

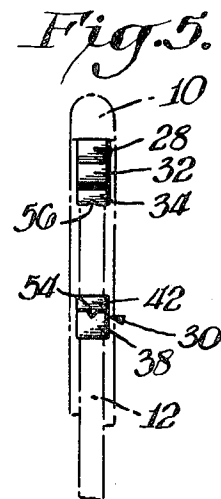
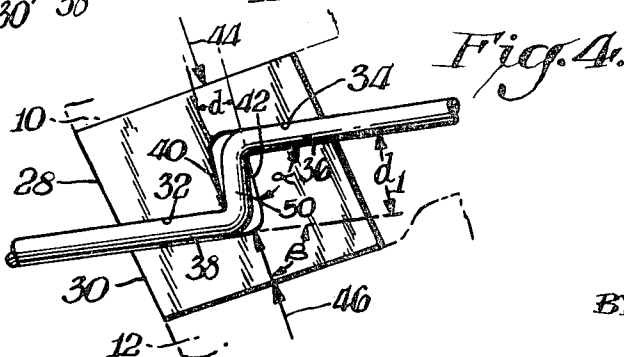
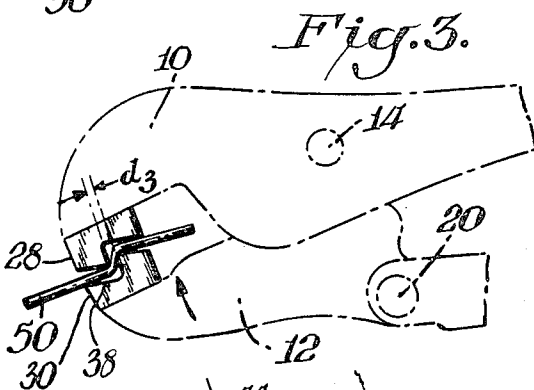
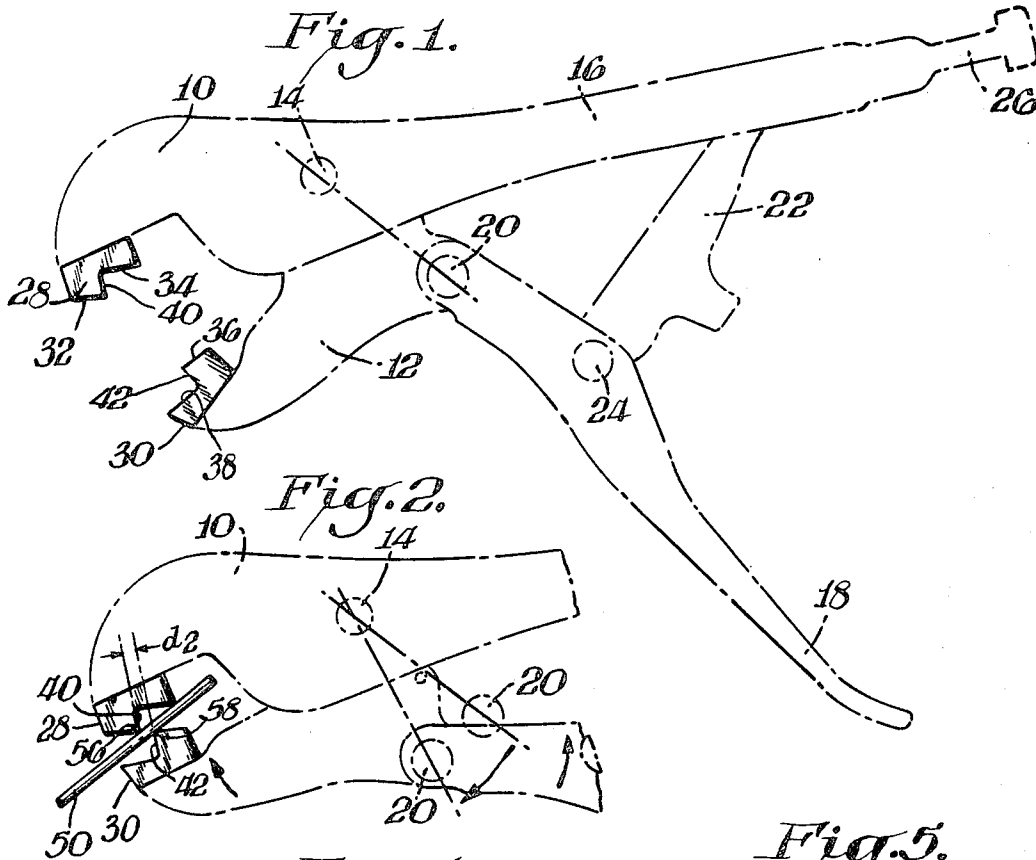
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WIRE CRIMPING TOOL

