Feb. 12, 1952 R. I. HAHN ET AL 2,585,459

APPARATUS FOR SIZING TUBING

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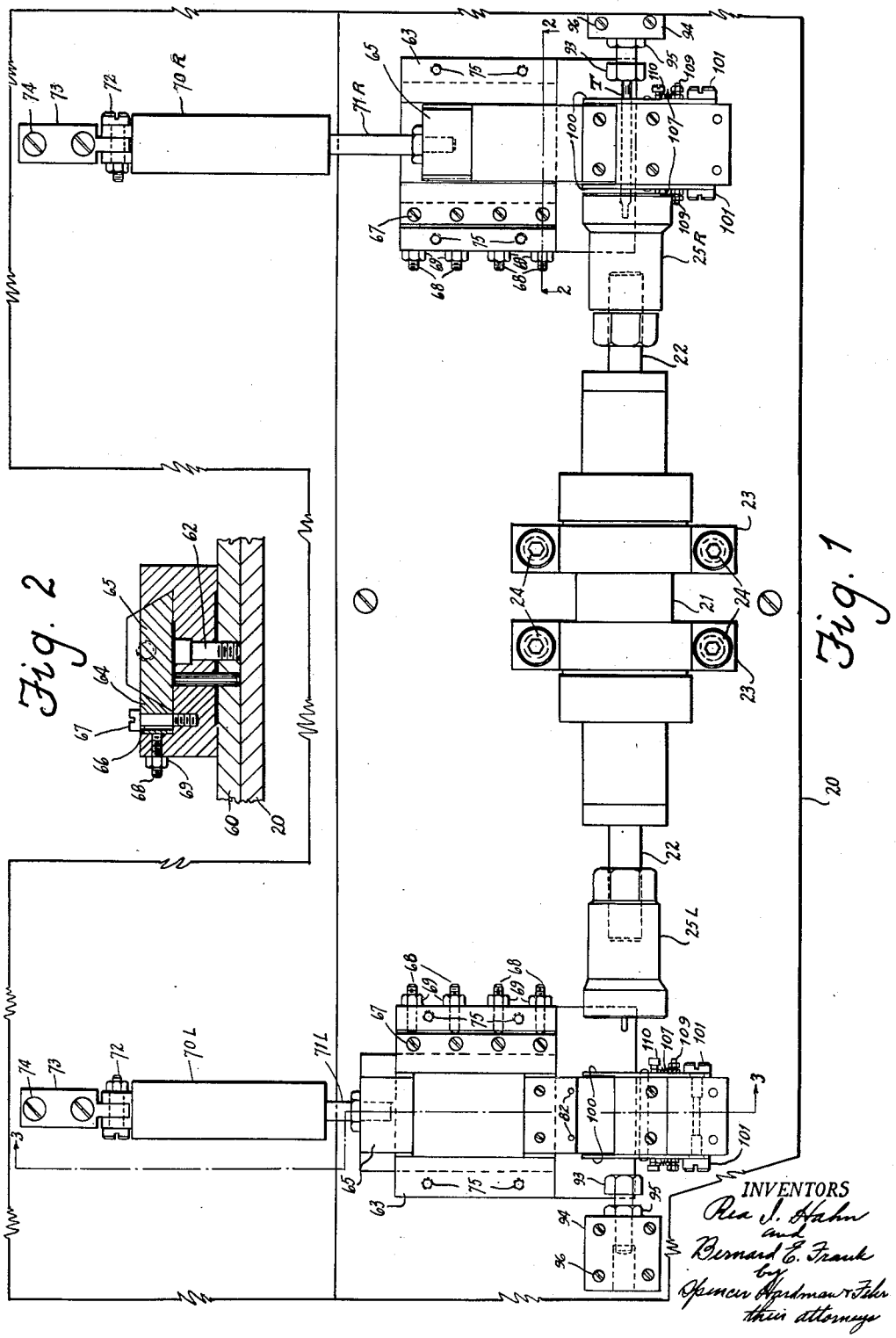


