June 10, 1969 W. R. BAUER 3,449,534

SWITCH BLADE WITH STRAIGHT SIDED STIFF TONGUE AND ARCUATE SIDED BOWED FLEXIBLE TONGUE

Original Filed March 8, 1967 Sheet 1 of 3

FIG-1

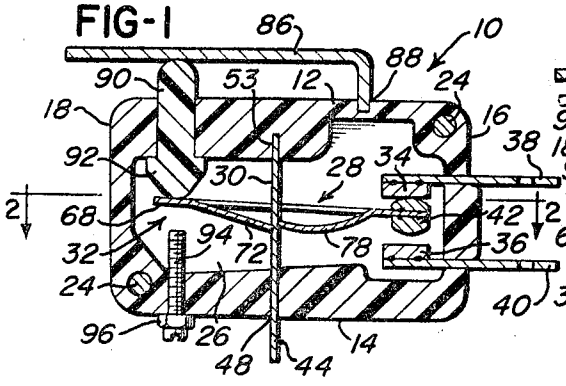


FIG-4

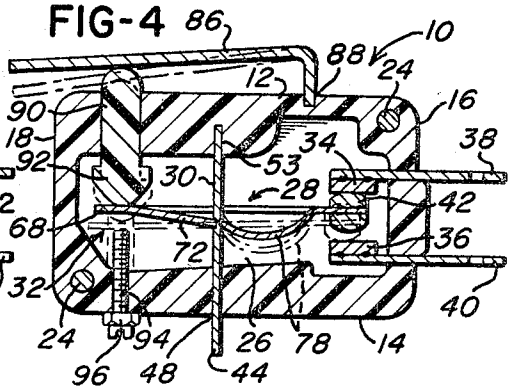


FIG-2

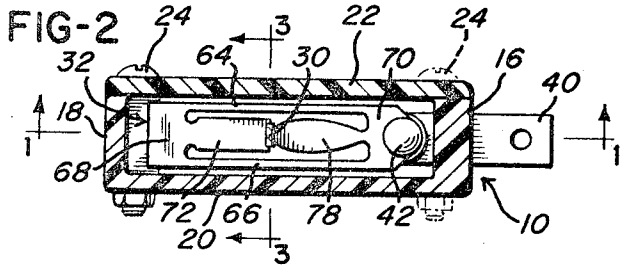


FIG-8

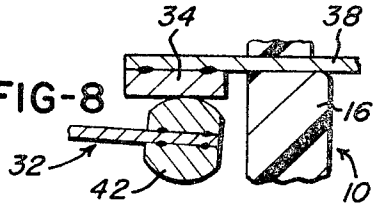


FIG-10

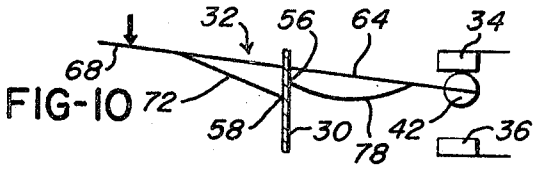


FIG-9

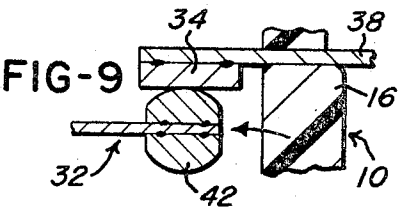


FIG-11

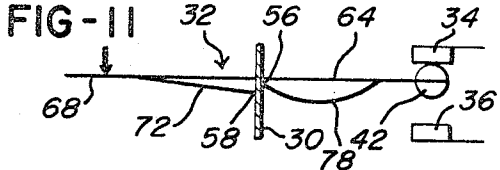


FIG-24

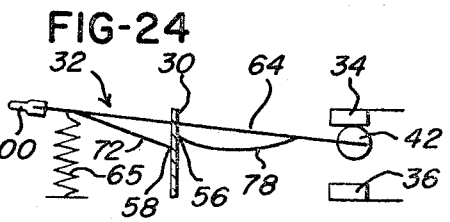
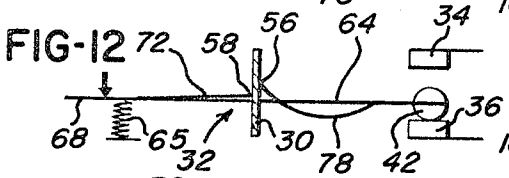


FIG-12



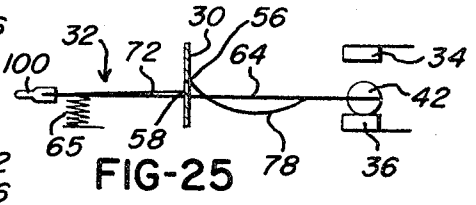


FIG-25

FIG-13

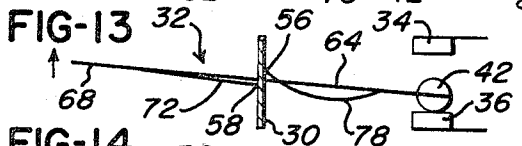
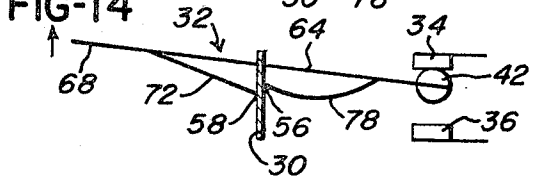


