Sept. 20, 1960 W. F. KUSSY 2,953,771

ELECTRICAL CONNECTOR

Filed April 17, 1958 2 Sheets-Sheet 1

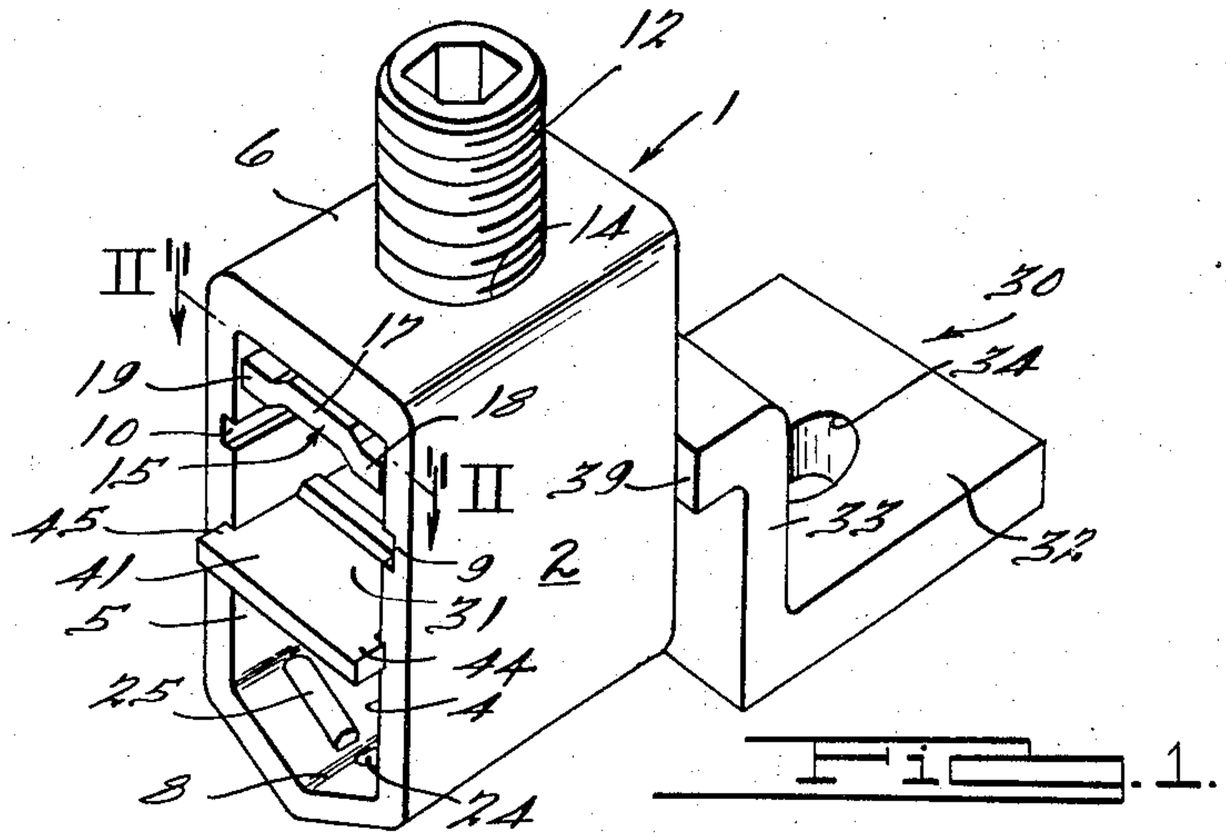

Fig. 1.

