

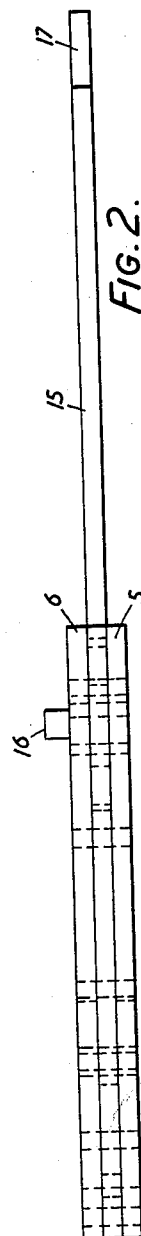
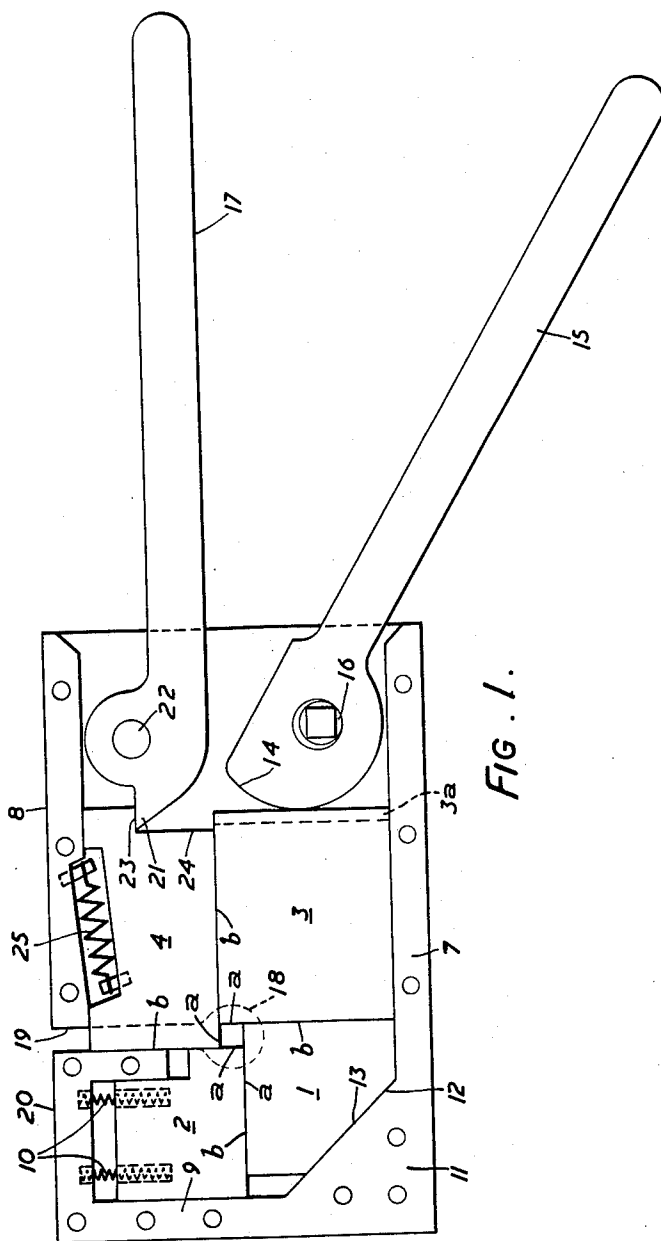
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CRIMPING TOOL FOR ELECTRICAL CONNECTORS

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3,133,461 CRIMPING TOOL FOR ELECTRICAL CONNECTORS

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This invention relates to the production of crimped electrical connections. It is well known to produce electrical connections by means of a sleeve into which one or more electrical connectors are inserted, and which is then crimped to force it into close gripping contact with the electrical connector or connectors.

The crimping operation is performed by means of a crimping tool, which generally includes a movable die which compresses the cross section of the sleeve into a suitably shaped second die, also referred to as a bucket, which in the closed position of the tool determines, together with the movable die, the desired outline of the crimped cross-section.

This construction of the tool necessitated the provision of a separate pair of dies for each diameter, or for each narrow range of diameters, of the sleeves to be crimped, if undesired unidirectional flattening of the smaller-diameter sleeves is to be avoided. It is an object of the present invention to provide an improved crimping tool which will, without exchanging any die-members, crimp sleeves within a relatively large range of diameters to a predetermined cross-sectional shape.

