

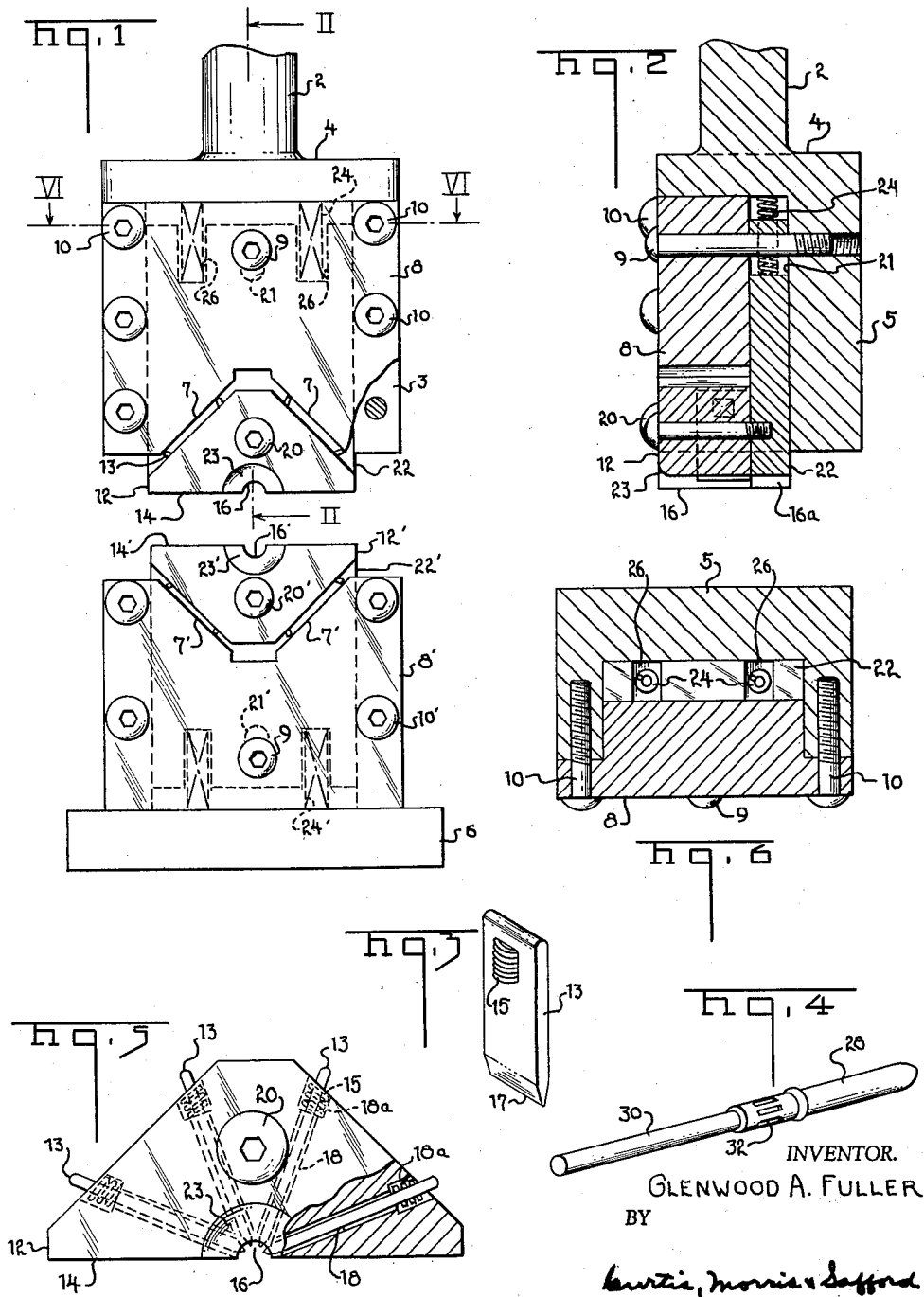
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INDENTING DIES FOR ELECTRICAL TERMINALS

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1

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INDENTING DIES FOR ELECTRICAL TERMINALS

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This invention relates to a die set for indenting a tubular article. In the following description of the invention, it is described and disclosed with particular reference to the indentation of tubular terminals for the purpose of crimping them onto the ends of conductors, however it will be apparent that the invention is amenable to other uses.

