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Boyajian

[11] **3,716,879**

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[54] MANUALLY ACTUATABLE TOOL

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[52] **U.S. Cl.**.....**7/5.6,** 72/409, 7/14.1 R, 30/194

[51] **Int. Cl.**.....**B25f 1/04**

[58] **Field of Search**.....7/5.6, 4, 14.1 R, 5, 5.1, 5.3, 7/5.4, 5.5; 72/409; 30/194, 197, 226, 227, 238, 250, 252

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Assistant Examiner—Roscoe V. Parker, Jr.
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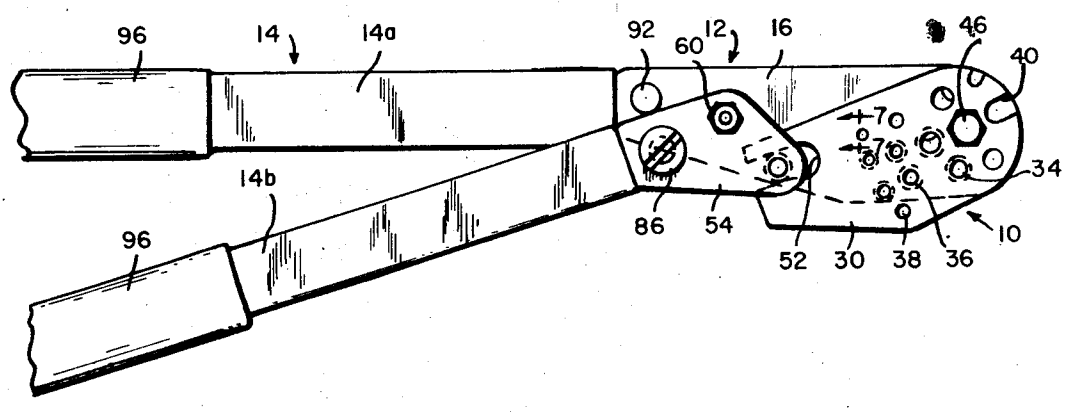
[57] **ABSTRACT**

A tool for cutting or bending wires, rods, bolts and the like embodying as components shearing instrumentalities and bending instrumentalities operable by a common pair of pivotally connected rigid handles.

