

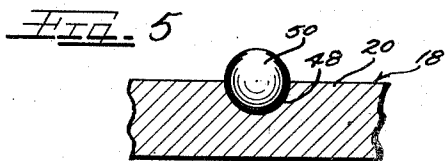
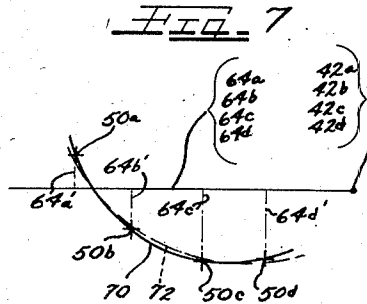
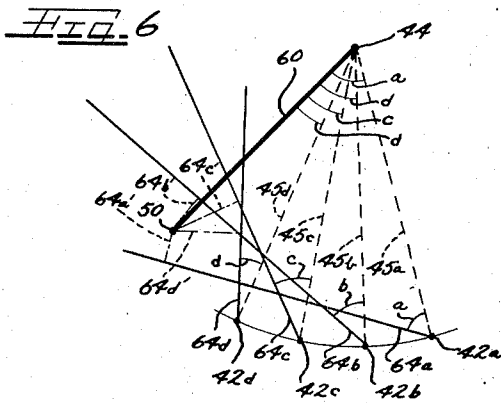
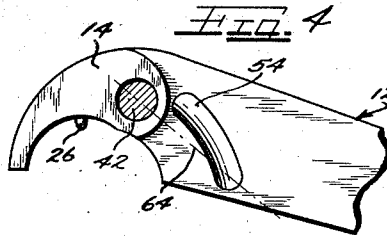
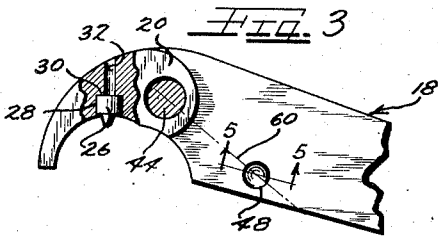
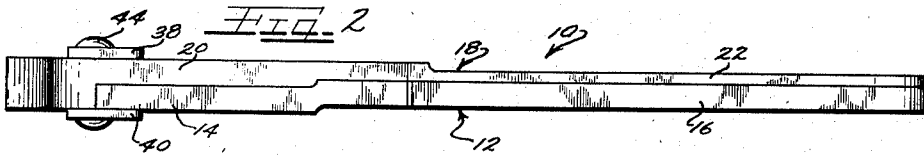
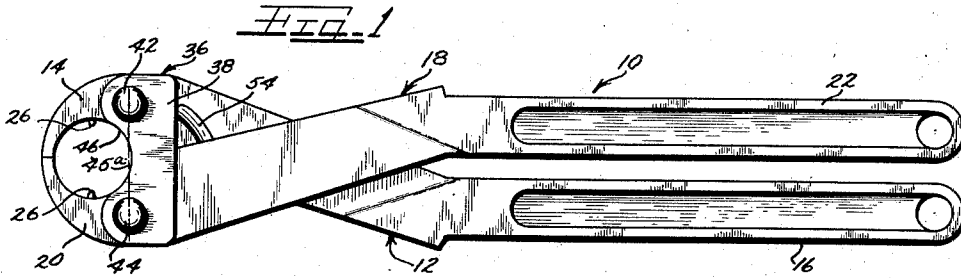
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2,806,394

PLIER-TYPE INDENTER TOOL

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2,806,394

PLIER-TYPE INDENTER TOOL

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8 Claims. (Cl. 81—15)

This invention relates to working tools, and in a particular application the present invention relates to pliers-like, hand actuated, movable-jaw indenter tools adapted to effect an indenting operation to a cylindrical object such as a pipe or conduit connector, although other applications of the concepts here presented will be apparent to those skilled in the art.

In piping, conduit, or the like, where two tubular sections are to be joined by a sleeve-like connector, it has been found desirable to clinch, crimp, or otherwise indent the connector inwardly against the section which it overlies. This provides advantages of tightly locked frictional engagement, positive electrical grounding, etc. It is to such an operation that the device of the present invention principally pertains.

One object of the present invention is to provide a new and improved indenting tool or device.

