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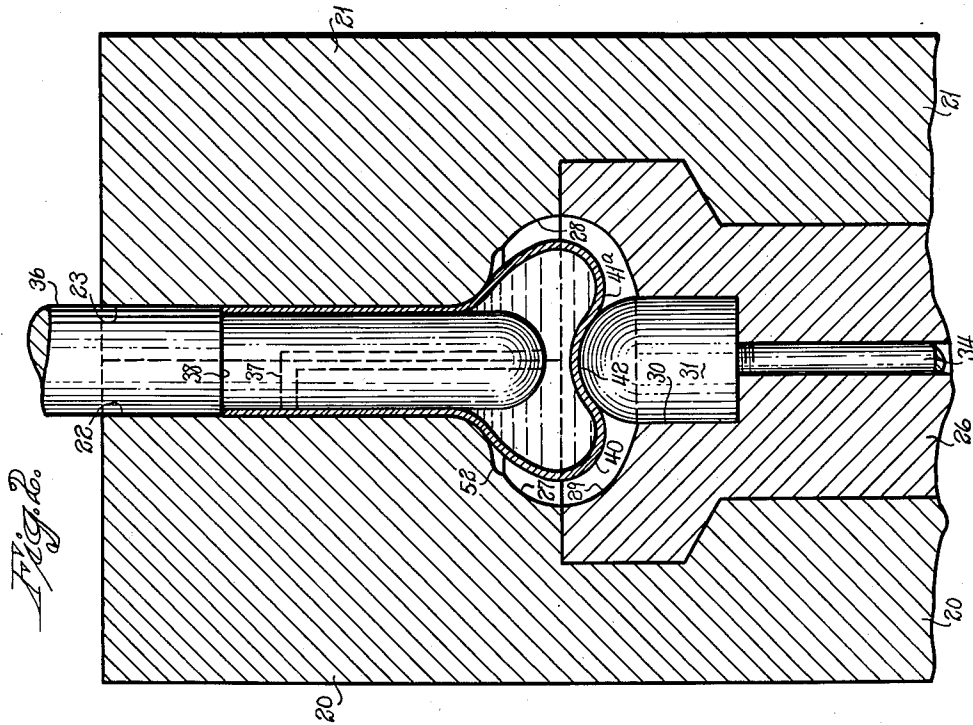
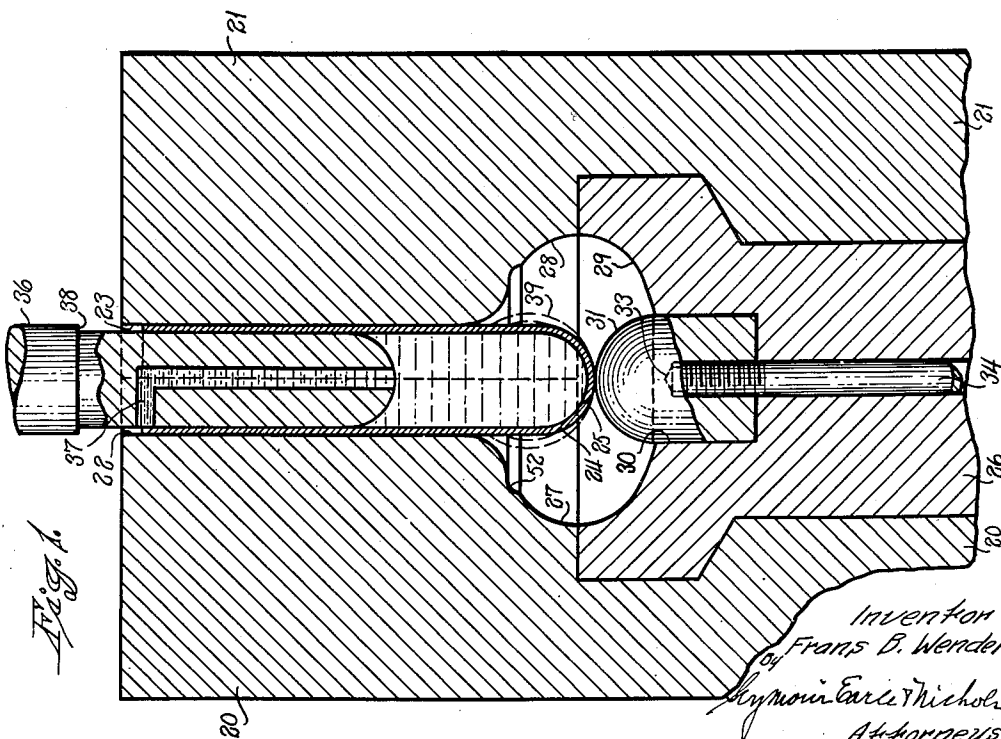
F. B. WENDEL

