Aug. 5, 1969 S. ROSENFELD ET AL 3,459,029

ADJUSTABLE CRIMPING TOOL

Filed Feb. 28, 1967 3 Sheets-Sheet 1

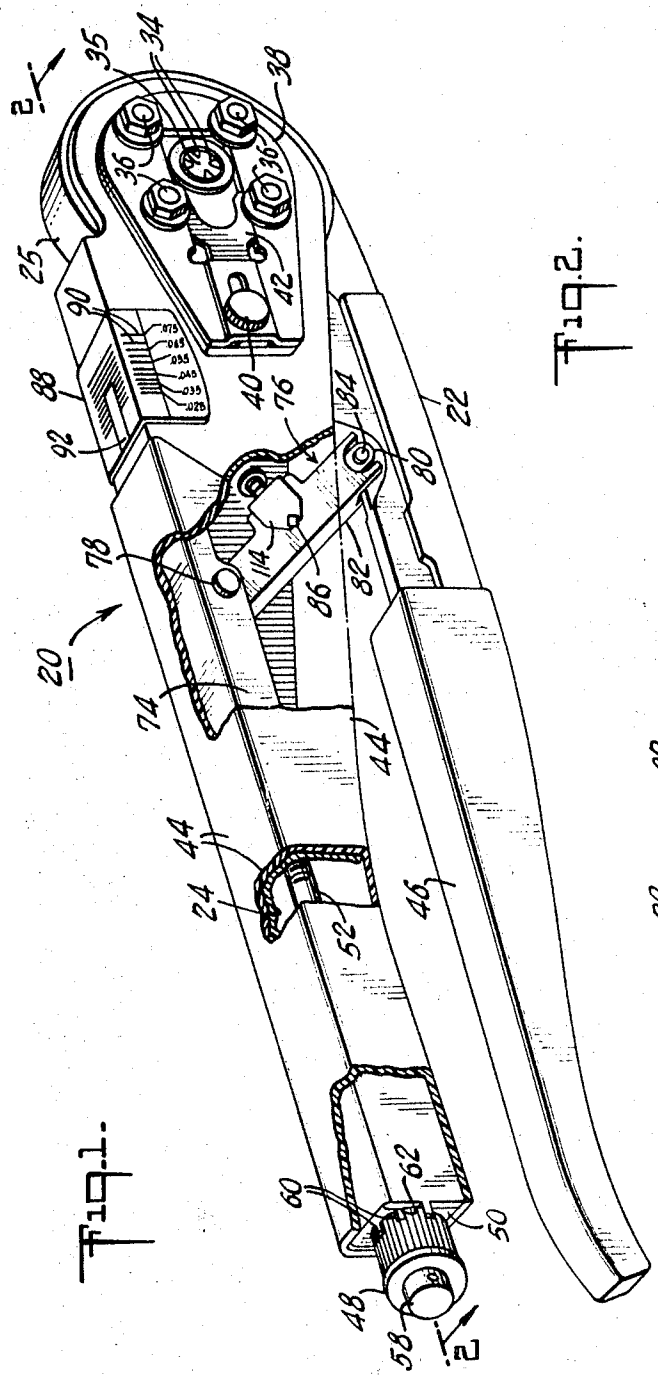

Fig. 1.

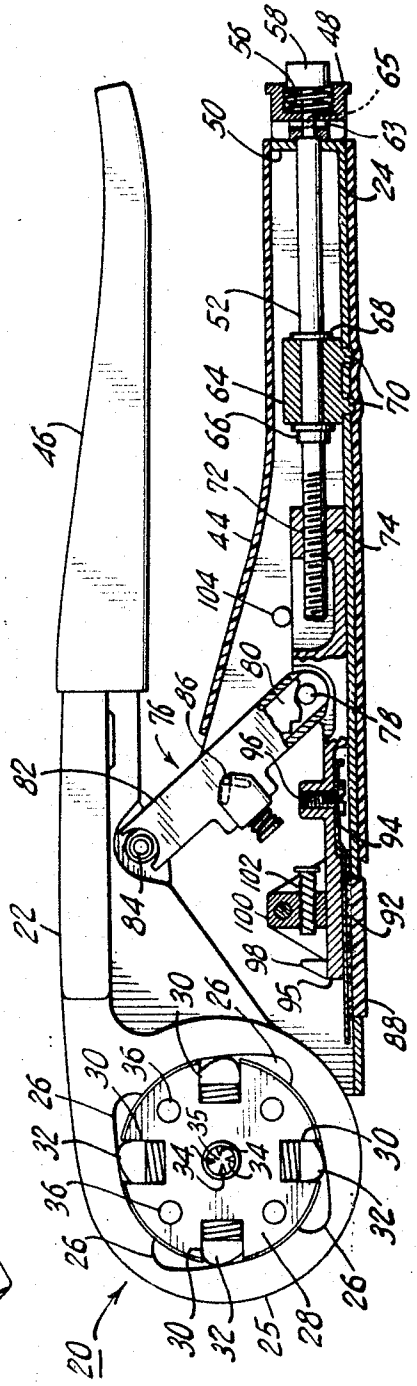

Fig. 2.

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Fig. 3.

