Nov. 19, 1957 W. F. BROSKE 2,814,026

ELECTRICAL CONNECTORS

Filed Jan. 8, 1951 2 Sheets-Sheet 1

Fig. 1.

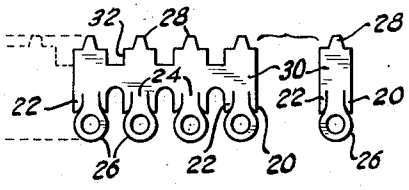


Fig. 2.

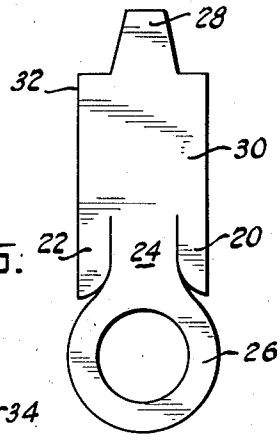


Fig. 3.

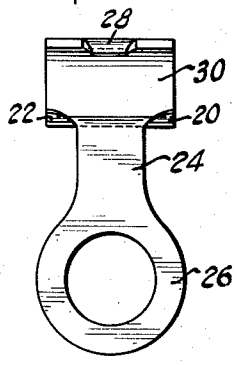


Fig. 4.

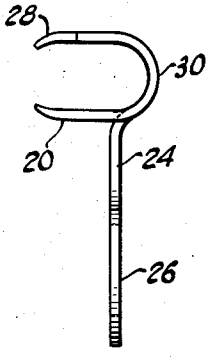


Fig. 5.

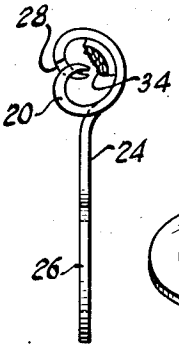


Fig. 6.

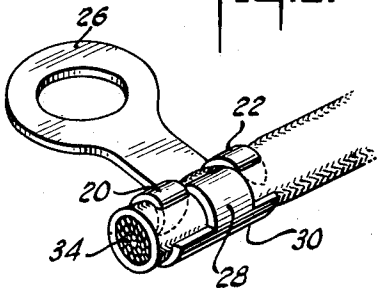


Fig. 7.

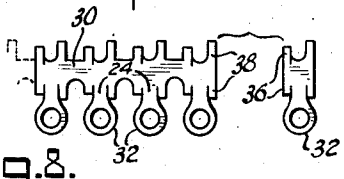


Fig. 8.

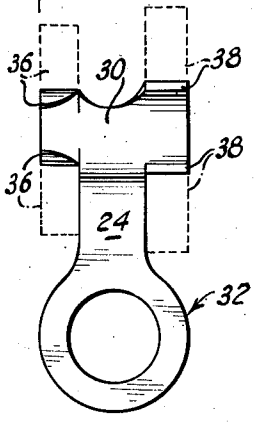


Fig. 9.

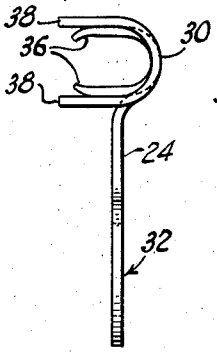


Fig. 10.

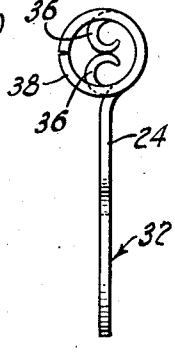
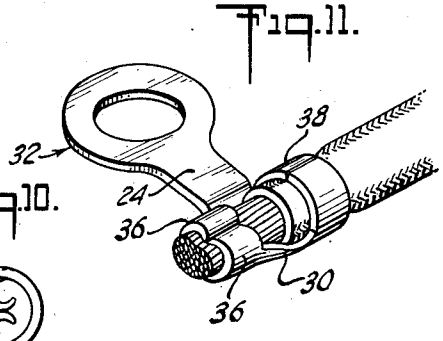


Fig. 11.



INVENTOR:
WILLIAM F. BROSKE.

BY
Curtis, Morris & Safford.
ATTORNEYS:

Nov. 19, 1957 W. F. BROSKE 2,814,026

ELECTRICAL CONNECTORS

Filed Jan. 8, 1951 2 Sheets-Sheet 2

Fig. 12.

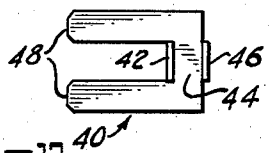


Fig. 14.

