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Hilton

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[54] **HAND-OPERATED CRIMPING TOOL**

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[52] **U.S. Cl.** ..... **29/203 HT**

[51] **Int. Cl.** **H01r 43/04**

[58] **Field of Search** ..... 29/203 H, 203 D, 203 HT, 29/203 DT; 72/410

[56] **References Cited**

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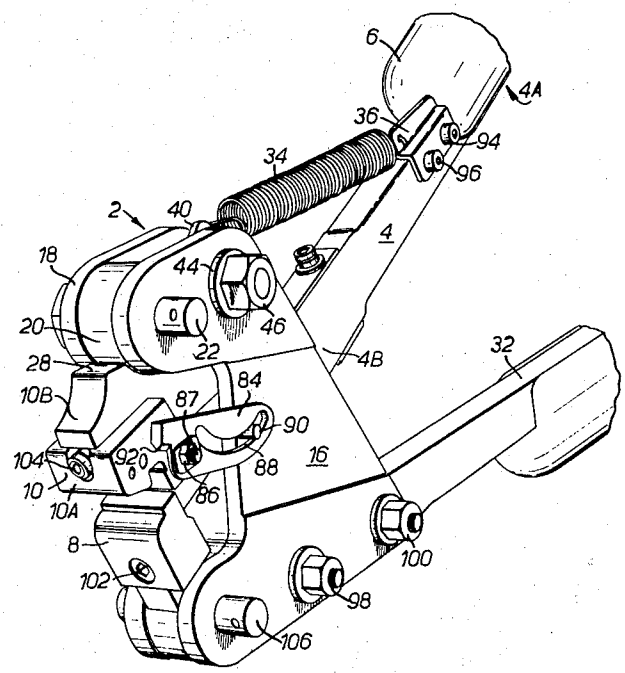
[57] **ABSTRACT**

A hand-operated crimping tool which comprises two handles; a crimping arrangement positioned on one and including a fixed crimping die and a movable crimping die; spring biasing means such as a leaf spring biasing the movable die away from the fixed die and a rotatable cam for rolling over a surface of the movable die; the cam and the said surface of the movable die being so shaped relatively to each other that depression of the said one handle causes the cam to roll over the surface and move the movable die from an open position in which the two dies are spaced apart to allow insertion of a device to be crimped, to a crimping position in which the two dies effect a desired crimping of the device, and then to a release position in which the two dies are spaced apart to allow removal of the crimped device. Swinging cutters on either side of the movable die are preferred.

