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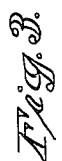
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TUBE EXTRUSION APPARATUS

Filed July 15, 1942

2 Sheets-Sheet 1



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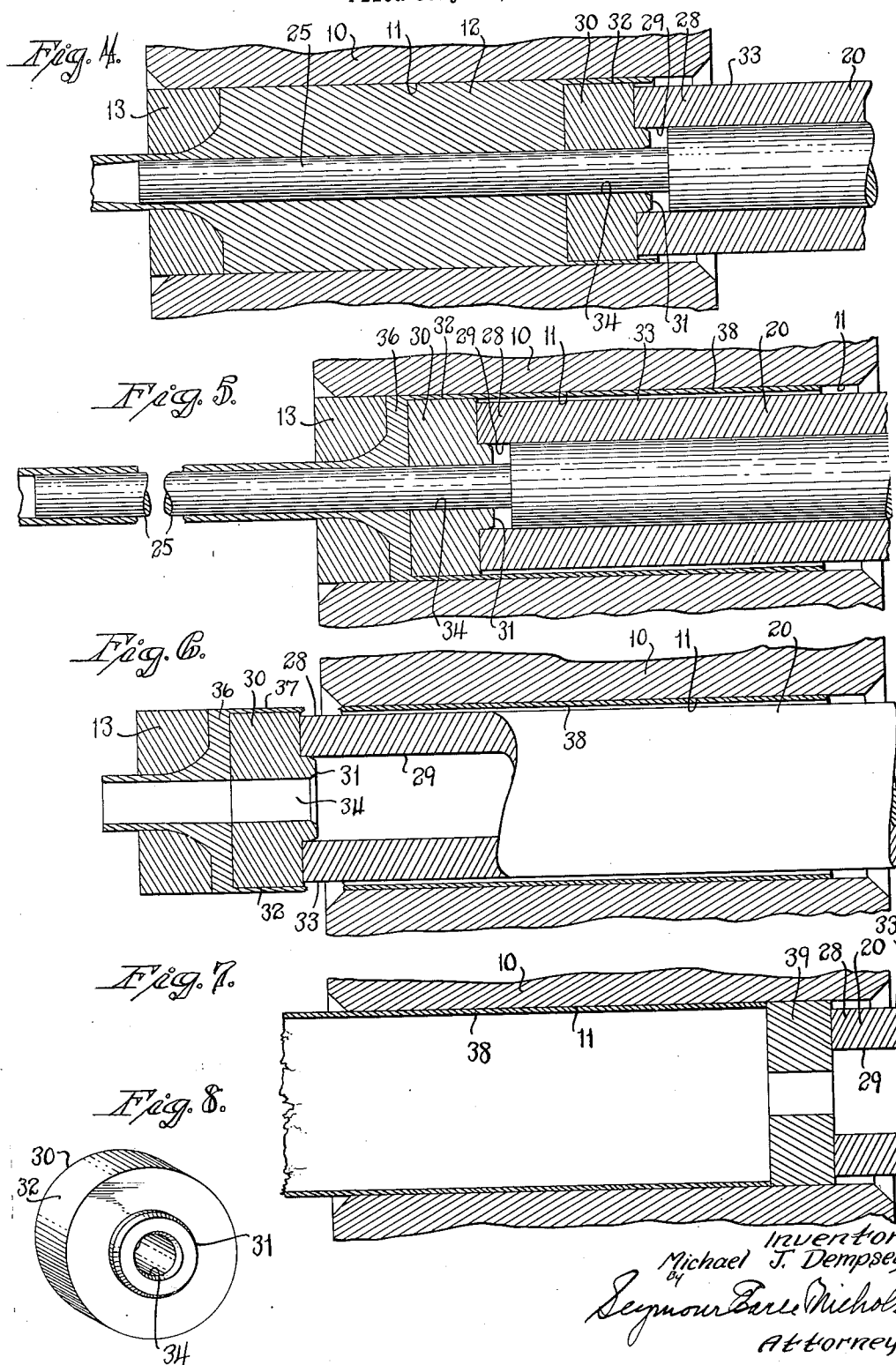
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UNITED STATES PATENT OFFICE

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TUBE-EXTRUSION APPARATUS

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1 Claim. (Cl. 207—3)

This invention relates to improvements in tube-extrusion apparatus.