Another object is to provide a novel indenting device of opposed, movable jaw type, and providing substantially rectilinear travel of indenting lugs carried by the jaws thereof. This type actuation assures a penetration of the indenter lugs into the work-piece generally radially rather than circumferentially thereof, hence providing an easier, neater, and generally more satisfactory indentation.

A further object is to provide an indenting device having the mechanical advantage characteristics corresponding to a first class lever arrangement, but having the work-engaging movement characteristics corresponding to a third class lever arrangement to obtain substantially rectilinear travel of the jaws.

These and other objects, features, and advantages of the present invention will be readily apparent from the following description of an illustrative embodiment thereof, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a plan view illustrating a device embodying principles of the present invention;

Figure 2 is a side elevational view thereof;

Figure 3 is a fragmental elevational view, with portions broken away, of one of the jaw members thereof;

Figure 4 is a fragmental elevational view of the other jaw member;

Figure 5 is an enlarged detail section taken along the line 5—5 of Figure 3, showing guide means including a ball member; and

Figures 6 and 7 illustrate a construction for determining a generation of the curvature of a guide means for the device.

By way of example, an indenter device 10 of a general pliers-like, hand actuated, movable jaw type has been chosen to illustrate the concepts of the present invention.

Such an indenter device 10 is shown as having a first jaw member 12 having a jaw portion 14 and a handle portion 16, and a generally similar second jaw member 18 having a jaw portion 20 and a handle portion 22.

An indenting lug 26 is carried by the inwardly facing side of each of the jaws 14—20. As shown, each indenter lug 26 is fixed to its associated jaw by being press fitted

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into a bore 28 provided in the jaw, and the bottom 30 of the bore provides a bottoming or thrust shoulder for the lug 28. Desirably, a smaller diameter bore 32 extends from the bore bottom 30 to the other face of the jaw, to provide a passage adapted to accept a suitable knock-out tool (not shown) adapted to eject the indenter lug 26 when and if replacement of a lug becomes necessary.

Although the two jaw members 12—18 cross intermediate their ends, it is to be noted that they are not directly pivotally interconnected for relative rotation about any fixed pivot axis. Instead, their interconnection is according to concepts and principles now to be described.

According to the present invention, in the illustrated embodiment, two jaw members 12—18 are interconnected by a novel and advantageous arrangement to provide a somewhat complex or "floating" pivotal association, which provides that as the handle portions 16—22 thereof are squeezed to draw the jaw portions 14—20 relatively together, the indenter lugs 26 will approach each other by substantially rectilinear travel.

The advantageous lug movement hereby achieved provides a special advantage in that as the lugs penetrate the tubular member (not shown) to provide the desired indentation thereof, the penetration will be generally radially of the tube rather than circumferentially thereof, thus providing an easier, neater, and generally more satisfactory indentation.

Accordingly, as shown the jaw members 12—18 are linkingly connected as by a link means 36, here comprising a pair of juxtaposed links 38—40. The links 38—40 are shown as pivotally connected to the jaw members 12 and 18, respectively, by pivot pins 42—44 located at opposite ends of the link means 36 and on opposite ends of a reference link-line 45.

As shown at 46, the edge of the links 38—40 presented towards the work to be gripped is arcuately relieved or cut away, to cooperate with the inwardly presented faces of the jaw portions 14—20 to provide a seat for the work. As shown, the contour of the relief 46 may desirably be such that it presents an arcuate surface tangent to the inwardly presented jaw faces.

Additional means interconnect the jaw members 12—18 to interrelate them for the desired floating pivotal association thereof.

Accordingly, as shown, the jaw member 18 is shown as provided with guide means projecting towards and into guiding association with the other jaw member 12. As shown, such guide means comprises a recess or ball-receiving socket 48, having a ball 50 carried therein. The ball 50 is thus fixed with relation to jaw member 18, and projects toward the jaw member 12.

For co-operative association with the fixed ball 50, an associated guide portion is provided by the other jaw member 12.

Such guide portion in the embodiment shown is provided as an arcuate groove 54 formed by suitably cutting away material from the jaw member 12 in its region of engagement with the jaw-member 18.

The curvature of the groove 54 may be theoretically generated as by the method shown in Figures 6 and 7.

