May 10, 1966 E. L. SCHLAGE 3,249,990

METHOD OF MAKING A DOOR KNOB

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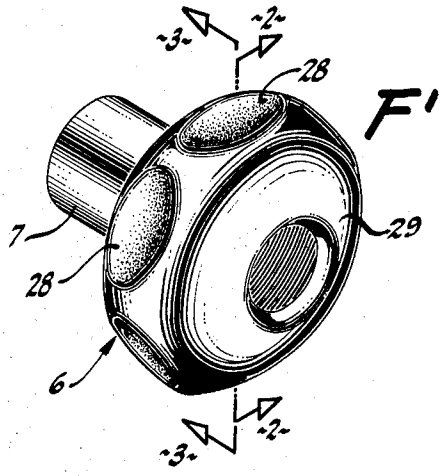

FIG-1

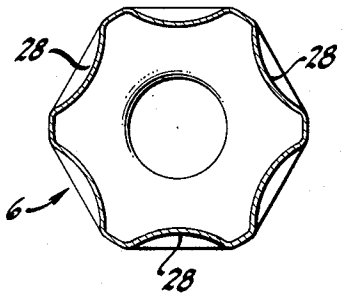

FIG-2

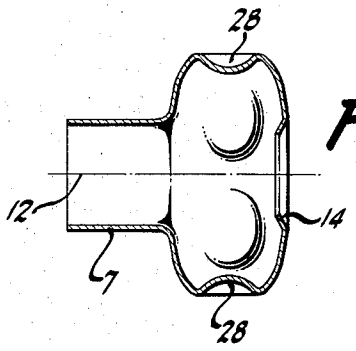

FIG-3

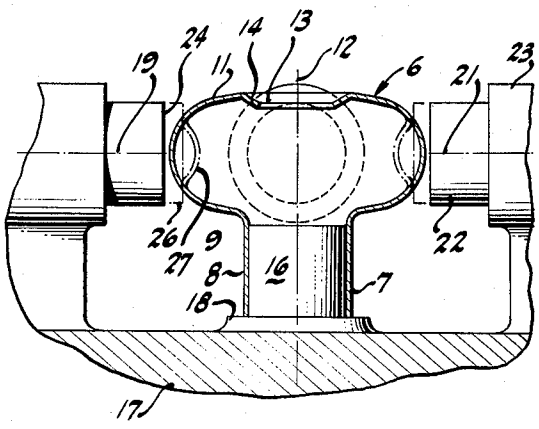

FIG-4

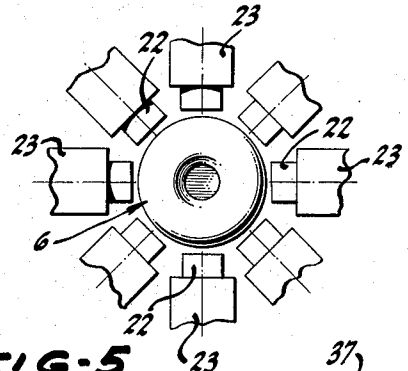

FIG-5

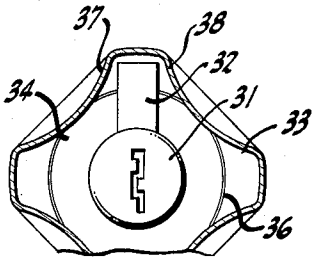

FIG-6

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METHOD OF MAKING A DOOR KNOB

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7 Claims. (Cl. 29—161)

My invention relates to knobs customarily utilized with door locks for rotary movement and for pushing and pulling in order to actuate the lock or latch and to maneuver the door. Such knobs are made in a variety of ways, but often include a hollow metal globular member having a tubular shank attached thereto or integral therewith.

In the fabrication of globular door knobs, metal is usually employed and is formed by means of internal hydraulic pressure to achieve the desired shape and contour of the knob. It is desirable to have the metal relatively thin for easy workability and low cost, but a knob of too-thin metal is easily damaged or injured and does not have the requisite durability and strength.

Another object of the invention is to provide a method for forming a door knob which utilizes simple techniques to achieve an improved product.

A further object of the invention is to provide a door knob which can be formed to a complex shape either before or after the final finish has been applied.

A still further object of the invention is in general to afford an improved method of providing a door knob as well as to afford an improved door knob itself.

