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SCREW TERMINAL**BACKGROUND OF THE INVENTION**

This invention relates generally to screw terminals and, more particularly, to a screw terminal which comprises a terminal
5 frame for holding therein an electric wire by means of a screw fastened, and a terminal plate having a terminal contact electrically connected to the wire through the screw.

DESCRIPTION OF RELATED ART

There has been known such screw terminal that comprises
10 the terminal frame which holds therein the electric wire by fastening the screw and the terminal plate which is electrically connected through the screw to the wire.

As shown in FIGS. 19A and 19B, for example, a known screw terminal has been arranged such that a terminal plate 70 having
15 a terminal contact 71 is formed integrally on one body side (left-hand side in FIG. 19A) of a terminal frame 72 having on the other body side (right-hand side in FIG. 19A) thereof a screw hole 73, and the electric wire (not shown) disposed along inner periphery of the terminal plate 70 is held against the periphery
20 with a screw (not shown) inserted and fastened through the screw hole 73 so as to connect electrically the wire to the terminal plate 70. In this case, there has been an advantage that the terminal plate 70 and terminal frame 72 made integral need not be mutually connected at any later step.

25 Also in Japanese Registered Utility Model No. 2,506,602, there has been suggested a screw terminal in which a terminal frame holding therein the electric wire is formed integral with the terminal plate.

However, the screw terminal varies much in the type, including one considerably complicated in integralizing configuration between the terminal frame and plate, so that blanking efficiency in preparing parts has been low to be
5 remarkable in wasted amount of material and thus to be high in costs. Because of the complicated integralizing configuration, further, there has been a problem that metal molds and the like facilities have been costly.

SUMMARY OF THE INVENTION

10 Taking into account the foregoing, an object of the present invention is to provide a screw terminal made low in the manufacturing costs.

The above object of the present invention is realized by a screw terminal characterized in comprising a terminal frame
15 formed from a plate metal rolled annular with both ends thereof mutually coupled and having a threaded hole made through peripheral wall of the frame for holding an electric wire between inner periphery and a tip end of a screw fastened through the threaded hole, and a terminal plate having a terminal contact
20 and mounted to the terminal frame to be electrically connected to the electric wire through the screw. In this screw terminal, the terminal frame and plate respectively formed separately are mutually mounted to be integral, they are respectively not complicated in the configuration so that, in contrast to the case
25 of integralization, the blanking efficiency is made high and excellent in avoiding waste of material, to restrict required costs for such facilities as the metal molds, and to reduce the manufacturing costs.

Other objects and advantages of the present invention shall be made clear in the following description of the invention detailed with reference to preferred embodiments shown in accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view in a first embodiment of the screw terminal according to the present invention;

FIGS. 2A, 2B and 2C show respectively a front view, a bottom view and a side view of the screw terminal in FIG. 1;

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FIG. 3 is an explanatory view for assembling work of the screw terminal of FIG. 1;

FIG. 4 is a perspective view of a terminal frame only of the screw terminal in FIG. 1;

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FIGS. 5A, 5B and 5C are respectively a plan view, a front view and a side view of the terminal frame in the screw terminal of FIG. 1;

FIG. 6 shows in a perspective view the screw terminal in a second embodiment according to the present invention;

FIGS. 7A, 7B and 7C are respectively a front view, a bottom view and a side view of the screw terminal in the embodiment of FIG. 6;

FIG. 8 is an explanatory view for assembling work of the screw terminal in the embodiment of FIG. 6;

FIG. 9 is an explanatory view of a mounting state of the screw terminals in the first and second embodiments onto a casing;

FIG. 10 is a perspective view of the screw terminal in a third embodiment according to the present invention;

FIGS. 11A, 11B and 11C are respectively a front view, a bottom view and a side view of the screw terminal in the third embodiment of FIG. 10;

