latter has been increased in force, so that contact levers 71 and 72 are pivotally moved to close the circuit, as shown in FIG. 10.

The switch assemblies illustrated and described herein may be connected to a suitable mounting board 91 or the like (FIG. 10) by means of a threaded nut 92 and threaded ring 93 engaging the peripheral threads 38 of bushing 37.

In the specification, there is explained the principles of the invention, and the best mode in which it is contemplated applying those principles, so as to distinguish the invention from other inventions; and there is particularly

pointed out and distinctly claimed the part, mode or combination which the invention or discovery is claimed.

While there is shown and described certain preferred embodiments of the invention, it will be understood that modifications and changes may be made without departing from the function and scope thereof, as will be clear to those skilled in the art.

It is claimed:

1. A momentary switch comprising a base, a pair of spaced apart stationary contacts mounted in said base, a pair of separate and independent contact levers each pivotally supported intermediate its respective ends in said base, each lever being operative to establish electrical connection with a respective stationary contact, first spring biased means operative on both contact levers for simultaneously closing the electrical circuits between said levers and their respective stationary contacts, and second spring biased means operative upon both contact levers for simultaneously opening the electrical circuits between said levers and their respective stationary contacts, said second spring biased means establishing electrical connection between said contact levers.

2. A switch according to claim 1 wherein the normal biasing strength of one of said means is greater than the normal biasing strength of the other means according as the switch is intended to be normally closed or normally open, and further comprising means for increasing the biasing strength of the means of normally lesser strength to overcome the biasing force of the other spring biased means.

3. A momentary switch comprising a base, a pair of spaced apart stationary contacts mounted in said base, a pair of contact levers pivotally supported on said base, each lever being operative to establish electrical connection with a respective stationary contact, a first spring biased actuator bar operative upon both contact levers to produce positive pivotal motion of the latter in one direction to close the circuit between said levers and said stationary contacts simultaneously, and a second spring biased actuator bar operative upon both contact levers to produce positive pivotal motion of the latter in the opposite direction to open the circuit between said levers and said stationary contacts simultaneously, said second bar establishing electrical connection between said contact levers.

4. A momentary switch comprising a base, a pair of spaced apart stationary contacts mounted in said base, a pair of separate and independent contact levers each pivotally supported intermediate its respective ends in said base, each lever being operative to establish electrical connection with a respective stationary contact, first spring biased means operative on both contact levers for simultaneously closing the electrical circuits between said levers and their respective stationary contacts, and second spring biased means operative upon both contact levers for simultaneously opening the electrical circuits between said levers and their respective stationary contacts, said second spring biased means establishing electrical connection between said contact levers, the normal biasing strength of one of said means being determined to be greater than the normal biasing strength of the other means according as the switch is intended to be normally closed or normally open.

5. A momentary switch comprising a base, a pair of spaced apart stationary contacts mounted in said base, a pair of separate and independent contact levers each pivotally supported intermediate its respective ends in said base, each lever being operative to establish electrical connection with a respective stationary contact, first spring biased means operative on both contact levers for simultaneously closing the electrical circuits between said levers and their respective stationary contacts, and second spring biased means operative upon both contact levers for simultaneously opening the electrical circuits between said levers and their respective stationary contacts, said second spring biased means establishing electrical connection between said contact levers, the normal biasing strength of one of said means being determined to be greater than the normal biasing strength of the other means according as the switch is intended to be normally closed or normally open, and means operative upon the spring biased means of normally lesser strength to increase the biasing force thereof to overcome the biasing force of the other spring biased means.

6. A switch comprising a base, a pair of spaced apart stationary contacts mounted in said base, a pair of contact levers, each lever having a fulcrum intermediate its ends by which it is pivotally supported in said base, each lever being operative to establish electrical connection with a respective stationary contact, first spring biased means operative on both of said levers on one side of their respective fulcrums for simultaneously closing the electrical circuits between said levers and the respective stationary contacts, and second spring biased means operative on both levers on the opposite sides of the respective fulcrums for simultaneously opening the electrical circuits between said levers and their respective stationary contacts, said second spring biased means establishing electrical connection between said contact levers.

7. A switch according to claim 6 wherein the normal biasing strength of one of said means is greater than the normal biasing strength of the other means according as the switch is intended to be normally closed or normally open, and further comprising means for increasing the biasing strength of the means of normally lesser strength to overcome the biasing force of the other spring biased means.

8. A momentary switch comprising a base, a pair of spaced apart stationary contacts mounted in said base, a pair of separate and independent contact levers each pivotally supported intermediate its respective ends in said base, one portion of each lever being operative to establish electrical connection with a respective stationary contact, first spring biased means normally maintaining both of said levers simultaneously in contact with said respective stationary contacts, second spring biased means bearing simultaneously upon another portion of each of said levers, a plunger operative upon the second spring biased means to increase the strength thereof to surpass that of the first spring biased means whereby said levers are caused to move pivotally and open the circuits between said levers and their respective stationary contacts.

