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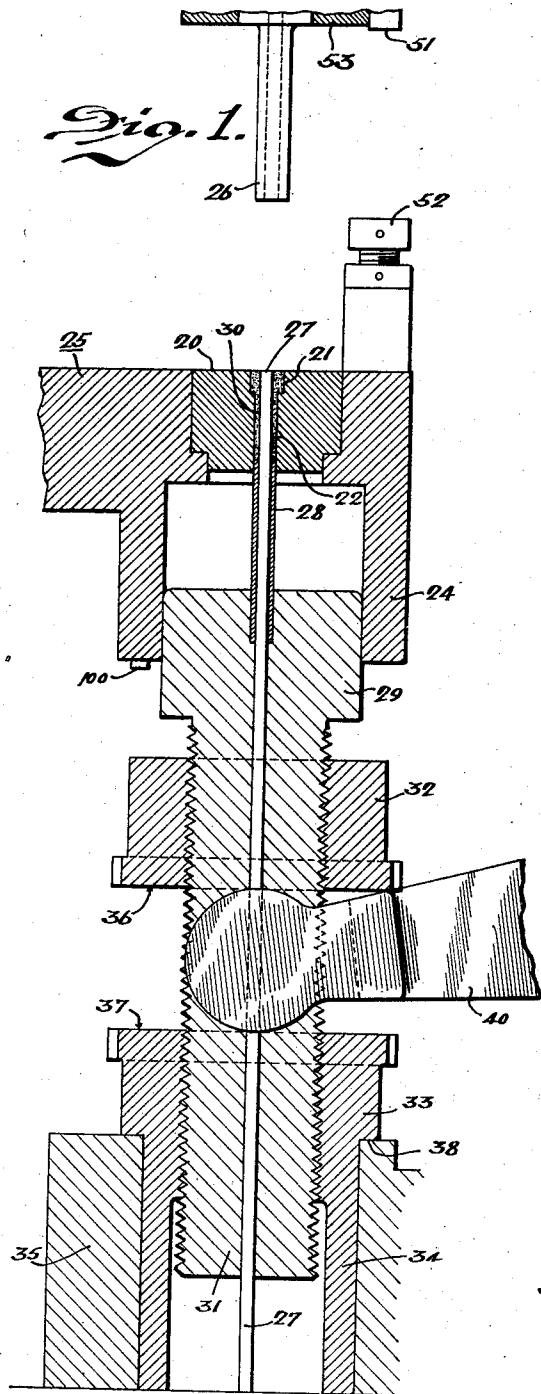
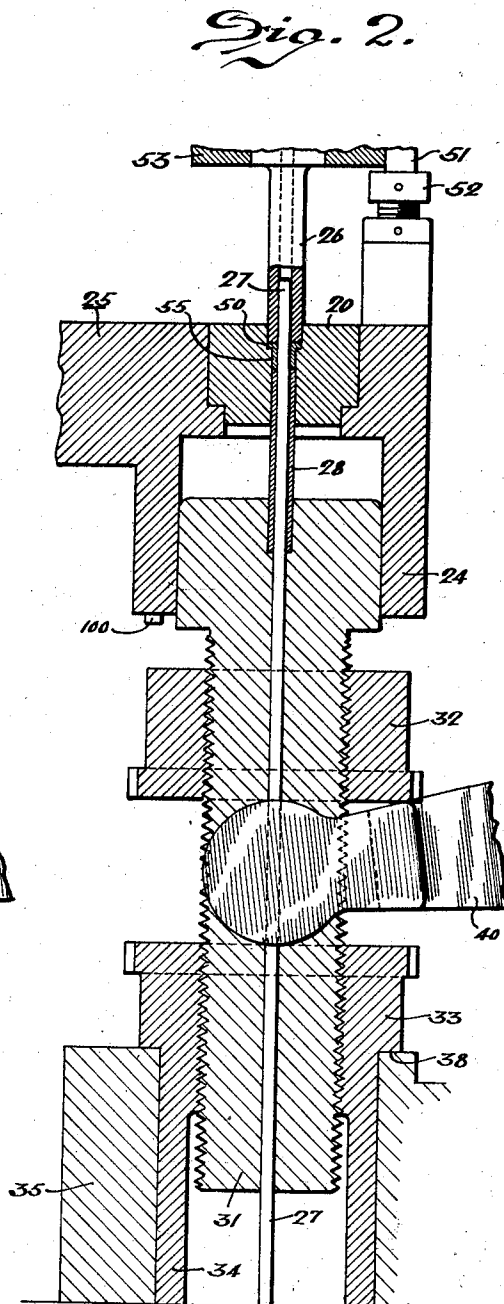
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1,820,235