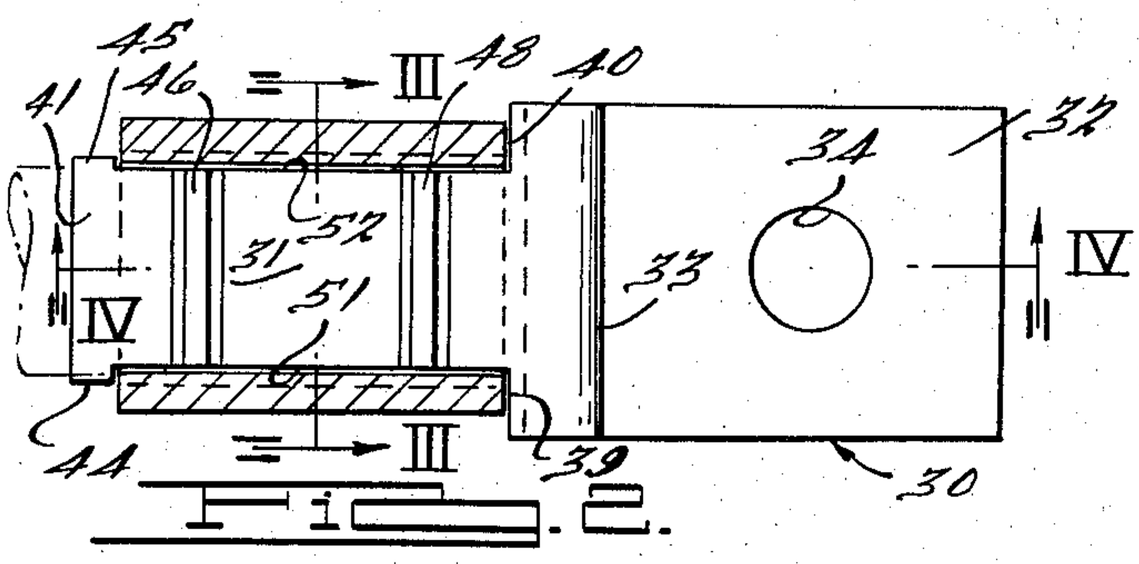

Fig. 2.

Fig. 4.

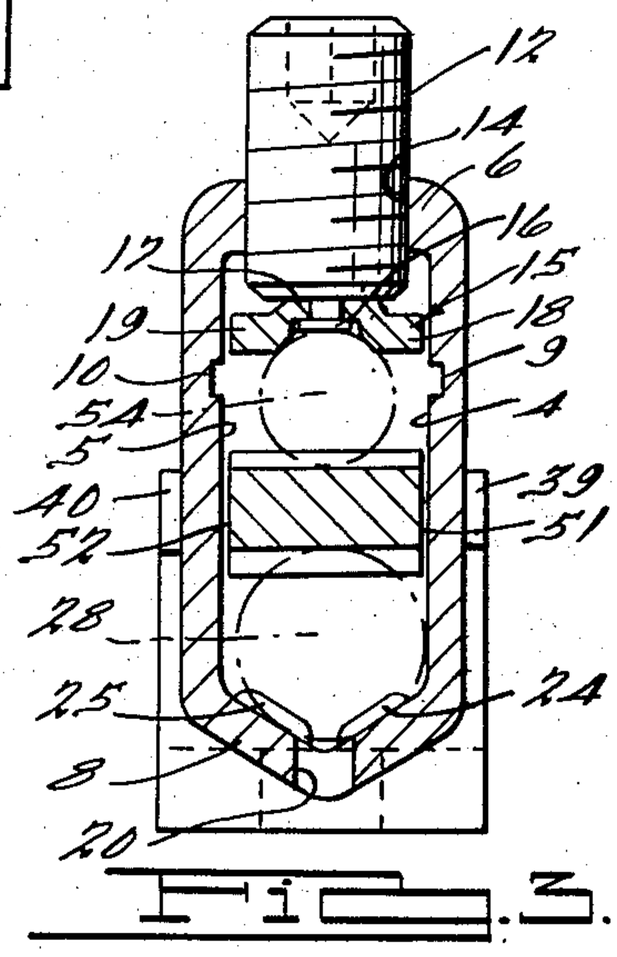

Fig. 3.

INVENTOR.
Werner F. Kussy.
BY
Harold J. Cuthbertson
ATTORNEY.