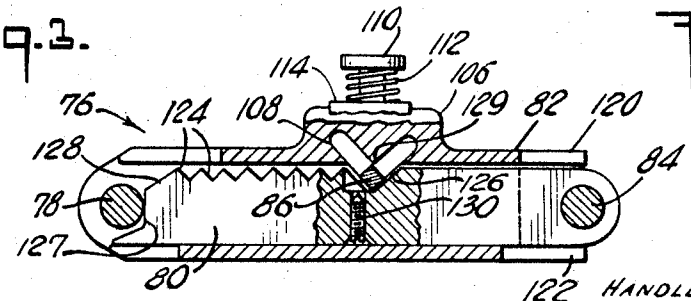
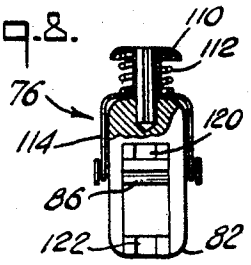
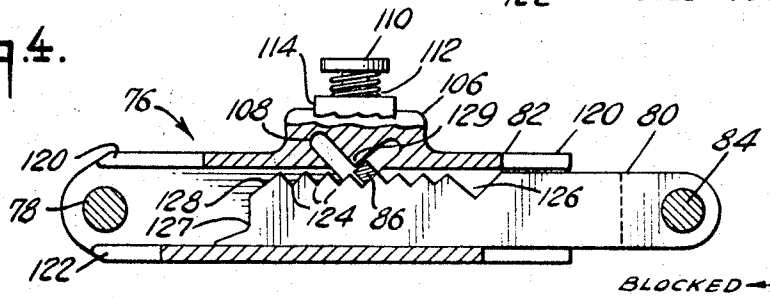


Fig. 8.



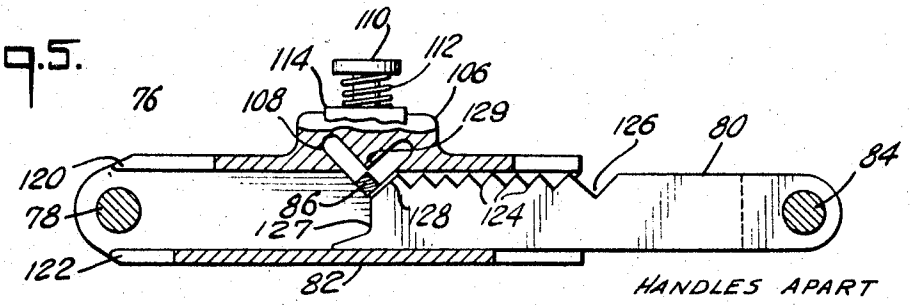
HANDLES TOGETHER

Fig. 4.



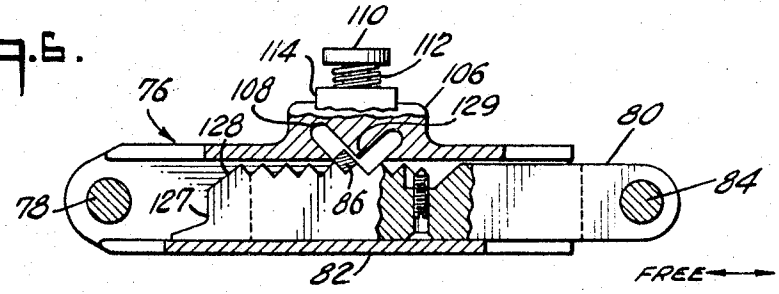
BLOCKED ← → FREE

Fig. 5.



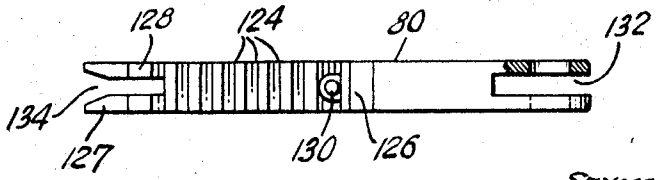
HANDLES APART

Fig. 6.



FREE ← → BLOCKED

Fig. 7.