BRIQUETTING MACHINE

Filed Feb. 15, 1929

4 Sheets-Sheet 1



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Fig. 3.

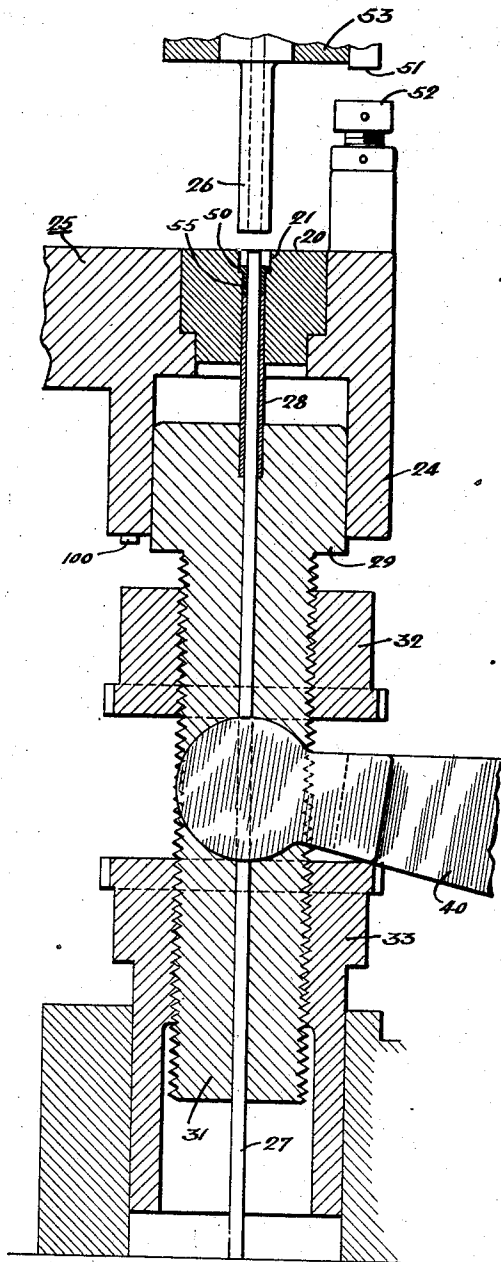
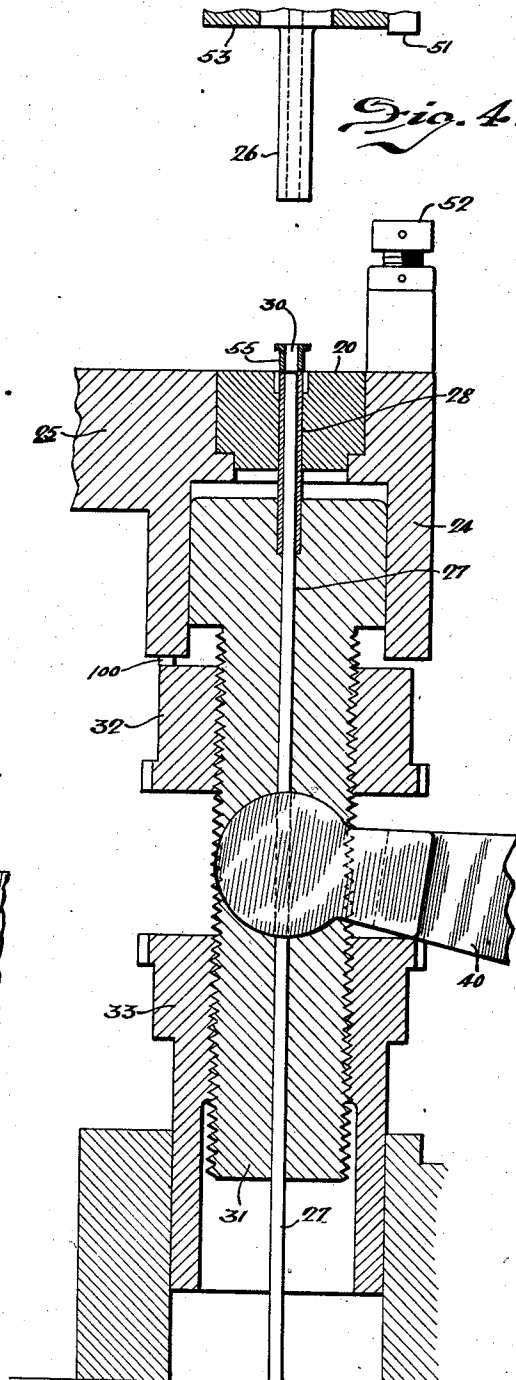