Fig. 1

Fig. 2

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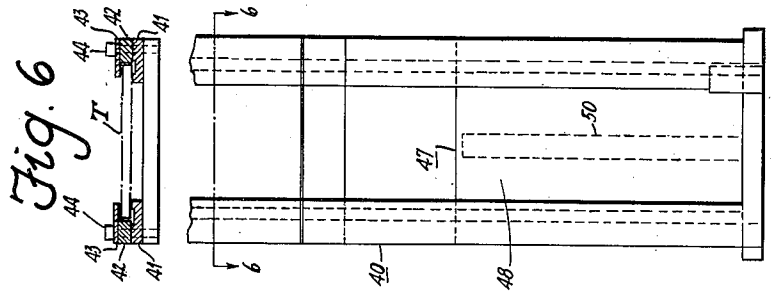


Fig. 6

Fig. 5

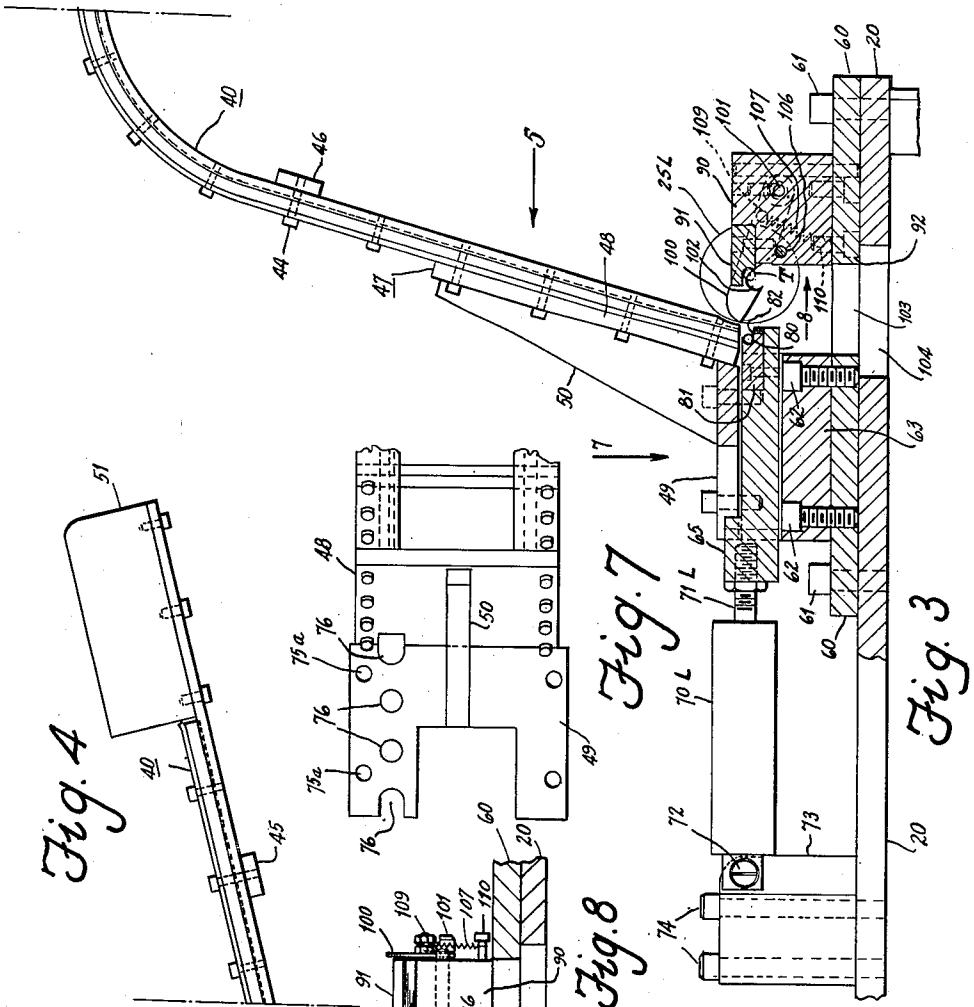


Fig. 3

Fig. 4

Fig. 7

Fig. 8

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APPARATUS FOR SIZING TUBING

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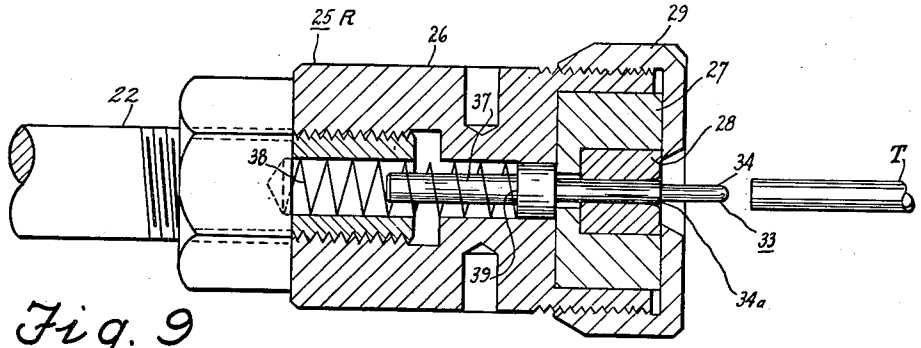


