Feb. 19, 1957 J. G. SMITH 2,782,287

SWITCH MECHANISM

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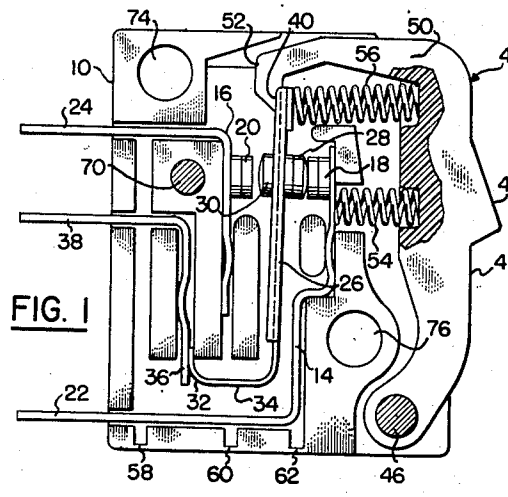


FIG. 1

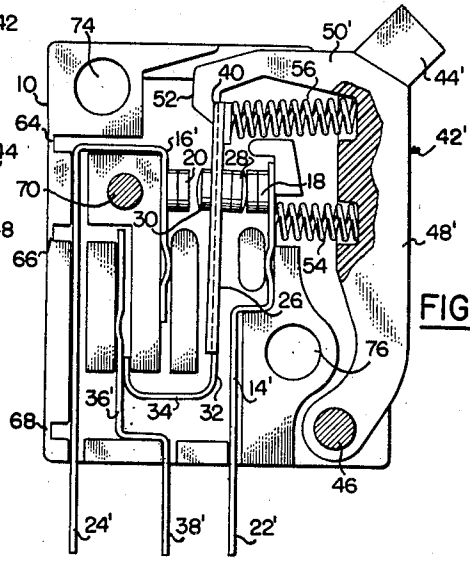


FIG. 2

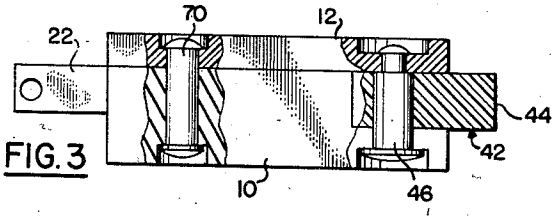


FIG. 3

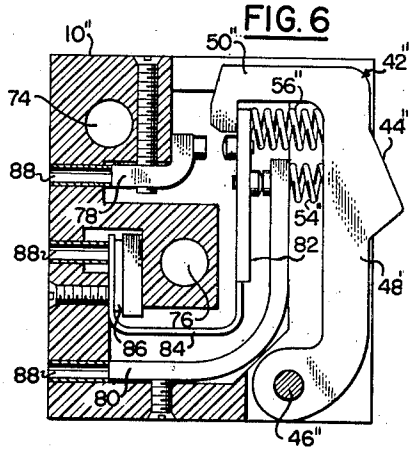


FIG. 6

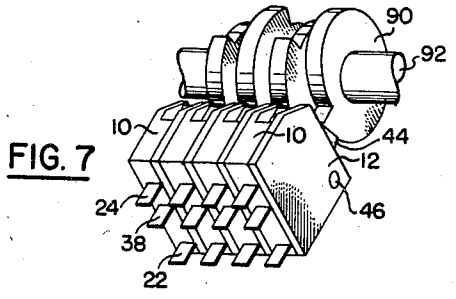


FIG. 7

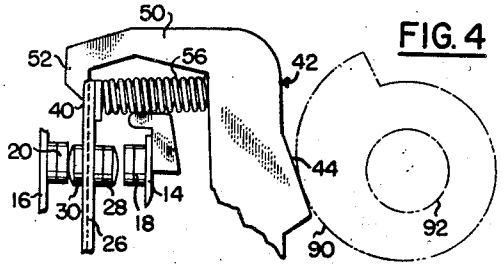


FIG. 4

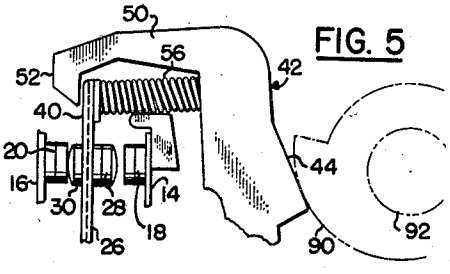


FIG. 5

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SWITCH MECHANISM

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5 Claims. (Cl. 200—153)

This invention relates to switch mechanisms and particularly to an improved switch especially adaptable for use in computers and the like.