10 Claims, 8 Drawing Figures



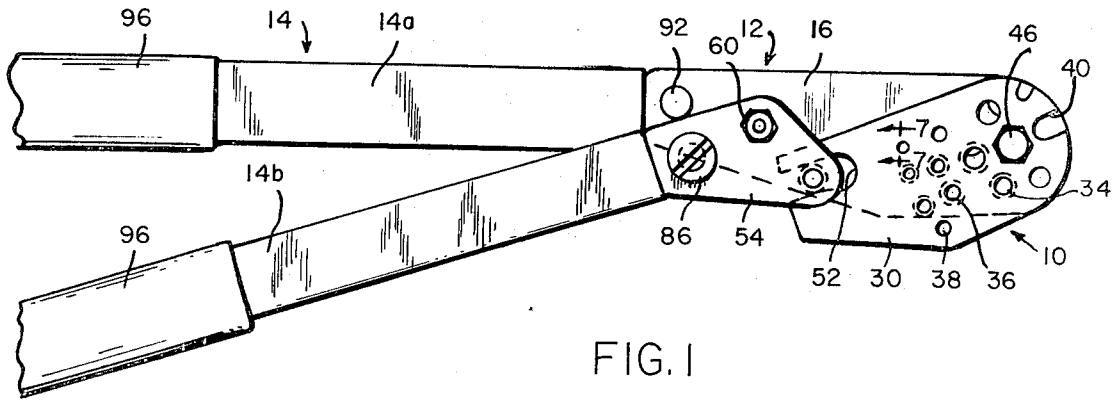


FIG. 1

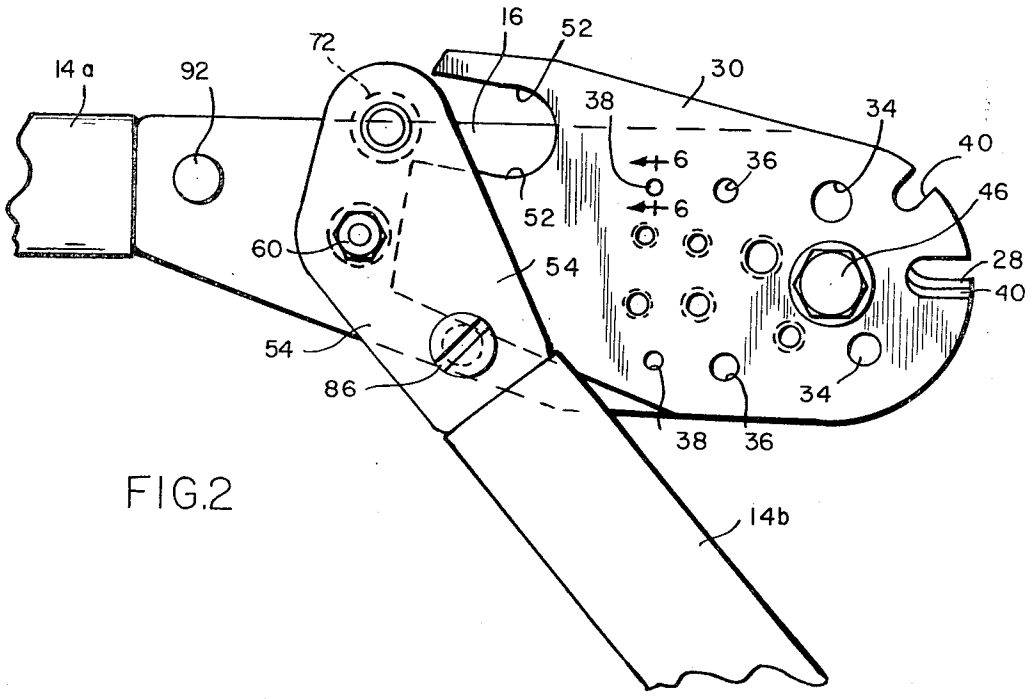


FIG. 2

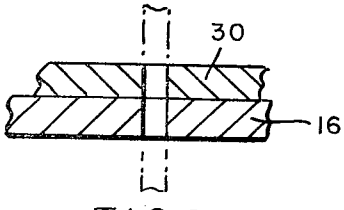


FIG. 6

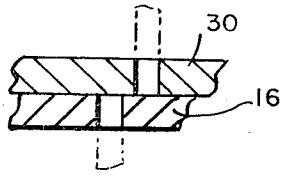


FIG. 7

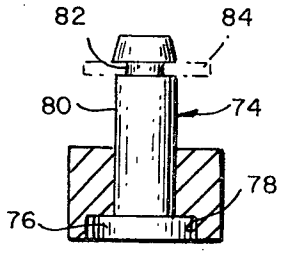


FIG. 8

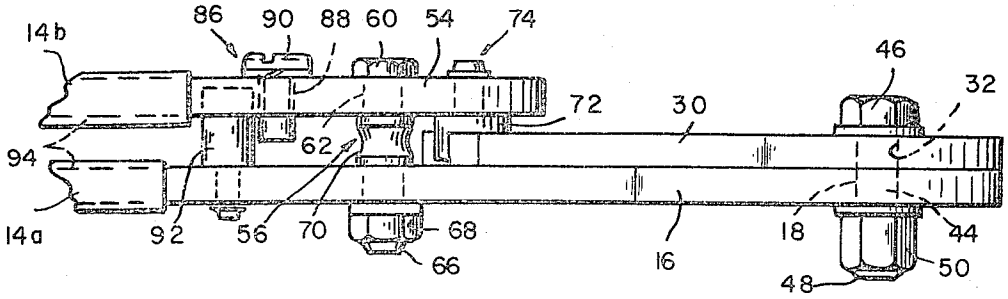


FIG.3

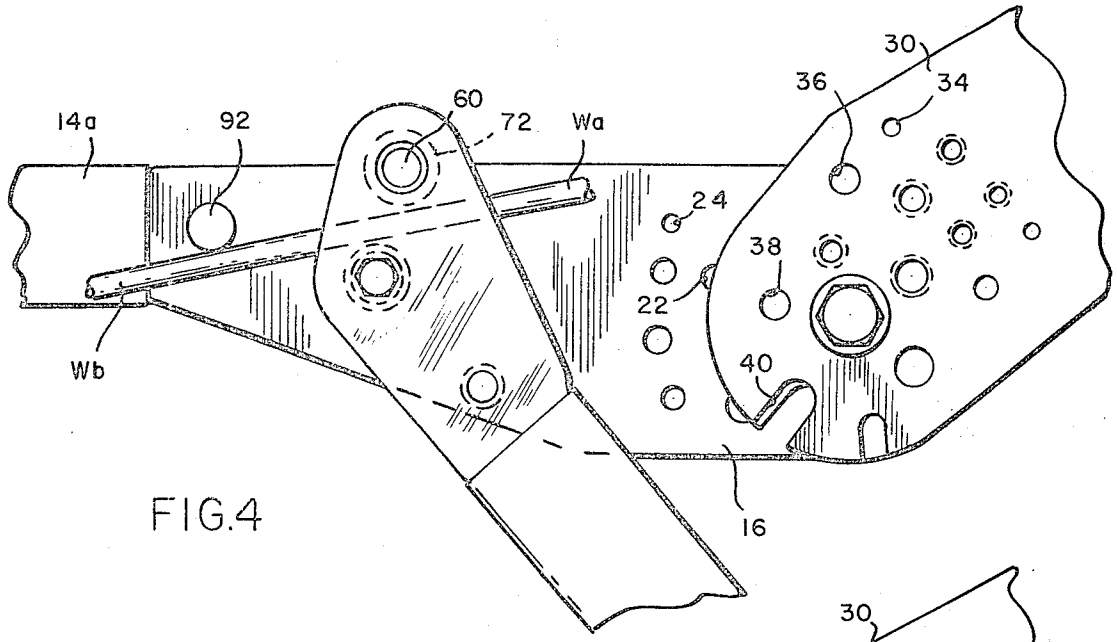


FIG.4

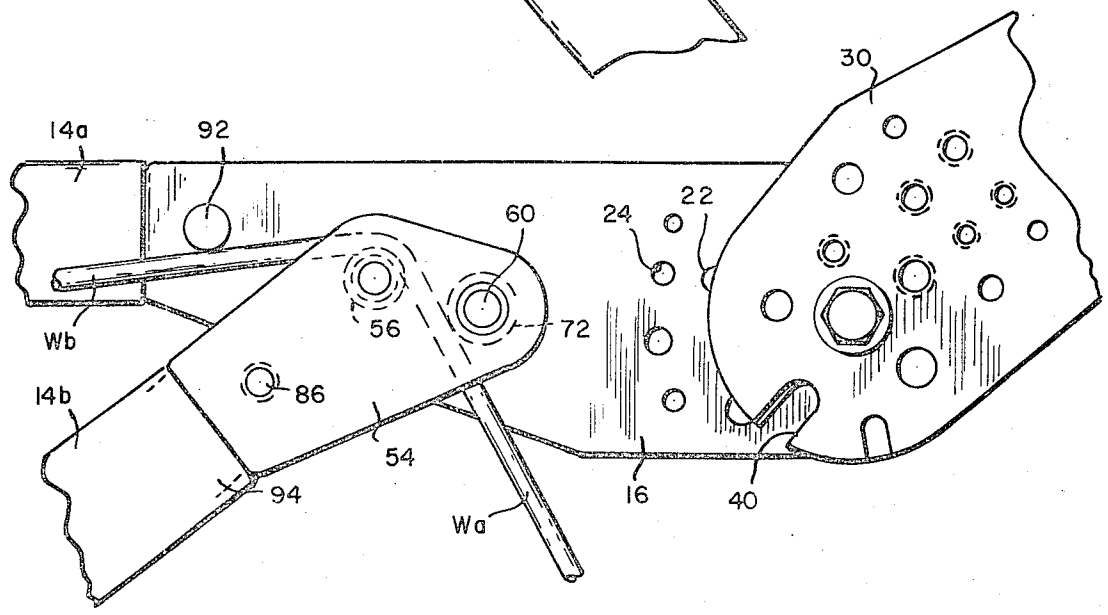


FIG.5

MANUALLY ACTUATABLE TOOL

BACKGROUND OF THE INVENTION

In my pending application Ser. No. 730,570, filed May 20, 1968 and now U.S. Pat. No. 3,585,662, there is shown a compound tool embodying shearing and bending instrumentalities wherein two rigid lever arms are pivotally connected at one end for angular movement relative to each other and a shear plate is pivotally supported at one end to one of the lever arms intermediate its ends. The overlying portions of one lever and the shear plate contain cutting edges and the other lever carries a force-applying member which is operable by swinging movement of the levers to effect shearing movement of the shear plate. The same force-applying member in conjunction with the pivot axis of the levers provides for applying a bending force to a wire or rod. The compound tool of this invention embodies the same instrumentalities and principle of operation as the aforesaid tool, redesigned to simplify construction for production purposes.

SUMMARY