FIG-14



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WERNER R. BAUER

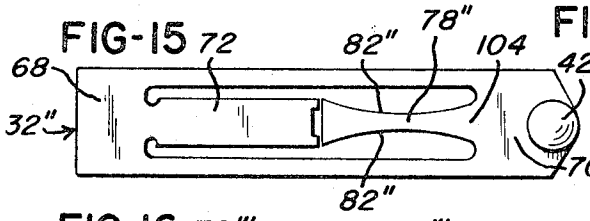
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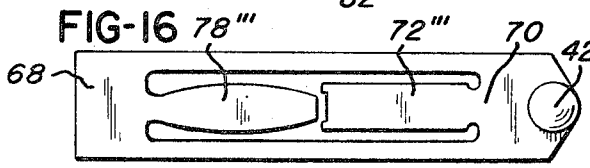
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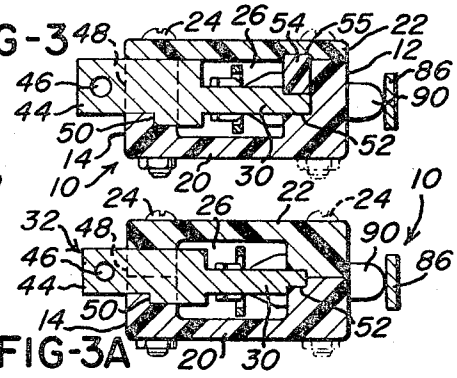
June 10, 1969 W. R. BAUER 3,449,534

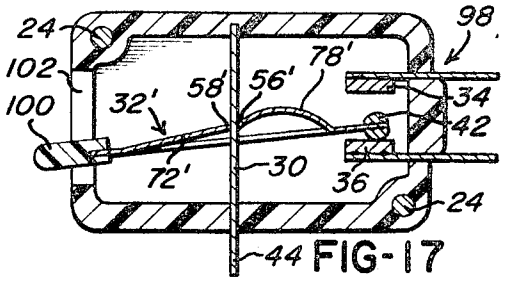
SWITCH BLADE WITH STRAIGHT SIDED STIFF TONGUE AND ARCUATE SIDED BOWED FLEXIBLE TONGUE

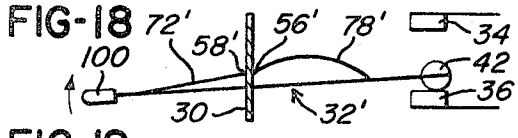
Original Filed March 8, 1967 Sheet 2 of 3

