MANUALLY ACTUATABLE TOOL
Alfred Z. Boyajian, P.O. Box 811,
Manhattan Beach, Calif. 90266
Filed May 20, 1968, Ser. No. 730,570
Int. Cl. B25F 1/04
U.S. Cl. 7—14.1 7 Claims
ABSTRACT OF THE DISCLOSURE
An implement, by means of which stiff rod or wire, for example, of metal, including hard steel as well as other materials, and also including smooth rods or wires which have been screw-threaded, may be severed cleanly, leaving but little burr, or in accordance with another embodiment, may not only be cut but, if desired, bent through an angle of 180° or more and to a radius as small as 1/2 the diameter of the rod, and wherein such cutting and/or bending are accomplished by the application of manual force within the range of that which may be exerted by an ordinary workman. The implement includes an elongated base member and an elongated handle member pivotally secured to one another by a post adjacent to but spaced from the corresponding ends of the members. The base member pivotally mounts a rigid cutter having a non-cutting edge and a cutting edge and a pivotal axis parallel to that about which the handle swings. The handle member carries a force applying element for alternatively applying force to (1) the non-cutting edge of the cutter to cause the cutting edge of the cutter to cooperate with a cutting edge on the base member to sever a rod or (2) a rod for bending the same about the post.

BACKGROUND OF THE INVENTION
Unless one has machine tools available, the bending of stiff metal rod or wire to a predetermined angle, particularly to a bend of small radius, is difficult, usually involving the setting of pins in predetermined holes in a metal block or the like, and the application of force by means of pliers or the use of a length of stiff tubing or the like as a handle to provide the desired leverage. When the cutting of such stiff rod or wire is to be done, especially when the diameter of the rod or wire is as much as 1/4 inch or greater, particularly if it be screw-threaded, the operation usually requires the use of a hack saw; cold chisel, or the like, and, at best, tends to leave a burr end which is especially undesirable if the rod is to be threaded into a nut. In accordance with the present invention there is provided a manually actuable implement or tool whereby stiff rod or wire, up to 1/4 inch in diameter, is cut to desired length, leaving but little burr, or, in accordance with one embodiment of the invention, may also be bent through an angle of 180° more or less, and to a radius as small as one-half its diameter.

SUMMARY
Objects of the invention are to provide an implement or tool having the above capabilities but which is simple, inexpensive to manufacture; which is rugged and durable; and capable of treating material, such as hard steel, alternatively, by bending or cutting, rods of a diameter of at least 1/8 of an inch, and by means of which even hard steel rod of the last-named diameter may be bent or cut by the application of mechanical force well within the capacity of the ordinary artisan.

In the drawings,

FIG. 1 is a fragmentary plan view of the tool as it appears when not in use;

FIG. 2 is a fragmentary front elevation showing a rod positioned on the base member in readiness for bending;

FIG. 3 is a fragmentary front elevation, to smaller scale, illustrating the commencement of the bending operation, the cutter being idly disposed;

FIG. 4 is a fragmentary view showing the rod as having been bent through an arc of 180°;

FIG. 5 is a fragmentary front elevation showing the cutter positioned in readiness to receive a rod to be severed (no rod being shown), the rod-receiving holes in the cutter now registering with corresponding holes in the base member;

FIG. 6 is a view similar to FIG. 5 (no rod being shown), but showing the cutter as having been swung part way through its operating stroke so that the rod-receiving holes in the cutter are partially occluded by the base member;

FIG. 7 is a fragmentary transverse section on the line 7—7 of FIG. 6, showing that end of the cutter which is designed for severing machine screws or other threaded rods;

FIG. 8 is a front elevation of the base member, omitting other parts;

FIG. 9 is a fragmentary front view of the pivot end of the handle member;

FIG. 10 is a fragmentary section on the line 10—10 of FIG. 3;

FIG. 11 is a section on the line 11—11 of FIG. 6;