Fig. 4.



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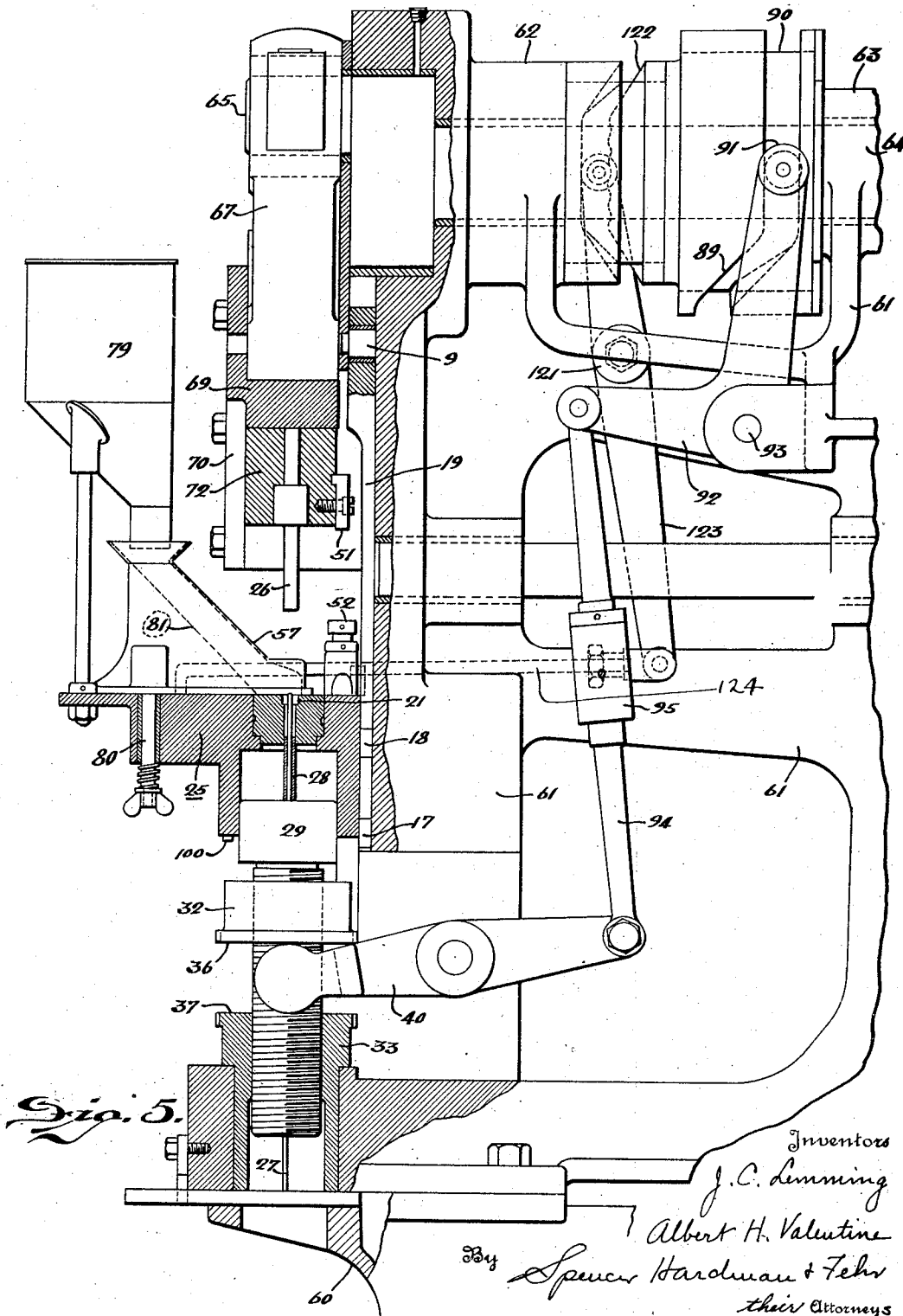
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