Accordingly as shown in Fig. 6, the line 60 represents the jaw 20, and more specifically represents a line on jaw 20 connecting the fixed ball 50 with the link-pivot 44. In the geometric solution, this line is shown as held fixed. Thus the position of the fixed ball 50, and of link pivot 44, both of which are on jaw 20, are fixed.

The lines 45a, 45b, 45c and 45d represent arbitrarily chosen positions of the link-line 45 of the link means 36. Line 45a represents the position of the link when the jaws are in a relatively closed condition. In that position, the link line 45a is at an angle α with respect to the reference line 60. The other link lines 45b, 45c, and 45d are at

angles *b*, *c*, and *d*, respectively, with respect to the same line. Those link-lines 45*b*, 45*c*, and 45*d* represent the position of the link with the jaws in progressively relatively opened condition. The points 42*a*, 42*b*, 42*c*, and 42*d* respectively represent the position of link pivot 42 at the various positions 45*a*, 45*b*, 45*c*, and 45*d* of the link line 45.

Next to be constructed is a reference line 64*a*. This reference line 64*a* represents the position of a reference line 64 of jaw 14 when the two jaws are in such a condition of closure that link line 45 is in position 45*a*. Line 64*a* is constructed by drawing a line through link-pivot point 42*a* at an angle *a* with respect to link line 45*a*, thus providing that both the fixed line 60 of jaw 20, and the reference line 64*a* just drawn to represent jaw 14, are at the same angle to the link-line 45*a*, that angle being the angle *a*.

In like manner, reference lines 64*b*, 64*c*, and 64*d* are constructed, respectively passing through link-pivot points 42*b*, 42*c*, and 42*d*, and at angles *b*, *c*, and *d* from link-lines 45*b*, 45*c*, and 45*d*.

The equality of angles in the above construction, wherein the lines 64*a*, 64*b*, 64*c*, and 64*d* are drawn at angles equal to the angle between the fixed line 60 of jaw 20 and the position of the link-line 45 at each of the four chosen positions of the jaws, is significant. This provides that the two jaw members 12 and 18 will move in a rocking or floating pivotal movement in which they do not shift longitudinally with respect to each other, hence that their indenter lugs 26 are maintained for guided movement in aligned paths of approach.

It will be observed that with respect to the various reference lines 64*a*, 64*b*, 64*c*, and 64*d*, the fixed point 50 is at various locations.

Those particular relative locations of the point 50 represent points on the curve sought to be developed. They may be plotted and utilized in developing the curve by superimposing the lines 64*a*, 64*b*, 64*c*, and 64*d* as in Figure 7.

As shown in Figure 7, therefore, the reference lines 64*a*, 64*b*, 64*c*, and 64*d* have been superimposed. This may be done as by constructing perpendiculars 64*a'*, 64*b'*, 64*c'*, and 64*d'*, from the point 50 in Figure 6 to obtain a measure of the relative location of the point 50 with respect to the reference lines 64*a*, 64*b*, 64*c*, and 64*d*. The values may then be transferred to Figure 7 where those lines have been superimposed. The points 50*a*, 50*b*, 50*c*, and 50*d* thus plotted hence represent the relative positions of the point 50 with respect to each of the superimposed lines.

Connecting the points 50*a*, 50*b*, 50*c*, and 50*d*, by a smooth curve provides the desired curve of generation 70, for those points represent points on the jaw member 12 which pass adjacent the fixed guide means provided by ball 50 of the other jaw member.

A circular arc 72 is shown in Fig. 7 as superimposed onto the theoretically generated curve 70 to illustrate the approximation of the theoretical curve 70 to a circular arc. It is thus seen that through the normal range of movement of the jaws, and with the general proportions here involved, the curvature of groove 54 may be circular and yet be substantially of the curvature of the curve 70 as theoretically generated.

A device constructed according to the concepts and principles herein disclosed provides a novel and advantageous indenter means having indenter lugs which are moved in a substantially rectilinear path. This provides for easier, neater and otherwise advantageous indentations as above set forth. The mechanical advantage characteristics corresponding to a first class lever arrangement are obtained without the disadvantage of the relatively sharply curving path of travel of portions of gripping jaws so interconnected; instead, the path of travel hereby obtained gives the lugs an approach path

which is substantially rectilinear, corresponding more to that of a third class lever arrangement.