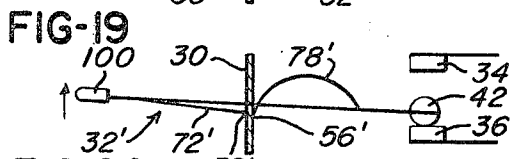


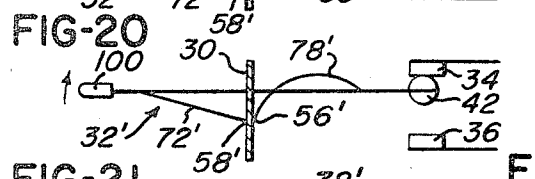


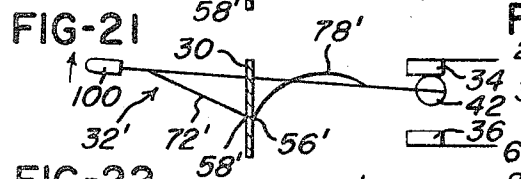


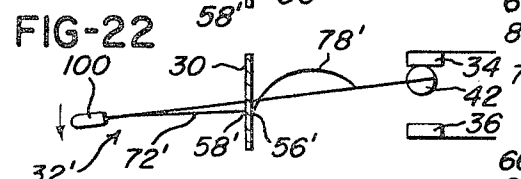


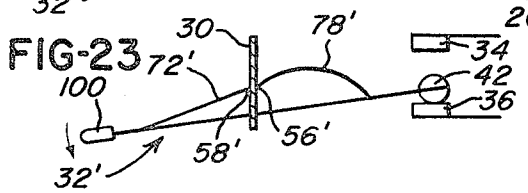


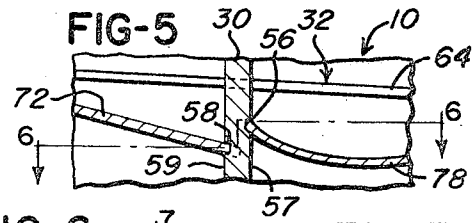


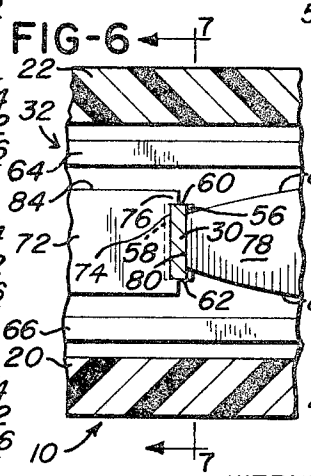


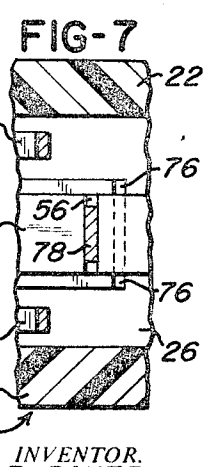












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BY

Cauder & Cauder

HIS ATTORNEYS

FIG-26

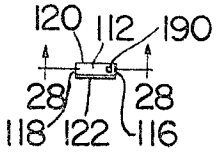


FIG-27

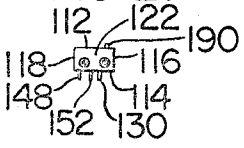


FIG-28

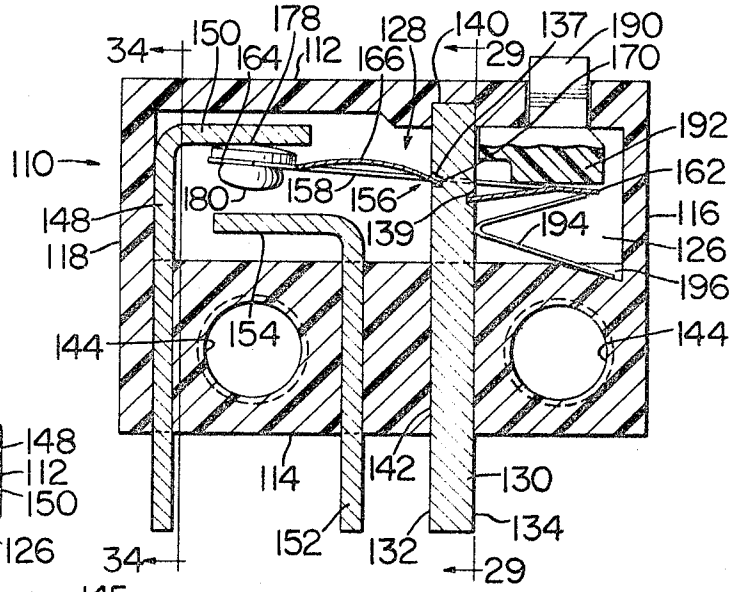


FIG-34

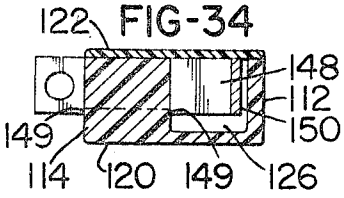


FIG-29

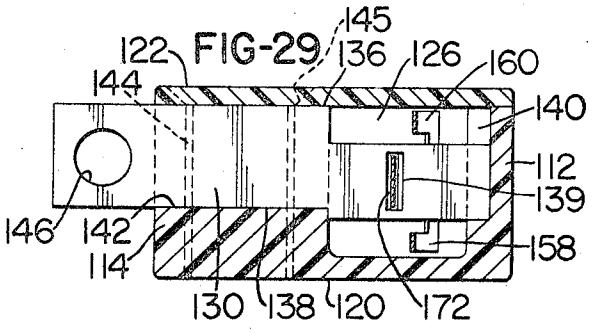


FIG-30

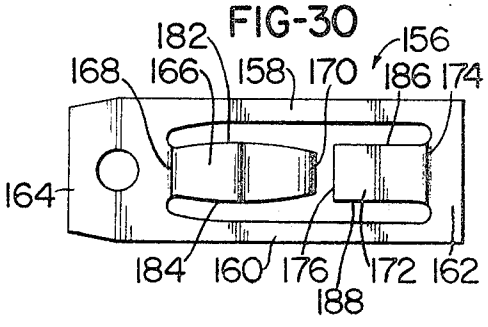


FIG-33

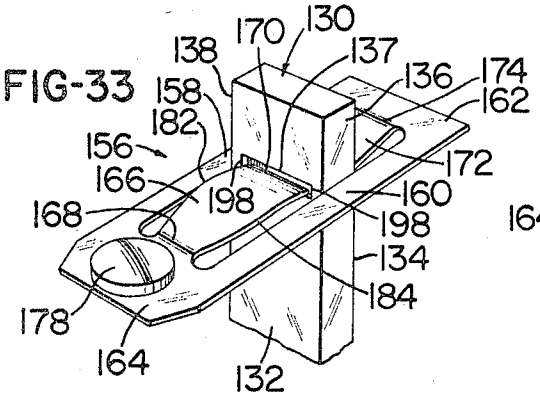


FIG-31

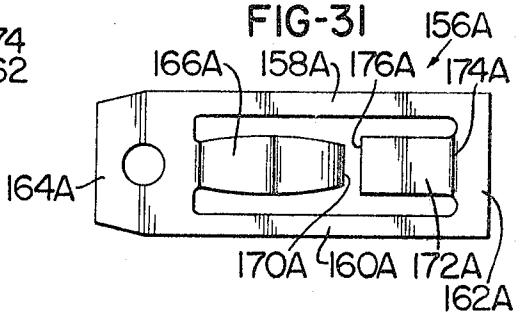
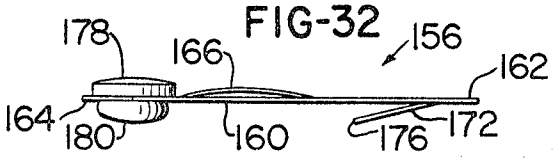


FIG-32



United States Patent Office 3,449,534 Patented June 10, 1969

3,449,534

SWITCH BLADE WITH STRAIGHT SIDED STIFF TONGUE AND ARCUATE SIDED BOWED FLEXIBLE TONGUE

Werner Robert Bauer, Radnor, Pa., assignor to Robertshaw Controls Company, Richmond, Va., a corporation of Delaware

Continuation of application Ser. No. 642,614, Mar. 8, 1967. This application June 26, 1968, Ser. No. 742,979
Int. Cl. H01h 15/18
U.S. Cl. 200—67 11 Claims

ABSTRACT OF THE DISCLOSURE

This application discloses a switch construction having a flexible snap switch blade with opposite inward tongues connected to the ends of the blade. One of the tongues is a relatively flexible longitudinally arcuate sided tongue and the other is a relatively stiff, longitudinally parallel sided tongue. The tongues engage opposite notches in a central rod. These members are mounted in a switch cavity of a casing from which an actuating plunger and electrical connectors extend. The switch construction may be made of very small size and relatively large current carrying capacity.

This application is a continuation of application Ser. No. 642,614, filed Mar. 8, 1967, and is a continuation-in-part of copending parent application Ser. No. 431,107, filed Feb. 8, 1965, both now abandoned.

This invention relates to a flexible flat sheet metal blade switch.

