May 25, 1948. J. L. VAILL 2,442,224

MACHINE FOR FLARING OR DEFORMING ENDS OF TUBES

Filed Sept. 28, 1944. 4 Sheets-Sheet 1

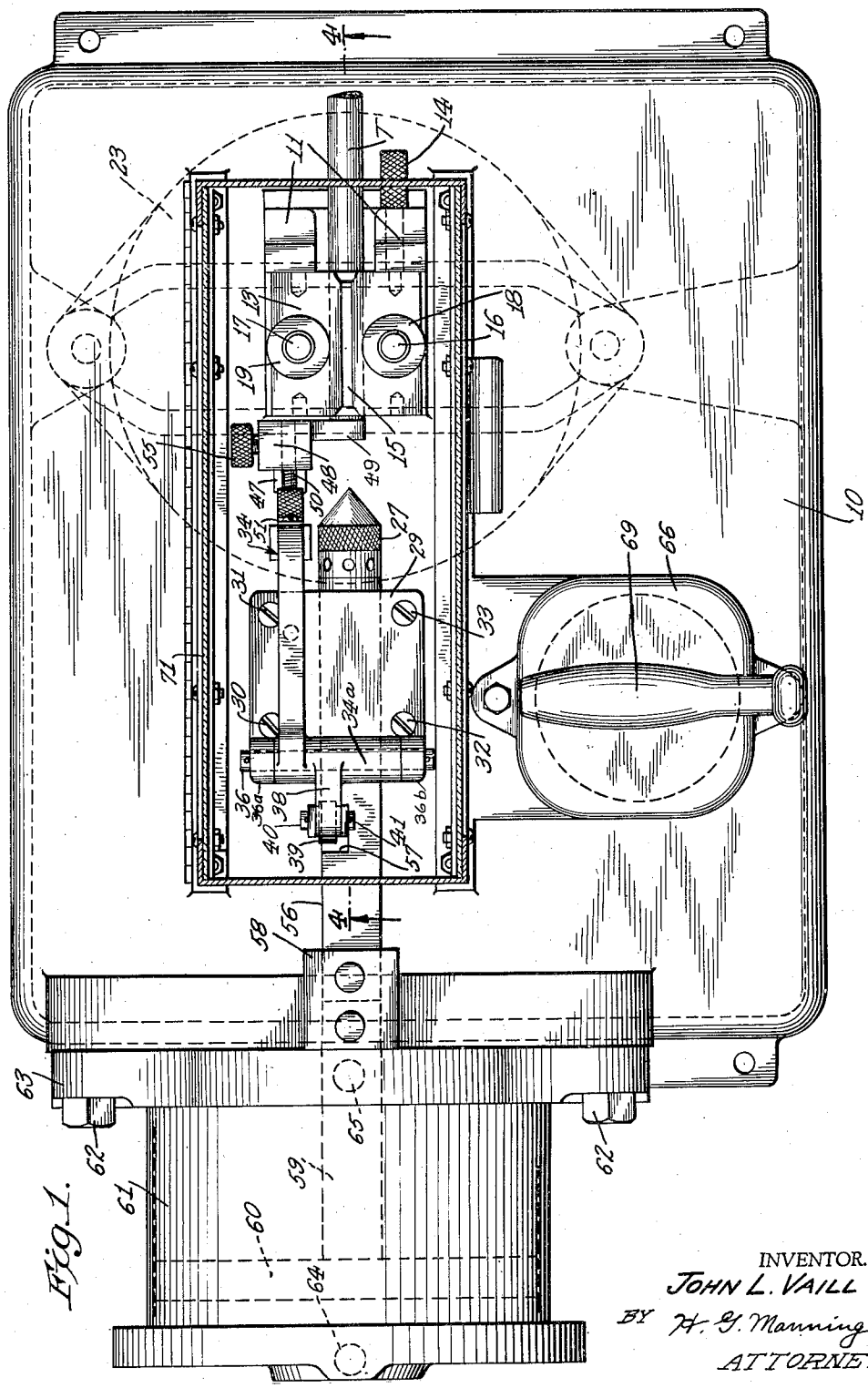


Fig. 1.

