July 2, 1963 G. P. PATRIQUIN ETAL 3,096,115

KNOB CONSTRUCTION

Filed Sept. 15, 1960

FIG. 1

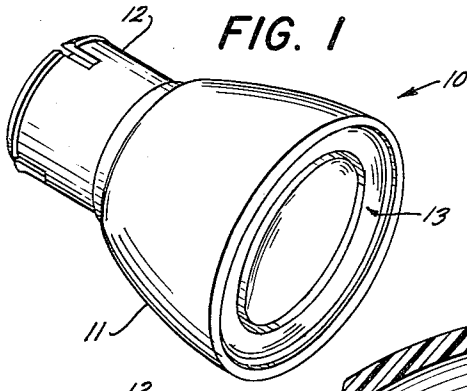


FIG. 2

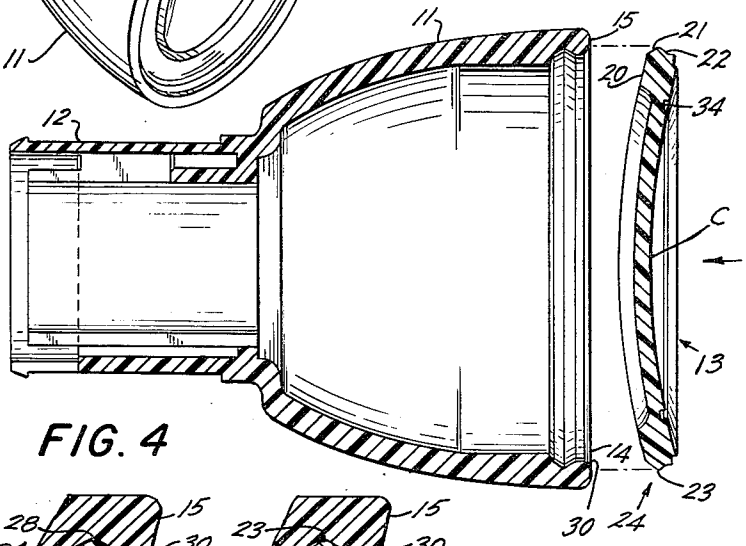


FIG. 3

FIG. 4

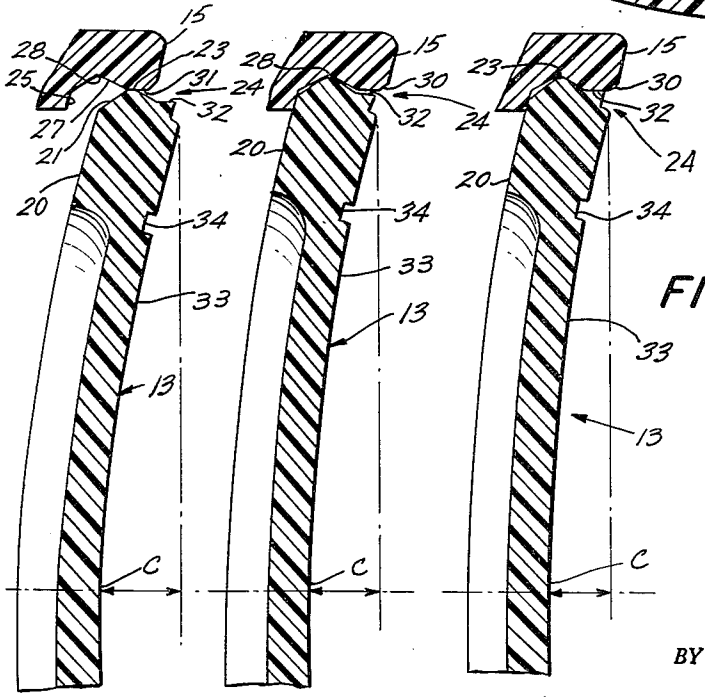


FIG. 5

INVENTORS
GEORGE P. PATRIQUIN
NORMAN R. ADLER

BY J. F. Bassuches

their ATTORNEY

United States Patent Office

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KNOB CONSTRUCTION

George P. Patriquin, Gardner, and Norman R. Adler, Fitchburg, Mass., assignors to Independent Lock Company, Fitchburg, Mass., a corporation of Massachusetts

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This invention relates to a knob construction and more particularly to a door knob construction.

Still more particularly this invention relates to a door knob characterized by simplicity of assembly, economical construction, attractive appearance, and durability.

This invention further relates to a two-part door knob construction, the components of which are especially adapted to be fabricated of resilient plastic, and which, when so fabricated, provide a rugged and attractive unit.

This invention further relates to a plural or multi-part knob construction which may be fabricated of resilient plastic, the components of which are maintained in integrated conditions by reliance upon the resilient characteristics of the material employed, integration of the said parts serving to form an exceedingly rigid structure notwithstanding the relatively flexible nature of the parts prior to integration.

Still more particularly this invention relates to a door knob assembly wherein a resilient concave end cap member is retained in end closing relation within a hollow knob shell member which may or may not be fabricated of resilient material, the two parts being united solely by a resilient interfit, and when thus united having no substantial tendency to rattle or shift position with respect to each other.

