July 21, 1964 E. J. NIELSEN 3,141,722

PRESSURE WIRE TERMINAL CLAMP WITH SELF-RETAINED WIRE CLAMP

Filed May 7, 1962

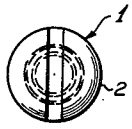


Fig. 1.

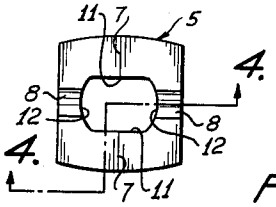


Fig. 3.

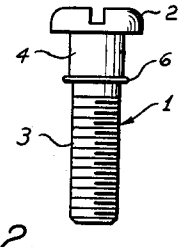


Fig. 2.

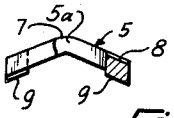


Fig. 4.

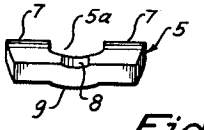


Fig. 5.

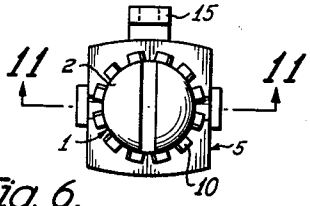


Fig. 6.

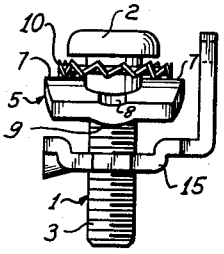


Fig. 10.

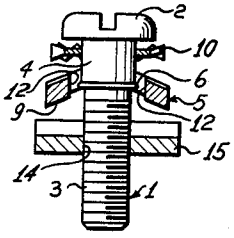


Fig. 11.

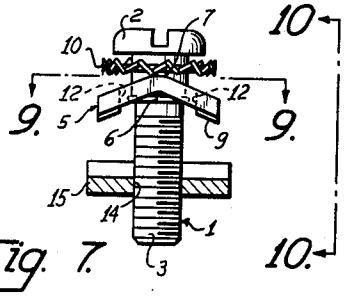


Fig. 7.

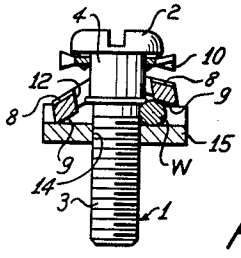


Fig. 12.

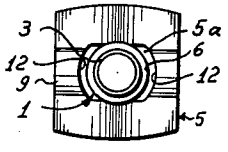


Fig. 8.

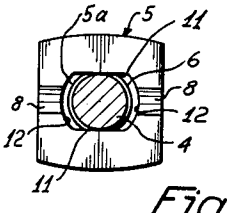


Fig. 9.

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PRESSURE WIRE TERMINAL CLAMP WITH SELF-RETAINED WIRE CLAMP

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This invention relates to electrical connectors and more particularly to a terminal connector by which one or two electrical conductors or wires can be detachably secured to a terminal.

The invention is described herein as embodied in a wire connector of the type disclosed in U.S. Patent No. 3,081,507, issued March 19, 1963, of Joseph J. Gribble, entitled "Wire Connector," wherein it is particularly desirable, its use in connection with other clamps being readily apparent from the illustrative example.

More specifically the invention is directed to a connector employing a screw and clamp wherein the clamp is held captive to the screw.

Heretofore screws with captive clamps have been employed in wire connectors. However, in such captive clamp structures adequate provision has not been made for securing the clamp to the screw in a manner assuring adequate rocking of the clamp relative to the screw so that the clamp can accommodate itself to the particular wire being connected thereby without binding on the screw, while at the same time assuring withdrawal of the clamp by the screw from a connected wire with a very few turns of the screw.