The blade of the switch may be an entirely flat ridgeless snap action sheet metal flexible blade entirely free of relatively sharp right angle stiffening bends or ridges, and having outer ribbon shaped tension members joined integrally with blade end cross members. Such blade may have an inward relatively flexible longitudinally arcuate edged snap tongue, and a relatively stiff longitudinally parallel edged pivot tongue. The cooperation of these two tongues during the snap action of the blade is such that much less force is required to actuate the blade past the snapping zone than is required with a substantially parallel sided flexible tongue.

Said blade may have its substantially parallel sided relatively stiff unperforated compression tongue integrally joined to one of said end cross members and extending and terminating in a straight transverse inner end which rocks or pivots in a straight notch in a straight pivot rod of the switch.

The blade may also have its relatively flexible compression tongue integrally joined to the other of said end cross members and extending inwardly and terminating in a straight transverse inner end which rocks on another notch on the other side of such pivot rod.

Said flexible compression tongue is so shaped that it produces a much more evenly distributed stress throughout the length of such flexible tongue. For this purpose, the flexible tongue is provided with arcuate longitudinal edges. These arcuate edges may be symmetrical with respect to each other, and may also be convex or concave with respect to each other.

The stress distribution throughout such flexible arcuate sided flexible tongue is such that there is a much less flexing force needed to snap the switch blade past the snap point than is required with a substantially parallel sided compression flexible member.

The switch blade and pivot rod may be encased with other switch parts in a suitable casing with an outwardly extending actuating plunger for the blade.

The switch construction may be made of surprisingly small size and surprisingly large current carrying capacity.

Other advantages are apparent from this description, the appended claimed subject matter, and/or the accompanying drawing in which:

FIGURE 1 is a cross section of a switch embodying this invention taken along the line **1—1** of FIGURE 2.

FIGURE 2 is a cross section of FIGURE 1, taken along the line **2—2** of FIGURE 1.

FIGURE 3 is a cross section taken along the line **3—3** of FIGURE 2.

FIGURE 3A is a view similar to FIGURE 3, but showing a modification of the casing and flat metal pivot rod.

FIGURE 4 is a figure similar to FIGURE 1 with the parts shown in actuated position in dotted lines.

FIGURE 5 is an enlarged cross-section of the flat metal pivot rod in engagement with the inner ends of the blade tongues.

FIGURE 6 is a cross section along the line **6—6** of FIGURE 5.

FIGURE 7 is a cross section along the line **7—7** of FIGURE 6.

FIGURE 8 is an enlarged cross section of the contact members before the start of actuating movement.

FIGURE 9 is a view similar to FIGURE 8 showing the contact members after the start of the actuating movement, but before the snap action.

FIGURES 10–12 are diagrammatic progressive illustrations of the downward snap action of the switch of FIGURE 1.

FIGURES 13 and 14 are similar to FIGURES 10–12, but showing the upward return movement.

FIGURES 15 and 16 are plan views of other embodiments of blade constructions.

FIGURE 17 is a cross section similar to FIGURE 1 but showing a modified casing construction and modified tongue and rod engagement.

FIGURES 18–21 are diagrammatic progressive illustrations of the upward snap action of the switch of FIGURE 17.

FIGURES 22 and 23 are similar to FIGURES 18–21, but showing the downward snap action.

FIGURES 24 and 25 are diagrammatic illustrations of the application of the blade construction of FIGURES 1–7 to the handle actuation of FIGURE 17, with a return spring actuation added.

FIGURES 26 and 27 are respectively top plan and side elevation views of the outer walls of a very small switch made according to this invention, the views being drawn to actual scale in the application drawing.

FIGURE 28 is a vertical cross section, in greatly enlarged scale, of the switch of FIGURES 26 and 27, and taken along the line **28—28** of FIGURE 26.

FIGURE 29 is a cross section taken along the line **29—29** of FIGURE 28, said FIGURE 29 being rotated 90° with respect to FIGURE 28.

FIGURE 30 is a top view of the switch blade of FIGURES 28 and 29, with the movable contacts removed.

FIGURE 31 is a view similar to FIGURE 30 but showing a slightly modified embodiment.

FIGURE 32 is a side elevation of the switch blade of FIGURE 30 or 31, with the movable contacts added.

FIGURE 33 is a perspective view of the switch blade and supporting rod of FIGURES 28 and 29.

FIGURE 34 is a cross section along the line **34—34** of FIGURE 28 in reduced scale.

Certain words indicating direction, relative position, and the like, are used in the specification and claims for the sake of brevity and clearness of description. However, it is to be understood that such words are used only in connection with the illustrations in the drawings, and that the parts of the actual embodiments, when in use, may have entirely different directions, relative posi-

tions, and the like. Examples of such words are "vertical," "horizontal," "upper," "lower," etc.

A switch, such as is illustrated in FIGURES 1–9, may have an insulative casing **10** having an insulative wall or wall construction including opposite casing sides or side walls **12** and **14**, FIGURE 3, opposite casing ends or end walls **16** and **18**, FIGURES 1 and 2, a casing bottom or bottom wall **20**, and a casing cover or cover wall **22**. The casing cover **22** may be detachably secured by bolts **24** which may be at the corners of the casing. These walls form a switch cavity **26** which may be covered and uncovered by means of the cover or cover wall **22**.

Before the cover **22** is placed over the switch cavity **26**, a switch construction **28** may be placed in the cavity **26** in such a manner that the switch parts are properly secured in the cavity **26** by the covering action of cover **22**.

Such switch construction **28** may include a rigid, flat, metal, electrically conductive rod **30**, a snap action, sheet metal blade **32**, a pair of stop members **34** and **36**, one or both of which may be connected to an electrical conductor, such as **38** and/or **40**, which may extend out through the insulative casing wall. Either or both of said stop members **34** and/or **36** may be an electrically conductive contact member.

