Aug. 22, 1961 S. A. MASON 2,997,686

QUICK WIRING DEVICE

Filed July 10, 1959

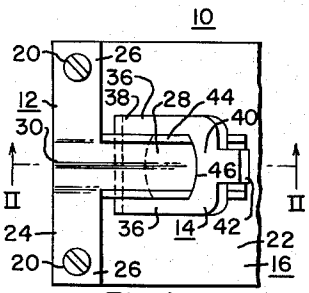


Fig. 1.

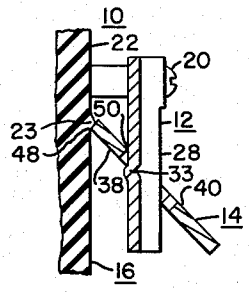


Fig. 2.

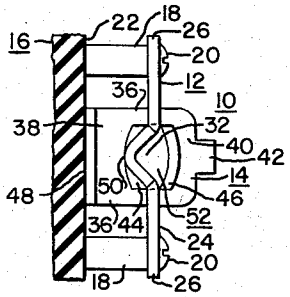


Fig. 3.

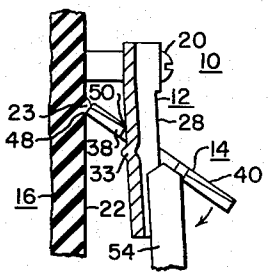


Fig. 4.

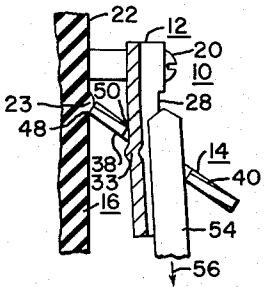


Fig. 5.

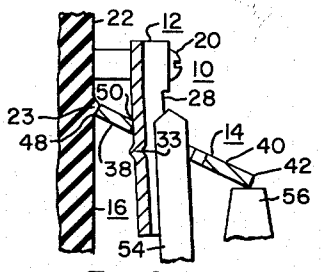


Fig. 6.

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QUICK WIRING DEVICE

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9 Claims. (Cl. 339—149)

The present invention relates to electrical terminal devices which are utilized to transfer electrical energy between conductors in electrical networks.

A historical review of the development of terminal devices indicates that creative effort has been directed toward providing terminal devices having structures which are easily manufactured and which readily engage conductors when placed in use. This effort has been consistent with market requirements for cost reduction and contemporary demands for simplicity in design and ease of operation of terminal devices.

The screwless-type terminal device is an outgrowth of this effort, and it is particularly characterized by the fact that it automatically engages and retains inserted conductors, such as those provided in the form of wires. Thus, simplicity is provided through this automatic feature commonly termed "rapid wiring." It is fundamental to note that certain physical principles control the mechanical relations between component structural elements in providing the rapid wiring feature in screwless terminal devices associated with prior art mechanical environments. In new mechanical environments for terminal devices, different mechanical relations exist so that different physical principles or different combinations thereof must be inventively applied to substantially different structural elements in order to provide adequately the rapid wiring feature. If, for example, the rapid wiring feature is to be provided in a terminal device positioned in a relatively limited space, buckling of the wire engaging members of the terminal device becomes a problem because the members are necessarily miniaturized to satisfy space limitations.

It is, therefore, an object of the invention to provide an electrical terminal device having novel means for affording rapid electrical and mechanical engagement of a conductor.

It is another object of the invention to provide an electrical terminal device having novel means for affording rapid electrical and mechanical engagement of a conductor and for affording ready release of the conductor.

It is a further object of the invention to provide an electrical terminal device having novel means for affording rapid electrical and mechanical engagement of a conductor so that any pull on the conductor results in firmer engagement thereof through the influence of tensile reaction by the terminal device.

These and other objects of the invention will be more apparent upon study of the following detailed description of an illustrative embodiment of the invention as related to the accompanying drawings, in which:

FIGURE 1 is a top plan view of a screwless terminal device constructed in accordance with the principles of the invention;

FIG. 2 is a longitudinal sectional view of the terminal device taken along the reference line II—II of FIG. 1;

FIG. 3 is an end view, partially in section, of the terminal device of FIG. 1;

FIG. 4 is a longitudinal sectional view of the terminal device taken along the reference line II—II of FIG. 1, here with a conductor being partially inserted;

FIG. 5 is a longitudinal sectional view of the terminal device taken along the reference line II—II of FIG. 1, here with the conductor being fully inserted; and

FIG. 6 is a longitudinal sectional view of the terminal device taken along the reference line II—II of FIG. 1 illustrating a method for disengaging the fully inserted conductor.