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ADJUSTABLE CRIMPING TOOL

Filed Feb. 28, 1967 3 Sheets-Sheet 3

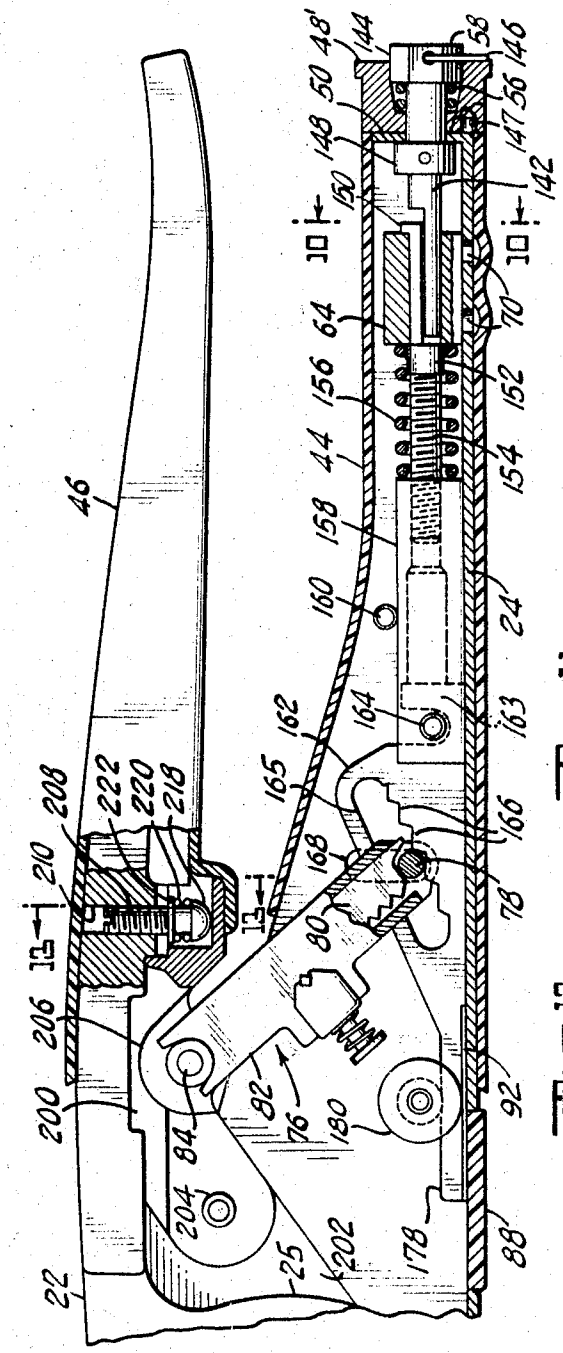

Fig. 9.

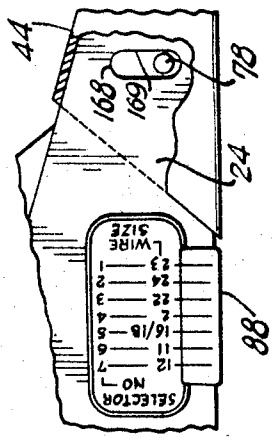

Fig. 12.

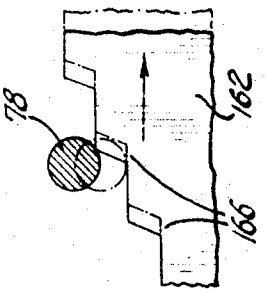

Fig. 11.

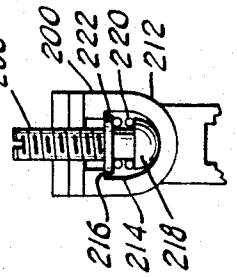

Fig. 13.

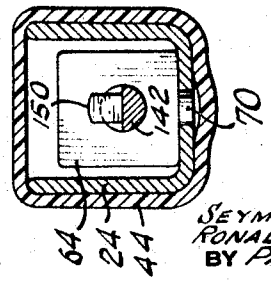

Fig. 10.

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3,459,029

ADJUSTABLE CRIMPING TOOL

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Int. Cl. B21d 31/00, 41/00; B21j 7/16
U.S. Cl. 72—402 17 Claims

ABSTRACT OF THE DISCLOSURE

The crimping tool is adjustable by means of a micrometer-type of mechanism to adjust the depth of crimp. In one embodiment the tool is infinitely adjustable, and in another embodiment it is adjustable in steps. Improved accuracy in determining depth of crimp is obtained by a combination ratchet and stop mechanism.

This invention relates to tools for crimping electrical connectors onto conductors; more particularly, this invention relates to adjustable hand-operated crimping tools; that is, to such tools in which the depth of the crimping indentation is adjustable.

In prior hand-operated adjustable crimping tools, the mechanisms used for adjusting the depth of crimp are less than satisfactory in that they are inaccurate, and in that they make the tool relatively complicated and unwieldly to use. Accordingly, one object of the present invention is to provide a truly accurate, simple, and easy to use mechanism for adjusting the crimping depth of hand-operated crimping tools.

Ratchet mechanisms have been provided in many prior hand-operated crimping tools in order to force the operator to complete each crimping operation. The ratchet mechanism will not allow the tool handles to be separated until they have been brought together to a pre-determined position at which the desired full depth of indentation has been achieved. Prior crimping tools also have means for preventing the crimp from being too deep. A stop is provided which stops one handle from coming closer than desired to the other handle. Many prior tools are deficient in that there is a considerable amount of distance between the stop point and the "release point" of the ratchet mechanism, that is, the point at which the ratchet allows the handles to move apart. This distance is variable and creates considerable inaccuracy and non-uniformity in the depth of crimp provided by the tools.

Accordingly, it is another object of the present invention to provide a hand-operated crimping tool in which the depth of crimp is controlled accurately and by means of a relatively simple and compact mechanism. It is a further object to provide a simple and reliable ratchet mechanism which is easily adjustable to compensate for manufacturing tolerances in the tool. It also is an object to provide such a mechanism which is relatively low in cost and is relatively easy to assemble.

In one of the embodiments of the invention described herein, the depth of crimp is "infinitely" adjustable; that is, the depth of crimp is adjustable in very small increments as opposed to large steps. In another embodiment of the invention disclosed herein, the depth of crimp is adjustable only in relatively large steps which are of a pre-determined magnitude. In the latter type of tool, it has been a problem in the past that sometimes the workman does not properly adjust the tool and adjusts it by only part of a step. This is not desirable since the tool may be damaged.

To solve this problem, it is another object of the present invention to provide a step-adjustable hand-operated crimping tool in which one of the pre-determined step levels is operative regardless of whether the tool is properly adjusted by the operator. It also is an object of the present invention to provide an easy-to-use indicator device to indicate the depth of crimp to which the tool is adjusted.