It will thus be seen from the foregoing description, considered in conjunction with the accompanying drawings, that the present invention provides a new and improved tool having the desired advantages and characteristics, and accomplishing its intended objects, including those hereinbefore pointed out and others which are inherent in the invention as described.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. An indenter tool, comprising a pair of jaw members each comprising a handle portion and a jaw portion, indenter lug means carried on said jaw portions, a link means linkingly interconnecting said jaw portions, substantially spherical guide means carried by one jaw member, said other jaw member being provided with an associated concave groove and arcuate guide portion receiving said substantially spherical guide means to interrelate said jaw members for floating pivotal movement.

2. An indenter tool, comprising a pair of jaw members each comprising a handle portion and a jaw portion, indenter lug means carried on said jaw portions, a link means linkingly interconnecting said jaw portions, guide means carried by one jaw member, said other jaw member being provided with an associated arcuate guide portion receiving said guide means to interrelate said jaw members for floating pivotal movement.

3. An indenter tool, comprising a pair of jaw members each comprising a handle portion and a jaw portion, indenter lug means carried on said jaw portions, a link means linkingly interconnecting said jaw portions, guide means with a convex surface carried by one jaw member, said other jaw member being provided with a concave channel forming an associated arcuate guide portion receiving said guide means to interrelate said jaw members for floating pivotal movement.

4. An indenter tool, comprising a pair of jaw members each comprising a handle portion and a jaw portion, indenter lug means carried on said jaw portions, a link means linkingly interconnecting said jaw portions, guide means with convex extending surface carried by one jaw member and projecting therefrom toward the other jaw member, said other jaw member being provided with a concave groove forming an associated relieved arcuate guide portion receiving said guide means to interrelate said jaw members for floating pivotal movement.

5. A work-gripping tool comprising a pair of jaw members each comprising a handle portion and a jaw portion, a link means linkingly interconnecting said jaw portions, one jaw member being provided with a recess adapted to receive a ball, a ball in the recess, said other jaw member being provided with an associated arcuate groove into which the ball extends to interrelate said jaw members for floating pivotal movement.

6. An indenter tool, comprising first and second jaw members each comprising a handle portion and a jaw portion, indenter lug means carried on said jaw portions, a link means linkingly interconnecting said jaw portions and connected thereto by a first pivot and a second pivot, respectively, guide means carried by said first jaw member, said second jaw member being provided with an associated guide portion receiving said guide means to interrelate said jaw members for floating pivotal movement, said guide portion being arcuate and of substantially the same curve as the curve developed on said second jaw member by the guide means as the second jaw member is moved with respect to said first jaw member in such a manner that the angle between a reference line connecting the guide means and said first link pivot and a reference line connecting said first and second link pivots is equal to the angle between said reference line connecting said first and second link pivots and a reference line on said

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second jaw member and passing through said second link pivot and a contact point of said guide means.

7. A work-gripping tool, comprising first and second jaw members each comprising a handle portion and a jaw portion, indenter lug means carried on said jaw portions, a link means linkingly interconnecting said jaw portions and connected thereto by a first pivot and a second pivot, respectively, guide means having an outwardly extending concave surface carried by said first jaw member, said second jaw member being provided with an associated concave guide portion receiving said guide means to interrelate said jaw members for floating pivotal movement, said guide portion being arcuate and of substantially the same curve as the curve developed on said second jaw member by the guide means as the second jaw member is moved with respect to said first jaw member in such a manner that the angle between a reference line connecting the guide means and said first link pivot and a reference line connecting said first and second link pivots is equal to the angle between said reference line connecting said first and second link pivots and a refer-

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ence line on said second jaw member and passing through said second link pivot and a contact point of said guide means.

8. An indenter tool, comprising a pair of jaw members each comprising a handle portion and a jaw portion, indenter lug means carried on said jaw portions, a link means linkingly interconnecting said jaw portions, a ball receiving socket carried by one jaw member, a ball carried by said socket, said other jaw member being provided with an associated arcuate guide portion receiving said ball for interconnecting said jaw members for floating pivotal movement.

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