April 15, 1958 J. J. KUESER 2,831,090

SWITCH BLADE CONSTRUCTION

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Fig. 1

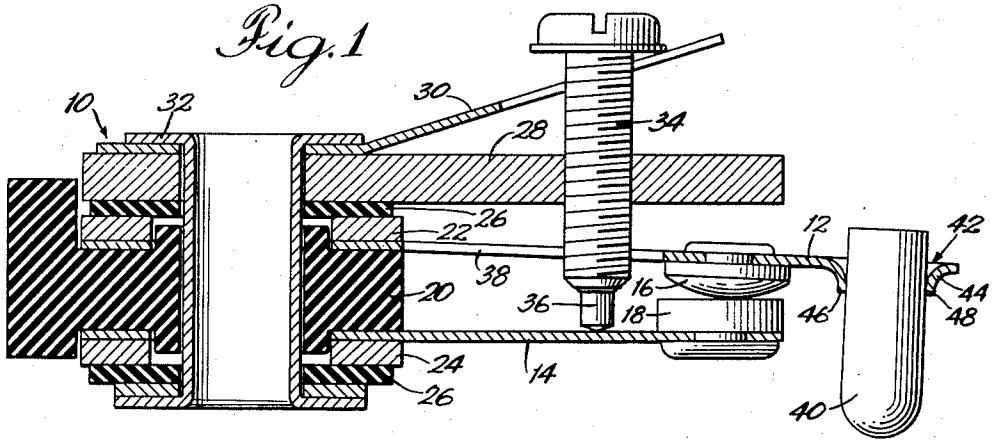


Fig. 2

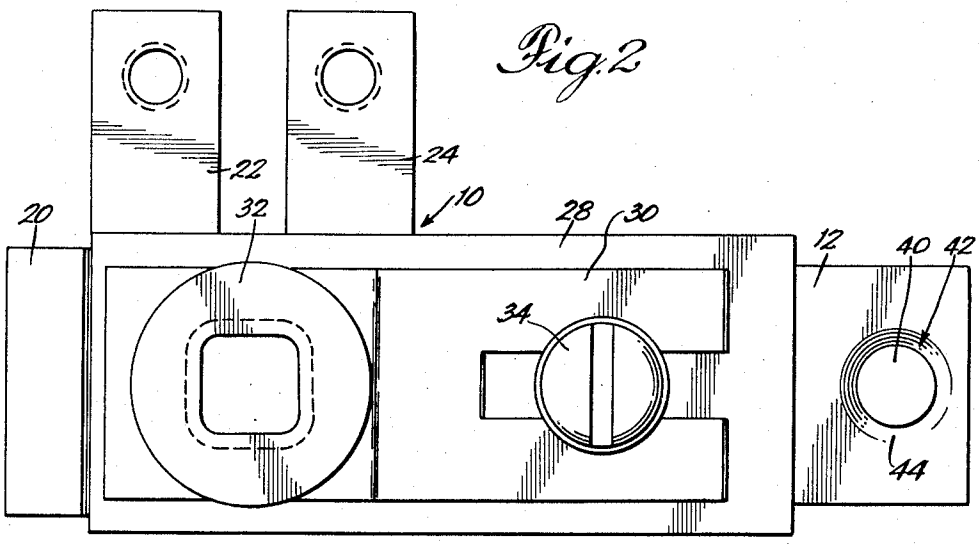


Fig. 3

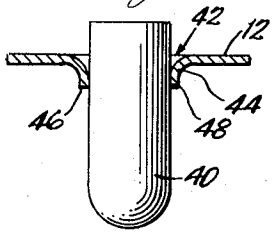
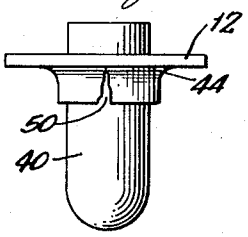


Fig. 3a



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SWITCH BLADE CONSTRUCTION

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4 Claims. (Cl. 200—138)

This invention relates to an improvement in the construction of sheet metal switch blades, and more particularly to switch blades which carry insulator studs adapted to be engaged to effect movement of the switch blade which carries the insulator stud.

The use of resilient sheet metal switch blades which carry insulator studs, or pins, adapted to be engaged by another member, such as a bimetal of a thermostatically controlled switch, to effect movement of the switch blade is, of course, notoriously old. However, the means of securing the insulator pin or stud to the sheet metal switch blade has posed a difficult problem for many years.

