Oct. 16, 1934. S. SMITH 1,977,327

PUSH BENCH DIE HOLDER

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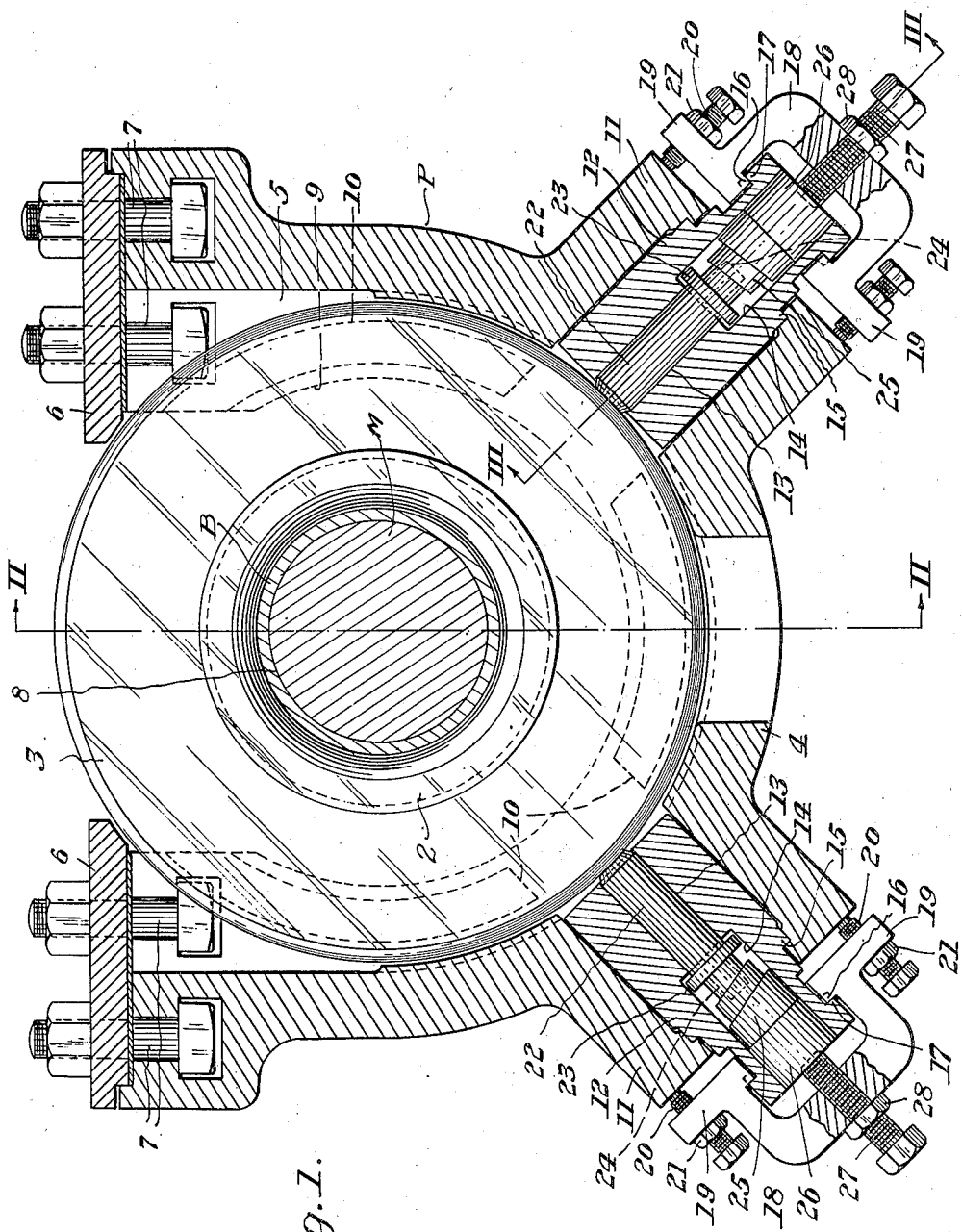


Fig. 1.

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Fig. 2.