Fig. 9

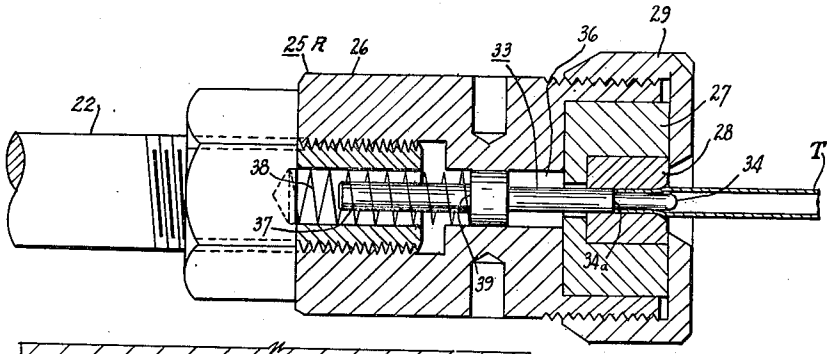


Fig 10

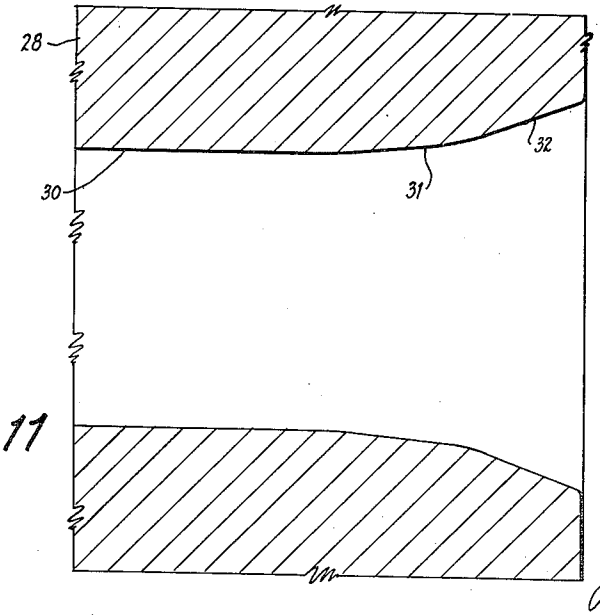


Fig. 11

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APPARATUS FOR SIZING TUBING

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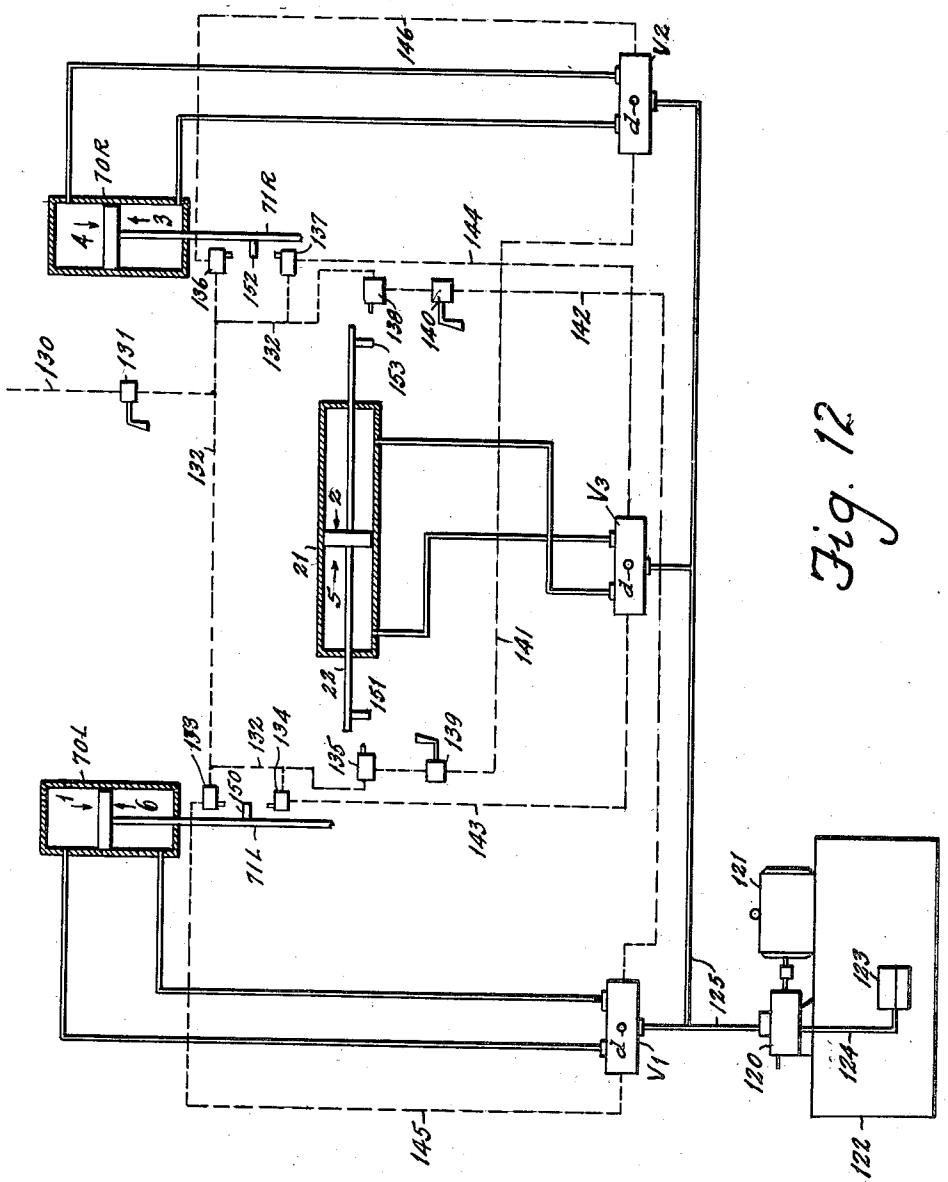


Fig. 12

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UNITED STATES PATENT OFFICE

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APPARATUS FOR SIZING TUBING

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Application October 30, 1948, Serial No. 57,483

3 Claims. (Cl. 153—10)

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This invention relates to the manufacture of tubing.

Its object is to provide apparatus for sizing the inside and outside diameter of an end portion of a piece of tubing.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a plan view of a duplex machine embodying the present invention. In Fig. 1 the magazines are omitted.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1.

Figs. 3 and 4 together show a side view of one of the magazines and a sectional view on line 3—3 of Fig. 1.

Fig. 5 is a fragmentary, side view of the magazines, looking in the direction of arrow 5 of Fig. 3.

Fig. 6 is a sectional view on the line 6—6 of Fig. 5.

Fig. 7 is a fragmentary, plan view of the magazines, looking in the direction of arrow 7 of Fig. 3.