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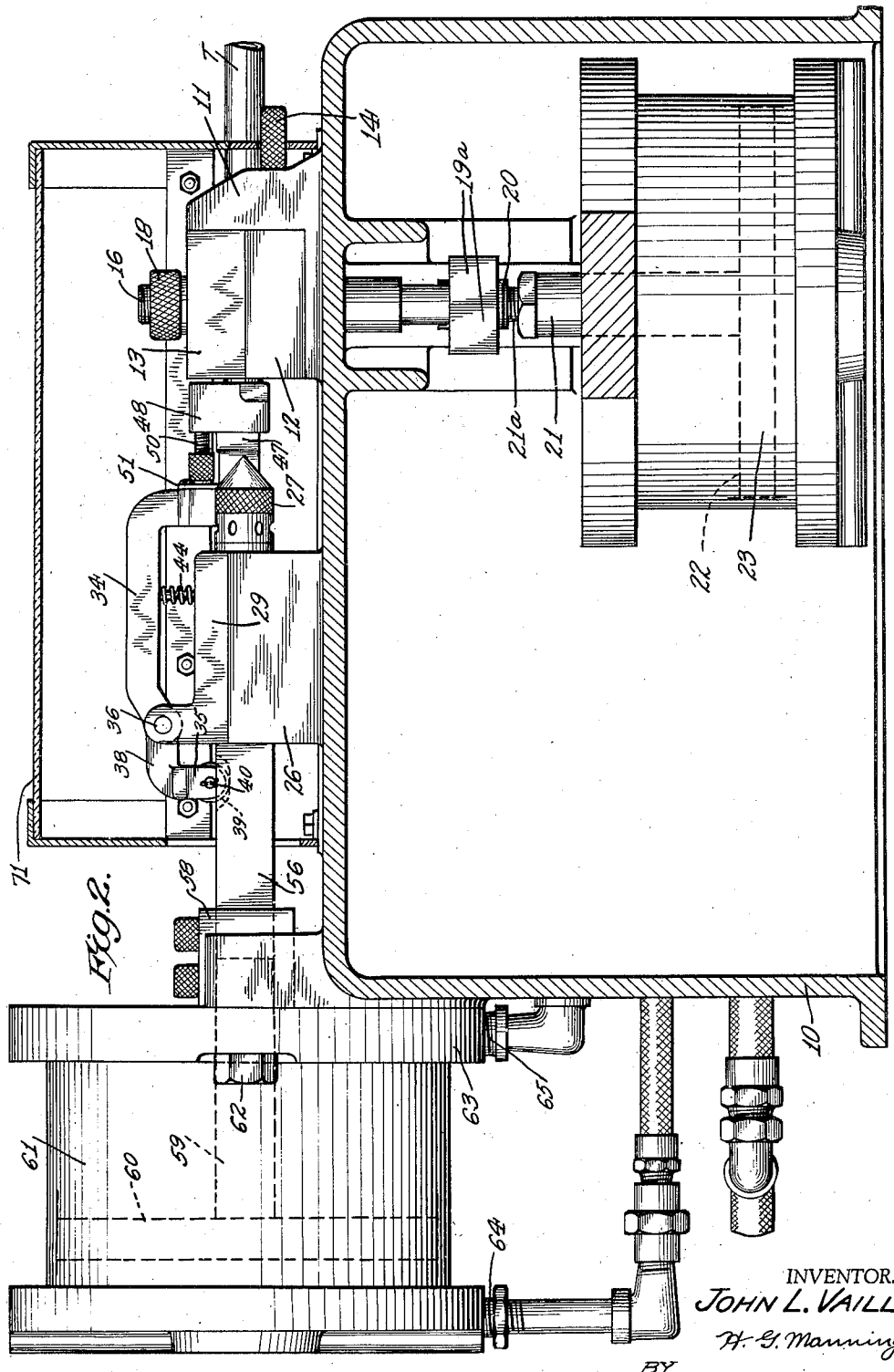


Fig. 2.

