

July 29, 1958

G. A. FULLER

2,845,606

INSULATED WIRE END TERMINAL

Filed April 1, 1954

5 Sheets-Sheet 1

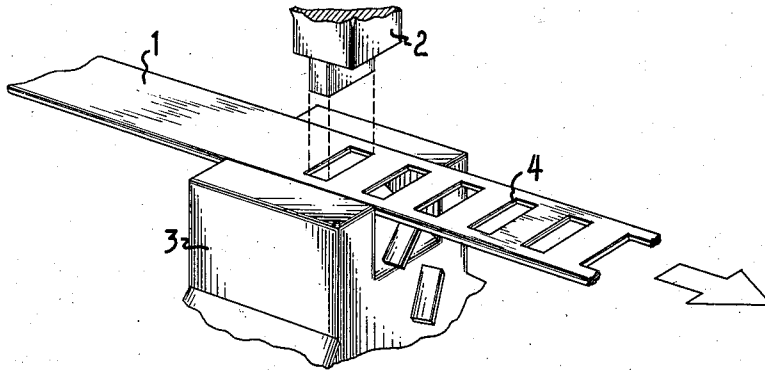


Fig. 1

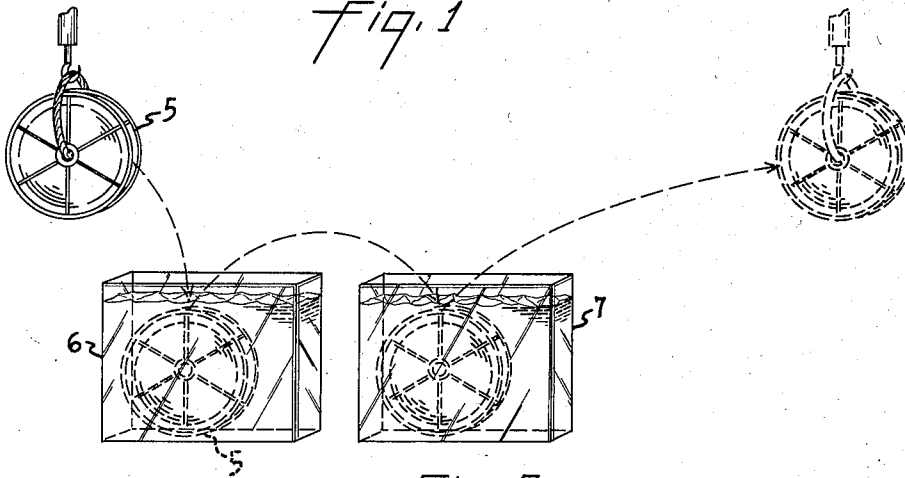


Fig. 2

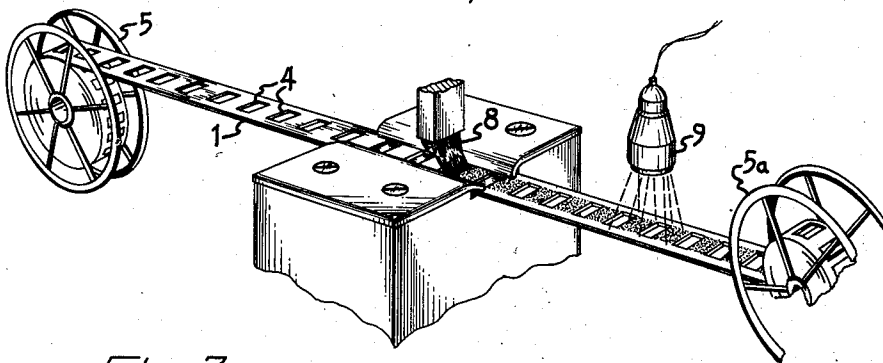


Fig. 3