Sept. 20, 1960

W. F. KUSSY

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2 Sheets-Sheet 2

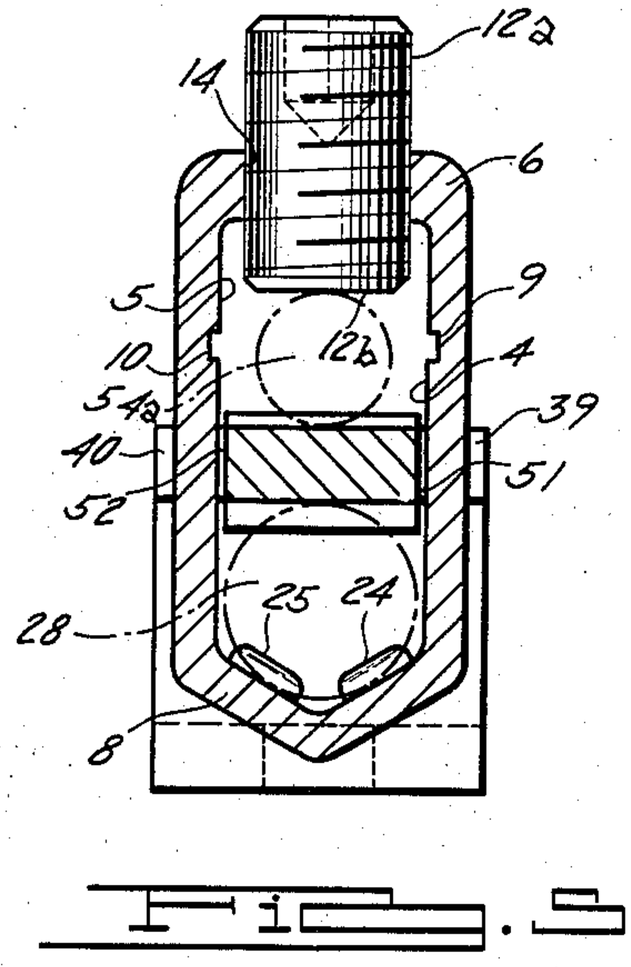

Fig. 3.

