

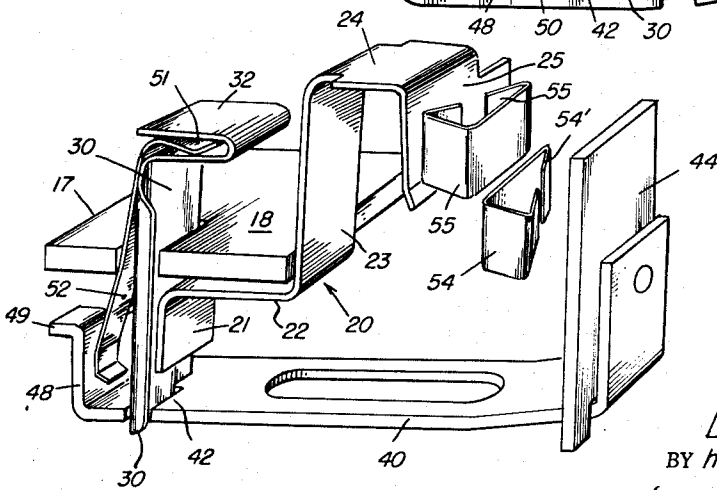
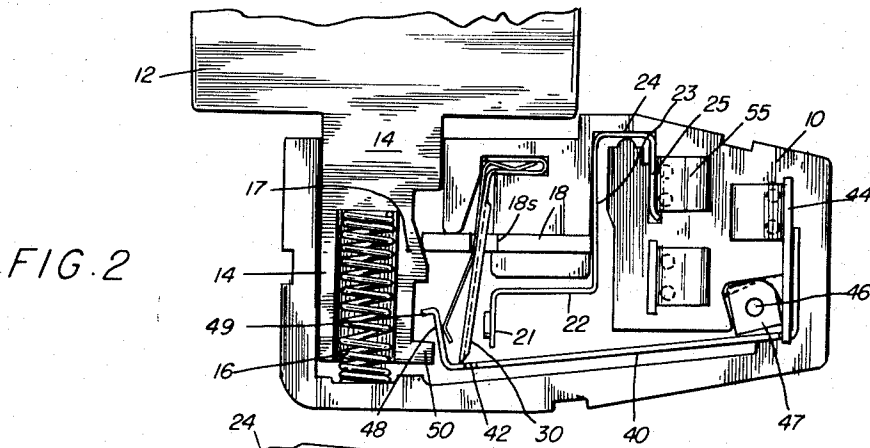
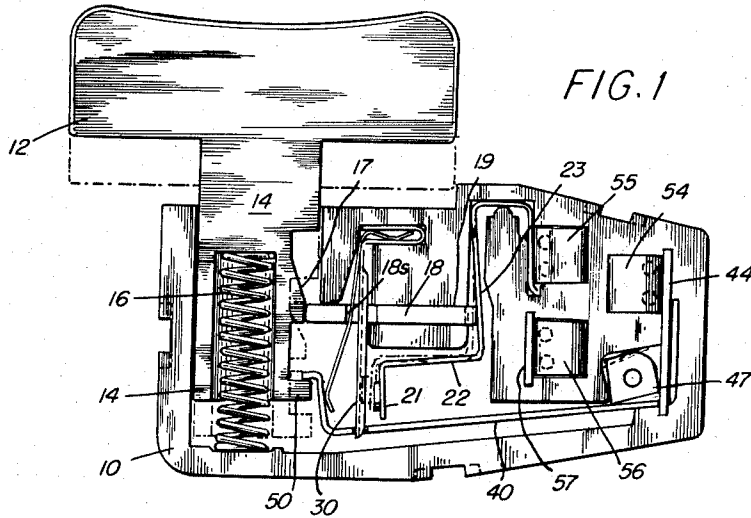
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TOOL HANDLE SWITCH WITH OVERLOAD PROTECTION

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TOOL HANDLE SWITCH WITH OVERLOAD PROTECTION

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This invention relates to electric switches and more particularly to a switch useful in the handles of electric power tools such as saws, drills and the like. More specifically, the invention relates to provision in such a switch for automatic separation of the contacts on the occurrence of a predetermined overload current.