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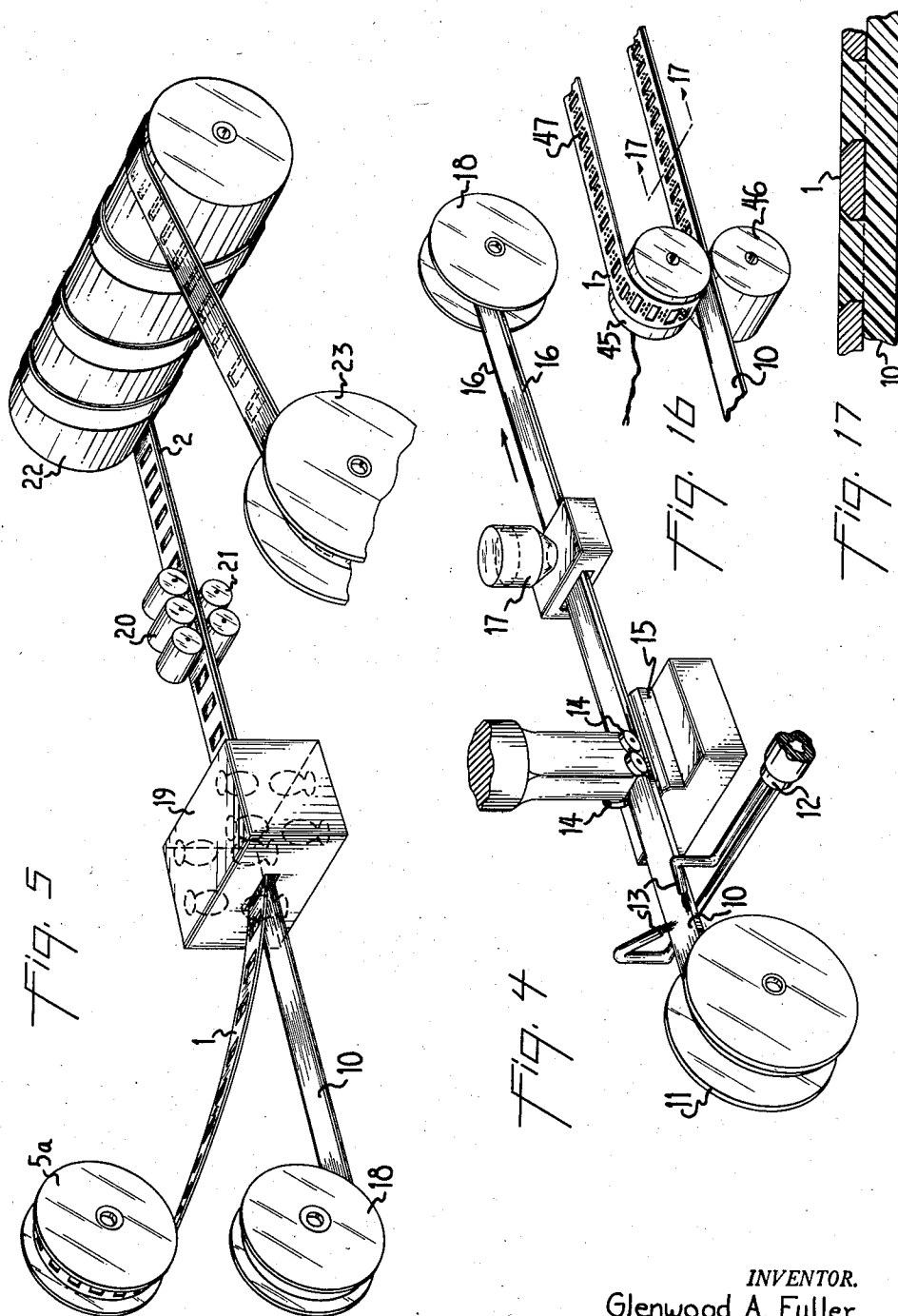
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Filed April 1, 1954

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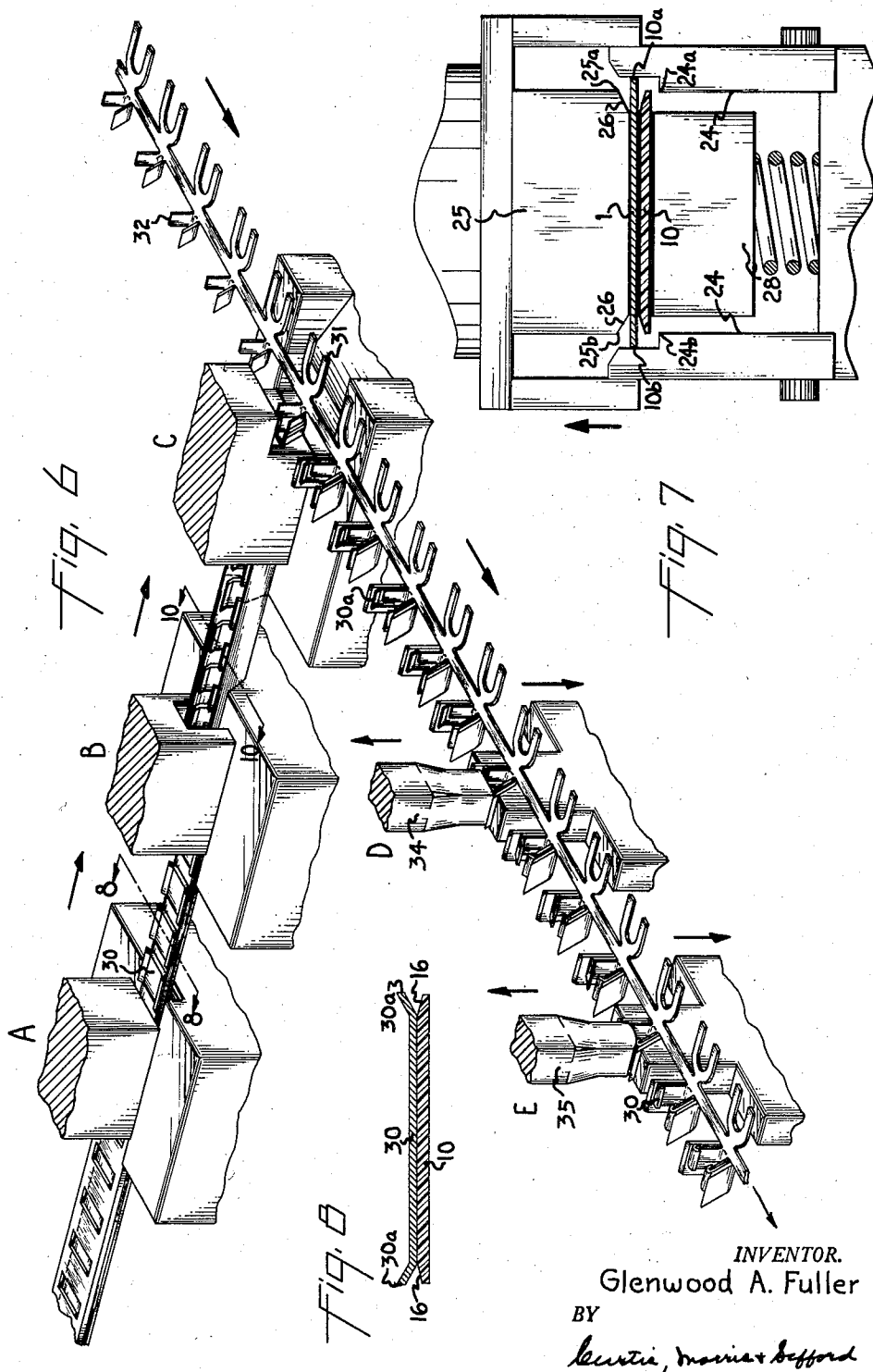
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Fig. 9