In accordance with the broad principles of the invention, a screwless terminal device is formed so that an inserted conductor is electrically and mechanically engaged by automatic action of the terminal. Any pull on the conductor is opposed by tensile reaction of the device causing firmer engagement of the conductor, but the conductor can be independently released through the use of a suitable instrument.

With reference to FIGS. 1, 2, and 3, a screwless terminal device **10** can form part of an electrical apparatus (not shown) and therein serve as means for transmitting electrical energy when conductively connected with conductors associated with electrical energy sinks or sources (not shown). The screwless terminal device **10** comprises a conductor receiving terminal lug **12** and a conductor engaging clip **14**, each of which can be fabricated in accordance with ordinary manufacturing methods, such as by a stamping or a punching operation. As shown in FIG. 3, the lug **12** is supported above an insulating base **16** that is integral to the aforementioned electrical apparatus and by a pair of spacers **18** and is secured to the base **16** by screws **20**. It is to be particularly noted that the lug **12** can be supported on the base **16** by other means. For example, a terminal device or member (not shown) can include an integral lug and be formed so that, when the terminal member is clamped against a base, the integral lug is disposed in a position relative to this base substantially the same as the lug **12** is disposed relative to the base **16** in FIG. 3. A more thorough description of this modification of the invention is set forth in an application of S. A. Mason, filed concurrently herewith, entitled Wiring Device, Serial Number 826,266 and assigned to the present assignee.

With further reference to FIGS. 1, 2 and 3, the lug **12** can be connected to an electrically conductive portion of the aforementioned electrical apparatus through the use of clamping means, solder, or any other suitable means. Although the base **16** can have any form which particularly adapts it for use in the parent electrical apparatus, it is shown in FIGS. 1 and 3 as having a slab-like form with a clip retaining ridge **23**, but with an otherwise generally flat surface **22** which provides for frictional cooperation with the clip **14** in a manner to be described more fully. Additionally, openings (not shown) are provided in the base **16** for reception of the screws **20**.

The spacers **18** are stationed against the insulating base **16** in order to support the lug **12** in a position substantially parallel to, but separated from, the base **16**. As previously noted, the construction of the spacers **18** between the base **16** and the lug **12** is not critical, and, in fact, any structure that supports the lug **12** in a position substantially parallel to, but separated from, the base **16** could equivalently be employed provided the space between the lug **12** and the base **16** remains free for reception of the clip **14**.

The conductor receiving terminal lug **12** is preferably but not necessarily T-shaped. A crossbar **24** is supported at its ends **26** by the spacers **18** and associated parts as previously described. A cantilever arm **28** is joined to a middle portion **30** of the crossbar **24** and is substantially transverse thereto. An indentation is made along the length of the arm **28** and across the cross-bar middle portion **30** so that an aligned channel **32** exists for reception of a conductor. Additionally, a clip retaining tang **33** projects from the arm **28**.

The conductor engaging clip **14**, of a relatively hard material such as stainless steel but not limited thereto,

is generally rectangularly shaped. The clip **14** comprises side portions **36**, end portion **38** and an opposite end portion **40** with a tab **42**, so that an opening **44** is partially circumscribed by sharp curvilinear edges **50** and **46** of the end portions **38** and **40**, respectively, and otherwise circumscribed by the clip side portions **36** to provide for slippage of the clip **44** onto the arm **28** of the lug **12**.

Thus far the structure of elements usable with the invention has been described, and it remains to set forth the cooperation of these elements according to the principles of the invention. The size of the clip **14** and the lug **12**, respectively, is determined by the standard wire sizes which the terminal device **10** must engage and by the space in the aforementioned electrical apparatus in which the terminal device **10** must fit. In any case, the lug arm **28** is supported substantially parallel to the base surface **22**, but it is separated therefrom, so that the clip end portion **38** necessarily glides angularly between the base surface **22** and the lug arm **28** when the clip **14** is slipped onto the lug arm **28**.

Once the clip **14** is fully inserted, an outer edge **48** of the end portion **38** is stationed against the ridge **23** and the base **16** and the inner edge **50** of the end portion **38** is stationed against the arm **28** and adjacent to, but separated from, the arm tang **33**. Thus, the base ridge **23** and the arm tang **33** prevent, with the exception of tolerable limitations, further inward and outward gliding motion of the clip **14** between the base **16** and the arm **28** and therefore substantially retain the clip **14** in its inserted position. The arm **28** of the lug **12** passes through the clip opening **44** so that a wire-engaging passage **52** is defined by the contour of the arm channel **32** and the clip curvilinear edge **46**.