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Fig. 3.

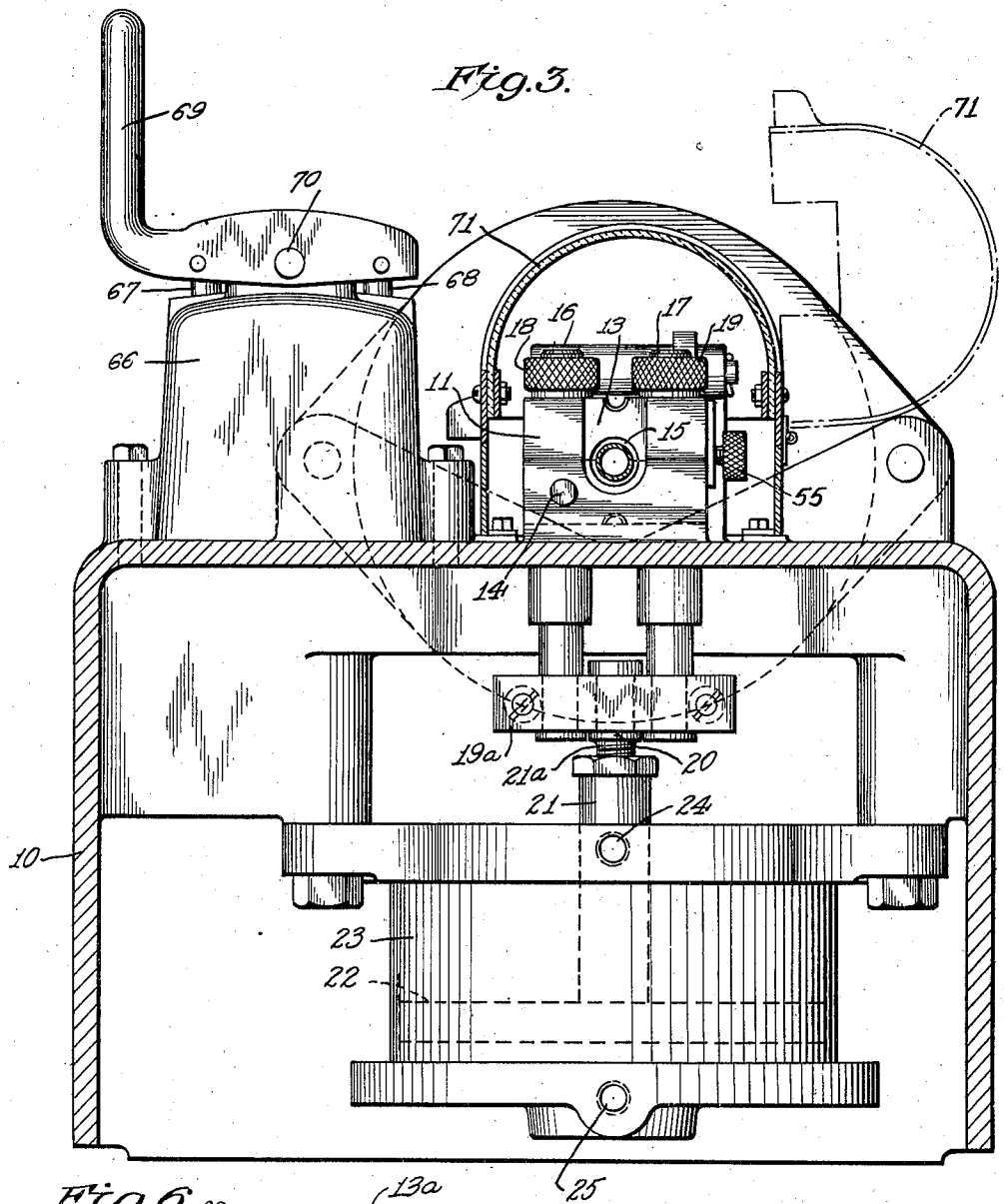
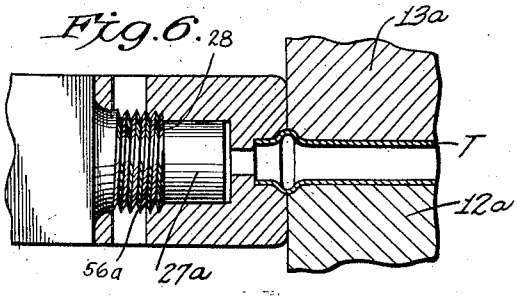


Fig. 6.



