Sept. 20, 1955 G. B. BENANDER 2,718,626

ELECTRICAL CONNECTORS

Filed Nov. 18, 1953

Fig. 1.

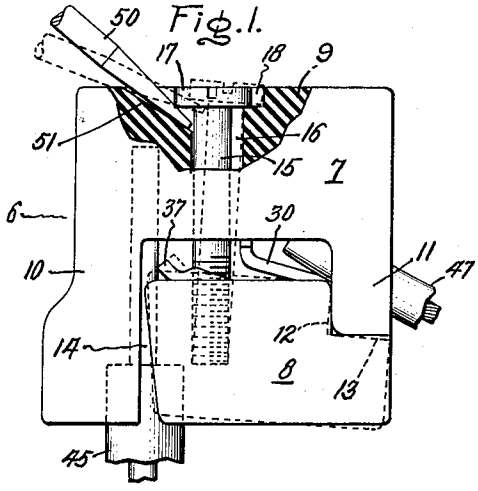


Fig. 2.

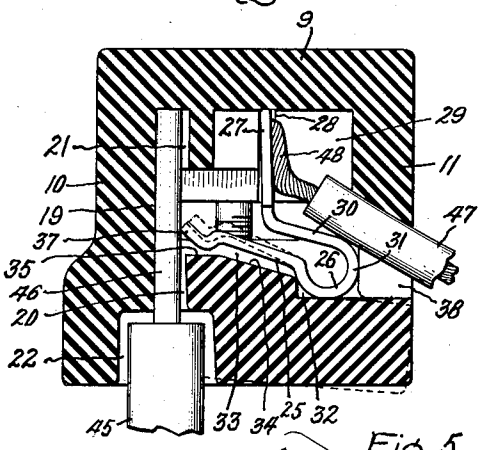


Fig. 5.

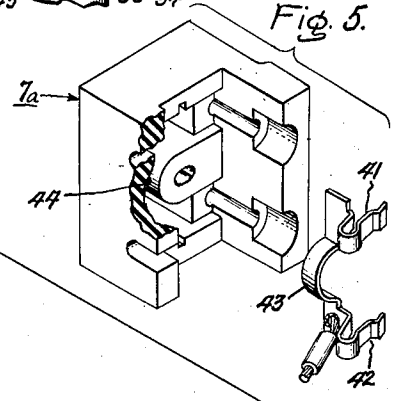


Fig. 3.

Fig. 6.

Fig. 4

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2,718,626

ELECTRICAL CONNECTORS

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Application November 18, 1953, Serial No. 392,877

6 Claims. (Cl. 339—266)

The present invention relates to electrical connectors for connecting together two conductor or wire ends, at least one of which is a straight stiff conductor end not readily bent.

The object of the invention is to provide an improved connector which is simple in structure; comprises a minimum number of parts capable of being manufactured and assembled at low cost; is handy to use; and effects a firm connection which meets the rigid requirements of the National Board Fire Underwriters and Underwriters' Laboratories, Inc.

For a consideration of what I believe to be novel and my invention, attention is directed to the following specification and to the claims appended thereto.

In carrying out my invention in a now preferred form, I provide a housing comprising a base member and a cover member. The base member has two side walls. The cover member at one edge is mounted on one side wall in a manner such that it may have limited pivotal movement thereon. The other edge of the cover member terminates short of the other side wall of the base member to provide opposed spaced-apart adjacent surfaces, and in such surfaces are opposed grooves which define one or more conductor-receiving openings through which the bore end of a conductor may pass into the connector. The base and cover members are connected together by a suitable fastener, such as a bolt, the arrangement being such that the two members may be moved relatively to each other. In the housing, associated with each conductor-receiving opening, is a locking member for engaging a conductor end inserted through a conductor-receiving opening to clamp or lock it in the opening, the locking member being arranged in a manner such that when the base and cover members are moved relatively to each other it will be moved to release the conductor end so the connector and conductor may be separated. The connector may be used to connect a flexible lead wire, for example, to a straight stiff conductor end, the lead wire being electrically connected to the locking member.

In the drawing,

Fig. 1 is a side elevation, partly in section, of a connector embodying the invention.

