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Smith et al.

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[54] **ELECTRICAL TERMINAL CONFIGURATION**

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[73] Assignee: **General Electric Company**, New York, N.Y.

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[52] **U.S. Cl.** ..... **339/59 R**; 200/284; 339/272 UC

[51] **Int. Cl.** **H01r 7/08**

[58] **Field of Search**. 200/284; 339/59 RM, 198 RC, 339/198 GN, 272 RA, 272 UC

[56] **References Cited**

UNITED STATES PATENTS

2,205,322	6/1940	Thomas	339/272 UC
2,329,471	9/1943	King	339/198 C
3,238,495	3/1966	Lanius	339/198 R
3,344,394	9/1967	Kingsbury	339/272 R

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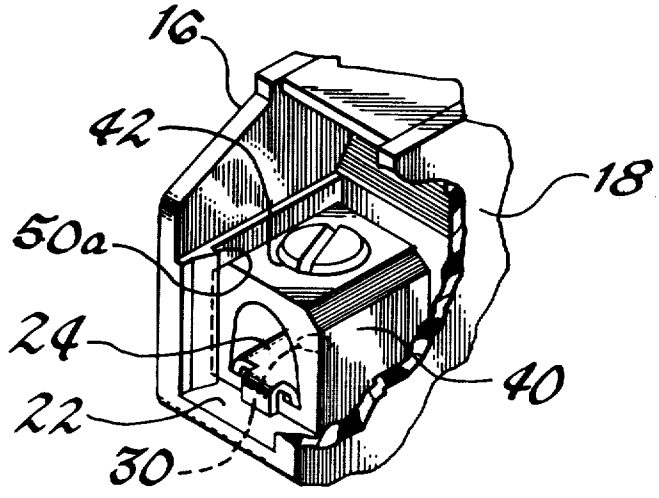
[57] **ABSTRACT**

A terminal strap is formed having turned down side edges and a turned down frontal tab for supporting the strap in spaced relation to the floor of a terminal recess formed in the molded case of a circuit breaker. An inverted U-shaped lug is slideably received on the strap with upwardly formed flanges engaging the turned down side edges. Lips formed on the deflectable sidewalls of the terminal recess retain the lug in place. The strap is also formed with a tapped hole to accommodate a bolted joint binding head screw or wire keeper in lieu of the lug.

7 Claims, 5 Drawing Figures



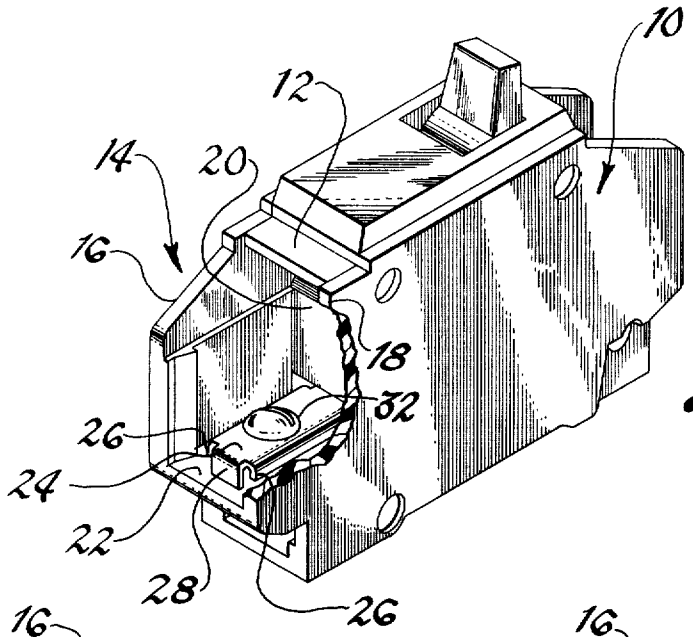


Fig. 1.

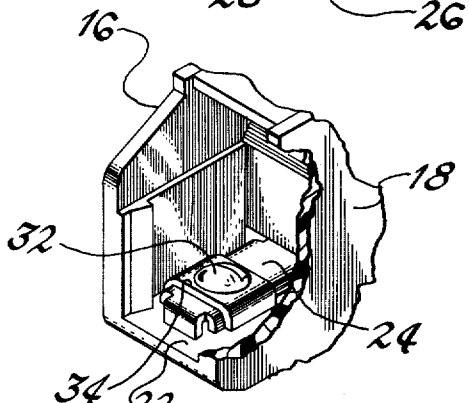


Fig. 2.