FIG. 12 is a smaller scale diagrammatic drawing showing the appearance of the device as it might be designed for the market;

FIG. 13 is a view similar to FIG. 1, but illustrating a somewhat simpler embodiment of the inventive idea, differing in particular from the arrangement of FIG. 1 in that it omits any special provision for bending rod or wire, being designed primarily for severing such material;

FIG. 14 is a plan view of the device shown in FIG. 1;

FIG. 15 is a fragmentary bottom plan view showing the pivoted end of the handle member;

FIGS. 16, 17 and 18 are plan views, respectively, of cutters which may be used in substitution for the cutter shown in FIGS. 13 to 15; and

FIG. 19 is a diagram illustrative of the force-multiplying leverage which makes the implement effective.

Referring to the drawings, the numeral 10 (FIGS. 1, 2, 3 and 4) designates one of two elongate rigid members which, as here illustrated, are as they would appear if made from flat steel plate, for example, 1/16 of an inch in thickness, the member 10, as here shown, and which, for convenience, is referred to as the “base member” being, for example 1/2 inches in width and approximately 12 inches in length. The member 11, here called the “handle member,” which is of material of the same thickness as the member 10, may, for example, be 1/4 inches in width and 12 inches in length, it being understood that these dimensions are given for illustration and without limitation, but merely as indicative of those of a tool capable of effective use, for example, for bending stiff steel rod or wire 1/4 inch in diameter, more or less, or for severing rod or wire of similar diameter with a clean cut, whether the rod or wire be smooth or screw-threaded.

As more clearly shown in FIG. 8, the base member 10 is provided near each of its opposite ends with a hole H, H1, respectively, these holes being 1/8 inch in diameter, the center of the hole H being spaced 1/4 of an inch from the longitudinal edge E and 3/8 of an inch from the end edge D, while the hole H1 is similarly located with reference to the edges D1 and D2 respectively. The handle member 11 is provided with a hole H2 (FIG. 9) whose center is spaced from the longitudinal edge E a distance of approximately 3/8 of an inch and from the end edge D2 a distance of approximately 3/8 of an inch, while a
hole H has its center approximately ¾ of an inch from the longitudinal end E and approximately ½ inch from the end edge D. Again it will be understood that these dimensions are merely illustrative of proportions which provide for effective operation and may be varied, but generally in corresponding proportions, in making a tool for working rod of substantially different dimensions from those above suggested.

The hole H in the base member 10 (FIG. 8) is preferably screw-threaded and receives a shoulder bolt 12 (FIG. 14) that passes through both ends of the perforation slot 13. The central portion 13 of larger diameter which, as shown in FIG. 1, spaces the handle member 11 from the base member 10, the bolt 12 extending beyond the handle member 11 and being provided with a nut 14 at its upper end. The central part 13 of this bolt 12 constitutes a stationary post and defines a fulcrum axis about which the handle may swing, the bolt passing through the hole H (FIG. 9) in the handle member.

The hole H in the handle member is desirably screw-threaded and receives a pin or stud 16 (FIGS. 1 and 10) having a locking nut 17 at the forward side of the handle member. FIG. 10 also shows the perforation slot 18 and contact member 19 which may be arranged to turn on the exposed rear portion of the pin 16, constituting the rod-contacting element of the bending member, thus subjected to the pin and stud. If desired, the slot 18 may be omitted. The axes of the parts 12 and 16 are approximately ¾ of an inch apart.

The base member 10 is provided with one or more screw-threaded holes 19 and 20, respectively (FIG. 6), for the reception of a work-positioning post or stud 21 (FIG. 1). A work-clamping member 22 (FIG. 1) is mounted on the base as shown diagrammatically in FIGS. 1 and 2, this clamping member being provided with a channel through which the rod R, which is to be bent, may be passed, while a bolt 23 is loosened, but is firmly clamped in place by tightening the bolt. As shown in FIG. 2 a piece R of rod has been placed upon the base 10 (after the handle 11 has been swung in a counter-clockwise direction) so that the bending element 16, as shown in FIG. 2, is spaced above the post 12, while the main part of the rod engages the stud 21.