In the art of electric switches, and especially those designed for high speed use in computing equipment, the disadvantages of the commercially available switches are their large size, short mechanical life and contact reaction or bounce. In the open construction of such switches they are subject to ingress of dust and foreign material and the possibility of short circuiting. In the enclosed type of such switches they have been largely of the snap action type which at high speeds and with any degree of overthrow are short lived.

An important object of the present invention is to provide a switch mechanism which is especially desirable for use in computers and the like and which is reliable in operation at high speeds and has a long mechanical and electrical life.

Another important object of the invention is to provide a switch mechanism in which relatively high contact pressures are utilized to actuate a movable switching member but without loading the switching member, thus enabling the operation of the mechanism at high speeds and without contact bounce.

Another important object of the invention is to provide a basic switch structure which is readily convertible in the process of fabrication to one of several finished designs by the simple substitution of parts.

A still further important object of the invention is to provide an improved switch mechanism which has its parts designed in a novel manner for assembly into a small compact enclosed switch for operation at high speeds without contact reaction or bounce and which is designed for stacking with similar switch mechanisms in a multiple switch assembly for use in confined spaces of computing machines.

Various other objects, advantages and meritorious features of the invention will become more fully apparent from the following specification, appended claims and accompanying drawings wherein:

Fig. 1 is a top plan view of a switch mechanism illustrating one embodiment of the invention and with the cover member removed to expose the interior thereof;

Fig. 2 is a similar view as Fig. 1 but showing a modified form of switch structure provided by the substitution and rearrangement of certain of the parts thereof;

Fig. 3 is an edge view of the switch structure of Fig. 1 partly broken away in section;

Figs. 4 and 5 are fragmentary views of the contact area in the switch mechanism of Fig. 1 illustrating successive positions of the operating parts in the actuation of the switch;

Fig. 6 is a plan view similar to Figs. 1 and 2, illustrating another form of switch structure embodying the invention; and

Fig. 7 is a perspective view illustrating a stack of similar switches each constructed in accordance with the invention and predisposed for operation by a series of

rotary cam elements on a common shaft of a computing machine.

Referring now to the embodiment of the invention illustrated in Figs. 1 and 3, there is illustrated a small, compact switch for use in computing machines, the operating parts of which are enclosed and sealed from the accumulation of dust and other foreign matter. The body of the structure illustrated in Figs. 1 and 3 is composed of a main body section **10** and a subsidiary body section **12**, the latter serving as a cover for the switch body. The two body sections are formed of electrical insulating material such as a phenolic type of plastic. The main body section, as shown in Fig. 1, is formed at the time it is molded with connecting cut-away areas opening out through one side of the section, the side walls of these cut-away areas extending generally vertically to the plane of the body section and serving as supporting surfaces for several of the relatively fixed operating members of the switch. The cover section **12** overlies the side of the body section **10** through which these cut-away portions open and thus seals the same from the ingress of dust and other foreign matter.

The operating members of the switch of Fig. 1 include a pair of relatively stationary contact terminals or members **14** and **16** which have internal portions extending generally parallel to one another in opposed confronting relation. Carried on these internal parallel portions of the terminal members **14** and **16** are projecting contact points or buttons **18** and **20** respectively. These buttons are preferably in line with one another, as illustrated in Fig. 1. The contact members **14** and **16** are shown as being in the form of metallic strips preferably formed of brass and their opposite end sections remote from the contact buttons are arranged to pass through a side edge of the switch body. The projecting end sections of the terminal members **14** and **16** are indicated at **22** and **24** respectively. The contact points or buttons may be formed of any suitable materials, such as silver, tungsten or palladium-silver alloy, and secured to the terminal members in any suitable way, as brazing or riveting.