As herein illustrated, the tool embodies in combination cutting instrumentalities and bending instrumentalities, the cutting instrumentalities comprising a first rigid shear plate containing at one end a plurality of cutting edges arranged in a predetermined pattern with respect to a common center, an elongate handle fixed to the other end, a second rigid shear plate containing at one end a corresponding number of cutting edges arranged in a corresponding predetermined relation with respect to a common center, said second shear plate containing at its opposite end a cam slot, a fastener pivotally connecting the two shear plates in face-to-face shearing relation to each other and a force-applying element for turning said second shear plate in shearing relation to the first shear plate comprising a lever pivotally mounted on the first shear plate adjacent the cam slot at said opposite end of said shear plate for rotation about an axis parallel to the axis of pivotal movement of the shear plates, a cam element fixed to the lever in radially spaced relation to said pivot axis thereof such as to occupy said cam slot in said second shear plate, and a handle fixed to the lever in radial relation to its pivot axis and in angularly spaced relation to said cam roller such that angular movement of the lever about its pivot by a force applied to said handle will swing the second shear plate relative to the first shear plate to displace all of the cutting edges of the two shear plates in shearing relation to each other and said bending instrumentalities comprising said cam element on said lever which comprises a force-applying means, said pivot which comprises a fulcrum, and a part fixed to the first plate such that in one position of the lever a straight line tangent to the part and to the cam element is spaced from the fulcrum a distance at least as great as the diameter of the largest wire to be bent so that an unbent wire may be inserted between the part and the cam element at one side and the fulcrum at the other, said part being operable to hold the wire while it is bent around the fulcrum.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

FIG. 1 is a plan view of the compound tool with the operating arms shown in the shearing position;

FIG. 2 is a fragmentary plan view showing the shearing instrumentalities in a position to receive a part to be cut;

FIG. 3 is an elevation of FIG. 2;

FIG. 4 is a fragmentary plan view showing the shearing instrumentalities disabled and the bending instrumentalities in a position to receive a part to be bent;

FIG. 5 is a fragmentary plan view showing the bending instrumentalities in a position following bending;

FIG. 6 is a section taken on the line 6—6 of FIG. 1 showing a pair of cutting edges in registering relation;

FIG. 7 is an elevation corresponding to FIG. 6 showing the same cutting edges offset; and

FIG. 8 is a fragmentary section taken on the line 8—8 of FIG. 3.

