United States Patent

DeAngelo et al.

[15] **3,683,414**

[45] **Aug. 8, 1972**

[54] **TERMINAL DEVICE**

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[21] Appl. No.: **28,186**

Related U.S. Application Data

[63] Continuation of Ser. No. 731,246, May 22, 1968, abandoned.

[52] **U.S. Cl.** .....**339/272 UC,** 24/125 N, 339/274

[51] **Int. Cl.** **H01r 11/10**

[58] **Field of Search**.....339/217, 219, 251, 272, 274; 24/125 N, 135 N; 306/1.5; 287/54

[56] **References Cited**

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[57] **ABSTRACT**

An improved terminal device comprises resilient means for compensating for cold flow of a conductor that may be pressure-connected to the terminal device.

14 Claims, 5 Drawing Figures

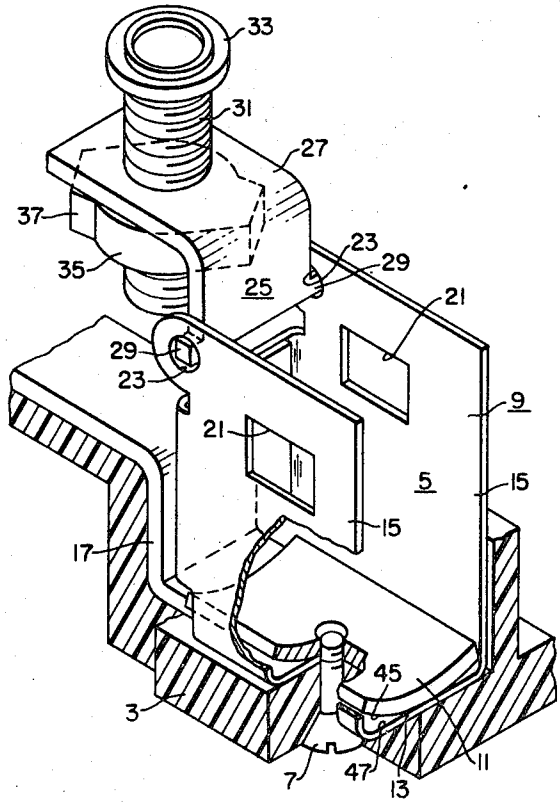


FIG. 1.

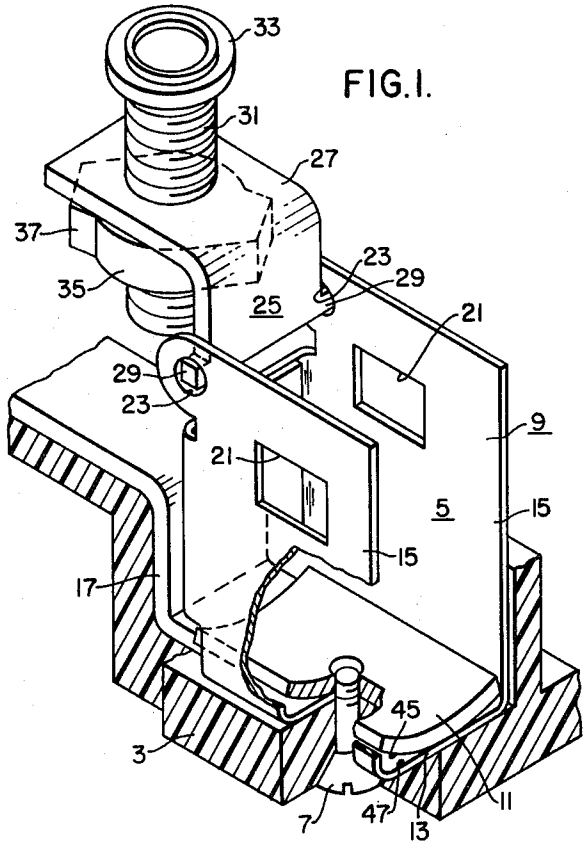


FIG. 2.