It is essential that the insulator stud be secured firmly to the sheet metal switch blade so as to avoid any tendency to become loose, or wobble, or tilt, as such action may interfere with the proper operation and calibration of the thermostatically operated switch of which the switch blade is a part thereof. Once the thermostatically controlled switch has been properly calibrated at the factory, any looseness or tilting of the insulator pin thereafter will bring about improper operation of the switch.

Numerous attempts have been made to solve this problem, and heretofore the best practical solution devised included cementing the stud to the switch blade with special cements. The latter solution, while of considerable use and success, nevertheless still has its failings in that after considerable usage, or even when new if the cement has not been properly cured, the cement cracks and the studs fall out of place so that the thermostat then doesn't work at all.

The object of the instant invention is to provide a novel switch blade construction carrying an insulator stud which is constructed that any tendency of the insulator stud to become loose or fall off the switch blade is, to all intents and purposes, completely eliminated.

In the instant invention, the switch blade is formed to define a stud-receiving hole and a collar, of resilient material formed from the switch blade, surrounding the hole, and a hard ceramic insulator pin is press fit into the hole and collar so that the material of the collar frictionally engages the pin to hold the pin in position.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

A preferred embodiment of the invention is shown in the accompanying drawings, in which:

Figure 1 is a cross-section view through a typical switch assembly showing a switch blade thereof constructed in accordance with this invention;

Figure 2 is a top plan view of the switch of Figure 1;

Figure 3 is a fragmentary detail view of the assembly of the ceramic pin in the switch blade; and

Figure 3*a* is a fragmentary detail similar to Figure 3 illustrating a typical failure of material that occurs when the collar on the switch blade is formed of a length beyond the critical limits disclosed herein.

Referring now to the drawings, there is shown in Figures 1 and 2 a typical switch construction **10** which includes the improvement of this invention. So that the entire device shown will be understood, it is noted that the typical switch construction **10** includes a stacked arrangement of parts which comprises switch blades **12** and **14** that respectively carry contacts **16** and **18**. The switch blades are carried on an annular block insulator **20**, and said blades **12** and **14** are respectively in electrical contact with connector plates **22** and **24**. Appropriate mica insulating washers **26** are provided. There is also provided a mounting plate **28** and a bifurcated spring member **30**, and the entire assembly is connected by means of an eyelet **32**, the ends of which are spun over to clamp the parts together.

The mounting plate **28** carries an adjusting screw **34** having an insulated tip **36** for engagement with the switch blade **14**, so as to control the position of the blade **14** relative to the switch blade **12**. The bifurcated spring **30** cooperates with the head of the adjusting screw **34** to prevent the screw **34** from working loose. The switch blade **12** is provided with a central aperture **38** through which the adjusting screw **34** extends, as is well known in the art.

The switch blade **12** is normally biased toward blade **14** and is of greater length than the switch blade **14**, as seen in Figure 1. The extended end of switch blade **12** carries therein an insulator pin, or stud, **40** which is adapted to be engaged by a thermostatically controlled member such as a bimetal (not shown), to effect separating of the contacts **16** and **18**, in a manner well known in the art.

The instant invention is directed to the manner in which the insulator stud **40** is connected to the switch blade **12**. The switch blade **12** is punched, or otherwise appropriately formed, so as to define a hole **42** therethrough in which the insulator stud **40** is mounted. In the forming of the hole **42** the material which immediately surrounds the hole **42** is extruded and formed to define a collar **44**, and the annular edge **46** which would normally surround and define the hole **42** is displaced from the plane of the main portion of the switch blade **12** so that said edge **46** is disposed in a plane spaced from, and substantially parallel to, the plane of the main portion of the switch blade **12**.

The insulator stud **40** is an elongated member formed of an appropriate ceramic, and is arranged to be force fit through the circular opening **42** in the switch blade. The stud **40** is of such a size relative to hole **42** and collar **44** that it frictionally engages a circumferential, inner peripheral portion **48** of the collar **44**, so as to effect a permanent resilient gripping of the ceramic stud **40** by the material of the collar **44**.

The formation of the collar **44** is very critical in that if the collar **44** is of too short an axial length, the edge **46** is disposed convergingly toward the plane of the main portion of the switch blade **12** and thus provides a sharp edge which, when in contact with the ceramic pin **40**, may impress such great stresses on the pin **40** as to effect compression-failure of the ceramic. If the collar **44** is formed of too great a length, then it may be stretched beyond its elastic limit so that the driving of the pin **40** through the hole **42** into frictional engagement with the collar **44** may produce sufficient stresses on collar **44** to effect structural failure of the collar **44**, such as by tearing so as to produce a fissure, as shown at **50** in Figure 3*a*.

