June 21, 1932. C. MINGORI 1,863,693

MACHINE FOR BENDING METAL TUBES IN THE COLD STATE

Filed May 31, 1930

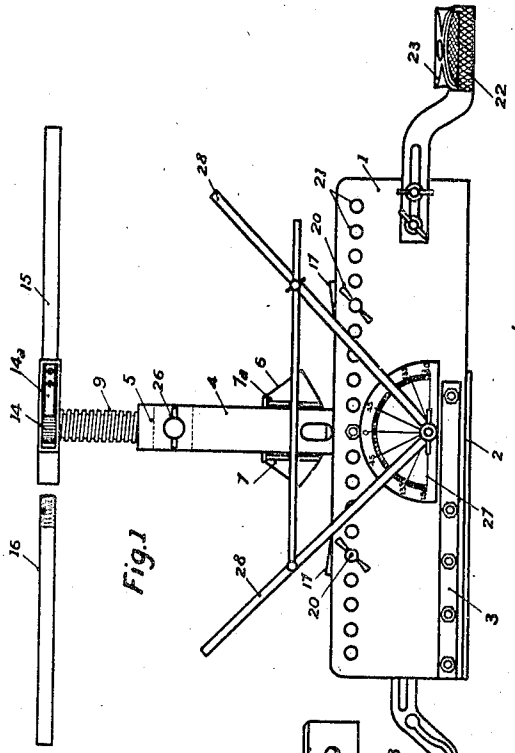


Fig. 1

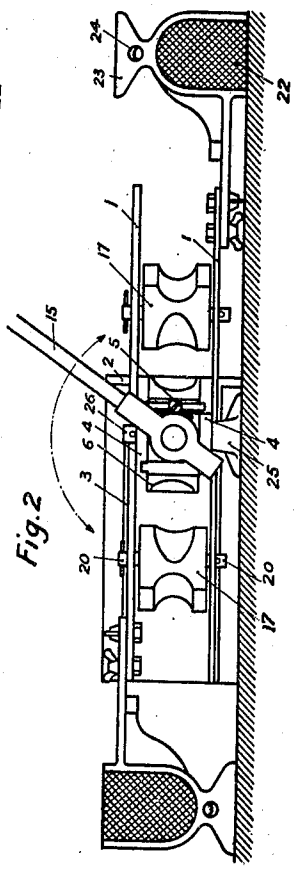


Fig. 2

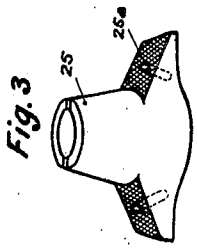


Fig. 3

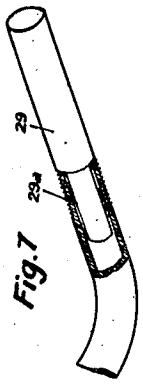


Fig. 7

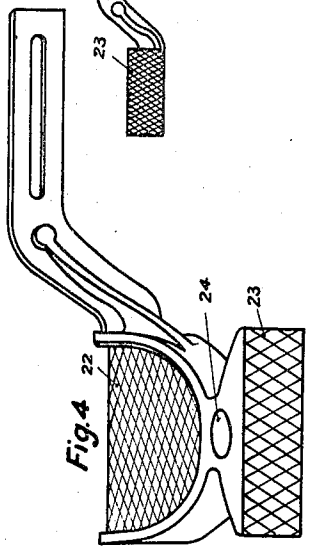


Fig. 4

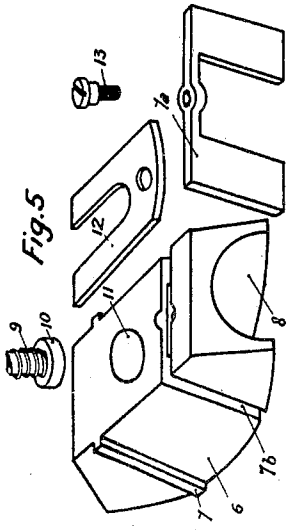
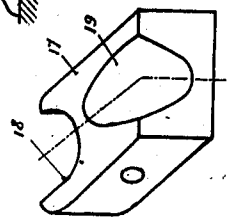


Fig. 5



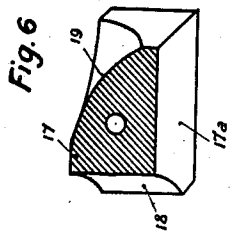


Fig. 6

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UNITED STATES PATENT OFFICE

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MACHINE FOR BENDING METAL TUBES IN THE COLD STATE

Application filed May 31, 1930, Serial No. 457,775, and in France January 23, 1930.