Interposed between the fixed terminal members **14** and **16** and supported for movement in the space between the contact buttons **18** and **20** is a movable switching member **26** which is in the form of a flat blade or arm extending generally parallel to the inner end sections of the terminal members. The arm **26** carries a contact point or button **28** on one side thereof and another contact point or button **30** on the other side thereof which are capable of engaging the contact buttons **18** and **20** respectively of the terminal members at separate times. The arm **26** is mounted on a flexible metallic strip **32** which is curved intermediate its ends to provide a U-shaped bend **34**. The strip **32** may be formed of Phosphor-bronze material. The arm or blade **26** is mounted on one end section of the flexible member **32**. The opposite end section of the flexible member is attached by spot welding or otherwise to a stationary terminal member **36** which, like the terminal members **22** and **24**, has an extension **38** projecting from the switch body. Preferably, as shown, the three external terminal end sections **22**, **24** and **38** extend from the same edge of the switch body and generally parallel to one another. Normally, without any pressure being imposed upon the blade or arm **26** of the switching member, the blade lies in a plane half way between the contact buttons **18** and **20** of the terminal members and thus its own contact buttons **28** and **30** would be out of contact therewith. Because of the springiness of the flexible strip **34**, the arm **26** is capable of swinging in the area between the contact buttons **18** and **20** to engage one or the other thereof. It is also evident from Fig. 1 that the blade or arm **26** has an end extension **40** projecting beyond the working area of the contact buttons and beyond

the terminating edge of the fixed terminal member **14**.

The switching member **26** is moved from one to the other of its two contact positions by means of an actuator or operating finger generally indicated at **42** and lying in a plane between the opposite sides of the switch body. The operating finger **42** has an overall or general C-shaped configuration and lies within a recess formed in the main body section **10** which opens out through an edge of the body differing from that from which the outer terminal ends of the members **22, 24** and **38** project. The greater portion of the finger **42** lies within the recess and thus within the outer confines of the body, but the finger is provided with a rise or hump **44** which projects out of the recess in which the finger is located and beyond the outside of the switch body for engagement by an external operating force.

As previously mentioned, the finger **42** is of a general C-shaped formation. One end of the finger is pivoted in the body by means of a small rivet or pin **46** which, as shown in Fig. 3, may also serve to secure the cover section **12** to the main body section **10**. As is evident in Fig. 1, the pivoted axis for the finger is located adjacent to one corner of the body and at a relatively remote distance from the operating area of the contact buttons. From the pivot axis the finger has a relatively straight body portion **48** which extends alongside of and generally parallel to the inner end section of the stationary terminal member **14**. Beyond this portion **48** the finger is bent at approximately 90° to provide a portion **50** which extends toward the opposite terminal member **16** and close to the working area of the contact buttons. The extremity of the finger portion **50** is inturned to form a step or lip **52** extending toward the operating area of the buttons and shaped to engage the side of the switching arm **26** opposite to the terminal member **14**. It is evident from Fig. 1 the C shape configuration of the finger is such that if a straight line is drawn from the pivot end of the finger to the lip end **52** it will pass generally through the working area of the contact buttons.

Interposed between the finger portion **48** and the fixed terminal member **14** is a coiled wire spring **54**, the tension of which is so designed as to yieldingly urge the finger away from the terminal member. A second coiled wire spring **56** is provided which is interposed between the finger portion **48** and the free end **40** of the switching member **26**. The two springs **54** and **56** are spaced apart and arranged with their axes in generally parallel relation to one another. The first coiled spring **54** exerts a pressure to move the finger **42** away from the stationary terminal member **14** and in so doing brings the lip **52** of the finger into engagement with the free end of the switching blade **26** and carries the same therewith bringing the contact points or buttons **28** and **18** into contact with one another to close an electrical connection therebetween. The second coil spring **56** bodily moves along with this movement of the blade and finger. Thus Fig. 1 illustrates the normal operating position of the parts with the switching member **26** in electrical contact with the stationary terminal **14**.

When the finger **42** is moved inwardly of the body and against the resistance of the coil spring **54**, it operates through the second spring **56** and exerts pressure on the extension **40** of the switching member urging the latter in the same direction of the movement of the finger and toward the opposite stationary terminal member **16**. The lip **52** moves with the finger thus freeing the switching member for this movement. Figs. 4 and 5 illustrate progressive positions of the operating members of the switch when the finger is actuated in this direction. In Fig. 4 the finger has been partially depressed into the body sufficient to move the switching member so that the contact point or button **30** thereof is in engagement with the button **20** of the fixed terminal member **16** thereby making an electrical connection therewith. Fig. 5 illustrates the final position of the parts after the finger has been fully depressed. It is evident from Fig. 5 that the finger has an overthrow position in which the lip **52** is moved away from the end **40** of the switching member while the force applying spring **56** is further compressed.

It is evident that during the operation of the mechanism from one switching position to the other that a high contact pressure is obtained in either switching position without loading or applying other than only an extremely mild force upon the leaf spring element **32**. The helical coil springs **54** and **56** do this work, thus preserving the leaf spring for long mechanical life. When the external force applied on the finger is removed, the first coil spring **54** returns the operating parts to the normal position shown in Fig. 1.