Fig. 2 is a transverse sectional view of the connector, the section being taken at one side of the center line through a connector locking or clamping structure.

Fig. 3 is an exploded perspective view of the connector.

Fig. 4 is a detail sectional view.

Fig. 5 is an exploded perspective view of a modification.

Fig. 6 is a detail view illustrating use of the invention in connection with a heating unit for an electric range.

Referring to the drawing, **6** indicates the housing of the connector which comprises a base **7** and a cover **8** both formed from a suitable insulating material such as a molding compound. Base **7** has a bottom wall **9** and

opposed side walls **10** and **11**. Cover **8** closes the space between side walls **10** and **11**, it being hinged or movably connected at one edge to one side wall and terminating at its free edge adjacent to the other side wall. In the present instance, the hinge means comprises walls **12** and **13** at the one edge of the cover which define a notch or transversely extending recess in cover **8** in which the outer end of wall **11** is located, the wall **12** fitting against the inner surface of wall **11**, and the wall **13** fitting against the top surface of wall **11**. The free edge of cover **8** terminates short of wall **10**, i. e., it stands in spaced relation to wall **10** as indicated at **14** in Fig. 1, whereby the free end of cover **8** may be pivoted inwardly toward bottom wall **9**, the inner corner of wall **12** pivoting against the inner surface of wall **11** as indicated in dotted lines in Fig. 1. The cover is held against the base by a short bolt **15** which passes through an opening **16** in bottom wall **9** and threads into an opening in cover **8**. Opening **16** is oblong, being wider than the diameter of the bolt in a direction transversely of the base as shown clearly in Fig. 1, and the head **17** of the bolt is positioned in an oblong recess **18** in the base. This forms in substance a lost motion connection between the bolt and base **7** whereby the cover and base can be moved relatively to each other to move the cover toward bottom wall **9**; or conversely, by tilting bolt **15** sidewise the cover can be moved inwardly toward the base. The manner in which the bolt may tilt with respect to base **7** is indicated in dotted lines in Fig. 1. Also, as shown in Fig. 1, side wall **11** is shorter than side wall **10** by an amount such that the outer surface of cover **8** is flush with the top surface of side wall **10**.

In adjacent surfaces of side wall **10** and cover **8** are opposed grooves **19** and **20**, respectively, which define a conductor-receiving opening through which a conductor end may be inserted into the connector housing. The inner end of groove **19** debouches into a hole **21** in bottom wall **9** adapted to receive a conductor end, and the outer ends of grooves **19** and **20** are enlarged, as is indicated at **22**, to form a counterbored outer end of a size to house the covering on a conductor the end of which is inserted into the housing.

For gripping a conductor end and clamping the connector thereto there is provided a spring locking tongue **25** similar to that disclosed and claimed in my application Serial No. 321,149, filed November 18, 1952, and assigned to the same assignee as is the instant application. The locking tongue is arranged in the housing with what may be termed its inner end **26** positioned against a wall of the housing which forms a rigid backing for it, and means is provided for holding it firmly against such wall. In the present instance, such wall is the inner surface of side wall **11**. Its outer end is free and extends to a position where it projects somewhat over the inner edge of the conductor-receiving opening formed by grooves **19** and **20**. The locking tongue is formed integral with and is carried by an anchoring strip **27** the side edges of which are held in opposed grooves **28** in the side walls of a cavity **29** in bottom wall **9**. The anchoring strip is connected to the locking tongue by an offset arm **30**, the connection between the arm and the locking tongue being in the form of a rounded elbow **31** which is positioned in the corner between wall **11** and cover **8**. In the cover is a pocket **32** in which the elbow is located, and connected with the pocket is a groove **33** having an upwardly and inwardly sloping bottom surface **34** along which locking tongue **25** extends and a flat surface **35** against which its outer end normally rests as shown clearly in Fig. 4. With this arrangement the locking tongue, the anchoring strip and the offset arm, which are an integral structure, are held in the housing

between the base and the cover with elbow **31** firmly anchored in the corner in which it is located. Preferably, the free end of locking tongue **25** is shaped to provide a transversely extending bead **36** which rests against surface **35**, and an angularly extending tip **37**. In side wall **11** is a slot **38** for receiving a conductor to be attached to anchoring strip **27**.

