Oct. 13, 1959 W. F. BROSKE 2,908,887

ELECTRICAL CONNECTORS

Original Filed Jan. 8, 1951

Fig. 1

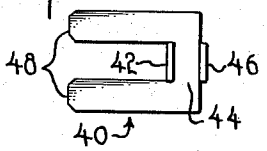


Fig. 3

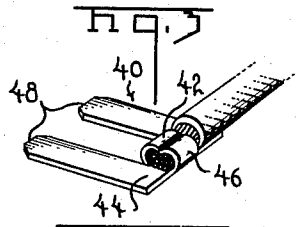


Fig. 2

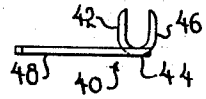


Fig. 7

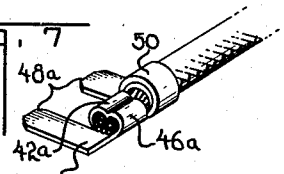


Fig. 4

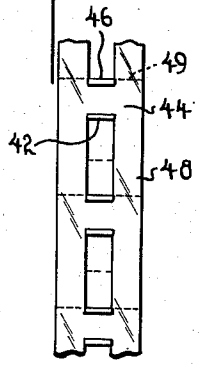


Fig. 5

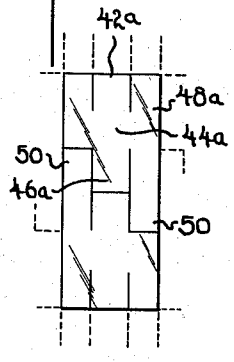


Fig. 6

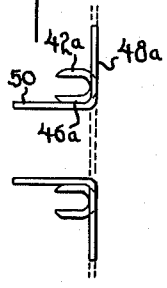


Fig. 8

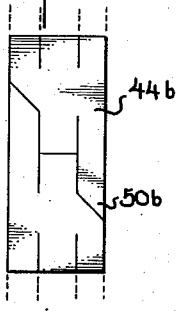


Fig. 9

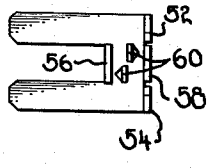


Fig. 10

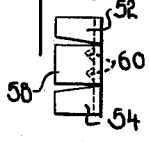


Fig. 11

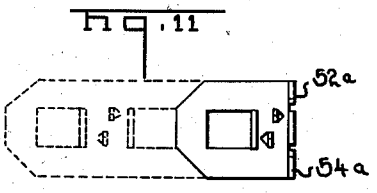


Fig. 12

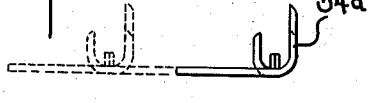
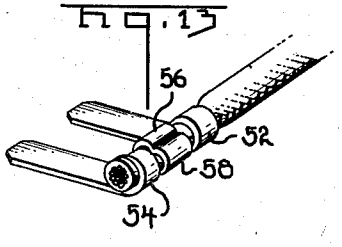


Fig. 13



United States Patent Office 2,908,887 Patented Oct. 13, 1959

2,908,887

ELECTRICAL CONNECTORS

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Original application January 8, 1951, Serial No. 204,888, now Patent No. 2,814,026, dated November 19, 1957. Divided and this application April 18, 1957, Serial No. 660,016

6 Claims. (Cl. 339—223)

This invention relates to electrical connections and to connectors individually and in strips and to methods for making the same. This application is a division of application Serial No. 204,888 filed January 8, 1951, now Patent No. 2,814,026, issued November 19, 1957.

In the past, one of the cheapest connections used for connecting a wire to a binding post or other fastenings has been a flat strip of material with one end wrapped around the wire and a portion extending laterally from the wire with an opening therein for the reception of the binding post. Such connectors whether soldered onto the wire or merely relying on tight wrapping usually make inferior connections and although it is possible to make a good connection by pressure-forming or cold forging together the wire and the rolled portion of such a connector, the length of the rolled metal from the fixed tongue around the wire gives problems of withstanding forces imposed on the wire.

Accordingly, it is a primary object of this invention to provide connectors and connections of the highest quality at low cost. Another object of the invention is to make a connector of the flag contact or lateral tongue type which is adapted for application by pressure-forming onto a wire. Another object is to provide connectors of the type referred to which are capable of efficient, reliable and economical application by automatic or semi-automatic machines. Another object is to effect such economies in material and in application as to make feasible the use of higher quality connections.