In the art of making solderless connections, it is common to secure a terminal or connector to a conductor by indenting the connector. For example, one common type of termination comprises a tubular plug-type terminal which receives the end of a conductor having a wire contacting ferrule affixed thereto. The tubular terminal is indented radially inwardly to secure a mechanical and electrical connection between the terminal and the ferrule thereby to electrically connect the terminal with the conductor. It is frequently desirable when indenting such terminals to provide a plurality of indentations of the same depth and size at spaced points around the circumference of the terminal. It is also desirable to support the terminal while such indentation is being carried out for the reason that terminals of this type must conform to relatively close dimensional tolerances and the indentation process must be such that these dimensional tolerances will be adhered to.

An object of the present invention is to provide a crimping die set for crimping a tubular article by radial indentation of the tubular article at a plurality of spaced points around its circumference. A further object is to provide a crimping die set which is operative to indent an article at a plurality of circumferentially spaced points to an equal depth. A further object is to provide an indenting die set which, in operation, supports the article being indented in such manner that the indenting operation does not result in undue bending or flexing and does not disturb the dimensional tolerance of the article being indented.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

Figure 1 is a frontal view, with parts broken away, of the preferred embodiment of the invention;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a perspective view of a punch which forms a part of the invention;

2

Figure 4 is a perspective view of an electrical termination produced by the die set of the instant invention;

Figure 5 is an enlarged front elevational view of one of the die blocks which forms part of the invention; and

Figure 6 is a sectional view taken along the line and looking in the direction of the arrows VI—VI of Figure 1.

In the disclosed embodiment the reference numeral 2 denotes a reciprocating ram or the like which mounts on its end an upper die carrier 4. The platen 6 of the ram mounts a similar die carrier (not shown in section) and the upper and lower die carriers each accommodates a substantially similar die structure. Since the die parts carried by the upper and lower die carriers are substantially alike, a description of one will suffice for both. Accordingly, only the upper die parts will be specifically described in detail. Similar reference numerals will be used to denote corresponding parts of the upper die and lower die and, prime marks will be used to differentiate between the parts of the upper die and the lower die.

Upper die carrier 4 provides a depending back 5, and a pair of depending sidewalls 3. A camming block 8 is positioned between sidewalls 3 and is secured to the die carrier by means of a threaded fastener 9 which extends through the camming block and into the back of the die carrier. Additional fasteners 10 secure the camming block to the sidewalls 3 as shown in Figure 6. The camming block provides a pair of reentrant camming surfaces 7 which extend at right angles to each other and which face the lower die set. The lower camming block provides similar camming surfaces 7' which face upwardly toward the upper camming surfaces. Additionally it should be noted that these camming surfaces 7, 7' intersect the center line of the die set at an angle of 45° in the preferred embodiment.

A die block 12 is disposed within the cavity formed by the reentrant camming surfaces 7 and is secured at its back end to a slide block 22 by means of a threaded fastener 20. The slide member extends upwardly between the back of camming block 8 and the back 5 of die carrier and provides a slot 21 through which fastener 9 extends. Springs 24, positioned in recesses 26 in the top of the slide block between the upper end of slide block 22 and the opposing surface of die carrier 4 normally urge the slide block and die block downwardly relative to the die carrier as shown in the drawing but the slide block and die block can be moved relatively into nesting relationship with the camming block as explained below. Such relative motion of the die block and slide are, of course, permitted by virtue of the lost motion pin-slot connection, 9, 21 between the camming block and the slide block.