This invention has for object a new machine for bending in the cold state, metal tubes, characterized not only by its simplicity, its strength and ease of manipulation in situ without foundation or support but more particularly by the special formation of the presser foot and of the two lateral bearing members, by the addition of three feet which permit of laying the machine on the right or left hand side and of forming neighbouring elbows in different planes, by the addition also of an indicating compass which gives the exact and not approximate angles required.

The accompanying drawing given by way of example shows:

Figure 1 a side elevation of the improved machine in the upright position; Fig. 2 the same machine lying on one side; Figs. 3 and 4, to a larger scale and in perspective, the small foot which is placed beneath one of the uprights when the machine is on its side so as to provide stability not only in the upright position but when on either the right or left side; Fig. 5, to the same scale as Figs. 3 and 4, the different parts of the presser foot or block ensuring its being securely held and guided, between the uprights and its fixture at the end of the operating screw; Fig. 6, the two lateral bearings for the tube to be bent, shown in perspective, the one in section taken on the median plane; Fig. 7 the end mandrel serving to form a bend quite near the end of a tube.

The new machine consists of:

Two lateral cheeks 1 of slight height resting on a base plate 2 to which they are secured by angle irons 3, the base plate not extending from one end to the other of the cheeks but having a length equal to only two thirds approximately of the cheeks in such a manner as to leave a passage permitting of making S bends in the tubes.

Two vertical standards or uprights 4 secured to the centre of the two cheeks, interconnected at their upper parts by a block screw threaded axially, indicated by 5, serve as a slideway for the presser member. The two uprights are provided with a small aperture through which the exact position of the tube to be bent beneath the presser foot can be seen.

A bending matrix of particular shape marked 6 the lower face of which is ground or formed like the arc of a circle, is provided with an incurved groove 8 the diameter of which is less than that of the tube to be bent by 1/30th which overcomes the risk of the tube being crushed oval and prevents the deformation exceeding 1/60th of the external diameter of the tube. This matrix slides between the uprights 4, and it has two ribs laterally arranged marked 7 serving as guides which bear against one of the sides of the uprights and a removable horseshoe shaped member 7*a* adjusted in a groove formed at 7*b* and ensuring that the foot is held during its sliding movement, by its flanks which project here and there from the foot like the ribs 7 against the other two sides of the uprights 4. A set of several interchangeable matrices in the groove, having each a different caliber, enables all current diameters of tubes to be bent.

A pressure screw 9 screws into the block 5 and bearing against the groove 11 formed in the foot 6 by means of its head which is of larger diameter.

A small plate 12 formed U-shape fixed to the matrix 6 by means of the same screw 13 as the member 7*a* and retaining in the hollowed out or recessed portion 11, the head 10 of the screw which is thus connected rigidly to the pressure matrix.

A ratchet 14 and a pawl 14*a* causes the screw 9 to turn under the action of the operating arms 15, 16 one of which is dismountable to allow the machine to operate on its side.

Two bearings for the tube which is to be bent and which are marked 17 disposed suitably in regard to the bending matrix 6, between the cheeks 1, comprise, as shown more clearly at Fig. 6, a plane surface 17*a*, a semi-cylindrical groove 18 hollowed out in one of the end faces and a second groove of round section 19 recessed for the stop opposite to that separating the face 17*a* from that carrying the groove 18. These bearings are mounted on axes 20 engaged in two of the

holes 21 formed in line on the cheeks 1, and can oscillate freely under the reaction of the tube which is bent through the action of the pressure roller and are placed at such a height that the tube is not engaged between the cheeks 1 before bending but lies slightly above so that it can already possess bends which will be neighbour to the bend or elbow to be formed and in different planes without the cheeks 1 interfering or inconveniencing the operation.

Two pedals 22 are secured to the extremities of the machine for the purpose of giving great stability in the three positions of working. For this purpose these pedals have a large surface to bear on the ground in the upright position and the machine is stabilized by putting one foot on these pedals,—further each pedal is prolonged by a foot piece 23 and its total length is equal to the width of the machine such that the two pedals always bear on the ground with one or other of their extremities which are ribbed to increase the adherence when the machine is put on its right or left side, so avoiding any rocking during working. Moreover, an inclined hole 24 set in a direction opposite to the force exerted by the rotation of the arms of the lever 15, 16, permits of anchoring the machine in the soil with anchoring pins when such is possible, particularly when the machine is actuated by a single workman.

A small centre bearing or shoe 25 serves in combination with the two pedals as a third bearing point in triangular formation, when the machine is on its side by coming beneath the uprights 4 and adjusting itself on the ends of the axes 26 ensuring the fixation of the interconnection 3 which protrudes appropriately in order to engage in the shoe. The machine is thus supported level and the operation of the ratchet 14 is rendered possible, the lever arm 16 having been dismantled.