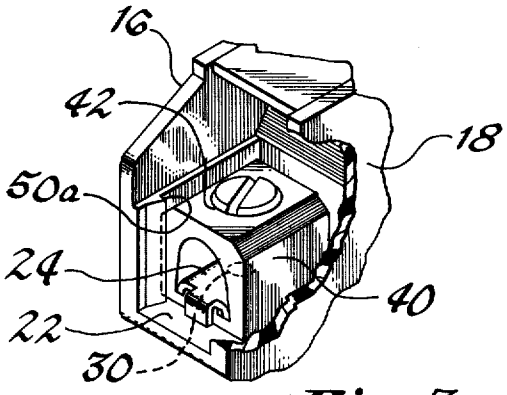


Fig. 3.

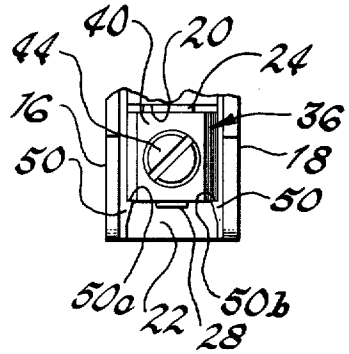


Fig. 4.

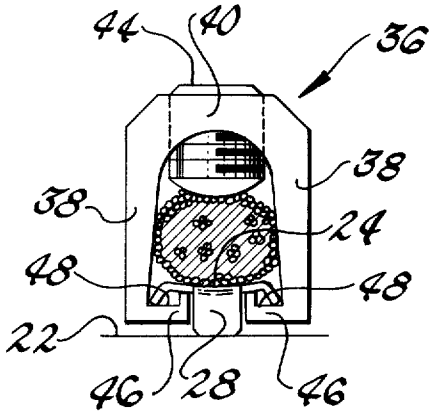


Fig. 5.

ELECTRICAL TERMINAL CONFIGURATION

BACKGROUND OF THE INVENTION

Terminal connections for molded case circuit breakers take a variety of forms depending upon the configuration and size of the conductor to be connected thereto. For large diameter, high current rated conductors of single or multiple strands a lug is the preferred form of terminal connector. Wire keepers are quite satisfactory for making terminal connections with smaller sized, lower current rated conductors. For still smaller conductors, a simple binding head screw may be used. In addition, certain installations call for the circuit breaker terminal connection to be effected with a conductor in the form of a busbar. For each of these terminal connection configurations, specific provisions must be made in the terminal strap, the mounting of the terminal strap, and/or the molded circuit breaker case.

With the current widespread use of aluminum conductors, a special problem has arisen in making a lastingly good electrical terminal connection. Aluminum, being an especially soft metal, has a tendency to cold flow or "creep" under the clamping pressure initially perfecting the terminal connection, such that, in time, adequate contact pressure between the aluminum conductor and the terminal strap is often lost. To alleviate this problem, it has been proposed to include additional spring elements in the clamping force train, as disclosed in the commonly assigned copending applications, Ser. Nos. 347,127, now Pat. No. 3,824,555 and Ser. No. 405,686, filed Oct. 11, 1973, now U.S. Pat. No. 3,864,005.

It is accordingly an object of the present invention to provide a terminal arrangement which is universally adaptable to a variety of electrical connectors.

A further object of the invention is to provide a terminal arrangement of the above character, wherein the terminal strap is designed to readily accommodate alternative forms of electrical connectors.

Yet another object of the invention is to provide a terminal arrangement of the above character, wherein various forms of electrical connectors are readily field installable.

An additional object of the present invention is to provide a terminal arrangement of the above character, which in one form alleviates one of the more significant problems inherent in making terminal connections to aluminum wire.

Other objects of the present invention will in part be obvious and in part appear hereinafter.

SUMMARY OF THE INVENTION

In accordance with the present invention, the terminal strap of a circuit interrupting device, such as a molded case circuit breaker, is formed having turned down side edges and is terminated in a turned down tab acting to support the strap with its side edges in spaced relation to the floor of a terminal recess formed in the case of the device. At a point inwardly from the turned down tab, the terminal strap is formed with a tapped hole capable of receiving a binding head screw for making terminal connection with small diameter wire conductors. The terminal strap sides are spaced from the terminal recess sidewalls and the upper surface is sufficiently elevated from the floor of the terminal recess, such that a wire keeper may clamp a larger diameter wire conductor to the terminal strap using a screw threaded in the strap hole.