Other objects together with the foregoing are attained in the embodiments of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIGURE 1 is an isometric view showing one form of door knob pursuant to the invention and resulting from the practice of the method of the invention;

FIGURE 2 is a cross section, the plane of which is indicated by the lines 2—2 of FIGURE 1;

FIGURE 3 is a cross section, the plane of which is indicated by the lines 3—3 of FIGURE 1;

FIGURE 4 is a cross section somewhat similar to FIGURE 3 but showing stages in the performance of the method of the invention;

FIGURE 5 is a schematic plan of the parts shown in FIGURE 4; and

FIGURE 6 is a partial cross section comparable to that of FIGURE 2 and showing the relationship of part of a lock mechanism and the knob of the invention.

The method of the invention includes the initial provision of a knob 6, as particularly shown by the full lines of FIGURE 4. This knob can be fabricated in any of the customary ways to afford a cylindrical shank 7 circular in cross section and comprised of a relatively thin metal wall 8 constituting a tubular configuration. The shank 7 merges smoothly in a curve 9 with a thin metal globular portion 11 of the knob. The shank and the globular portion are usually integral but can be of two or more pieces. The globular portion is not necessarily a strict sphere in the geometrical sense, althouh it can be of such contour except for the merging shank. Usually the globular portion 11 is circular in cross section in a plane normal to the rotational axis 12 of the knob, but is flattened from true sphericity into approximately the shape illustrated in FIGURE 4. It might be said that the exterior surface of much of the knob, except for the shank, is comparable to the outer portion of a toroid. The knob 6 is thin walled throughout and has an enlarged portion which is substantially convex in all cross sections. Sometimes there is an exception in that concentric with the axis 12 the knob 6 has a central opening 13 defined and bounded by an inwardly directed marginal flange 14.

The metal of the knob is usually brass or aluminum and can remain unfinished until after final forming but it is convenient to put the final surface finish on the knob configuration when it is entirely and smoothly convex and of a globular shape. The surface finish is often a bright plating with a mirror finish protected by an overlay, for example, of a clear lacquer.

Pursuant to the method of the invention, the knob as described is installed on a circular cylindrical stud 16 projecting upwardly from a frame 17 and rests snugly against a stop 18 also upstanding from the frame 17. This positioning of the knob securely locates it and holds it frictionally against the stud 16. The height of the globular portion 11 is such that its transverse central plane coincides generally with the axes 19 and 21, for example, of a plurality of plungers 22. Each of the plugers is arranged with its axis in a plane normal to and in radial relationship with the vertical axis 12. Each plunger is slidable along its own axis within a surrounding cylinder 23. The plungers 22 are movable in a radially inward direction by means of fluid pressure, either air or hydraulic, and are suitably retracted from the center by spring or pressure return. Each of the plungers 22 terminates in a forward planar face 24 parallel to the central axis 12.

After the convex knob has been positioned on the stud 16 as shown in FIGURE 4, the various plungers 22 are simultaneously forced toward the central axis 12. At initial contact, the end face 24 of each plunger is tangentially disposed with respect to the adjacent convex portion of the globular section 11 of the knob 6. The continued advance inwardly of each plunger produces a progressive deformation of the thin wall material of the knob until the plunger arrives at a stopping point indicated by the dotted lines 26 in FIGURE 4. During the inward movement of the plunger after its first contact with the external surface of the knob, the material of the knob wall deforms inwardly and as a matter of fact advances inwardly along the center line faster than the advance of the plunger itself. Thus when the plunger comes to rest in the position indicated, the material of the knob has thereby been deformed into a position shown by the dotted lines 27 in FIGURE 4 to define a depression 28 concave in all directions merging smoothly but abruptly with the undeformed portion of the knob. This concavity is curved in all cross sections and herein is termed a "spherical" concavity.

During this deformation of the knob material, the plating and surface finish often are completely undisturbed and remain mirror bright, but sometimes the deformed parts are invested with a plurality of tiny surface cracks so that the resulting depressed portions 28 have a matte or brush like finish affording an appropriate contrast.

Since the knobs are of a material which has the characteristic of workhardening, when the material is deformed from its initially convex contour into the ultimately resulting spherically concave contour, all of the wall material embracing the concavity is worked. Thus, the concave wall is harder or stiffer upon the completion of the operation than it was before. The net result is that the concavity affords a strengthening and stiffening configuration not only because of its changed geometrical contour after the method has been practiced, but also because the stiffness of the material itself has been increased.