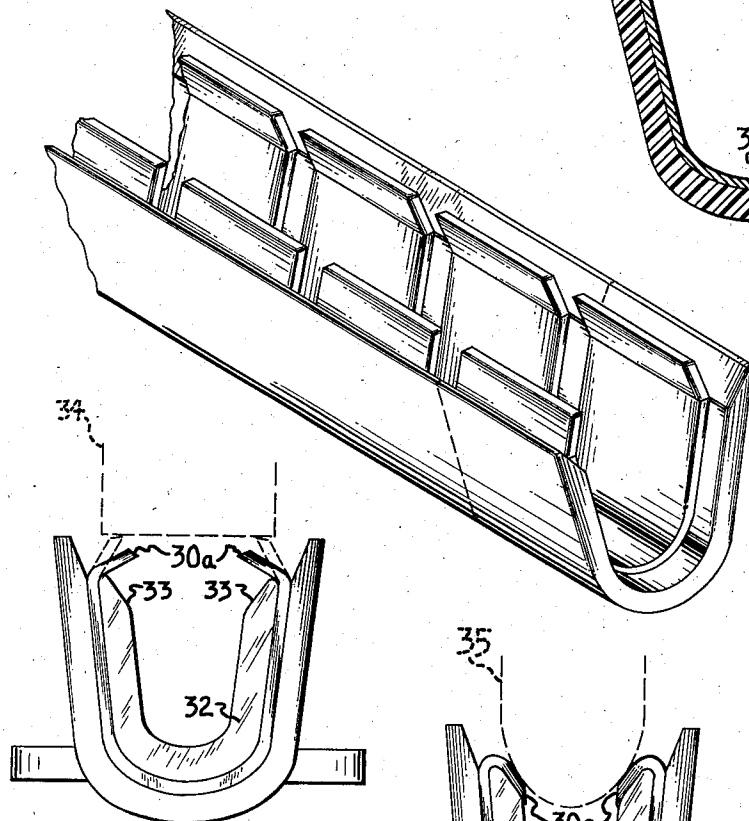


Fig. 10

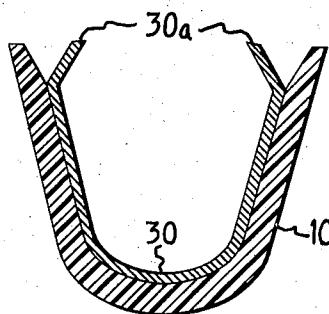


Fig. 11

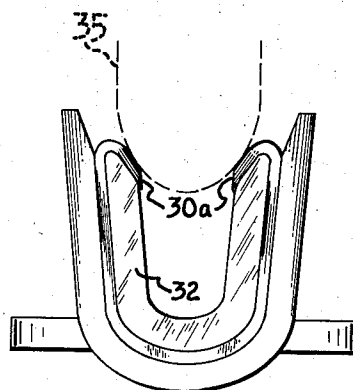
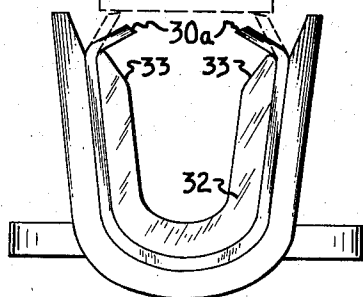


Fig. 12

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INSULATED WIRE END TERMINAL

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Fig. 13

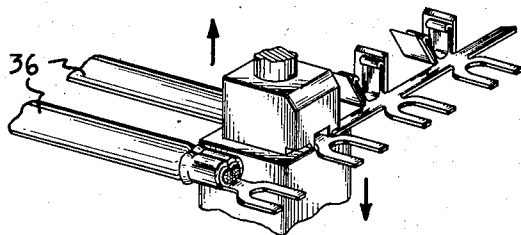


Fig. 14

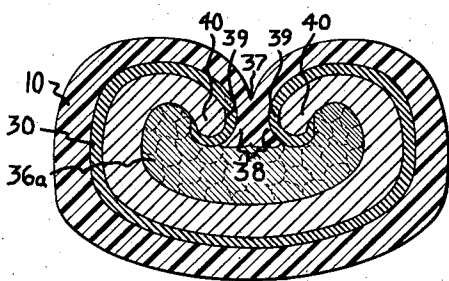
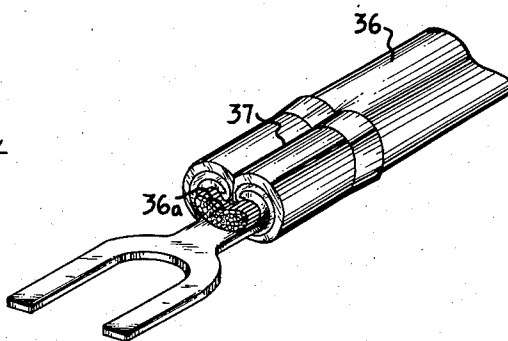