If now, with the parts thus positioned, the handle 11 is swung in a clockwise direction, the bending member 16 will travel in a circular arc about the center of the post 12, the free end portion of the rod with it and thus bending the rod about the post 12, the extent of bend depending upon the arc through which the handle 11 is swung. As shown in FIG. 4 the handle has been swung through an arc of 180° thus forming a U-shaped bend in the rod R. Obviously by swinging the handle through a lesser arc a bend of a different arcuate extent may be formed, for example, a right-angle bend. After forming a single bend the wire may be removed and replaced, and another bend formed (in the same wire, if desired) which may be of a different arcuate extent, if desired, from the first, or a bend made in the opposite direction, or disposed in a different plane.

By removing the bolt 12 and replacing it by one of a different diameter the radius of the bend made in the rod may be varied.

In order that the implement may be employed for cutting rod or wire as well as for bending it, there is provided, at its end, the cutters 4, 5, and 6. These cutters are provided with a backed plate such as that used for the base and handle, although preferably it may be made of a harder material or heat-treated to withstand the cutting stress. This cutter may, for example, be ¾ of an inch in thickness, approximately 4½ inches long and approximately 1½ inches wide. In order that the effective force on the cutting tool wire and also for severing screw-threaded rods such as machine screws, the opposite ends of this cutter are differently designed for alternative use, each of the opposite ends having a hole such as the hole 26 of FIG. 6, designed to receive a bolt 27 (FIG. 7) which passes through a hole 28 (FIG. 8) in the base member 10 and which provides a pivotal axis about which the cutter 25 may swing. The base member 10 is provided with a circular row of holes a, b, c, etc., progressing in diameter from the smallest hole a' (FIG. 8) which may, for example, be ¾ inch in diameter up to the largest hole j' which will be of the diameter of the largest rod or wire, for example, ½ inch, which is to be severed. The axes of these holes are equally spaced from the axis of the hole H.

Each end of the cutter 24 is provided with a like circular row of holes concentric with the axis of the cutter pivoting bolt 27 when the parts are assembled, so that when the cutter 24 is placed in the position shown in FIG. 5 each hole a, b, c, etc., of the row at the pivot end of the cutter will accurately register with one of the holes a', b', c', etc., in the base member. The holes at one end of the cutter are simple circular bores but those at the other end of the cutter are screw-threaded (FIG. 7) according to standard gauge.

In order that the cutter may be placed in the position shown in FIG. 5 a hole or not one end or the other is to be used), the cutter has arcuate slots 30 and 31 in its opposite longitudinal edges to provide clearance for the post 12 so that the cutter may be positioned as shown in FIG. 5. In this position the bending member 16 contacts the upper edge E10 of the cutter at a substantial distance along a radius connecting the axis of the bolt 27 with the axis of the bending member 16 and the holes a, b, c, etc., of the cutter register with like holes in the base member.

If, for example, a length of rod is inserted through the largest hole f of the cutter (FIG. 5) which is now registered with the largest hole f' (FIG. 6) of the base, and the handle 11 is swung in a clockwise direction, the bending member 16, which is in contact with the edge E10 of the cutter, will swing the cutter about the axis of the bolt 27 and thus move the hole f in the cutter out of registry with the hole f' of the base, and continued movement of the handle in the same direction will eventually move the cutter so that the material of the base will completely cut out the hole f in the cutter thus severing the rod.