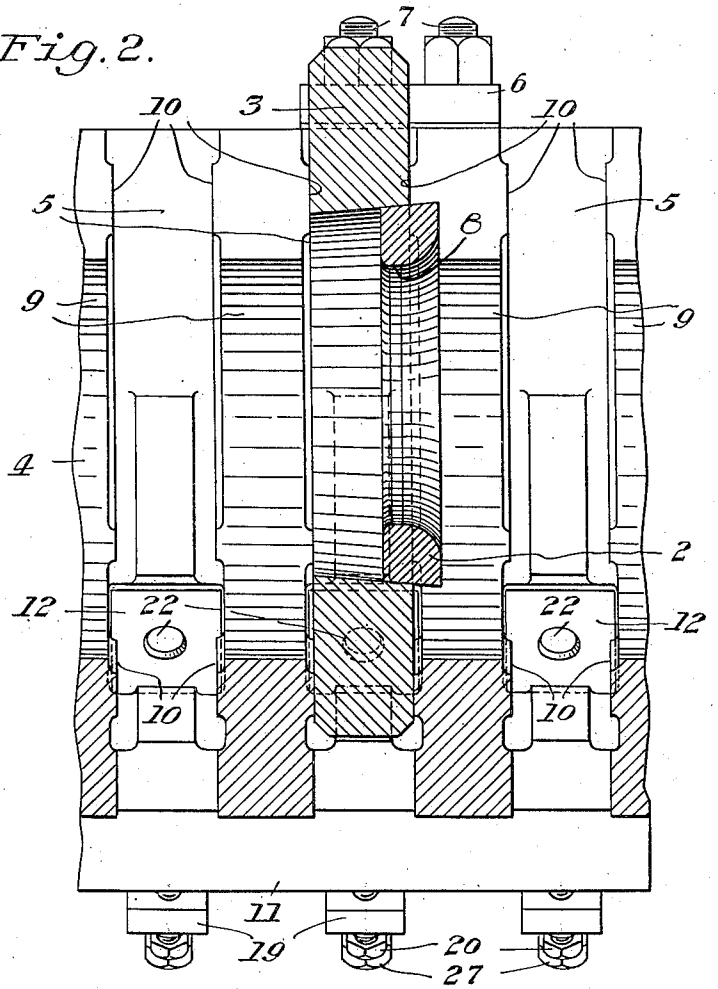
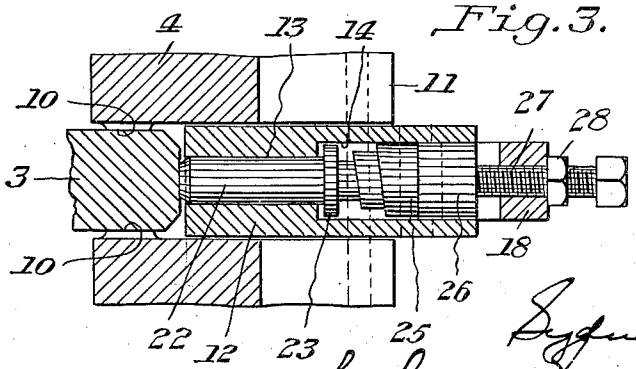


Fig. 3.



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PUSH BENCH DIE HOLDER

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Application October 11, 1932, Serial No. 637,362

10 Claims. (Cl. 205—7)

This invention relates to the manufacture of hollow articles by the push bench process. It relates more particularly to a method and apparatus for the push bench manufacture of hollow articles, including pipes, tubing, etc.

In the manufacture of hollow articles by the push bench process a previously formed blank or "bottle" open at one end and closed at the other is placed over the nose of a mandrel, and such mandrel and blank are pushed through a series of dies to thin and elongate the blank. High temperatures and pressures are attendant upon the operation, tending to warp the mandrel. Furthermore, the mandrels, if of any considerable length, are not perfectly rigid but are flexible to a certain extent, although every effort is made to reduce such flexibility to a minimum. The weight of the mandrel tends to cause its nose or foremost portion to sag. All of these factors have a tendency to cause the formation of eccentric tubes due to the fact that the mandrel and the respective dies through which it passes may not at all times be exactly coaxial. If the mandrel is warped it tends to more highly compress the metal against the dies on the convex side of the mandrel than on the concave side. The foremost portion of the mandrel due to its weight tends to more highly compress the metal below the mandrel than that above it.