Fig. 15

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2,845,606

INSULATED WIRE END TERMINAL

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AMP Incorporated, a corporation of New Jersey

Application April 1, 1954, Serial No. 420,331

8 Claims. (Cl. 339—276)

The present invention relates to an improvement in insulated connectors. An object of said invention has been to provide a connector, conveniently in the form of a terminal, wherein the wire engaging barrel portion is of U-shape and carries an outer layer of insulating plastic which effectively closes the barrel seam when the edges thereof are turned inwardly and crimped on an end portion of a conductor wire.

A further object has been to provide an insulating connector which can be made advantageously from strip materials by steps of method in which the insulating layer or strip is initially adhered to a relatively thin metal reinforcing and retaining strip to form a plurality of interconnected composite insulating covers for application to the U-shaped barrel portions of terminal connectors.

A further object of the invention has been to provide a connector having a composite barrel cover comprising a layer of insulation adhered to a metal retaining piece, edge portions of which are clinched onto the barrel and thus hold the insulating layer in operative position on said barrel to be pressed into seam closing condition as part of a crimping operation whereby the terminal is secured to the end of a wire.

It is also an object of the invention to provide an insulated connector which is capable of being made at least in part by operation of high speed machines and which can be rapidly economically and effectively crimped onto wire ends or the like.

A terminal type connector according to the present invention includes a wire receiving barrel having an insulating cover comprising a layer of insulating material, as a tough plastic, which is bonded to the outer face of a malleable flexible metal layer, said metal layer being secured to said barrel with lateral edge portions overlapping and clinched to lateral edge portions of the barrel.

One method of making one form of connector within the above definition includes the steps of producing a composite insulating cover blank by bonding together a flexible layer of malleable sheet metal and a flexible layer of insulating material, as plastic, with lateral edge portions of each of said layers remaining free or unbonded to adjacent lateral edge portions of the other, deforming said composite cover blank to a U-shaped cross section, and securing said U-shaped cover to the outside of a U-shaped barrel of a terminal connector with the sheet metal layer of the cover embracing the barrel by folding and clinching lateral edge portions of the metal layer over lateral edge portions of said U-shaped barrel.

Other objects and important features of the invention to which reference has not been made hereinabove, will appear in the following description and claims.

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Although in the accompanying drawings I have shown a preferred embodiment of my invention and have described the same and various modifications thereof and have shown and described a method of making said embodiment in this specification, it is to be understood that these are not intended to be either exhaustive or limiting of the invention, but on the contrary are chosen for purposes of illustration in order that others skilled in the art may so fully understand the invention, its principles and the application thereof, that they may embody, practice and adapt it in various forms, each as may be best suited to the requirements of its particular use.

In the drawings:

Figure 1 is a diagram showing in perspective an embodiment of mechanism which punches regularly spaced holes through the web of a flexible metal strip;

Figure 2 is a diagram illustrating in perspective the step of cleaning the punched metal strip;

Figure 3 is a diagram illustrating in perspective one arrangement of apparatus for applying an adhesive coating or primer to the cleaned metal strip;

Figure 4 is a diagram illustrating in perspective an arrangement of apparatus for heating and beveling the lateral edges of a strip of insulating plastic material;

Figure 5 is a diagram showing in perspective apparatus whereby the above mentioned metal strip and said strip of plastic are bonded together by application of pressure to form a composite web of flexible metal and insulating plastic;

Figure 6 is a view in perspective, partly diagrammatic, illustrating one form of apparatus wherein at stage A, lateral edge portions of the metal layer of said composite web or strip are cut off along the outer end lines of the previously punched holes, leaving a succession of equispaced reinforcing metal pieces adhered to the continuous plastic strip; and lateral edges of said metal pieces adhered to the continuous plastic strip; and lateral edges of said metal pieces are bent in a direction away from adjacent lateral edge portions of the underlying plastic strip; at stage B, the composite strip is deformed to trough shape, or to a substantially U-shaped cross section; at stage C, the plastic strip is cut transversely between adjacent metal reinforcing pieces and the composite units are brought into position with respect to individual barrels of a previously blanked connector strip; and in stages D and E edge portions of the metal pieces of the severed composite insulating covers are engaged with and clinched to the barrels of the successively presented connectors of the strip of interconnected connector blanks;

Figure 7 is a fragmentary view in elevation and partly in transverse vertical section of a die employed at stage A, Figure 6, for cutting off the lateral edge portions of the metal layer of the composite insulating strip and bending lateral edge portions of the metal reinforcing pieces in a direction away from adjacent edge portions of the plastic strip;

Figure 8 is a transverse vertical section on the line 8—8 of Figure 6, showing the composite strip as it emerges from stage A, Figure 6.