6 Claims, 6 Drawing Figures



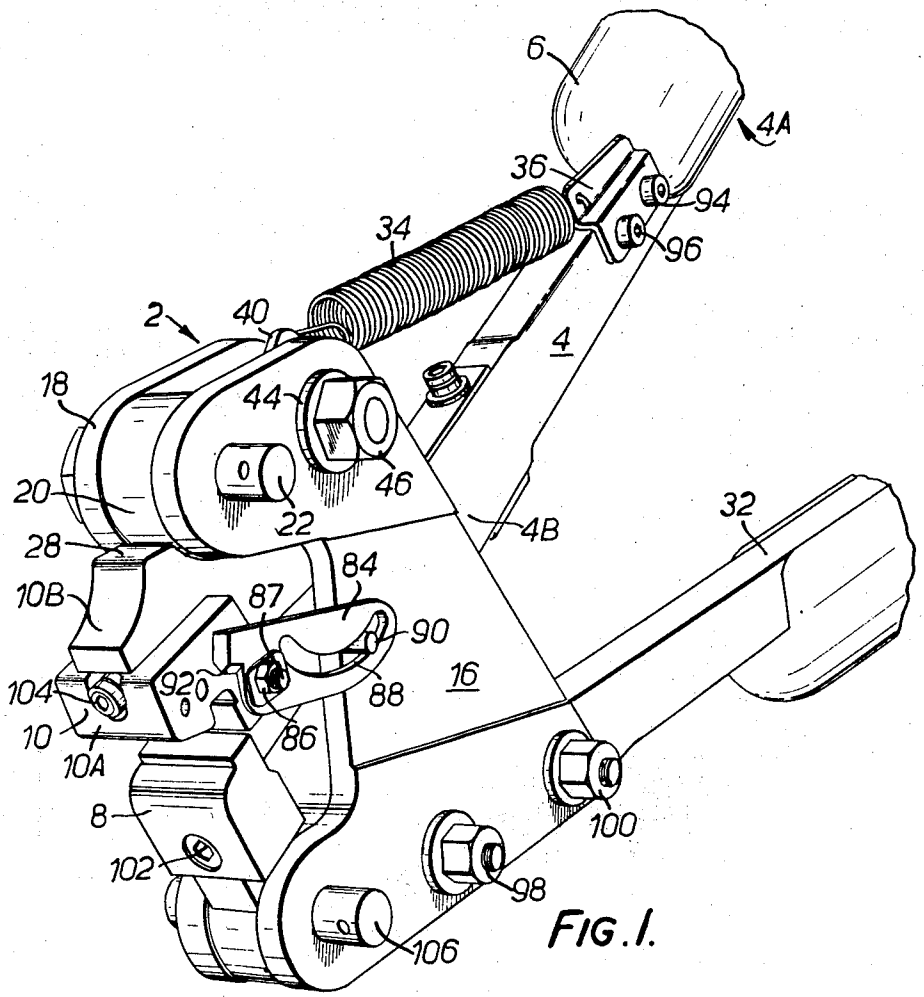


FIG. 1.

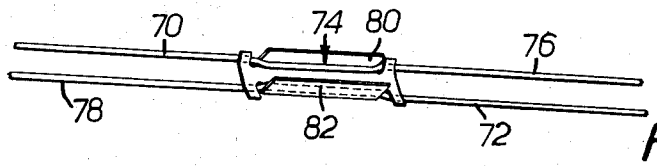


FIG. 5A.

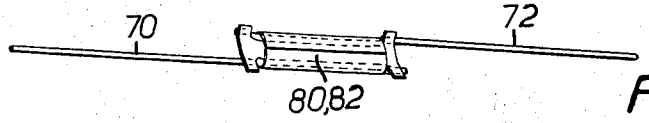


FIG. 5B.