Referring now to the drawings, the compound tool comprises shearing instrumentalities **10** and bending instrumentalities **12** operable by handle members **14**. The shearing instrumentalities comprise a shearing plate **16** having at one end a pivot hole **18** about which there are arranged at different radial distances rows of holes of different diameter comprising holes **20** of a relatively large diameter close to the pivot hole, holes **22** of a smaller diameter radially further from the pivot hole and holes **24** of a still smaller diameter still further from the pivot hole. Some of these holes are of smooth bore and others are threaded. The end of the shear plate **16** is arcuate, having as its radius the pivot hole **18** and this arcuate portion contains one or more U-shaped notches **28**. The shear plate **16** has at its opposite ends one of the two rigid handles **14***a*.

The shearing instrumentalities comprise a second shear plate **30** which also contains at one end a pivot hole **32** around which there are disposed in concentric relation holes **34**, **36** and **38** corresponding in spacing from each other and in radial distance from the pivot hole to the spacing of the holes in the first shear plate and the radial distances of the holes in the first shear plate from the pivot hole. The shear plate **30** like the shear plate **16** has also an arcuate edge, the radius of which is at the center of the pivot hole, corresponds to the radius of the arcuate edge of the shear plate **16** and contains U-shaped notches **40** corresponding to those in the shear plate **16**.

The two shear plates are mounted face-to-face and pivotally connected to each other by a pivot pin **42** comprising a bolt **44** having a head **46** on one end and at its other end a threaded portion **48** on which is threaded a nut **50** together with a locking element to prevent the nut from working free by manipulation of the tool.

At the distal end of the shear plate **30** there is a cam slot **52** by means of which the shear plate **30** is adapted to be oscillated relative to the shear plate **16**. Oscillation is effected by a lever **54** pivotally mounted on the shear plate **16** in spaced parallel relation thereto so as to overlie the distal end of the shear plate **16** by means of a pivot pin **56** comprising a bolt **58** having a head **60** thereon which is inserted through a hole **62** in the lever, through a spacer element **64** situated between the lever and the shear plate **16** and through the shear plate **16** and has on its projecting end a threaded portion **66** on which there is threaded a nut **68**. The spacer element **64** contains a peripheral groove **70**. The axis of the pivot pin **56** for the lever is spaced from the axis of the pivot pin **42** for the shear plates a distance which is

slightly greater than the radial length of the shear plate **30** from the axis of its pivot pin to its distal end so that the shear plate **30** can be swung laterally from side-to-side with respect to the pivot pin **56**.

The lever **54** has secured to one end the other handle **14*b*** of the pair of handles by means of which the tool is operated, the handle **14*b*** being situated radially with respect to the pivot pin **56** and at its other end a cam element **72** of a diameter such as to fit within the cam slot **52** in the shear plate **30**. The cam element **72** is rotatably supported on the lever **54** by a pin **74** having a head **76** thereon which sets into a recess **78** in the cam element **72** and a shank **80** which extends through the cam element and through the lever **54** which contains a circular groove **82** adapted to receive a spring lock washer **84**. The supporting pin **74** for the cam element **72** is located at a radial distance from the axis of the pin **56** and at an angular distance from the handle **14*b*** such as to provide for a high mechanical advantage when the handle is turned about the axis of the pivot pin **56** to apply a very high shear force to the shear plate **30**.