Noting that the effective lever arm between the axis of the post 12 and the bending member 16 is short, as compared with the lever arm represented by the distance between the center of the bolt 27 and the bending member 16, and that the lever arm constituted by the length of the handle, measured from the center of the post 12 to the part of the handle gripped by the user's hand is very long as compared with the length of the arm between the post 12 and the bending member 16, it is evident that a relatively small force is all that is necessary to be applied to the handle to cause the cutter to sever a rod by movement of the cutter, in swinging about the center of the bolt 27. In order that the device may be used for cutting an element which cannot be passed through one of the holes a, b, c, etc., in the cutter as, for example, the link of a chain, the base 10 is provided with a notch 40 (FIG. 8), in its edge and the cutter with a similar notch 41 (FIG. 6), the notches 40 and 41 being placed in registry as shown in FIG. 5 preparatory to cutting a link. The link is pushed into the notches and the handle swung to move the cutter out of registry with the base thereby severing the chain link.

Preparatory to cutting a threaded member such as a machine screw, the bolt 27 is removed and the cutter is shifted end-for-end so as to bring its threaded holes in register with respect to the holes a, b, c, etc., in the base so that the effective force is applied uniformly to be inserted into the selected one of the threaded holes in the cutter while said hole is registered with one in the base and then, by manipulation of the handle, as above described, the cutter is swung so as to sever the screw. With this
arrangement a machine screw may be severed so as to leave substantially no burr such as would require removal before the screw may be used.

The cutter device is desirably of heat-treated hardened steel and desirably that portion of the base member which has the series of holes of different diameters for use in cutting should be hardened in order to insure a sharp cut. It is also contemplated that these holes, employed in cutting, may be tapering to a slight extent to provide a cutting edge somewhat less than a right angle, although such a tool would probably require renewal of the cutter at frequent intervals.

The tool as illustrated in FIGS. 1 to 6, for example, is shown in its simplest form but it will be understood that it is subject to design changes, to make it more attractive for commercial production, by making the members 10 and 11, for example, of a different stock material or specially shaped and finished as, for example, suggested in FIG. 12 where the parts 10 and 11 are shown as shaped to provide convenient hand grips. It will also be understood that the part herein referred to as a "base member" will ordinarily be held in one hand while the part 11 is held in the other hand, but if desired the part 10 may be fixed in position (when the device is to be used), for example, by gripping it between the jaws of a bench vise or the like, or that part 10 may be provided with holes for the reception of bolts whereby it may be permanently secured to a suitable post or other support, thus making it easier for the user to perform the bending or cutting operation since he would then use both hands to actuate the handle if desired.

However, the implement as herein specifically disclosed comprises both bending and cutting means but it is obvious that the cutter may be omitted, if desired, or, alternatively, the cutter may be shown removed for cutting by means other than that here specifically described.

Referring to FIGS. 13 to 19, and in particular FIGS. 13 to 15, the numeral 10a designates a base member which may be identical with the base member 10 above described, while the character 11a designates a handle member generally similar to the handle member 11 previously described, but differing slightly from the latter in that, adjacent to its pivoted end, where it is provided with a hole 11a for the reception of the pivot bolt 12a, it has an integral thicker portion or pad 16a shaped as a cam to constitute a force-applying element (functionally the equivalent of 16 of the pivot embodiment) in the performance of the cutting operation.

The cutter 24a illustrated in FIGS. 13 and 14 is generally like the cutter 24 of the previous embodiment, being a plate-like elongate rigid member which has holes at its opposite ends for the selective reception of a pivot bolt 27a by means of which it is pivotally connected to the base member 10a. This bolt 27a is removable so that the cutter may be reversed end-for-end as respects that end which is at the pivot point. Associated with each of said bolt-receiving holes is a group of holes of progressively varying diameter like the holes a, b, c, etc., of the arrangement shown in FIG. 6. The cutter 24a may be provided with a notch 13a in one of its longitudinal edges which cooperates with a similar notch (not shown) in the edge of the base member, like the notch 40 shown in FIG. 6, these notches functioning when it is desired to cut material which cannot be passed through one of the holes a, b, c, etc.

