

Feb. 21, 1939.

J. ROGOFF

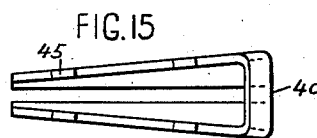
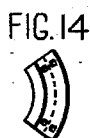
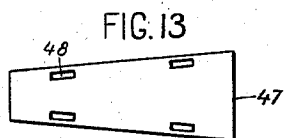
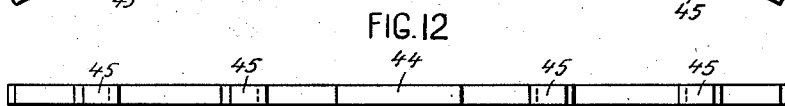
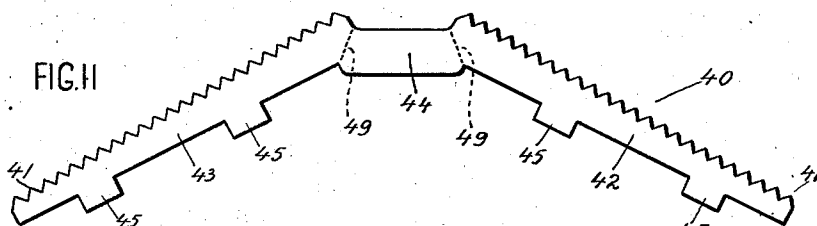
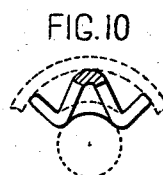
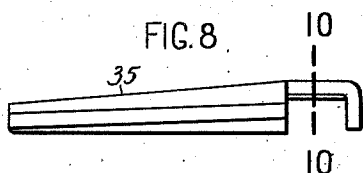
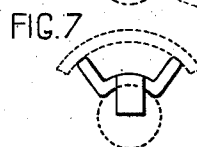
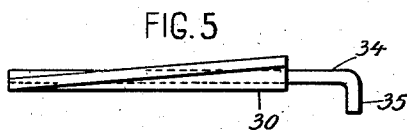
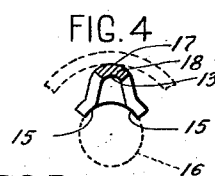
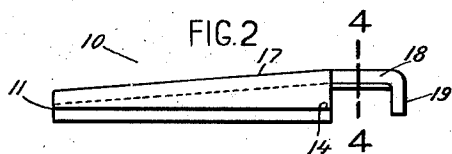
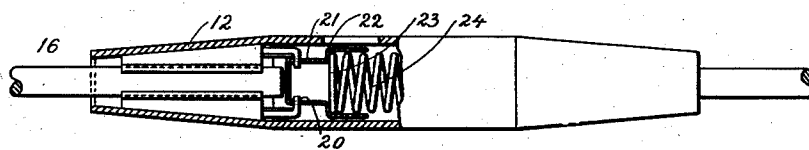
2,148,173

CONNECTOR WITH SHEET METAL JAWS

Filed June 16, 1937

2 Sheets-Sheet 1

FIG. 1



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CONNECTOR WITH SHEET METAL JAWS

