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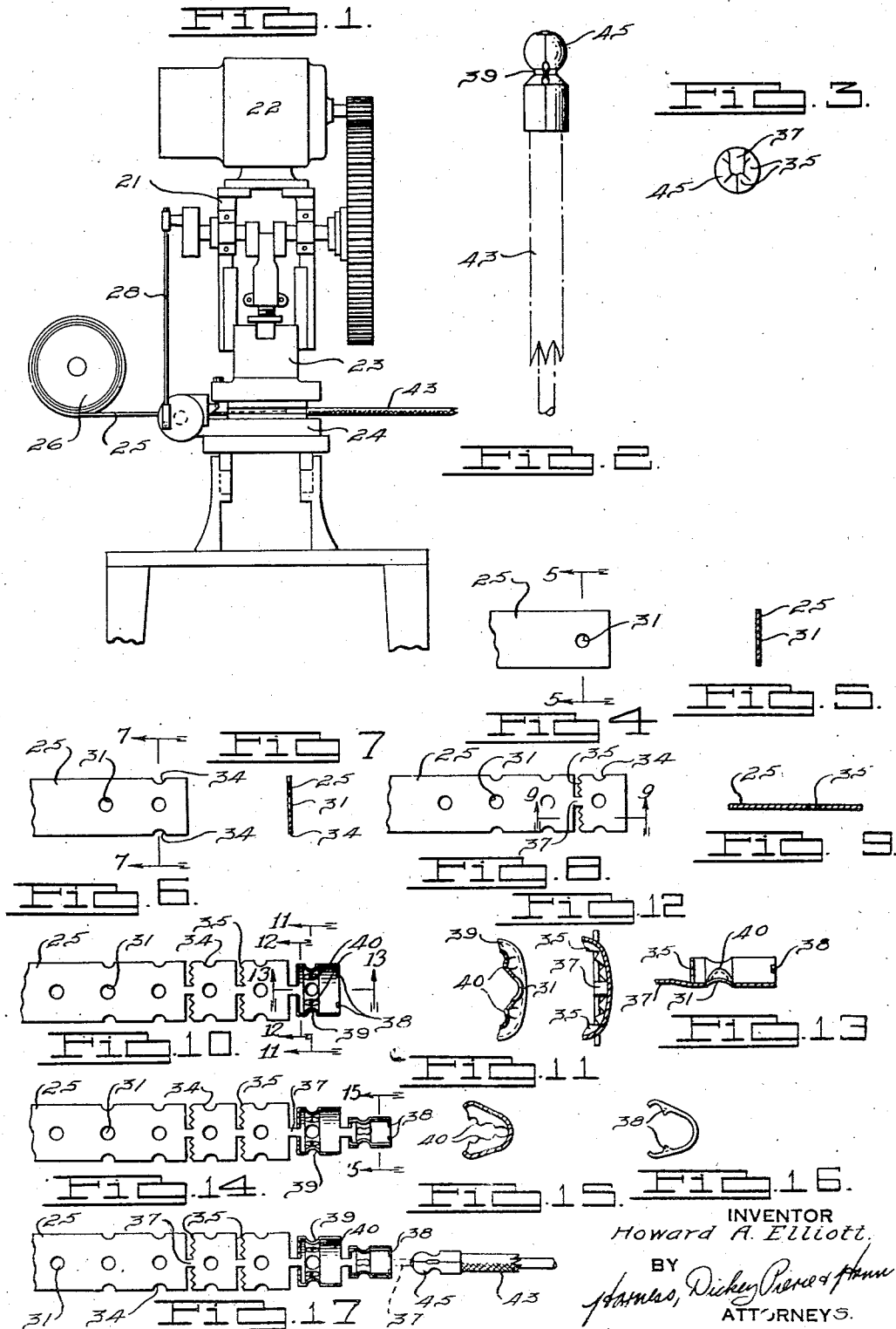
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METHOD OF MAKING TERMINAL TIPS