FIG. 12 is an explanatory view for an assembling work of
5 the screw terminal in the third embodiment according to the present invention; FIG. 13 is a perspective view of the screw terminal in a fourth embodiment according to the present invention;

FIGS. 14A, 14B and 14C are respectively a front view, a
10 bottom view and a side view of the screw terminal in the fourth embodiment of FIG. 13;

FIG. 15 is an explanatory view for the assembling work of the screw terminal in the fourth embodiment according to the present invention;

15 FIG. 16 is an explanatory view for the operation of the screw terminal in the fourth embodiment of FIG. 13;

FIGS. 17A and 17B are respectively a partial section of the screw terminal in the fourth embodiment of FIG. 13;

FIG. 18 shows in a perspective view a state in which the
20 screw terminal of FIG. 1 is used in practice; and

FIGS. 19A and 19B show respectively in a plan view and a side view a known screw terminal.

While the present invention shall now be described with reference to the respective embodiments shown in the
25 accompanying drawings, it should be appreciated that the intention is not to limit the invention only to these embodiments shown but rather to include all alterations, modifications and equivalent arrangements possible within the scope of appended

claims.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1 to 3, there is shown a screw terminal in an embodiment according to the present invention, which comprises
5 a terminal frame 1 and a terminal plate 10 mounted to the frame. As shown in FIGS. 4 and 5, the terminal frame 1 is constituted by rolling a plate metal to be annular so that, in its section, one lengthwise side 1e will be square and the other lengthwise side will be semicircular, while both ends of the plate metal
10 are mutually coupled by engaging one end of which formed as a coupling projection 1c in the other end of which formed as a coupling recess 1d. Here, the coupling projection 1c is formed substantially in T shape, and the coupling recess 1d is formed complement of the T shape for receiving the projection 1c. In
15 the one lengthwise side 1e forming part of peripheral wall of the terminal frame 1, a threaded hole 1a is bored through the wall for passing a screw (not shown), and outer periphery of this threaded hole 1a is formed in a countersink rim 1b preferably by means of a burring work, so as to increase contacting surface
20 area between the terminal frame 1 and the screw which is preferably a countersunk type. The one lengthwise side 1e of the terminal frame 1 is further provided with a columnar projection 6 for mounting thereto as caulked the terminal plate 10 and with a tab 7 projected at one lengthwise end and raised
25 in the same direction as the projection 6.

On the other hand, the terminal plate 10 is formed substantially in U or L shape, one longer end part 10a of which is placed on the one lengthwise side 1e, with the projection 6

of the terminal frame 1 inserted in a hole 11 made in the one longer end part 10a and with the countersink rim 1b of the terminal frame 1 inserted through an inserting hole 10e made in the end part 10a of the terminal plate 10 at a position corresponding to the rim 1b. In the present instance, an intermediate part 10b of the U-shaped terminal plate 10 is placed against one axial end opening of the terminal frame 1, and the other shorter end part 10c of the U-shaped terminal plate 10 having on outer face a terminal contact 10d is disposed to oppose the other semicircular side opposite to the square side of the frame 1.

Further, the raised tab 7 on the square side 1e of the terminal frame 1 is inserted in an opening 12 made at a corner part between the one end part 10a and the intermediate part 10b of the terminal plate 10. When the terminal plate 10 is mounted to the terminal frame 1, in particular, both side edges of the tab 7 are brought into contact with both side edges of the opening 12, whereby the terminal plate 10 is prevented from being tumbled or rotated and a load on caulked mounting portion of the terminal plate 10 to the projection 6 of the terminal frame 1 is reduced. It is also possible to replace the projection 6 with a welding by means of a large electric current with respect to a current concentrating portion, for coupling the terminal frame and plate 1 and 10.