Figure 9 is a view in perspective of a portion of the composite strip as it emerges from the dies employed at stage B, Figure 6, and with a substantially U-shaped cross sectional contour;

Figure 10 is a transverse section on the line 10—10 of

Figure 6, showing the composite strip in U-shape substantially as produced at stage B of Figure 6.

Figure 11 is a fragmentary view, partly diagrammatic, illustrating a preliminary step stages D, Figure 6, in clinching edge portions of the metal piece or layer of the composite insulator or cover to the U-shaped barrel of a connector terminal;

Figure 12 is a view similar to that of Figure 11 illustrating the concluding step, stage E, Figure 6, in clinching edge portions of the metal piece or layer of the composite insulator cover to the U-shaped barrel of the terminal aforesaid;

Figure 13 is a view in perspective, partly diagrammatic, illustrating one form of apparatus for crimping said individual terminal or connector barrels and their respective composite insulating pieces on the bare wire ends of electrical conductors and severing the terminal from the strip of terminals; and a completed terminal or connector with insulated barrel;

Figure 14 is a view in perspective, on enlarged scale, of an insulated terminal crimped to a conductor and with the insulating plastic layer pressed into seam closing position;

Figure 15 is a transverse section, on enlarged scale, across the insulated barrel of a completed terminal connector of the type shown in Figure 13.

Figure 16 is a fragmentary diagrammatic perspective view of a modification of some of the ideas as set forth in Figure 5; and

Figure 17 is an enlarged cross sectional view taken along the line 17—17 in Figure 16.

The sheet metal layer or strip employed to form part of the hereinafter described composite insulating cover may, for many purposes, be of soft malleable copper about .01 inch in thickness. A suitable plastic material for use with such a metal strip, having in mind both its insulating effectiveness and durability and its workability in commercial processing, is advantageously one which is tough and not subject to cold plastic flow much greater than that of the metal of the strip to which it is to be bonded and of the terminal to which it is to be applied as part of a composite cover, whereby a crimping pressure may be transmitted through the plastic and effective metal flow and consequent pressure-forming of said metal can be produced without puncturing or dangerously weakening the plastic coat. A number of plastics are known having the quality of toughness, resistance to fracture on bending and cold forming and a resistance to cold plastic flow comparable to that of the softer metals such as annealed copper and soft brass and soft steel. Particularly suitable among these plastics above mentioned are the superpolymers and copolymers, especially the polyamides known under the general term "nylon," the vinyl-chloride plastics and the vinyl-chloride vinyl-acetate copolymers, in which the amount of the vinyl acetate is less than 5% and advantageously about 3%, and the vinylidene chloride polymers, particularly vinylidene-chloride vinyl-chloride copolymers, as commonly known under the name Saran.

Advantageously, these resins when intended for application as an insulating layer to a metal reinforcing strip, for example, may be in sheet or strip form produced from solutions or plasticized compositions by ordinary methods and subsequently baked or leached; and the plasticized composition may even be applied in that condition to the metal by plastic coating or laminating methods and the solvent and/or plasticizing agent subsequently baked or leached out of the plastic. If the plasticizer is removed after laminating there is a tendency to shrinkage, which should advantageously be relieved by heating to the softening point of the plastic at which its "elastic memory" is erased and internal stresses relieved.

In a co-pending application of Robert C. Swengel, Serial No. 523,004, filed February 19, 1944, now abandoned, there is disclosed the advantage of cementing an

insulating plastic cover onto a metal ferrule or barrel which is to be bent or pressure-formed onto a wire or like conductor.

Also in a co-pending application of William F. Broske, Serial No. 27,087, filed May 14, 1948, now Patent No. 2,786,191, dated March 19, 1957, it is disclosed that a sheet of tough insulating material can be similarly cemented to a sheet of malleable metal; and electrical connectors can be formed from the resulting composite laminated sheet by ordinary manufacturing methods, particularly stamping, drawing, bending, etc.

As one example of an insulating material suitable for use with my invention, I refer to the copolymer of vinyl-chloride and vinyl-acetate having the acetate in proportion about 7% vinyl-acetate to 93% vinyl-chloride and an average molecular weight in excess of about 20,000, such as is commercially available under the name "Vinylite VYNW" in a sheet or strip of a few hundredths of an inch in thickness, e. g., about .03 inch. One surface of such a strip or sheet may be coated with adhesive, or otherwise suitably prepared, and then pressed onto a strip or sheet of electrical copper, one surface of which has been cleaned and coated or primed with a compatible adhesive such as a vinyl polymer type adhesive, e. g. vinyl chloride polymer and polyvinyl acetate copolymer in methyl ethyl ketone. Suitable adhesives are described in the publication of Bakelite Corporation, "Vinylite Resins for Surface Coatings, Technical Data," copyright 1942. For particular applications and uses, other adhesives may be desired.