Filed April 1, 1931

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

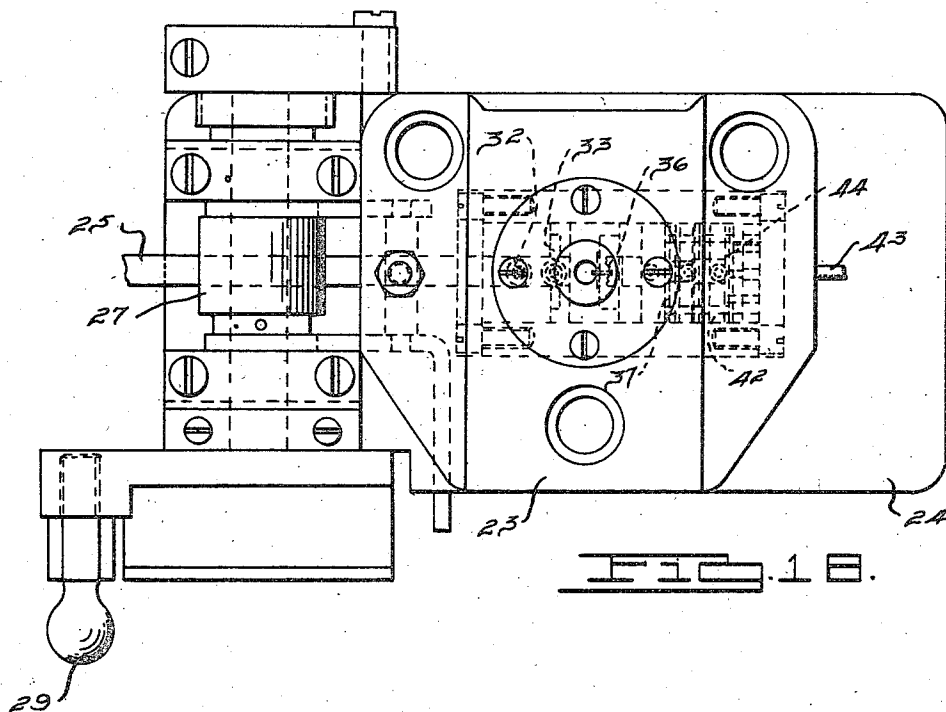


FIG. 18.

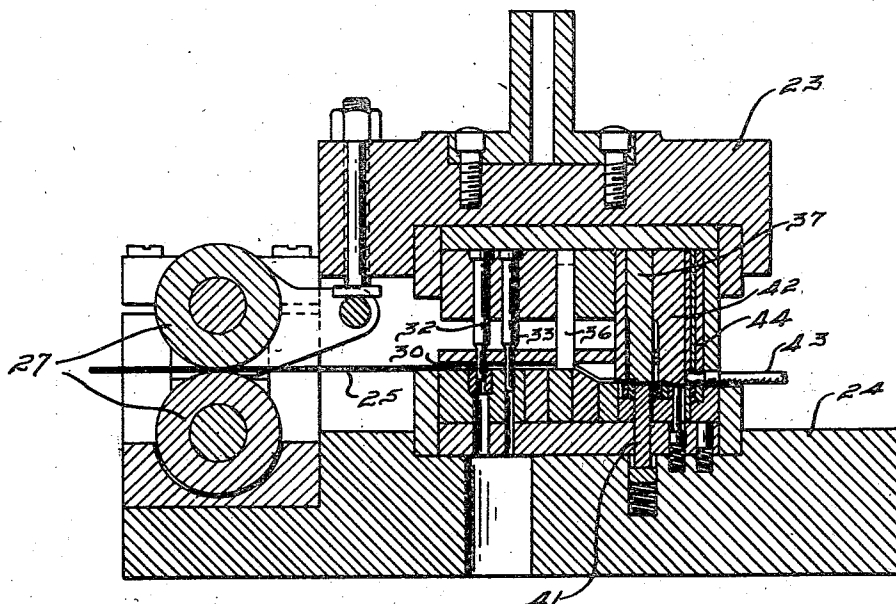


FIG. 19.