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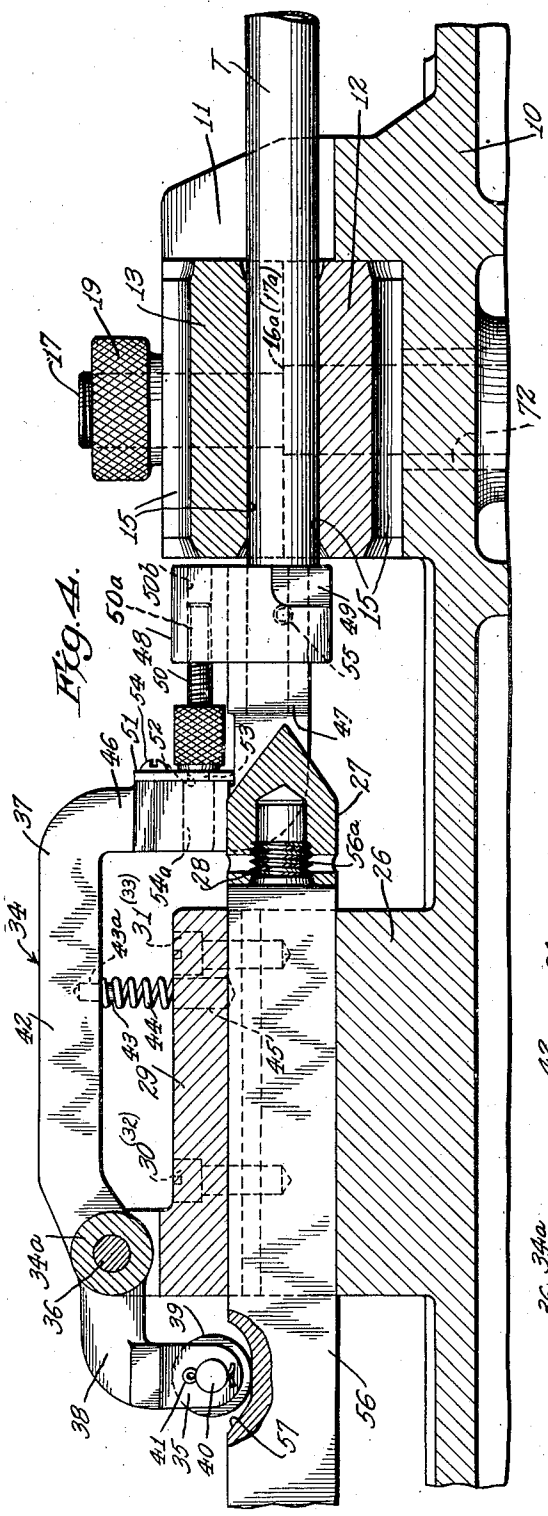


Fig. 4.