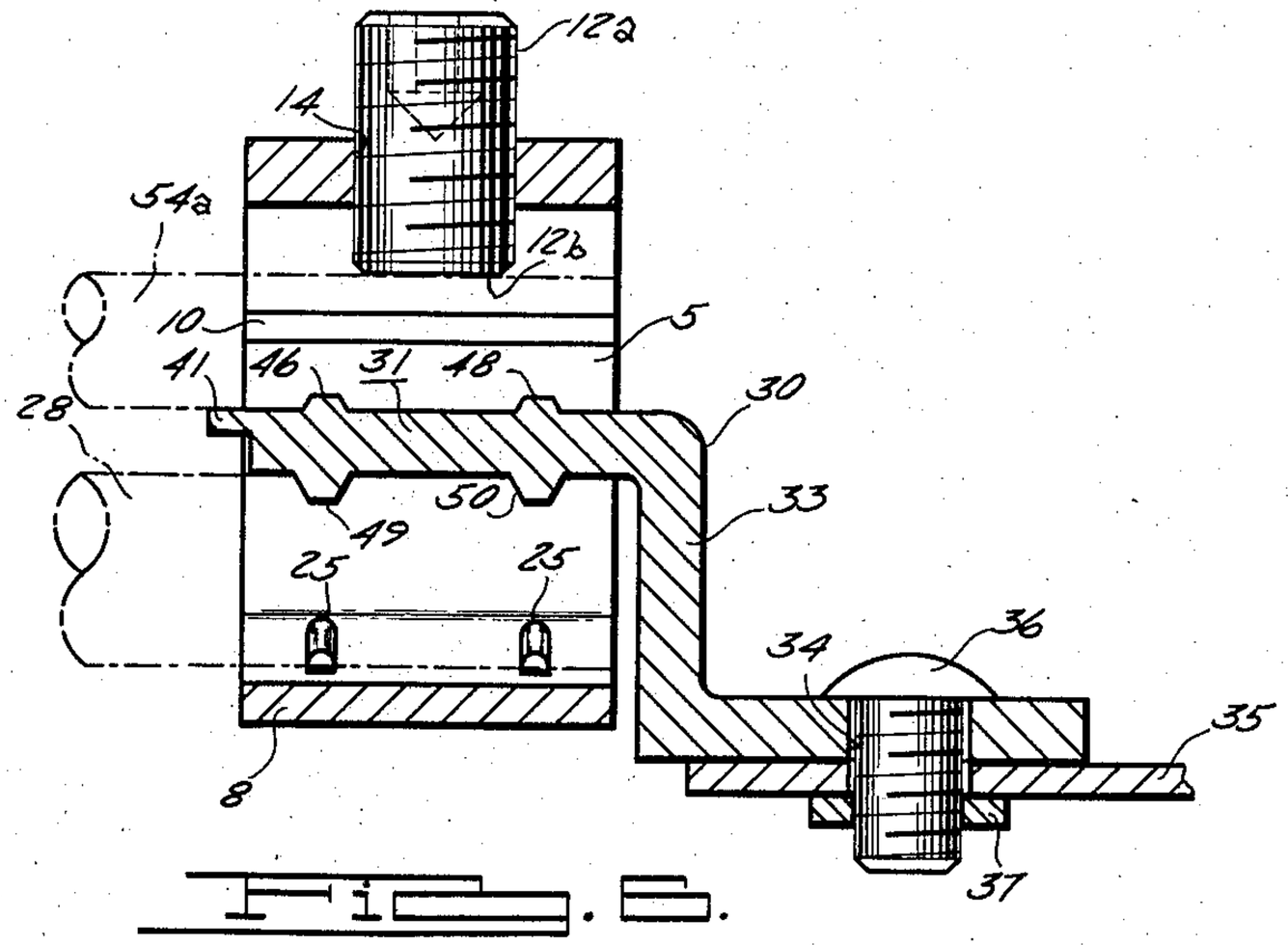

Fig. 4.

INVENTOR.

WERNER F. KUSSY

BY

Harold J. Patalsen

United States Patent Office

2,953,771

Patented Sept. 20, 1960

2,953,771

ELECTRICAL CONNECTOR

Werner F. Kussy, Birmingham, Mich., assignor to Square D Company, Detroit, Mich., a corporation of Michigan

Filed Apr. 17, 1958, Ser. No. 729,116

5 Claims. (Cl. 339—272)

This invention relates generally to electrical connectors, and more particularly to an electrical connector having a housing which may be formed by extrusion and which is adapted to receive a similarly formed tang in a novel interlocking relationship.

Electrical connectors of the solderless type are extensively used in modern electrical installations because they are a fast and flexible yet positive means for joining electrical conductors. Because of the increased use of aluminum conductors, a need has arisen for a solderless connector that can be used with both aluminum and copper conductors.

Solderless connectors formed from copper are not suitable for use with aluminum conductors because the higher coefficient of expansion of aluminum causes the aluminum conductor, when the junction is heated, to expand more than the copper of the connector resulting in an extrusion of the aluminum conductor from under the tang of the connector. Upon cooling, the aluminum conductor contracts more than the copper connector eventually resulting, after several heating and cooling cycles, in loosening of the junction.

Solderless connectors formed from aluminum can be used with either aluminum or copper conductors because the aluminum connector expands the same amount as, or more than, the conductor upon heating of the connection depending upon which metal is used for the conductor. Consequently, there is no tendency for either an aluminum or a copper conductor to extrude from under the tang of an aluminum connector.

Accordingly, an object of the present invention is to provide an improved solderless electrical connector formed from aluminum and thereby usable with either aluminum or copper conductors.

In many prior connectors, to prevent rotation of the tang with respect to the housing, the tang and housing have been so assembled that the tang cannot be readily removed from the housing. It is desirable, however, to have a connector in which the tang and housing are easily separated thereby to facilitate the making of a connection with the tang bolted in position on a control panel or the like. Furthermore, separable housings and tangs are advantageous because each can then be manufactured and sold separately. The tang and housing of the connector of the present invention can be readily separated and yet this tang is substantially restrained from rotation with respect to the housing and is positively locked against separation when in operative position. Furthermore, the housing and tang are so shaped that both can be formed from aluminum by extrusion.

A further object is to provide an improved solderless connector having its tang restrained from substantial rotation about any axis with respect to the housing yet being easily removable therefrom when desired.

