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W. W. CAMP ET AL
TIE PIN WITH IMPROVED FASTENING MEANS FOR
CIRCUIT BREAKER HANDLES
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Fig. 1.

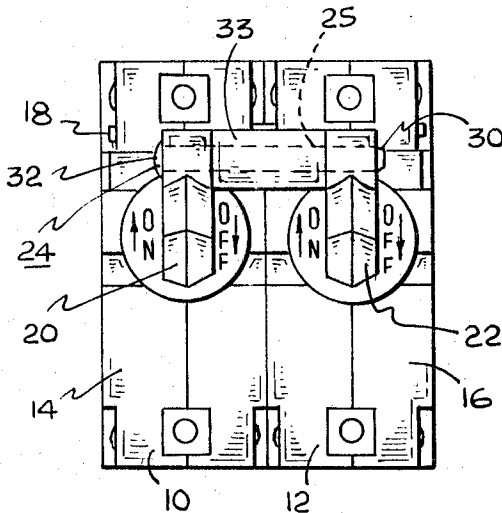


Fig. 2.

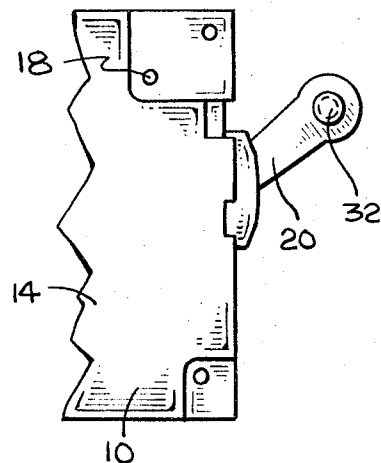


Fig. 3.

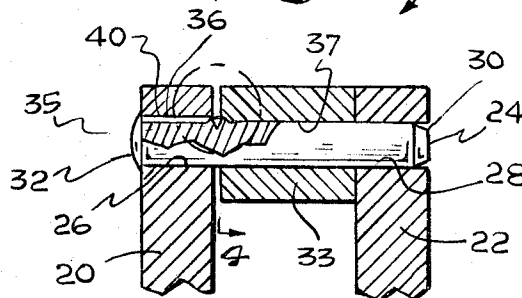
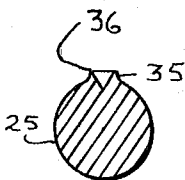


Fig. 4.

Fig. 6.

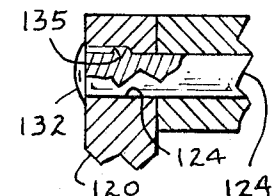
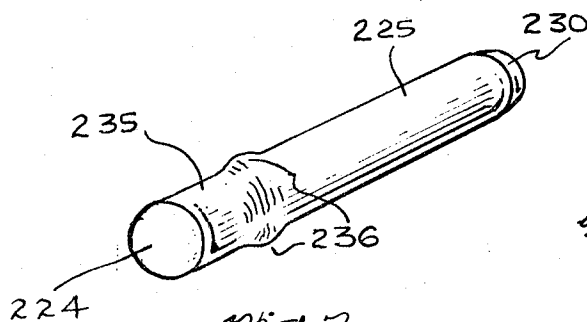


Fig. 7.

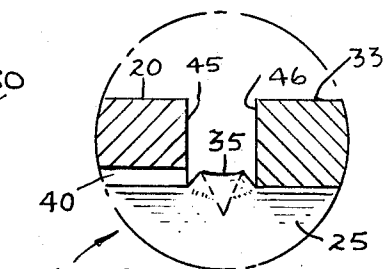


Fig. 5.

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TIE PIN WITH IMPROVED FASTENING MEANS FOR CIRCUIT BREAKER HANDLES

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This invention relates to a tie pin for connecting the handles of circuit breakers which are placed side-by-side.

It is often desired to connect the handles of circuit breakers which are placed side-by-side so that the handles of the circuit breakers may be operated in unison.