In applying the insulation bearing connector disclosed in Broske's patent aforesaid to a wire, a bare end portion of such a wire is inserted into the hollow barrel which, with its insulating cover, is then crimped by means of any suitable broad area crimping dies, for example, one of those described in the patent of S. N. Buchanan No. 2,379,567, or the patents of Carlson, Nos. 2,359,083 and 2,359,084, or in the patents of James C. Macy, Nos. 2,639,754; 2,557,126 or 2,600,012. In Broske's patent aforesaid the forming pressure of the dies is transmitted by the tough plastic to the metal; and the latter is formed and flows into tight intimate and secure connection with the wire or other conductor. During this operation the plastic bonded directly on the exterior of the barrel withstands the crimping pressure transmitting it to the metal and avoiding puncture, so that when the pressure-formed connection is completed, it is insulated and requires no further covering.

In producing insulated terminals and connections according to the present invention wherein a composite insulating cover is employed, a suitably malleable copper strip 1, Figure 1, is advanced by feeding mechanism, not shown, between dies 2 and 3 which stamp equispaced holes 4 in the strip. The width of strip 1 and the dimensions and spacing of holes 4 will be determined primarily by the dimensions of the barrels of the connectors to which the composite insulating covers are to be applied. Thus for a commonly used type and size of terminal barrel, copper strip 1 is advantageously about $\frac{3}{4}$ inch wide; and holes 4 are about $\frac{1}{16}$ inch wide, $\frac{5}{8}$ in long, and spaced about $\frac{1}{16}$ inch apart.

As strip 1 comes from dies 2 and 3, it is conveniently wound on a spider frame reel 5 or the like, Figure 2. Said reel and the strip wound thereon are immersed for a period of about three minutes in a suitable cleaning bath carried in a tank 6 which may advantageously be a solution consisting of 5% sodium dichromate, 10% sulfuric acid and 85% water, by volume, at a moderate or ordinary room temperature. The wound strip is rinsed in tank 7 and, after removal therefrom, is allowed to dry on reel 5.

To provide an effective bond between the metal and the insulating plastic, a coating of adhesive is applied to that portion of one face of stamped strip 1 which is to be covered by the insulating plastic strip. Thus, as

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shown in Figure 3, strip 1 may advantageously be fed from reel 5 past an adhesive applying device, as a brush or applicator 8, which deposits a thin coating of said adhesive on one face of those portions of the strip lying between holes 4 therein. The coating or primer is dried, as by an infra-red lamp 9, or other suitable means, and wound on reel 5a, Figure 3, if desired.

The plastic strip which provides the insulating layer of the composite terminal barrel cover hereinafter to be more fully described, is advantageously formed from a sheet of tough plastic such as previously referred to. For use with a copper strip 1 of the dimensions above set forth, the plastic strip 10, Figure 4, may conveniently be $\frac{5}{8}$ inch wide and approximately .032 inch thick.

To effectively produce insulated terminals according to the present invention, plastic strip 10, conveniently wound on a reel 11, is advanced in the direction of the arrow, Figure 4, past a suitable heating device, such as a burner 12 provided with jet nozzles 13 arranged to direct a flame toward lateral edge portions of strip 10 as it moves between said nozzles. The amount of heat applied will preferably be that needed to adequately soften said edge portions so that they may be reduced in thickness by the pressure of beveling rollers 14 mounted opposite a platen 15. Said rollers 14, by pressing the heat softened edges of strip 10 against platen 15, form longitudinally extending edge bevels 16, which, for a strip $\frac{5}{8}$ inch wide, may present longitudinally extending inclined faces measuring about $\frac{1}{32}$ inch wide; and the edge thickness of the strip is reduced to about .015 inch. These relationships are indicated approximately in Figure 8 which shows such a strip on exaggerated scale.

Referring again to Figure 4, the heated and beveled plastic strip 10 is advanced in operative relation to a cleanser device 17 where a cleansing solution such as an alcohol solution is applied to strip 10.

As pointed out in Broske's patent aforesaid, where the adhesive coating on the metal strip is somewhat tacky, or is made so by moistening with a solvent, e. g. methyl ethyl ketone, the resin or plastic strip may be joined to the metal strip at room temperature by pressing them together between platens or between press rolls.

However, I prefer to do this pressing together of metal strip 1 and plastic strip 10 as indicated in said Broske patent, at an elevated temperature but below the fusion point of the resin strip or sheet, e. g., 180°–200° F., and with sufficient pressure at the given temperature to effect preliminary adhesion of the sheet to the metal. The laminated sheet thus produced is then transferred from the press to an oven where it is raised to a temperature between 350° to 375° F., and held at such temperature for a period between one and two hours, the temperature conditions being maintained as uniform as possible by forced circulation of hot gases through the oven. During this oven treatment, the coating softens to give maximum adhesion thereof to the metal; and both plasticizer and residual solvent which may be contained in the lacquer are driven off. To a greater or lesser extent, curing of the plastic with increase in average polymer length is also carried on, thus leaving a tough and only slightly plasticized layer of insulating plastic on the metal. Other methods of lamination are known to the art and may be used for purposes of this invention. See for example, the Brous Patent 2,234,621.

As shown in Figure 5 herein, the metal strip 1 and the plastic strip 10 are advanced in contact through a heating chamber 19 and with sufficient pressure at the temperature (180°–200° F.) therein developed to effect preliminary adhesion of the plastic to the metal. The composite strip thus formed, and while the plastic layer thereof is still soft, is pressed between upper rolls 20 and lower rolls 21, as it is advanced toward roll 22.