The above mentioned disadvantages of the push bench process may to a great extent be obviated by arranging the dies to automatically center themselves with respect to the mandrel and blank. For example, the dies may be floatingly supported so that when the mandrel and blank pass therethrough the dies may move transversely of the axis of the mandrel to equalize the pressure about the blank. The dies may be resiliently supported and may normally be resiliently positioned generally coaxially with the mandrel to facilitate entry of the mandrel and blank thereinto and may be made free to float transversely of the mandrel although maintained against substantial movement in the direction of the axis of the mandrel. By such provision hollow articles whose wall thickness is substantially the same circumferentially may be formed.

Other objects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings I have shown a present preferred embodiment of the invention, in which

Figure 1 is a vertical transverse cross-sectional view through a push bench;

Figure 2 is a fragmentary vertical longitudinal cross-sectional view taken on the line II—II of Figure 1 but with the mandrel and blank omitted for the sake of clearness; and

Figure 3 is a fragmentary cross-sectional view taken on the line III—III of Figure 1.

Referring more particularly to the drawings, there is provided a push bench P having a mandrel M and a plurality of dies with which the mandrel is adapted to cooperate in the formation of hollow articles. One of the dies is shown at 2. It is mounted in a die holder or ring 3 and to all intents and purposes the die 2 and the holder or ring 3 may be considered as being integral. In the specification and claims the word "die" is not limited to the die 2 alone but also, unless plainly otherwise used, comprehends the die holder or ring 3.

The push bench also comprises a ring bed designated generally by reference numeral 4 and which is provided with a series of longitudinally spaced transverse slots or grooves 5. Each of such slots or grooves is of such thickness in a direction longitudinally of the push bench as to snugly and firmly receive one of the die holders 3 provided with a suitable die. The grooves are open at the top, as shown in Figure 1, permitting insertion and removal of the dies. Retaining plates 6 are provided at opposite sides of the push bench for preventing accidental removal of the die holders. The plates 6 are held in place on the ring bed by bolts 7.

The ring bed has a central opening 8 therethrough, and generally U-shaped inward projections 9 extend thereinto and define the longitudinal boundaries of the slots or grooves 5. The opposite sides of the projections 9 are spaced apart at the top a sufficient distance to enable insertion and withdrawal of a die of any appropriate size. The projections 9 are provided on their opposite longitudinal faces with outwardly projecting bearing portions 10 which serve to properly position the die holders and maintain the same in place longitudinally of the push bench.

Each of the slots 5 is substantially larger transversely of the push bench than the die holder adapted to be inserted thereinto so that such die holder may be free to move substantially in any transverse direction. By this provision the dies are free to automatically position themselves coaxially with the mandrel and the blank B as the mandrel and blank pass therethrough, the pressure on the blank being equalized circumferen-

tially thereof. If the mandrel is perfectly straight and its nose does not sag there will be no occasion for movement of the die, but in the event that the mandrel becomes warped or out of shape the die will move transversely of the axis of the mandrel to automatically center itself, as above mentioned. The plates 6 are not clamped down tightly against the die holders, but substantial clearance is left to permit vertical movement of the die holders and dies within the slots 5. Thus the die holders and dies are free to move at any angle and to any extent required during the operation. Of course the transverse edges of the slots and the plates 6 limit the transverse movement of the dies, but the parts may be so designed and proportioned as to permit of a desired amplitude of movement.