As represented in FIGURE 4, a conductor or wire **54**, upon being inserted into the device **10** for engagement therewith, slides along the channel **32** and through the passage **52** exerting a force on the sharp edge **46** of the clip **14**. This force creates a counterclockwise moment on the clip **14**, as viewed in FIG. 4, and, accordingly, causes the clip **14** to rotate, and to bow slightly in instances where the resiliency of the clip material and the thickness of the clip **14** allows the same, about its edge **48**. Reactionary forces by the base **16** on the edge **48**, by the arm **28** on the edge **50**, and by the edge **46** on the conductor **54** create a net clockwise moment that opposes the counterclockwise moment caused by the insertion of the wire **54**. Rotation, and bowing in the previously mentioned specific instances, of the clip **14** continues until the two opposing moments equal each other so that a state of equilibrium exists for the clip **14**. As a consequence of the rotation of the clip **14**, the cantilever arm **28** is bent outwardly from the base **16** because added separation between the base **16** and the arm **28** is necessary to accommodate the rotated clip end portion **38**, but if the clip **14** is constructed so that it also bows, the arm **28** will bend only nominally away from the base **16**. The outward bending of the arm **28** and the tendency of the clip **14** to resume its original angular position causes the conductor **54** to be pressed more firmly against the sharp edge **46** of the clip **14**. Thus, when the conductor **54** is fully inserted (FIG. 5), the terminal device **10** rigidly engages the conductor electrically and mechanically because the clip edge **46** then exerts a reactionary force which indents the conductor **54** and binds the same against the lug arm **28**.

When the conductor **54** is pulled along arrow **56** in FIG. 5, a force in the direction of the arrow **56** is exerted on the clip edge **46**. In accordance with well-established principles of mechanics, this force can be resolved into a component that acts longitudinally along the plane of the clip **14** and one that acts transversely to the plane of the clip **14**. The transversely resolved force creates a clockwise moment which acts to rotate the clip **14** in a clockwise direction and to alleviate, in the mentioned specific instances, any prior counterclockwise bowing in the clip **14**, thereby further identing and more firmly

engaging the conductor **54**. The longitudinally resolved force causes tensile stress in the clip **14** so that it cannot fail by buckling as it could if pull on the conductor **54** caused compressive stress in the clip **14**.

FIG. 6 depicts a method that is used to release the conductor **54** from the terminal device **10**. Any relatively blunt-edged instrument **56**, such as a screwdriver, can be pressed against the tab **42** until the clip **14** bends sufficiently in a counterclockwise direction so that the clip curvilinear portion **46** is released from engagement with the conductor **54**.

The terminal device described herein can be modified in numerous ways without departing from the broad principles of the invention. Accordingly, it is desired that the invention be not limited in scope to the embodiment and modifications thereof described, but that the invention be accorded an interpretation consistent with the scope and spirit of its broad principles.

What is claimed is:

1. An electrical terminal arrangement comprising a base having a projecting ridge, at least one spacing member positioned against said base, a conductive lug having a cantilever arm with a projecting tang and having a channel for receiving a conductor, said lug being supported on said spacing member thereby separating said cantilever arm from said base, and an elongated clip having an opening through which said lug arm is extended, said clip including an end portion that is positioned at one extremity against said base and adjacently of said base ridge and at its opposite extremity adjacently of said clip opening against said lug arm and adjacently of said lug arm tang to restrain said clip from substantial movement along said lug arm, the spacing of said lug arm from said base and the location of said clip opening being so provided as to require said clip to extend angularly relative to said lug arm, said lug arm channel and said clip opening defining a passage through which said conductor can be passed causing said clip to deflect relative to said lug arm sufficiently to clamp mechanically and electrically said conductor against said lug arm, said clip responding in tension to withdrawal forces on said conductor resulting in a more firm engagement of said conductor, said clip additionally having an opposite end portion enabling said conductor to be released when said opposite end portion is pressed away from said conductor.

2. An electrical terminal device being positioned when used above a base surface, said device comprising a conductive lug having a trough portion for receiving a conductor, and an elongated clip having one end positioned on said base surface and having an opening, said trough portion extending through said clip opening, said clip opening being so located and said trough portion being so spaced from said base surface as to require said clip to be extended angularly relative to said trough portion, said trough portion and said clip thus defining a passage through which said conductor can be passed causing said clip to deflect relative to said trough portion through one of unitary pivotal movement and bowing movement and a combination of these movements sufficiently to clamp electrically and mechanically said conductor against said trough portion, said clip responding in tension to restrain disengagement of said conductor.