Other and further objects will be in part obvious and in part pointed out in the following description and claims taken in conjunction with the accompanying drawings in which:

Figure 1 is a plan view of a connector according to the present invention with the ferrule portion formed into a trough to receive the wire;

Figure 2 is a side view of the connector of Figure 1;

Figure 3 is a perspective view of the connector of Figure 1 crimped onto a wire;

Figure 4 is a plan view of a strip layout of the connector of Figure 1;

Figure 5 is a plan view of a layout of another connector according to the present invention;

Figure 6 is a side view of the connector of Figure 5;

Figure 7 is a perspective view of the connector of Figure 5 crimped onto the wire with an insulation support;

Figure 8 is a plan view of a layout of still another connector according to the present invention;

Figure 9 is a plan view of another connector adapted for crimping on an insulated wire showing the insulation piercing barbs;

Figure 10 is an rear end view of the connector of Figure 9;

Figure 11 is a plan view of a modification of the connector of Figure 9;

Figure 12 is a side view of the connector of Figure 11;

Figure 13 is a perspective view of the connector of Figure 9.

With the connectors known prior to this invention, of the type having an end wrapped on the full diameter of the ferrule, stresses imposed on the wire transversely of the ferrule acted at a moment arm equal to the diameter of the ferrule and tended to unwrap the end. Therefore the connector had to be made of relatively heavy gauge metal often greater than required in the contact portion and often of hardness greater than the optimum for crimping the ferrule onto the wire. According to one feature of my invention, important economies of material are effected by utilizing material cut from the shank of the flag contact portion or from the opening for the binding post, to engage the wire and by stamping up ears from the flag tongue to cooperate with ears stamped out on the other side opposite to the flag. These ears are advantageously turned up to form with the root portion between them, a trough into which the wire may be inserted. This allows the curling of each upstanding ear on a radius less than the overall radius of the ferrule thus increasing the rigidity of the ferrule portion and reducing the moment arm at which stresses transmitted by the wire tend to open the ferrule. Consequently the thickness of metal required to withstand such stresses is reduced to bring the requirements of the ferrule portion more nearly into conformity with those of the flag contact portion and thereby effect savings in the thickness of the metal required.

In one embodiment of the invention, the material for the ferrule-forming portion is, at least in part taken from the regions of the connector which ultimately are to receive the binding post or connector screw. Thus, in the connector of Figure 1, the ear **42** on the flag contact edge of the root section **44** is punched up from the opening in the flag contact **40** and a corresponding ear **46** is punched up on the opposite edge of the root section to form a trough with said root section (Figure 2). When the connector is to be applied, the wire is inserted in the trough and the ears **42** and **46** are curled in to intimate engagement with the wire (Figure 3). This crimping operation is advantageously performed in a curling die having parallel interior side faces to support the ears and merging into end faces substantially tangential therewith and cylindrical with a radius equal to one-quarter of the width between said parallel faces. This utilizes the invention set forth and claimed in a patent to James C. Macy, Serial No. 679,630, filed June 27, 1946, now Patent No. 2,557,126.

As the ears are upstanding on each side of the root section they may be of a length such that, beyond a central portion adapted to make a nest for the bottom half of the wire, the length of the ear is substantially more than one-quarter and less than half the circumference of the wire, thus allowing a curling in on a radius less than the overall radius of the ferrule. This smaller radius reduces the moment arm at which stresses transmitted by the wire may tend to open the ferrule and consequently reduce the thickness of the metal required. Also, since the ferrule is formed by oppositely curled ears from each side of the root section, it is better suited to withstand stresses from all directions than flag connectors heretofore known having a wrapped ferrule only.

As shown in Figure 4, this connector is adapted to forming in a strip of integrally joined connectors. This can be made from strip sheet metal of uniform width with little or no scrap loss, the ear **42** being struck up from between the flag contact "tines" **48** of the same connector, as already described, and the ear **46** being struck up from the outer portion of the opening in the flag contact of the next adjacent connector. This leaves

the prongs 48 of each flag contact integrally attached to the root section 44 of the adjacent connector so as to give a continuous strip for automatic feeding of the crimping machine. It is often advantageous to nick or partially sever each of the prongs 48 along its line of junction 49 with the adjacent connector so as to facilitate severing in the applying machine.

Figures 5 through 7 show respectively a plan of layout on the sheet-metal strip, showing an efficient use of metal, a side elevation of the flag-type connectors made from said strip and layout, and a perspective view of one such connector crimped on an insulated conductor having a stripped end. This represents a connector similar to Figure 1 but with shorter "tines" 48*a* and a long ear 50 extending from the root section 44*a* of one connector beside the ears 46*a* and 42*a* of both adjacent connectors which are advantageously paired in mirror image relationship so that each ear 50 is severed from the root section 44*a* of the adjacent connector and also from the ear 46*a* of each of the adjacent connectors. This connector may be completely severed and formed in progressive dies at the factory or ear 50 may be punched up with the ears 42*a* and 46*a* as shown in Figure 6 and on application curled around the insulation of the wire to give mechanical support thereto, producing the connection of Figure 7. The ears 50 may be left joined or only partially severed from the root section of the adjacent connector and thus fed to an applicator machine which severs these ears 50 and curls them into embracing engagement around the insulated wire, when the bared end of its conductor is engaged by the ears 42*a* and 46*a*. When they are left joined they require shearing or cutting members in the applicator machine to sever each ear from the next. Such dies may be connected to and removed with the crimping dies and each connector may be severed from the adjacent connector at the same time that the ears are crimped onto the wire. Where such connected strip is desired, however, it is better to leave the root sections joined or only partially joined, and sever the ears 50 and 46*a* and form then to the extent shown in Figure 6. As shown in Figure 5, two such strips are advantageously made from a single sheet metal strip of the width represented in full lines in Figure 5.