Fig. 2 illustrates a modification of the invention wherein the basic structure is preserved where differently designed parts having the same function are substituted for certain of the parts shown in the embodiment of Fig. 1. In Fig. 2 the finger identified at **42'**, for example, is generally like that previously described except that the external knob for actuating the finger has been changed in shape and is located at the juncture of the portions **48'** and **50'** for projection from one corner of the switch body. The fixed terminal members also have been modified so that they project from another edge of the switch body. As shown in Fig. 2, new terminal members **14'** and **16'** have been substituted which are generally like those described in connection with Fig. 1 but have terminal extensions **22'** and **24'**, respectively, which are shaped so as to extend through an edge of the switch body closer to the pivotal axis of the finger. Likewise, a terminal member **36'** has been substituted for the similarly numbered element in Fig. 1 and arranged so that it has its terminal extension **38'** projecting from the same edge as the terminal ends **22'** and **24'**.

In order to provide optional location of the terminal extensions from one or the other edge of the same switch body, the main body section **10** is provided during its fabrication with weak wall portions identified at **58, 60** and **62** of Fig. 1, and at **64, 66** and **68** of Fig. 2. These weak wall portions are frangible and can be broken through when the switch is assembled and depending upon the selection of the terminal members they will be extended from the switch body either as shown in Fig. 1 or in Fig. 2. It is obvious that other modifications of the switch body and operating parts may be made in order to vary the application of the switch mechanism.

The two body portions **10** and **12** are secured together by rivets or other suitable connecting means. One of these rivets has already been identified at **46** as the pivotal axis for the actuator **42**. Another rivet is indicated at **70** adjacent to the opposite corner of the body. The switch body is also provided with one or more holes extending completely through from one side to the other side thereof. In the illustrated embodiments of the invention both the main body portion and the cover portion are provided with two registering holes identified at **74** and **76**. These holes may serve to receive rods or other supporting elements upon which one or more of these switch bodies are mounted.

Fig. 6 illustrates a modification of the invention wherein the two terminal members and the contact member are formed of relatively thicker metallic material and terminate completely within the body. The two terminal members are identified at **78** and **80** and the contact member at **82**. The contact member is secured as in the manner previously described to a flexible strip **84** which in turn has its opposite end secured to another metallic member **86** within the body. Extending through one edge of the switch body are circular holes in which are received sleeve-like conducting elements **88**. One conducting element is associated with each of the two terminal members and the member **86** and is connected thereto. These sleeve elements serve as sockets for the reception of external terminals to provide an electrical connection.

In Fig. 7 there is illustrated a plurality of the switch mechanisms, such as the type illustrated in Figs. 1 and 3, mounted in a row and compactly assembled together into a stack. The actuating members of these switch mechanisms are all arranged to project from one side of the stack in juxtaposition to a series of rotary cams **90** mounted on a common operating shaft **92**. Since each switch mechanism has flat parallel sides they may be mounted in such close side-by-side relation. In actual practice the switch mechanism embodying the invention is quite small, and may be an inch square or less in its major plane and one quarter of an inch thick or less.

What I claim is:

1. A switch structure comprising two relatively fixed, spaced apart and confronting contact members; a contact arm mounted for movement between the two contact members and operable upon movement to engage one or the other contact member; an actuating finger for controlling the movement of the arm and swingably mounted for movement in the plane of movement of the arm; a pair of coil springs; one of said springs being interposed between the finger and one of the contact members; the other of said springs being interposed between the finger and the movable arm; the first spring being under such tension as to urge the finger away from the contact member; the second spring acting as the operating connection between the finger and the movable arm and operable to move the arm into engagement with one of said contact members and thereafter yieldingly compress as further movement of the finger in the same direction is absorbed thereby; and means carried by the finger engageable with the side of the arm opposite to the direction in which the finger is urged to thereby draw the arm in the direction of movement of the finger and into engagement with the other of said contact members when the finger is moved by the first spring.