2,157,044

PROCESS FOR PRODUCING KNOBS OR THE LIKE

Filed Feb. 24, 1937

3 Sheets-Sheet 1



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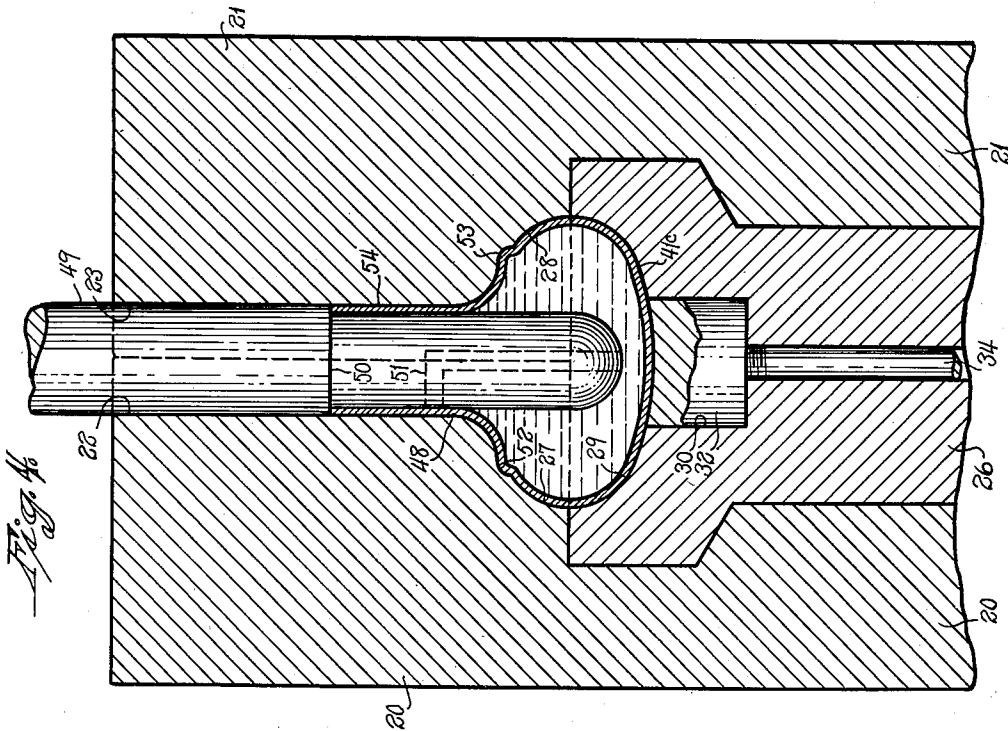
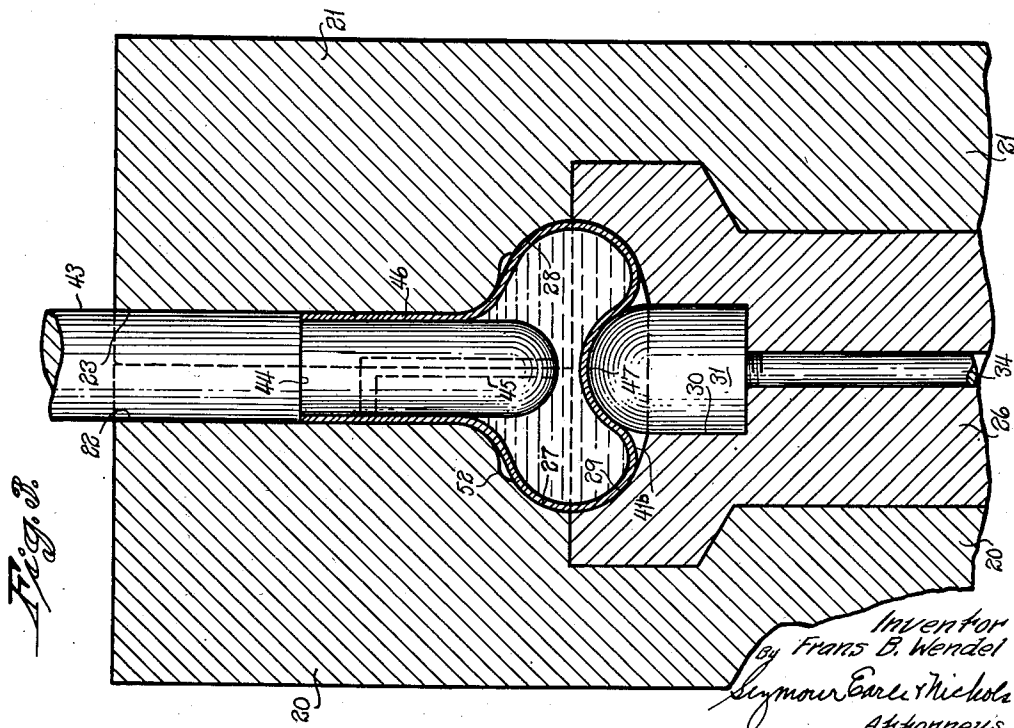
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3 Sheets-Sheet 2