A further object is to provide an improved solderless connector having a tang that is restrained from substantial rotation about any axis with respect to the housing and, when in operative position, is restrained from movement out of the housing although freely slidable toward and away from a conductor gripping surface of the housing.

A further object is to provide a solderless connector having its housing, tang and pressure plate designed and shaped so as to be formable by an extrusion process.

An aluminum solderless connector in accordance with the present invention comprises a tubular housing adapted to receive one or more electrical conductors. The housing has a pair of parallel-spaced side walls and integral top and bottom walls extending therebetween, the inner surface of the bottom wall defining a conductor-gripping surface. A removable tang extends between the inner surfaces of the side walls of the housing and is restrained for movement only toward and away from the conductor-gripping surface. This restraint of the tang is provided by the side edges of the tang and by spaced shoulders defined by a T-shaped outer end portion and a pair of spaced shoulders on an inner end portion. The inner surfaces of the housing side walls are provided with recesses, respectively, which accommodate the projections of the T-shaped portion and enable the tang to be easily disassembled from the housing when desired.

Other objects and advantages of this invention will become apparent from the following description, wherein reference is made to the drawings, in which:

Figure 1 is a perspective view of an assembled connector in accordance with this invention.

Figure 2 is a sectional view taken as indicated at II—II of Figure 1.

Figure 3 is a sectional view taken as indicated at III—III of Figure 2.

Figure 4 is a sectional view taken as indicated at IV—IV of Figure 2.

Figure 5 is a sectional view, similar to Figure 3, but showing another embodiment of the invention.

Figure 6 is a sectional view, similar to Figure 4, but showing the embodiment of the invention shown in Figure 5.

Referring to the drawings, a solderless connector **1** is shown as comprising a tubular housing **2** open at opposite ends and having side walls defining parallel internal side wall surfaces **4** and **5**, a top wall **6**, preferably flat as indicated, and a V-shaped bottom wall **8**. The housing **2** preferably has a cross-sectional configuration such as shown so that it can be formed readily from aluminum or other similar metal by an extrusion process. The side walls near the top wall **6** are provided at their inner surfaces **4** and **5** with aligned longitudinal grooves **9** and **10**, respectively, which provide for assembly and disassembly of the connector **1** as will be discussed hereinafter. A suitable set screw **12** extends through a threaded hole **14** in the top wall **6** of the housing **2** and may be rotatably coupled to a pressure plate **15** as by a rivet **16**. If the pressure plate **15** is not used the inner end face of the set screw **12** substantially performs its function as will be explained hereinafter in connection with Figures 5 and 6. The grooves **9** and **10** are spaced downwardly from the top wall **6** a sufficient distance to permit the screw **12** to retract the pressure plate **15** above the grooves **9** and **10** in non-interfering relation thereto.

The pressure plate **15**, also preferably formed from aluminum by extrusion, has a central portion **17** offset upwardly from the plane of coplanar side bearing portions **18** and **19** to provide for balanced pressure within the connector as will be explained. The width of the pressure plate **15** is slightly less than the distance between the side wall surfaces **4** and **5**, so that the pressure plate is guided by the side wall surfaces during translatory movement in response to advancement or retraction of the screw **12**. The thickness of the pressure plate **15** is

greater than the width of the grooves 9 and 10 so that entry of the plate 15 into the grooves is prevented.

A hole 20 extending through the apex of the V-shaped bottom wall 8 of the housing 2 facilitates attachment of the pressure plate 15 to the set screw 12 as by the rivet 16. The V-shaped bottom wall 8 of the housing 2 may be provided with a plurality of longitudinally spaced, laterally extending ribs 24—25 which assist in restraining a conductor 28 from longitudinal movement out of the connector after tightening of the screw 12.