Alternatively, a lug, uniquely designed in accordance with the invention, may be used to perfect electrical connection with still larger diameter, higher current rated electrical conductors or cable. The lug is formed in a U-shaped configuration such that it can be inverted and slid on the terminal strap without interference with the turned down frontal tab. The legs of the lug carry short, inwardly extending feet, which are undercut to form longitudinally extending notches for receiving the turned down sides of the strap. By virtue of this construction, when the lug clamping screw is threaded down against a conductor inserted therein, the sides of the terminal strap are pulled upwardly by the lug, thus deforming the normally planar contact surface of the strap to at least partially conform to the wire. If the material of the terminal strap has sufficient elasticity, such that the deformation of the strap is not entirely plastic, any creepage of the conductor tending to relax the contact pressure between it and the strap will be adequately compensated by the partial return of the strap to its initial configuration.

Two sidewalls of the terminal recess are formed with latch means to retain a factory-installed lug in place during shipment and installation.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view, partially broken away, of a molded case circuit breaker incorporating a terminal configuration in accordance with one embodiment of the invention;

FIG. 2 is a fragmentary perspective view of a terminal configuration according to an alternative embodiment of the invention;

FIG. 3 is a fragmentary perspective view of a terminal configuration according to still another embodiment of the invention;

FIG. 4 is a top view of the terminal configuration of FIG. 3; and

FIG. 5 is an end view of the terminal configuration of FIG. 3.

Like reference numerals refer to like parts throughout the several views of the drawing.

Detailed Description

The terminal configurations of the present invention are illustrated as being incorporated in a molded case circuit breaker, such as generally indicated at **10** in FIG. 1. The circuit breaker may be of a variety of sizes, shapes and current ratings. For example, the terminal configurations of the invention may be incorporated in the Q line of circuit breakers as manufactured by General Electric, Plainville, Connecticut in current ratings from 5 to 250 amperes. It can be readily appreciated that such a wide range of current ratings calls for different terminal configurations.

Referring to FIG. 1, circuit breaker **10** includes a molded case **12** having a terminal recess **14** provided in at least one end thereof; the recess being defined by case sidewall extensions **16** and **18**, a backwall **20**, and a bottom wall or floor **22**. A terminal strap **24** emanates

from the case interior through an opening in backwall **20** into the terminal recess **14.** The terminal strap, formed of conductive metal spring stock, is provided with turned down lateral edges **26** and terminates in a downwardly turned frontal tab **28.** The tab rests on floor **22** to support the strap with its turned lateral edges **26** in spaced relation thereto. A tapped hole **30** (seen in FIG. 3) is formed in the strap **24,** which, in the terminal configuration of FIG. **1,** receives a binding head screw **32** for clamping a small, low current carrying wire (not shown) in electrical contacting engagement with the terminal strap. It will be noted that the top and front of terminal recess **14** are open to facilitate the making of the terminal connection.

The tab **28** serves to support the strap against the downward pressure exerted by the electrician in turning binding head screw **32** down tight.

In the embodiment of the invention illustrated in FIG. **2,** a channel-shaped wire keeper **34** is engaged under the head of screw **32** to clamp larger diameter wire or multi-stranded cable in electrical contacting engagement with strap **24.**

In the embodiment of the invention illustrated in FIGS. **3** through **5,** a lug, generally indicated at **36,** is used to make terminal connection with large diameter, higher current carrying conductors. Lug **36,** as seen in FIGS. **3** and **5,** is constructed, according to this embodiment of the invention, in a U-shaped configuration having a pair of depending legs **38** joined by a bridging section **40.** A tapped bore **42** in bridging section **40** receives a clamping screw **44** for advancement into the open interior of lug **36.** The lower ends of legs **38** carry inwardly extending feet **46** which are undercut to provide longitudinally extending notches **48.**