The operation of the device shown in FIGS. 13 to 15 in so far as the cutting operation is concerned is the same as that of the embodiment shown in FIGS. 1 to 12 except in that the edge of cam 16a functions like stud 16 of FIG. 6.

In FIGS. 16, 17 and 18 cutters of slightly different type are suggested, any one of which may be selected and substituted for the cutter 24a shown in FIGS. 13 to 15. Thus the cutter K1 (FIG. 16) is generally triangular in contour, having holes 26a, 26b and 26c adjacent to its several corners for the reception of a removable bolt such as 27a for pivoting it to the base. Associated with each of the holes 26a, 27a and 26c there is a group G of holes corresponding to the holes a, b, c of FIG. 6. The holes of all these of these groups may be all oxidized or in the form of a thread, or those of one group may be of one sort and those of another group of a different sort. As shown in FIG. 16 one edge of the cutter K1 is provided with a notch 40w for cooperation with a notch in the edge of the base member as above described.

In FIG. 17 the cutter K2 is approximately square having pivot-receiving holes 26d, 26e, 26f and 26g at its four corners, respectively, each of said holes having associated therewith a group G of holes of progressively varying diameter such as the holes a, b and c of FIG. 6.

FIG. 18 shows a cutter of circular form having holes 26m, 26n, 26o and 26p for the reception of the pivot bolt for connecting it to the base and with each of these holes 26m, etc., there is a group G of holes of progressively varying diameter like the holes a, b and c of FIG. 6. It is obvious that cutters of other shapes may be provided, if desired.

In FIG. 19 the multiplying leverage employed in accordance with the present invention is diagrammatically indicated against a background (broken lines) of the base member, cutter and handle member, as shown in FIG. 6. In FIG. 19 the location of one of the effective edges of the cutter is indicated at £m. A line b1 extending from this point E to the axis of the cutter pivot 27 represents the short arm of a bell-crank lever whose longer arm B extends to the point Er where the force-applying element 16 of the handle 11 member touches the edge of the cutter 24.

A line Z1 extending from the point Er to the pivot axis 12 about which the handle member swings, designates the short arm of a second bell-crank lever whose longer arm Z2 extends from the pivot axis 12 to the free end of the handle member 11.

Consideration of this diagram will indicate that a force applied to the free end portion of the handle member, tending to move the arm Z2 in the direction of the arrow A1, will press the force-applying element 16 against the long arm B of the cutter rocking lever in the direction of arrow X1, thus moving the short arm b of the cutter lever through an arc which is very short compared with that of the free end portion of the handle member, thus multiplying the applied force in inverse ratio to the amount of movement of the end of the bar Z2 and the free end of the short arm b of the cutter actuating lever.

It may further be observed that the slot 30 (FIG. 5) formed in the edge of the cutter 24 provides freedom for movement of the cutter through a long arc such that the end of the handle member may be moved a substantial distance, resulting in a force at the cutting edge capable of cutting hard steel wire of substantial diameter.

While certain specific embodiments of the invention have herein been disclosed by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the scope of the appended claims.

1. A manually actutable tool operative alternatively to bend or to sever a stiff rod or wire, said tool comprising, in combination, two rigid, elongate members, which, for convenience but without limitation, are identified as a "base member" and a "handle member" respectively, means for pivotally connecting one end of each handle member to the base member and for spacing the handle and base member apart longitudinally of the pivot axis a distance at least as great as the diameter of the largest rod to be treated, a rigid cutter of hard steel; pivot means connecting the cutter to the base member to swing the cutter about an axis parallel to the axis of said pivot means; and for applying bending force there is a cylindrical part fixed to the handle member with its axis parallel to that of the pivot which unites the handle and base mem-
bar and spaced from the latter axis a distance at least as great as the diameter of the largest rod to be treated, said rigid cylindrical part being actuable, by the swinging of the handle relatively to the base member, alternatively to bend a rod extending longitudinally of the base member, or to actuate the cutter thereby to sever a length of rod arranged parallel to the axis of the pivot which unites the handle and base member.