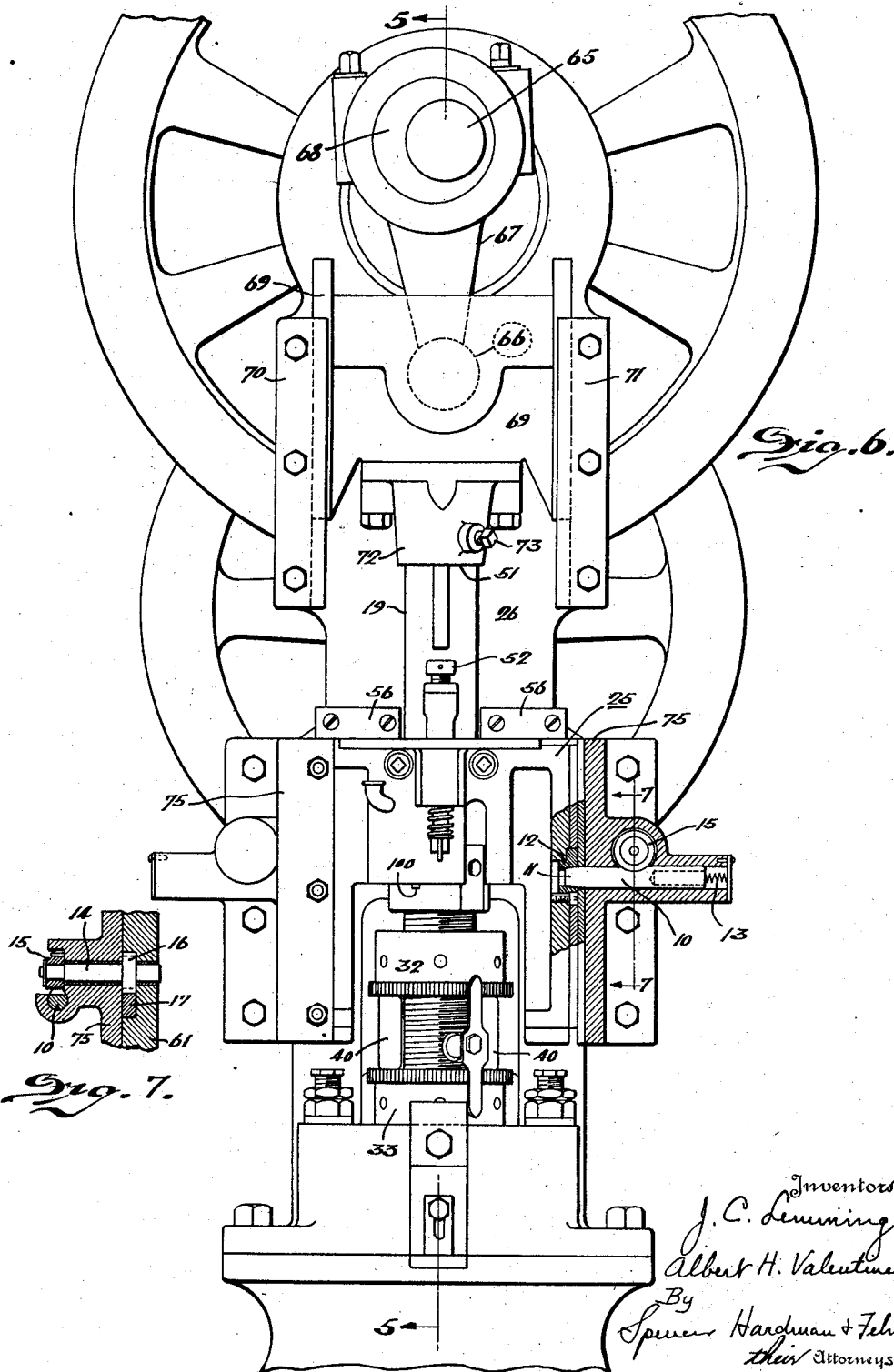
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BRIQUETTING MACHINE