It has been determined that the length of the collar **44** should be so selected that the terminus **46** of collar

44 is spaced from the switch blade 12 a distance of from two or four times the thickness of the material of the switch blade, and preferably said terminus 46 should be spaced from the switch blade 12 a distance in the range of three times the thickness of the material of said switch blade.

The foregoing critical limits have been determined particularly for use with a switch blade wherein the average thickness of the blade was .012 inches. It was determined that the spacing of terminus 46 from the switch blade 12 should be in the range of .024 to .048 inches, with a preferable average spacing of .036 inches. A switch blade of this type was formed of a high content nickel stainless steel known commercially as "Permanickel," having a bright finish, being fully hardened and spring tempered, but not age hardened, and having a hardness rating of Rockwell "C" 30/40. Said material has a yield strength of about 120,000 pounds per square inch and has a 15% elongation. In the manufacture of the switch blade 12, after it is stamped and formed, it is stress relieved by heating to 500° F. for one one hour, during which time the blade 12 must be free of load. Thereafter the blade is cooled in air, and later pickled and bright dipped.

The type of ceramic that may be used in constructing the insulator stud 40 may, for example, be a steatite which is fired to a dense structure throughout, and a typical commercial form is referred to as "Alsimag #35," having a ball mill finish so that the entire surface is a smooth finish throughout. It is important that stud 40 be of very hard ceramic construction.

The arrangement of the ceramic pin and the collar 44 is such that when the ceramic pin extends through the collar 44 the pin is forced into engagement with an annular band portion 48 of the collar, which portion 48 has some axial length thereby increasing the area of contact between pin 40 and collar 44, so that the compressive force exerted by the collar 44 is distributed over a relatively large area wherein the pin 40 is in contact with the collar 44, so as to distribute the compressive force and to avoid compression-failure of the ceramic.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. A bimetal-operated switch blade construction comprising, in combination, a sheet metal switch blade, means defining a circular opening through said switch blade and a collar of metal formed from the metal of said switch blade surrounding said circular opening, said metal collar being shaped so that the circular edge in the switch blade, which would normally surround said opening, is disposed in a plane spaced from and substantially parallel to the plane of the main portion of said switch blade, and an elongated ceramic pin being force fit through the circular opening in said switch blade and being in frictional gripping engagement with a circumferential portion of the inner surface of said metal collar, to effect a permanent resilient gripping of said ceramic pin by the material of said collar without effecting structural failure of the material of said collar.

2. A bimetal-operated switch blade construction comprising, in combination, a sheet metal switch blade, means defining a circular opening through said switch blade and a collar of metal formed from the metal of said switch blade surrounding said circular opening, said metal collar being shaped so that the circular edge in the switch blade, which would normally surround said opening, is disposed in a plane spaced from and substantially parallel to the plane of the main portion of said switch blade, and an elongated ceramic pin being force fit through the circular opening in said switch blade and being in frictional gripping engagement with a circumferential portion of the inner surface of said metal collar, to effect a permanent resilient gripping of said ceramic pin by the material of said collar, and the terminus of said collar being spaced from said switch blade a distance of from 2 to 4 times the thickness of the material of said switch blade.

3. A bimetal-operated switch blade construction comprising, in combination, a sheet metal switch blade, means defining a circular opening through said switch blade and a collar of metal formed from the metal of said switch blade surrounding said circular opening, said metal collar being shaped so that the circular edge in the switch blade, which would normally surround said opening, is disposed in a plane spaced from and substantially parallel to the plane of the main portion of said switch blade, and an elongated ceramic pin being force fit through the circular opening in said switch blade and being in frictional gripping engagement with a circumferential portion of the inner surface of said metal collar, to effect a permanent resilient gripping of said ceramic pin by the material of said collar, and the terminus of said collar being spaced from said switch blade a distance in the range of 3 times the thickness of the material of said switch blade.

4. A bimetal-operated switch blade construction comprising, in combination, a sheet metal switch blade, means defining a circular opening through said switch blade and a collar of metal formed from the metal of said switch blade surrounding said circular opening, said metal collar being shaped so that the circular edge in the switch blade, which would normally surround said opening, is disposed in a plane spaced from and substantially parallel to the plane of the main portion of said switch blade, and an elongated ceramic pin being force fit through the circular opening in said switch blade and being in frictional gripping engagement with a circumferential portion of the inner surface of said metal collar, to effect a permanent resilient gripping of said ceramic pin by the material of said collar, and the axial length of said collar being selected to effect sufficient compressive action between the collar and the ceramic pin to hold the ceramic pin firmly in position and to provide sufficient area of contact between the collar and ceramic pin to distribute said compressive force on the ceramic pin to prevent compression-failure of the ceramic.

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