Movement of the handles **14*a***, **14*b*** toward and from each other will by means of the aforesaid lever **54**, cam element **72** and slot **52** provide for oscillation of the shear plate **30** relative to the shear plate **16**. When the handles are disposed at their furthest angular position from each other, as shown in FIG. **1**, the two plates are so positioned that the cutting edges in the respective plates are in alignment and it is possible when they are in this position to insert a rod, wire or bolt through the aligned holes or notches for shearing. The larger holes are arranged closest to the axis of rotation of the shear plates where the greatest mechanical advantage is realized and the smaller holes at the greater distances so that about the same effort is required to effect shearing of all wire diameters. Movement of the handles from the position shown in FIG. **2** to the position shown in FIG. **1** effect angular movement of the shear plates and hence shearing action. A stop screw **86** is mounted on the lever **54** to determine the position of the shear plates at their position of registration. The stop screw **86** is threaded into a threaded hole **88** in the lever at a radial distance form the axis of the pin **56** which is slightly greater than the radial distance of the pin **74** which supports the cam element and comprises a screw bolt **89** having a head **90** thereon screwed into the threaded hole **88** in the lever so that its inner end extends through the lever into a position such as to engage an edge of the shear plate **30** when the handles of the tool are swung to their wide open position. The stop screw **86** by engagement with the edge of the shear plate **30** limits the movement of the shear plate **30** to a position of registration of the shearing edges therein with the shearing edges in the shear plate **16**, and at the same time prevents disengagement of the cam element from the cam slot. A stop post **92** fixed to the shear plate **16** rearwardly of the pivot pin **56** with respect to the shear plate **30** and projecting upwardly therefrom into the plane of the lever provides for limiting the proximity of the handles relative to each other in their shearing position thus preventing bringing the handles so close together as to pinch or crush the operator's fingers.

The component parts of the tool so far related in describing the shearing action comprise also the components of the bending instrumentality and these parts are the pin **56** for the lever **54** which comprises a fulcrum, the cam element **72** which operates as a force-applying member for effecting bending and the stop post **92** which operates as a support for the part which is to be bent. The use of the tool for bending is provided for by moving the shear plate **30** to an out of the way position (FIG. **4**) and this is achieved by backing off the stop screw **86** so as to remove the inwardly projecting end thereof from engagement with the shear plate **30**, swinging the lever **54** in a counterclockwise direction about its pivot pin so as to disengage the cam element **72** from the cam slot **52** and then turning the shear plate **30** about its pivot pin **42** to a position such as shown in FIG. **4**. The tool may now be used for bending of a wire by inserting the wire W between the cam element **72** and the pivot pin **56** for the lever from the side of the stop post **92** so that the position W*a* to be bent extends beyond the pivot pin **56** toward the distal end of the tool and so that the portion W*b* to remain unbent extends rearwardly from the pivot pin along the near side of the stop post. Rotation of the lever **54** with the wire in this position will bring the cam element **72** into engagement with the portion W*a* of the wire which is to be bent and bend it around the pivot pin **56** which comprises the bending fulcrum. If the length of the wire to be bent is greater than the distance between the pivot pin **56** and the shear plate **30** the latter may be entirely removed. It is to be noted that the distance between the pivot pin **56** and the lever and the cam element must be at least as great as the largest diameter of wire which is to be bent.

For the purposes of the invention the tool may be made in different sizes with different leverages to enable cutting and bending parts of different kind and different size, — the shear plates being comprised of rigid plate stock of soft steel. The shear plate **16** and the lever **54** at the ends to which the handles **14*a***, **14*b*** are attached are reduced to provide tenons **40** of substantially rectangular cross-section for receiving the handles which are comprised of bars of tubular stock of rectangular configuration forced onto the tenons **94** and spot welded thereto. The distal ends of the handles are provided with non-metallic handle grips **96** to protect the hands of the operator from injury.

The tool, as thus constructed, is extremely easy to operate both for the purposes of shearing and for bending, can be easily converted from one use to the other and vice versa without disassembling any of the parts and hence without loss of the parts when changing from one operation to the other, is attractive in appearance and is adapted to simple manufacturing operations.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents falling within the scope of the appended claims.