In its more general applications, the connector will be used to connect two rigid conductor ends to a circuit wire or circuit wires, and in the drawing the connector is shown as comprising two locking structures which are alike, one located on each side of bolt **15**. It is to be understood, however, that the connector may comprise a single locking structure or more than two locking structures.

In Figs. 1 to 4, the two locking tongues are shown as being separate members adapting the connector to connect two rigid conductor ends to two separate circuit wires. There are instances, however, where it is desirable to connect two rigid conductor ends to a single circuit wire or to connect two rigid conductor ends to each other, in which case the two locking tongues will be connected together or built as a unitary structure. This arrangement is shown in Fig. 5 wherein the two locking tongues **41** and **42** are connected by a cross bar **43**. Otherwise the structure may be the same as that of Figs. 1 to 4 except that base **7***a*, corresponding to base **7** of Figs. 1 to 4, is provided with a suitable groove **44** in which cross bar **43** fits.

In Figs. 1 and 2, **45** indicates a length of insulated conductor having a rigid bare conductor end **46** connected by the connector to an insulated lead wire **47**, which may be a flexible or solid conductor, having a bare end **48** connected to anchoring plate **27** by solder, a weld or other suitable means.

A rigid conductor end, such as the end **46**, is connected to the connector, or, conversely, the connector is connected to the conductor end by passing the end into the conductor-receiving opening in the connector. In Fig. 4, conductor end **46** is shown about to be passed through the conductor-receiving opening, a thing which may be done by pushing the connector onto the conductor end, or vice versa. At this time bead **36** rests against flat surface **34** and the end of the tongue projects part way over the conductor-receiving opening. When the conductor end passes through the opening its end surface first engages the end of the locking tongue flexing it inwardly until the conductor end surface moves past the end of the tongue. The end of the tongue then engages the side of the conductor end, clamping the conductor end against the bottom of groove **19**. The conductor end is thus firmly locked in the connector, it being gripped or wedged between the end of the locking tongue and the bottom of groove **19**; and the locking tongue being clamped between the conductor end and the inner surface of side wall **11**. When thus positioned, any pull tending to move the conductor end out of the opening will serve to wedge the conductor end more firmly between the side wall of the opening and the locking tongue.

To release a locking tongue to permit of the removal of a conductor end from the connector, the free end of cover **8** is moved on its pivot inwardly toward base **9** to thus move the free end of the locking tongue from contact with the conductor end as shown in dotted lines in Figs. 1 and 2. This may be done to advantage by a tool, such as a screw driver, by placing the end of the tool under the head **17** of bolt **15** and prying down after the manner indicated in Fig. 1 where **50** indicates a tool end, the base being provided with a notch **51** at the edge of recess **18** through which the tool end may be inserted to a position in engagement with the underside of head **17**. By pressing down on the outer end of the tool, the base and cover may be moved relatively to each other to bring the inner surface of cover **8** into engagement with the free end of the locking tongue and move the tongue from engagement with the conductor end. The connector and the conductor end may be then moved relatively to each other to separate them.

An application of my invention, one in which it finds great utility, is that of connecting flexible lead wires to the rigid conductor ends of sheathed wire heating units such as those used in electric ranges, water heaters and the like, and this application of the invention is illustrated in Fig. 6. In Fig. 6, **55**, **56**, **57** and **58** indicate the terminals of the sheathed wire heating elements of the heating unit of an electric range wherein the terminals **55** and **56** are to be connected to lead wires **59** and **60**, respectively, and the terminals **57** and **58** are to be connected to a single lead wire **61**. In each instance, the sheath has been removed at the terminals to provide bare conductor ends of suitable length. Lead wires **59** and **60** are first connected each to the anchoring strip **27** of a locking tongue as shown in Fig. 2, after which the two locking tongues are positioned in a base **7** and a cover **8**, then attached to the base by a bolt **15**, the two lead wires extending out through the two slots **38**. Similarly, lead wire **61** is connected to a locking tongue structure as shown in Fig. 5, and the locking tongue structure then assembled in a connector housing in the manner just described. There is thus provided the one type of connector on the ends of lead wires **59** and **60** as indicated at **62** in Fig. 6, and the other type of connector on the end of lead wire **61** as indicated at **63** in Fig. 6. To make the connections it is necessary merely to slip the one connector **62** over the bare ends of terminals **55** and **56** and the other connector **63** over the bare end of terminals **57** and **58**, operations which are quickly and easily performed. And if occasion arises, a connector can be quickly and easily removed after the manner already described by prying under the head of a bolt with a screw driver or other tool to move the base and cover members relatively to each other thereby releasing the locking tongues, enabling the connector to be pulled off the terminal ends.