With increasing use of portable power tools in the home and industrially, a need has arisen for protection of the tool motors against overload. Protection by fuses at a point remote from the tool requires loss of time in getting at and replacing the fuse. Moreover, a new fuse must be readily available or even greater time is lost. In portable power tools, there is a considerable tendency among the unskillful persons, and also among both skilled and unskilled when proceeding with undue haste, to overload the motor by imposing on the tool a greater load or duty than it was designed to handle normally.

In accomplishing one of the objects of the invention, overload protective means, preferably of a kind which can be manually reset, is incorporated in the switch unit itself so that both the switch and its overload protective means can be quickly and economically mounted in the tool handle at one time by the tool manufacturer when the tool is assembled.

Another object of the invention is to provide such a switch with manually resettable overload protection which will trip and remain tripped while the actuator is maintained in the "On" position.

Another object is to provide such a switch in which the overload protection is restored or reset to its normal-operating condition by return of the actuator to its "Off" position.

Another object is to provide such a switch with overload protection including a bimetal, in which the parts may be returned to normal "On" position and will remain there only after the bimetal is cooled by dissipation of the heat of the overload.

Another object of the invention is to provide such a switch with overload protection, including a bimetallic latch-trip in which it is necessary not only for the bimetal to cool sufficiently to be able to return to latching position, but also for the actuator to be released and returned to "Off" position before the circuit can again be closed.

Another object is to provide a switch having the foregoing characteristics in which the switch actuator or a trigger is automatically returned to "Off" position by a biasing spring which will also reset the switch and overload means.

Another object is to provide a switch of the foregoing characteristics which can be economically manufactured and installed in the handles of power tools and the like without the need for substantial increase in space or major redesign of the handle or substantial increase in the weight of the whole combination.

Other objects and advantages of the invention will appear as the invention is described in connection with the accompanying drawing.

In the drawing:

FIG. 1 is a plan view of a switch embodying the invention with the cover plate removed and the switch shown in normal "Off" position and full lines and in "On" position in broken lines.

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FIG. 2 is a view similar to FIG. 1 with the parts in tripped position.

FIG. 3 is a perspective view of the current carrying parts and movable contact operating slide.

Referring to the drawing, the switch parts are mounted in a body or base 10 of molded insulation recessed at appropriate places, as will presently appear, for reception of the switch parts.

When all the parts are assembled in the base, a flat liner plate of sheet insulation (not shown) may be placed over the open face of the base and held there beneath and by a metal cover plate (not shown) which is secured on the base in any suitable conventional fashion to maintain them in place and protect the parts from dust and accidental contact.

The switch is operated by an actuating member or trigger 12 molded in T-shape from insulation. The head of the T lies parallel to one side of the base 10 while the leg 14 extends into the base and slides in a transverse passage formed near one end of the base.

To bias the trigger normally in "Off" position of the switch and return it there automatically when finger pressure on the trigger is released, the leg 14 is formed with a longitudinal groove to receive a coiled compression spring 16. One end of the spring presses against the end of the groove while the other rests against the wall of the base opposite the passage into which the trigger leg 14 enters.

To operate a movable switch contact, one side of the trigger 14 is provided with a cam surface 17 which engages the end of a contact operating slide plate 18 stamped from sheet insulation. This plate slides in a longitudinal slot 19 at right angles to the trigger leg 14. One end of the slide 18 engages the operating cam 17 while the other engages the movable contact member, designated generally by the numeral 20. This movable contact member is stamped from sheet metal in the form of a strip which is laid edgewise in recesses formed for it in the base 10. The movable contact member 20 is U-bent at one end which may be called the terminal end and is L-shaped at the other or contact end.

The tip 21 of the contact end has a contact button thereon facing and engageable with a similar button on a normally stationary contact member 30, hereinafter more fully described. The tip 21 is joined at a right angle to a leg 22 extending longitudinally of the base. The leg 22 is in turn joined to one leg 23 of the two transversely extending legs 23, 25 of the U or terminal portion of the member. The legs 23 and 25 are joined by a connecting portion 24. The connecting portion 24 and the leg 25 are both held firmly in their respective recesses in the base while the remainder of the member is loosely positioned in its recess so as to be movable. The contact end 21, 22 is biased by inherent springiness of the U-portion 23, 24, 25 into its closed position (dotted in FIG. 1 and full lines in FIG. 2).