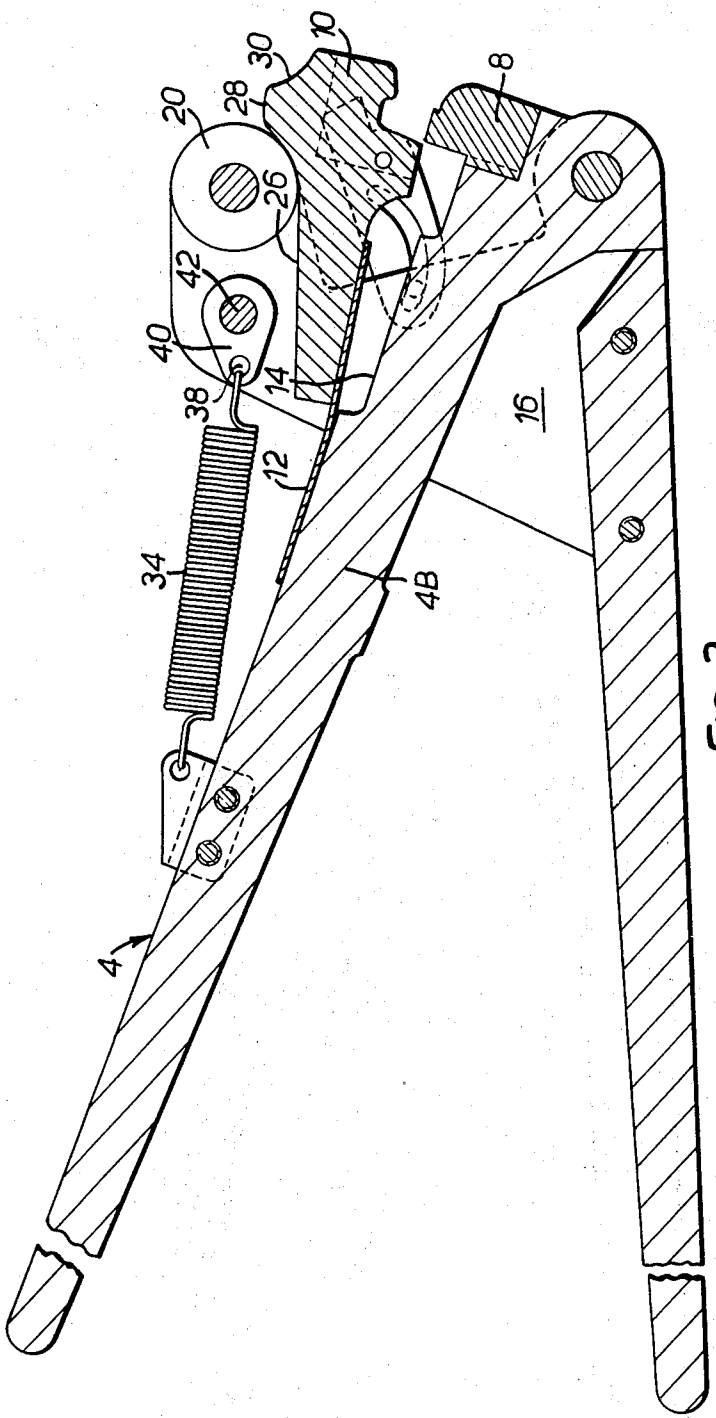


FIG. 2.

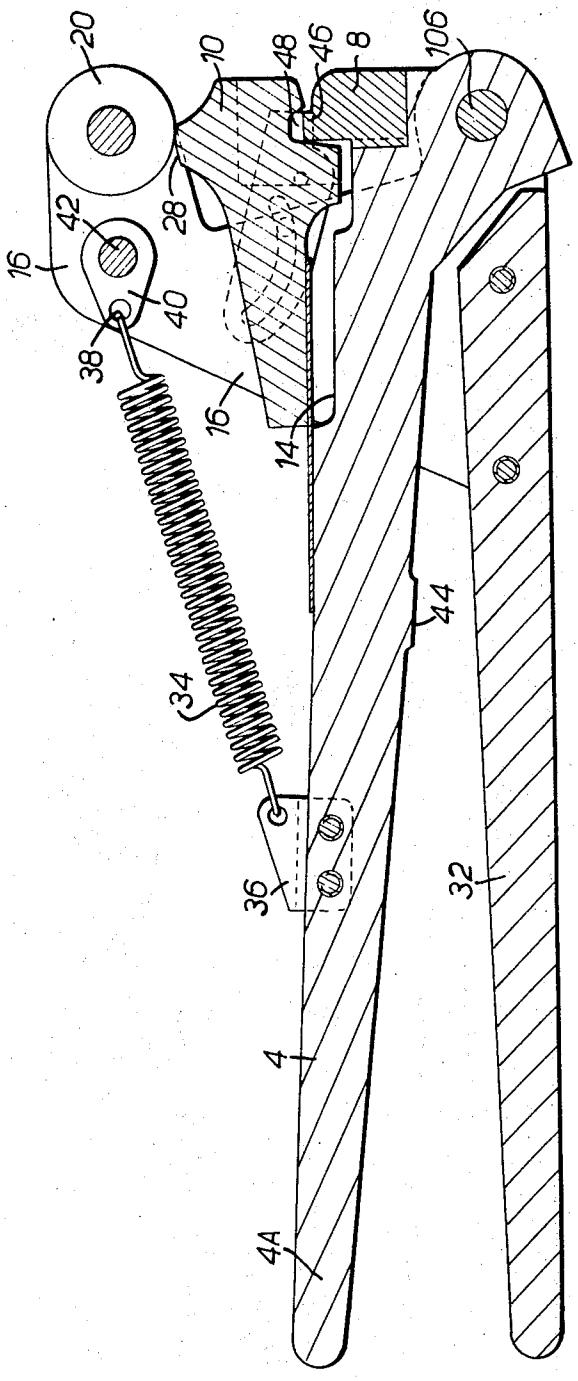


FIG. 3.