As shown in FIG. 3, a screw 13 is screwed in a direction A into the threaded hole 1a made in the one square side 1e of the terminal frame 1, so that an end of the electric wire (not shown here) inserted in a direction B from the other axial end opening into interior space of the frame 1 will be fastened as

held between a tip end 13a of the screw 13 and an inner periphery 5 on semicircular side opposite to the square side 1e of the terminal frame 1, the electric wire is thus mechanically held, and the terminal plate 10 is electrically connected to the wire.

5 When the wire is inserted in the direction B into the interior of the terminal frame 1, the intermediate part 10b of the terminal plate 10 closing the one axial opening of the frame 1 is effective to prevent the wire from being excessively inserted. In this manner, a screw terminal P1 is constituted by the terminal frame 10 1, terminal plate 10 and screw 13.

The screw terminal according to the present invention will be incorporated, for example, in a plug-socket 60 having a switch, as shown by dotted lines in FIG. 18, wherein three of the screw terminals of the present embodiment are employed (with the 15 terminal frame 1 shown as simplified). The plug socket 60 includes a switch lever 62 exposed on front side face, and three plug-blade inserting ports 60b opened also on that face, which ports 60b are disposed on top face of a projected land 60a on the front face of the socket 60, and a cover plate 61 having 20 apertures 61a and 61b respectively for exposing the top face of the land 60a and switch lever 62 is fitted over the socket 60.

In another embodiment shown in FIGS. 6 and 7, the terminal plate 20 substantially U-shaped is mounted to the terminal frame 1 such that the intermediate part 20a is fitted over the square side 1e of the frame 1, a shorter blind end part 20b closes one 25 axial end opening of the frame 1 and the other longer end part 20c having at extended end a terminal contact 20h is fitted over the other axial end opening of the frame 1. The intermediate

part 20a of the plate 20 is provided with the inserting hole 20e for the countersink rim 1b and the receiving hole 21 for the caulking projection 6 of the frame 1, and the longer end part 20c is provided with a wire inserting hole 20f matching with the
5 other axial end opening of the frame 1 and with short bent parts 20g at both widthwise side edges towards the shorter end part 20b and forming locking parts.

The opening 22 for inserting the tab 7 of the terminal frame 1 is made at a corner part between the intermediate part
10 20a and the longer end part 20c of the terminal plate 20 so that, when the terminal plate 20 is mounted to the terminal frame 1, both side edges of the tab 7 engage with both side edges 22a of the opening 22 so as to prevent the terminal plate 20 from being tumbled or rotated and to reduce any load to the caulked mounting
15 part of the projection 6 to the receiving hole 21. Instead of the projection 6, the welding by means of a large current with respect to the current concentrating part may be performed to couple the terminal frame and plate 1 and 10.

Here, as shown in FIG. 8, the screw 13 is fastened into
20 the threaded hole 1a in the square side 1e of the terminal frame 1 in the direction A to hold, between the tip end 13a of the screw 13 and the opposing inner periphery 5 of the frame, the wire (not shown) inserted in the direction B from the wire inserting hole 20f in the longer end part 20c of the terminal plate 20 into the
25 interior of the terminal frame 1, whereby the wire can be mechanically held and the wire and terminal plate can be electrically connected through the screw. The shorter end part 20b of the terminal plate 20 is acting as means for preventing

any excessive insertion of the wire being inserted in the direction B. In this manner, a screw terminal P2 is constituted by the terminal frame 1, terminal plate 20 and screw 13.

While the screw terminal P1 shown in FIGS. 1 and 2 is disposed within a casing of wiring equipment and so on in the posture shown in FIG. 3, the screw terminal P2 shown in FIGS. 6 and 7 is disposed in the casing in the posture shown in FIG. 8 in which the terminal frame 1 is reversed in the vertical direction in contrast to that in FIG. 3. In this case, the position of the threaded hole 1a of the terminal frame 1 is so set, as shown in FIG. 9, that the height at the axial line of the screw with respect to a plane of the casing on which the screw terminal is disposed will be the same even when the screw terminal is reversed in the axial direction, as shown in FIG. 9.