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2 Sheets-Sheet 2

FIG.16

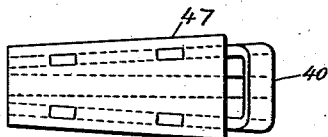


FIG.17

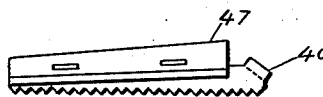


FIG.18

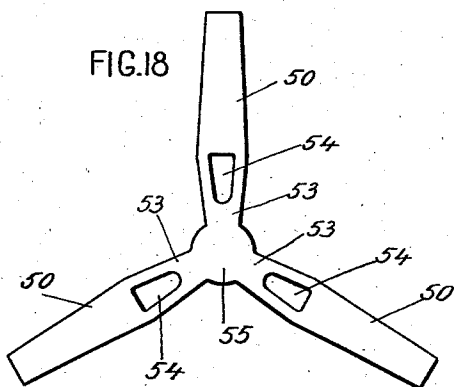


FIG.19

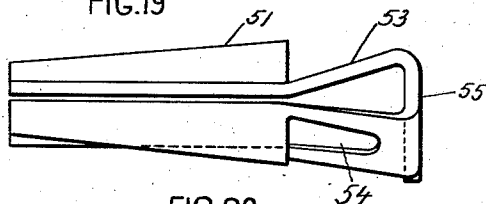


FIG.20

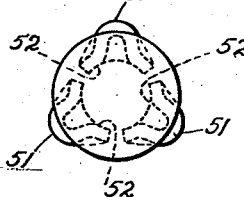


FIG.21

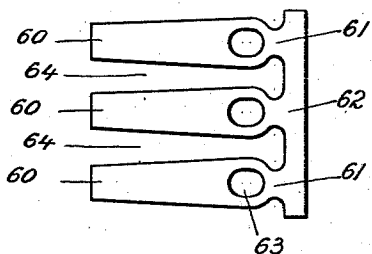


FIG.22

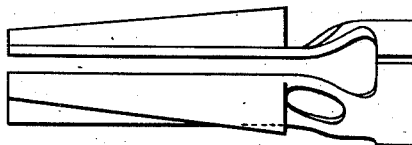


FIG.23

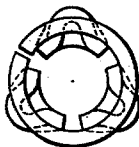


FIG.24

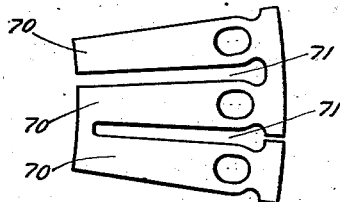


FIG.25

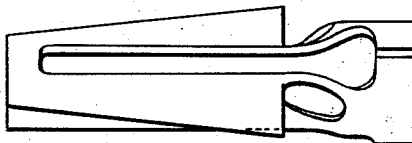
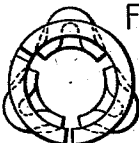


FIG.26



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UNITED STATES PATENT OFFICE

2,148,173

CONNECTOR WITH SHEET METAL JAWS

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Application June 16, 1937, Serial No. 148,489

8 Claims. (Cl. 24—126)

My invention relates to connectors for electrical wires and cables and more specifically to splice connectors which join two conductors on end by simply inserting the ends of the two conductors into the openings in the connector. The conductor is gripped by jaws with serrated internal contact faces and smooth tapered outer faces which ride in a tapered envelope. The friction between the wire and the jaw gripping face must be greater than the friction between the tapered face of the jaw and that of the envelope in order for the connector to function. As tension is applied to the wire the jaws are pulled further into the taper and are in turn forced with greater pressure on the conductor, thus increasing the holding power of the jaws. In a properly designed connector of this type the conductor will break before it will slip in the jaws.

In the past the jaws of electrical splice connectors of the self tightening type have been invariably manufactured as forgings or as screw machine products. Both these methods are expensive and are difficult to apply on fully automatic machinery. Accordingly, one of the primary objects of my invention is to provide satisfactory jaws which are cheaper and more economical to manufacture than forgings or screw machine products. I have discovered that sheet metal can be used for this purpose. The benefit of using sheet metal from this standpoint is readily apparent, inasmuch as the material itself is inexpensive and it can be fabricated very cheaply on high speed automatic machines.

Sheet metal for use in manufacturing jaws possesses several apparent defects which make it seemingly inapplicable for use as jaws. It was hitherto thought necessary to get a continuous bearing surface against the envelope, and at the same time get continuous serrations on the cable gripping surfaces which grip the wire on a large proportion of its circumference. As outlined in co-pending application No. 64,805, now issued as Patent Number 2,118,666, serrations which grip the wire at spaced points on the circumference, would hold the wire just as securely as continuous serrations and at the same time would nick the wire to a lesser extent so that breakage of the wire would not occur at the splice but at a point remote from the connector. This disposes of the necessity for large areas of continuous serrations for cable gripping purposes. The assumption also made was that the outside tapered faces of the jaws must be made in the form of a truncated cone in order to have the greatest possible bearing on the inner tapered wall of the envelope.

This was supposed to provide more even pressure on both envelope and conductor, thus obtaining a better grip on the wire and minimizing the distortion of the envelope. Various expedients have been devised to insure this condition, such as increasing the number of jaws; placing "weak back" or slotted portions in the backs of the jaws in order that they flex and conform more closely to the inner taper of the envelope, etc.

I have found that it is not necessary to have a large bearing surface on the tapered faces of the jaws for efficient performance of the splice connector. I have found that if each jaw rides on only a single line of pressure or on only a comparatively small bearing area, the resultant grip on the wire will be just as efficient as if a much larger area were in contact. Such jaws will grip the conductor securely and, under increasing tension, will hold the wire without slip until the wire breaks. The only precaution that must be taken is to make sure that there are no sharp edges on the tapered bearing face of the jaws which might cut into and distort the envelope.