The drawings and description that follow describe the invention and indicate some of the ways in which it can be used. In addition, some of the advantages provided by the invention will be pointed out.

In the drawings:

FIGURE 1 is a perspective view of an infinitely adjustable hand crimping tool constructed in accordance with the present invention;

FIGURE 2 is a cross-sectional view taken along line 2—2 in FIGURE 1;

FIGURES 3 through 6 are partially cross-sectional and partially cut-away views of the ratchet mechanism of the device shown in FIGURES 1 and 2, in various operational positions;

FIGURE 7 is a plan view of a component of the mechanism shown in FIGURES 3 through 6;

FIGURE 8 is an end view, partially broken away, of the structure shown in FIGURE 3;

FIGURE 9 is a partially broken-away cross-sectional view, similar to FIGURE 2, of an embodiment of the step-adjustable tool constructed in accordance with the present invention;

FIGURE 10 is a cross-sectional view taken along line 10—10 of FIGURE 9;

FIGURE 11 is a partially schematic enlarged view of a portion of the structure shown in FIGURE 9;

FIGURE 12 is a view of another portion of the structure shown in FIGURE 9; and

FIGURE 13 is a cross-sectional view taken along line 13—13 of FIGURE 9.

The crimping tool 20 shown in FIGURES 1 and 2 is of the infinitely-adjustable type. Furthermore, it is of the cam-operated type; that is, the type in which movement of the handles toward one another actuates cams which drive indenting members or "dies" into the connector to crimp it onto a conductor.

The crimping tool 20 includes a first handle 22 and a second handle 24. Plastic covers 44 and 46 cover the lower portions of the handles 24 and 22, respectively, in order to provide a smooth insulated hand-grip for the user of the tool. Referring particularly to FIGURE 2, the handle 22 has an annularly-shaped head portion 25 with four internal curved cam surfaces 26. A cylindrical die-holder 28 forms the head portion of the other handle 24. Die holder 28 is fitted inside the hole in the head portion 25 of handle 22 and has four symmetrically-shaped die holding slots 30. In each of the slots 30 is positioned a cam follower 32 and a compression spring. A die member 34 is attached to each of the cam followers 32. Each die member 34 has a pointed tip which extends into a central opening 35 in the die holder 28.

The handles 22 and 24 are shown in the closed position; that is, with the handles as close to one another as they can be. Actually, the use of the crimping tool starts with the handles apart and the dies 34 retracted. Then a wire with a connector placed loosely on its end is inserted into the central hole 35 and the handles 22 and 24 are squeezed together by the operator to the position shown in the drawings. Squeezing the handles together brings the cam surfaces 26 to bear against the cam followers 32 to press the die members 34 into the connector and crimp the connector onto the wire. When the handles are released, the springs in the slots 30 force the cam followers 32 into

the enlarged portions of the cam surfaces 26 and the dies are pushed away from the connector so that it can be removed from the crimping tool.

The die-holder member 28 (not shown in FIGURE 1) is held in the handle 24 by means of four bolts 36 and mating nuts. A thumb-screw 40 secures a connector holder 42 onto the handle 24 by means of a holding plate 38. As is well known in the prior art, by loosening the thumb-screw 40, member 42 can be moved longitudinally towards and away from the crimping opening 35 so as to locate and hold a connector locator (not shown) for locating a connector in the proper position for crimping.

Other details of the operation of the crimping head itself are well known in the prior art and will not be described in greater detail here.

In accordance with the present invention, the depth to which the tips of dies 34 penetrate into the connector during crimping can be adjusted by means of a rotatable knob 48 positioned at the end of the handle 24. Handle 24 has a channel-shaped cross section, as is shown in FIGURE 1. The end of handle 24 has an end plate portion 50 against which the knob 48 abuts. As is shown in FIGURE 2, knob 48 is longitudinally slidable upon the flattened end of a shaft 52 which extends longitudinally into the channel in the handle 24. Knob 48 has a central hole with a shape matching that of the flattened end of the shaft 52. The end of shaft 52 is slidably fitted into the hole in the collar portion 54, thus drivably coupling knob 48 to shaft 52. Knob 48 has an axial recess into which is fitted a compression spring 56 which abuts against a collar 58 which is secured to the end of the shaft 52. The spring 56 thrusts the knob 48 and the collar 58 away from one another and thereby thrusts the knob 48 towards the end plate portion 50.

As is shown in FIGURE 1, knob 48 has a plurality of slots 60 spaced around its inner periphery. The end of handle 24 has a projection 62 which fits into one of the slots 60 to hold the knob 48 against undesired rotation. The length of the projection 62 is such that when the knob 48 is pulled outwardly against the compression force of spring 56, the projection 62 becomes disengaged from the slots 60 and the knob 48 is free to be turned for adjustment of the crimping tool. The knob 48 has a hole 63 (see FIGURE 2), and the flat end of shaft 52 has a hole 65 which is aligned with hole 63 when the knob 48 is in its position closest to the plate 50. When the knob is in the latter position, a piece of wire can be inserted through the holes to lock the knob in place and prevent the setting of the tool from being changed.

Referring again to FIGURE 2, the shaft 52 is rotatably supported in the handle 24 by means of a bearing block 64 which is secured to the handle by a pair of integral rivets 70. The shaft 52 is prevented from sliding longitudinally by a pair of collars 66 and 68 suitably secured on the shaft 52 and abutting against the ends of the block 64.