The oven treatment as pointed out in Broske's patent aforesaid, or other suitable curing procedure, is applied to said pressed composite strip. As shown in Figure 5,

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the web of said strip is taken up in a succession of spiral turns on said roll 22 and thence is wound on a reel 23. This reel and the composite strip wound thereon are transferred to an oven (not shown) wherein the temperature is held at between 350°–375° F. so that the plastic components of said strip are heat treated, as described in Broske's said patent, to effect curing of the plastic layer and, in the present instance, to produce an intermediate product with maximum adhesion between the plastic layer 10 and the metal layer 1 of the composite or laminated insulating strip. This heat treating may also be done by internally heating roll 22.

Another method of laminating plastic strip 10 to metal strip 1 is to make holes in the metal strip, counterbore or swage the holes from one side, heat the metal strip and then apply the plastic strip by pressing it onto the side opposite the counterbored side. In Figure 16 is shown a way of bringing about this type of lamination. Drum 45 is heated internally, in this instance by resistance coils placed against the outer surface. Metal strip 1 engages drum 45 long enough to be heated sufficiently to soften the top of plastic strip 10 so that this softened plastic, under the pressure which unheated drum 46 exerts against drum 45, will flow into holes 46 of strip 1. Drum 45 heats the metal strip to a temperature between 350° F. and 450° F., but this may vary depending on the type of insulation strip that is used. It is advantageous to heat the metal strip rather than the plastic strip because in this manner only the top layer of plastic is softened instead of the whole plastic strip. Also, the plastic instead of cooling as it reaches counterbore 49 is further heated, keeping the plastic fluid so that it will completely fill the counterbore and have no voids. Once the plastic has hardened, it is firmly bonded to the metal, the plastic which fills the counterbore being securely wedged in place. No adhesives are necessary in this type bonding and high terminal temperatures are possible without serious danger of breaking the bond.

Figure 17 shows a cross section of the strip at 17—17. The diameter of the hole in this embodiment is .031 inch. while the hole is counterbored at 45° to a depth of one half the metal strip thickness. The holes are transversely arranged and there is alternately a row of three holes and then a row of two holes. The holes of the second row are placed midway between the center lines of the holes in the row of three and the center of the middle hole in this row coincides with the centerline of the metal strip. The centers of the holes in each row are about .062 inch apart and the lines of centers of the holes in adjacent rows are also about .062 inch apart.

As indicated in Figure 6, the laminated strip is advanced step by step through several stages, in the last of which separated segments of the strip are secured in barrel insulating position on the barrels of terminals as the latter are brought successively into position to receive said separated parts or insulating covers.

For convenience, the procedures here involved are considered in five stages indicated generally in Figure 6 as at A, B, C, D, and E respectively. At stage A, the side edge portions of metal strip 1 are trimmed off, as by dies 24 and 25, Figure 7. The arrangement is such that one of said dies, as 24, has cutting edges 24a and 24b transversely spaced apart sufficiently to clear the transverse dimension of the plastic strip 10, said cutting edges being advantageously the same length as or slightly longer than the longitudinal distance between adjacent ones of the slots 4 in said metal strip 1. The other die, as 25, has transversely spaced shearing edges 25a and 25b arranged to cooperate with said cutting edges 24a and 24b, respectively, and is beveled at 26.

With each increment of advance of the laminated strip in relation to stages A, B and C, Figure 6, a part thereof corresponding to one cover unit is brought to dies 24 and 25, stage A, so that a portion of the metal strip 1 laterally defined by adjacent slots 4 is supported on a yielding

platen 28 with opposite end portions arranged between the opposed cutting edges of said dies. Thus when movable dies 24 are actuated toward the fixed die 25, in the direction of the arrow, Figure 7, cutting edges 24a and 24b advance past the outer edge portions of plastic strip 10, engage and displace edge portions 10a and 10b of strip 10 toward the bevel faces 26, and sever said portions 10a and 10b as shearing edges 24a and 24b pass the cutting edges 25a and 25b. Edge portions 10a and 10b are then removed by a blower from the cutting area. As the shearing edges 24a and 24b move against the portions 10a and 10b of metal strip 10, said portions will be bent inwardly, as may be seen in Figure 7, and carry with them adjacent portions of the metal strip which are thus bent into engagement with the bevel faces, 26, 26. Also, as shearing edges 24a, 24b pass edges 25a, 25b of fixed die 25, the edge of the metal strip between said dies is slightly drawn and therefore reduced in thickness, as shown in exaggerated degree at 30a, Figure 8. Drawing of the edges 30a gives the edges a slope similar to the inner surface of U-shaped barrel 32, shown in Figure 12, thereby permitting easy insertion of conductor. As it emerges from the metal cutting and shaping operations at stage A, Figure 6, the continuous plastic strip 10 now carries equispaced separate metal pieces 30 bonded thereto and with their attenuated lateral edges displaced or bent away from adjacent lateral edges of said plastic strip 10. As seen more clearly in Figure 8, the reduced edge portions 30a of piece 30 are inclined away from the bevel edge faces 16 of strip 10.

At stage B, the composite or laminate product is deformed to approximately a U- or trough shaped cross sectional contour, as seen in Figures 9 and 10, for example, any suitable die means being employed for the purpose. When in this form the edge portions 30a of the metal piece 30, Figure 10, are inclined inwardly toward each other and the tapered edge faces 16 of the plastic are opposite the outer faces of said edge portions 30a.