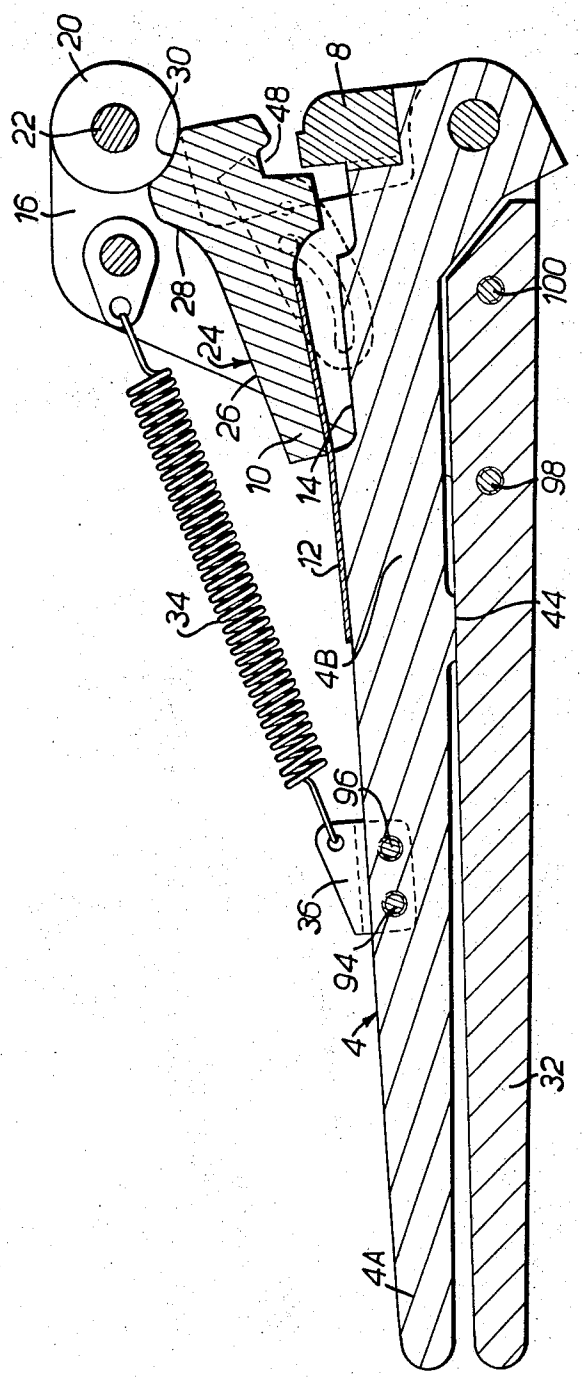


FIG. 4.

HAND-OPERATED CRIMPING TOOL

This invention relates to a hand-operated crimping tool.

This invention provides a hand-operated crimping tool comprising a lever; a crimping arrangement positioned on the lever and including a fixed crimping die and a movable crimping die; spring biasing means biasing the movable die away from the fixed die; and a rotatable cam for rolling over a surface of the movable die, the cam and the said surface of the movable die being so shaped relatively to each other that depression of the lever causes the cam to move the movable die from an open position in which the two dies are spaced apart to allow insertion of a device to be crimped, to a crimping position in which the two dies effect a desired crimping of the device, and then to a release position in which the two dies are spaced apart to allow removal of the crimped device.