In FIG. 9, the screw terminal P1 is disposed to place one end E of the terminal frame 1 to be up and the other end F to be down, whereas the screw terminal P2 is disposed to place the one end E down and the other end F up. Provided here that a distance in a direction perpendicular to the axial line of the threaded hole 1a from the one end E of the frame 1 to the axial line is a_2 and a distance in the same direction from the other end F to the axial line is a_1 , the position of the threaded hole 1a is so set as to satisfy $a_1 = a_2 + \text{thickness of longer end part 20c}$ (the thickness of the terminal plate 20), taking into account that in the screw terminal P2 the longer end part 20c of the terminal plate 20 is disposed between the bottom of the frame 1 and the plane of disposition in the casing.

With the above arrangement, the height of the screw with

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respect to the plane of disposition in the casing can be unified, and the screw terminal can be made excellent in the appearances. Further, it is not required to render the shape of the casing to be complicated for unifying the height of the screw. Since
5 in the foregoing embodiments the terminal frame 1 and terminal plate 10 or 20 are prepared separately and joined integral by means of the caulked mounting or welding, the terminal frame 1 as a common part through both embodiments and the terminal plates 10 and 20 as different parts are respectively prepared, so that
10 their shape will not become complicated respectively, the blanking efficiency is kept excellent in contrast to an event where the parts are integrally prepared, any waste of material can be eliminated, and costs for such facilities as the metal molds can be restrained to be able to reduce the manufacturing
15 costs.

In another embodiment according to the present invention as shown in FIGS. 10 to 12, a terminal frame 31 is formed with a plate metal bent not annular but to be U-shaped in section, and a terminal plate 40 substantially U-shaped is mounted at a
20 longer leg part 40a as held widthwise between both opposing end parts 31a of the U-shaped frame 31. The longer leg part 40a is formed to have the countersink rim 40e made by the burring work, and the contacting surface area between the terminal plate 40 and the screw is enlarged.

25 The longer leg part 40a is provided at both widthwise side edges with four shorter projections 41 projecting out of both lengthwise end parts to be received in four holes 32 at corresponding positions of the frame 31, so that the terminal

plate 40 is mounted to the terminal frame 31. In this event, an intermediate part 40b between the longer leg part 40a and the other shorter leg part 40c is disposed to close one axial end opening of the frame 31, and the shorter leg part 40c is provided
5 with a terminal contact 45. Further, a longer center projection 43 is provided between the two shorter projections 41 on each side of the longer leg part 40a to project towards the both end parts 31a of the frame 31, to be received in mounting holes 35 at corresponding positions of the frame 31.

10 Referring next to a manner in which the terminal plate 40 is mounted to the terminal frame 31, the U-shape of this frame 31 is in an open state before the mounting, and the projections 41 and 43 on one side of the longer leg part 40a of the terminal plate 40 are inserted respectively into the holes 32 and 35 in
15 one of the opposing end parts 31a of the frame 31. Then the frame 31 is further bent into the U-shape while inserting the projections 41 and 43 on the other side of the longer leg part 40a of the plate 40 into the holes 32 and 35 in the other end part 31a of the frame 31. Exposed ends of the respective
20 projections 41 and 43 on both sides are caulked over both end parts 31a, and the terminal frame 31 is mounted thereby to the terminal plate 40.

Further, the screw 13 is inserted and fastened into the threaded hole 40d in the longer leg part 40a of the terminal plate
25 40 in the direction A as shown in FIG. 12, so as to hold the wire (not shown) inserted into the terminal frame 31 in the direction B from the axial end kept open, between the tip end 13a of the screw 13 and the inner periphery 36 at central curved part of

the terminal frame 31, whereby the wire can be held mechanically and at the same time the wire and terminal plate 40 are mutually electrically connected through the screw 13. When the wire is inserted into the terminal frame 31 in the direction B, the intermediate part 40b of the terminal plate 40 functions to prevent the wire from being excessively inserted. Here, the screw terminal Q1 is formed with the terminal frame 31, terminal plate 40 and screw 13.