In accordance with this invention, the connector 1 has a tang 30 of substantially constant cross-section and preferably extruded from aluminum. The tang 30 comprises a locking plate portion 31 received in the housing 2, and a terminal portion 32, the terminal portion 32 being offset downwardly from the locking plate portion 31 by a transverse portion 33 preferably normal to the locking plate and terminal portion. The terminal portion 32 is provided with a central hole 34 to facilitate fastening of the tang 30 to an electrical bus bar 35 or the like (Figure 4) as by a bolt 36 and a nut 37. The sides of the locking plate portion 31 are cut away to define a pair of spaced shoulders 39 and 40 on opposite sides of the locking plate 31 adjacent to but spaced from the transverse portion 33. The shoulders 39 and 40 abut edge faces of the side walls of the housing 2 to restrict movement of the tang 30 inwardly of the housing and are positioned to provide clearance between the transverse portion 33 and the housing 2.

The cut-away sides of the locking plate 31 also define a T-shaped end portion 41 having a pair of ears 44 and 45 extending outwardly from opposite sides thereof. The locking plate portion 31 is substantially thicker than the width of the grooves 9 and 10 to prevent entry of the locking plate portion 31 into the grooves, but the ear portions 44 and 45 are slightly thinner than the width of the grooves 9 and 10. The horizontal transverse dimension between the outer extremities of the ears 44 and 45 is less than the distance between the bases of the grooves 9 and 10 but greater than the dimension between the inside walls 4 and 5. The ears 44 and 45 thus are accepted by the longitudinally extending grooves 9 and 10, respectively, to facilitate assembly and disassembly of the connector 1, but shoulder against the edge faces of the side walls of the housing 2 when the locking plate portion 31 is moved out of alignment with the grooves 9 and 10. The shoulders defined by the ears 44 and 45 cooperate with the shoulders 39 and 40 on the other end of the locking plate portion 31 of the tang 30 to prevent longitudinal movement of the tang with respect to the housing 2 and rotation of the tang about a horizontal transverse axis.

The locking plate 31 of the tang 30 is preferably provided with a pair of longitudinally spaced, laterally extending ribs 46 and 48 on the top surface thereof which cooperate with the bearing portions 18 and 19 of the pressure plate 15 to provide balanced pressure on the tang 30 when only one conductor is secured in the connector. A second pair of longitudinally spaced, laterally extending ribs 49 and 50 on the bottom surface of the locking plate 31 cooperate with the ribs 24—25 on the bottom wall 8 of the housing 2 to restrain the conductor 28 from longitudinal movement with respect to the housing when the screw 12 is tightened.

The cut-away portion of the locking plate 31 defines opposed parallel side walls 51 and 52 which closely fit the inner side wall surfaces 4 and 5 of the housing 2 and in cooperation with the ears 44 and 45 and the shoulders 39 and 40, restrain the tang 30 for only translatory movement with respect to the housing 2 toward and away from the ribs 24 and 25 on the bottom wall 8. Rotation of the tang about its longitudinal and vertical lateral axes is restricted by the parallel walls 51 and 52 of the locking plate 31 which cooperate with the side wall surfaces 4 and 5 of the housing 2. Rotation of the tang 30 about its horizontal transverse axis is restricted by engagement of the ears 44 and 45 of the T-shaped portion 41 with the front edge faces of the housing side walls and by engagement of the shoulders 39 and 40 with the rear edge faces of the housing side walls.

When a single conductor such as the conductor 28 is to be secured in the connector 1, the pressure plate 15 presses against the ribs 46 and 48 to force the locking plate 31 against the top of the conductor. However, when it is desired to connect two conductors to a single bus conductor, the pressure plate 31 of the tang 30 is disposed between the conductor 28 and a second conductor 54 (Figure 4). The transverse ribs 46 and 48 on the top surface of the locking plate 31 engage the conductor 54 and cooperate with the portions 18 and 19 on the pressure plate 15 to secure the conductor 54 from longitudinal movement with respect to the housing 2 when the screw 12 is fully advanced.

Assembly of the tang 30 within the housing 2 is accomplished by inserting the ears 44 and 45 of the locking plate 31 into the grooves 9 and 10 of the housing 2 and sliding the locking plate 31 longitudinally through the housing 2 until the shoulders 39 and 40 abut the housing. The tang 30 is then moved downwardly toward the bottom wall 8 until the ears 44 and 45 are out of alignment with the grooves 9 and 10.