One arrangement which has been used previously is to slip a cylindrical pin through the aligned holes in the handles, the pin having an enlarged head at one end (to limit movement of the pin in one direction) and an annular groove at the other end which receives an engaging type washer, i.e., a C-shaped spring washer (to limit movement of the pin in the opposite direction). It is an object of this invention to provide a tie pin which connects the handles of adjacent circuit breakers without requiring a separate engaging type washer.

In one embodiment of this invention, a cylindrical pin is inserted in suitable holes in the handles of adjacent circuit breakers. The pin makes a slip fit with the handles, except for a local part of the pin which carries a projection or protuberance extending out beyond the cylindrical surface of the pin. The handles are made of a material which is softer than that of the pin, so that when the pin is slipped into the holes, the projection cuts a key slot into one of the handles to lock the pin to the handle. Preferably, the projection is located near the end of the pin which is last to be inserted, so that the force for the cutting action need be applied only near the end of the pin insertion motion.

The foregoing and other objects of our invention, the principles of our invention, and the best mode in which we have contemplated applying such principles will more fully appear from the following description and accompanying drawings in illustration thereof.

In the drawings,

FIG. 1 is a front view of a multipole circuit breaker unit illustrating the handles of two circuit breakers connected by a tie pin constructed in accordance with this invention;

FIG. 2 is a partial side view of the multipole unit illustrated in FIG. 1;

FIG. 3 is a partial, sectional view through the handles illustrated in FIGS. 1 and 2, but at an enlarged scale;

FIG. 4 is a sectional view taken along the line 4—4 in FIG. 3, but showing only the tie pin;

FIG. 5 is a further enlarged sectional view corresponding generally to the encircled part of FIG. 3;

FIG. 6 is a partial, sectional view illustrating a modification of the invention; and

FIG. 7 is a perspective, but enlarged, view of a handle tie pin illustrating a further modification.

Referring to the drawings, two circuit breakers 10 and 12 are illustrated in FIG. 1 in side-by-side position to provide a two pole or multiple unit. The cases 14 and 16 of the circuit breakers are connected together by rivets 18 only one of which is partially shown in FIGS. 1 and 2, the rivets 18 extending through the cases 14 and 16, as is well known in the art.

The circuit breakers include aligned handles 20 and 22 pivotal about substantially the same axis. A handle tie pin 24 extends through suitable aligned and generally circular holes 26 and 28 in the handles 20 and 22 to interconnect or bridge the handles for unitary or joint movement.

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The tie pin 24 comprises a cylindrical shaft 25 having a chamfered end portion 30, to facilitate entrance into the handle holes, and an enlarged or upset head 32.

A cylindrical spacer 33 is placed between the handles 20 and 22, the spacer 33 having a circular hole 37 adapted to receive the part of the tie pin between the handles 20 and 22.

Adjacent the head 32, the shaft 25 is provided with an integral, local projection or protuberance 35 extending outwardly from the otherwise uniform and slim, cylindrical surface of the shaft 25. The projection 35 extends outwardly a radial distance greater than the radius of the hole 26 to provide a suitable interference fit with the handle 20, when the tie pin is forcefully pressed into the position shown in FIGS. 1 and 3. The projection 35 may have, as shown, a moon-like crater appearance, which extends outwardly from only a very small part of the cylindrical surface of the shaft 25 and has a raised, generally circular upper edge portion 36 which cuts or digs into a portion of the handle 20. When the projection 35 engages the handle 20, it cuts a chip out of the handle 20 and forms key slot 40 in the handle 20 (FIG. 3). It is assumed that a part of the chip enters into the hollow center of the crater-like projection 35 and thereby facilitates insertion of the tie pin.

The cylindrical surface of the shaft 25 makes a slip fit with the holes 26, 28 and 37 and the shaft is easily inserted into them, from left to right, as viewed in FIG. 3, until the projection 35 first engages the handle 20, and thereafter a force is applied to the head 32 to press the pin 24 to the final position shown in FIGS. 1 and 3.