Shaft 52 has a threaded portion 72 at its left end which mates with similar threads in what is termed herein as a "stop-block" 74. A ratchet mechanism 76 is mounted pivotally on the stop block 74 by means of a pin 78. The ratchet mechanism 76 includes a rack member 80 which slides longitudinally inside a pawl-bearing housing 82 which is pivoted to the stop block 74 by means of the pin 78. The rack member 80 is pivotally connected to the upper handle 22 by means of another pin 84. As will be described in greater detail hereinbelow, the pawl-bearing housing 82 carries a pawl member 86 which cooperates with the rack member 80 to insure that the operator brings the handles 22 and 24 close enough together to provide a full-depth crimp.

In accordance with the present invention, the lower end of the rack member 80 abuts against the pin 78 as is shown in FIGURE 2 in order to stop the movement of the handles 22 and 24 towards one another. Thus, the rack member serves both as a prop or stopping device and as a rack in the ratchet mechanism 76. This arrangement is highly advantageous as will be described in greater detail below.

As is shown at the top of FIGURE 1 as well as in FIGURE 2, a transparent window 88 is provided near the head of the tool 20. Crimp-depth indication marks 90 are provided on the window. As is shown in FIGURE 2, a marker 92 is mounted on a plate 94 which is adjustably secured to the left-hand portion of stop block 74 by means of a screw 96.

A stop member 100 is secured in the handle 24 and has an adjustable stop screw 102. The left-hand portion 95 of the stop block 74 has an upwardly-extending projection 98 which abuts against the left end of the screw 102 to limit the motion of the stop block 74 towards the adjustable knob 48. The upstanding portion of the stop block into which the screw 96 fits serves in a similar manner to limit the motion of stop block 74 in the opposite direction. Screw 102 is adjustable to define the limits of motion of the stop block. A roll-pin 104 helps keep the stop block 74 from moving upwardly.

The adjusting mechanism of the tool 20 operates as follows: The shaft 52 turns when the knob 48 is turned. Since stop block 74 cannot turn, the rotation of shaft 52 and threads 72 moves the stop block and its pivot pin 78 longitudinally in the handle 24. Since the rack member 80 is inclined with respect to the longitudinal axis of the shaft 52 and stop block 74, and since the rack member abuts against the pin 78 and serves as a stop member, longitudinal movement of the stop block varies the allowable movement of the handles towards and away from one another and thus varies the depth of crimp. As will be discussed in greater detail below, since the rack member 80 which is used as a stop member is an integral part of the ratchet mechanism 76, the distance between the position at which the end of rack member 80 abuts against pin 78 and the "release point" of the ratchet mechanism 76 always is precisely controlled and may be maintained within relatively close tolerances.

As the block 74 is moved to the left or right by turning the knob 48, the indicator marker 92 moves back and forth underneath the window 88 indicating the depth of penetration by the dies 34. By this means, the worker can quite easily adjust the depth of crimp with great accuracy. The micrometer type of adjustment mechanism which is provided enhances this accuracy. For example, eight notches 60 are provided around the periphery of the knob 48. Rotation of the knob 48 by one notch will change the crimping depth by approximately one-half of one thousandth of an inch. Of course, it is not necessary to provide such notches in an "infinitely" adjustable tool, but it is preferable to do so in order to be able to hold the knob in a position in which it has been set.

FIGURES 3 through 8 show further structural and operational details of the ratchet mechanism 76. Pawl-bearing housing 82 has a generally rectangular cross-sectional shape, as is shown in FIGURE 8. It has a raised portion 106 into which are cut two V-shaped slots 108, only one of which appears in FIGURES 3 through 6. The slots are cut in opposite side-walls of the housing 82. The pawl 86, which is of rectangular cross-sectional, extends between the slots 108. As is shown in FIGURE 8, an inverted U-shaped bracket 114 is secured to the ends of the pawl member 86. A pin 110 is fastened to the raised portion 106 of the housing 82 and extends through a hole in the cover portion of the bracket 114. A compression spring tends to thrust the upper flange of the pin 110 and the bracket 114 away from one another so as to bias the pivot pin 86 downwardly towards the rack member 80 and maintain it in engagement with the teeth of the rack member.

The rack member 80, which is shown in further detail in FIGURE 7, has centrally-located slots 132 and 134 in its ends to fit over webs in the handle 22 and block 74, respectively, and has a plurality of relatively shallow

notches or teeth **124**. The inclination of the sides of the notches is approximately the same as the inclination of the sides of the V-shaped slot **108**. At the right end of the shalow notches **124** is a relatively deep notch **126** (see FIGURE 4). The inclination of the sides of this deep notch also is about the same as the inclination of the sides of the slots **108**, and the bottom of notch **126** is at approximately the same level as the bottoms of the slots **108**. The bottoms of the shallow notches **124** are substantially above the bottoms of the slots **108**.

As the mechanism is shown in FIGURE 3, the handles of the crimping tool are together and the mechanism **76** is in the condition shown in FIGURE 2. Thus, the left-end portion **127** of the rack member **80** abuts against the pin **78** and prevents the handles from moving together any further. The pawl **86** rests in the bottoms of the slots **108** and the bottom of the large notch **126**.