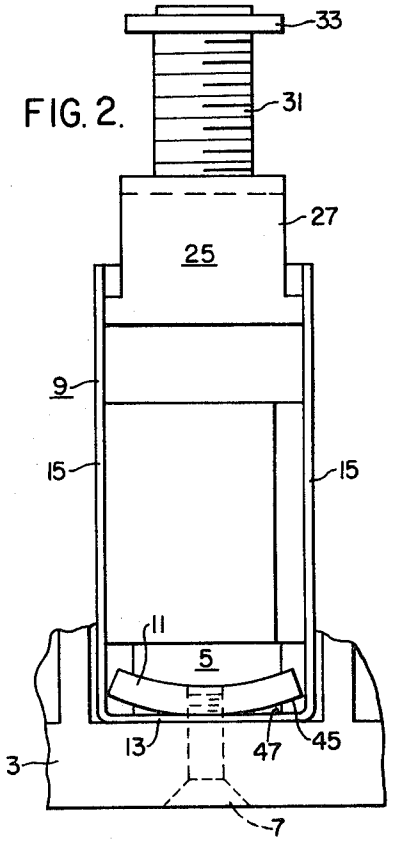
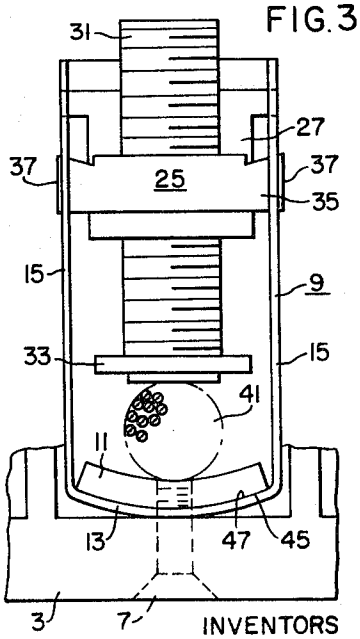


FIG. 3.



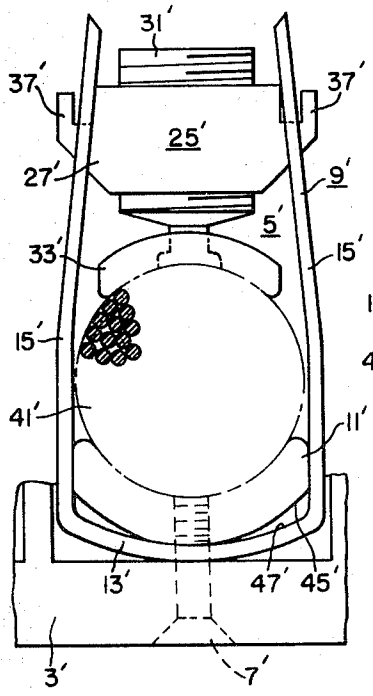


FIG. 4.

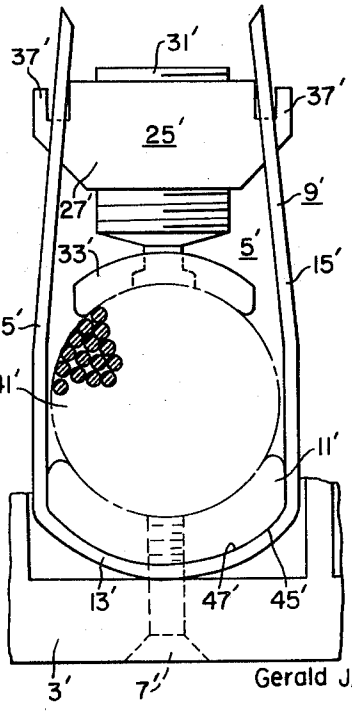


FIG. 5.

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TERMINAL DEVICE

This application is a continuation of application Ser. No. 731,246 filed May 22, 1968 and now abandoned.

CROSS-REFERENCE TO RELATED APPLICATION

This invention relates to terminal devices of the type disclosed in the copending application of Kenneth R. Coley, Serial No. 698,809, filed January 18, 1968.

PRIOR-ART AND BACKGROUND OF THE INVENTION

Terminal devices of the general type herein disclosed are disclosed in the patents to Rogoff U.S. Pat. No. 2,164,021; Thomas Jr. et al., U.S. Pat. No. 2,205,322; Gambale U.S. Pat. No. 2,780,793; and Bonnet et al., U.S. Pat. No. 2,877,443. In each of the above-mentioned patents, a terminal device comprises a clamp-type pressure connector that can be worked to a connected position to pressure-connect a conducting wire to the terminal device. It is well known, as evidenced by the introductory language in the above-mentioned Rogoff and Gambale patents, that conducting wire, and particularly aluminum conducting wire, has a tendency to cold flow under pressure. Thus, one of the problems in the terminal is that a pressure connection that is adequate at the time of the connection might thereafter loosen when the material of the conducting wire cold flows. Thus, an object of this invention is to provide an improved terminal device comprising resilient means for compensating for cold flow of a conductor that may be pressured-connected to the terminal device.