As shown in FIG. 5, it is preferred that the projection 35 be entirely to the right of the handle 20, i.e., not in engagement with the right hand surface 45 of the handle 20 nor engagement with the left hand surface 46 of the spacer 33. The reason for this preference is that with such an arrangement the pin 24 will tend more freely to rotate within the handles and spacer. When the pin 24 rotates away from the key slot 40, should a force be placed on the pin 24 tending to remove the pin from the handles, the force must be great enough to cut a new key slot in the handle 20.

However, as a practical matter the projection 35 may be straddled by either the surface 45 or 46, or by both surfaces 45 and 46, the latter being shown in FIG. 3.

The projection 35 may be formed by striking the shaft with a suitable conical punch having a relatively sharp point so as to upset a single, small, local part of the shaft 25, but it is understood that other means could be provided for forming the projection 35.

Also, the projection 35 could be placed between the spacer 33 and the handle 22 which would then mean that to remove the tie pin, after it has rotated away from the key slot which it cut on insertion, a longer key slot would have to be cut. Also, the tie pin could be placed so that the projection is between the end faces of the handle 22 or it could be placed about midway between the ends of the tie pin 24 in which case, when in assembled position, it would be in engagement with the spacer 33, but these embodiments are not illustrated.

FIG. 6 illustrates a modification of the invention in which the tie pin 124 has a projection 135 adjacent the head 132 and engaging the left handle 120 about half way in the hole 126, i.e., between the end surfaces of the handle 120. The advantage of this embodiment is that since a much shorter key slot 140 is cut by the projection 135, the force to press the pin 124 into the handle 120 need be applied for a short period of time only.

FIG. 7 illustrates a further modification of this invention in which the tie pin 224 is provided with an annular enlarged portion 235 which extends along the length of

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the shaft 225 but for only a short distance. The enlarged portion 235 has an elliptical-like shape to provide bulging or dome-like portions 236 at the major axis of the ellipse. The annular portion 235 may be placed relative to the handles in the position shown for the projections in FIGS. 3, 5 or 6, or any of the other positions described. If the material of the handle is a plastic one, having a sufficient memory or spring-like characteristic, the annular portion could be placed at the very last section of the pin 224 to enter the handle hole, and would tend to either compress a local part of the handle or expand it outwardly.

The annular portion 235 may be found by upsetting a local part of the shaft 225 such as by compressing a local part of the shaft 225 between suitable jaws of a vise or it may be cast in the desired form.

In the various embodiments, the projection or annular portion is small in height and width, so that finger pressure alone is sufficient to supply the force required to press the pin to its final position, even though the material of the handle may have substantial hardness. Finger pressure alone could also remove the pin, if the pin extended out beyond the handle 22 sufficiently, which is not normally the case, so that a suitable tool is used at the chamfered end to drive the pin out. While in some of the appended claims reference is made to "substantially finger pressure" it is understood that a similar, light force could be applied with a suitable tool, if desired, to both insert and remove the pin and that this is included within the phrase "substantially finger pressure."

It will be seen in FIG. 7 that while the forward end of the pin 224 has a chamfered portion 230, similar to the previous embodiments, the rear end of the pin has no enlarged head.

Although the enlarged head provides a convenient stop to inform the operator that the pin has been driven to the desired position, and prevents the pin from being overdriven, it is seen that the enlarged head is not required to prevent the tie pin from accidentally slipping out of the handles. However, the head does serve, in the embodiments illustrated in FIG. 1 to 6, to identify the end portion of the pin which has the projection so that when it is desired to remove the pin, the operator should know that a force should be applied to the right hand end of the pin, as viewed in FIG. 3, and directed to the left. This identification function can be performed in other ways though, such as by chamfering only the right end portion of the pin and leaving the left end portion flush and without a head, as illustrated in FIG. 7.

In all the embodiments, the tie pin is made from a harder material than of the handles, the pin being preferably made from steel and the handles and the spacer from a plastic material, such as nylon, although other materials, such as a zinc die-cast material could be used for the handles. While the tie pin has been shown as a solid piece, it is seen that it could be made as a tubular piece, for instance, and of other than a circular shape when viewed in a cross-section at right angles to its longitudinal axis.