The crimping tool **20** has four springs, one with each cam follower **32**, which tend to force the handles **22** and **24** apart. As the operator releases the handles, the handles spread apart and the rack member **80** starts moving to the right to the position indicated in FIGURE 4. During this motion, the pawl member **86** is forced upwardly into the right branch of the V-slot **108**. The thickness of the pawl is such and the notches **124** are so shallow that the pawl **86** cannot move into the left branch of the notch **108** as long as the pawl **86** is in one of the shallow notches **124**. Thus, the rack member **80** is free to move to the right, since the pawl **86** can travel freely in the right branch of the slot **108**, but is blocked against motion to the left because the pawl member **86** abuts against the lower point **129** between the branches of the V-slot **108**. In the position shown in FIGURE 4, it is not possible to force the handles together whereas it is possible to allow them to be separated. This prevents further crimping action until the crimped connector has been removed from the tool.

When the rack member **80** has moved to a position such as that shown in FIGURE 5 in which the end surface **128** of the rack has moved past the pawl **86**, the pawl is free to move to the bottoms of the slots **108** as is shown in FIGURE 5. In this condition, the handles are all the way apart.

When the handles again are moved towards one another to a position such as shown in FIGURE 6, the pawl **86** has moved into the left branch of the V-slot **108**. Although it is free to move in the left branch, it is blocked by the projection **129** from moving into the right branch. Thus, the rack member **80** is free to move to the left but is blocked from moving to the right. As a result, until the handles are moved all the way together to a position such that the pawl falls into the large notch **126**, the handles of the tool cannot be pulled apart.

Further in accordance with the present invention, a screw **130** with a pointed tip is positioned in a hole extending up to and through the left surface of the notch **126**. The screw **130** can be extended to the position shown in FIGURE 6 so as to provide, in effect, another shallow notch next to the deep notch **126** for adjustment of the ratchet mechanism to compensate for production tolerances and other sources of misalignment of the tool.

The use of a part of the ratchet mechanism as a stop member is a highly advantageous feature of the present invention. This arrangement provides accurate control of the "ratchet release point," that is, the point at which the pawl **86** falls into the deep groove **126**. It also accurately controls the position at which the surface **127** of the rack member abuts against the pin **78**. This combination permits exceptionally accurate control of the crimp depth provided by the tool. What is more, the mechanism is simple and does not get out of adjustment easily.

The ratchet mechanism **76** shown in the drawings has many advantages in and of itself. It is simple and easy to assemble, and is easy to adjust. It provides for positive guidance of the rack member **80** within the housing **82** so that there is little error in the stop and ratchet release settings. Furthermore, there is very little flexure of the pawl member **86** when it is placed under stress. This is because the distance between the point **129** and one of the teeth **124** is quite small and there is not a long length of pawl to be bent. The sturdiness of the pawl member **86** and its housing insure that the ratchet mechanism will be relatively trouble free.

The crimping tool **140** illustrated in FIGURES 9 through 12 is a "step" adjustable tool; that is, a tool in which the crimping depth can be adjusted only in certain pre-determined steps or increments. Such a tool may be preferred over the "infinitely adjustable" tool described above because the provision of pre-determined adjustment steps minimizes errors in following instructions by workmen using the tool.

Many of the components of the tool **140** shown in FIGURE 9 are identical to those of the tool **20** shown in the preceding figures, and the same reference numerals are used for corresponding components. The structure of the head portion **25** of the tool is identical to that of the tool **20** shown in FIGURES 1 and 2 and is not shown in FIGURE 9 in order to avoid unnecessary repetition.

The adjustment knob **48'** is drivably coupled to a relatively short shaft **142** which has a hexagonally-shaped right end portion or head **144**. The knob **48'** has a similarly hexagonally-shaped cavity into which the head **144** slides. A removable clip **146** has its ends secured in holes in the head **144** to limit the outward movement of the knob **48'** with respect to the head **144** and lock the knob in position. As in the FIGURE 1 embodiment of the invention, the spring **56** thrusts the head **144** and the knob **48'** apart so as to thrust the knob **48'** towards the plate **50**. A collar **148** is secured to the shaft **142** on the inside of plate **50** to rotatably secure the knob structure to the end plate.

In contrast to the embodiment shown in FIGURES 1 and 2, the knob **48'** has only one slot in its left surface. A single projection **147** is positioned on the plate **50**. Thus, only by rotation of the knob one or more full revolutions can the projection **147** be engaged in the single slot in the knob. The mechanism which will be described hereinbelow insures that the crimp depth will be adjusted one step of pre-determined magnitude for every revolution of the knob **48'**.

As shown in FIGURES 9 and 10, the left end of shaft **142** is cut in half longitudinally and has a flat surface. The flattened end of shaft **142** fits into the cylindrical hole through the center of bearing block **64** and drivably engages the similarly flat cut right end portion of another shaft **152** which has a threaded left end portion **154**. The flat portion at the right end of shaft **152** has an upstanding projection **150** (see FIGURE 10) which abuts against the right edge of the bearing block **64** for purposes to be described below. The shafts **142** and **152** thus are slidable longitudinally with respect to one another, and yet are positively coupled so that they both can be rotated by means by means of the knob **48'**.