To assemble the terminal configuration of FIGS. **3** through **5,** lug **36** is slid over the end of terminal strap **24;** the gap between feet **46** affording clearance for tab **22.** Moreover, the turned down strap edges **27** are sufficiently elevated from the terminal recess floor **22** by tab **28** to accommodate the passage of the lug feet **46** therebetween. As seen in FIG. **4,** the terminal recess sidewalls **18** carry vertically elongated lips **50** formed having frontal cam surfaces **50***a* and rear latch surfaces **50***b*. It is seen that upon the forcible insertion of the lug **36** onto strap **24,** the lips **50** are engaged to wedge the somewhat deflectable terminal recess sidewalls **18** apart sufficiently to accommodate completed lug assembly. Once the lug **36** clears the lips **50,** the sidewalls return to their normal separation, and the lug is thus confined in the terminal recess **14** by the latching surface **50***b* of the lips. This feature of the invention permits factory assembly of the lug with complete assurance that the lug will remain poised for convenient terminal connection at the wiring site.

Referring specifically now to FIG. **5,** a conductor **52** is shown being clamped by screw **44** in electrical contacting engagement with strap **24.** Particularly in the case of a multi-stranded conductor cable, the clamping pressure causes the cable cross-section to flatten, resulting in the exertion of laterally directed forces on the lug legs **38.** Spreading of the lug legs, which could fracture the terminal recess sidewalls **18** or disengage the lug from the strap, is prevented by the confinement of the strap side edges **26** in notches **48.** This physical relationship is also beneficial particularly when making terminal connections with aluminum conductors. As the lug connector is tightened, the underlying feet **46** of the lug, in effect, pull upwardly on the lateral edges of the strap, deforming the contact portion of the strap into a somewhat concave configuration in conformity with the engaging surface configuration of the cable **50.** If the terminal strap is formed of a conductive material having a measure of elasticity, such that the deformation of the strap is not entirely plastic in character, deleterious relaxation of the contact pressure between the conductor and the strap caused by creepage of the conductor matter is avoided by the partial return of the strap to its generally planar configuration. It is found that phosphor bronze and equivalent alloys are suitable terminal strap materials having the requisite conductivity and elasticity. Other suitable materials will occur to those skilled in the art.

While the present invention has been disclosed as terminal configurations for molded case circuit breakers, it will be understood that the teachings of the invention are applicable to a variety of electrical devices having terminal conductors in strap configuration.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An electrical termination comprising, in combination:

A. means forming a terminal recess, said recess bounded by an insulative backwall, opposed sidewalls and a bottom wall;

B. an elongated terminal strap of conductive metal spring stock extending through said backwall into said terminal recess, said strap having

1. turned down lateral edges,

2. a turned down frontal tab engaging said bottom wall to support said strap with said lateral edges in spaced relation to said bottom wall, and

3. means forming a tapped hole in said strap located inwardly from said tab; and

C. an electrical connector engaging said strap for clamping an electrical conductor thereto.

2. The electrical termination defined in claim **1,** wherein said electrical connector is in the form of a clamping screw threadedly engaging said tapped hole.

3. The electrical connector defined in claim **1,** wherein said electrical connector is in the form of a lug slideably received on said strap in engaging relation with said turned down lateral edges.

4. The electrical termination defined in claim **3,** wherein said recess sidewalls are laterally deflectable, and said termination further includes latch means carried by each said sidewalls for retaining said lug in position on said strap.

5. The electrical termination defined in claim **4,** wherein each said latch means includes a forward facing cam surface and rearward facing latch surface.

6. An electrical termination for electrical devices, said termination comprising, in combination:

A. an insulative case for the electrical device;

B. means forming a terminal recess in said case, said recess being bounded by a backwall, opposed sidewalls and a bottom wall;

C. an elongated terminal strap of conductive metal spring stock extending through said backwall into said recess, said strap having

1. turned down lateral edges;

2. a turned down frontal tab for supporting said strap with said lateral edges in spaced relation to said bottom wall, and

3. means forming a tapped hole in said strap located inwardly from said tab;

D. a lug slideably received on said strap in engaging relation with said turned down lateral edges thereof; and

E. latch means formed on at least one of said recess walls retaining said lug in position on said strap, said latch means accommodating assembly of said lug on said strap without opening said insulative case.

7. The electrical termination defined in claim 6, wherein at least one of said recess sidewalls is laterally deflectable, and said latch means is carried by said deflectable sidewall and comprises a forward facing cam surface and a rearward facing latch surface.

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