According to a broad aspect of the invention the crimping tool comprises three or more die members which are so arranged as to form, for a predetermined axial length, a substantially continuous profile line, and which are movable relative to each other in such manner as to reduce the dimensions of the profile enclosed by this line without substantially altering its geometrical shape, mechanical means being provided for effecting this constriction with the necessary force to effect crimping.

Preferably each die member has two surfaces respectively shaped and mutually arranged according to one side and to a continuous and conform extension of the next adjacent side of a line polygon, or if desired of an arc polygon, and the die member co-operate with each other in such manner that the last-mentioned surface of each die member co-operates with the first-mentioned surface of an adjacent die member so that the first-mentioned surfaces of all die members jointly form the polygon accommodating the sleeve and each form a guide surface on which the last-mentioned surface of the adjacent die member slides. The angle between said two surfaces of each die member must therefore be the supplement to the polygon angles, and kinematic means, for example cam means are provided for simultaneously sliding the die members on each other to constrict the size of the resulting polygon.

Preferably means are also provided for moving one or more of the dies in this manner independently of the others to break the continuity of the outline of the polygon and thus permit lateral removal of the crimped connections, a feature which extends the range of connections which can be successfully effected with the help of the tool.

In order that the invention may be more readily understood, one embodiment of a tool producing a square crimp will now be described in more detail with reference to the drawing accompanying the specification, in which

FIGURE 1 is an elevation of the tool without the front plate, and

FIGURE 2 is an elevation at right angles to FIGURE 1.

Referring now to the drawing, four die members in the form of plates 1, 2, 3, 4 are each formed with two flat surfaces *a* and *b* at right angles to each other and are so assembled between a back plate 5 and a front plate 6 that the surface *b* of each plate abuts the surface *a* of one and is abutted by the surface *b* of another adjacent plate, and the surface *b* of each plate is abutted by the surface *a* of an adjacent plate, whereby the projecting portions of the surfaces *a* enclose a profile in the form of a polygon, namely a square, the size of which can be varied by simultaneously sliding all surfaces *b* inwardly along the surfaces *a* of the adjacent die plates.

The die plates 3 and 4 are guided for movement between the back and front plates 5 and 6 in the direction of their surfaces *b* and *a* respectively by linear guide members 7 and 8, which are clamped between the front and back plates 5 and 6. Guide member 7 is provided with an extension 9 which extends at right angles to the main body of guide members 7 and serves to confine the die member 2 to linear movement at right angles to the movement of the die member 3; a pair of springs 10 bias the member 2 towards the main portion of guide member 7. The guide extension 9 is interconnected to the main body of guide member 7 by a portion 11 which is formed with a guide edge 12 co-operating with a similarly inclined surface 13 of the die member 1. It will thus be seen that when the die member 4 is held in its position, the springs 10 tend to slide the die member 2 along edge *b* of die member 4 in such a direction as to move edge *a* of die member 1 further away from edge *a* of die member 4, and that such movement of die member 1 will, due to the presence of the surfaces 12 and 13, also cause the die member 1 to be moved at right angles to this motion, sliding with its surface *a* on surface *b* of die member 2 and forcing the die member 3 to move with it so as to increase the distance of surface *a* of die member 3 from surface *a* of die member 2 by the same amount by which the distance between the respective surfaces *a* of die members 1 and 4 has been increased. Die member 3 thus comes to rest on a cam surface 14 which is provided on an actuating arm 15 pivoted between plates 5 and 6 by means of a pin 16. The cam 14 is so shaped that by moving the actuating arm 15 towards a second arm 17, the function of which will be described further below, die 3 is moved in the opposite direction, thus producing corresponding movement of dies 1 and 2 against the action of springs 10 and causing the sides of the crimping-die polygon defined by surfaces *a* to be reduced in length.

It will be observed that the shape of the polygon formed by the sides *a* of the four dies 1, 2, 3 and 4 remains unaltered throughout the movement, and that by suitably shaping the cam 14, the ultimate size of the polygon may be reduced to almost zero, so that one and the same tool can be used for crimping sleeves of any size from a maximum determined by the size of the tool to any desired smaller size.