The blade **32** of this invention has many advantages, which include:

(a) The previously described cooperation of the relatively flexible, arcuate sided tongue with relatively stiff, substantially parallel sided tongue.

(b) Rocking movement of its contact **42** before and after the snap action.

(c) Wiping action of the contacts before and after the snap action.

(d) Relatively large range of overtravel is permitted, if desired.

(e) A single blade construction is provided which permits easy assembly, as will become apparent.

(f) The cost of production is greatly reduced.

(g) No additional snap-spring construction is required.

(h) The blade may be telescoped or "threaded" on the pivot rod **30** to produce a sub-assembly which may be unitarily mounted in the cavity **26** of the casing **10**.

The rigid rod **30** may extend outside of the casing **10**, with the rod **30** passing through the casing wall **14**. The rod **30** may have an electrical conductor receiving end **44**, to which an electrical conductor may be secured by means of the opening **46**. The rod **30** may be inserted in a slot **48**, FIGURE 1, in the side wall **14**, as indicated by the dotted lines **48**, FIGURE 3. This portion of the rod **30** may have a notch **50** which engages a corresponding notch in the wall **14**, so that the rod **30** cannot be moved leftward, in FIGURE 3. The other end **52** of the rod **30** may enter an opening in the casing side wall **12**, in such a manner that the rod **30** cannot move rightward in FIGURE 3 because of the opening in the wall **12**. A suitable slot **53**, FIGURE 1, may be provided in the wall **12**, to receive the rod end **52**, and also an insulative slab **54**, which is held by a suitable notch **55** in the cover **22** and also in a notch in the end **52** of the rod **30**. It is to be noted that the right portion of the rod **30** which is shown in FIGURE 3 is relatively narrow, so that the blade **32** may be placed around the central portion of the rod **30** before such rod **30** and blade **32** are placed in the casing **10**.

It is to be seen that the blade **32** and the rod **30** may be telescoped or threaded with respect to each other over the right end of the rod **30**, FIGURE 3, and then such assembled rod and switch blade may be placed in the casing **10**, before the cover **22** is placed thereon. Thereafter, the slab **54** may be placed therein, if used, and then the cover **22** may be placed over the side walls of the casing, as shown in FIGURE 3 and bolted thereon. This secures the rod **30** and the switch blade **32** in position within the cavity **26** of the casing **10**.

The rod **30**, FIGURES 5–7, has two opposite flat sides **57** and **59** and two opposite narrow edges **60** and **62**, and has two straight continuous transverse tongue end receiving notches **56** and **58**, said notches extending completely across said flat sides.

The snap action, sheet metal blade **32** may be an entirely flat, ridgeless snap action blade which is entirely free of relatively sharp, substantially right angle bends and has two outer parallel tension ribbon shaped members **64** and **66** joined integrally and in the same plane with two flat blade end cross members **68** and **70**. The blade **32** also has a relatively stiff unpunctured compression tongue **72** integrally joined with the cross member **68** and extending inwardly and terminating in a continuously straight transverse pivot end **74**, FIGURE 6, which is engaged and pivots in and substantially coextensive with one of the notches **58** of the rod **30**. Lateral side movement locking means may be provided in the form of fork extensions **76** at respective ends of said continuously straight transverse end, said tongue **72** having parallel, unbent sides substantially throughout the major portion of the length of said tongue. Said fork extensions **76** straddle the rod edges **60** and **62**, as shown in FIGURE 6.

The blade **32** also has a relatively flexible bowed compression tongue **78** which is joined integrally to the other of the cross members **70** and extends inwardly and terminates in a straight transverse pivot end **80**, FIGURE 6, which is engaged and pivots in the other of the notches **56** of the rod **30**. The average width of the tongue **78** may be made less than the average width of the tongue **72** by making the side edges **82** of the tongue **78** longitudinally arcuate shaped or arcuate sided, whereas the sides **84** of the tongue **72** may be made longitudinally parallel and relatively straight throughout its major longitudinal extent.

The ridgeless flexible blade **32** which is provided with the inward, relatively flexible, longitudinally arcuate edged snap tongue **78**, and the relatively stiff longitudinally parallel edged pivot tongue **72**, has great advantage. Such blade **32** requires much less force to actuate the blade past the napping zone than is required when the blade is provided with a flexible snap tongue that has parallel sided flexible tongue edges.

This is so because the flexible snap tongue **78** with its arcuate sides or edges **82**, **82**, FIGURES 2 and 6, has a much more uniform or flatter stress distribution along the length of the tongue than is present in the parallel sided flexible snap tongue of the prior art, which has a much steeper and higher domed stress distribution along the length of such parallel sided tongue.

The reduced force required for snapping applicant's arcuate flexible tongue **78** is very advantageous as compared to the force required for snapping the parallel sided flexible tongue of the prior art. The switch has greater sensitivity. The switch parts do not wear out as fast. The switch can be made much smaller. Many other advantages are present.

The pair of stop members **34** and **36**, FIGURES 1 and 2, straddle the cross member **70** and its contact member **42** between which the blade **32** snaps to opposite positions, as indicated in FIGURES 1 and 4. As previously stated one or both of the members **34** or **36** may be a contact member with conductor flat rods **38** and/or **40**, which may be placed in suitable notches or slots in the end wall **16** of the casing and may be held in place by suitable enlargements in the width of the conductors **38** and/or **40**, not shown, so that these conductors may be held in place by the cover **22**, after the cover has been blotted in place.

If desired, an actuating blade **86** may be pivoted in an opening **88**, diagrammatically shown in the side **12** of the casing. The specific construction of the blade **86** and opening **88** may be substantially as shown in the patent to Besemer, No. 3,040,152, patented June 19, 1962.