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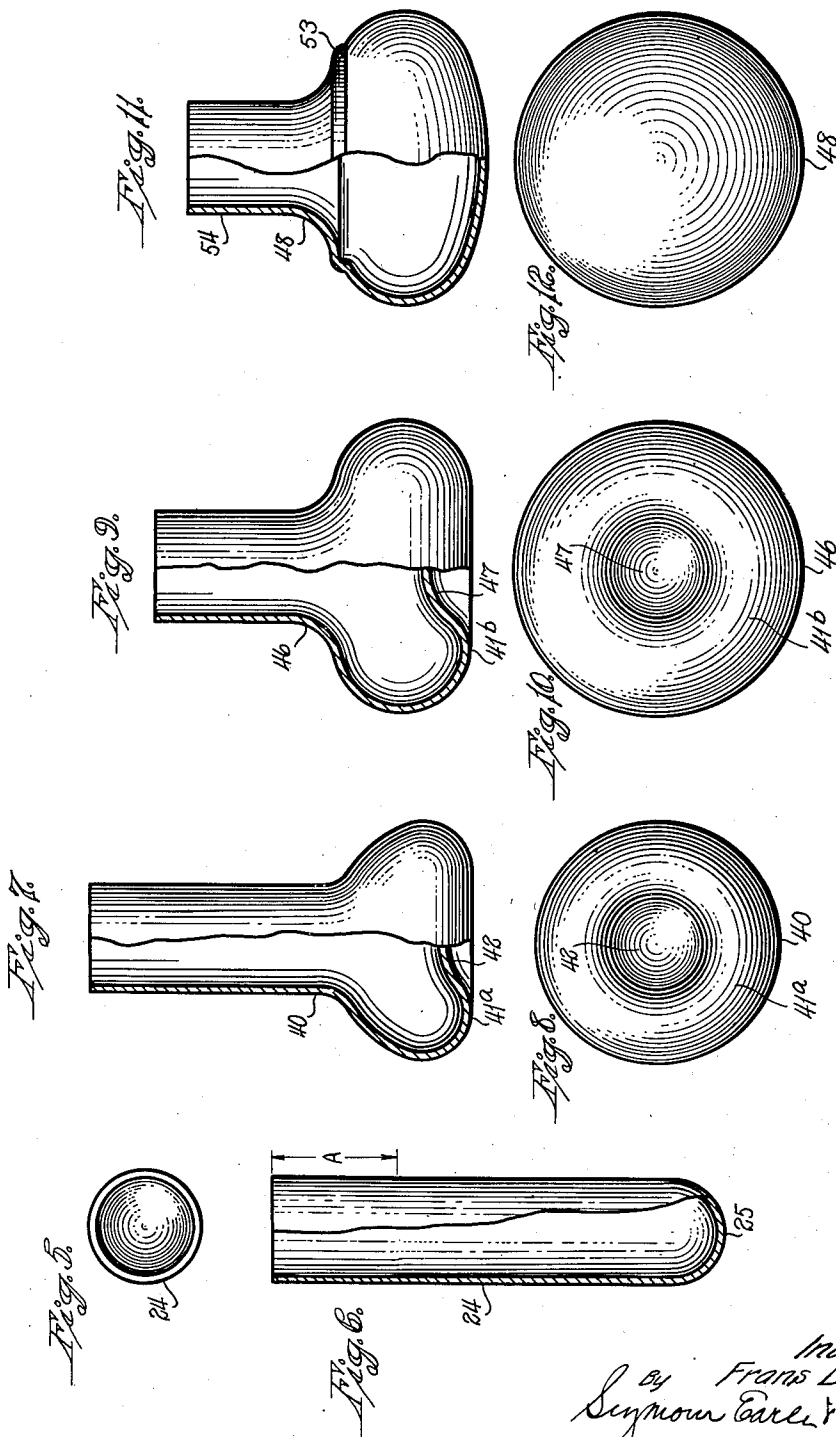
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,157,044