Since as has been described the longer central projections 43 of the terminal plate 40 are inserted into the corresponding holes 35 of the terminal frame 31, any load caused upon fastening the screw 13 may be applied to inserted portions of the projections 43 into the holes 35 so that the load to caulked portions of both end side projections 41 with respect to the holes 32 can be reduced, and the mounting of the terminal plate 40 to the terminal frame 31 can be rendered reliable.

In another embodiment as shown in FIGS. 13 to 15 of the present invention, the terminal plate 50 substantially U-shaped is mounted to the terminal frame 31 bent to be U-shaped with intermediate part 50a of the plate 50 held between both opposing end parts 31a of the frame 31, so as to close both axial end openings of the frame 31 with the shorter leg part 50b and the longer leg part 50c having at extended end the terminal contact 50h.

The intermediate part 50a is provided with the threaded hole 50d for fastening the screw, and the contacting surface area between the terminal plate 50 and screw is increased by forming the countersink rim 50e at peripheral edge of the hole 50d by

means of the burring work. At both side edges of the intermediate part 50a, further, the four projections 51 at both longitudinal ends on both sides are provided to project towards the opposing end parts 31a of the terminal frame 31, to be inserted into the
5 corresponding holes 32 in the opposing end parts 31a and caulked for the mounting of the terminal plate 50 to the terminal frame 31.

The intermediate part 50a is further provided with the central projections 53 respectively disposed between two
10 projections 51 on each side edge to project towards the respective opposing end parts 31a of the terminal frame 31 to be inserted into the corresponding holes 35 in both end parts 31a.

Referring next to the mounting of the terminal plate 50
15 to the terminal frame 31, the U-shape of the frame 31 is in an open state before the mounting, and the two projections 51 and central projection 53 on one side edge of the plate 50 are inserted in the corresponding holes 32 and 35 in one end part 31a of the frame 31. The open U-shape of the frame 31 is closed while
20 inserting the two projections 51 and central projection 53 on the other side edge of the intermediate part 50a into the corresponding holes 32 and 35 respectively in the other end part 31a, and exposed ends of the projections 51 are caulked to mount the terminal plate 50 to the terminal frame 31.

25 As shown in FIG. 15, further, the screw 13 is inserted and fastened into the threaded hole 50d in the intermediate part 50a of the terminal plate 50, so as to hold the wire (not shown) inserted in the direction B through the inserting hole 50f made

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in the longer leg part 50c of the plate 50 between the tip end 13a of the screw 13 and the inner periphery 36 at the central bent part of the terminal frame 31, to thereby mechanically hold the wire and also to electrically connect the wire to the terminal plate 50 through the screw. In inserting the wire into the terminal frame 31 in the direction B, the shorter blind leg part 50b functions to prevent any excessive insertion of the wire. Here, the screw terminal Q2 is constituted by the terminal frame 31, terminal plate 50 and screw 13.

10 Since, as has been described, the central projections 53 of the terminal plate 50 are inserted into the holes 35 of the terminal frame 31, the load caused upon fastening the screw 13 is applied to the inserted portions of the projections 53 in the holes 32, so as to reduce the load applied to the caulked portions of the projections 51 to the holes 32, and the mounting of the terminal plate 50 to the terminal frame 31 can be made reliable.