Fig. 8 is a view in the direction of arrow 8 of Fig. 3.

Figs. 9 and 10 are longitudinal, sectional views of the sizing die in its holder in two different positions relative to the tubing.

Fig. 11 is an enlarged, fragmentary, longitudinal, sectional view of a sizing die.

Fig. 12 is an hydraulic diagram.

A base 20 supports a cylinder 21 containing a piston attached to a rod 22. Brackets 23 and screws 24 secure the cylinder to the base. The rod is connected with sizing die units 25L and 25R, each of which comprises a shell 26 (Fig. 9) threadedly connected with the rod 21 and supporting a block 27 which supports the sizing die 28, said parts 27 and 28 being retained by a cap 29. As shown in Figs. 10 and 11, the die 28 has a cylindrical wall 30 merging with a slightly tapered wall 31, which merges with a wall 32 of greater taper. The wall 30 receives a pin 33 having a portion 34 of lesser diameter which determines the inside of the tubing which is swaged by the die 28 against the portion 34. Pin 33 has a larger diameter which slides in the bore 36 of shell 26 and a portion 37 surrounded by a spring 39 which, as shown in Fig. 9, is located between the rod 21 and a shoulder of pin 33 and normally urges the pin into the position shown in Fig. 9 so that the portion 34 extends beyond

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the cap 29. While the tubing T remains fixed, the unit 25R (Fig. 9) moves from the position shown in Fig. 9 to that shown in Fig. 10. During this movement, the shoulder 34*a* of pin 33 first engages the tubing and rod 33 stops moving toward the right. As the die 28 moves toward the right, its surfaces 32 and 31 successively engage the tubing and cause it to be squeezed around the portion 34, as shown in Fig. 10, thereby sizing the inside and outside diameters of that portion of the tubing between the portion 34 and the cylindrical wall 30 of die 28. During motion of unit 25R from the position shown in Fig. 10 to that shown in Fig. 9, the die 28 moves to the left relative to the pin 33 and the shoulder 34*a* scrapes from the die 28 any small particles of metal which came off from the tubing T during the swaging operation. The spring 39 restores the pin 33 to its normal position relative to the die 28.

The pieces of tubing which are operated upon are placed in a magazine 40 which comprises strips 41, 42 and 43 attached together by screws 44 thereby providing channels which receive the tubing, as represented by dot-dash lines in Fig. 6. These channels are held in spaced relation by bars 45 (Fig. 4), 46 (Fig. 3) and a frame 47 which has an inclined plate 48, a horizontal plate 49 and a stiffening rib 50. At their upper ends, the plates 41 support plates 51 which serve as guides to direct tubing T into the channels provided by plates 41, 42 and 43.

Referring to Fig. 3, base 20 supports a plate 60 attached by screws 61. Screws 62 attach to plate 60 a guide block 63 which together with a gib 64, provides ways for guiding a slide 65. Gib 64 is provided with enlarged holes 66 for receiving screws 67 which, on being loosened, permit adjustment of the gib 64 by screws 68 secured in adjusted position by nuts 69. Slide 65 is connected with rod 71L connected with a piston, not shown, in a cylinder 70L pivotally supported by a screw 72 fastened to a bracket 73 which screws 74 attach to the plate 20. The block 63 has tapped holes 75 for receiving screws, not shown, which pass through holes 75*a* in bracket plate 49, thereby securing the magazine 40 to the block 63. In order that the head of screws 67 will be accessible without removing the bracket 49 from the block 63, the plate 49 is provided with openings 76.

