Sept. 7, 1954 F. W. LIVERMONT ET AL 2,688,181

DOORKNOB BLANK

Original Filed May 16, 1949 2 Sheets-Sheet 1

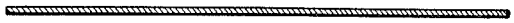


Fig. 1.

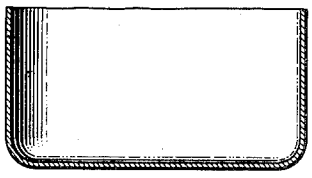


Fig. 2.

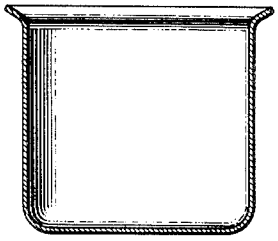


Fig. 3.

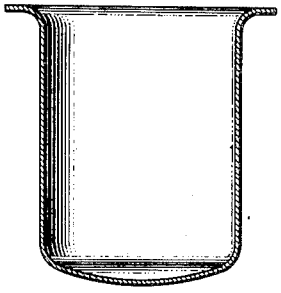


Fig. 4.

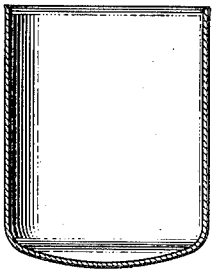


Fig. 5.

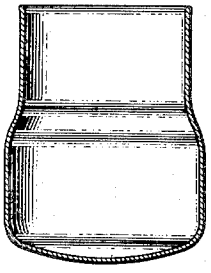


Fig. 6.

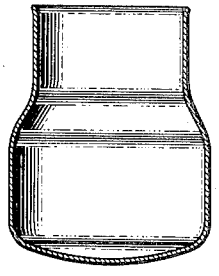


Fig. 7.

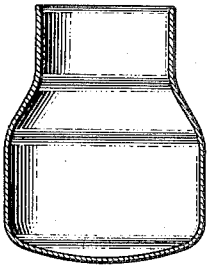


Fig. 8.

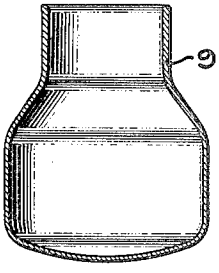


Fig. 9.

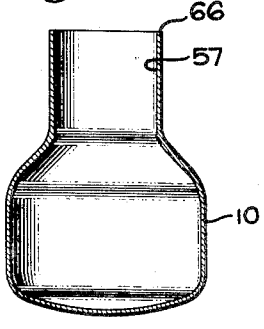


Fig. 10.

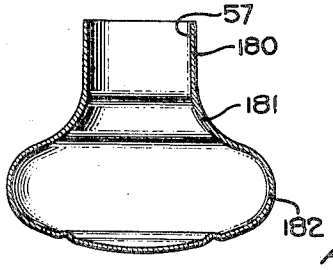


Fig. 11.