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METHOD OF MAKING TERMINAL TIPS

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8 Claims. (Cl. 153—1)

My invention relates to improvements in terminal tips and the method of making the same and more particularly to improvements in terminal tips for use on the contact end of conductors of electrical current.

It is the practice to place tips on the end of wire conductors which are adapted to be inserted in sockets or suitable receiving elements, in a manner whereby the conductor tips or terminals are in removable contact with the receiving members so that the wire conductor may be readily removed from the socket when desired. In the past such tips have been formed of brass rod or other suitable heavy material and have been turned out on screw machines, producing a machined product of bulky and heavy construction. The cost of manufacture of such tips is very high as compared with those manufactured by the improved method of my invention because of the machining and cutting required to shape the external surface of the tip so that it may cooperate with receiving socket members and further because the solid round rod stock of the old form now in use has to be bored axially to receive the conductor. The method of attaching the tip was also an expensive and slow operation since the ends of the conductors were secured to the tips by stripping the insulation from the conductor, inserting it within the axial bore of the tip and then bonding the two parts together with solder or like material.

The general object of my invention is to provide an improved terminal tip and an improved method of making and attaching the same to a conductor.

Another object of my invention is to provide a tip of light construction which may be formed of flat thin stock.

Another object of my invention is to provide a terminal tip which may be attached to the end of a conductor without the use of solder or other bonding material.

A further object of my invention is to form a tip of a light flat metal stock and attach it to a conductor on a single press performing both operations.

It is a still further object of my invention to form the tip from a strip of blank stock by a successive series of punching and forming operations to progressively stamp the blank from flat stock material, form it into the desired shape, separate it from the strip of stock material and attach it to the end of a conductor

upon a single stroke of a punch and forming press.

A still further object of my invention is to provide an improved method of forming and attaching a terminal tip to a conductor by a series of steps in successive stages which are entirely automatic, including the feeding of the work.

A still further object of my invention is to provide an improved method of making and attaching terminal tips whereby they are produced only as needed and attached directly to a conductor.

Another object of my invention is to provide a conductor tip and method of making and attaching the same which is simple, efficient and economical.

Further objects and advantages will become apparent throughout a reading of the following detailed description and accompanying drawings, in which:

Fig. 1 is a partially diagrammatic elevational view of a punch and stamping press by which the terminal tips of my invention are formed and attached to a conductor in accordance with the improved process of my invention.

Fig. 2 is an enlarged side elevation of a conductor shown with an improved terminal tip of my invention attached thereto.

Fig. 3 is an enlarged end view of one of the completed tips of my invention.

Fig. 4 is a plan view of a strip of flat stock material from which the tip of my invention is formed, illustrating its appearance after the first punching operation has been performed which is the first step of my improved process.

Fig. 5 is a cross-sectional view taken on the line 5—5 of Fig. 4.

Fig. 6 is a plan view of a portion of the material from which the tips are formed as it appears after the second step of my process has been performed thereon.

Fig. 7 is a cross-sectional view taken on the line 7—7 of Fig. 6.

Fig. 8 is a plan view of the material after the third step of my process has been performed thereon.

Fig. 9 is a cross-sectional view taken on the line 9—9 of Fig. 8.

Fig. 10 is a plan view of the material after the fourth step of my process has been performed.

Fig. 11 is an enlarged cross-sectional view taken on the line 11—11 of Fig. 10.

Fig. 12 is an enlarged cross-sectional view taken on the line 12—12 of Fig. 10.

Fig. 13 is an enlarged cross-sectional view taken on the line 13—13 of Fig. 10.

Fig. 14 is a plan view of the material after the fifth step of the process of my invention has been performed thereon.

Fig. 15 is an enlarged cross-sectional view taken on the line 15—15 of Fig. 14.