2. In combination with a switch having a pair of relatively fixed, spaced apart confronting terminal members and a movable contact arm interposed between the terminal members and capable of engagement with one or the other of the terminal members at different times, an operating finger mounted for swinging movement in the plane of movement of the contact arm and exhibiting generally the configuration of the letter **C**, means pivoting one end of the finger about a fixed axis and such that the finger extends alongside of one of the terminal members in spaced relation thereto and has its opposite free end in position to engage the contact arm on the side thereof opposite to the terminal member alongside of which the finger extends, a coil spring interposed between the finger and the terminal member along the side of which it extends and normally yieldingly urging the finger away therefrom, the free end of the finger serving to engage and move the arm in the same direction as the finger when the latter is moved by the spring, a second coil spring interposed between the finger and the contact arm and seated against the latter on the side thereof opposite to the side engaged by the free end of the finger, said second spring serving as the operating connection between the finger and the arm to move the latter in the same direction as the finger when the same is moved against the resistance of the first spring.

3. A switch mechanism comprising, in combination, a pair of relatively fixed terminal members predisposed in spaced apart confronting relation and each provided with a contact button facing toward the other, a contact arm supportingly positioned at one end for movement between the fixed terminal members and provided with a contact button on each side thereof aligning with the button of the terminal member on the same side thereof for engagement therewith when the arm is moved in that direction, the opposite end of the arm projecting beyond the contact buttons and terminating freely, an operating finger of generally **C** shaped configuration, means pivotally connecting one end of the finger on the side of the contact buttons opposite to the free end of the arm, the finger being mounted such that it extends around one of the terminal members and has its opposite end free and disposed on the side of the arm opposite to said last mentioned terminal member, a pair of coiled springs each seated at one end on the finger and extending generally parallel with one another, one of said springs having its opposite end seated on the terminal member around which the finger extends, the other of said springs having its opposite end seated on the free end of the arm on the side thereof opposite to that engageable by the free end of the finger, the disposition of the first spring being such that it yieldingly urges the finger away from the terminal members and thereby causes the free end of the finger to engage and move the arm therewith, the disposition of the second spring being such it serves as a yielding force transmitting medium between the finger and the arm when the former is moved against the resistance of the first spring.

4. A switch mechanism comprising, in combination, a body of electrical insulating material having a relatively flat generally rectangular configuration and being provided with cut out portions in the body opening out through one side thereof, a pair of spaced terminal members positioned in separate cut out portions of the body and disposed in relatively fixed spaced apart confronting relation to one another, a spring leaf contact member positioned in another cut out portion of the body and extending between the two terminal members and capable of movement into engagement with one or the other, said body being further provided with a recess therein opening through one edge of the body, an operating finger for controlling the contact member positioned in the recess and having an actuating projection extending outwardly beyond said edge of the body, means mounting said finger for swingable movement in the recess and in the direction toward and away from the members, a pair of coil springs in the body, one of said springs being interposed between the finger and one of the terminal members and acting to yieldingly urge the finger in the direction of its movement away from the terminal members, the other of said springs being interposed between the finger and the contact member and serving as the sole connection therebetween when the finger is moved in the direction of its movement toward the terminal members, an extension of the finger engageable with the side of the contact member opposite to the direction in which the finger is spring urged and operable when the finger is moved in that direction to engage and move the contact member in the same direction, and a separate conducting lead for each of said members extending through another edge of the body for electrical connection with circuitry external to the body.

5. A switch comprising, in combination, a body of electrical insulating material having a relatively thin flat generally rectangular configuration, a spring leaf contact member in the body having one end relatively fixed against movement while the opposite end is free to move in the direction of the plane of the body, an electrical terminal member in the body and positioned in relatively fixed condition on one side of the contact member and in confronting relation to the free end thereof, said body having a recess therein on the side of the contact member opposite to the terminal member and opening out through an adjacent edge of the body, an operating finger for controlling the contact member positioned in the recess and having an actuating projection extending outwardly beyond said edge of the body, means mounting said finger in the body for movement in the direction of the plane of the body and toward and away from the contact and terminal members, spring means in the body engaging the operating finger and yieldingly urging the same outwardly away from the contact and terminal members, a coil spring seated at one end on the operating finger and at the other end on the free end of the

contact member and serving as the sole operating connection therebetween when force is applied to the finger to move the same inwardly toward the contact and terminal members, said coil spring acting when the operating finger is moved inwardly to likewise move the free end of the contact member into engagement with the terminal member and thereafter to yieldingly compress its convolutions as it absorbs continued movement of the finger in the same direction, a hook-shaped extension on the operating finger engageable with the side of the free end of the contact member opposite to the direction in which the operating finger is urged by said spring means and operable when the finger is moved in that direction

to engage and move the contact member in the same direction to thereby disengage the contact member from the terminal member, and a separate conducting lead for the contact and terminal members extending through another edge of the body for electrical connection with the circuitry external to the body.

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