PROCESS FOR PRODUCING KNOBS OR THE LIKE

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Application February 24, 1937, Serial No. 127,458

10 Claims. (Cl. 113—44)

This invention relates to an improvement in processes for producing hollow bulbous objects from wrought metal, such for instance as door knobs.

One of the objects of the present invention is to provide a superior method or process whereby bulbous objects may be economically produced from wrought metal.

A further object is to provide a superior process or method by means of which bulbous wrought-metal objects may be produced by a step involving marked lateral enlargement without occasioning the splitting of the said enlargement.

Another object of the present invention is to provide a method whereby hollow bulbous objects may be rapidly and accurately produced without occasioning harmful marring of their surfaces.

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 and which are not claimed by me in a separate application.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a vertical central section through a die-block assembly showing a first-stage test-tube-shaped blank installed therein prior to being subjected to a bulging operation;

Fig. 2 is a similar view showing the blank forced into the die-assembly to produce a bulged second-stage blank;

Fig. 3 is a similar view illustrating the formation of a third-stage blank;

Fig. 4 is a similar view illustrating the formation of a fourth-stage blank;

Fig. 5 is a view looking toward the open end of the first-stage blank;

Fig. 6 is a view partly in side elevation and partly in central longitudinal section of the first-stage blank;

Fig. 7 is a similar view of the second-stage blank;

Fig. 8 is a bottom end view of the second-stage blank;

Fig. 9 is a view of the third-stage blank shown partly in side elevation and partly in central longitudinal section;

Fig. 10 is a view of the bottom end thereof;

Fig. 11 is a view of the fourth-stage blank shown partly in side elevation and partly in central longitudinal section; and

Fig. 12 is a view looking toward the under end of the fourth-stage blank.