SUMMARY OF THE INVENTION

An improved terminal device is provided for connecting a conducting wire to a terminal conductor of the terminal device. The terminal device comprises a generally resilient U-shaped shell, a terminal conductor positioned within the shell and clamp means. Each of the opposite legs of the shell is provided with an opening therein, and the clamp means comprises a support member having a pair of ears that extend into the opening means to engage the opposite legs of the shell. A clamp screw is threaded on the support member. When it is desired to connect a conducting wire to the terminal conductor, the conducting wire is placed between the legs of the shell to rest on the terminal conductor and the clamp screw is rotated to move axially downward. During the downward movement of the clamp screw, pressure is applied to the conducting wire, and the clamp means is forced upwardly which movement is resisted by the engagement of the ears of the support member with the opposite legs of the shell. Thus, by rotating the clamp screw, substantial pressure can be applied to pressure-connect the conducting wire to the terminal conductor of the conducting means. The terminal conductor and the shell are shaped such that the generally resilient shell is spring-charged as the terminal device is tightened so that if the conducting wire should cold flow the bias of the spring-charged shell will compensate for the cold flow to maintain pressure between the conducting wire and the terminal conductor.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view, with parts broken away, illustrating a terminal device constructed in accordance with principles of this invention;

FIG. 2 is an end view, with parts broken away, of the structure seen in FIG. 1;

FIG. 3 is an end view similar to FIG. 2 illustrating the terminal device in a connected position connecting a conducting wire to the terminal device;

FIG. 4 is an end view similar to FIG. 3 illustrating a different embodiment of the invention with the terminal device being shown in the pre-connected position; and

FIG. 5 is a view similar to FIG. 4 with the terminal device being shown in the connected position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, there is shown, in FIGS. 1–3, an insulating support 3 and a terminal device 5 fixedly mounted on the insulating support 3 by means of a screw 7. The insulating support 3 may be part of the insulating housing of a circuit breaker as disclosed in the above-mentioned patent application of Kenneth R. Coley, Ser. No. 698,809.

The terminal device 5 comprises a generally U-shaped shell 9, of resilient material such as sheet steel, and a rigid terminal conductor 11. The shell 9 comprises a base part 13 and a pair of opposite leg parts 15 that extend upward from the base part 13. The terminal conductor 11 is positioned on the base part 13 between the legs 15. The screw 7, which extends through an opening in the insulating base 3 and through an opening in the base part 13 of the shell 9, is threaded into a tapped opening in the terminal conductor 11 to fixedly secure the terminal device 5 to the insulating support 3. Other means may be used to secure the terminal device 5 on the support 3. For example the support 3 could be formed with depressions and projections that would capture the terminal device 5 in place. The terminal conductor 11 is bent over to form an elongated conductor 17 that may be electrically connected with a pair of contacts in the manner disclosed in the above-mentioned application of Kenneth R. Coley, Ser. No. 698,809. An opening 21 is provided in each of the legs 15 of the shell 9. Another opening 23 is provided in each of the legs 15 of the shell 25.

In addition to the shell 9 and terminal conductor 11, the terminal device 5 comprises clamp means 25. The clamp means 25 comprises a generally L-shaped metallic rigid support member 27 having a pair of projections 29 extending outward at the opposite sides of one leg thereof. The projections 29 are positioned in the openings 23 of the shell 9 to pivotally support the clamp means 25 for movement about the axis of the projections 29. A clamp screw 31, having a pressure plate or clamp plate 33 at one end thereof, is threaded in a tapped opening in the support member 27 to threadedly support the clamp screw 31 on the support member 27. The clamp means 25 also comprises a rigid support member 35 that is threadedly mounted on the clamp screw 31 and that comprises a pair of ears or shoulder projections 37. The support member 35 is threaded on the clamp screw 31 with a spacing of ap-

proximately one-half of a thread between the bottom of the support member 35 and the adjacent top surface of the support member 27. The clamp screw 31 is provided with an opening at the end opposite the end that supports the clamp plate 33 for receiving a tool that may be used to rotate the clamp screw 31.