Die block 12 provides a surface 14, and die block 12' provides a surface 14' which surfaces meet when the die set is closed to grip a terminal for the indenting operation. To facilitate such gripping of the terminal these opposed surfaces 14, 14' provide grooves 16, 16' shaped to conform to the particular terminal which is being gripped and crimped. In the disclosed embodiment these grooves form a cylindrical cavity so dimensioned as to closely hold a cylindrical terminal for the indenting operation while preventing any undue stressing or bending thereof. The lower end of slide block 22 is also grooved as indicated at 16a and the complementary surface of the slide block in the lower die set is also grooved so that the terminal is gripped at each end during the indenting operation.

A plurality of passages 18 having enlarged ends 18a are provided in each die block which passages radiate from the center of the grooves or, when the die blocks are against each other from the center of the terminal receiving cavity. It will be particularly noted that in the

disclosed embodiment these passages are spaced around the periphery of the terminal receiving cavity at angles of 45° from each other although in alternative embodiments of the invention, as will be explained below, other arrangements are feasible. Each passage 18 accommodates a punch 13 of the type shown in Figure 3 which provides an indenting portion at 17 at one end and an opening at the opposite end which opening accommodates a helical spring 15 of sufficient size as to extend beyond the surface of the punch. The punches, as shown best in Figure 1, are thus biased by their springs 15 radially away from the groove 16 or (when the dies are closed) away from the terminal receiving cavity formed by the grooves 16. However, these punches can be driven relatively through their respective die blocks and into the cavity to perform an indenting operation. It should be particularly noted that all of the punches intersect their associated camming surfaces at the same angle and in the disclosed embodiment this angle is 67½ degrees. Again, as will be explained below, alternative embodiments of the invention are feasible in which this angle can be departed from. The front surface of each die block is funnel shaped as indicated at 23, 23' for the purpose of guiding the wire during the inserting operation and prior to the crimping operation.

In operation the operator places a terminal 28 on the lower die 12' and within the groove 16' thereof. Thereafter the wire 30 is inserted into the terminal and the press is set in motion to cause the upper die set carried by the ram 2 to descend. As explained above, normally the parts will be in the position shown in Figures 1 and 2 and as the face 14 of upper die block 12 meets the face 14' of the lower die block the terminal is gripped by the die blocks and slide blocks. Thereafter, and upon further descent of the ram, the two die blocks in their meeting position are moved downwardly to cause the lower die block 12' to nest within lower camming block 8' and against camming surfaces 7'. At the same time upper camming block 8 moves downwardly relative to its associated die block 12 and slide 22 so as to cause the upper die block to similarly nest against the camming surfaces 7. As these die blocks nest within their associated die carriers, the punches 13 are forced radially, against the force of the springs 15, into the cavity formed by the grooves 16, 16' and thereby indent the terminal 28 upon the enclosed end of wire 30 as shown at 32.

An important feature of the invention is that each one of the eight punches 13 is urged inwardly at the same speed and by the same amount. As previously mentioned it is highly desirable under many circumstances to provide a plurality of indentations in the terminal such as the terminal shown in Figure 4 of the drawing and it is also desirable that all of these indentations be the same depth. The instant invention accomplishes this result by virtue of the particular arrangement of the die blocks and punches as disclosed herein. Additionally, it will be noted that prior to indentation of the terminal, it is gripped firmly by the camming block 12 and by extension of the groove 16 in the slide member 22. Since this gripping of the terminal takes place at each end thereof the indentation is accomplished without any danger of warping or otherwise deforming the terminal in the operation and close dimensional tolerances can be maintained in spite of the severity of the crimping operation.

While in my disclosed embodiment I provide the eight punches at spaced 45 degree angles around the periphery of the cavity formed when the die blocks are against each other, it will be obvious to those skilled in the art that the punches might be unevenly spaced around the terminal receiving cavity, however, each pair of punches must intersect its associated camming surface at the same angle and, if all of the punches are going to be driven into the terminal by the same amount each individual punch must intersect its camming surface at the same angle as the other punches. The disclosed arrangement of having the

camming surfaces 7 intersect each other at a 90° angle is preferable for most circumstances since in this particular case the indentations are all spaced evenly around the periphery or circumference of the terminal.