The crimping tool of the present invention may be operated by depressing the lever to effect crimping as mentioned above. Since the crimping is effected by means of a single lever, the crimping tool can be mounted on a base which can be secured in position on a table, wall or other support. Alternatively, it may be desired to have the crimping tool readily movable and in this case it will be advantageous to provide the tool with a second lever so that the two levers effectively form a pair of handles which are squeezed together to effect crimping.

The movement of the dies from a crimping position to an open position due to the continued downward movement of the lever is extremely advantageous. Firstly, the separation of the dies from the crimping position to the open position allows a crimped device to be easily removed from between the dies without damage. Secondly, the continued downward pressure required by an operator to cause the dies to move from the crimping position to the open position, means that the operator will not stop short of applying full crimping pressure.

Generally, the open position in which the two dies are spaced apart to allow insertion of a device to be crimped will be a different position from the release position in which the two dies are spaced apart to allow removal of the crimped device. However, if desired, the open position and the release position can be the same to the extent that the spacing apart of the two dies is the same for both positions. Obviously, the thickness of a crimped device will generally be less than the thickness of a device before crimping, so that in the release position it will usually not be necessary to open the dies as wide as in the open position.

Preferably the cam is rounded or cylindrical and in this case the surface of the movable die may have a first plane or flat portion such that when the cam is in contact with this portion, then the dies are in the open position. The first plane portion preferably merges into a humped portion which is so shaped that when the cam is in contact with this humped portion, then the dies are in the crimping position. Also preferably, the humped portion merges at the apex of the hump into a concave portion which is such that when the cam rests in this concave portion, then the dies are in the release position. Obviously, various shapes for the cam and/or the surface of the movable die can be employed to ensure that the dies can be moved from the open position to the crimping position and then to the release position.

The movable die may be a female die in which case the fixed die will be a male die. Alternatively, the movable die may be a male die and the fixed die will be a female die. In some instances, the two dies may have two plane mating surfaces and there will be no penetration of one half of the die into an aperture in the other half of the die.

The crimping tool in accordance with the present invention may be employed to crimp wires in connectors. In such applications of the invention, the crimped connectors often contain surplus wire. There are also other applications in which the crimped device contains surplus material. It may be desirable to remove this surplus material, e.g., surplus wire, and to this extent the crimping tool may be provided with one or more cutters. In one embodiment of the invention, the crimping tool is provided with a cutter on each side of the two dies. Such a cutter may be pivotted to the movable die and provided with a curved slot which receives therein a pin or other projecting member attached to a fixed part of the crimping tool. Thus, during movement of the movable die, the cutter will be caused to move with the die over a path constrained by the curved aperture. Thus, cutting of surplus material is effected. In the case where a cutter is employed on each side of the dies, cutting may take place immediately adjacent the two sides of the dies. The employment of two cutters is suitable for in line jointing. If "butt" jointing should be required, then a single cutter may be employed with a relatively wide edge to cut the free end portion of each wire at the same end of the connector. The employment of two pivotted cutters as mentioned above moving over a curved path tends to prevent the completed crimped and cut device from becoming wedged between the cutters. Such wedging can occur if two fixed cutters are employed.

Preferably, the lever and cam are held in position by pivot pins which are eccentric. This enables adjustment of the gap between the two dies in the open, crimping and release positions to be adjusted. Also, if desired, the lever may be provided with a spring effective to facilitate the return of the lever to the open position.

An embodiment of the invention will now be described solely by way of example and with reference to the accompanying drawings, in which

FIG. 1 is a perspective view of a crimping tool in accordance wih the invention, the dies of the tool being in the open position;

FIG. 2 is a longitudinal cross-section through the tool shown in FIG. 1, the dies of the tool in FIG. 2 also being in the open position;

FIG. 3 is a longitudinal cross-section through the crimping tool shown in FIG. 1, the dies of the tool in FIG. 3 being in the crimping position;

FIG. 4 is a longitudinal cross-section through the crimping tool shown in FIG. 1, the dies of the tool in FIG. 4 being in the release position;

FIG. 5A is a perspective view of two wire conductors positioned in an open, uncrimped connector; and

FIG. 5B is a perspective view, in crimped condition, of the wires and connector shown in FIG. 5A.