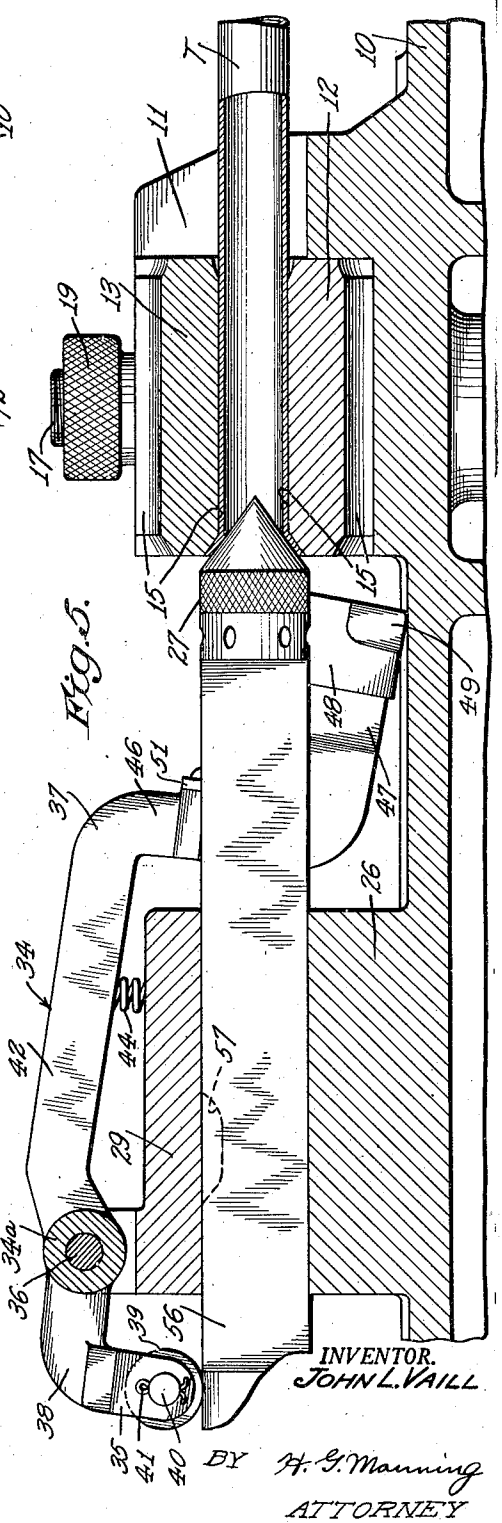


Fig. 5.

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Patented May 25, 1948

2,442,224

UNITED STATES PATENT OFFICE

2,442,224

MACHINE FOR FLARING OR DEFORMING ENDS OF TUBES

John L. Vaill, Middlebury, Conn.

Application September 28, 1944, Serial No. 556,189

4 Claims. (Cl. 153—79)

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This invention relates to tube end forming machines, and more particularly to a manually-controlled fluid-operated machine for beading, flaring, flanging, expanding, sinking, double-lap flaring, or double-lap flanging the end of a tubing of any workable material such as aluminum, steel, etc.

One object of the present invention is to provide a machine of the above nature in which the end of the tubing will be pressed against an adjustable stop member and then clamped by means of a pair of cooperating die members before the shaping or forming operation.

Another object of the invention is to provide a machine of the above nature in which the stop member has a vernier screw in order to facilitate the adjustment thereof.

A further object is to provide a machine of the above nature in which the stop member will be swung downwardly out of the way of the punch before the latter strikes the end of the tubing.

A further object is to provide a machine of the above nature having a split horizontal chucking die, the upper section of which is movable downwardly for clamping the work tightly against the lower section before the shaping operation.

A further object is to provide a machine of the above nature in which the upper die section is held downwardly upon the tubing by a fluid-operated piston during the shaping operation.

A further object is to provide a machine of the above nature, in which provision is made of a set of interchangeable dies and punches which will permit a wide variety of tubing sizes and shapes to be formed on a single machine.

A further object is to provide a machine of the above nature in which the chucking dies and the flaring and beading punches may be interchanged rapidly from one size to another.

A further object is to provide a machine of the above nature which will perform automatically the forming operation in a fraction of the time required with former manual methods, and which machine may be operated by relatively unskilled labor on a mass production basis.

A further object of the present invention is to provide a machine of the above nature which will be simple in construction, inexpensive to manufacture, easy to install and manipulate, compact, ornamental in appearance, safe to operate, and very efficient and durable in use.

With these and other objects in view there have been illustrated on the accompanying drawings, two forms in which the invention may conveniently be embodied in practice.

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In the drawings,

Fig. 1 represents a top plan view of the tube end forming machine.

Fig. 2 is a side view of the same, shown partly in section.

Fig. 3 is a transverse sectional view of the same, looking from the right of Fig. 2.