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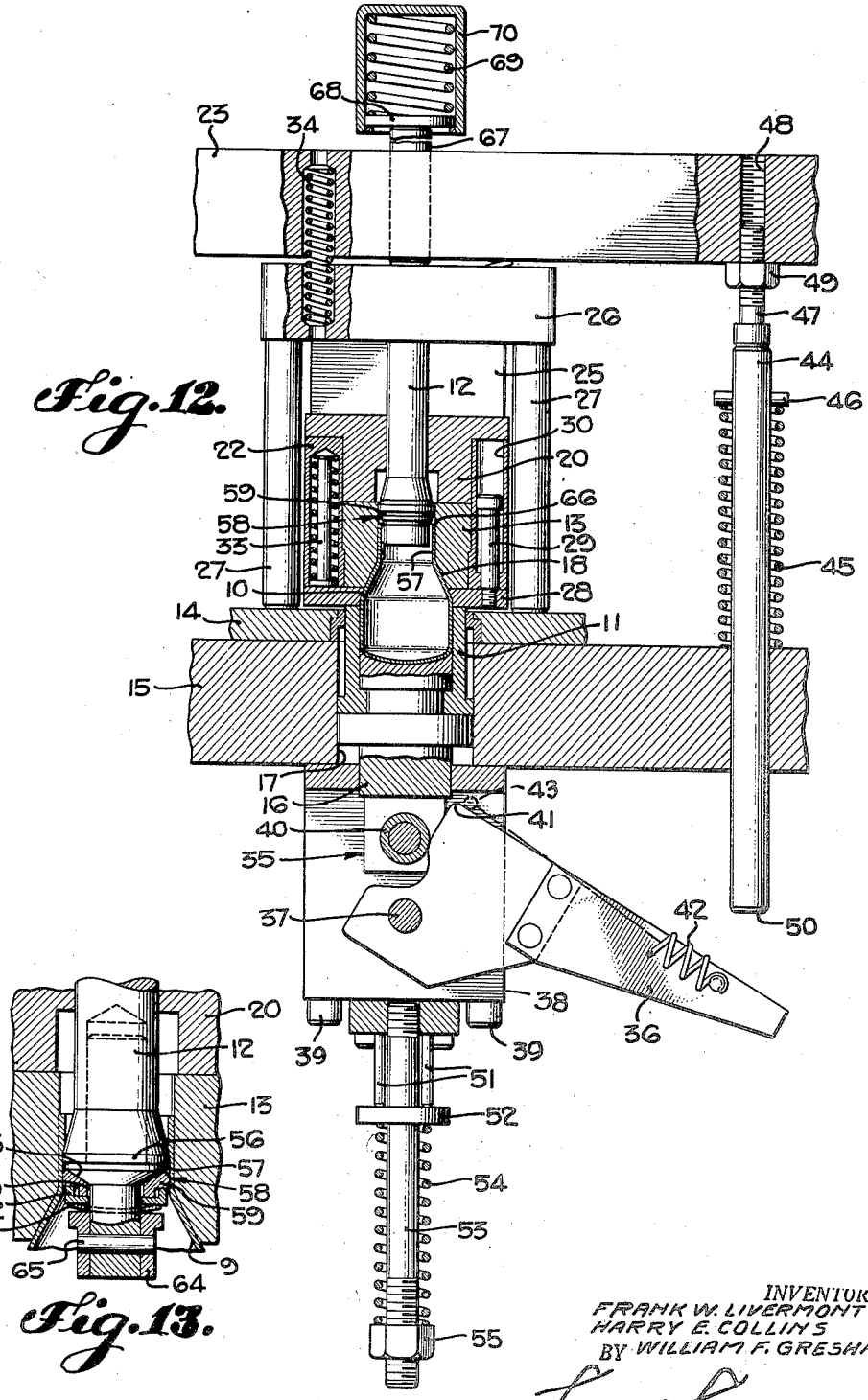


Fig. 12.

Fig. 13.

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DOORKNOB BLANK

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Original application May 16, 1949, Serial No. 93,524. Divided and this application August 4, 1952, Serial No. 302,528

1 Claim. (Cl. 29—190)

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This invention relates to the art of metal stamping and processing, and is particularly directed to a blank for producing a door knob having a large generally spheroidal portion and a coaxial integral neck.

This application is a division of our copending application Serial No. 93,524, filed May 16, 1949, entitled Door Knob and Method and Apparatus of Fabrication.

It is an object of our invention to provide a novel form of blank for the manufacture of a one-piece door knob by hydraulic expansion.

Another object is to provide a blank of this type having a large expandable bulbous part having an elongated substantially cylindrical side wall and a bottom wall in a relatively soft and stress-relieved condition, whereby it can be readily hydraulically expanded into a generally spheroidal form, and an integral cylindrical neck which is hard and dense and which has accurately sized internal and external surfaces.

Other and more detailed objects and advantages will appear hereinafter.

In the drawings:

Figures 1 to 11 illustrate diagrammatically the sequence of steps we employ in forming a one-piece door knob from a flat sheet of material. Thus, the flat sheet shown in Figure 1 is drawn to form a cup in Figure 2, and this cup is deepened in the steps shown in Figures 3 and 4. The flange on the cup shown in Figure 4 is removed to produce the cup shown in Figure 5, and an annealing operation normally takes place after the formation of the cup shown in Figure 5. The annealed cup of the shape shown in Figure 5 is then necked down in conventional dies in sequence as shown in Figures 6, 7, 8 and 9. This inherently results in an increased thickness in the necked down portions, without an increase in thickness of the blank below the flared portion, as is apparent from a comparison of Figs. 6 and 9. The bulb-shaped stamping shown in Figure 9 is then processed in accordance with our invention to produce the bulbous part shown in Figure 10 which has a smooth ironed bore of accurate size within the neck portion. The bulbous part shown in Figure 10 is then expanded hydraulically in accordance with our invention to produce the finished door knob shown in Figure 11.