The specific advantages of the present invention are that the clamp is lifted by the screw from clamping position upon very slight axial movement of the screw in the unscrewing direction, that the clamp can rock freely about an axis of the screw without binding so that it accommodates itself properly to the wire during its application, and the clamp is mounted on a screw having an enlarged shank between the under side of the screw and the inner end of the threaded portion of the screw. Various other objects and advantages will become apparent from the following description, wherein:

FIG. 1 is a top plan view of the screw of the present connector, with the clamp removed;

FIG. 2 is a side elevation thereof;

FIG. 3 is a top plan view of a clamp to be associated with the screw;

FIG. 4 is a vertical sectional view of the clamp taken on the line 4—4 in FIG. 3;

FIG. 5 is a right side elevation of the clamp illustrated in FIGS. 3 and 4;

FIG. 6 is a top plan view of the screw and clamp in assembled relation, with a lock washer between the screw head and the clamp, connected to an electrical terminal conductor;

FIG. 7 is a front elevation of the assembled screw, clamp, and lock washer, illustrated in FIG. 6;

FIG. 8 is a bottom plan view of the screw and clamp assemblage of FIG. 7, the terminal conductor being omitted for clearness in illustration;

FIG. 9 is a horizontal sectional view taken on the line 9—9 in FIG. 7;

FIG. 10 is a right side elevation of the assemblage shown in FIG. 7;

FIG. 11 is a vertical sectional view taken on the line 11—11 in FIG. 6; and

FIG. 12 is a view similar to FIG. 11, showing the screw and clamp in an installed position on the terminal conductor in which it is clamping a single wire.

Referring to the drawings, the electrical connector is described herein for convenience in an upright position.

It comprises a screw 1 having at its upper end a head 2 of the type adapted for operative engagement by a screwdriver. Beginning at its lower end, the screw has a threaded portion 3 which extends back toward the head and terminates at its upper end in spaced relation to the underside of the head. A shank 4 is provided between the head and inner end of the portion 3. Preferably, the shank 4 is of larger diameter than the threaded portion 3. A clamp 5 is mounted on the shank 4. In order to mount the clamp 5 on the shank 4 in a captive relation and for proper rocking relative to the screw axis, the clamp 5 is provided with a central opening 5*a* in which the shank 4 is accommodated. A portion of the metal of the shank 4 beneath the clamp 5 is formed into an annular bead 6 which renders the clamp 5 captive to the screw shank 4.

The clamp 5 is one such as described in the above identified co-pending application. It comprises a small sheet metal plate bent or bowed between its lateral edges to V-shape cross section. It is disposed on the shank so as to be concave downwardly or away from the head 2 while providing a ridge 7 exposed toward the head 2. The clamp 5 is stamped to form a groove 8 on its upper face and an underhanging ridge or abutment 9 on its lower face. The groove and abutment are positioned to extend transversely of a length of the wire to be gripped thereby. In mounted position of the clamp 5 the abutments 9 are pressed against wires at the opposite sides of the screw and force the wires inwardly of the connector clamp 5 and against the screw 1, as more fully described in the above co-pending application.

The clamp 5 is slid onto the shank 4 of the screw 1 with its ridge 7 facing toward the underside of the head 2 prior to the forming of the annular bead 6 on the bolt. If desired, a lock washer 10 may be mounted on the shank between the upper face of the clamp 5 and the underside of the head 2. After the clamp is assembled on the shank 4, the bead 6 is formed to make the clamp captive to the screw.

In order to assure proper rocking of the clamp 5 on the shank 4, the opening 5*a* is elongated in a direction transversely of the ridge 7 for proper cooperation with the bead 6. The bead has a greater diameter than the minimum diameter of the opening 5*a* whereby it engages the clamp at the edges 11 of the opening 5*a*, at the ends of the minimum diameter, with an interference fit which prevents the clamp 5 from sliding off the screw. However, it is necessary that the clamp rock freely about a rocking axis, transversely of the screw axis, which is generally parallel to the ridge 7 or to the minimum diameter of the opening 5*a* so as to accommodate itself properly to the wire. The major diameter of the opening 5*a* is such that the bead 6 can enter part way into the opening 5*a* near its ends 12 consequent upon rocking of the clamp about the said rocking axis.

As illustrated in FIG. 7, the screw is to be fastened into a threaded bore 14 of a metal terminal conductor 15 by threaded engagement therewith. In FIG. 7 the clamp is shown in its lowered position resting on the bead 6. When it is desired to clamp a wire between the clamp 5 and the terminal conductor 15, the screw is screwed into the bore sufficiently to hold it in place. Wires W are inserted beneath the clamp 5 at opposite sides of the screw 1. The screw is then screwed down, lowering the clamp until the clamp rests on the wire. Further downward movement of the screw causes the bead 6 to move downwardly out of engagement with the clamp. Next, the underside of the screw head 2 engages the ridge 7 and applies adequate downward pressure on the top of the ridge 7 to force the wire W tightly against the conductor 15 and the clamp into tight clamping engagement with the