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

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BRIQUETTING MACHINE

Application filed February 15, 1929. Serial No. 340,111.

This invention relates to a briquetting apparatus for highly compressing powdered metals or other finely divided materials into the form of a bushing having two portions of different diameters such, for instance, as a bushing having a radial external flange at one end thereof.

Patent No. 1,679,408 to J. H. Davis et al., August 7, 1928, discloses an apparatus for briquetting such bushings from a material of finely divided copper, tin and graphite or various other similar mixtures. In using this patented apparatus, difficulty has been experienced in maintaining to exact dimension the thickness of the flange portion of the bushing. This difficulty arises due to the fact that if there is a slight variation in the quantity or compressibility of the powdered material put into the molding die cavity, the distance the larger ram will travel into the larger bore of said cavity will vary to a corresponding extent and hence the flange thickness of the briquetted bushing will vary correspondingly.

Now the object of this invention is to provide a briquetting apparatus which will overcome the above described difficulty as well as to provide a simple and more positive mechanism in general for briquetting bushings similar to that described in said patent.

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 one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical section through the molding die cavity and illustrates the relative positions of the upper or larger ram, the molding die, and the lower or smaller ram at the beginning of the briquetting operation.

Fig. 2 is a similar vertical section, and illustrates the relative positions of the parts when the material being briquetted is under highest compression, that is, at the end of the down-stroke of the upper ram and before the lower ram has started to rise.

Fig. 3 illustrates the relative position of the parts after both the upper and lower

rams have started their up-strokes, the die being carried up to its initial position by the up-movement of the lower ram.

Fig. 4 illustrates the relative position of the parts when both upper and lower rams are at the top of their strokes, the die being in its normal or raised position, and the briquetted bushing having been ejected from the mold cavity by the lower ram.

Fig. 5 is a side view of the main portion of the machine, this view being partly in section on line 5—5 of Fig. 6.

Fig. 6 is a front end view of the machine with the hopper and funnel mechanism removed, but shows a portion in section to illustrate the bolt mechanism for positively holding the die table in its normal or raised position for a portion of the down-stroke of the upper ram.

Fig. 7 is a detail section on line 7—7 of Fig. 6 further illustrating the bolt mechanism for positively holding the die table in raised position until the upper ram has reached a predetermined position in the die cavity.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring to Figs. 1 to 4, numeral 20 designates the molding die having a larger bore 21 and a smaller bore 22 concentric therewith. Die 20 is rigidly fixed to and supported by the die table 25 which is held stationary only during the initial part of the down-stroke of the upper tubular ram 26 and is movable therewith for the latter part of said down-stroke, as will be clearly described hereafter.

A stationary solid rod or mandrel 27 fixed to the machine base extends upwardly through the center of bores 22 and 21 when the die table 25 is in its up-position (see Fig. 1) and hence forms the molding cavity lying between the bores 21 and 22, the rod 27, and the upper and lower tubular rams 26 and 28 respectively. The lower tubular ram 28 is shown at its lowest position in Figs. 1 and 2. Ram 28 is solidly fixed to a reciprocating head 29 having a large screw-threaded shank 31. Shank 31 has two large

nuts 32 and 33 fixed in spaced relation thereupon. The lower nut 33 has a depending skirt 34 which is suitably guided in its vertical reciprocation by the guide bearing 35 which is a stationary part of the machine.