Figures 12 and 13 illustrate the method and apparatus employed for forming the blank shown in Figure 10. Figure 12 is a sectional view of a preferred form of apparatus for simultaneously reducing the outer diameter of the neck portion of the part and for ironing the internal diameter

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of the neck portion. The parts are shown in position corresponding to the completion of the operative stroke of the press platen. Figure 13 is a fragmental sectional elevation showing the action of the mandrel in ironing the internal bore of the neck.

Referring to the drawings, the die set and associated parts shown in Figures 12 and 13 are used in making the blank shown in Figure 10 from the necked cup 9 shown in Figure 9. The five operations for producing the parts shown in each of Figures 6–10 are preferably performed in sequence in a dial feed press. In addition, a preoiling operation and an extracting operation may be performed in the same press. The part 9 is placed upright within the lower die 11 so that the necked portion extends upwardly in axial alignment with the punch 12 and with the upper die 13. The lower die 11 is retained by means of a die holder 14 secured to an axially immovable base or fixed platen 15. A plunger 16 is slidably mounted within a bore 17 in the fixed platen 15 so that the lower die 11 may move relative to the fixed platen 15 under certain conditions described below. The upper die 13 is provided with a flared central opening 18 at its lower end which joins a cylindrical bore 19 which extends axially through the die 13. The die holder 20 is connected to the die 13 by means of threaded elements 21 and a die holder sleeve 22 encircles the die 13 and the die holder 20. The die holder 20 is anchored with respect to the moving platen 23 by means of threaded elements 24. The upper portion of the die holder 20 is provided with a transverse axially extending slot 25 which receives the sliding crosshead 26 which carries the punch 12. A pair of stop rods 27 is fixed at the ends of the crosshead 26 and extends downwardly on opposite sides of the die holder sleeve and is arranged to contact the upper surface of the lower die holder 14 at one stage in the operative cycle.

A retaining ring 28 is provided with a central opening shaped to fit the contour of the part 9 at the large end of its tapering portion and prevents bulging. This plate is carried on a plurality of screws 29 slidably mounted within the axially extending recesses 30 formed in the die sleeve 22. A plurality of compression springs 31 are received within other recesses 32 formed in the die sleeve 22 and encircle upstanding pins 33 fixed on the plate 28. From this description it will be understood that the retaining ring 28 is normally moved downwardly by means of the coil springs 31 and the limit of its downward movement is fixed by engagement of the heads of the cap screws 29

with shoulders at the lower ends of the recesses 30. As the die 13 moves downwardly during the operating cycle the retaining ring 28 rests on the upper end of the lower die 11 and remains stationary while the upper die 13 moves downwardly.

As the moving platen 23 moves downwardly under influence of the moving platen of the punch press (not shown), the retaining ring 28 moves over the upper end of the part 9 and the punch 12 enters the upper open end of the necked portion of the part 9. It will be observed that the largest diameter of the punch 12 is smaller than the smallest diameter of the interior of the part 9 so that the punch enters without difficulty. Continued downward movement of the moving platen 23 and die 13 brings the flared lower end 18 of the die into contact with the upper necked portion of the part 9 with the result that the necked portion is further reduced in diameter. Downward movement of the punch 12 and crosshead 26 is arrested at the instant that the lower ends of the stop rods 27 engage the upper surface of the lower die holder 14. Further downward movement of the platen 23 and die 13 is made possible by the release of latch means generally designated 35 which allows the lower die 11 to move downwardly with respect to the axially immovable platen 15. The latch means may include a latching lever 36 pivotally connected at 37 between a pair of stationary brackets 38. These brackets may be secured to the platen 15 by means of threaded elements 39.

A roller 40 mounted on the plunger 16 cooperates with a nose portion 41 on the latching lever so that clockwise movement of the lever as viewed in Figure 12 serves to permit descent of the plunger 16 and lower die 11. A tension spring 42 secured at one end to the lever 36 and at the other end to the pin 43 on bracket 38 serves normally to hold the latching lever 36 in a horizontal position. A vertical tripping bar 44 is slidably mounted with respect to the platen 15 and is resiliently supported by means of a coil spring 45 acting on cross-pin 46. A cap screw 47 may be threaded into a recess 48 provided in the upper platen 23 and held in adjusted position by means of a lock nut 49. The spring 45 normally maintains the upper end of the trip rod 44 in contact with the head of the cap screw 47. The lower end 50 of the trip rod 44 is adapted to contact the outer end of the latching lever 36 upon descent of the upper platen 23. The position of the cap screw 47 is adjusted on the platen 23 so that the lower end 50 of the trip rod 44 releases the latching lever 36 at the instant that the upper die 13 comes in contact with the relatively stationary retaining ring 28.