From the foregoing discussion it is apparent that the two major objections to sheet metal jaws are not valid. There is no need to have a continuous contact face bearing on either the conductor or the inner tapered wall of the envelope.

It is possible to manufacture a sheet metal jaw which will have both contact faces continuous circumferentially. It is much easier, however, to make a jaw with one of the faces continuous and the other discontinuous circumferentially. When neither face need be continuous, it is not only practical but decidedly economical to make the jaw of sheet metal.

Accordingly, an important object of my invention is to provide sheet metal jaws for tubular splice connectors which provide satisfactory contact surfaces with the tubular envelope, and efficient cable gripping surfaces.

In addition to assuming that small bearing area between the tapered faces of the jaws and envelope would have a detrimental effect on the grip of the connector, previous devices have been designed with the assumption that a small area would be detrimental to electrical conductivity. As was stated in co-pending application No. 59,362, electrical contact resistance is proportional, not to the area, but to the amount of pressure applied between two surfaces. By my construction I get a smaller area in contact, but the total pressure between contact faces of the jaws and envelope is greater than in other constructions for any given tension on the wire because of

the reduced frictional resistance between the contact faces of the jaws and envelope. This frictional resistance is kept to a minimum because of the smoothness possible to obtain with sheet metal. Such smoothness cannot be obtained on

5 a screw machine jaw because of the ridges left by the cutting tool or by a forged jaw because of the unavoidable minor pitting which takes place in such fabrication.

10 An additional object of my invention, therefore, is to provide sheet metal jaws capable of withstanding extremely high contact pressures over small relatively non-frictional sliding surfaces.

15 Not only are sheet metal jaws economical to manufacture, they also are superior due to the inherent properties of the sheet metal. One of the most requisite properties of a good jaw is to obtain a cable contact surface of the maximum hardness possible. This is necessary in order

20 that the serrations on the jaws bite into the surface of the conductor rather than crush flat. Since most conductors on which these splices are used are hard drawn wires, the need for exceptionally hard jaw serrations is obvious.

25 In both forged and screw machine products it is not possible to obtain the maximum hardness inherent in any given material. This is true because, as is well known, considerable cold working is necessary to bring a metal or alloy to

30 maximum hardness. In a forged product, the metal is formed hot into the shape of the jaws and even if it is given an additional cold stamping operation, the hardness can be increased only a relatively small amount. In a screw machine

35 product the jaw is cut from rod which must be reasonably soft in order to be free cutting. However, even if the rod is cold rolled to maximum hardness, such hardness is obtainable only at the outer skin of the rod and the material gets progressively softer as the center of the rod is

40 approached. Inasmuch as the cable contact surface is formed from that section of the rod quite close to the center, it can be readily seen that the maximum hardness of the material is not obtainable for the cable contact face.

45 It is well known that sheet metal can be cold worked to a greater degree of hardness than other forms of metal. Not only is this true but the additional cold working operations of forming the sheet metal into jaws actually harden the material still further. The serrations themselves may be cut into the jaw face or preferably may be made exceptionally hard by cold stamping the

50 sheet metal jaw face in order to raise the serrations.

From the foregoing it can be seen that another object of my invention is to fabricate sheet metal jaws for electrical splice connectors of high hardness which will grip even hard drawn wires securely.

Another object is to provide a jaw which will not distort and can be reused.

65 Many other novel results are attained and other objects readily discernible from a consideration of the devices described in the following specification and illustrated in the accompanying drawings in which:

70 Fig. 1 is a partial sectional view of one form of my novel sheet metal jaws assembled within a tubular connector.

Fig. 2 is a side view of my novel sheet metal jaw.

75 Fig. 3 is an end view of the same.

Fig. 4 is a sectional view, along lines 4-4 of Fig. 2.

Fig. 5 is a side view of another embodiment.

Fig. 6 is an end view of the same.

Fig. 7 is another end view.

Fig. 8 is a side view of another embodiment.

Fig. 9 is an end view of the same.

Fig. 10 is another end view.

Fig. 11 is a side view of one piece of another two piece embodiment.

Fig. 12 is a top view of the same.

Fig. 13 is a top view of the other piece.

Fig. 14 is an end view of the same.

Fig. 15 is a side view of the first piece, folded.

Fig. 16 is a top view of the assembled jaw.

Fig. 17 is a side view of the same.

Fig. 18 is a plan view of an integral set of sheet metal jaws.