By my invention I provide a connector which is small and compact and comprises few parts which can be manufactured at low cost and which are easily assembled. In this connection, it will be noted that a connector for two conductor ends comprises only five parts, the two molded parts, the two locking members and the bolt; and that in assembling the parts it is necessary merely to place the two locking members in the base and attach the cover to the base by means of the bolt. Since the two locking members are held between the base and the cover, no additional fastening means for them is required.

What I claim as new and desire to secure by Letters Patent in the United States is:

1. In an electrical connector, a housing comprising two housing members having along one side engaging parts around which one member may be moved inwardly toward an opposed wall of the other member and along a side opposed to said one side, spaced-apart adjacent surfaces having walls which define a conductor-receiving opening between such opposed surfaces, means fastening said two housing members together which permits of relative movement of the two members, and a locking member in the housing having a part which projects over an edge of said conductor-receiver opening for clamping a conductor end positioned in such opening, and a part which extends across the inner surface of said one member whereby said locking member may be moved from engagement with a conductor end by movement of said one member relatively to the other member.

2. In an electrical connector, a housing comprising a base having a bottom and side walls and a cover which is hinged on one side wall of the base and extends across the base to a position adjacent to the other side wall of the base, said cover being movable inwardly toward the bottom wall of the base, walls which define a conductor-

receiving opening between the free edge of the cover and the adjacent side wall of the base, and a locking tongue in the housing which at one end is anchored against a wall of the housing and extends across the base adjacent to the inner surface of said cover to a position where its free end projects over an edge of said conductor-receiving opening, whereby the free end of said locking tongue may be moved to release a conductor locked in said conductor-receiving opening by movement of said cover inwardly toward the bottom wall of the base.

3. In an electrical connector, a base member and a cover member, said members having engaging surfaces on which they may pivot relatively to each other and opposed surfaces provided with walls which define a conductor-receiving opening, a holding element which passes through an opening in one of said members and is fastened to the other member for holding the engaging surfaces in contact, the opening in said one member through which the holding element passes being larger than the holding element to provide a lost motion connection whereby said members may be moved relatively to each other, and a locking tongue having a fixed end and a free end which projects over an edge of said conductor-receiving opening, said locking tongue extending along a wall of one of said members whereby by moving said members relatively to each other said locking tongue may be moved to release a conductor clamped in the conductor-receiving opening by said locking tongue.

4. The combination defined by claim 3 wherein the holding element is arranged centrally of the housing with a conductor-receiving opening and a locking tongue in each side thereof.

5. In an electrical connector, a housing comprising a base member having a bottom and side walls and a cover member which engages one side wall of the base member and extends across the base member to a position adjacent to the other side wall of the base member, said cover being movable inwardly toward the bottom wall of the base member, walls which define a conductor-receiving opening between the free edge of the cover member and the adjacent side wall of the base member, a locking tongue in the housing which at one end is anchored against a wall of the housing and extends across the base member adjacent to the inner surface of said cover member to a position where its free end projects over an edge of said conductor-receiving opening, and a holding element which passes through an opening in one of said members and is fastened to the other member for holding the cover member in engagement with said one side wall, the opening through which said holding element passes being larger than the holding element to provide a lost motion connection between said members whereby the free end of said locking tongue may be moved to release a conductor locked in said conductor-receiving opening by movement of said cover member inwardly toward the bottom wall of the base.

6. The combination defined by claim 5 wherein the holding element is arranged centrally of the housing with a conductor-receiving opening and a locking tongue on each side thereof.

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