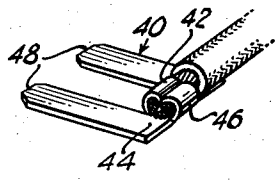


Fig. 13.

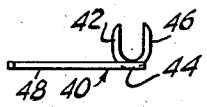


Fig. 18.

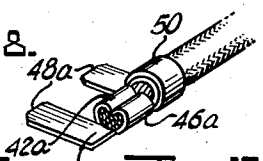


Fig. 15.

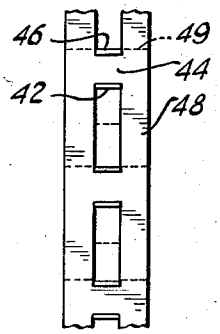


Fig. 16.

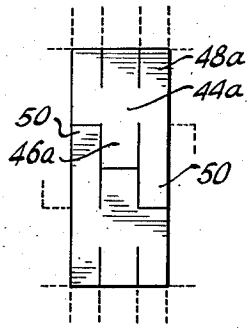


Fig. 17.

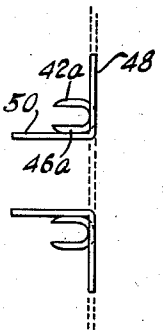


Fig. 19.

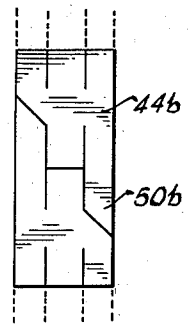


Fig. 20.

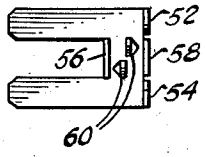


Fig. 21.

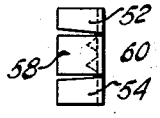


Fig. 22.

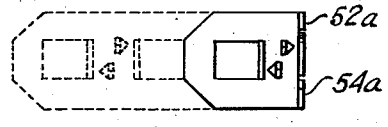


Fig. 23.

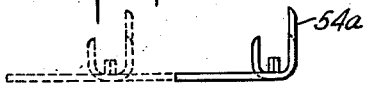


Fig. 24.

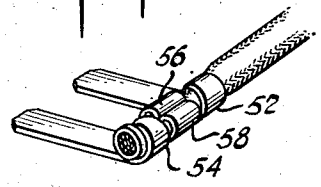
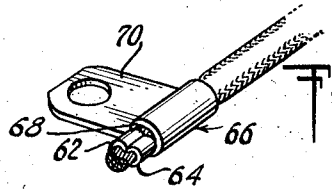


Fig. 25.



INVENTOR:
WILLIAM F. BROSKE
BY
Curtis, Morris & Safford
ATTORNEYS:

United States Patent Office 2,814,026 Patented Nov. 19, 1957

2,814,026

ELECTRICAL CONNECTORS

William F. Broske, Harrisburg, Pa., assignor to AMP Incorporated, a corporation of New Jersey

Application January 8, 1951, Serial No. 204,888

6 Claims. (Cl. 339—276)

This invention relates to electrical connections and to connectors individually and in strips and to methods for making the same.

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 strip of connector blanks according to the present invention;

Figure 2 is an enlarged plan view of a single blank in a strip of connector blanks according to the present invention;

Figure 3 is a plan view of a connector with the ferrule portion formed into a trough to receive the wire to be connected;

Figure 4 is a side view of Figure 3;

Figure 5 is a view similar to Figure 4 showing penetration of the connector into the wire after crimping;

Figure 6 is a perspective view of the crimped connector of Figure 5;

Figure 7 is an plan view of a strip of connector blanks showing an alternative embodiment of the invention;

Figure 8 is an enlarged plan view showing an individual connector of Figure 7 with the ferrule portion formed into a trough for reception of the wire;

Figure 9 is a side view of Figure 8;

Figure 10 is a view similar to Figure 9 showing the connector after crimping;

Figure 11 is a perspective view of the connector of Figure 10;

Figure 12 is a plan view of another connector according to the present invention with the ferrule portion formed into a trough to receive the wire;

Figure 13 is a side view of the connector of Figure 12;

Figure 14 is a perspective view of the connector of Figure 12 crimped onto a wire;

Figure 15 is a plan view of a strip layout of the connector of Figure 12;

Figure 16 is a plan view of a layout of another connector according to the present invention;

Figure 17 is a side view of the connector of Figure 16;

Figure 18 is a perspective view of the connector of Figure 16 crimped onto the wire with an insulation support;

Figure 19 is a plan view of a layout of still another connector according to the present invention;

Figure 20 is a plan view of another connector adapted for crimping on an insulated wire showing the insulation piercing barbs;

Figure 21 is a rear end view of the connector of Figure 20;

Figure 22 is a plan view of a modification of the connector of Figure 20;

Figure 23 is a side view of the connector of Figure 22;

Figure 24 is a perspective view of the connector of Figure 20;

Figure 25 is a perspective view of still another connector according to the present invention.