wire. As the clamp is moved into clamping position, the abutments 9 cam the wires W toward and against the screw. If two wires are being connected, then, of course, the clamp retains a horizontal position, as illustrated in FIG. 7, as it is lowered. In this position its corners are equidistant from the upper surface of the conductor 15 while the ridge 7 is against the underside of the head and the clamp is holding the wires in connected position. However, as illustrated in FIG. 12, quite frequently only a single wire W will be clamped to the conductor 15 by the clamp 5, in which case the clamp must tilt to a position such as illustrated in FIG. 12, so that its corners are considerably a greater distance above the conductor 15 at one side of the screw than at the other side. Since the opening 5*a* is elongated and has an interference fit with the bead 6 only at two points on the edges 11 of the opening, and clearance at the ends 12 of the opening, the clamp can rock without binding so as to engage the wire indicated at W, draw it tightly against the upper face of the conductor 15 and inwardly against the side of the screw 1.

To assure proper rocking, the bead 6 is spaced a sufficient distance from the underside of the head in relation to the thickness of the clamp 5 and the height of the ridge 7, so that one or two turns of the screw in the unscrewing direction are sufficient to start the raising of the clamp 5 clear of the wires when two wires are clamped.

Another turn or two can raise it clear of a single clamped wire.

The axial movement of the clamp relative to the head is very limited, being only a very small fraction of the movement heretofore permitted in captive clamps. In the form illustrated, for example, the clamp is about .060 inch in thickness and its maximum movement axially relative to the head is .030 inch. The diameter of the shank is about .150 inch, and the diameter of the bead is about .170 inch. The hole has a minor diameter of about .160 inch and a major diameter of about .190 inch. These figures, of course, are not limitations but indicate the proper proportioning of the clamp and the screw for a given size of screw.

Preferably, the axial distance between the bead and the underside of the head of the screw is the minimum distance which will not impair maximum tilting of the clamp on the screw during clamping of the wire or wires by the clamp. If a lock washer is included in the assembly, the axial distance between the screwhead and bead must be increased to compensate for the thickness of the lock washer. When the parts are sized according to the foregoing a minimum rotation of the screw from the tightening position in the loosening direction will cause an earliest controlled movement of the clamp from the clamping position.

As mentioned, a lock washer 10 may be disposed between the under face of the head 2 and the upper face of the clamp 5, or it may be omitted. Herein, and in the claims, wherein it is said that the underside of the head is in pressure engagement with the clamp, it is to be understood that this is to include the direct engagement of the under face of the head with the upper face of the clamp or the pressure exerted by the under face of the head through a lock washer on the upper face of the clamp.

Having thus described my invention, I claim:

1. A screw and captive clamp assembly for clamping conductors to a terminal and comprising a screw having a head at one end with an underside facing toward the other end, a threaded portion extending from the other end toward the head and terminating part way toward the head from said other end, and a smooth shank between the underside of the head and the adjacent end of the thread, a rigid clamp having an oblong opening therethrough, said shank being accommodated in the opening, a raised annular bead on the screw in spaced relation to the underside of the head for retaining the clamp on the shank with limited axial movement relative to the shank, said bead having a greater diameter than the width of the opening and less diameter than the length of the opening so that the circumferential portion of the bead facing the end of the opening can enter the opening upon tilting of the clamp relative to the screw, about an axis extending transversely of the opening, said clamp having clamping portions at opposite sides of said axis, respectively, said portions having upper surfaces, respectively, which slope upwardly toward the undersurface of the head of the screw inwardly, endwise of the opening, toward the screw axis and thereby provide a ridge which is interrupted by the opening and extends in a direction generally transversely of the opening, and which is engageable by the underside of the head, whereby the clamp can rock about said ridge as a fulcrum as the clamp is moved by the screw head to clamping position, and said clamping portions having undersurfaces, respectively, for engaging conductors to be clamped.

2. The screw and clamp assembly according to claim 1 wherein the undersurfaces of said clamping portions, respectively, slope upwardly inwardly toward the screw axis in said direction endwise of the opening so that the clamp is of inverted V-shaped section in a plane defined by the screw axis and in endwise dimension of the opening, and the bead is disposed between the undersurface of the clamp and a plane through the lower edges of the clamp and normal to said first plane.

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