The blade **86** may be manually operated and may actuate a switch blade pushing pin **90** which engages the end or cross member **68** of the switch blade **32**. The pin **90** may be enlarged at **92**, so that such enlargement **92** prevents or limits the upward movement of the pin **90**. If desired, a stopping member or screw **94** may be provided in the wall **14**, to be engaged by the cross member **68** of the blade **32**, and thus limit the downward movement in FIGURE 1 of the cross member **68**. If desired, a lock nut **96** may be provided to hold the pin **94** in the selected adjusted position.

FIGURES 8 and 9 show the advantages of the spherical or concave surfaces of the movable contacts **42** and how the switch movement caused by initial downward movement of the pin **90** before the blade **32** reaches its snapping position may cause the contacts **42** to slide with respect to the contact **34**, this movement also being indicated in FIGURE 4. FIGURE 9 shows the travel leftward as the end **68** of the blade is pushed down and before the snap action takes place. This rocking and sliding action maintains the contact surfaces in a clean condition and an electrically conducting condition.

FIGURES 10, 11, and 12 are diagrammatic views showing how the contact **42** remains against the stationary contact **34** until after the tension members **64** pass the notch **56**. A construction in which the notch **56** is above the notch **58** would cause the switch to return to the position of FIGURE 10 automatically, unless the tension members are allowed to be pushed down below the notch **58**, as shown in FIGURE 12. Under these conditions, the switch construction may remain in the down position, until it is manually pushed up, or is pushed up by the action of a compression spring **65** which may be placed under the cross member **68**, in a manner somewhat similar to that shown in FIGURES 24 and 25. Such spring **65** may be omitted, however, if the screw **94** of FIGURE 1 is adjusted so the blade **32** cannot be pushed down as far as shown in FIGURE 12.

FIGURES 13 and 14 show how the switch construction may be snapped from a low position to a high position, if no spring **65** is provided, with the corresponding movement of the movable contact **42** by causing the tension member **64** or tension line to cross the notch position **56**.

However, it is to be understood that it is not the actual tension members that determine the exact snapping point, but rather the tension and compression lines which are produced by the various members, which approximate the positions above described. However, there is a definite snapping point very near the positions which have been described, although they may not be exactly at such points.

In FIGURE 17, the casing **98** is shown which may be, in general, the same as casing **10** of FIGURES 1, 2 and 4, but with the side and end walls not as irreguar in cross section. The rod **30** and the blade **32'** and the contacts **34**, **36** and **42** may be, if desired, substantially identical with those heretofore described in connection with the previous FIGURES 1–9. However, the left end of the blade **32'** may be provided with a handle **100**, which may extend through a slot **102** in the casing wall. The left end of the blade **32'** may be actuated manually by an operator's finger which may push the handle **100** in either direction, as is readily obvious from such FIGURE 17.

However, the tongues **72'** and **78'** of FIGURE 17 have their inner ends engaging notches **58'** and **56'** which are substantially equally opposite each other, along the length of pivot rod **30**, so that the forces are applied to the rod **30** at exactly opposite positions. Under these conditions, the blade **32'** of FIGURE 17 will remain in the position to which the blade **32'** is snapped. That is, if the user snaps the blade **32'** down to the lower position, as shown in FIGURE 17, the blade will remain there until he pushes it up to the upper position, and vice versa. This is illustrated in FIGURES 18 and 23, which progressively illustrate the fact that the handle **100** may cause the contact **42** to move from stationary contact **36** to stationary contact **34** by upward movement of the handle **100** as is in FIGURES 18–21 and will remain at the position shown in FIGURES 20, 21, to which it is moved. FIGURES 22, 23 show how the handle **100** will cause the contact **42** to move downwardy and to remain in the down position of FIGURE 23 until the user selects to move the handle **100** up.

FIGURE 15 shows a modified embodiment in a blade **32''**. In this blade, the stiff tongue **72** may be substantially the same as in the previous figures. However, the flexible tongue **78''** has its sides **82''** arced inwardly, instead of outwardly as in the previous embodiment. This construction will cause the tongue **78''** to impart a greater rocking action on the contact **42** because the area at **104** between the tongue **78''** and the crosspiece **70** is stiffer than in the embodiment of FIGURE **2**.

In the embodiment of FIGURE 16, the stiff tongue **72'''** is attached to the crosspiece **70**, which carries the contact **42**, and the flexible tongue **78'''** is attached to the crosspiece **68**. Many of the advantages of all of the embodiments previously described are also provided in this modified embodiment shown in FIGURE 16.

In FIGURE 4, the tongues **72** and **78** are shown with their inner edges opposite each other, corresponding to the positions of the inner edges of the embodiments of FIGURES 17–23. If the edges of the tongues of FIGURE 4 are placed as in such FIGURES 17–23, then a spring similar to spring **65** of FIGURES 12, 24 and 25 may be added, as shown in dotted lines in FIGURE 4, which may be placed around the screw **94** with one end engaging the wall **14** and the other end engaging the cross member **68**. This will cause the blade **32** and plunger **90** of FIGURE 4 to be upwardly biased to move to their upper positions when the actuating blade **86** is released.

The embodiments of FIGURES 17–23 may be biased in upward or downward directions by providing a spring similar to spring **65** either above or below the left cross member of the blade **32'**, if desired. Such spring will cause the switch to be biased to return to upward or downward position when released, as is obvious.

FIGURES 26–32 show an extremely small snap switch which has a surprisingly high current capacity. FIGURES 26 and 27 are top and side views of the outside of the switch casing drawn to scale. The actual dimensions for FIG. 26 are .190 x .385 inch and for FIG. 27 are .260 x .385 inch. The weight is .57 gram.

Such switch may have an insulative casing **110** having an insulative wall or wall construction including two opposite sides or side walls **112** and **114**, two opposite end walls **116** and **118**, and a bottom wall **120**. These walls may be integrally joined together to form a switch cavity **126** which may be closed by a flat cover **122**.