The opposed faces 36 and 37 of the spaced nuts 32 and 33 respectively form cam surfaces which are engaged by the bifurcated lever 40, which upon being actuated as hereinafter described will vertically reciprocate the large screw 31 and hence also the lower ram 28. Head 29 of large screw 31 is suitably guided by the guide bearing 24 depending from die table 25. The central stationary rod 27 is fixed at its lower end to a stationary part of the machine (not shown) and has an easy sliding fit in an axial aperture through the large screws 31 and a snug sliding fit within the tubular rams 28 and 26.

The operation of the parts shown in Figs. 1 to 4 will now be described. When the parts are in position as shown in Fig. 1, the molding cavity 30 is filled level full with the comminuted mixture of metals and other ingredients which are used to form the briquetted bushing. Then while the die table 24 and the lower ram 28 remain stationary and are solidly supported, the upper ram 26 is caused to descend until its lower end enters bore 21 of the die cavity to an exactly predetermined desired distance and so compresses the material within the bore 21 to form a flange 50 on the bushing of the exact predetermined thickness desired. At this point in the down-stroke of ram 26, a stop 51 fixed to the head 53 of ram 26 strikes an adjustable stop 52 fixed to the die table 25 and then further down-movement of ram 26 carries the entire table 25 together with the die 20 rigid therewith downward while the lower ram 28 still remains stationary. This movement of course maintains the flange 50 of the bushing being formed at a constant predetermined thickness while the material in the lower portion of the mold cavity 30 is being highly compressed by the relative movement of the die 20 and ram 26 to the lower ram 28 (see Fig. 2). The die table 25 is solidly supported against down-movement by two opposed laterally movable bolts 10 (see Fig. 6) substantially up to the time when stop 51 engages stop 52. At this point the two bolts 10 are quickly withdrawn from engagement with table 25 by mechanism hereinafter described, whereupon table 25 is free to be forced down by the further down-movement of the ram 26 and its stop 51 fixed therewith. Thus the molding powdered material introduced into the cavity 30 will be compressed into a briquette having the form indicated at 55 in Fig. 2. The height of the briquetted bushing 55 will be about one-third of the height of the cavity 30 as shown in Fig. 1. The exact thickness of flange 50 thereof will of course be determined by the position of stop 52 which is shown to be adjustable to enable said thickness to be adjusted within certain limits to the exact dimension desired. The depth of bore 21 of the cavity 30 should be approximately three times the desired thickness of the flange 50 so that the briquetted bushing 55 will be substantially of the same density in its flange portion as in its body portion. If there is a small variation in the amount of powdered material with which cavity 30 is filled, it will cause a slight variation in the density of the briquetted bushing 55, but it will not cause any variation in the dimensions thereof since the thickness of flange 50 is determined by the engagement of stops 51 and 52 as above described and since the total length of the bushing is determined by the length of the stroke of the upper ram and the predetermined bottom position of the lower ram 28. The bottom position of the lower ram 28 may be adjusted exactly as desired by screwing the large nut 33 up or down on the large screw 31. The shoulder 38 on nut 33 rests upon the top of the fixed guide bearing 35 to solidly support the lower ram in its bottom position (see Figs. 1 and 2). Of course the bottom position of bifurcated lever 40 must be adjusted to correspond to that of the lower nut 33 and also the position of the upper nut 32 must be correspondingly adjusted for the proper spacing between the faces 36 and 37 of nuts 32 and 33.