When it is desired to connect a conducting line 41 (FIG. 3) to the terminal device 5, the clamp means 25 is pivoted about the axis of the ears 29 to the open position seen in FIGS. 1 and 2. During this movement to the open position, the clamp means 25 moves along a plane parallel to the planes of the side walls 15 of the shell 9. With the clamp means 25 in the open position seen in FIGS. 1 and 2, the conducting line 41 may be moved down into position through the open top of the shell 9 to rest on the terminal conductor 11. The conducting line 41 extends into the shell 9 through the open end seen on the right in FIG. 1. With the conducting line 41 resting on the terminal conductor 11, the clamp means 25 is pivoted from the open position seen in FIG. 3 to a preconnected position wherein the pressure plate 33 rests on top of the conducting line 41. With the clamp means 25 in the preconnected position, the clamp screw 31 is rotated to the connected position seen in FIG. 3. As the clamp screw 31 is rotated to the connected position, the ears 37 on the support member 35 enter into the openings 21 (FIG. 1) in the side walls 15 until the ears 37 engage edges of the openings 21 which engagement prevents further rotational movement of the member 35. With the support member 35 prevented from rotating, further rotation of the clamp screw 31 continues to move the screw 31 axially downward and the pressure plate 33 is thereby forced against the conducting line 41. As can be seen in FIG. 2, the bottom surface 45 of the terminal conductor 11 is curved so that the bottom surface extends laterally, from the center which rests on the base plate 13, in a curved upward direction. The front surface 47 of the base 13 is generally flat so that there is a space at each side of the terminal conductor 11, between the surface 47 of the base 13 and the angular surface 45 of the terminal conductor 11. As was previously set forth, the terminal conductor 11 is a generally rigid conductor and the shell 9 is a generally resilient member. As pressure is exerted on the conducting line 41, the force tends to lift the clamp means 25 tending to move the clamp means 25 toward the open position seen in FIG. 1. This opening movement of the clamp means 25 is prevented by the engagement of the ears 37 with the upper edges of the side walls at the openings 21, and as the screw 31 is tightened, the force will draw the side walls 15 of the generally resilient shell 9 upward until the surface 47 of the base 13 mates with the curved surface 45 of the terminal conductor 11 (FIG. 3) whereupon an additional tightening movement will increase the pressure connection between the conducting line 41 and the terminal conductor 11. When the screw 31 is in the fully connected position, the conducting line 41 is sandwiched between the pressure plate 33 and the terminal conductor 11 with an effective pressure connection, and the shell 9 is spring-charged (FIG. 3) so that if the material of the conducting line 41 cold-flows at some time after the connection has been made, the resilience or bias of the spring-charged shell 9 will serve to compensate for the cold flow of the conducting line to thereby maintain connecting pressure between the conducting line 41 and the terminal conductor 11. As can be seen in FIG. 3, the front surface of the terminal conductor 11 is also curved to provide increased contact area between the conducting line 41 and the front surface of the terminal conductor 11. The conducting line 41 is a standard type of conducting wire that is made up of a plurality of conducting strands.

When it is desired to disconnect the conducting line 41 from the terminal device 5, the screw 31 is rotated in the opposite direction. During the initial part of this movement, the support member 35, which is free to move in the opening direction in the openings 21, is rotated with the screw 31 until the ears 37 leave the openings 21 and until a part of the member 35 engages a suitable stop part of one leg of the support member 27. Further rotation of the screw 31 is not necessary because when the ears 37 are free of the opening 21 the clamp means 25 is free to be pivoted about the axis of the projections 29 to the open position seen in FIGS. 1 and 2. With the clamp means 25 in the open position seen in FIGS. 1 and 2, the conducting line 41 can be removed from the terminal device 5.