In order to positively move the movable contact to the normal open-circuit or "Off" position, the high point of cam 17 pushes the slide 18 to the right (see FIG. 1) when undepressed as in FIG. 1 in full lines; and the other end of the slide presses against the leg 23 of the movable contact member to separate the contact button from the fixed contact button on the member 30. On depressing the trigger, the cam 17 moves down or into the base further, during which movement the slide 18 is moved to the left by the spring pressure of the movable contact leg 23. This causes the button on the contact tip 21 to engage the contact button on the normally stationary contact member 30.

The two positions as just described are the two normal "On" and "Off" positions of the switch.

The normally stationary contact 30 is stamped from sheet metal in inverted L-shape with one end 32 of the L reversely bent and lying in a slot provided for it in the base. The other leg of the contact 30 is flanged along its opposite parallel edges to provide stiffness and has a contact button mounted thereon near its end. The mounting of the reversely bent end 32 in its slot biases the other leg 30 away from the movable contact tip 21.

A slot 18s is cut into the side of the slide 18 of sufficient width to permit passage of the contact end 30 without engagement therewith as the slide moves during normal current operations.

To hold the end 30 fixed in a position where it may be engaged and disengaged under normal current conditions by the movable contact member as the trigger is depressed and released, a bimetallic strip 40 is provided. This also serves on the occurrence of a predetermined overload, as a means to release the stationary contact, as will presently appear. The bimetal 40 extends along the wall of the base opposite the wall in which the fixed and movable contact members are mounted. Near one end, a slot 42 is cut transversely into one edge of the bimetal in position to receive the free end of the stationary contact member 30. The other end of the bimetallic member opposite the trigger is bent at right angles and riveted to a substantially rectangular terminal-and-mounting plate 44 stamped from sheet metal. This terminal plate may be mounted in the base by sliding opposite edges of the plate in slots running from the open face of the base toward the back wall.

An adjustment bolt 46 passing through the back wall of the base threads into an adjustment nut 47 which presses against the bimetal 40 as the bolt is tightened. For this purpose, the recess provided for the nut 46 has its wall opposite the bimetal slightly inclined toward the bimetal from the open face of the base toward the back of the base, i.e. toward the bottom of the recess. Thus, the tightening of the bolt and pressure of the nut on the bimetal moves the opposite end of the bimetal slightly and provides sufficient adjustment for variations in position of the bimetal and for different current settings. A coiled compression spring (not visible) is mounted on the bolt 46 behind the nut, biasing the nut outwardly of its recess.

In order to reset the bimetal, its free end has an approximately right angle bend 48 toward the interior of the base. A lip 49 is bent over from said bend in position to be engaged by a shoulder 50 formed on the end of the trigger leg 14, as the trigger rises from the position of FIG. 2 to the full line position of FIG. 1.

In order to insure continuous electric contact between the contact member 30 and the bimetal 40 in all switch positions, a conductive leaf spring member 52 of generally L-shape is formed from resilient sheet metal having a short leg 51 inserted between the two parts of the reverse bend 32 of the fixed contact and a long leg 52 extending alongside the contact 30 and slidably engaged at its end with the bend 48 of the bimetal.

From the foregoing, the operation of the device may be understood. Upon finger pressure being applied to the trigger 12 when in the position of FIG. 1, the trigger is depressed against the force of the coil compression spring 16. This depression allows the slide 18 to move to the left under the biasing pressure movable contact arm 23 by reason of the high point of the cam 17 moving away from the left end of the slide. Thus, the end 21 of the movable contact carries its contact button into engagement with the button on the normally stationary contact 31, as shown by the dotted lines in FIG. 1.

If the trigger is then released, the spring 16 will return the trigger to its original position. During this return movement of the trigger, the cam 17 moves the slide 18 to the right (as viewed in the drawing), which causes the movable contact to be moved out of engagement with the stationary contact again, thus opening the circuit.