While the slide 65 is in the position shown in Fig. 3, the lowermost tubing in the magazine descends into the notch 80 provided in a plate 81 attached to slide 65. The tubing is retained in the notch 80 by a sharp-edged insert plate 82

attached to plate 81. When the slide 65 moves right from the position shown in Fig. 3 (position of left slide 65, Fig. 1) to the position corresponding to that occupied by the right slide 65 (Fig. 1) the tubing T is carried to the position represented by dot-dash circle T (Fig. 3) which places it in alignment with the sizing unit 25L. In this position, the tubing T is clamped between the plate 81 and a plate 91 secured to a block 90 attached by screws 92 to plate 60. While the slide 65 is advanced to the block 90 (position of right slide 65, Fig. 1) the sizing unit 25L moves left to perform the swaging operation shown in Fig. 10. During the swaging operation, the tubing T engages a stop screw 93 supported by bracket 94 and secured in adjusted position by lock nut 95. Screws 96 attach bracket 94 to base 20. After the swaging operation performed on a piece of tubing on the left side of the machine as viewed in Fig. 1 and following the advancement of a piece of tubing at the right side of the machine into position for swaging, the piston rod 22 moves right to move the left unit 25L away from the left piece of tubing T and the right unit 25R against the right piece of tubing. Thereafter the left slide 65 returns to the position shown in Fig. 3 but the tubing does not move with it because it is caught by levers 100 pivotally supported on screws 101 threaded into block 90 and provided with notches 102 which receive the tubing and prevent its movement with the slide 65 as the latter returns to receiving another piece of tubing from the magazine. After the plate 81 moves from under the tubing, the tubing gravitates through the openings 103 and 104 in plate 60 and base 20 respectively. The levers 100 are normally located against pins 106 by springs 107 which, as shown in Fig. 8, connect studs 109 on levers 100 with studs 110 attached to block 90.

Referring to Fig. 12, the pistons in the cylinders 70L and 70R and 21 are operated hydraulically by pressure fluid which a pump 120 operated by motor 121 draws from a tank 122 through a filter 123 and an inlet pipe 124 and forces it through pipe 125 to the inlets of valves V1, V2 and V3, each having a discharge or a drain pipe *d* connected with the tank by pipes not shown. Each of the valves are connected with a cylinder by two pipes and are controlled by compressed air which passes through circuits represented by dash lines. The inlet 130 is connected by manually controlled valve 131 with line 132 connected with valves 133, 134, 135, 136, 137 and 138. Valves 135 and 138 are connected with two manually controlled valves 139 and 140, respectively, connected with pipes 141 and 142, respectively, connected with air cylinders in the left end and right end, respectively, of valves V2 and V1. Valves 134 and 137 are connected by pipes 143 and 144, respectively, with air cylinders in the left end and right end, respectively, of valve V3. Valves 133 and 136, respectively, are connected by pipes 145 and 146, respectively, with air cylinders in the left end and right end, respectively, of valves V1 and V2.