One object of this invention is to extrude tubes having an external surface uniformly free from defects.

Another object of this invention is to extrude tubes of uniform or concentric wall thickness.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings forming part of the present disclosure, in which one way of carrying out the invention is shown for illustrative purposes:

Fig. 1 is a schematic longitudinal central sectional view of a tube-extrusion apparatus made in accordance with the present invention;

Fig. 2 is an enlarged longitudinal central sectional view of a portion of the apparatus shown in Fig. 1, with certain of the parts in a different position;

Fig. 3 is a view similar to Fig. 2 with the billet in partly extruded condition;

Fig. 4 is a view similar to Fig. 3 after the billet has been pierced;

Fig. 5 is a view similar to Fig. 4 after the billet has been extruded into a tube;

Fig. 6 is a view similar to Fig. 5 showing the pressure-plate, billet-remnant or butt and die being forced out of the container;

Fig. 7 is a view similar to Fig. 6 showing the sleeve-remnant which resulted from the extrusion of the billet, being forced out of the container; and

Fig. 8 is a perspective view of the pressure-block.

Referring to the drawings, a container 10 has a hole 11 therethrough in which is adapted to be placed a heated billet of metal 12 that is to be extruded. An extrusion-die 13 is held in one end of the container 10 by means of a die-holder 14 releasably locked in place by a U-shaped locking-wedge 15 which is supported against a crosshead or block 16. When the locking-wedge 15 is moved transversely upward by means of the rod 17 actuated by any suitable power-means (not shown), the die-holder 14 which is carried by an arm 18 connected to suitable power-means (not shown), is adapted to be withdrawn through the hole or opening 19 in the crosshead or block 16.

An extrusion-ram 20 is secured to a main piston 21 mounted in a hydraulic cylinder 22, and is adapted to be forced by fluid pressure in the cyl-

inder 22 into the hole 11 of the container 10, and to be moved in the reverse direction by means of the pull-back hydraulic cylinders 23 and pistons 24. The extrusion-ram 20 has a hole longitudinally therethrough to contain a piercing-mandrel 25 operable in opposite longitudinal directions by means of the hydraulic cylinder 26 and piston 27. The outer or forward end-portion 28 of the extrusion-ram 20 has its outside diameter substantially smaller than the diameter of the hole 11 in the container 10 and has the outer end-portion 29 of its longitudinal hole concentric with its outer surface.

A pressure-plate 30 whose outside diameter is substantially less than the diameter of the hole 11 of the container 10 has an annular flange 31 having a free sliding fit in the hole-portion 29 so as to maintain the outer surface 32 of the pressure-plate 30 concentric with the outer surface 33 of the extrusion-ram 20. The extrusion-ram 20 is so mounted as to be capable of movement in and out of the hole 11 of the container 10 while being maintained concentric with the hole 11 and therefore the outer surface 32 of the pressure-plate 30 will also be maintained concentric with the hole 11 in the container 10. The pressure-plate 30 has a hole 34 through which the piercing-mandrel 25 is freely slidable so as to maintain the piercing-mandrel also concentric with the hole 11 of the container 10.

Assuming the apparatus to be in operable position and a heated billet 12 placed in the hole 11 of the container 10 ready for extrusion, a pressure-plate 30 is raised preferably by any suitable power-means 35 to a position in line with the hole 11 of the container 10, whereupon the extrusion-ram 20 and piercing-mandrel 25 are moved forward to engage the pressure-plate 30 and move it into the hole 11 of the container 10 to a position shown, for example, in Fig. 2, ready for the start of the actual extrusion operation. The extrusion-ram 20 and piercing-mandrel 25 move forward to the position shown in Fig. 3 where the billet 12 is initially extruded to a small extent as shown in Fig. 3. Now with the extrusion-ram 20 and pressure-plate 30 remaining stationary, the piercing-mandrel 25 is moved forward to the position shown in Fig. 4, to pierce the billet 12 and start the extrusion of a portion of a tube. Next, the extrusion-ram 20 and piercing-mandrel 25 move forward to the end of their stroke position shown in Fig. 5, which completes the extrusion of the billet into a tube. The locking-wedge 15 thereupon is moved to unlocked position and the die-holder 14 is retracted within the opening 19