This connection gives the stronger, better electrical contact as in the above embodiments along with good mechanical insulation support with an added saving of metal due to the strip layout.

The connector of Figure 8 is like that of Figures 5 through 7 but gains a greater length for the insulation supporting ear 50*b* and a more favorable curling ability by a diagonal cut between it and the web portion of the root section 44*b*, thus one can accommodate a wider range of wire sizes.

Figures 9 through 13 show a second type of connector adapted for application to unstripped, insulated wire. In this case the ears 52 and 54 are curled around the insulation and wired ears 56 and 58 are curled in together and driven through the insulation to contact the wire. Barbs 60 are struck up from the root section to pierce the insulation and contact the wire at a third point on its circumference and thus prevent rotation of the wire to a position where contact with the connector might be broken. The strip layout in Figures 11 and 12 is generally similar to that of Figure 4 except for closing the connector tines to form a ring and the provision of insulation supporting ears 52*a* and 54*a* extending from the margins of the root sections opposite the contact flag. Preferably the ends of ears 52*a* and 54*a* are diagonally cut to increase their length.

Figure 13 shows the insulation terminal with the insulation supporting ears 52 and 54 wrapped around and gripping the insulation and ears 56 and 58 curled through the insulation to contact the wire.

Although in this specification and the accompanying drawings there are shown a number of different embodiments of the invention and various other modifications are suggested, it is to be understood that these are not exhaustive or limiting of the invention but, on the contrary, are chosen and presented here for the purpose of illustrating and explaining the invention and the formalities thereof and its possibilities for variation so that others skilled in the art will be enabled to modify it and embody it in numerous other ways each as may be best adapted to the conditions of a particular use.

I claim:

1. A sheet metal electrical connector comprising a ferrule forming portion including a root section, ear means laterally projecting oppositely from each side of said root section, said ear means being substantially of the same length and malleable for cold forging into engagement with the metal core of a conductor disposed along said root section, and a contact flag portion extending from one side of said root section, the sides of the ear means on the flag portion side of said root section being disposed between portions of said flag portion and in immediate contiguity therewith.

2. A sheet metal electrical connector comprising a ferrule forming portion including a root section, ear means laterally projecting oppositely from each side of said root section, said means being malleable for cold forging into engagement with the metal core of a conductor disposed along said root section; a contact flag portion extending from one side of said root section, the ear means on the flag portion side of said root section being taken from the material of said flag portion and leaving an opening therein; and an insulation supporting ear extending from the side of said root section opposite said flag portion for supporting engagement with the insulation of the conductor.

3. In electrical connection with a wire, a connector of malleable sheet metal comprising a ferrule root portion along which said wire is disposed, a contact flag portion extending from one side of said root portion laterally of said wire, a pair of ears extending to substantially equal length from opposite sides of said root section, said ears forming with the interposed section of said root portion a ferrule tightly embracing said wire, the ear on said one side being formed of material taken from within the borders of and leaving an opening in said flag portion.

4. In electrical connection with an insulated wire having a bared end, a connector of malleable sheet metal comprising a ferrule root portion along which said wire is disposed, a contact flag portion extending from one side of said root portion laterally of said wire, a pair of ears extending to substantially equal length from opposite sides of said root section, said ears forming with the interposed section of said root portion a ferrule tightly embracing said bared end, the ear on said one side being formed of material taken from within the borders of and leaving an opening in said flag portion, and an insulation supporting ear extending from the side of said root section opposite said flag portion and immediately adjacent one of the ferrule-forming ears.

5. A series of integrally joined electrical connectors comprising an integral strip of sheet metal, a plurality of regularly spaced transverse sections of said strip defining connector root portions extending from side-to-side of the strip, a pair of ferrule-forming ears for each of said root portions turned up from within the sides of and leaving openings in said strip on opposite sides of the associated root portion about bending axes transverse to the strip length, and contact flag portions laterally extending from and including the strip material bordering the opening on one side of the respective root portions.

6. A series of electrical connectors as defined in claim 5 wherein the turned up ears are centrally positioned

relative to the strip and root portions, and another ear for each connector extends longitudinally along the side of the strip from the side of the root portion opposite the associated contact flag portion.

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