If an overload current had occurred while the trigger was still depressed, the heat of the current passing through the bimetal 40 would have caused the bimetal to bend away from the end of the contact 30, releasing the end of that contact from its engagement in the slot 42. Since the contact 30 is biased by its reverse bend 32 that contact will move to the left and separate from the movable contact as shown in FIG. 2. During this movement, as well as during the normal engaging and disengaging movement of the movable contact, the leaf spring connector 52 remains at all times in engagement at its lower end with the bend 48 of the bimetal and at its upper end in engagement with the reversely bent portion of the fixed contact. This prevents any possibility of arcing between the lower end of the contact 31 as it is disengaged from the slot in the bimetal during circuit interruption on overload.

When finger pressure is removed from the trigger after overload operation, the cam 17 pushes the slide 18 to the right. This motion not only moves the movable contact back to the normal open-circuit position shown in full lines in FIG. 1, but also forces the normally stationary contact 30 back to the position of FIG. 1. The movement of the contact 30 back to the position of FIG. 1 is accomplished by engagement of one side of a slot 18s in the slide 18 engaging the leaf spring connector 52 and the contact 30. It will be recalled that this slot is wide enough so that during normal opening and closing movement of the switch, i.e. as the trigger is depressed and released during normal current conditions, no side of the slot will engage the contact member 30 or the leaf spring connector 52.

The raising of the trigger after overload also provides for positive resetting of the bimetal by reason of the engagement of the shoulder 50 with the lip 49. However, if the bimetal is still overheated and bent at the time this resetting movement occurs, and if the trigger is immediately depressed again, the bimetal lip 49 will follow the shoulder 50 during depression of the trigger and will immediately disengage, again, the contact 30 from the slot 42. Thus, the switch cannot be maintained closed (a) during continuance of an overload condition, or (b) until the bimetal has cooled sufficiently to permit it to again perform its latching and holding function.

For convenience in connecting said wires to the switch parts, spring clips or wire gripping members 54 and 55 substantially in the form illustrated in FIG. 3 may be provided. These spring clips, as illustrated, comprise stampings from the resilient sheet metal into right triangular shape with a gap in the hypotenuse. The clips are each mounted in recesses provided therefor in the base, the clip 55 being adjacent the terminal portion 25 of the movable contact member and the clip 54 being adjacent the terminal plate 44 of the bimetal. A pair of small holes or apertures may be formed in the base directly adjacent the terminal plate 44 and terminal portion 25 for the insertion of a conductor wire or wires. As the wires pass through the holes, they engage the jaws 54' and 55' of the wire gripping members and are frictionally held by those jaws biting into the wires when any pull is exerted to withdraw the wires. One hole may be used to insert a pin to press the jaw away from the wire when it is desired to release the wire.

An additional gripping member 56 and isolated terminal plate 57 may be provided for use in making a connection between the cord and motor winding.

Many modifications within the scope of the invention are possible. Therefore, the invention is not limited to the specific form illustrated and described.

What is claimed is:

1. An electric switch comprising a depressible operating member biased in opposition to depression, a member movable by said operating member, a movable contact movable by said movable member, another contact to-

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ward which said movable contact is biased, the bias of said movable contact pressing said movable member toward said depressible member, said other contact being biased to disengage said movable contact, a latching member which is normally independent of movement of said depressible member and normally holds said other contact latched in a given position, said movable contact being movable to engage and disengage said other contact while the latter is thus held, said latching member being responsive to overload current to release said other contact, and means movable by said depressible member to return said latching member to latching position, said return means being ineffective to retain said other contact if the overload conditions are continuing.

2. An electric switch comprising a depressible operating member, a member movable by said operating member, a movable contact movable by said movable member, another contact toward which said movable contact is biased, the bias of said movable contact pressing said movable member toward said depressible member, said other contact being biased to disengage said movable contact, a latching member which is normally independent of movement of said depressible member and normally holds said other contact latched in a given position, said movable contact being movable to engage and disengage said other contact while the latter is thus held, said latching member being responsive to overload current to release said other contact, and means movable by said depressible member to return said latching member to latching position.