3. An electrical terminal device being positioned when used above a base surface, said device comprising a conductive lug having an arm for receiving a conductor, an elongated clip having an opening through which said arm is extended and having one end against said base surface, said clip opening being so located and said arm being so spaced from said base surface as to require said clip to be extended angularly relative to said arm, said arm and said clip defining a passage through which said conductor can be passed causing said clip to deflect relative to said arm through one of unitary pivotal movement and bowing movement and a combination of these movements sufficiently to clamp electrically and mechanically said

conductor against said arm, said clip responding in tension to restrain disengagement of said conductor, and means forming part of said clip for relaxing the clamping action on said conductor upon actuation by external cooperating means so as to release said conductor.

4. An electrical terminal device being positioned when used above a base surface, said device comprising a conductive lug having a cantilever arm for receiving a conductor, and an elongated clip having side and end portions circumscribing an opening with one of said clip end portions being located between said base surface and said arm, said arm extending through said clip opening, said end portion being so sized and said arm being so spaced from said base surface as to require said clip to extend angularly of said arm, said arm and said clip defining a passage through which said conductor can be passed to be engaged by said arm and by said clip which deflects relative to said arm through one of unitary pivotal movement and bowing movement and a combination of these movements, said clip being responsive in tension to engage the conductor more firmly when a withdrawal force is exercised on the conductor, the other of said clip end portions enabling said conductor to be released when said other end portion is forced away from the conductor.

5. An electrical terminal device being positioned when used above a base surface, said device comprising a resilient conductive trough portion for receiving a conductor, and an elongated clip having one end positioned on said base surface and having an opening through which said trough portion extends to provide a conductor receiving orifice bounded by the periphery defined by a transverse section of said trough portion and by an edge portion of said clip adjacent said clip opening, means for supporting said trough portion relative to said base surface and for normally holding said clip in angular relation to said trough portion, said clip deflecting relative to said trough portion and engaging said trough portion to force said trough portion away from said base surface as a cantilever when said conductor is passed through said orifice, said orifice boundary portions thereby being enabled to engage said conductor.

6. An electrical terminal device being positioned when used above a base surface, said device comprising a conductive lug having a conductor engaging portion, a clip having an opening through which said conductor engaging portion extends, means for supporting said lug and said clip relative to said base and for enabling said clip to be positioned angularly relative to said conductor engaging portion, said clip deflecting relative to said conductor engaging portion through one of unitary pivotal movement and bowing movement and a combination of these movements when a conductor is passed through said clip opening to be clamped against said conductor engaging portion.

7. An electrical terminal device being positioned when used above a base surface, said device comprising a conductive lug having a conductor engaging portion, a clip having an opening through which said conductor engaging portion extends, means for supporting said lug and said clip relative to said base and for enabling said clip to be positioned angularly relative to said conductor engaging portion, said clip deflecting relative to said conductor engaging portion through one of unitary pivotal movement and bowing movement and a combination of these movements when a conductor is passed through said clip opening to be clamped against said conductor or engaging portion, and said conductor engaging portion being deflected outwardly against said conductor in response to the deflection of said clip so as to enhance the clamping action.

8. An electrical terminal device being positioned when used above a base surface, said device comprising a conductive lug having a conductor engaging portion, a clip having an opening through which said conductor engaging portion extends, means for supporting said lug and said clip relative to said base and for enabling said clip to be positioned angularly relative to said conductor engaging portion, said clip deflecting relative to said conductor engaging portion through one of unitary pivotal movement and bowing movement and a combination of these movements when a conductor is passed through said clip opening to be clamped against said conductor engaging portion, said supporting means including a projection on said conductor engaging portion engageable with said clip so as to preclude withdrawal of said clip over said conductor engaging portion.

9. An electrical terminal device being positioned when used above a base surface, said device comprising a conductive lug having a conductor engaging portion, a clip having an opening through which said conductor engaging portion extends, means for supporting said lug and clip relative to said base and for enabling said clip to be positioned angularly relative to said conductor engaging portion, said clip deflecting relative to said conductor engaging portion through one of unitary pivotal movements and bowing movement and a combination of these movements when a conductor is passed through said clip opening to be clamped against said conductor engaging portion, and said clip being tensed when withdrawal movement of said conductor is attempted.

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