Various forms of dies may be employed in carrying out the present process, and for purposes of illustration there is shown in Figs. 1 to 4 inclusive a three-part die-assembly comprising two similar complementary die-blocks 20 and 21, respectively provided with vertical channels 22 and 23 of semicircular form in cross-section, and together providing a cylindrical passage for the reception of a test-tube-shaped wrought-metal blank 24 (Figs. 1, 5 and 6), which blank for convenience of description may be designated as the "first-stage" blank. The said first-stage blank may be produced from wrought-metal, such, for instance, as copper or steel, by drawing or other operations, in a manner well known in the art.

Preferably, and as shown especially well in Fig. 6, the exterior of the first-stage blank 24 is of straight cylindrical form save at its closed end 25, which is of hemispherical form as shown. The wall of the hollow first-stage blank 24 is preferably formed of uniform thickness throughout the zone marked "A" in Fig. 6, and from the lower terminus of this zone "A" the wall thickness progressively increases toward the spherically-contoured closed end at the center 25 of which it reaches its maximum thickness.

The die-blocks 20 and 21, before referred to, are arranged in cooperative relationship with a third die-block 26, with respect to which latter they are movable to permit the introduction and removal of various blanks of the character as will hereinafter appear. The inner ends of the semicylindrical channels 22 and 23 formed respectively in the die-blocks 20 and 21 merge into enlarged semiannular portions 27 and 28, which together with an upwardly-opening annular recess 29 in the upper face of the die-block 26 provide a cavity conforming in shape to the desired bulbous form of the portion of the object to be produced, which in the instance being described is a hollow door knob.

Leading downwardly from the central portion of the upwardly-opening recess 29 in the die-block 26 is a cylindrical socket 30 which is adapted to interchangeably receive a deflecting-block 31 of the character shown in Figs. 1 to 3 inclusive, or a filler-block 32 of the character shown in Fig. 4. For the purpose of securing the blocks 31 and 32 in place, each thereof is provided with a threaded bore 33 having threaded into it the upper end of a retaining-bolt 34 extending upwardly through the die-block 26.

After the die-blocks 20, 21 and 26 have been

assembled and firmly clamped together the test-tube-shaped first-stage blank 24 is filled with water, oil or other suitable medium and is introduced into the vertical passage formed by the registering semicylindrical channels 22 and 23 until its lower end rests against the deflecting-block 31.

A plunger 36 is now forced downwardly into the first-stage blank 24 by a toggle press or other suitable means for imparting a powerful thrust upon the said plunger and force the same toward the deflecting-block 31. The plunger 36 is provided with an L-shaped relief-passage 37 which opens at one end through the spherically-contoured lower end of the said plunger and opens at its opposite end through the periphery of the said plunger at a predetermined point below a thrust-shoulder 38 formed upon the latter.

During the first portion of the downward stroke of the plunger 36 a portion of the liquid contained in the blank 24 will be expelled through the relief-passage 37 due to displacement caused by the said plunger. When however the upper end of the relief-passage 37 passes by the upper edge of the blank 24 the further escape of liquid will be substantially prevented by the sealing action of the wall of the blank. The continued downward movement of the plunger will cause a hydraulic pressure within the lower portion of the blank 24 with the result that the same will be bulged outwardly by this pressure into substantially the form shown by the broken lines 39 in Fig. 1 before the thrust-shoulder 38 contacts the upper edge of the blank. When during the downward stroke of the plunger its thrust-shoulder 38 engages with the upper edge of the blank as just referred to, the said shoulder will force the said blank downwardly so that the lower portion thereof will ultimately assume substantially the form of the second-stage blank 40 shown in Figs. 2, 7 and 8. In this connection it will be appreciated that the fluid or other suitable medium within the first-stage blank 24 will serve to prevent the same from collapsing under the thrust of the plunger 36 and will compel the blank to bulge outwardly and downwardly as illustrated in Figs. 2, 7 and 8 before referred to. During the operation above described the deflecting-block 31 will act to cause the bottom end wall 41^a of the blank to assume a concavo-convex form, thus producing in the end of the blank a spherically-contoured recess 42.