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WIRE CRIMPING TOOL

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ABSTRACT OF THE DISCLOSURE

A tool having jaws and appropriate handles for actuating the jaws is fitted with stepped jaw dies having faces. The opposing die faces are substantially parallel and form acute angles with the respective vectors representing the directions of jaw movement.

This invention relates to a wire crimping tool and, more particularly, to a simple tool capable of placing a reverse or S-shaped bend in a piece of wire.

Small gasoline engines as well as many larger automobile engines use throttle and choke wires. Often these wires break, become bent, or otherwise damaged and require replacement. These wires are normally supplied as replacement stock in cut lengths. At the end of the throttle wire which engages the engine throttle or choke, there is a reverse or S-shaped bend or crimp. While this practice is workable, the throttle wires must be stocked in a great variety of different sizes and lengths to accommodate the many different engine or choke connections, hence stocking is a substantial problem.

Throttle wire of this type is also supplied in several hundred foot reels. In this event, it is necessary for the repairman or garage mechanic to cut the wire to length and form the small S-shaped bends at one end of the wire to engage the throttle or choke valves. Since most throttle wire is steel, it is relatively difficult to bend. Because of the relatively small offset in the S-bend, which is slipped through a hole in the throttle or choke valve's operating lever, it is difficult to form. One requirement of these throttle wires is that the S-bends be substantially 90°. This prevents interference with the valve operation. It is difficult if not impossible in some cases for the repairer to make such bends using ordinary hand tools. To say the least, forming such bends is unduly time consuming.

It is, therefore, an object of this invention to provide an improved tool for forming S-shaped bends in wire.

Another object of this invention is to provide an improved relatively simple tool for forming S-shaped bends in wire which tool is easy to construct and use.

In a preferred embodiment of this invention, the tool may be formed using a conventional lock-type pair of pliers such as those sold under the trademark "Vise Grip." Mating dies for selectively bending a wire are positioned in the opposing jaws of these lock-type pliers. Each of the dies has two faces which are separated by a step-type riser and lie in substantially parallel planes. The parallel faces of each of the dies form an acute angle with the respective vectors defining the path of relative movement of each of the jaws. The riser of each jaw die has a height which exceeds the spacing between the risers when the jaw dies are closed. This has the advantage of slightly stretching the wire during forming of the 90° corners or bends. This helps to fix the bends.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation as well as additional objects and advantages thereof will best be understood from the following description when read in

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connection with the accompanying drawings, in which:
FIGURE 1 is a side view of a wire bending tool constructed in accordance with this invention;

FIGURE 2 is a partial side view of the wire bending tool of FIG. 1 at the beginning of its operation in position for engagement with a piece of wire;

FIGURE 3 is a partial side view of the wire bending tool of FIG. 1 during its operation;

FIGURE 4 is a fragmentary view showing the jaw dies of the tool of FIG. 1 at the completion of their operation; and

FIGURE 5 is an end view of the jaw dies of this invention modified in accordance with one embodiment of this invention.