Now after completion of the down-stroke of the upper ram head 53 as above described, it immediately moves up withdrawing the upper ram 26 from the bore 21 and the stop 51 from engagement with stop 52 in the die table 25, and simultaneously the lever 40 is actuated to raise the large screw 31 and lower ram head 29. (See Fig. 3). When the lower ram 28 is thus raised it bears upon the bottom of bushing 55, and since bushing 55 is ordinarily very tight within the cavity in die 20, the entire table 25 will be raised to its normal top position thereby. When table 25 strikes suitable fixed stops 56 (see Fig. 6) at its top position, the further up-movement of ram 28 will eject the briquetted bushing 55 from the die cavity 30 and beyond the upper end of the central stationary rod 27. (See Fig. 4). From this position bushing 55 may be easily pushed laterally from the machine by the cavity filling funnel member 57 (see Fig. 5) which moves across the top face of table 25 after each molding operation to register with and refill the cavity 30 with powdered material for the next operation. After ejecting the bushing 55, the lower ram 28 is returned to the position shown in Fig. 1 by the bifurcated lever 40. During down-movement of ram 28 the die table 25 is maintained locked in its top position by the inward movement of the lateral bolts 10 as shown in Fig. 6 by actuating mech-

anism hereinafter described. The briquetted bushings 55 are subsequently sintered in a non-oxidizing atmosphere and further treated to provide suitable bearing bushings, which subsequent treatment, however, forms no part of this present invention, but one such process is disclosed in Patent No. 1,556,658 to Harry M. Williams, issued Oct. 13, 1925.

One form of machine for supporting and operating the parts heretofore described will now be described, referring to Figs. 5, 6 and 7. This machine includes a base 60 which supports a vertically extending frame 61 providing bearings 62 and 63 for a power-driven shaft 64 carrying a crank pin 65. Crank pin 65 is connected with a cross-head pin 66 by means including a connecting rod 67. An adjustable eccentric bushing 68 connects the connecting rod 67 with crank pin 65. The pin 66 has a bearing within a cross-head 69 slidable between the crosshead guides 70 and 71 supported by the main frame 61. The lower end of the crosshead 69 supports a socket member 72 for receiving the upper tubular ram 26 which is fixed in position by a set screw 73. The abutment stop 51 is rigidly fixed to member 72 as clearly shown in Fig. 5.

The die table 25 is guided in its vertical movement by the lateral guides 75 which are supported upon the main frame 61. Each of the lateral guides 75 has mounted therein a spring pressed locking plunger or bolt 10 whose inner tapered end 11 fits very snugly into a corresponding tapered recess 12 in the side of the die table 25 when said die table is in its top position as shown in Fig. 6. The two bolts 10 are urged inwardly by the small coil compression springs 13. The bolts 10 are moved out of engagement with table 25 by the small shafts 14 mounted above each of the bolts 10 and each having a small pinion 15 which engages rack teeth on the top side of bolts 10 (see Figs. 6 and 7). Shafts 14 each have a second pinion 16 fixed thereon and located in line with and meshing with laterally reciprocable racks 17 which are supported upon suitable guide slots in the stationary frame 61 directly back behind the die table 25. These two aligned horizontal racks 17 have their inner ends spaced only a short distance apart and both in the path of the tapered cam 18 (see Fig. 5) at the lower end of the vertically reciprocating rod 19 whose upper end is supported at 9 to the crosshead 69. When the crosshead 69 descends, the cam rod 19 also descends and the cam 18 at its lower end engages the inner ends of both the racks 17 and projects them laterally in opposite directions, thus causing the two small shafts 14 to rotate in such direction as to quickly withdraw the bolts 10 from the sockets 12 in die table 25. The time of such withdrawal of bolts 10 is accurately

adjusted so as to occur just in time to permit the down-movement of die table 25 upon the engagement of stops 51 with the stop 52 as described above. After table 25 starts moving up and cam 18 has cleared the inner cam ends of racks 17, the two bolts 10 are urged by the coil springs 13 against the moving sides of the table 25 and so snap into their recesses 12 as soon as they register therewith and so solidly support table 25 in its top position until the next cycle of operation.

The lever 40 is actuated to move as above described by a driven cam 89 having a groove 90 which receives a roller 91 attached to a bell crank lever 92 which is pivoted at 93 upon frame 61. The levers 92 and 40 are connected by a link 94 including a turnbuckle 95 to permit of the proper adjustment of the bifurcated end of lever 40 with respect to the cam surfaces 36 and 37.