Upon release of the latching device 35 the lower die 11 moves downwardly under the force applied by the upper die 13 acting through the retaining ring 28. The necking is completed when die 13 contacts ring 28—further downward movement performs the ironing operation described below. A plurality of parallel pins 51 is slidably mounted in the brackets 38, and at their upper ends these pins contact the plunger 16 and at their lower ends rest on an annular plate 52 encircling a stationary bolt 53 carried by the brackets 38. A compression spring 54 encircles the bolt and is confined between the plate 52 and the nut 55. The function of the spring 54 is to return the plunger 16 and lower die 11 back to its initial position after completion of the operative cycle.

It will be observed in Figure 13 that the upper

die 13 acts to reduce the diameter of the neck of the part 9 to such an extent that the inner diameter of the neck is smaller than the diameter of the cylindrical surface 56 on the punch 12. Accordingly, when the latch mechanism 35 is released to allow the lower die 11 to move downwardly with respect to the platen 15, the bulbous part 9 is carried downwardly with respect to the punch 12. In other words, the relative movement between the descending part 9 and the stationary punch 12 is such that the cylindrical surface 56 reduces the wall thickness of the neck of the part 9 in an "ironing" operation so that said thickness is substantially less than that of the adjacent flared or conical portion of the blank, as clearly shown in Figure 12. Thus, the necking die 13 moves the part 9 downwardly, stripping it over the enlarged portion 56 of the punch 12 while confining the outer diameter of the neck. The result is that a smooth cylindrical dense surface 57 of final finished size is produced on the inner diameter of the neck of the part 9, and this surface 57 is exceptionally uniform and accurate in diameter.

The punch 12 is provided with a segmental expansion ring 58 which may comprise a plurality of ring segments 59 mounted within a groove 60 formed on the punch 12 below the location of the cylindrical surface 57. A dished washer 61 acts as a spring and urges the retaining ring 62 to move upwardly so that the ring segments 59 are caused to move radially outwardly by the conical surface 63 formed on the punch 12. The hub 64 may be fastened on the punch 12 by means of a pin 65. The segmental expansion ring 58 has a maximum diameter which will pass into the open end of the part 9 when it is initially inserted in the lower die 11. However, when the upper or necking die 13 further contracts the neck of the part 9 around the punch 12, the contracted inner diameter of the neck of the part 9 is smaller than the diameter of the cylindrical surface 57. The ring segments 59 are contracted by contact with the inner wall of the neck of the part 9 and hence the segmental ring 58 offers no resistance during the ironing operation illustrated in Figure 14. When the ironing operation is complete, however, and when the segmental ring 58 moves out of the confinement of the neck of the part 9, the ring segments 59 expand under the influence of the resilient annular washer 61 and overlie the upper end 66 of the part 9. This relationship is shown in Figure 12.

When the platen 23 moves upwardly on the return part of the stroke, the ironing die 13 moves upwardly with the platen and the ironed part now designated 10 sticks in the upper die 13 by reason of the tight fit of the neck therein following the ironing operation. As the platen 23 moves upwardly the plunger 16 carries the lower die 11 back toward its initial position under the action of the compression spring 54 acting through pins 51.

Spring 69 is mounted on the moving platen of the press and by initial compression and through the pin 67 applies a continuously downward force on the crosshead 26. This is effective to cause ejection of the workpiece at the start of the upward movement of the platen leaving the workpiece in the lower die 11, from which it is removed at the next station of the dial piece (not shown). The plate 68 may be interposed between the spring 69 and pin 67 and the spring may be enclosed within the shell 70.

This completes the operations producing the

neck and the blank is then ready to have its bulbous part 10 expanded hydraulically, to form the completed door knob illustrated in Figure 11, in the manner fully disclosed in our parent application, supra.

Having fully described our invention, it is to be understood that we do not wish to be limited to the details herein set forth, but our invention is of the full scope of the appended claim.

We claim:

A blank for producing a door knob having a large generally spheroidal portion and a coaxial integral neck, comprising: a single integral shell having a large expandable bulbous part comprising an elongated substantially cylindrical side wall and a bottom wall, a relatively small coaxial cylindrical neck, and an intermediate flaring portion integrally joining the lower end of the cylindrical neck and the upper end of the cylindrical side wall of said bulbous portion, the neck being of uniform diameter from said flared portion to its outermost extremity and being hard and dense and having smooth cylindrical inside and outside surfaces of final finished size, and the bulbous portion being relatively soft and in a stress-relieved state to permit hydraulic expansion thereof from its elongated cylindrical form into a generally spheroidal form.

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