Another embodiment of the invention is shown in FIGS. 4 and 5. In FIGS. 4 and 5, the parts that are similar to parts of the first embodiment (FIGS. 1–3) are given the same reference characters as the parts of the first embodiment, with the reference characters being primed in FIGS. 4 and 5. As can be seen in FIGS. 4 and 5, the conducting line 41′ is a larger-diameter line, and the surfaces of the terminal conductor 11′ and pressure plate 33′ that engage the conducting line 41′ are curved to provide increased surface engagement between the line 41′ and the members 11′, 33′. The pressure plate 33′ is mounted on the inner part of the screw 31′ with a swivel-type mount so that the screw 31′ can be rotated without rotating the pressure plate 33′ which will move axially with the screw 31′. The support member 27′ serves both functions of the supports 27 and 35 of the first embodiment in that the screw 31′ is threaded on the support member 27′ and the ears 37′ are formed integral with the support member 27′. The support member 27′ is not supported for pivotal movement on the shell 9. When it is desired to remove the clamp means 25′, the legs 15′ are spread apart and the clamp means 25′ is removed completely away from the shell 9. As can be seen in FIGS. 4 and 5, the legs 15′ are formed to converge inwardly so that when the clamp means 25′ is moved in position and the legs 15′ are released they will move inwardly and the ears 37′ will project through the openings in the legs 15′. Although the base 13′ is curved, it can be seen that the radius of curvature is longer than the radius of curvature of the bottom portion 45′ of the terminal conductor 11′ so that there are spaces at the lateral corners between the surface 47′ of the base 13′ and the surface 45′ of the terminal conductor 11′. When it is desired to pressure-connect the conducting wire 41′ to the terminal device 5′, the clamp means 25′ loosened or removed and the conducting wire 41′ is placed in position. The clamp means 25′ may be positioned in the pre-connected position seen in FIG. 4.

In order to pressure-connect the conducting wire 41′ to the terminal conductor 11′, the screw 31′ is rotated to move the pressure plate member 33′ downward with

the ears 37' engaging the legs 15' at the upper edges of the associated openings to resist upward movement of the clamp means 25'. As the clamp means 25' is tightened, the legs 15' are drawn upward closing the openings between the surface 47' and the surface 45' (FIG. 4) until the surface 47' mates with the surface 45' whereupon an additional tightening movement will provide a firm pressure-connection between the conducting wire 41' and the terminal conductor 11'. It can be understood that when the clamp means is in the connected position seen in FIG. 5 the shell 9 is spring-charged so that if the material of the conducting line 41' should cold flow at a time subsequent to the tightening or connecting operation, the resilience or bias of the spring-charged shell 9 will compensate for the cold flow to maintain connecting pressure between the conducting line 41' and the terminal conductor 11'.

What we claim is:

1. A terminal device comprising a generally rigid terminal conductor, a shell of generally resilient material, said shell being generally U-shaped and comprising a base part and a pair of leg parts extending upward from the base part in a generally parallel relationship, said terminal conductor being positioned over said base part between said leg parts, said terminal conductor and said shell being formed to provide a space at each lateral side of said shell between said terminal conductor and said base of said shell, said terminal device comprising clamp means, with a conducting wire placed between the leg parts of said shell on said terminal conductor said clamp means being operable from a pre-connected position to a connected position during which movement said clamp means exerts a downward force on said conducting wire and an upward force on said leg parts of said shell to pressure-connect said conducting wire to said terminal conductor and during which movement said shell flexes to a spring-charged condition as said leg parts of said shell are drawn upward diminishing said spaces whereby if said conducting wire subsequently cold flows the bias of said spring-charged shell will compensate for said cold flow to maintain pressure between said conducting wire and said terminal conductor, and substantially all of the spring charging action of said shell occurring through the flexing of said shell that diminishes said spaces, said leg parts of said shell being generally flat leg parts extending upward from said base part in a generally parallel relationship, each of said leg parts of said shell having an opening therein, said clamp means comprising support means and a clamp screw threadedly mounted on said support means, said support means comprising a pair of ear projections, in said connected position of said terminal device said ear projections being positioned in said openings and said clamp screw being adjusted to force said conducting wire downward into pressure engagement with said terminal conductor which downward force operates to bias said clamp means upward such that said ears in said openings engage said leg parts to draw said leg parts upward to spring-charge said shell.

2. A terminal device according to claim 1, said terminal conductor comprising a back surface shaped to engage the base part of said shell and shaped to provide said spaces between said back surface and said base part of said shell in the pre-connected position which spaces are diminished as said shell is spring-charged when said clamp means is operated to the connected position.