Preferably the plungers 22 are disposed opposite each other so that the forces on the knob during deformation are reasonably well balanced and no great strain has to be taken by the stud 16. Under some circumstances, however, it is desired to provide an asymmetrical arrangement of concavities on the finished knob so that the stud 16

may have to withstand some lateral forces during the formation of the concavities or depressions.

The amount of stroke of the plungers **22** can be varied as desired to afford either a relatively light dimpling; that is, relatively shallow concavities in the knob, or concavities so extensive as virtually to merge with each other around the periphery of the knob. The individual plungers may also have different strokes; for example, to alternate small and large or shallow and deep concavities. It is normally preferred, especially as shown in FIGURE 1, to provide fairly extensive concavities but to leave them somewhat spaced apart in order to avoid the fairly sharp intersections which occur if the concavities virtually merge with each other.

After the plungers **22** have been advanced as far as desired, and after the material has been deflected sufficiently from its initial position to assume a permanent set in its new, concave condition, the plungers are withdrawn sufficiently to free the knob. The knob is then lifted from the stud **16** and is ready for use, although it can be further finished.

In actual use the indented knob is found ot be substantially stronger and stiffer than an underformed knob of similar wall thickness and material. The indented knob also affords an improved grip for rotation and also for pushing and pulling since the user's fingers fall naturally into the concavities or engage the noncircular cross section of the knob with considerable facility. The improved stiffness of the knob is particularly apparent in an axial direction along the axis **12**; for example, when the knob is banged against a wall because the door to which it is attached is flung open recklessly. The outer face **29** of the knob is supported with somewhat more rigidity than is the case without the depressions.

In many instances the knobs are utilized with plain tubular actuators working through the central opening **13**, but in some cases pin tumbler locks are employed. As shown in FIGURE 6, the usual pin tumbler lock has a body **31** with an extension **32** projecting radially therefrom. To receive this lock the knob is usually made of two pieces, particularly an outer, originally globular shell **33** and a separate shank section **34** flanged and upon assembly secured along a line of attachment **36** to the shell **33**. Before assembling the two knob sections, the lock **31** is positioned and held (by auxiliary means, not shown) in a location so that the extension **32** is received between the bounding walls **37** and **38** of the adjacent concavities or depressions. The parts of the knob are then assembled. In this fashion it is not necessary to provide other means for preventing relative rotation between the extension **32** and the knob as the clearances between those members are small enough to afford appropriate interengagement between the lock and the knob.

What is claimed is:

1. A method of providing a door knob comprising forming a hollow deformable body having an approximately globular portion and having a cylindrical shank merging with said globular portion, supporting said body solely by engagement with said shank, and while said body is so supported abutting diametrically opposite parts of said globular portion with the planar parallel faces of opposite diametrically aligned plungers and then forcing said plungers simultaneously inwardly toward each other until permanent spherical concavities of lesser extent than said planar faces are formed in said globular portion.

2. A method of providing a door knob comprising supporting a hollow deformable body having an approximately globular portion in a fashion to leave said globular portion substantially free, then engaging parallel planar members against opposite convex areas of said globular portion and then simultaneously forcing said planar members against said engaged areas with sufficient pressure to force said convex areas permanently to assume spherically concave configurations.

3. A method of providing a door knob comprising simultaneously forcing diametrically opposite convex portions of a hollow approximately globular metal body toward each other by parallel planar walls until said portions take a permanent set with spherically concave contours said portions being of lesser extent than said walls.

4. A method of providing a door knob comprising putting a finish coating on a hollow approximately globular body, and then forcing a plunger having a planar face radially against a localized peripheral portion of said body and toward the center thereof by pressure of said planar face upon said coating.

5. A method of providing a door knob comprising subjecting a localized peripheral convex portion of a hollow globular metal body to pressure from the planar face of a radial plunger acting toward the center of said body and of sufficient magnitude to displace said convex portion into a spherically concave contour of lesser extent than said face.

6. A method of providing a door knob comprising subjecting a localized peripheral convex portion of a hollow globular metal body to a force exerted on said body by a planar member initially disposed tangentially to the exterior surface of said globular body and then moving radially inwardly of said body.

7. A method of providing an intented door knob comprising providing a hollow door knob having a smooth approximately spherical member and defined by a thin wall of work-hardenable material, simultaneously abutting a pair of opposite, parallel planar plunger faces against diametrically opposite convex portions of said member, then moving said plunger faces toward each other sufficiently to deform and work harden the portions of said member engaged by said plunger faces, and continuing said plunger movement until said portions and the adjacent knob wall define spherical concavities of an extent less than the extent of said plunger faces.

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