Assume that the cycle starts with a forward movement of piston rod 71L which is downward as viewed in Fig. 12, said movement being indicated by arrow 1. This movement of rod 71L effects feeding of stock toward the right as viewed in Fig. 3 and the clamping of it between the jaws 81 and 91. At the end of this movement of rod 71L, a lug 150, moving with that rod, operates valve 134 to cause pressure fluid to enter the left air cylinder of valve V3 and to condition this valve for passage of pressure fluid to the right end of cylinder 21 so that the rod 22 will move left as indicated by arrow 2. This movement of rod 22 effects the sizing operation on the piece of tubing at the left side of the machine; and, during this movement, a lug 151 moving with rod 22, operates on valve 135 to cause it to pass compressed air to the air cylinder in the left end of valve V2, thereby conditioning the said valve for passage of hydraulic fluid to the front end (lower in Fig. 12) of cylinder 70R to cause the rod 71R to move rearwardly (up in Fig. 12, as indicated by arrow 3); and, during this movement, a lug 152, moving with rod 71R, operates valve 136 to cause admission of compressed air to the air cylinder in the right end of valve V2 causing piston rod 71R to move downwardly as indicated by arrow 4 to effect the feeding and clamping of a piece of tubing at the right side of the machine and to cause the lug 152 to operate valve 137 to effect admission of compressed air to the right air cylinder of valve V3 which conditions the latter for passage of hydraulic fluid to the left end of cylinder 21, thereby causing rod 22 to move right as indicated by arrow 5 to effect the sizing operation of the tubing at the right side of the machine and to cause a lug 153, moving with the rod 22, to operate valve 138 to cause the admission of compressed air to the air cylinder in the right end of valve V1 which so conditions valve V1 that hydraulic fluid is admitted to the forward end (lower in Fig. 12) of cylinder 70L, thereby causing rod 71L to move up as indicated by arrow 6, to retract the tube clamping and feeding means preparatory to the next operation and to cause lug 150, moving with rod 71L, to operate valve 133 to effect admission of compressed air to the air cylinder in the left end of valve V1 which conditions it for admission of hydraulic fluid to the rear end (upper in Fig. 12) of cylinder 70L; and the cycle is repeated as before. The cycle can be stopped by closing valve 131 and it will be resumed again when valve 131 is opened.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. Apparatus for sizing tubing comprising a sizing die unit comprising a shell, a die having a hole therethrough defined by a cylindrical wall merging with a conical wall flaring outwardly, a pin supported by the die and movable therewith, said pin having a cylindrical portion fitting within the cylindrical wall portion of the die, said cylindrical portion terminating at an annular shoulder, said pin having a cylindrical portion of smaller diameter extending from the annular shoulder, the largest inside diameter of the conical wall portion being greater than the outside diameter of the tubing, the inside diameter of the cylindrical wall portion being less than the outside diameter of the tubing and the diameter of the second cylindrical portion of the pin being less than the inside diameter of the tubing, a spring engaging the pin and normally maintaining the pin in a position such that the shoulder of the pin is located adjacent to the face of the die and the portion of smaller diameter is in the front of the die, means for supporting the tubing in alignment with the pin, and means for effecting relative axial movement in one direction between the die unit and the tubing to cause engagement of the end of the tubing first with the annual shoulder of the pin and then relative

axial movement between the pin and tubing together and the die, whereby the tubing is swaged between the cylindrical wall portion of the die and the second cylindrical portion of the pin, and for effecting relative axial movement in the opposite direction between the die unit and the tubing to effect release of the tubing from the die and to permit the return of the pin to normal position by said spring, said annular shoulder then operating to scrape from the die metal particles which had been dislodged from the tubing during the swaging operation.

2. Apparatus for sizing tubing comprising an hydraulic servo having a horizontal cylinder, a piston and a piston rod extending through the cylinder, sizing dies attached, respectively, to the ends of the rod, devices for clamping pieces of tubing in alignment with the dies, each device comprising a fixed jaw and a jaw movable into clamping position from a loading position, stops respectively for engaging ends of the tubing remote from the sizing dies when the tubing is clamped in alignment therewith, two magazines, each adapted to contain a stack of horizontally disposed pieces of tubing and each disposed adjacent a loading position so that the lowermost piece of tubing is received by the movable jaw when in its loading position, hydraulic servos each including cylinders and pistons connected with a movable jaw, a pressure fluid source, valves connected with the source for distribution of pressure fluid to the ends of the cylinders, and means under control by the servo pistons for controlling the valves to effect in sequence the feeding of a piece of tubing from one magazine and the clamping and sizing thereof and the feeding of a piece of tubing from the other magazine and the clamping and sizing thereof.

3. Apparatus for sizing tubing comprising a magazine for containing a stack of horizontally disposed pieces of tubing, a horizontally movable sizing die, means for clamping a piece of tubing in alignment with the die and comprising a fixed jaw and a second jaw movable from a position under the stack in the magazine where said movable jaw can receive the lowermost piece of tubing in the stack to a position to clamp the piece of tubing between itself and the fixed jaw, a pivotally supported lever having its free end portion located for engagement by the piece of tubing as it is moved by the movable jaw from the magazine to the fixed jaw, said lever being engaged by the piece of tubing during the movement of said tubing to the clamping position so that the lever is cammed upwardly and having a notch on its lower edge which hooks over the tubing when the latter is clamped between the clamping jaws, said notch preventing movement of the tubing with the movable jaw when the latter is retracted, means for retracting the movable jaw when the sizing operation is completed to permit the tubing to drop from its position engaging the notch and fixed jaw, and a stop for engaging the end of the tubing remote from the sizing die.

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