3. A terminal device according to claim 2, an insulating support, and mounting means fixedly supporting said base part of said shell and said terminal conductor on said insulating support.

4. A combination according to claim 3, said insulating support having opening means therein, said base part of said shell having opening means aligned with the opening means of said insulating support, said terminal conductor having a tapped opening therein aligned with said opening means of said base part and said opening means of said insulating support, and a screw member passing through said opening means in said insulating support and through said opening means in said base part of said shell and being threaded in said tapped opening in said terminal conductor to fixedly mount said terminal device on said insulating support.

5. A combination according to claim 4, said terminal conductor comprising a curved front surface for providing increased surface contact between said terminal conductor and said conducting wire.

6. A combination according to claim 5, said clamp means comprising said clamp screw and a pressure plate connected to said clamp screw with a swivel-connection which permits said clamp screw to be rotated without rotating said pressure plate while moving said pressure plate axially with said clamp screw, and said pressure plate having a curved surface for engaging said conducting wire in the connected position of said terminal device.

7. A terminal device comprising a generally rigid terminal conductor, a shell of generally resilient material, said shell being generally U-shaped and comprising a base part and a pair of generally flat leg parts extending upward from the base part, said terminal conductor being positioned over said base part between said leg parts, said terminal conductor and said shell being formed to provide a space at each lateral side of said shell between said terminal conductor and said base of said shell, said terminal device comprising clamp means, with a conducting wire placed between the leg parts of said shell on said terminal conductor said clamp means being operable from a pre-connected position to a connected position during which movement said clamp means exerts a downward force on said conducting wire and an upward force on said leg parts of said shell to pressure-connect said conducting wire to said terminal conductor and during which movement said shell flexes to a spring-charged condition as said leg parts of said shell are drawn upward diminishing said spaces whereby if said conducting wire subsequently cold flows the bias of said spring-charged shell will compensate for said cold flow to maintain pressure between said conducting wire and said terminal conductor, and substantially all of the spring charging action of said shell occurring through the flexing of said shell that diminishes said spaces.

8. A terminal device according to claim 7, said terminal conductor comprising a bottom surface resting on the base part of said shell in proximity to the transverse center portion of said terminal conductor with said bottom surface moving frontward away from said base part at the lateral sides of said terminal conductor

to provide one of said spaces between said bottom surface of said terminal conductor and said base part of said shell at each side of said center portion of said terminal conductor in the pre-connected position of said terminal device.

9. A terminal device according to claim 7, each of said leg parts of said shell having an opening therein, said clamp means comprising support means and a clamp screw threadedly mounted on said support means, said support means comprising a pair of ear projections, in said connected position of said terminal device said ear projections being positioned in said openings and said clamp screw being adjusted to force said conducting wire downward into pressure engagement with said terminal conductor which downward force operates to bias said clamp means upward such that said ears in said openings engage said leg parts to draw said leg parts upward to spring-charge said shell.

10. A terminal device according to claim 9, said terminal conductor comprising a back surface shaped to engage the base part of said shell and shaped to provide said spaces between said back surface and said base part of said shell in the pre-connected position which spaces are diminished as said shell is spring charged when said clamp means is operated to the connected position.

11. A terminal device according to claim 10, an insulating support, and mounting means fixedly supporting said base part of said shell and said terminal conductor on said insulating support.

12. A combination according to claim 11, said insulating support having opening means therein, said base part of said shell having opening means aligned with the opening means of said insulating support, said terminal conductor having a tapped opening therein aligned with said opening means of said base part and said opening means of said insulating support, and a screw member passing through said opening means in said insulating support and through said opening means in said base part of said shell and being threaded in said tapped opening in said terminal conductor to fixedly mount said terminal device on said insulating support.

13. A combination according to claim 12, said terminal conductor comprising a curved front surface for providing increased surface contact between said terminal conductor and said conducting wire.

14. A combination according to claim 13, said clamp means comprising said clamp screw and a pressure plate connected to said clamp screw with a swivel-connection which permits said clamp screw to be rotated without rotating said pressure plate while moving said pressure plate axially with said clamp screw, and said pressure plate having a curved surface for engaging said conducting wire in the connected position of said terminal device.

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