As was mentioned hereinbefore, Figures 5 and 6 depict an embodiment of the invention wherein the pressure plate 15 and certain other elements, hereinafter described, are omitted. In Figures 5 and 6 the same reference numerals have been employed to designate elements hereinbefore described. If the pressure plate 15 is omitted, an inner end face 12*b* of a set screw 12*a* performs substantially the same function as the pressure plate 15. The set screw 12*a* is similar to the set screw 12 except that it is not provided with the rivet 16 or means to receive such a rivet. The set screw 12*a* extends through a threaded hole 14 in the top wall of the housing 2. It will be understood that, since rivet 16 is omitted, the hole 20 through the apex of the V-shaped bottom wall 8 of the housing 2 may also be omitted, as Figures 5 and 6 show. A conductor 54*a* shown in Figures 5 and 6 is similar to the conductor 54, hereinbefore described, and is secured in the same manner except that instead of being gripped by the pressure plate 15 it is gripped by the inner end face 12*b* of the set screw 12*a*. If preferred, the set screw 12*a* may be of greater length than the set screw 12 to compensate for length lost by the omission of the pressure plate 15.

What is claimed is:

1. A solderless connector comprising an open-ended tubular housing, said housing having top and bottom walls extending transversely between spaced longitudinally-extending side walls defining flat interior side wall surfaces that are parallel to each other and each having edge faces at opposite ends which lie in a plane substantially normal to the longitudinal axis of said housing, a pressure applying means in said housing movable toward and away from said bottom wall, a longitudinally directed groove in one of said side walls intersecting the edge faces thereof, a tang releasably engageable with said housing and having a portion extending between said side wall surfaces between said pressure applying means and said bottom wall, said portion being in close proximate relationship to said side wall surfaces so as to be restrained thereby from excessive rotary motion about a longitudinal axis, said tang being thicker than the width of said groove and having a pair of longitudinally spaced shoulders on one side thereof adapted to engage said edge faces respectively of said one of said side walls to restrict longitudinal movement of said tang with respect to said housing, and one of said shoulders being defined by an ear portion thinner than the width of said

groove and receivable therein to permit disengagement of said tang from said housing.

2. A solderless connector in accordance with claim 1 characterized in that each of said side walls has a longitudinally extending groove, said grooves being equidistant from said top wall, and said tang has a pair of longitudinally spaced shoulders on each side thereof, the shoulders on the end of said tang defined by said ear portions being receivable in said grooves to permit disengagement of said tang from said housing.

3. A solderless connector comprising an open-ended tubular housing, said housing having top and bottom walls extending transversely between spaced longitudinally-extending side walls defining flat interior side wall surfaces that are parallel to each other and each having edge faces at opposite ends which lie in a plane substantially normal to the longitudinal axis of said housing, a pressure applying means in said housing movable toward and away from said bottom wall, mutually aligned longitudinally directed grooves, in said side walls, respectively, each of said grooves intersecting the edge faces of its side wall, a tang releasably engageable with said housing and having a portion extending between said side wall surfaces between said pressure applying means and said bottom wall, said portion being in close proximate relationship to said side wall surfaces so as to be restrained thereby from excessive rotary motion about a longitudinal axis, said tang being thicker than the width of said grooves and having a pair of transversely spaced

shoulders at one end thereof adapted to engage said edge faces, respectively, at one end of said housing, said tang having a pair of transverse projections extending outwardly at the other end portion to define transverse shoulders adapted to engage said edge faces, respectively, at the other end of said housing, whereby longitudinal movement of said tang with respect to said housing is restricted, and said projections being thinner than the width of said grooves and receivable therein, respectively, to permit disengagement of said tang from said housing.

4. A connector in accordance with claim 3 characterized in that said pressure applying means comprises a screw threaded portion threadedly engaged with a tapped opening in said top wall.

5. A connector in accordance with claim 3 characterized in that said pressure applying means comprises a pressure plate of greater thickness than the width of said grooves, a screw received in a tapped opening in said top wall, and means rotatably securing said pressure plate on the end portion of said screw nearest said bottom wall.

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