The walls **112**, **114**, **116**, **118** may be covered and uncovered by means of the cover **122**. The cover **122** may be secured to the walls **112**, **114**, **116** and **118** by any suitable means, such as by adhesive means, fasteners, and the like.

Before the cover **122** is placed over the cavity **126**, a switch construction **128** is placed in the cavity **127** in such a manner that the switch parts are properly secured in the cavity **126** by the covering action of the cover **122**.

The switch construction **128** may include a rigid, straight, flat metal electrically conductive rod **130** with opposite relatively wide flat sides **132** and **134** and opposite relatively narrow edges **136** and **138**.

The rod **130** may be embedded in preformed notches **140** and **142** in the opposite side walls **112** and **114** and extends out of the side wall **114**, which wall **114** is relatively thick relatively to the walls **112**, **116** and **118**. Suitable screw mounting holes **144** may extend through the wall **114** for mounting the switch on a support panel and the like. A suitable electrical conductor

receiving opening **130** is provided for attaching an electrical conductor, if desired. The rod **130** has opposite tongue end receiving notches **137** and **139**.

An electrical conductor bar **148** extends out of and is embedded in the side wall **114** and has an inward stationary contact first elbow **150** extending into the switch cavity **126**. Another electrical conductor bar **152** extends out of and is embedded in and extends out of the side wall **114** and has a second elbow **154** spaced from the first elbow **150**. These bars **148** and **152** may be embedded in preformed notches in wall **114**, as shown in FIGURE 34 and have shoulders **149** to lock them in place.

A snap action sheet metal blade **156**, somewhat similar to blade **32**, has outer flat ribbon-shaped tension members **158** and **160** and opposite end cross members **162** and **164** joined integrally with the tension members **158** and **160**.

The tension members **158** and **160** extend past and outside the rod edges **136** and **138**.

The blade **156** has an inward, relatively flexible, snap tongue **166** with its tongue end **168** integrally connected to the blade end cross member **164** and with its other tongue end **170** engaging the rod notch **137**.

The blade **156** also has an inward relatively stiff pivot tongue **172** with one pivot tongue end **174** integrally connected to the other blade end cross member **162**. The other pivot tongue end engages the other rod notch **139**.

The blade **156** also has convex surfaced movable contact members **178** and **180** on the blade end cross member **164** which alternately engage the stationary contact elbows **150** and **154**.

The flexible snap tongue **166** has opposite longitudinally arcuate edges **182** and **184**. The stiff pivot tongue **172** has opposite longitudinally parallel edges **186** and **188**. These tongues **166** and **172** have all of the characteristics and advantages heretofore described.

As shown mainly in FIGURES 30, 32 and 33 the snap action sheet metal blade **156**, when it is in an unassembled and unflexed condition, as shown in FIGURES 30 and 32, is entirely free of relatively sharp right angle bends, has two outer parallel ribbon shaped tension members **158** and **160**, joined integrally and in the same plane with two flat end cross members **162** and **164**. The blade also has a flat, relatively stiff, compression tongue **172** with straight parallel unbent edges **186** and **188** and is integrally joined at **174** at a relatively small angle, as shown in FIGURE 32, to the cross member **162**. This tongue **172** extends inwardly and terminates in a straight transverse notch engaging pivot end **176**. Such blade **156** also has another relatively flexible compression bowed tongue **166** integrally joined to the other **164** of such cross members at **168** and at a relatively small angle. The blade **166** has longitudinally symmetrically arcuate side edges **182** and **184** and terminates in a straight transverse notch engaging pivot end **170**.

The snap action sheet metal blade **156** is assembled over the rod **130** with the two tension members **158** and **160** and the two end cross members **162** and **164** surrounding the rod **130**, as shown in FIGURE 33, and with the transverse notch engaging pivot ends **170** and **176** engaging respective ones of the tongue and receiving notches **137** and **139**, as shown in FIGURE 28.

A pair of stationary stop members **150** and **154** are alternately engaged by the cross member **164** when the blade **156** snaps to opposite positions. One or both of the members **150** and **154** may be electrical contact members with conductor ends extending out of the insulative casing wall. The plunger **190** extends outside of the casing, and engages the other **162** of the cross members to reciprocate the blade.

A plunger **190** engages the blade end cross member **162** and extends out of the side wall **112**. The plunger has an enlargement or bead **192** to provide suitable enlarged contact with the cross member **162** and the side wall **112**. The plunger **190** may be of any desired cross section, such as square, round, or the like.

A compression leaf spring **194** may be V-shaped with one end engaging the cross member **162** and the other end engaging a notch **196** in the wall **114**. The spring **194** returns the blade to its upper position in FIGURE 28 after the blade has been pushed down by the plunger **190** and then released.

The blade **156** snaps down when the plunger is pushed down in a manner similar to the blades **32** and **32'** heretofore described.

The notches **137** and **139** are not as wide as the rod **132** and have end shoulders **198** for preventing undue sidewise displacement of the blade **156**.

The blade **156A** of FIGURE 31 is substantially similar to the blade **156** of FIGURE 30. The blades **156A** and **156** may be used in the same switch construction of FIGURES 26–29, 33 and 34. The main difference between the blades **156** and **156A** is that the tension ribbon members **158A** and **160A** remain of uniform thickness for a greater length than the ribbon members **158** and **160**. Otherwise the two blades **156** and **156A** are substantially the same.

The holes **144** may be used to receive mounting screws, as previously described. Such holes may be threaded, as shown, or unthreaded, if desired. The holes may be countersunk at **145** at one end to receive countersunk screw heads.

Alternatively, the holes **144** may receive screws that fasten the cover **122** to one end of the wall **114** and hold the cover **122** against the adjacent ends of walls **112**, **116** and **118**.