away from the die 13. After the extruded tube has been severed from the butt or remnant 36 of the ingot 12 by any suitable means, the extrusion-ram 20 is forced forward and tears the sleeve-portion 37 from the main sleeve-portion 38 which remains tightly jammed in the hole 11 of the container 10, and pushes the pressure-plate 30, the butt or remnant 36 and the die 13 out of the hole 11 of the container 10. The extrusion-ram and piercing-mandrel are thereupon withdrawn out of the hole 11 of the container 10 and a stripper-block 39 which slidably fits in the hole 11 of the container 10 is placed in position as shown in Fig. 7 and the end of the extrusion-ram is forced against the stripper-block 39 to cause it to force the sleeve 38 out of the hole 11 of the container 10, as illustrated in Fig. 7.

Inasmuch as the outer surface of the pressure-plate 30 is held concentric with or uniformly spaced from the wall of the hole 11 of the container 10 by means of the extrusion-ram 20, and as the outer or forward end of the piercing-mandrel 25 has a sliding fit in the hole 34 of the pressure-plate 30, the piercing-end of the piercing-mandrel will also be guided in a concentric relation with the wall of the hole 11 of the container 10. By virtue of these facts, sleeve-portion 37, 38 of waste metal which is stripped from the ingot during extrusion operation is of substantially uniform wall thickness with the consequence that the defects originally present in the outer surface of the billet are all substantially removed and remain behind in the sleeve-portion 37 and 38, so that the external surface of the finished tube will be substantially free from the defects which were present in the external surface of the billet. And inasmuch as the piercing-mandrel is maintained concentric with the hole 11 of the container 10, it is also maintained concentric with the hole of the die 13, thereby extruding a tube whose wall is of uniform thickness.

Instead of employing a single pressure-plate for carrying out operations of extruding a large number of tubes, it is preferable to employ a set of pressure-plates so that each pressure-plate only extrudes every sixth or eighth billet, thus helping to retain the heat treatment or temper of the pressure-plates and prevent them from being forged out of shape from overheating as a result of contact with the highly-heated billets. For similar reasons, the piercing-end portion of the piercing-mandrel is preferably de-

tachable by screw-thread connection or otherwise, so that other piercing-ends can be substituted.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claim are intended to be embraced therein.

I claim:

1 Tube-extrusion apparatus including: a container having a hole therethrough; a die adjacent one end of the container and having a hole therethrough leading outwardly from the container-hole; an extrusion-ram whose outer end-portion is substantially smaller than the container-hole, the ram being mounted for movement of its said outer end-portion in and out of the other end of the container-hole and substantially concentric thereof, and the said ram having a central longitudinal hole extending inwardly from its outer end and providing an inner peripheral surface which is substantially concentric with the outer peripheral surface of the outer end-portion of the ram; a piercing-mandrel carrier mounted for longitudinal movement in said longitudinal hole and carrying at its forward end, a piercing-mandrel of substantially smaller diameter than the diameter of said inner peripheral surface and piercing-mandrel carrier; and a pressure-plate substantially smaller than the container-hole and abutting against the outer end of said extrusion-ram and having centering flange-means extending into the space between the said ram and the said piercing-mandrel, the outer peripheral surface of said centering flange-means removably fitting the said inner peripheral surface of said outer end-portion of said ram, and the said pressure-plate having a longitudinal hole therethrough substantially centric with the said outer peripheral surface of said centering flange-means and slidably fitting and guiding the said piercing-mandrel; and said pressure-plate and said outer end-portion of said ram being sufficiently smaller than said container-hole to cause a billet which is being extruded, to form a sleeve surrounding said pressure-plate and said outer end-portion of said ram.

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