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.

Referring to Figure 2, ears **20** and **22** are severed from the shank **24** of the flag contact **26** and ear **28** is severed from the metal adjacent the opposite edge of the root section **30** of the connector **32**. These ears are then turned up to form a trough with the root section **30** of the connector **32** (Figures 3 and 4) into which the wire may be inserted.

Referring further to Figures 3 and 4, it will be seen that by providing a wire-receiving trough in the root section **30** and causing the shank **24** of the flag contact **26** to start from one upstanding edge of this trough, the amount of shear required to provide ears **20** and **22** long enough for their intended purposes will be less than would be the case were the shank **24** to extend from the bottom of the connector ferrule. The offsetting of the bottom of the trough from the shank **24**, which is shown in Figs. 3 and 4, also serves to provide greater clearance for the edge of the concave anvil part of the connector crimping mechanism.

When it is desired to apply the connector, the wire is inserted and the ears are curled in to pierce the insulation and intimately engage the wire (Figures 5 and 6). This crimping operation is advantageously performed in a curling die having parallel interior side faces to support the ears and merging into end faces 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.

The resulting connection is shown in Figure 6 wherein the ears 20, 22 and 28 have been curled in with their ends driven through the insulation into the wire **34**. 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 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 1, the connector just described is well adapted to forming in multiple in a strip for use with automatic application equipment.

In Figure 8, a connector embodying this invention is shown adapted for crimping ot a wire where the insulation has been stripped from the end. This connector is provided with two pairs of opposite ears **36** and **38**. The ears **36** are curled in against each other and forged down with their ends against the wire to form the electrical connection between the wire and said terminal, and the ears **38** are made of length such that they surround and grip the insultation to provide mechanical support for the wire. The ears are severed from the sheet metal of the tongue, but left integral with the root portion and are turned up as in the first embodiment to form a trough with the root section of the ferrule-forming portion (see Figure 9).

When the connector is to be applied, the wire is inserted in the trough and the ears **36** and **38** curled in and crimped onto the wire and insultation respectively, as shown in Figures 10 and 11. The resulting connection (Figure 11) has good electrical contact with strong mechanical engagement and support of the insulated conductor.

As shown in Figure 7, this terminal is also readily adaptable for forming in multiple in a strip for use in automatic application machines.

In another embodiment of the same broad invention, the material for the ferrule-forming portion is, at least in part taken from the open ring which receives the binding post or connector screw. Thus, in the connector of Figure 12, 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 13). When the connector is to be applied, the wire is inserted in the trough and the ears 42 and **46** are curled in to crimp the wire (Figure 14) in a manner similar to that of the ears **36** in Figure 11.

As shown in Figure 15, 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 16 through 18 show respectively a plan of layout on the sheet-metal strip, showing an efficient use of metal, and a side elevation of the flag-type connectors made from said strip and layout. This represents a connector similar to Figure 12 but with shorter "tines" *48a* and a long ear **50** extending from the root section *44a* of one connector beside the ears *46a* of both adjacent connectors which are advantageously paired in mirror image relationship so that each ear **50** is severed from the root section *44a* of the adjacent connector and also from the ear *46a* 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 *42a* and *46a* as shown in Figure 17 and on application curled around the insulation of the wire to give mechanical support thereto, producing the connector of Figure 18. The ears **50** may be left joined or only partially severed from the root section of the adjacent connection 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 *42a* and *46a*. 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 *46a* and form then to the extent shown in Figure 17. As shown in Figure 16, two such strips are advantageously made from a single sheet metal strip of the width represented in full lines in Figure 16.

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 19 is like that of Figures 16 through 18 but gains a greater length for the insulation supporting ear *50b* and a more favorable curling ability by a diagonal cut between it and the web portion of the root section *44b*, thus one can accommodate a wider range of wire sizes.

Figures 20 through 24 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. Figure 24 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.