I claim:

1. A tool for cutting or bending stiff wires, bolts, rods and the like, said tool embodying, in combination, cutting means and bending means, said cutting means comprising a first rigid shear plate containing at one end a plurality of cutting edges arranged in a predetermined pattern with respect to a common center, an elongate handle fixed to the other end, a second rigid shear plate containing at one end a corresponding

number of cutting edges arranged in a corresponding predetermined relation with respect to a common center, said second shear plate containing at its opposite end a cam slot, a pin pivotally connecting the two shear plates in face-to-face shearing relation to each other and a force-applying element for turning said second shear plate in shearing relation to said first shear plate comprising a lever, a pin pivotally mounting the lever on the first shear plate adjacent the cam slot at said opposite end of said second shear plate for rotation about an axis parallel to the axis of pivotal movement of the shear plates, a cam element mounted on the lever in radially spaced relation to said pivot pin of the lever such as to occupy said cam slot in said second shear plate, and a handle fixed to the lever in radial relation to the pivot pin of the lever and in angularly spaced relation to said cam element such that angular movement of the lever about its pivot pin by a force applied to said handle will swing the second shear plate relative to the first shear plate to displace all of the cutting edges of the two shear plates in shearing relation to each other, and said bending means comprising; said cam element which defines a force-applying means, fixed to said lever extending toward said first shean plate said pivot pin of the lever which defined a fulcrum extending between said lever and said first shear plate and a part fixed to the first shear plate extending toward said second shear plate; said force-applying means, said fulcrum, and said part being arranged such that in one position of the lever a straight line tangent to the part and to the force-applying means is spaced from the fulcrum a distance at least as great as the diameter of the largest wire proposed to be bent so that an unbent wire may be inserted between the part and the force-applying means at one side and the fulcrum at the other side, said part being adapted to hold the wire at one side of the fulcrum while the force-applying means travels around the fulcrum from the one side to the other to effect bending.

2. A tool according to claim 1, wherein certain of the cutting edges are constituted by holes perpendicular to the shear plates which in one position of the plates are aligned so that a part to be cut may be inserted through said holes and which in another position are displaced relative to each other such as to have cut through the part.

3. A tool according to claim 1, wherein certain of the cutting edges are constituted by holes arranged in concentric rows with respect to the pivot pin connecting the shear plates with the holes in the several rows decreasing in size from the row closest to said pivot pin to those in the row furthest from the pivot pin.

4. A tool according to claim 1, wherein said shear plates have arcuate portions of corresponding radius rotatable about the axis of the pivot pin pivotally connecting the shear plates, said arcuate portions containing notches which in one position of the lever are in alignment and in another position displaced with respect to each other, said notches when in alignment being adapted to receive a part for an application of a shearing force thereto.

5. A tool according to claim 2, wherein the holes in said first shear plate are smooth.

6. A tool according to claim 2, wherein certain of the holes in said second shear plate are threaded and others are smooth.

7. A tool according to claim 1, wherein said lever is rotated by movement of the handles toward each other to effect shearing, and said part on the first shear plate projects therefrom into the plane of the lever and constitutes a stop post limiting movement of the handles toward each other to a predetermined angle of separation at said shearing position.

8. a tool according to claim 1, comprising a part movable with the lever as the handles are moved apart to bring the shear plates into a position of alignment of the cutting edges therein to limit movement of the lever beyond said position.

9. A tool according to claim 1, wherein the pivot pin for the lever and constituting the fulcrum has a peripheral groove of substantially half-circular cross-section.

10. A tool according to claim 1, wherein the length of the second shear plate from its pivot pin to its distal end is less than the distance between its pivot pin and the pivot pin of the lever so that the second shear plate is free to oscillate relative to the pivot pin of the lever, and said cam is at a radial distance from the pivot pin of said lever such as to be movable by rotation of the lever along the cam slot to effect oscillation of the second shear plate and to be disengaged from the cam slot by rotation of the lever beyond a predetermined position, and a limit pin carried by the lever operable by engagement with the second shear plate to limit rotation of the lever beyond said predetermined position.

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