Two inclined holes 25*a* permit of anchoring the centre block by means of an anchoring pin as in the case of the pedals 22.

A protractor 27 suitably graduated is secured to each of the cheeks 1 at their middle and two arms of a set square 28 pivoting around the centre of these protractors can be spread apart at will to form any angle. The graduation of the protractors is of a special kind viz: The numbers indicated correspond in fact with half the angles but indicate the inclination which must be given to each arm of the set square to obtain the required angle. If, for example it is desired to obtain a bend at 90 degrees, the two arms 28 are placed on the two numbers 90 on either side of the zero mark which however only gives an actual angle of 45 degrees with zero but an angle of 90 degrees between such two marks themselves.

A mandrel is formed of two cylindrical parts of different diameters: the one 29 having the external diameter of the tube and the other 29*a* having the diameter of the inside of the tube in which it is fully engaged, its length being greater than the length commonly given to the screw threaded ends of tubes in order to avoid risk of rupture; this mandrel being arranged at the end of the tubes when it is desired to form a bend very near the end thereof, the mandrel resting then in lieu or place of the tube on one of the lateral bearings of the bending tool.

The advantages of the improved machine are as follows:

It can work indifferently whether upright, lying on its left side or lying on its right side and is perfectly stable in all its positions so permitting of making any kind of bend in no matter what plane.

Its bearings serve in turn for making a simple bend in a tube which was originally straight, by placing the latter in the semi-cylindrical grooves 18; for making close to an existing bend, a second bend in the same plane but in the opposite direction by placing the part already bent in a groove having a rounded longitudinal section such as 19; finally, by laying down the machine for making a second bend very close to one which has already been formed and situated in a different plane, by placing the bent part on the plane surface 17*a* of the bearings which arrangement is rendered possible by the fact that the bearings project slightly beyond the cheeks and nothing interferes with the tube which moves laterally.

Its system for indicating the angle by means of an adjustable set square and protractor enables an apprentice to produce bends of the exact angle desired because it suffices, having spread apart the two arms of the square to produce said angle, to stop the pressure of the bending matrix 5 when the two ends of the tube on either side of the bend have taken up a position parallel to the arms of the square thus avoiding loss of time occurring by the successive withdrawal and engagement of the tube in a machine for obtaining a bend by trial or step by step.

The new manner of mounting the matrix 6 between the uprights ensures perfect guiding by means of two pairs of projecting ribs parallel for the complete height of the pressure bearing which eliminates any oscillation no matter how little between the pressure bearing and the warping of the bent tubes, which is of importance in heating installations where it is always necessary to consider the inclination of the tubes leaving and returning to the boiler.

Finally, the auxiliary mandrel permits, as described, of making bends or elbows nearer the ends of the tubes than has hitherto been possible.

I claim:

1. A machine for cold bending metal tubes comprising a matrix, two uprights, said matrix sliding between said uprights, said matrix bending the tubes by pressure, a screw adapted to provide said pressure, ratchet mechanism for operating said screw, two oscillating bearings, one of said bearings being mounted on each side of said matrix, means for adjusting said bearings, two cheeks for supporting the tube to be bent, a pedal carried by each cheek, for giving stability to the machine, the oscillating bearings being mounted between said cheeks, means for indicating the angle to which the tube is to be bent, a foot carried by each pedal, said feet acting as bearings, said feet being ribbed, and forming extensions of said pedals such that they have a length equal to the total width of the machine to give perfect stability.

2. An improved bending machine for tubes as claimed in claim 1, including a centre bearing disposed beneath the uprights of the machine and at an appropriate height, a pressure screw screwing into said centre bearing and forming a third bearing point combined with the two pedals to provide a tripod supporting the machine level and permitting the ratchet mechanism to operate.

3. An improved machine for bending tubes as claimed in claim 1, including means for anchoring said machine to the ground comprising two pedals and a centre bearing having inclined holes therein said holes being disposed in a direction opposite the direction of power.

4. An improved machine for bending tubes as claimed in claim 1 including a bending matrix comprising two lateral guiding ribs against the uprights, a horseshoe shaped member fitted in a groove and ensuring the holding and guiding of the matrix against the uprights on the side opposite that having the ribs, said horseshoe shaped member being secured by a screw which also holds a stirrup securing the head of the screw giving pressure integral with the matrix.

5. An improved bending machine for tubes as claimed in claim 1 including a protractor secured on each cheek of the machine and two arms of a set square, said arms being adjustable to permit of obtaining at one movement the exact angle required by placing each arm thereof on the corresponding number of the angle desired and bending the tube until its ends become parallel with the arms of said set square.

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