Fig. 4 is a longitudinal sectional view of the same, taken along the line 4—4 of Fig. 1, looking in the direction of the arrows, and showing the tubing in clamped position before the forming operation.

Fig. 5 is a longitudinal sectional view, similar to Fig. 4, showing the appearance of the punch and tubing at the end of the flaring operation.

Fig. 6 is a fragmentary sectional view, similar to the right hand portion of Fig. 5, showing the appearance of the machine after a bead has been formed adjacent the end of the tubing by a beading punch, but before the punch has been withdrawn.

Referring now to the drawings in which like reference numerals denote corresponding parts throughout the several views, the numeral 10 indicates the base housing of the machine, which housing is preferably made of cast metal, and has on the forward part of its upper surface an upstanding end thrust lug 11. The thrust lug 11 is adapted to support a pair of cooperating complementary bottom and top chucking dies 12, 13, the former of which is held down in fixed position by means of a horizontal holding screw 14 mounted in said thrust lug 11, and having an exterior knurled knob on the end thereof.

The chucking dies 12, 13 are provided with opposed semi-cylindrical grooves 15, 15 which serve to engage and clamp the tubing T tightly in position during the forming operation. The upper chucking die 13 is adapted to be raised and lowered out of clamping position by means of a pair of vertical drawbars (or chucking studs) 16, 17, preferably round in cross section. The tops of the drawbars 16, 17 are threaded for receiving knurled holding nuts 18, 19 which engage tightly against the movable top chucking die 13. The bottom of the top die 13 rests upon a pair of intermediate shoulders 16a, 17a formed on the drawbars 16, 17.

The drawbars 16, 17 are connected at their lower ends by means of a two-part holding bracket 19a, 19a to a flanged adapter member 20 resting upon the sections of said bracket 19a, 19a, said adapter 20 being in turn adjustably connected at its lower end to a depending piston rod 21 by means of a threaded section 21a located on

said adapter member and screwed into a tapped hole in said piston rod 21.

The piston rod 21 is connected to a die-clamping piston 22 which is adapted to reciprocate within a cylinder 23 located at the bottom of the housing 10, said piston 22 being operated by means of fluid pressure such as compressed air supplied through ports 24, 25 to cause said piston to move downwardly and upwardly, respectively, as desired.

After the tubing T, which may be of aluminum or any other workable material, has been clamped tightly between the chucking dies 12, 13, it is adapted to be beaded, flared, flanged, expanded, sunk, double-lap flared, double-lap flanged, etc., by means of a horizontal plunger 56, which is preferably rectangular in cross section and is adapted to slide within a bearing 26 mounted upon the top of the base housing 10. The plunger 56, as illustrated in Figs. 1–5, carries a detachable flaring punch 27 upon its forward end, said punch having a hollow tapped rear end 28 which is adapted to be screwed upon the reduced forward threaded end 56*a* of the plunger 56 (as best shown in Fig. 4). In the modification disclosed in Fig. 6, the beading punch 27*a* has been substituted for the flaring punch 27.

The plunger 56 is held within the bearing 26 by means of an upper plunger bearing cap 29, and four cap screws 30, 31 (32, 33) are employed to attach said cap 29 to said bearing 26.

In order to limit the inward movement of the tubing T, when it is being inserted between the chucking dies 12, 13, provision is made of an adjustable stop block 48 carried on the forward end of a rocker arm 34, which has a rear depending end 38 split to form a pair of bearing lugs 35, 35, which embrace a pin 40 carrying a roller 39, said pin 40 being held in place by cotter pins 41, 41. The rocker arm 34 has an enlarged hub 34*a* which fits over a horizontal pivot pin 36, the latter being mounted in upstanding bearings 36*a*, 36*b* formed in the top of the plunger bearing cap 29.

An intermediate section 42 of the rocker arm 34 is pressed upwardly at all times by means of a pilot pin 43 fitted into a recess 43*a*—said pin 43 being engaged by a coiled spring 44 which is seated at its bottom end in a recess 45 formed in the top of the plunger bearing cap 29.