Referring to the drawings, there is shown a hand crimping tool 2 comprising a lever 4. The lever 4 has an upper portion 4A provided with a hand grip 6. The lever 4 has a lower portion 4B provided with a fixed

crimping die 8 and a movable crimping die 10. As most clearly seen in FIGS. 2 to 4, the movable die 10 is fixed to the portion 4B of the lever 4 by means of a leaf spring 12. Obviously, if desired, another type of spring such as a compression spring could be employed. The leaf spring 12 is rigidly fixed to the portion 4B of the lever 4 and projects outwardly over a recessed portion 14 formed in the portion 4B. The movable die 10 is fixed to the leaf spring 12 above the said recessed portion 14. The leaf spring 12 acts to bias the movable die 10 away from the fixed die 8.

The crimping tool 2 is provided with two side plates 16, 18, and position between these two side plates 16, 18, is a rotatable cam in the form of a roller 20. The lever 4 pivots with respect to the side plates 16, 18, about an eccentric pin 106. The roller 20 is held in position by means of an eccentric pivot pin 22. The upper surface 24 of the movable die 10 is contoured to the shape or cam face shown most clearly in FIGS. 2 to 4. More specifically, this contoured upper shape comprises a plane or flat portion 26 which merges into a humped portion 28. The apex of the humped portion 28 suddenly descends into a concave portion 30. In FIG. 2, the roller is shown in the open position in which it is on the flat portion 26 and just about to ascend the humped portion 28. In this position, the roller 20 does not cause downward movement of the movable die 10 against the upwardly exerted pressure of the leaf spring 12. In the position shown in FIG. 3, the roller 20 is at the apex of the hump 28. This movement of the roller 20 from the position shown in FIG. 2 to the position shown in FIG. 3 has been caused by downard pressure of the lever 4 towards a bottom lever 32, the two levers 4, 32, effectively forming a pair of handles. As the lever 4 is moved downwardly, the movable die 10 is in effect pulled backwards towards the end portion 4A of the lever 4. The cam roller 20 rotates and the die 10 effectively rolls underneath it or, put another way, the roller 20 rolls up the slope onto the top of the hump 28 to the position shown in FIG. 3. At the same time, a tension spring 34 is strssed. The tension spring 34 is hooked on to the handle 4 by means of a bracket 36 and is also hooked on to the side plate 16 by passing through an aperture 38 in a plate 40 fixed to the plate 16 by means of a bolt 42, a washer 44 and a nut 46. The tension spring 34 biases the lever 4 towards the open position shown in FIG. 2 and thus facilitates the returning of the lever 4 to its open position ready for a fresh crimping movement.

In FIG. 4, the roller 20 is shown in a position in which it has passed over the hump 28 and rests within the concave portion 30. In this position, the handles 4 and 32 are substantially together, being spaced slightly apart by a stop member 44 which is provided to ensure that the handles 4, 32 do not come exactly together and possibly trap a portion of the user's hand. The roller 20 has been caused to rest in the concave portion 30 by reason of a further depression of the lever 4, from the position shown in FIG. 3 to the position shown in FIG. 4, this depression causing the movable die 10 to move further backwards and causing the roller 20 to drop off the hump 28 into the concave portion 30. With the roller 20 positioned in the concave portion 30, the dies 8, 10 are in the release position and a crimped device, e.g., a crimped electrical connector, can easily be removed from the dies.

In the crimping position of the tool as shown in FIG. 3, it will be seen that a projection 46 on the fixed die 8 has penetrated into an aperture 48 in the movable die 10. The relative height of the projection 46 and the depth of the aperture 48 is such that, if the adjustment by means of the eccentric pins 22, 106 is made so that contact of the projection 46 in the aperture 48 can just be felt when the dies 8, 10 are in the crimping position without any device to be crimped therebetween, then correct crimping will be carried out when a device to be crimped is placed between the dies 8, 10.