2. A manually-actuable tool operative to bend or sever a hard, stiff rod or wire, said tool embodying, in combination, wire severing means and wire bending means, said wire severing means comprising an elongate rigid base member, a post fixed to the base member, an elongate rigid handle member, the post defining a pivotal axis about which the handle may swing relative to the base member, said pivotal axis being adjacent to but spaced from one end of the handle member, a rigid cutter having a non-cutting edge and a cutting edge, the latter edge cooperating with an edge of the base member to make a shear cut, and a pivot element whose axis is parallel to that about which the handle swings and which connects the cutter to the base member, a force-applying element projecting from the handle member adjacent to but spaced from the pivotal axis about which the latter swings, and which, by engagement with a non-cutting edge of the cutter, at a substantial distance from the pivotal axis of the cutter, causes the latter to rock relatively to the base member in response to the swinging of the handle member about its pivot, the cutting edge of the cutter being spaced from the axis about which the cutter swings a distance substantially less than the distance between the axis, about which the cutter swings, and the point at which the force-applying element of the handle member contacts the non-cutting edge of the cutter whereby force is applied to the free end portion of the handle member, for swinging the latter, is effectively multiplied for moving the cutting edge of the cutter relatively to the cooperating edge of the base member, and said bending means comprising said post about which the handle member is adapted to swing and said force-applying element projecting from the handle member operable by rotation of the force-applying element about the axis of the post to effect bending of the wire about the post, and said handle is operating alternatively to actuate the severing means or the bending means.

3. A tool according to claim 2, further characterized in that the force-applying element comprises a cylindrical stud having its axis parallel to but spaced from that of the post and which is fixed to the handle member adjacent to that end of the handle member which is pivotally connected to the post.

4. Apparatus according to claim 2, characterized in that the force-applying element comprises a stud fixed to the actuating handle member and a sleeve rotatably mounted on the stud and providing an anti-friction element for contact with the rod which is being bent thereby to assist in maintaining the rod in proper position while undergoing the bending operation, and so tending to minimize deformation of the rod where it is engaged by the sleeve, said sleeve having means whereby it is self-adjusting axially, along the stud, to register with any diameter of the rod.

5. A tool according to claim 2, wherein the post which pivotally connects the handle member to the base member comprises a rigid shoulder bolt, screw-threaded at opposite ends and whose opposite end portions pass through holes in the base member and the handle member, respectively, one of said threaded ends engaging a screw-threaded hole in the base member, and nuts engaging the threads at both ends, respectively, of said bolt, the central portion of the bolt being of larger diameter than its end and providing a pivot for the handle member.

6. A tool according to claim 2, further characterized in that the post is fixed to the base member and in that the cutter is pivotally connected to the base member to swing about an axis parallel to that of the post; the actuating handle is a rigid, elongate member pivotally arranged to swing about the axis of the post, and the element for applying force to the rod for bending the latter or for actuating the cutter is fixedly secured to the actuating handle at a distance from the post at least as great as the diameter of the largest rod to be treated.

7. Apparatus according to claim 4, characterized in that the sleeve has a peripheral groove for engagement with the peripheral surface of the rod to be bent thereby to assist in maintaining the rod in proper position while undergoing the bending operation, and so tending to minimize deformation of the rod where it is engaged by the sleeve, said sleeve having means whereby it is self-adjusting axially, along the stud, to register with any diameter of the rod.

References Cited

UNITED STATES PATENTS

54,520 5/1866 Flum 30—227X
1,831,447 11/1931 Heinrich.

FOREIGN PATENTS

17,406 8/1904 Austria.

ROBERT C. RIORDON, Primary Examiner
R. V. PARKER, Jr., Assistant Examiner

U.S. Cl. X.R.
7—5.6; 30—194; 72—409