The plunger 36 is now lifted clear of the second-stage blank and the die-blocks 20, 21 and 26 are separated to permit the removal of the said blank 40 which latter after being emptied of residual fluid may be subjected to an annealing operation to soften the same and relieve it of the hardness and cold-working strains occasioned by the forming operation before described. The annealing temperature and the length of time to which the blank is subjected to such temperature in order to achieve the desired softening action will vary widely depending upon the material from which the blanks are formed and other circumstances fully understood by those skilled in the art of metal working.

After the second-stage blank has been annealed it is again filled with liquid and is held in position between the die-blocks 20, 21 and 26 which latter are now closed and clamped together preparatory to converting the second-stage blank into a third-stage blank as will be presently described.

The second-stage blank is now subjected to the action of a plunger 43 (Fig. 3) which substantially corresponds to the plunger 36 before referred to save that its thrust-shoulder 44 is slightly closer its rounded lower end. Like the plunger 36 the plunger 43 is provided with an L-shaped relief-passage 45 which as the plunger descends has its lateral terminal sealed by the inner surface of the blank before its thrust-shoulder 44 engages the outer edge thereof. In this manner the blank is subjected to a relatively-slight hydraulic bulging action before the thrust-shoulder engages the outer edge of the blank to forcibly move the tubular portion of the said blank downwardly toward the deflecting-block 31.

At the conclusion of the downward stroke of the plunger 43 the blank will assume substantially the shape shown in Figs. 3, 9 and 10 and may therefore be designated for convenience of description as a third-stage blank 46. The third-stage blank owing to the presence of the deflecting-block 31 will have its end wall 41^b more deeply impressed to provide a spherically-contoured recess 47.

The plunger 43 is now withdrawn from the blank and the die-blocks 20, 21 and 26 are separated to permit the removal of the third-stage blank 46 which latter after being emptied of residual fluid will be subjected to an annealing operation.

After the third-stage blank has been softened and again filled with liquid it is inserted between the die-blocks and the latter are again closed and firmly clamped together. Prior to the closing of the die-blocks the deflecting-block 31 will have been removed from the socket 30 in the die-block 26 and the filler-block 32 substituted therefor. This filler-block 32 just referred to instead of projecting into the die cavity, as did the deflecting-block 31, has a concaved upper surface shaped to complement and symmetrically continue the curvature of the die cavity 29.

In effecting the formation of the fourth-stage blank 48 shown in Figs. 4, 11 and 12 a plunger 49 (Fig. 4) is employed which plunger substantially corresponds to the plungers 43 and 36 before described save that the distance from its thrust-shoulder 50 to its rounded lower end is somewhat shorter and preferably the laterally-extending upper end of its L-shaped relief-passage 51 is located a greater distance from the said thrust-shoulder 50. By this means the plunger 49 subjects the blank to a greater hydraulic pressure than occurs during the preceding stages, before the thrust-shoulder 50 engages the upper edge of the blank.

This hydraulic pressure serves to force the end wall 41^b of the third-stage blank downwardly into the continuous symmetrical form 41^c shown in Figs. 4, 11 and 12 and, coupled with a relatively slight end thrust exerted upon the blank by the thrust-shoulder 50 of the plunger 49, to cause the metal of the blank to be deflected outwardly into an annular groove 52 half of which is formed in each of the die-blocks 20 and 21. This deflection of the metal into the annular groove 52 serves to provide the fourth-stage blank with an annular bead 53.

The fourth-stage blank may be considered as a finished door knob save for being subjected to desired polishing operations and such machining operations upon its tubular shank 54 as will provide for the coupling of the same to a spindle or whatever other device is desired.

The number of operations necessary to convert the test-tube-shaped first-stage blank 24 of Figs. 5 and 6 into the blank shown in Figs. 11 and 12 may vary widely depending upon the ductility of the wrought metal employed and other factors obvious to those skilled in the art.