In the drawing of FIG. 1 there is seen a tool constructed in accordance with this invention. This tool includes two pivoted die carrying upper and lower jaws 10 and 12, respectively. The upper and lower jaws 10 and 12 are pivoted as by a rivet at a pivotable position 14. The jaws 10 and 12 have suitable operating handles illustrated in this case as conventional lock-type pliers. Typically, such pliers have a fixed handle 16 and a moving handle 18. The fixed handle 16 is part of a unitary piece which forms the upper jaw 10. The moving handle 18 is pivoted to the rear portion of the lower jaw 12 as by a rivet at a pivotable position 20. In addition, at a point on the moving handle 18 relatively close to the pivotable connection 20, a fulcrum arm 22 is suitably attached at a fulcrum pivot 24. The free end of the fulcrum arm 22 engages an adjusting bolt 26 (only the end of which is shown) which threadably engages the end of the fixed handle 16. As is well known, by adjustment of the bolt 26 the jaws 10 and 12 may be made to close to a greater or lesser extent.

The tool thus far described may be made out of either a malleable casting or stamped from pieces of sheet metal or other suitable material. At their mating surfaces, each of the jaws 10 and 12 is provided with complementary or mating upper and lower dies 28 and 30, respectively, which are formed of steel or similar hardened metal.

Close examination of the dies 28 and 30 illustrated reveals that each die has two faces. These are numbered 32 and 34 for the upper die and 36 and 38 for the lower die 30. The respective faces 32-34, 36-38 of each die are planar and lie in parallel planes when in the closed position. Furthermore, the respective faces 32-34 and 36-38 of each die are separated in elevation by a riser 40 and 42, respectively, to form mating or complementary stepped portions when the jaws are closed together.

As may be seen, in the enlarged view of FIG. 4 the directions of closing movement of the respective jaws 10 and 12 are denoted by the arrows 44 and 46, respectively. It is this direction of relative closing movement of the jaws that establishes the final positions of the respective die faces and risers. These arrows may be considered vectors which control the final relative positions of the die faces and risers. Accordingly, these relative positions will be defined with reference to these vectors 44 and 46.

In the preferred embodiment of this invention, the respective die faces 32-34, 36-38 lie in planes which form an acute angle β with respect to the respective vectors 44 and 46 representing the instantaneous direction of the motion of the jaws 10 and 12 along their arcuate path as they close. In a preferred embodiment this angle β is 75° as measured counterclockwise from the vector 46 (or 44) to the plane of either face 36 or 38 of the lower die 30.

In like manner, the angle α between the plane of either of the risers 40 and 42 and the plane of either of the adjacent die faces 30 and 32 or 36 and 38 is acute. In each instance the angle α is measured in the conventional counterclockwise sense from the riser to the associated die face plane. It is important that the angle between the

riser 42 and the upper face 36 of the lower die 30 not exceed 90°. If it does, the bends formed in the wire will not be sharp. Preferably this angle α should be about 70°.

It is noted that the risers 40 and 42 are separated, when the jaws are closed, by the spacing d (FIG. 4). This spacing must be left in order to accommodate the diameter of the wire to be bent or crimped. Without the spacing, the wire would be sheared by the scissors action of the risers or of the terminating edges 56, 58 of the die faces 32, 36. This distance d , in a preferred embodiment of the invention, is less than the height d_1 of either of the risers 40 or 42. This imparts a stretch to the wire during the formation of the bend which aids in setting the bend.

The operation of the tool of this invention is illustrated in the sequence of drawings FIGS. 2, 3 and 4. In this sequence, the dies 28 and 30 are seen first in FIG. 2 to engage a length of wire 50 which is to be bent. It will be noted from FIG. 2 and FIG. 3 that the spacing d_2 between the risers 40 and 42, as measured along the plane of the mating die faces, decreases as the jaws and dies of the tool close to that of d_3 as seen in FIG. 3. This also is an important feature of the invention. As the dies 28 and 30 are brought together, the wire 50 begins to acquire the S-shaped bend as illustrated in FIG. 3. The sharpness of the bends is enhanced by the fact that the spacing d_2 or d_3 between the risers 40 and 42 decreases as the bend is formed.