Fig. 19 is a side view of the same folded in position.

Fig. 20 is an end view of the same.

Fig. 21 is a plan view of another modification.

Fig. 22 is a side view of the same, folded.

Fig. 23 is an end view of the same, folded.

Fig. 24 is a plan view of still another modification.

Fig. 25 is a side view of the same, folded.

Fig. 26 is an end view of the same.

In Fig. 2, reference number 10, designates the sheet metal jaw with end section 11 curved to fit the circular perimeter of the conductor. This section is approximately the apex of the frusto-conical outline of the tapered ends 12 of the splice connector, shown in Fig. 1. As shown in Fig. 4, the jaw is longitudinally folded at 13, allowing the sides 14 to be formed to engage the sides 15 of the conductor wire 16. This forms the gripping surfaces which are provided with teeth, preferably of the type disclosed in co-pending application No. 64,805. The outer surface 17, created by the fold 13, engages the inner wall of the tapered end 12, in practically a line contact.

The jaw is preferably provided with an extending neck 18, shown in cross-section in Fig. 4, with an axially depending spur 19, which engages a slot 20, in a cap shaped member 21. This cap has a peripherally extending shoulder 22 in which is set a washer 23 forming an abutment for the compression spring 24, which forces each jaw assembly at each end of the connector to their extreme positions.

In my preferred embodiment, three such jaws constitute a unit assembly and the cap 21 is provided with a corresponding number of slots 20, to hold the jaws in position.

As shown in Fig. 4, the jaw engages the outer envelope 26 of the connector, and the conductor 16, shown in dotted line.

In Figs. 5, 6, and 7, a modified form of jaw is illustrated. The sheet metal jaw 30 is longitudinally curved at 31, to form the gripping surfaces 32. The widest section of the jaw is upwardly bent to form two connector engaging surfaces 33. The neck 34 and spur 35 are provided to engage the slot 20 in the cap 21.

In Figs. 8, 9, and 10, is illustrated a combination of the jaws shown in Figs. 2 and 5.

Whereas jaw 10 is folded at 19 to form a connector engaging surface 17 longitudinally along the axis, jaw 30 has the two wing sections 33 performing this function. And whereas jaw 10 has two wing sections 14, forming the cable gripping surfaces, jaw 30 uses a central fold 31 for this purpose.

Jaw 35 in Fig. 8, has both types of connectors engaging surfaces, namely wings 36 and central fold 37, and both types of cable gripping surfaces, namely, wing sections 38 and fold section 39. They are best illustrated in operation in Fig. 10, the connector shell and cable being shown in dotted position.

It should be noted that the jaws shown in Figs. 2, 5, and 8 have a springy action, by reason of the longitudinal folds. This gives the connection a locking effect that has been found desirable.

In Figs. 11 and 12 are shown a two piece type of sheet metal jaw. One piece consists of metal stamping forming a cable gripping section 40 provided with serrated teeth 41, along the outside edge of the two legs 42 and 43. The width of the legs increases as it approaches the central section 44. This gives the necessary conical shape when folded, as shown in Fig. 16. On the sides of the legs 42 and 43, opposite the serration 41, are shown a plurality of lugs 45 which function as locking means for the two pieces in a manner hereinafter set forth.

Fig. 12, illustrates the thickness of the cable gripping section.

In Fig. 13 is shown the connector engaging section 47, which is formed into a segmented frusto-conical shape. A plurality of slots 48, are provided for insertion of the lugs 45 in member 40. A cap for contact with the connector spring which engages the central section 44, is not shown as its construction is obvious to those skilled in the art.

Member 40 is folded along the dotted lines 49 taking the U-shape illustrated in Fig. 15. Lugs 45 are then inserted into slots 48 of member 47 which completes the assembly shown in Figs. 16 and 17.

In Fig. 18 an integral three jaw assembly is shown. Jaws 50 are folded longitudinally to form bearing surfaces 51, and cable gripping surfaces 52, similar to the individual jaw construction shown in Fig. 2, 3, and 4, although it is readily apparent that any satisfactory jaw formation can be used, such as illustrated in Figs. 5 and 8.

Each jaw is provided with an extending neck section 53, apertures at 54 to give the neck section greater flexibility. The neck sections terminate in a cap 55 upon which the connector spring rests. The jaws are shown in folded position in Figs. 19 and 20.

These jaws are kept in spaced position circumferentially and longitudinally by the cap 55 and extending neck section 53, and are outwardly expanding to keep the cable passage clear.