Referring now to FIGS. 5A and 5B, there is shown in FIG. 5A two wires 70, 72 passing through an electrical connector 74. A free end portion 76 of the wire 70 projects on one side of the connector 74 and a free end portion 78 of the wire 72 projects on the other side of the connector 74. By pulling the two free end portions 76, 78 in opposite directions, the wires 70, 72 may be held taut in the connector 74 which may then be placed in the crimping tool 2, with the dies 8, 10 in the open position as illustrated in FIGS. 1 and 2. Depression of the lever 4 to the crimping position illustrated in FIG. 3 causes the upstanding side walls 80, 82 of the connector 74 to be bent over or crimped as illustrated in FIG. 5B. Subsequent further depression of the lever 4 enables the dies 8, 10 to move to the release position shown in FIG. 4 and the crimped connector 74 with attached wires 70, 72 can be removed.

It will be noted from FIG. 5B that the free ends 76, 78 of the wires 70, 72 have been removed. This was achieved in the crimping tool 2, during the crimping action, by means of two cutters 84 (only one being shown) placed one on each side of the dies 8, 10. The cutters 84 are pivotally fixed to the movable die 10 by means of a pivot pin 87 and a nut 86. Each cutter 84 is provided with an elongate arcuate slot 88 which receives a trunnion 90 projecting outwardly from the side plate 16 or 18. Each cutter 84 pivots about the pivot pin 87 and the pivotting action is controlled by movement of the trunnion 90 in its slot 88. In the crimping position, a cutting edge 92 on each cutter 84 is arranged to cut through the free end portions 76 or 78 of the wires 70 or 72.

Assembly of the tool 12 is relatively easy. Thus, for example, the bracket 36 is secured to the lever 4 by means of the Allen screws 94, 96. Similarly, the side plates 16, 18 are bolted together using bolts 98, 100. The fixed die 8 is screwed to the end portion 4B of the lever 4 by means of the screws 102. The die 10 is formed into two parts 10A, 10B, and the two parts are screwed together by a screw 104. Thus, if wear should occur in any parts of the crimping tool, e.g., in the die part 10A or in the die 8, replacement can easily be fitted by simply unscrewing or unbolting the defective parts and effecting an appropriate replacement.

What we claim is:

1. A hand-operated crimping tool comprising a lever; a crimping arrangement positioned on the lever and including a fixed crimping die and a movable crimping die; spring biasing means biasing the movable die away from the fixed die; and a rotatable cam for rolling over a surface of the movable die, the cam and the said surface of the movable die being so shaped relatively to each other that depression of the lever causes the cam to move the movable die from an open position in which the two dies are spaced apart to allow insertion of a device to be crimped, to a crimping position in

which the two dies effect a desired crimping of the device, and then to a release position in which the two dies are spaced apart to allow removal of the crimped device.

2. A hand-operated crimping tool according to claim **1,** including a second lever which is so arranged that the two levers form a pair of handles which are squeezed together to effect crimping.

3. A hand-operated crimping tool according to claim **1,** in which the spacing apart of the two dies is different for the open position and the release position.

4. A hand-operated crimping tool according to claim **1,** in which the cam is rounded or cylindrical; and in which the surface of the movable die has a plane portion such that when the cam is in contact with this portion then the two dies are in the open position, said plane portion merging into a humped portion which is so shaped that when the cam is in contact with this humped portion then the dies are in the crimping position, and said humped portion merging at the apex of the hump into a concave portion which is such that when the cam rests on this concave portion then the dies are in the release position.

5. A hand-operated crimping tool according to claim **1,** including a cutter on each side of the two dies.

6. A hand-operated crimping tool according to claim **5,** in which each cutter is pivotted to the movable die and is provided with a curved slot which receives therein a pin or other projecting member attached to a fixed part of the crimping tool.

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