Further, if the hole 37 in the spacer 33, FIG. 3, is made slightly smaller than the outside diameter of the shaft 25, no projection, such as the projection 35, need be provided, as in this embodiment the tie pin would be pressed or force fit into the spacer 33 and is received in a sliding fit in the holes in the handles.

In the instance where no projection is provided on the pin, the force fit could also be provided in the handles, as well as in the spacer, or only in the handles, by making the diameter of these holes suitably smaller than the outside diameter of the pin shaft.

While this invention has been shown in an embodiment wherein the tie pin connects the handles of two circuit breakers, it will be understood that three circuit breakers, or any reasonable number, could be similarly connected. If more than two circuit breakers are so connected, additional spacers would also be provided. However, the

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spacers may be eliminated completely, if a tie pin having an enlarged head is used and the projection is placed along the length of the tie pin so that the head and projection are on opposite sides of the same handle, i.e., clamping the handle as shown in FIG. 5, or the projection is in engagement with a handle when the tie pin is in its final position, i.e., the position shown in FIG. 6.

Further, while only one projection or annular portion has been shown, it is understood that two or more could be used, if more interference is desired between the tie pin and the handle.

Also, while particular shapes have been described for the projection and annular portion, it is seen that other equivalent shapes could be used.

It will be understood that, to minimize the possibility of breaking handles, referring to FIG. 3 for example, the handle 20 should be more supported, usually by supporting the handle 22 which through the spacer 33 in turn supports the handle 20, as the pin is driven to its final position.

What we claim is:

1. In combination, side-by-side circuit breaker handles and a tie pin for connecting the handles, said tie pin comprising a shaft connecting said handles, said shaft having a local projection, said shaft being small enough to easily slip into holes in the handles except for said projection, said projection providing a cutting interference between a local part of said tie pin and one of said handles, said tie pin being made from a material which is harder than said handles, whereby said projection cuts a slot into at least one of said handles, said projection being small enough so that the force required to drive said tie pin to its final position is substantially finger pressure.

2. The structure recited in claim 1 wherein one end of said tie pin has a head and said projection is formed adjacent said head.

3. The structure recited in claim 1 wherein said tie pin has a shaft having a cylindrical outer surface easily received in circular holes in said handles, said projection having a crater-like shape to provide a circular edge portion to cut a slot into at least one of the handles.

4. The structure recited in claim 1 wherein said projection engages one of the handles when said tie pin is in its final position.

5. The structure recited in claim 1 and further including a spacer between handles, said projection engaging said spacer when said tie pin is in its final position.

6. The structure recited in claim 1 wherein said projection is disposed between said handles when said tie pin is in its final position.

7. The structure recited in claim 2 wherein the projection is spaced from said head by the width of one handle to clasp said handle therebetween when said tie pin is in its final position.

8. The structure recited in claim 4 and further including a spacer between adjacent handles, and said tie pin extending through said spacer.

9. The structure recited in claim 1 wherein said projection has an annular shape.

10. The structure recited in claim 1 wherein said projection has a dome-like shape.

11. The structure recited in claim 7 wherein said projection has a crater-like shape.

12. In combination, circuit breakers having side-by-side handles, a tie pin connecting said handles, a spacer between two handles, said handles and spacer having holes receiving said tie pins, at least one of said holes being smaller than said tie pin to form a force fit when said tie pin is assembled to said spacer and handles.

13. The structure recited in claim 12 wherein the holes in the handles receive the tie pin with a slip fit and the force fit is provided only by said spacer.

14. The structure recited in claim 12 where the hole in the spacer receives the tie pin with a slip fit and the

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force fit is provided by at least one of the holes in the handles.

15. In combination, circuit breakers having side-by-side handles, a tie pin connecting said handles, said handles having holes receiving said tie pin, one of said holes being smaller than a local part of said tie pin to form a force fit between said local part of said tie pin and one of said handles when said tie pin is assembled to said handles, the remainder of said holes receiving said tie pin with a slip fit.

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