In Figure 25 another connector is shown wherein oppositely disposed ears **62** and **64** are turned up at the end of the ferrule-forming portion **66** and the end-portion **68**, an extension of the flag contact **70** in and beyond the root section, is rolled up to receive the insulated wire and may be crimped onto the insulation when the ears **62** and **64** are crimped onto the stripped portion of the wire. This connection provides the strong electrical contact of the above embodiments with a good mechanical insulation support making a slight loosening of the rolled portion

unimportant since tight positive electrical contact is assured.

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 including a ferrule-forming portion comprising a root section shaped to form a wire-receiving trough having ears upstanding from the opposite edges of the side walls thereof, said ear being tangential extensions of said trough, and a flag contact portion integral with said root section and extending from the same side wall edge of said trough as one of said ears and in a direction transverse to said ear.

2. A sheet metal electrical connector including a ferrule-forming portion comprising a root section having an insulated conductor disposed along the length thereof, two ears laterally extending from each side of said root section forming oppositely disposed pairs, one pair of said ears extending to the same length from the center of said root section and curled partially around and driven against the core exposed at the end of said conductor on a radius of curvature less than the overall curvature of the ferrule, the other pair of ears being curled around the insulation of said conductor for mechanical support thereof said ears being malleable for cold forging, and a flag contact portion extending from between the ears on one side of said root section and immediately adjacent thereto.

3. A sheet metal electrical connector including a ferrule-forming portion comprising a root section having an insulated conductor disposed along the length thereof, malleable ears laterally extending from opposite sides thereof, two of said ears on opposite sides being relatively short and extending to the same length from the center of said root section and curled partially around and driven against the core exposed at the end of said conductor on a short radius of curvature less than the overall curvature of the ferrule, at least one other of said ears being relatively longer and curled on a longer radius around the insulation of the conductor for mechanical engagement and support thereof, and a flag contact portion extending from the same side of said root section as one of said two ears and immediately adjacent thereto.

4. A sheet metal electrical connector including a ferrule-forming portion comprising a root section shaped to form a wire-receiving trough having two ears upstanding from each of the side wall edges thereof to form oppositely disposed pairs for crimping on a wire, said ears being tangential extensions of said trough and a flag contact portion integral with said root section and extending from between the ears on one sidewall edge of said trough and in a direction transverse to said ears.

5. A sheet metal electrical connector including a ferrule-forming portion comprising a root section shaped to form a wire-receiving trough having two ears upstanding from each of the sidewall edges thereof to form oppositely disposed pairs for crimping on a wire, said ears being tangential extensions of said trough and a flag contact portion integral with said root section and extending from between the ears on one edge of said trough and in a direction transverse to said ears, one pair of oppositely disposed ears being of a length for curling on a radius into contact engagement with the central conductor of an insulated wire and at least one other ear being longer for curling on a longer radius around the insulation of the wire for mechanical engagement and support thereof.

6. A strip of connectors ready for application to wires which comprises a plurality of such connectors each an integral part of the strip and integrally connected to the adjacent connector in only a part of their adjacent edges, each having a flag contact portion and a ferrule-forming portion, said ferrule-forming portion comprising a root section integrally connected along a lengthwise edge thereof with said flag portion and adapted to receive a wire along the length thereof, and a plurality of upstanding ears integrally connected along opposite sides of said length, at least one of said ears being immediately contiguous to said flag portion, said flag portion extending from between two years on one side of said root section.

References Cited in the file of this patent

UNITED STATES PATENTS

962,921	Schneider	June 28, 1910
1,070,948	Dodd	Aug. 19, 1913
1,309,887	Fulton	July 15, 1919
1,676,387	De Lorme	July 10, 1928
1,946,713	Rowley	Feb. 13, 1934
2,279,915	Cram	Apr. 14, 1942
2,288,918	Parker	July 7, 1942
2,301,288	Knauf et al.	Nov. 10, 1942
2,432,966	Del Camp	Dec. 16, 1947
2,436,852	Carmichael	Mar. 2, 1948
2,439,947	Pontius	Apr. 20, 1948
2,511,806	Macy	June 13, 1950
2,526,937	Cripe	Oct. 24, 1950
2,557,126	Macy	June 19, 1951
2,558,052	Klumpp	June 26, 1951

FOREIGN PATENTS

585,670	Great Britain	Feb. 18, 1947
589,656	Great Britain	June 26, 1947
884,641	France	Aug. 23, 1943