Moreover in order to avoid the need of using a very steep cam and accordingly requiring a great operating force in a tool which is intended to be used up to a relatively great maximum size, the cam may be so designed so to move the jaws only over a relatively small stroke, corresponding to the required compression of the sleeve, when the arm 15 is moved once towards the second arm 17, pre-setting means being further provided which allows the initial position of the jaw 3, and thus of all the jaws, to be preset according to the approximate size of sleeve to be employed. Such presetting means may comprise flat packing pieces 3a interposed between guide 3 and cam 14 or adjustment means for the position of the pin 16

in the front and back plates 5 and 6, for example similar to the ratchet arrangement employed in some adjustable spanners.

In order to allow the insertion of the sleeve and connections to be crimped and the removal of the crimped assembly, the first and back plates 5 and 6 are provided with apertures 18 in the vicinity of the polygon surfaces provided by the edges *a*.

The aperture 18 is extended by a slot 19 which penetrates between the end of guide member 8 and the adjacent L-shaped guide 20 which forms an extension of guide members 7, 11 and 9. The die member 4 is normally held fixed in its illustrated position by a nose 21 provided on an extension of the arm 17, the latter arm being pivoted on a pin 22 extending between the plates 5 and 6, movement of arm 17 towards the arm 15 beyond the illustrated position being prevented by abutment of the lateral surface of the nose 21 against a side surface 23 of die member 4. To allow introduction of removal of an assembly to be crimped, the arm 17 is moved away from the arm 15, i.e. in an anticlockwise direction in FIGURE 1. This causes the nose 21 to recede from the co-operating surface 24 of the die member 4, whereupon the member 4 can be moved along guide member 8 away from die member 2, to permit removal of the crimped connection out of the polygon section formed by edges *a* through the gap 19, a facility which is particularly invaluable in the case of the formation of crimped connections between two wires or cables of a great length, since it avoids the necessity of drawing the whole of one of the wires or cables through the polygonal aperture. This outward movement of the die member 4 is assisted by a tension spring 25 accommodated in a recess of member 4.

This invention is not limited to all the features of the embodiment described. Thus for example hydraulic operation may be substituted for mechanical operation when this is convenient.

What I claim is:

1. A crimping tool comprising in combination a tool holder having a handle, at least three plate-like die members mounted in the tool holder and so arranged as to jointly form, over a predetermined thickness, a substantially continuous profile line, said die members being movable relative to each other in the tool holder in such a manner as to constrict the dimensions of the profile enclosed by said profile line without substantially altering its geometrical shape, a lever manually movable towards said handle against a spring loading, means coupling said lever to one of the die members for effecting, upon such movement, such constriction with the necessary force to effect crimping, and means for moving at least one of the dies independently of the other dies to break the continuity of said profile line and thus permit lateral insertion and removal of workpieces into and from the tool.

2. A crimping tool comprising in combination a tool holder having a handle, four plate-like die members mounted in the tool holder and so arranged as to jointly form, over a predetermined thickness, a substantially continuous profile line enclosing a square aperture, each die member having two edge surfaces disposed at right angles to each other and so arranged that one of said edge surfaces forms one side and the other forms a continuous extension of a next adjacent side of the square, the last-mentioned edge surface of each die member co-operating with the first-mentioned edge surface of an adjacent die member so that the first-mentioned edge surfaces of all die members, in addition to jointly forming the square aperture accommodating the element to be crimped, each form a guide surface on which the last-mentioned surface of such adjacent die member slides, two of the die members, respectively forming two opposite sides of the square, being guided in the tool holder by guide means which in the case of one of said die members are perpendicular to, and in the case of the other of said two die members are parallel to the square-forming side of the respective die member, a third die member being guided in the tool holder by a surface at 45° to the sides of the square, and a fourth die member being normally fixed in the tool holder, whereby said four die members are movable relative to each other in the tool holder in such manner as to constrict the dimensions of the square without substantially altering its geometrical shape, a lever manually movable towards said handle against a spring loading, and means coupling said lever to one of the die members for effecting, upon such movement, such constriction with the necessary force to effect crimping.

3. A crimping tool as claimed in claim 2, wherein the fourth die member is movable in the tool holder in the direction of the movement of the first die member but is normally held in contact with the die member which is movable parallel to its polygon-forming surface by a withdrawable stop.

4. A crimping tool as claimed in claim 3, wherein the stop is provided on the handle of the tool holder, the handle being pivoted in the tool holder for movement from a normal position in which this movement towards the hand lever is limited by a stop, away from the manually movable lever to release the stop locking the fourth die member.

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