3. An electric switch comprising a depressible operating member, a member movable by said operating member, a movable contact movable by said movable member, another contact toward which said movable contact is biased, the bias of said movable contact pressing said movable member toward said depressible member, said other contact being biased to disengage said movable contact, a latching member which is normally independent of movement of said depressible member and normally holds said other contact latched in a given position, said movable contact being movable to engage and disengage said other contact while the latter is thus held, said latching member being responsive to overload current to release said other contact.

4. An electric switch comprising a manually depressible operating member biased in opposition to manual operation, a member movable rectilinearly by said operating member in a direction lateral with respect to movement of the operating member, a movable contact controlled by said depressible member, another contact toward which said movable contact is biased, said other contact being biased to disengage said movable contact, a latching member normally holding said other contact in a given position in which it is engaged and disengaged by movement of said movable contact, said latching member being responsive to overload current to release said other contact, and means movable by said depressible member to return said latching member to latching position, said return-means being ineffective to retain said other contact if the overload conditions are continuing.

5. An electric switch comprising a digitally depressible operating member biased in opposition to digital depression, a member movable by said operating member, a movable contact engaged by said second-mentioned member and actuating said movable contact, and another contact toward which said movable contact is biased, said other contact being biased to disengage said movable contact, and a current-carrying latching member which is normally independent of movement of said depressible member and normally holds said other contact latched in a given position, said movable contact being movable to engage and disengage said other contact while the latter is thus held, said latching member be-

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ing responsive to overload current to release said other contact.

6. An electric switch as claimed in claim 5 having means movable by said depressible member to return said latching member to latching position.

7. An electric switch as claimed in claim 5 having means movable by said depressible member to return said latching member to latching position, said return-means being ineffective to retain said other contact if the overload conditions are continuing.

8. A normally-open electric switch comprising an operating member, a movable contact moving between two positions by operation of said operating member, another contact engageable and disengageable by said movable contact, means fixedly mounting said other contact at one end leaving its other end free to move, said other contact being biased to disengage said movable contact, a current-carrying latching member separate from said other contact normally engaging and holding said other contact in position to be engaged and disengaged by said movable contact, said latching member being responsive to overload current to release said other contact, and means biasing said operating member to a position wherein said contacts are disengaged while said latching member is holding said other contact in position to be engaged by said movable contact.

9. An electric switch comprising an operating member, a movable contact moving between two positions by operation of said operating member, another contact engageable and disengageable by said movable contact, said other contact being biased to disengage said movable contact, and a current-carrying latching member separate from said other contact normally engaging and holding said other contact in position to be engaged and disengaged by said movable contact, said latching member being responsive to overload current to release said other contact, and means to maintain electrical connection between said latching member and said other contact after the latter disengages said movable contact, to avoid arcing between said latching member and other contact.

10. An electric switch comprising an operating member, a movable contact moving between two positions by operation of said operating member, another contact engageable and disengageable by said movable contact, said other contact being biased to disengage said movable contact, a latching member which is normally independent of movement of said depressible member and normally holds said other contact latched in a given position, said movable contact being movable to engage and disengage said other contact while the latter is thus held, said latching member being responsive to overload current to release said other contact, an insulating base having slots receiving said contacts for screwless mounting thereof in said base, and said contacts being made of resilient metal strips to impart thereto the aforesaid biasing actions.

11. An electric switch comprising an operating member movable between an original and a second position, an actuating member moved by said operating member, a movable contact engageable by said actuating member, another contact engageable and disengageable by said movable contact, a latching member normally holding said other contact in position to be engaged and disengaged by said movable contact but responsive to overload current to release said other contact for separation from said movable contact, said actuating member engaging both said contacts during return of said operating member to original position to restore said second contact to said normally-held position and to move said movable contact against its bias to second-contact-disengaged position.

12. An electric switch as claimed in claim 11 having means to maintain electrical connection between said latching member and said other contact after the latter

disengages said movable contact, to avoid arcing between said latching member and other contact.

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