Also, the switch may be simultaneously covered and mounted on a panel and the like by screws or bolts passing through holes **144** and being screwed or bolted on the panel as desired. This simultaneously secures the cover **122** to the walls **112**, **114**, **116** and **118**, and the casing **110** to the panel and the like.

While the form of the invention now preferred has been disclosed, as required by statute, other forms may be used, all coming within the scope of the claimed subject matter.

A new, useful and unobvious switch construction has thus been provided by this invention.

What is claimed is:

1. A snap acting switch comprising:

a switch casing having a switch cavity and an electrically insulative casing wall;

a rigid flat metal, electrically conductive rod having an electrical conductor receiving end outside said casing and a straight portion extending through said casing wall into said switch cavity, said rod being unperforated and unbent in said casing and having two opposite straight flat sides and two opposite narrow edges and with two straight transverse tongue and receiving notches respectively on said opposite flat sides;

a snap action sheet metal flexible blade entirely free of relatively sharp right angle bends in said switch cavity, having two outer parallel ribbon shaped tension members joined integrally and in the same plane with two flat freely movable blade and cross members, said blade having a parallel sided, relatively stiff, unperforated compression tongue integrally joined to one of said cross members and extending inwardly and terminating in a straight transverse pivot end in one of said notches, said tongue having parallel unbent sides substantially throughout the major portion of the length of said tongue, said blade having another relatively flexible compression bowed snap tongue integrally joined to the other of said cross members and extending inwardly and terminating in a straight transverse pivot end in the other of said notches, said flexible compression tongue having longitudinally symmetrically arcuate side edge, said tension members, said blade end cross members, said stiff compression tongue, said flexible snap tongue all being integrally joined together so that they can

flexibly bend respectively to each other where they are joined together during snap operation of said blade;

a pair of stop members straddling and being alternately engaged by one of said cross members when said blade snaps to opposite positions, and one of said stop members being an electrical contact member with a conductor extending out of said insulative casing wall;

and means for reciprocating the other of said cross members.

2. A switch according to claim 1 in which said arcuate edges are concave toward each other.

3. A switch according to claim 1 in which said arcuate edges are convex toward each other.

4. A snap acting switch comprising:

a conductive pivot rod having two opposite flat sides and two opposite narrow rod edges and with two straight transverse tongue end receiving rod notches respectively on said opposite flat sides;

an entirely flat, ridgeless snap action sheet metal blade entirely free of relatively sharp stiffening ridges and having outer flat ribbon shaped tension members joined integrally and entirely in the same plane with two flat opposite blade end cross members, said tension members passing outside said rod edges, said blade having an inward relatively flexible longitudinally arcuate edged compression bowed snap tongue with one tongue end integrally connected to one of said blade end cross members and its other tongue end engaging and pivoting in one of said rod notches, said blade having an inward relatively stiff unperforated parallel edged pivot tongue with one pivot tongue end integrally connected to the other blade end cross member and with its other pivot tongue end engaging and pivoting in the other of said rod notches, said tension members, said blade end cross members, said stiff compression tongue, said flexible snap tongue all being integrally joined together so that they can flexibly bend respectively to each other where they are joined together during snap operation of said blade;

convex surfaced movable contact members on a first named one of said blade end cross members;

stationary contact members alternately engaged by said movable contact members;

and means for moving the second named one of said blade end cross members.

5. A snap switch according to claim 4 in which said arcuate edges are concave with respect to each other.

6. A snap switch according to claim 5 in which said arcuate edges are convex with respect to each other.

7. A snap acting switch comprising:

a switch casing having a switch cavity and an electrically insulative casing wall;

a rigid, flat metal, electrically conductive rod having an electrical conductor receiving end outside said casing, extending through said casing wall into said switch cavity, and having a straight portion inside said cavity with two opposite flat sides and two opposite narrow edges and two straight transverse tongue end receiving notches respectively on said opposite flat sides;

a snap action sheet metal blade which, when it is in unassembled and unflexed condition, is entirely free of relatively sharp right angle bends, has two outer parallel ribbon shaped tension members joined integrally and in the same plane with two freely movable flat end cross members, said blade also having a flat, relatively stiff, compression tongue with straight parallel unbent edges and integrally joined at a relatively small angle to one of said cross members and extending inwardly and terminating in a straight transverse notch engaging pivot end, said blade also having another relatively flexible compression bowed snap tongue integrally joined to the other of said cross members at a relatively small angle, having longitudinally symmetrically arcuate side edges and terminating in a straight transverse notch engaging pivot end, said tension members, said blade end cross members, said stiff compression tongue, said flexible snap tongue all being integrally joined together so that they can flexibly bend respectively to each other where they are joined together during snap operation of said blade;

said snap action sheet metal blade being assembled over said rod with said two tension members and said two end cross members surrounding said rod, and with said transverse notch engaging pivot ends engaging respective ones of said tongue end receiving notches;

a pair of stationary stop members straddling and being alternately engaged by one of said cross members when said blade snaps to opposite positions, and at least one of said stop members being an electrical contact member with a conductor end extending out of said insulative casing wall;

and reciprocating means extending outside said casing for reciprocating the other of said cross members.

8. A combination according to claim 7 in which said blade has convex surfaced movable contact members which alternately engage said stationary stop members.

9. A combination according to claim 7 in which said reciprocating means is a plunger engaging said other of said cross members and extending out from said cavity through said insulative wall.

10. A combination according to claim 7 in which said casing has opposite casing side walls, opposite casing end walls, a casing bottom wall forming said switch cavity with said conductive rod passing through one of said side walls and with the inner end of said rod in a slot in the other of said side walls.

11. A combination according to claim 10 in which a cover is provided for said casing end walls and side walls with means for locking said rod against longitudinal and sidewise movement.

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