The forward end 37 of the rocker arm 34 is provided with a depending section 46 which terminates in a horizontal front section 47, which is substantially rectangular in shape for slidably supporting the hollow stop block 48 fitted around said section 47 and having a laterally-extending horizontal finger 49 which limits the amount the tubing T may be inserted through the chucking dies 12, 13.

The position of the block 48 on the horizontal rectangular section 47 may be accurately adjusted by means of a vernier screw 50 carried by the depending section 46 of the rocker arm 34, and having a knurled section to facilitate the manipulation thereof. The screw 50 has a reduced threaded end 50*a* which is fitted into a horizontal tapped hole 50*b* in the top of the stop block 48 (see Fig. 4).

Provision is also made of a small vertical locking plate 51 having a recess 52 fitting over a neck 53 on the vernier screw 50 for holding the latter in position. A horizontal screw 54 is provided for attaching the plate 51 to the depending end 46 of the rocker arm 34. The vernier screw 50 has an unthreaded rear cylindrical section 54*a* fitted within the depending section 46 of the rocker arm 34. A transverse set screw 55 is also provided in the stop block 48 for engaging the rectangular section 47 of the rocker arm 34.

In order to cause the stop block 48 to be lowered automatically out of the path of the punch 27 before it strikes the inner end of the tubing T, provision is made of a cam recess 57 in the top surface of the plunger 56, just behind the bearing 26.

The plunger 56 is connected by a coupling 58 to a piston rod 59 secured to a piston 60 which fits within a cylinder 61 located at the rear of the machine. The cylinder 61 is connected to the main housing 10 by means of a pair of holding screw bolts 62, 62, which are screwed into a flange 63 on the front of said cylinder 61. Compressed air or other fluid under pressure is admitted to the rear and front ends of the cylinder 61 by means of ports 64, 65, the fluid being under the control of a double four-way valve 66 having a pair of vertical plungers 67, 68 which are driven alternately up and down by the manipulation of an angular valve handle 69 loosely connected to said plungers, said handle being pivotally mounted upon a horizontal pin 70.

In order to protect the operator from accidental contact with the moving parts of the machine, provision is made of a semi-cylindrical guard 71 of any suitable transparent molded plastic material, said guard 71 being shown in open position by dotted lines in Fig. 3. Provision is also made of a pair of self-lubricating porous bronze bushings 72 (shown by dotted lines in Fig. 4) forming bearings for the vertical drawbars 16, 17, which are attached to the upper chucking die 13.

Operation

Assuming that the upper chucking die 13 is in raised position, the operator will first insert the tubing T between the dies 12, 13 until the end of said tubing strikes the stop block finger 49 which has previously been adjusted to the desired position on the rocker arm 34, by means of the vernier screw 50.

By rocking the control handle 69 forward or to the left, as shown in Fig. 3, fluid under pressure will be admitted to the top of the chuck-operating piston 22, and subsequently, after a short period of time, fluid will be admitted to the rear of the punch-operating piston 60. This will cause the upper chucking die 13 to be first firmly clamped against the tubing T, and the plunger 56 will thereafter be driven forward by the piston 60 to force the punch 27 against the end of the tubing to form a bead, flare, flange, etc., thereon, as desired. It will, of course, be understood that the stop lug finger 49, in the meantime, will have been forced downwardly by the engagement of the cam recess 57 on the plunger 56 with the roller 39 on the rear of the spring-pressed rocker arm 34.

To complete the cycle of operation, the control handle 69 will then be reversed, causing the punch to be withdrawn and thereafter opening the dies. The tubing T may then be removed manually from the end of the machine.

It will thus be seen that the present machine is extremely easy to operate because it is merely necessary for the operator to sit or stand in front of the machine and manually insert a tube through an opening in the side of the casing thereof until it engages the stop member, and to then operate the control handle, whereupon the chucking dies will be closed, and the forming

operation will thereafter be performed automatically.

One advantage of the present invention is that the stop block 48 may readily be adjusted on the end of the rocker arm by manipulating the vernier screw 50 so as to control the outside diameter of the bead or the shape of the flare, flange, etc., formed on the tubing with a high degree of accuracy.