The construction above described forms in itself a complete operative device, but it is preferred to provide means for normally holding the dies substantially centrally of the push bench and so as to be coaxial with the mandrel if the latter is perfectly straight and does not sag. To this end the ring bed is provided with oppositely positioned downwardly and outwardly extending hollow projections 11 in each of which is mounted a block 12, the parts being so constructed and arranged that a pair of blocks 12 are positioned opposite each other with their centers substantially in a vertical plane passing through the center of each slot 5. Each block 12 is axially bored, having a relatively small bore 13 at its forward portion and a relatively large bore 14 at its rearward portion. The diameter of the forward portion of each of the blocks 12 is greater than that of the rearward portion and an annular shoulder 15 is formed thereon adapted to abut against a corresponding shoulder formed on the corresponding projection 11 of the ring bed whereby to hold the block against downward and outward movement.

Each block 13 is also provided with a shoulder 16 facing opposite the shoulder 15 and with which cooperates a shoulder 17 of a clamp 18. Each clamp 18 has outwardly extending arms 19 in each of which is threaded a set screw 20 provided with a lock nut 21. The respective screws 20 are turned clockwise until their noses engage the lower extremities of the respective projections 11 and are then tightened and locked to positively maintain the respective blocks 12 in the position shown in Figure 1.

Mounted within each of the blocks 12 is a pin 22 having an enlarged head 23. The body of the pin is positioned within the bore 13, the head being positioned within the bore 14. A reduced extension 24 extends from the head 23 of each of the pins. Each pin is of such length that its nose may project a substantial distance inwardly of the extremity of the corresponding block 13 for a purpose to be presently described. A convolute spring 25 is provided within each bore 14 and a plug 26 slidable in each bore 14 is also provided to bias the corresponding spring 25. Each spring is biased between the corresponding plug 26 and pin 22, being centered with respect to the pin by the projection 24.

Each clamp 18 is provided substantially centrally with an adjusting screw 27 whose nose engages the corresponding plug 26. By adjustment of the screw 27 the corresponding plug 26 may be positioned as desired, thus controlling the tension of the corresponding convolute spring 25. A lock nut 28 is provided for each adjusting screw 27.

The noses of the respective pins 22 project into the central opening in the ring bed and serve to resiliently support the respective dies. The respective springs are preferably adjusted so that when each die holder and die is put in place the same will be supported substantially centrally of the longitudinal opening in the ring bed and generally coaxially with the mandrel. This will facilitate entry of the mandrel and blank into the die. During movement of the mandrel and blank through each die the die will be free to move in any direction transversely so as to center itself automatically with respect to the mandrel and die and equalize the pressure exerted on the blank circumferentially thereof.

While I have shown and described a present preferred embodiment of the invention, it is to be distinctly understood that the same is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims.

I claim:

1. A push bench comprising a mandrel, a die, a die support and resilient means associated with the die support whereby to permit movement of the die transversely of the axis of the mandrel.

2. A push bench comprising a mandrel, a die, resilient means for supporting the die for movement transversely of the axis of the mandrel, and means for supporting the die against substantial movement generally parallel to the axis of the mandrel.

3. A push bench comprising a mandrel, a die and a support for the die, said support comprising a slot of such width generally in the direction of the axis of the mandrel as to snugly receive the die in that direction, the support having resilient means associated therewith whereby to permit movement of the die transversely of the axis of the mandrel.

4. A push bench comprising a mandrel, a plurality of dies, supporting means for the dies, and resilient means associated with the supporting means whereby to permit movement of the dies transversely of the axis of the mandrel.

5. A push bench comprising a mandrel, a die, means for supporting the die in a position generally coaxial with the mandrel, and means permitting movement of the die transversely of the axis of the mandrel.

6. A push bench comprising a mandrel, a die and resilient means normally supporting the die in a position generally coaxial with the mandrel but permitting movement of the die transversely of the axis of the mandrel.

7. A push bench comprising a mandrel, a die and a plurality of resilient means supporting the die for movement transversely of the axis of the mandrel.

8. A push bench comprising a mandrel, a die, a plurality of supporting members for supporting the die, resilient means biasing said supporting members, and means for varying the effect of said resilient means.

9. A push bench comprising a mandrel, a die, supporting means for the die, and spring means biasing the supporting means.

10. A push bench comprising a mandrel and a spring-pressed floating die cooperating therewith for the formation of hollow articles.

SYDNEY SMITH.