The invention is herein disclosed in a relatively simple embodiment. It will also be obvious that the invention can be incorporated into various types of automatic machines or hand tools for crimping in which the type of termination shown in Figure 4 is desirable. In the copending application of Carl H. Bucher, Daniel J. Crowley, and Earl E. Folkenroth, filed April 23, 1956 for Feeding and Crimping Method and Apparatus, Serial No. 579,937, there is disclosed one such utilization of the invention in an automatic machine in which automatic feeding means for terminals is shown in conjunction with the instant crimping apparatus.

In the disclosed embodiment the eight punches are radially spaced around the terminal-receiving grooves with their indenting edges 17 extending parallel to the axis of the terminal as positioned in the cavity formed by the grooves when the die blocks are against each other. This arrangement produces a terminal of the type shown in Figure 4 having eight indentations each of which extends parallel to the longitudinal axis of the terminal. Under many circumstances it is desirable to arrange the punches 13 such that they each lie in plane which is oblique to the axis of the terminal as positioned in the cavity formed by the grooves 16, 16'. In such an arrangement, the indenting edges 17 of the punches are askew to the axis of the terminal and the resulting crimped connection, instead of having the appearance shown in Figure 4, provides eight indentations which extend for a short distance obliquely of the terminal axis. Crimped connections of this type are specifically disclosed and in the copending application of Glenwood A. Fuller and Robert Ullman, Serial No. 402,248, filed January 5, 1954, and issued as Patent No. 2,816,276.

Other 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 when viewed in their perspective against the prior art.

I claim:

1. Means for indenting a cylindrical article comprising a pair of complementary die blocks providing meeting surfaces having grooves therein, said grooves forming a cavity when said blocks are against each other for receiving and gripping said article, a pair of carrier blocks each incorporating camming surface, said carrier blocks being relatively movable along a rectilinear path towards and away from each other, each of said die blocks being secured to and having a lost-motion connection with one of said carrier blocks, a first resilient means in each die block and carrier assembly normally maintaining each die block at the limit of its lost motion travel away from its associated carrier block, radially extending slot means in said die blocks, punch means movable relatively through said slot means and into said cavity when said die blocks are against each other, and second resilient means in said die blocks normally maintaining said punch means radially outwardly, whereby upon initial movement of said carrier blocks relatively towards each other said meeting surfaces of said die blocks are brought into abutting relationship, and upon further relative movement of said carrier blocks, said first resilient means is partially compressed securely to grip said article and upon further relative movement of said carrier blocks, each of said die blocks moves relatively against its respective carrier, and said punch means are driven relatively through their respective die blocks to indent said article.

2. Means for indenting a cylindrical article comprising

a pair of complementary die blocks providing meeting surfaces having grooves therein, said grooves forming a cavity when said die blocks are against each other for receiving and gripping said article, a pair of carrier blocks each incorporating at least two camming surfaces, said carrier blocks being relatively movable along a rectilinear path towards and away from each other, each of said die blocks being secured to and having a lost-motion connection with one of said carrier blocks, resilient means in each die block and carrier assembly normally maintaining each die block at the limit of its lost motion travel away from its associated carrier block, radially extending slots in said die blocks opening into said grooves, a punch disposed in each of said slots and movable therethrough, a spring associated with each punch, said springs normally urging said punches radially away from said grooves and outwardly of said die blocks and against one of said camming surfaces, whereby upon relative movement of said carrier blocks towards each other, said article is initially gripped as said die blocks are brought into abutting relationship,

5

and upon further relative movement of said carrier blocks, said article is gripped with increasing pressure as said resilient means are compressed while said punches are driven radially toward and into said article by said camming surfaces with concomitant compressing of said springs.

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