In 21 is shown another three jaw integral construction, requiring a much smaller blank.

The jaws 60 are provided with neck sections 61, which are integrally connected at 62. Apertures 63 are similarly provided as shown in the conductor illustrated in Fig. 18. Cut-out sections 64 separate the free end of the jaws which give them the necessary frusto-conical shape, shown in Fig. 22. The length of section 62 is such as to give the formed assembly the necessary diameter for free movement in the connector.

The jaws are shown as shaped, similar to the construction illustrated in Figs. 2, 3, and 4.

If greater flexibility is desired, the jaws may be blanked in the form shown in Fig. 24. Here the jaws 70 are separated by alternating cut-out section 71. The jaws are shaped into the frusto-conical form and individually formed as the modification shown in Figs. 21, 22, and 23.

By my constructions, I have illustrated varying types of sheet metal jaws, each satisfactorily provided with connector engaging and cable gripping surfaces. It will be noted that in each instance, the connector gripping surfaces are free from edge contacts which normally cut the connector envelope, and thereby weakening it. By the use of sheet metal surfaces, I have provided relatively non-frictional sliding contacting surfaces. By making the jaws of stamped sheet metal I can obtain a hardness impossible with screw machine or forged products made of the same alloy.

By the use of metal of high hardness, I am able to use extremely high pressures insuring minimum electrical resistance, increasing the electrical efficiency of the connector.

By the use of sheet metal, I reduce the cost of the various parts thus attaining a desirable economy.

I have thus described my invention, but I desire it understood that it is not confined to the particular forms or uses shown and described, the same being merely illustrative, and that the invention may be carried out in other ways without departing from the spirit of my invention, and, therefore, I claim broadly the right to employ all equivalent instrumentalities coming within the scope of the appended claims, and by means of which, objects of my invention are attained and new results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to attain these objects and accomplish these results.

What I claim and desire to secure by Letters Patent, is as follows:

1. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a truncated cone and a wedge-shaped cable gripping means having a cable gripping surface made of sheet metal with a uniform thickness, and a casing engaging surface inclined thereto to form the wedge, said wedge-shaped cable gripping means positioned about the cable to space the cable from the casing.

2. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a truncated cone and a wedge-shaped cable gripping means made of sheet metal with a uniform thickness, having a cable gripping surface and a casing engaging surface inclined thereto to form the wedge, said wedge-shaped cable gripping means positioned about the cable to space the cable from the casing.

3. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a truncated cone and a plurality of sets of wedge-shaped cable gripping jaws, each jaw having a cable gripping surface made of sheet metal with a uniform thickness, and a casing engaging surface inclined thereto to form the wedge, said wedge-shaped cable gripping jaws positioned about the cable to space the cable from the casing.

4. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a truncated cone and a plurality of sets of wedge-shaped cable gripping jaws, each jaw having a cable gripping surface made of sheet metal with a uniform thickness, and a casing engaging surface inclined thereto to form the wedge, a plurality of said jaws being flexibly joined to form

a set, said wedge-shaped cable gripping jaws positioned about the cable to space the cable from the casing.

- 5 5. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a truncated cone and a wedge-shaped cable gripping means made of sheet metal with a uniform thickness, having a longitudinally extending fold to
10 divide the wedge shaped means into a cable gripping surface, and a casing engaging surface inclined thereto to form the wedge, said wedge-shaped cable gripping means positioned about the cable to space the cable from the casing.
- 15 6. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a truncated cone and a wedge-shaped cable gripping means made of sheet metal with a uniform thickness, having a plurality of longitudinally extending
20 folds to divide the wedge-shaped means into cable gripping surfaces, and casing engaging surfaces inclined thereto to form the wedge, said wedge-shaped cable gripping means positioned

about the cable to space the cable from the casing.

7. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a truncated cone and a wedge-shaped cable gripping means having a cable gripping section made of
5 sheet metal with a uniform thickness, and a casing engaging section inclined thereto to form the wedge, said sections being interlocked to form a unitary assembly, said wedge-shaped cable
10 gripping means positioned about the cable to space the cable from the casing.

8. A connector for connecting a cable comprising a casing substantially tubular in shape having an interior surface substantially that of a
15 truncated cone and a plurality of wedge-shaped cable gripping jaws made of a single sheet of metal with a uniform thickness, having cable gripping surfaces, and casing engaging surfaces inclined thereto to form the wedge, said wedge-
20 shaped cable gripping jaws positioned about the cable to space the cable from the casing.

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