 In the event of the screw terminal Q1 as shown in FIG. 12 and of the screw terminal Q2 as shown in FIG. 15, they are disposed on the casing of the wiring equipments or the like with the terminal frame 31 disposed vertical with respect to the casing and, in the case of the screw terminal Q1 where the one leg part of the terminal plate is not present underneath the terminal frame 31, the positioning of the screw terminal Q1 onto the casing can be made by means of such ribs 47 provided on the casing to abut both ends in widthwise direction H of the frame 31 as shown in FIG. 16A, while FIG. 16B shows similar positioning ribs 47 in a modified case of the screw terminal Q1. Since in the case of the screw terminal Q2 shown in FIG. 15, on the other

hand, the longer leg part 50c of the terminal plate 50 is present underneath the terminal frame 31 and to project out of the semicircular side end of the frame 31, the positioning onto the casing of the terminal Q2 on the square side end from which the terminal plate does not extend can be attained with a locking rib 48 provided on the casing to abut the particular end of the frame as shown in FIGS. 17A and 17B, whereas a rib cannot be provided to abut the other end out of which the longer leg part 50c extends. For this reason, the longer leg part 50c is provided at its both widthwise side edges and close to the other end of the frame 31 with short bent parts 50g to be vertical to the extending direction of the longer leg part (direction I) as locking means, and a pair of ribs 49 are provided on the casing on both sides of the leg part 50c and on outer side in the direction I of the bent parts 50g for positioning the screw terminal Q2 onto the casing by locking the bent parts 50g against the ribs 49. These bent parts 50g are also functioning as means for bearing the fastening load of the screw by the locking of the bent parts 50g to the ribs 49 in the same direction I as that of fastening the screw.

What is claimed is:

1. A screw terminal characterized in comprising a terminal frame formed with a plate metal bent annular and coupled mutually at both ends and having at peripheral wall a threaded hole for holding an electric wire between a tip end of the screw fastened through the threaded hole and an inner periphery of the frame, and a terminal plate having a terminal contact and mounted to the terminal frame to be electrically connected to the wire through the screw.
2. The screw terminal according to claim 1, characterized in that the terminal frame has a projection, and the terminal plate has a corresponding hole to the projection, for mounting the terminal plate to the terminal frame by inserting the projection of the frame into the corresponding hole of the plate and caulking the projection with respect to the plate.
3. The screw terminal according to claim 1, characterized in that the terminal plate is mounted to the terminal frame by means of a welding.
4. The screw terminal according to any of preceding claims 1 to 3, characterized in that the terminal frame has a tab erected, and the terminal plate has a corresponding opening for allowing both side edges of the tab to contact with side edges of the opening when the terminal plate is mounted to the terminal frame.
5. The screw terminal according to any of preceding claims 1 to 4, characterized in that the threaded hole of the terminal frame is positioned to render the distance from one

axial end of the annular terminal frame to the center axis of the threaded hole to be equal to a sum of the distance from the other axial end of the frame to the center axis of the threaded hole and the thickness of the terminal plate.

5 6. The screw terminal according to any of preceding claims 1 to 5, characterized in that the terminal frame is provided at outer periphery of the threaded hole with a countersink rim.

7. The screw terminal according to any of preceding
10 claims 1 to 6, characterized in that both ends mutually coupled of the plate metal forming the terminal frame comprise one projected end and the other recessed end complementary in shape to the projected end.

8. A screw terminal characterized in comprising a
15 terminal frame made with a plate metal bent into a U-shape to have mutually opposing both end parts, and a terminal plate having a terminal contact and comprises at least part mounted between the mutually opposing end parts of the terminal frame and provided with a threaded hole, a screw fastened through the
20 threaded hole in the terminal plate holding an electric wire between a tip end of the screw and an inner periphery of the terminal frame for electrically connecting the wire to the terminal plate through the screw.

9. The screw terminal according to claim 8,
25 characterized in that the terminal plate is provided at both side edges of the mounted part with shorter projections and longer projections, and the terminal frame is provided at the opposing end parts with corresponding shorter and longer holes for

receiving the shorter and longer projections of the plate.

10. The screw terminal according to any of preceding claims 1 to 9, characterized in that the terminal plate is provided with a locking part to be locked to a rib provided in
5 a casing in which the screw terminal is to be disposed.