The threaded left end **154** of the shaft **152** fits into an eccentrically located threaded hole in the right end of a block **158** of circular cross-section. The block **158** fits under a spring **160** which holds the member down and yet allows it to move longitudinally. A compression spring **156** is positioned between the left edge of block **64** and the right edge of block **158** and thrusts the blocks **64** and **158** away from one another. A stepped stop member **162** is pivotally connected to the block **158** by means of a pin **164** in block **158** which fits into a hook-shaped portion **163** at the right end of the stop member **162**. Member **162** has an inclined slot **165** whose lower edge has a series of steps or notches **166** cut into it. The pin **78** of ratchet mechanism **76** rests in one of the notches **166**, the particular notch depending upon the position of the stop member **162**. FIGURE 12 shows the front wall of the handle **24**, as the handles **22** and **24** move toward and away from one

another. When the pin 78 nears the bottom of the slot 168, it comes to rest on one of the steps 166 and against the back wall 169 of slot 168. Since rack member 80 abuts against the pin 78, the motion of the handles towards one another is stopped at a point depending upon the step or notch 166 in which the pin 78 is held.

The left end 178 of the member 162 passes under the center portion of a dumbbell-shaped guide roller 180. Secured to end portion 178 in an indicator strip 92 which moves beneath the window 88 to indicate the depth of crimp, as in the embodiment of the invention shown in FIGURES 1 and 2.

The tool 140 operates as follows: Turning the knob 48' through one revolution causes the screw 154 to move the block 158 to the right or left by a distance equal to the width of one of the steps 166 on the member 162, thus raising or lowering the stop point of the pin 78 and increasing or decreasing the crimp depth of the tool by one step.

Occasionally, a workman fails to rotate the knob 48' through one complete revolution and leaves the mechanism in a position such as that shown in FIGURE 11 where the pin 78 engages the point of one of the teeth forming the steps 166 instead of seating itself in one of the steps. This condition is quite undesirable because it could damage the tool, and because the crimp depth of the tool will not be set at any of the desired values. In accordance with the present invention, this condition is automatically corrected. As is shown in FIGURE 9, the spring 156 normally holds the projection 150 against the right edge of block 64. Thus, there is an amount of clearance between the ends of shafts 142 and 152 which enables the shafts to slide towards one another by a distance sufficient to permit the pin 78 to slip down one step and thus come to rest on the next lower step when the handles are squeezed together. Thus, the tool automatically adjusts itself to ensure that its depth of crimp is set at one of the predetermined step values despite improper adjustment.

Further precise adjustment of the crimping depth is provided by the mechanism shown in FIGURES 9 and 13. A separate stop member 200 is provided on the upper handle 22 of the tool 140. Stop member 200 is pivotally mounted on the web portion 202 of the handle 22 by a pin 204. The pin 84 to which the rack 80 is connected is mounted in a web portion 206 of the upper stop member 200.

The amount of angular spacing between the handle 22 and the pivot point 84 of the rack 80 is adjustable by means of a threaded screw 208 in a similarly threaded hole 210 in the handle 22. As is shown in FIGURE 9, the upper end of the screw has a slot into which a screw driver can be inserted for turning the screw and adjusting the angular spacing between the handle 22 and the pivot point 84. The plastic cover 46 normally covers the hole because it is not desired to have the user adjust the screw 208. Instead, this adjustment is made at the factory and the plastic cover placed over the hole afterwards in order to prevent tampering by the user of the tool.

As is shown most clearly in FIGURE 13, the stop member 200 has a curved portion 212 with a rounded internal slot 214 with ridges 216 at its upper edges. The bottom end 218 of the screw 208 is rounded, and a compression spring 220 is positioned between the flat portion of the rounded head 218 and a washer 222 whose edges abut against the ridges 216. The spring 220 tends to thrust the bottom portion 218 and the washer 222 apart. Thus, the bottom portion 218 of the screw 208 always is forced against the curved bottom of the rounded slot in portion 212 of the stop member 200 when the handles 22 and 24 are squeezed together, and the screw 208 holds the handle 22 at a specified angular adjustment with respect to the pivot pin 84. By means of the screw 208, the tool can be adjusted at the factory to compensate for manufacturing tolerances and the like and provide extremely accurate control of the crimping depth of the tool. Further adjustments can be made by using the auxiliary tooth 130 in the ratchet mechanism 76, as was described above.

The above description of the invention is intended to be illustrative and not limiting. Various changes or modifications in the embodiments described may occur to those skilled in the art and these can be made without departing from the spirit or scope of the invention as set forth in the claims.

We claim:

1. A tool for crimping electrical connectors onto conductors, said tool comprising, in combination, a plurality of crimping dies, handle means including a pair of handles coupled to said dies to move said dies towards one another for crimping and away from one another after crimping, ratchet means connected between said handles for preventing movement of said handles away from one another until they have moved toward one another to a pre-determined position relative to one another, said ratchet means including a ratchet member secured to one of said handles, a stop surface on the other of said handles, and means for guiding said ratchet member into engagement with said stop surface to limit the movement of said handles toward one another.

2. Apparatus as in claim 1 in which said ratchet means includes a rack and a pawl member, each pivoted to a different one of said handles, and in which said guiding means comprises one of said ratchet and pawl members.

3. Apparatus as in claim 2 with said rack having a series of relatively shallow notches each having a first depth, and a relatively deeper notch, a pawl member slidably mounted in a slot in said guiding means and biased into engagement with said notches on said rack, said slot having two oppositely-inclined branches and a lower portion positioned below the bottoms of said shallow notches so as to maintain said pawl in one of said branches of said slot while in engagement with one of said shallow notches, the pawl being free to move in either slot branch when engaged with said deeper notch.

