UNIVERSAL PUNCH FOR TUBE BENDING

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This invention relates to metal working and particularly to an improvement in tube bending apparatus. Many methods and apparatus have been devised for bending tubes, by which the tube is inserted into a slotted or shaped punch against the region of the tube to be bent while the latter is held in position by thrust blocks or even by a die provided for shaping the outside region of the bend obtained. In certain of these processes the punch, especially where no die is used, must have a shape adapted to the tube for application against the tube length which is to be bent. Under these conditions and considering the tube diameter and the degree of the bending angle, which can attain 180°, different punches have to be used. The manufacture of these punches is rather difficult.

To avoid having to manufacture a special punch for the work to be executed in each particular case, this invention has for its object the provision of a universal punch conceived in such manner as to permit the bending of tubes of different diameters and on different bending radii.

The "universal" punch embodying the invention consists mainly of a frame in which grooves radiate from a common center and which receives a set of plates which can easily be manufactured in series, each cut out to the desired profile, these plates as assembled forming a template to be engaged in the tube to be bent. By varying the degree of insertion of the plates into the grooves, the punch is adjusted to the bending angle desired to be given to the tube.

The following description when read in connection with the attached drawings will afford a better understanding of the manner in which the invention can be executed.

Figure 1 shows in side view one of the slotted side plates of the punch.

Figure 2 is a side view of retainer plates which press against the side plates of Figure 1 closing the slots at one side to form guiding grooves.

Figure 3 shows the assembled punch in sectional elevation.

Figure 4 shows the assembled punch in position for tube bending operation.

The tube bending punch consists of a frame essentially constituted by two upright side plates such as 10, Fig. 1, in which slots 11 etc. are arranged radiating fanwise from a common center. These side plates 10 are mounted as shown in Fig. 3 on a base 12 and on both sides of the frame retainer plates 14, 15 (Fig. 2) are arranged which prevent former plates 16 from sliding laterally out of the slots 11 into which they are inserted. As shown in Figs. 1, 2 and 4, the plates 14 and 15 are secured to the side plates 10 by screws or the like seated in the holes 50, 51 respectively.

The assembly which has been described above serves, except for the substitution of different former plates, for quite a set of different bendings. For bending a tube of a determined diameter, a set of former plates 16 is manufactured each having a generally semi-circular cut-out 18 adapted to the diameter of a tube T to be treated. Manufacture of these former plates is relatively easy and economical as it is only necessary to pile-up several plates and then to cut them out simultaneously in order to obtain the set of substantially identical former plates necessary to provide a bending groove for the operation.

Dependent upon the radius and the angle of the final bend which it is desired to obtain from tube T, for instance 60°, 90° or 120°, or any other value, the former plates 16 are more or less deeply inserted into the grooves 11.

To this end a set of key or limit plates 20, 21—28 of suitable length are inserted at the bottom of the slots 11 and provide, as can be seen from Figs. 3 and 4, a stop against which the lower edge 30 of each former plate 16 engages in such manner that the plates 16, in accordance with the bending radius to be obtained project more or less from the grooves 11.

When the punch is mounted the former plates 16 look as shown in Fig. 4. The tube T to be bent may be suitably heated and is for instance supported against two rollers 32, 33 carried as part of a fixed part 34 as in a press. The former plates 16 at the center are in engagement from the outset against tube T, as indicated by straight lines in Figure 4, so that the assembled punch may be moved in the direction as by a plunging movement in the direction of arrow A in order to bring about the bending of tube T, which is kept in place by rollers 32, 33. When the operation is terminated a 90° bend of the tube shown in dotted lines in Fig. 4 is obtained.

Limit stop lugs 36 are provided, preferably on the side edges of the plates 16 to extend beneath the lower edge 38 of covering retainer plates 15 as shown in Fig. 4. In this manner, after the bending operation has been finished, the former plates 16 which might remain wedged on the tube T, are retained by stop blocks 36 when the punch is shifted in the direction opposite to arrow A, and, consequently, cannot jump out of the grooves that are created by covering the upper parts of slots 11 with the retainer plates 15. The punch is then ready for a new operation on another tube section without it being necessary to put the former plates 16 back into place into their grooves.

Modifications in detail may be made without exceeding the scope of the invention. The spacing between plates 16 can vary according to the nature of the metal to be treated.

What I claim is:

1. A universal punch for tube bending consisting of a frame comprising similar side plates each provided with grooves which radiate in fan shape from a common center; means maintaining said plates in spaced relation; a set of movable former plates inserted in said grooves formed with cut-outs on one edge whose bases bear against the tube to be bent; and keys in the lower parts of said grooves to restrict the insertion of former plates into the grooves to variable levels determined by the length of the keys according to the desired bending radius to be given to the tube.

2. In apparatus for bending a tube on a relatively short radius; a base plate; a pair of guide plates mounted in spaced parallel relation on the base plate and each formed with a series of radial slots converging from one edge of each plate opposite similar slots in the other plate; a series of substantially identical former plates disposed normally to said guide plates with their side edge portions mounted in the slots in the latter and formed at their outer end edges with substantially semicircular grooves for receiving a tube to be bent; a series of limit plates mounted in and abutting the bases of the slots in said guide plates for engagement by the lower end edges of said former plates for determining
the projection of their opposite end edges from the open ends of said slots; retainer plates secured to the outer faces of said guide plates and overlying the upper parts of the slots therein to prevent lateral disengagement of the former plates from the slots in which they are mounted; stop members at the lower portions of said guide plates projecting outwardly through the slots in the latter and engageable with said retainer plates for preventing end-wise displacement of said retainer plates from the slots in said guide plates; and means for pressing a tubular workpiece into the bending groove in said former plates.

3. In apparatus for bending a tube on a relatively short radius; a base plate; a pair of guide plates mounted in spaced parallel relation on the base plate and formed with a series of radial slots opening inwardly in convergent relation from one edge of each plate opposite similar slots in the other plate; a series of substantially identical former plates disposed normally to said guide plates with their side edge portions mounted in the slots in the latter and formed at their outer end edges with substantially semi-circular recesses aligned to create a bending groove for receiving a tube to be bent; a series of limit plates mounted in and abutting the bases of the slots in said guide plates for engagement by the lower end edges of said former plates for determining the projection of their opposite end edges from the open ends of said slots; retainer plates secured to the outer faces of said guide plates and overlying the upper parts of the slots therein to prevent lateral disengagement of the former plates from the slots in which they are mounted; and means for pressing a tubular workpiece into the bending groove in said former plates.

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