A further advantage of the present invention is that all moving parts of the machine except the operating handle are enclosed by a protective casing, thereby making it entirely safe for the operator.

A further advantage is that the shaping or forming operation on the ends of tubing may be done with extreme ease, and moreover, the present machine will leave no score marks or dirt on the interior of the tubing for the reason that no tools touch the inside thereof.

A further advantage is that by flaring the ends of a tubing by this machine, there will be less reduction in gauge or hardening of the metal than occurred with former types of spinning or rolling machines now in common use.

A still further advantage is that when a bead is formed on a tube by the present machine, the gauge of the metal will actually be increased at the bead, resulting in greater strength at this point, which would not be possible with any known spinning or rolling process.

A further advantage is that it is possible with the present machine to produce a flare in which all waviness is eliminated.

While there have been disclosed in this specification two forms in which the invention may be embodied, it is to be understood that these forms are shown for the purpose of illustration only, and that the invention is not to be limited to the specific disclosures, but may be modified and embodied in various other forms without departing from its spirit. In short, the invention includes all the modifications and embodiments coming within the scope of the following claims.

Having thus fully described the invention what is claimed as new, and for which it is desired to secure Letters Patent, is:

1. In a machine for automatically forming a bead, flare, flange, etc., selectively, upon the end of a tubing capable of being cold worked, chucking means to clamp said tubing, a punch, a reciprocating plunger carrying said punch in alignment with said tubing, stop means to limit the position of the end of said tubing with respect to said chucking means prior to the movement of said punch-carrying plunger, means to adjust the longitudinal position of said stop means comprising a spring-pressed rocker arm located above the position of said plunger, a stop block carried on the forward end of said rocker arm and initially serving as an abutment for said tubing when it is manually inserted into said chucking means, and a roller on the rear end of said rocker arm, said plunger having a cam recess within which said roller is initially engaged, whereby the movement of said plunger will cause said roller to be lifted for swinging said rocker arm and depressing said stop block out of the path of said punch before said punch engages the end of said tubing.

2. In a machine for automatically forming the end of a tubing, means for chucking said tubing

before the forming operation, a punch-carrying plunger, a spring-pressed rocker arm located above said plunger and carrying a stop block on its forward end, said stop block serving as an abutment for the inward motion of said tubing when it is manually inserted into said chucking means, means to depress said stop block out of the path of the punch just before said punch engages the end of said tubing, said stop block being adjustably mounted on the forward end of said rocker arm, and a vernier screw connected to said rocker arm and adjustably engaging said stop block to accurately locate the initial position of said stop block to gauge the length of the tubing inserted through said chucking means.

3. In a machine for automatically forming a bead, flare, flange, etc., selectively, upon the end of a tubing, chucking means to clamp said tubing, a punch, a reciprocating plunger carrying said punch in alignment with said tubing, said machine having an upstanding bearing for the forward end of said plunger, stop means to limit the position of the end of said tubing with respect to said chucking means prior to the movement of said punch-carrying plunger comprising a spring-pressed rocker arm carried by said machine, said rocker arm being pivoted to said bearing on an axis transverse to said plunger and having a forward abutment engageable by said tubing when inserted into said chucking means, and means responsive to the movement of said plunger to swing said rocker arm and depress said abutment out of the path of said punch before it engages the end of said tubing.

4. In a machine for automatically forming a bead, flare, flange, etc., selectively, upon the end of a tubing, chucking means to clamp said tubing, a punch, a reciprocating plunger carrying said punch in alignment with said tubing, stop means to limit the position of the end of said tubing with respect to said chucking means prior to the movement of said punch-carrying plunger, said stop means comprising a spring-pressed rocker arm having a forward abutment engageable by said tubing when inserted into said chucking means, said rocker arm being pivotally carried by said machine on an axis transverse to and offset from said plunger, and means operatively connecting said rocker arm and said plunger for swinging said rocker arm to depress said abutment out of the path of said punch upon the forming movement of said plunger toward said tubing.

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