4. Apparatus as in claim 1 in which said stop surface is on a first movable stop member on a first one of said handles, micrometer screw adjustment means in said first handle for moving said first stop member longitudinally in said first handle, said adjustment means comprising mated male and female threaded members, one coupled to said first stop member and the other to said first handle.

5. A tool for crimping electrical connectors onto conductors, said tool comprising, in combination, a plurality of crimping dies, handle means including a pair of handles coupled to said dies to move said dies towards one another for crimping and away from one another after crimping, a first stop member on a first one of said handles, a second stop member on a second one of said handles, a prop member secured to one of said stop members and movable into engagement with the other of said stop members to prop said handles apart and prevent their further closure after they have been closed together to a pre-determined closure spacing, micrometer screw adjustment means in said first handle for moving said first stop member longitudinally in said first handle to change said closure spacing, said adjustment means comprising mated male and female threaded members, one coupled to said first stop member and the other to said first handle.

6. Apparatus as in claim 5 in which said stop members are positioned so that said prop member is inclined with respect to said first handle when said handles are in a closed position, said first stop member having a surface inclined with respect to said handle in a sense opposite to the inclination of said prop member, said surface having a series of notches therein into which one end of said prop member is adapted to fit.

7. Apparatus as in claim 5 including means adjustable to angularly rotate said handle with respect to said second stop member to adjust the maximum depth of indentation produced by said dies.

8. Apparatus as in claim 5 including a window in said first handle, indentation depth markings adjacent said window, a marker in said window adjacent said depth markings, said marker being coupled to said first stop member for movement therewith.

9. Apparatus as in claim 6 including a hand-operable knob, and coupling means secured to one of said male and female threaded members and making longitudinally sliding and rotatably driving engagement with said knob and resilient means engaging said coupling means to thrust said first stop member against said prop member.

10. Apparatus as in claim 6 including a hand-operable knob adjacent one end of said first handle and drivably coupled to operate said micrometer screw adjustment means, said knob having a detent mechanism to lock said knob against rotation after one revolution, and including means for guiding said one end of said prop member against said first stop member at a pre-selected position, and in which the pitch of the threads of said micrometer screw means is such as to move said first stop member one notch with respect to said position for every revolution of said knob.

11. Apparatus as in claim 5 including a knob adjacent one end of said first handle and longitudinally slidably connected to said other one of said male and female threaded members, a detent member on said handle, a plurality of peripherally-spaced detent indentations in said knob, and resilient means biasing said knob towards said detent member.

12. A tool for crimping electrical connectors onto conductors, said tool comprising, in combination, a plurality of crimping dies, handle means coupled to said dies to move said dies towards one another for crimping and away from one another after crimping, said handle means comprising a pair of handles movable toward one another for crimping and away from one another after crimping, ratchet means connected between said handles for preventing movement of said handles away from one another until they have moved toward one another to a predetermined position relative to one another, said ratchet means comprising a rack member connected to one of said handles, a pawl-bearing member connected to the other of said handles, said rack having a series of relatively shallow notches each having a first depth, and a relatively deeper notch, a pawl member slidably mounted in a slot in said pawl-bearing member and biased into engagement with said notches on said rack, said slot having two oppositely-inclined branches and a lower portion positioned below the bottoms of said shallow notches so as to maintain said pawl in one of said branches of said slot while in engagement with one said shallow notches, the pawl being free to move in either slot branch when engaged with said deeper notch.

13. Apparatus as in claim 12 in which said rack member has an extendable member recessed into one inclined face of said deeper notch, the latter member being extendable outwardly from said face to form another one of said shallow notches adjacent said deeper notch.

14. Apparatus as in claim 12 including a first stop member on a first one of said handles, a second stop member on a second one of said handles, one of said rack and said pawl members comprising a prop member secured to one of said stop members and movable into engagement with the other of said stop members to prop said handles apart and prevent their further closure after they have been closed together to a pre-determined closure spacing, micrometer screw adjustment means in said first handle for moving said first stop member longitudinally in said first handle, said adjustment means comprising mated male and female threaded members, one coupled to said first stop member and the other to said first handle.

15. Apparatus as in claim 12 in which said slot is V-shaped with the point of the V pointing towards said rack, said rack member fits into and slides within said pawl-bearing member, said pawl-bearing member has a pair of opposed side-walls, each with one of said notches in it, a pawl extending between said slots with one end in each slot, a bracket connected to the ends of said pawl, and a resilient member biasing said bracket towards said pawl-bearing member.

16. Apparatus as in claim 1 in which said stop surface is on a first movable stop member on a first one of said handles, and said tool also includes adjustment means in said first handle for moving said first stop member longitudinally in said first handle.

17. Apparatus as in claim 5 in which said stop members are positioned so that said prop member is inclined with respect to said first handle when said handles are in a closed position, said first stop member having a surface inclined with respect to said handle in a sense opposite to the inclination of said prop member.

References Cited

UNITED STATES PATENTS

2,985,047	5/1961	Van Oort	72—402
3,199,335	8/1965	Holmes et al.	72—410
3,226,968	1/1966	Holmes	72—410

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,459,029 Dated Aug. 5, 1969

Inventor(s) S. Rosenfeld et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Column 1 the name of the assignee should be changed from "Buchanan Electric Products Corporation" to --Buchanan Electrical Products Corporation--.

SIGNED AND
SEALED
FEB 17 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, J
Commissioner of Patent