Fig. 16 is an enlarged end elevation of the formation shown in Figs. 14 and 15.

Fig. 17 is a plan view of the material shown after the sixth step of my process has been performed and the metal tip has been severed from the material strip and attached to the conductor.

Fig. 18 is a plan view of a portion of the press on which the tips of my invention are formed and attached, and

Fig. 19 is an enlarged cross-sectional view taken on the line 19—19 of Fig. 18 illustrating the positioning of the dies and punches by which the steps of my process of forming a tip and attaching it to a conductor are performed.

Referring now to the drawings in which like numerals designate like parts throughout the several views, a press 21, of any well known design and operated by an electric motor 22 or any other suitable source of power, is shown provided with a vertically reciprocable head 23 which carries the punches and forming members and a bed 24 which supports the dies and knock-out punches. The material used is a narrow strip of sheet metal stock 25, which, is of any suitable light metal having the desirable bending and forming characteristics. This material is rolled on a reel or spool 26 which is rotatably mounted in association with the press in some suitable manner (not shown in the drawings). A pair of feed rollers 27 are associated with the press and are intermittently rotated by a driving link 28 connected at one end with the crank of the press and at the other end with an arm 29 associated with the shaft of the feed rollers 27 whereby the material is advanced a predetermined distance upon the upstroke of the press, which action may be arranged in any suitable and well known manner.

The raw stock or material is transferred from rolled strip form into a completed tip and attached to the conductor by a plurality of operations which are performed on the blanks without any manual handling which consists in a series of punching and forming operations performed in successive stages upon the down stroke of the press in a manner whereby the complete cycle of operation is performed once upon each stroke of the press as will hereinafter be described in detail. The action, including the feeding of the work, is entirely automatic throughout.

As the press operates, the feed rollers 27 feed the material from which the conductor strips are to be formed through a guide slot 30, formed in the die assembly which is supported in the bed 24 of the press (best shown in Fig. 19), which properly positions the metal between the punching and forming members and the matrix dies.

The first step of the process of my invention consists in the operation of punching a center hole 31 in the blank strip 25 by means of a punch 32, upon the down stroke of the press. The appearance of the blank at the completion of this operation is best shown in Figs. 4 and 5. Upon the up stroke of the press the material is advanced the necessary predetermined distance,

which is equal to the length of one of the blanks, to assume a position below the next punch for the succeeding operation. Upon the next stroke of the press the second step is performed by a notching punch 33 which cuts notches 34 on the opposite edges of the strip of material 25 in alignment with the center hole 31, as shown in Figs. 6 and 7. This punch may be provided with a conventional centering member (not shown in the drawings) for engaging the center hole 31 to insure perfect alignment of the notches 34 with the hole 31 if desired.

The third step or operation is performed after the blank strip has been advanced two positions by two movements of the feed rollers as shown by the spacing of the punches in Fig. 19, so that two successive notching operations have been performed, as above described, before the blank reaches the position under the punch which is to perform the third operation. This step consists in the punching of transverse serrated edges 35, as illustrated in Figs. 8 and 9, by a punch 36 which cuts a series of points transversely of the forward edge of the blank. A narrow center tongue 37 is left to join the blank to the strip of material 25.

The blank strip is then advanced two more positions by the feed rollers in the same manner that it is advanced between the second and third steps as hereinabove described. The fourth step is then performed which consists in forming the blank by a forming punch 37 which curves or bends the side edges of the blank upwardly, bends the serrated edges 35 upwardly into a vertical position, and embosses the rear edge of the blank at 38, forms a groove 39 entirely across the blank, in alignment with the hole 31 and notches 34, embosses the blank at 40, forming inwardly extending projections within the groove 39 and causes the blank to assume a general arcuate form as illustrated in Figs. 10 to 13 inclusive. The blank remains attached to the material strip by the tongue 37. A suitable spring pressed knockout punch 41 of any well known design may be employed to raise the blank from the matrix die after the fourth operation has been performed so that it may be advanced to the next position.