Metallic powders are introduced into the molding cavity 30 through a funnel member 57 which is pivotally supported at 80 upon the die table 25. This funnel member 57 has a passage 81 therein and is swung about pivot 80 into registration with the cavity bore 21 for filling the cavity at the proper time and is then swung laterally away to clear the path of the upper ram 26 upon its descent. The funnel member 57 is actuated by a cam 122 rotated by shaft 64, a lever 123 having a fixed pivot on the frame 61 at 121, and a link 124 in such a manner that the lower end of the passage 81 will be brought into registration with the die cavity 30 and then the entire member 57 will be given several rapid lateral shakes by the shape of the cam 122 in order that the molding powder within the hopper 79 and the funnel passage 81 will be discharged to fill the die cavity 30 level full as shown in Fig. 1. Then member 57 is swung about pivot pin 80 to clear the path of travel of the upper ram 26 as stated above. During the swinging movement of member 57 into registration with the cavity 30, the side surface of member 57 will engage the previously molded briquette 55 when in its ejected position shown in Fig. 4 and shove it laterally across the top of die table 25 into a suitably located receptacle.

In the above description of the operation of the main parts of this apparatus it was stated that ordinarily the up-movement of the lower ram 28 raised the die table 25 to its top position by its force against the bottom of the briquetted bushing 55 which is at that time pressed tightly within the die cavity 30. If this frictional hold of bushing 55 upon the die is insufficient to raise the die table 25, or if the machine is operated without filling the die cavity with material, the top surface of nut 32 upon the up-stroke of the lower ram will engage the lug 100 on the bottom of the die table 25 and thus lift the die table to its top position (as shown in Fig. 4) where

it will be retained by the inward movement of the lateral bolts 10 as hereinabove described. The stop 100 should be so adjusted that die table 25 will be lifted by the nut 32 exactly to its top position and no further, since after bolts 10 snap into the tapered recesses 12 in the die table there can be no further up-movement of the table without breakage of some part.

10 While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

15 What is claimed is as follows:

1. Molding apparatus for briquetting a flanged end bushing, comprising: a reciprocatable die having a mold cavity provided by two bores of different diameters, a stationary
20 central mandrel projecting through said mold cavity, larger and smaller tubular rams received respectively by the bores at opposite ends of said mold cavity and having a sliding fit upon said central mandrel, means for
25 filling said cavity with material, means for forcing said larger ram into said larger bore a predetermined distance to form the bushing flange of the desired thickness, means for then holding said larger ram and die in
30 positively fixed relation and causing relative movement thereof with respect to said smaller ram to complete the briquetting operation, means for withdrawing said larger ram, and means for moving said smaller ram relative to
35 said die to eject the briquetted bushing.

2. Molding apparatus for briquetting a flanged end bushing, comprising: a reciprocatable die having a mold cavity provided by two bores of different diameters, a stationary
40 central mandrel projecting through said mold cavity, larger and smaller tubular rams received respectively by the bores at opposite ends of said mold cavity and having a sliding fit upon said central mandrel, means for filling
45 said cavity with material, means for forcing said larger ram into said larger bore a predetermined distance to form the bushing flange of the desired thickness, and stop means movable with said larger ram for actuating
50 said die at said predetermined point of travel and causing both to move together toward said smaller ram to complete the briquetting operation, and means for ejecting the briquette from the die.

3. Molding apparatus for briquetting a flanged end bushing, comprising: a reciprocatable die having a mold cavity provided by two bores of different diameters, a stationary
55 central mandrel projecting through said mold cavity, larger and smaller tubular rams received respectively by the bores at opposite ends of said mold cavity and having a sliding fit upon said central mandrel, means for filling said cavity with material, means for
60 forcing said larger ram into said larger bore

a predetermined distance to form the bushing flange of the desired thickness, stop means movable with said larger ram for actuating
70 said die at said predetermined point of travel, means for withdrawing said larger ram, and causing both to move together toward said smaller ram to complete the briquetting operation, and means for moving said smaller ram relative to said die to eject the briquetted bushing.

4. Molding apparatus defined by claim 1, including means to positively hold said die in fixed position until said larger ram has traveled said predetermined distance and to then automatically release said die to permit
80 its movement with said larger ram.

In testimony whereof we hereto affix our signatures.

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ALBERT H. VALENTINE.

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