9. A switch according to claim 8 wherein said second spring biased means establishes electrical connection between said contact levers.

10. A momentary switch comprising a frame, a pair of spaced apart stationary contacts mounted in said frame, a pair of contact levers pivotally supported in said frame, each lever being operative to establish electrical connection with a respective stationary contact, a first element positioned against a first portion of each of said levers, a first spring in said frame bearing upon said first element and causing the latter normally to urge both of said levers simultaneously into circuit closing relationship with their respective stationary contacts, a second element in said frame, a second spring in said frame bearing upon said second element and causing the latter yieldably to bear upon another portion of each of said levers, and a third element operable at will upon said second spring for increasing the biasing strength thereof to the extent of surpassing the biasing strength of said first spring whereby said levers are simultaneously moved pivotally by said second element into an open circuit position relative to their respective stationary contacts.

11. A switch according to claim 10 wherein said third element establishes electrical connection between said contact levers.

12. A switch according to claim 10, and further comprising a fourth element positioned between said third

element and corresponding portions of both of said levers, said fourth element establishing electrical connection between said levers, said fourth element being maintained in position by the biasing action of said second spring.

13. A switch according to claim 10, and further comprising spring means in said frame and operable upon said third element for normally maintaining the latter in a normally non-operating position.

14. A momentary switch comprising a frame, a pair of spaced apart stationary contacts mounted in said frame, a pair of contact levers pivotally supported in said frame, each lever being operative to establish electrical connection with a respective stationary contact, a plunger mounted in said frame, a first spring in said frame normally maintaining said plunger in a non-operating position, a second spring positioned within said plunger, a first element, said second spring bearing upon said first element and causing the latter to bear upon a portion of each of said levers, a second element in said frame, a third spring of greater biasing strength than said second spring in said frame and bearing upon said second element to cause the latter to normally urge both of said levers simultaneously into circuit closing position relative to their respective stationary contacts, said plunger being operable at will to increase the biasing strength of said second spring beyond that of said third spring and to cause said first element to pivotally move said contact levers simultaneously into the open circuit position against the pressure of said third spring.

15. A switch according to claim 14 wherein said second element establishes electrical connection between said two contact levers.

16. A momentary switch comprising a base, a pair of spaced apart stationary contacts mounted in said base, a pair of separate and independent contact levers each pivotally supported intermediate its respective ends in said base, one portion of each lever being operative to establish electrical connection with a respective stationary contact, first spring biased means normally maintaining both of said levers simultaneously spaced apart from their respective stationary contacts, second spring biased means bearing simultaneously upon another portion of each of said levers, a plunger operative upon the second spring biased means to increase the strength thereof to surpass that of the first spring biased means whereby said levers are caused to move pivotally and close the electrical circuits between said levers and their respective stationary contacts.

17. A switch according to claim 16 wherein said second spring biased means establishes electrical connection between said contact levers.

18. A momentary switch comprising a frame, a pair of spaced apart stationary contacts mounted in said frame, a pair of contact levers pivotally supported in said frame, each lever being operative to establish electrical connection with a respective stationary contact, a first element positioned against a first portion of each of said levers, a first spring in said frame bearing upon said first element and causing the latter to normally maintain both of said levers simultaneously spaced apart from their respective stationary contacts, a second element in said frame, a second spring in said frame bearing upon said second element and causing the latter yieldably to bear upon another portion of each of said levers, and a third element operable at will upon said second spring for increasing the biasing strength thereof to the extent of surpassing the biasing strength of said first spring whereby said levers are simultaneously moved pivotally by said second element into a closed circuit position relative to their respective stationary contacts.

19. A switch according to claim 18 wherein said third element establishes electrical connection between said contact levers.

20. A switch according to claim 18, and further comprising a fourth element positioned between said third element and corresponding portions of both of said levers, said fourth element establishing electrical connection between said levers, said fourth element being maintained in position by the biasing action of said first spring.

21. A switch according to claim 18, and further comprising spring means in said frame and operable upon said third element for normally maintaining the latter in a normally non-operating position.

22. A momentary switch comprising a frame, a pair of spaced apart stationary contacts mounted in said frame, a pair of contact levers pivotally supported in said frame, each lever being operative to establish electrical connection with a respective stationary contact, a plunger mounted in said frame, a first spring in said frame normally maintaining said plunger in a non-operating position, a second spring positioned within said plunger, a first element, said second spring bearing upon said first element and causing the latter to bear upon a portion of each of said levers, a second element in said frame, a third spring of greater biasing strength than said second spring in said frame and bearing upon said second element to cause the latter to normally maintain both of said levers simultaneously spaced apart from their respective stationary contacts, said plunger being operable at will to increase the biasing strength of said second spring beyond that of said third spring and to cause said first element to pivotally move said contact levers simultaneously into contact with their respective stationary contacts against the pressure of said third spring.

23. A switch according to claim 22 wherein said second element establishes electrical connection between said two contact levers.

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