The fifth step consists in forming and inwardly bending the blank by a forming punch 42 to cause the blank to assume the form illustrated in Figs. 14, 15 and 16. In this position the blank is still attached to the strip 25 by the tongue 37 but is nearly completely formed and nearly closed, being open only at the top to receive the conductor or wire end which is to be attached by the next step or operation.

The sixth step consists in placing the end of a conductor 43 or wire from which the insulation has been stripped at the end, into the partially closed blank formed by the fifth step of my process. A closing and shearing die 44, then closes the blank tightly about the end of the conductor folding it over to assume an annular or rounded form. This die also severs the tongue 37 from the strip 25 and folds this tongue over the butt end of the finished terminal tip 45 thus completing the formation and securely attaching the tip to the end of the conductor. Fig. 17 illustrates the last step of my process and Figs. 2 and 3 show the completed and attached conductor terminal tip.

It will be noted that in the attaching of the tip the embossed points 38 become embedded in the insulation of the conductor and the points

40 are firmly in contact with the wire. The serrated edges 35 together with the folded over tongue 37 completely close the butt end of the tip, as best shown in Fig. 3. The groove 39 assumes an arcuate shape in its completed form to co-operate with attaching devices in the receiving members with which the tip is to be associated when in use. No other attaching medium, such as solder or like bonding material, is required.

Upon each down stroke of the press head 23, each of the punches and dies will perform one step of the process, and upon the upward stroke of the press head the feed rollers will advance the blank strip one position forward. A progression of the successive stages of operation will be performed, and a completed terminal tip attached to a conductor upon the completion of each downward stroke of the press. All of the six steps of the process of forming and attaching terminal tip of my invention will be performed in their respective successive stages upon each stroke of the press and after the strip 25 has been threaded through the series of dies it will have the appearance of Figs. 14 and 17 at all times.

Many and numerous advantages result from the employment of my improved method of forming and attaching conductor tips, one of these being that the conductor tips are formed and attached directly to the conductors only as needed and not made in large numbers to be later attached by additional manual operations requiring soldering the conductor and tip together. There is very little waste material and the light flat stock in rolled form is well adapted to automatic feeding to the press.

It will be readily apparent that various changes may be made without departing from the spirit or scope of my invention, the form herein described being merely a preferred embodiment thereof.

I claim:

1. The method of converting a narrow flat strip of metal into a conductor terminal tip and applying it to the conductor which consists in arranging a row of dies to cut and form the material in a series of successive stages and intermittently feeding the strips successively to each of the dies, the first operation being the punching of holes in said strip, next notching the opposite edges of the strip in alignment with said hole, next forming a transversely serrated edge extending partially across said strip to form a blank, leaving a center tongue member joining the blank to the strip, next forming the blank by bending the side edges and serrated edge upwardly and reducing the size of the blank transversely thereof in alignment with the hole and notched edges, next forming the blank into substantially U-shape and lastly inserting the end of a conductor into said U-shaped blank and then closing the blank about the conductor in a manner to cause it to assume an annular form and shearing the tongue which connects the blank to the strip and forming the tongue across the end of the conductor to close said end.

2. The method of converting a narrow flat strip of metal into a conductor terminal tip and applying it to the conductor which consists in arranging a row of dies to cut and form the material in a series of successive stages and intermittently feeding the strips successively to each of the dies, partially severing a portion of the strip of metal by forming a transversely

serrated edge extending partially across said strip to form a blank, leaving a center tongue member joining the blank to the strip, forming said blank by bending the side edges and serrated edge upwardly and clamping the blank about the end of a conductor with the serrations converging to close the end of the formed terminal tip and severing the tip from the strip simultaneously with the attaching operation.