From the foregoing it will be seen that in producing hollow bulbous articles they are deliberately deformed prior to final shaping since it has been found that by means of this step the rupturing of the blank is avoided and rapidity of production greatly accelerated. As before noted the first-stage blank preferably has its wall tapered from the zone A downwardly to the point 25 so as to provide an extra thickness of metal at a location where the greatest degree of stretching is apt to occur.

It may further be noted that by first producing the deformation, such for instance as the concavo-convex portion 47, on the partly-finished bulbous article and then re-forming such deformation into the desired finished contour, it is possible without undue and costly manufacturing precautions to provide sufficient metal at a point remote from the tubular shank of the partly-finished bulbous article to insure the desired finished contour. This will be apparent when it is realized that by re-forming the deformation at a point remote from the initial source of metal (the tubular neck-portion of the blank), the adjacent metal is in effect compressed radially so that the metal is caused to seat itself wholly against all of the interior shapes of the die-cavity without danger of rupturing the metal, as might be the case if the metal were forced to final shape by hydraulic stretching.

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 claims are intended to be embraced therein.

I claim:

1. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof and submitting a portion thereof to constraining-action constraining the said portion from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion; and subsequently reshaping the said constrained portion to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

2. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof and submitting a portion thereof to constraining-action constraining the said portion from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion, the constrained offset portion being concavo-convexly curved with respect to an adjacent portion of bulbous-contour; and subsequent-

ly reshaping the said concavo-convexly constrained portion to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

3. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the blank radially of the axis thereof and submitting a portion of the closed end-wall to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall; and subsequently reshaping the said constrained portion to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

4. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the said blank radially and axially and submitting a portion of the closed end-wall to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall; and subsequently reshaping the said constrained portion to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

5. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the blank radially of the axis thereof and submitting a portion of the closed end-wall to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall, the said offset portion being concavo-convexly curved; and subsequently reshaping the said concavo-convexly constrained portion to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

6. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the blank radially and axially and submitting a portion of the closed end-wall to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall, the said offset portion being concavo-convexly curved with respect to an adja-

cent portion of the closed end-wall of bulbous-contour; and subsequently reshaping the said concavo-convexly constrained portion to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

7. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the blank radially of the axis thereof and submitting a portion of the closed end-wall to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall, the said offset portion being concavo-convexly curved and offsetting toward an open end of the blank; and subsequently reshaping the said concavo-convexly constrained portion in the direction away from the said open end of the blank to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

8. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the blank radially and axially and submitting a portion of the closed end-wall to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall, the said offset portion being concavo-convexly curved with respect to an adjacent portion of the closed end-wall of bulbous-contour, and offsetting toward an open end of the blank; and subsequently reshaping the said concavo-convexly constrained portion in the direction away from the said open end of the blank to complete the said bulbous-contour; whereby in

forming a bulbous enlargement stretching-strains are isolated in portions thereof and the rupture loss is substantially eliminated.

9. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the blank radially of the axis thereof and submitting a portion of the closed end-wall thereof to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall, the said offset portion being concavo-convexly curved and offsetting toward an open end of the blank; and subsequently curving the said concavo-convexly constrained portion in the direction away from the said open end of the blank to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and rupture loss is substantially eliminated.

10. A process for producing a hollow bulbous object comprising: applying expanding-force to a metal blank of tubular form at a closed end thereof to expand the blank radially and axially and submitting a portion of the closed end-wall to constraining-action constraining the said portion of the closed end-wall from expanding during the said application of expanding-force, to partially form a bulbous-contour to which stretching-strains of the metal are then substantially confined, and to form an offset thereto comprised of the constrained portion of the said closed end-wall, the said offset portion being concavo-convexly curved with respect to an adjacent portion of the closed end-wall of bulbous-contour, and offsetting toward an open end of the blank; and subsequently curving the said concavo-convexly constrained portion in the direction away from the said open end of the blank to complete the said bulbous-contour; whereby in forming a bulbous enlargement stretching-strains are isolated in portions thereof and the rupture loss is substantially eliminated.

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