In this manner, the sharp terminating edges or intersections 56 and 58 (FIG. 2) between the outermost faces 32 and 36, respectively, of the dies with each of the risers 40 and 42, respectively, engage the wire and initiate the bends. These edges 56 and 58 then move inwardly so as to exaggerate or sharply define the precise 90° bends in the wire as seen in the drawing of FIG. 4. Without such inward movement of the edges 56 and 58, sharp, precise bends cannot be formed. As the dies finally close together in FIG. 4, the portions of the wire 50 extending from either end of the dies (or bends in the wire) are parallel. Within the dies are formed two relatively accurate 90° corners which complete the S-shaped bend desired for throttle wires, for example.

In FIG. 5 there is illustrated an alternative embodiment of this invention wherein only the dies 28 and 30 are shown with the remainder of the tool shown only in phantom. In this instance, the lower face 38 of the lower die 30 has formed in the outer portion thereof a groove or notch 54 to aid in maintaining or positioning the wire 50 between the dies. A similar notch 56 is formed in the innermost face 34 of the upper die 28. This tends to prevent the wire from slipping out from between the dies when in use although this has not been found to be any great problem. The use of the lock-type pliers permits the tool to be used on wires of varying thicknesses or diameters with greater facility. Typically the spacing d (FIG. 4) is maintained sufficiently great to accommodate reasonably large diameter wires, although if too large a spacing d is used on a small wire, the bends will not be 90°; but rather a greater angle. Various dies can be supplied which may be removably mounted in the jaws of a given tool to afford adapting a given tool to various wire sizes.

In the alternative embodiments of the invention, both of the acute angles α and β may be varied within the limits of 0 and 90°. Preferably, however, the angle α should fall

within the range of 60° to 85° and the angle β within the range of 60° to 80°. A preferred embodiment of the invention uses $\alpha=70^\circ$ and $\beta=75^\circ$.

There has thus been described a relatively simple tool that greatly enhances placing an S-bend in steel wire which tool finds great utility in many repair shop applications.

While the invention has been disclosed herein in connection with certain embodiments and certain structural details, it is clear that changes, modifications or equivalents can be used by those skilled in the art; accordingly, such changes within the principles of this invention are intended to be included within the scope of the claims below.

What is claimed is:

1. A wire bending tool comprising:

two pivoted die-carrying jaws having suitable operating handles connected thereto,

each of said jaws adapted to receive a wire therebetween and to move together along respective first and second opposing paths,

said jaws dies each having two die faces lying in substantially parallel planes and spaced apart from each other, the said two die faces in a given jaw defining a stepped portion, said stepped portions in said dies being in opposing relationship with each other, and the parallel planes of each of said die faces forming a positive acute angle β with the respective first and second paths.

2. A wire bending tool in accordance with claim 1 wherein each of said jaw stepped portions has a riser having a planar face of substantially equal height.

3. A wire bending tool in accordance with claim 2 wherein the said risers are spaced apart by at least the diameter of said wire when said jaws are closed.

4. A wire bending tool in accordance with claim 3 wherein the height of each of said risers exceeds said closed spacing of said risers, thereby to stretch that portion of said wire adjacent said risers axially during operation.

5. A wire bending tool in accordance with claim 2 wherein the angle α from the plane of each riser to either of the contiguous die faces is acute.

6. A wire bending tool in accordance with claim 5 wherein the angle β is approximately 75°.

7. A wire bending tool in accordance with claim 6 wherein the angle α is 85°.

8. A wire bending tool in accordance with claim 5 wherein said risers are spaced apart by at least the diameter of said wire when said jaws are closed.

9. A wire bending tool in accordance with claim 3 which also includes depressed portions in each of said die faces, each defining mating grooves, thereby to facilitate the positioning of said wire.

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