At stage C, Figure 6, plastic strip 10 is severed midway between adjacent metal pieces 30, for example, along the dotted line Figure 9, while being retained in position to be advanced toward devices for attaching the severed length of plastic strip and the metal piece bonded thereto as an insulating cover to the open barrel portion of a terminal, or the like.

In employing cover attaching apparatus, as indicated in Figure 6 for example, a strip of connected terminals 31 each having a U-shaped barrel 32 is advanced in a direction to bring said barrels successively to stage C. The parts are so proportioned and arranged that each terminal stops with the free end of its barrel disposed opposite the outer end of a severed composite cover. Thus when the composite strip is next advanced, the foremost severed cover unit slides outwardly to engage barrel 32 and with the inclined edge portions 30a of its metal piece 30 slightly overlying the opposed longitudinal edges 33 of barrel 32, as indicated in dotted lines, Figure 11. Said edges are preferably relieved or slightly rounded to facilitate insertion of the wire end between them. When the strip of terminals is next advanced to the left, as seen in Figure 6, the last above described terminal barrel carries away from stage C a composite cover embracing said barrel in an initial position thereon.

At stage D, Figure 6, the inclined edge portions 30a are pressed from the dotted line inclined position to the full line position, Figure 11, by suitable means, as a plunger 34. At stage E, a plunger 35, or the like, is employed to further bend and press the edges 30a of the metal piece and thereby clinch the same closely and securely around the edges 33 of barrel 32. In a preferred form of barrel, the opposed walls may advantageously be tapered so that the edge thickness is less than that at the bend of the U. Thus, as the terminal is advanced beyond stage E, its barrel carries an in-

insulating cover securely attached thereto by the metal piece 30 which is clinched to longitudinal edge portions of said barrel.

The insulated terminals connected in strip form as above described may be wound on a reel and transported for application to conductors by suitable tools or machines at different locations; or they may advantageously in some instances be run directly into a terminal applying machine.

One form of equipment for this purpose is diagrammatically indicated in Figure 13 of the drawings herein. In operation a bared end 36a (see Figure 14) of a conductor, as 36, is brought within the barrel 32, conveniently through or over the lateral opening between the longitudinal edges thereof. Pressure is then applied to said insulating cover and thence to the metal strip and the metal barrel by suitable crimping dies, such for example, as those described and shown in Patent No. 2,600,012 to J. C. Macy. In a typical case, the crimping operation produces a crimped insulated connection with characteristics such as those shown in Figures 14 and 15.

Figures 14 and 15 show how the seam 37 along the insulated barrel of the connector is tightly sealed with the margins 38 of the insulating cover solidly and permanently clamped together by edge portions 39 and 40 of the two metal elements. The area of the interface of contact between opposing margins 38 is great enough and the pressures bonding them together high enough that the resulting seam is impervious to moisture and air and presents an effective insulating barrier of as high dielectric value as the unbroken insulating cover elsewhere around the barrel.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims.

I claim:

1. An insulated connector comprising a U-shaped wire receiving barrel, a layer of U-shaped insulating plastic material, and a U-shaped sheet metal attaching piece secured to inner surface portions of said plastic layer and engaging outer surface portions of said barrel and having free lateral edge portions bent to extend inwardly and across lateral edge portions of said U-shaped barrel to retain said insulation in position on said barrel.

2. An insulated connector according to claim 1 and wherein the lateral edge portions of said barrel are attenuated, and said free edge portions of the metal attaching piece overlap said attenuated edges of the barrel.

3. An insulated connector according to claim 1 and wherein the lateral edges of the insulating layer are tapered to reduce the edge thickness thereof and extend beyond said inwardly bent edge portions of said metal attaching piece.

4. An insulated connector according to claim 1 and wherein the lateral edge portions of said piece are tapered at their outer sides and the lateral edge portions of said insulating layer are tapered at their inner sides.

5. An insulated connector according to claim 1 and wherein said edge portions of the insulating layer extend beyond and are offset from the edge portions of said barrel.

6. An insulated connector according to claim 1 and wherein the metal attaching piece is adhered to inner surface portions of said plastic layer.

7. An insulated connector according to claim 1 and wherein the metal attaching piece is staked to inner surface portions of said plastic layer by projections of plastic material passing through openings in said metal attaching piece.

8. In an electrical connection of the type wherein a

connector barrel is pressure-welded to a central conductor and the barrel is surrounded by a tough, bendable insulating cover, that improvement which includes: a bendable carrier around the conductor interposed between the outer face of the barrel having edges extending substantially parallel to the axis of the conductor defining a butt seam construction along the connection, and said cover including opposed contiguous marginal portions compressed between said barrel edges and sealing the butt seam against admission of moisture.

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References Cited in the file of this patent

UNITED STATES PATENTS

1,214,470	Jeffery	Jan. 30, 1917
1,683,418	Shaw	Sept. 4, 1928
1,703,325	Smarr	Feb. 26, 1929
1,821,443	Mohr	Sept. 1, 1931
2,643,446	Matthysse	June 30, 1953
2,670,530	Regnier	Mar. 2, 1954