3. The method of converting a narrow flat strip of metal into a conductor terminal tip and applying it to the conductor which consists in arranging a row of dies to cut and form the material in a series of successive stages and intermittently feeding the strip successively to each of the dies, forming transversely aligned notches and holes in said strip, forming a blank by partially severing it from the strip, forming the blank into a U-shaped member having upstanding serrated edges and a transverse groove having projecting prongs closing said member about the end of a conductor and forcing said prongs in the groove into locking engagement with the conductor and converging said serrated edges to close the end of said tip and simultaneously severing the terminal tip from the strip of metal.

4. The method of converting a narrow flat strip of metal into a conductor terminal tip and applying it to the conductor which consists in arranging a row of dies to cut and form the material in a series of successive stages and intermittently feeding the strips successively to each of the dies, initially stamping out a blank while leaving a narrow tongue to join the blank to the strip, forming said blank into semi-closed position with upstanding serrated edges formed thereon and closing said blank about the end of a conductor in annular form and causing the serrated edges to engage the periphery of the conductor in interlocking engagement therewith and severing said formed tip from the strip simultaneously with the final attaching operation.

5. The method of forming and applying a metallic terminal tip to an electrical conductor comprising intermittently feeding a narrow flat strip of metal to a row of dies arranged to cut, form, shape and secure said metal to said conductor in successive stages comprising forming locating apertures in said strip and partially severing a portion of said strip and forming serrated edges at one end thereof, then forming said partially severed portion to a U-shaped form, turning said serrated edges inwardly and providing indentations with inwardly extending prongs about the intermediate part of said partially severed strip and closing said partially severed strip about the end of an electrical conductor with said serrated edges converged to cover the terminal end of said conductor with said indented prongs engaging the metal of said conductor.

6. The method of forming and applying a metallic terminal tip to an electrical conductor comprising intermittently feeding a narrow flat strip of metal to a row of dies arranged to cut, form, shape and secure said metal to said conductor in successive stages comprising forming transversely aligned notches in the edge of said strip for eliminating metal therefrom, partially severing a portion of said strip and forming serrated edges in the partially severed end thereof, forming said partially severed end to a U-shape with the serrated edge turned

inwardly and with a transverse groove intermediate the ends of said portion with inwardly projecting prongs in the bottom of said groove, placing the bared end of an insulated conductor in said U-shaped blank with the bared metal thereof in registry with said transverse groove and clamping said partially severed portion entirely about the end of said conductor with said grooved portion and its inwardly projecting prongs tightly engaging the bared metal of said conductor and with said serrated edges converging to cover the end of said conductor and form a bulbed end upon said tip.

7. The method of forming and applying a metallic terminal tip to an electrical conductor comprising intermittently feeding a narrow flat strip of metal to a row of dies arranged to cut, form, shape and secure said metal to said conductor in successive stages comprising forming transversely aligned apertures in said metal to provide for a contraction thereof, partially severing a portion of said metal containing said aligned apertures from said strip and forming serrations along said severed edge, forming said partially severed portion into U-shape with said serrations inturned and with an indented groove on the line of said transversely aligned apertures with prongs extending inwardly from the bottom of said groove, placing the bared end of an electrical conductor in said U-shaped blank

with the bare metal thereof in registry with said grooved portion and with insulation thereon extending within the confines of the free end of said partially severed portion, closing said partially severed portion entirely about the end of said conductor with said grooved portion and the prongs therein engaging the bared metal of said conductor and with said free end of said partially severed portion covering an insulated portion of said conductor and with the serrated end of said blank enclosing and covering the free end of said conductor.

8. The method of forming a flat strip of metal into a terminal tip for an electrical conductor and applying the same thereto comprising eliminating a portion of the metal along a transverse line intermediate the ends of said strip, forming serrations upon one end of said strip, forming said strip to a U-shape with said serrations extending inwardly and with an inwardly projecting groove along the transverse line where said metal has been eliminated, placing the end of a conductor in said U-shaped blank with the metal thereof in registry with said inwardly extending transverse groove and closing said blank entirely around the end of said conductor with said inwardly extending groove gripping said conductor and with said serrations covering the end of said conductor.

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