Accordingly, it is an object of this invention to provide an attractive and durable door knob assembly. A further object of this invention is to provide a door knob assembly of novel design admitting of the use of resilient plastic for the components thereof and assuring a rigid, rattle-free, durable and easily assembled structure.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, reference is made to the accompanying drawings forming a part hereof, in which—

FIGURE 1 is a perspective view of a door knob in accordance with the invention;

FIGURE 2 is a magnified vertical section of the components of the door knob assembly prior to integration; and

FIGURES 3, 4 and 5 are magnified diagrammatic views showing the position of the parts in progressive stages of assembly.

As seen in FIGURE 1, an assembled knob unit 10 includes gripping portion 11, integral shank portion 12, and an end cap or closure 13. The knob shank construction and the structure which is arranged to freely rotate in a bearing of a rose plate and method whereby the shank is assembled is not here described. An example of a rose plate with which our construction may be more usefully employed is fully set forth in our application, entitled Knob Retention Assembly, Serial No. 56,235, filed on even date herewith, and accordingly, the description herein will be limited to the novel knob and cap portions and method of assembling the same.

The knob assembly includes an end cap portion 13 which is seated in annular groove 14 formed adjacent the end portion 15 of the hollow shell or gripping portion 11. While the knob shell and end cap portions 11 and 13 may be made of a wide variety of resilient materials, it has been found that nylon plastic may be advantageously employed. As an example of a preferred nylon plastic, reference is made to "Zytel" 101, which is a polymeric amide

resin or the resin formed by reacting adipic acid with hexamethylene diamine, as more fully described in the publication entitled, "Zytel Nylon Resin," copyright 1956, by E. I. du Pont de Nemours & Co., Inc., page 9. It should be understood that while high resiliency is a necessary characteristic of the cap portion 13, a rigid or semi-rigid shell member may be employed.

The end cap member 13 is of generally concave, or more accurately, of concavo-convex form.

The leading face 20 of the cap 13 slopes outwardly from a leading peripheral portion to define an annular cam shoulder 21. A rearwardly sloping annular shoulder 22 adjoins the leading annular shoulder 21 defining at the junction of said shoulders an outwardly directed annular apex or rim 23. It should be noted that the rim 23 is slightly rounded rather than forming a sharp edge at the intersection of shoulders 21, 22.

The groove 14 in which the periphery 24 of the cap 13 is seated includes a rearwardly or outwardly directed retainer ledge 25, an outwardly sloped annular shoulder 26 adjacent thereto, and an inwardly or forwardly sloped annular trailing cam shoulder portion 27, the said sloped shoulders defining at their outer junction a sharp rim 28.

The relative dimensions of the cap 13 and knob 11 are such that the apex or rim 23 of the cap, prior to insertion within the groove 14, is of greater diameter than the rim 28 of groove 14.

The cap 13 is assembled into the knob shell by shifting the cap axially into the knob. The initial axial shifting brings the leading cam face 21 of cap 13 into contact with the end portion 15 of knob shell 11, which end portion may be chamfered as at 30. The cam 21 and chamfer 30 interact under the axial force applied, to flex the cap 13, thereby increasing the concavity of said cap 13 to the point where the apex 23 of the cap passes into and beyond the axially directed interior section 31 of the knob shell. (See FIGURE 3.)

The axial force aforesaid is most efficiently applied at or near the center point C of cap 13, such pressure thereby aiding to increase the concavity of the cap 13 by bowing the cap about the center C as a fulcrum.

With the continued application of axial force as aforesaid, the cap and knob assume the approximate relative positions shown in diagrammatic FIGURE 4, where the abruptness or angle of the edge 21 has been reduced to the axial line to help the wedging action, the cap snapping or springing radially outwardly when the periphery thereof reaches the groove 14. The leading face 20 of the cap is shown in FIGURE 4 to be in contact with the rearwardly directed ledge 25 of groove 14, thereby aligning the cap the proper distance inwardly from the end 15 of the shell 11.

As seen by comparing FIGURES 4 and 5, the cap 13 is bowed or displaced to a greater degree of concavity in the view of FIGURE 4, due to the fact that the axial force applied to the center point C of the cap has not been fully released.

The release of such force results in the cap 13 assuming the position where the peripheral and annular contact of the trailing edges occur, shown in FIGURE 5, wherein the radius of curvature or concavity is less, due to the slight return rearwardly of the center C of the cap. The decrease in the radius of curvature is accompanied by a rocking or wedging of the peripheral portions of the cap with respect to the groove, which rocking action tends to lock the cap firmly into position within the groove and assure a rigid, rattle-free, almost seamless, fit for the life of the knob assembly.

The wedging fit of the cap in the groove 14 is a result of the coaction of cam shoulder 22 of the cap against shoulder 27 of the groove 14 under the outward radial

expanding stresses of the cap. As will be readily recognized from the foregoing description, said shoulders 21 and 22 under the outward urging forces exerted by the cap, tend to shift the entire cap forwardly, forcing the front face portions 20 adjacent the periphery of the cap tightly against the shoulder 25 of the groove 14. Thus the radial stress in the cap, obtained by confining the latter within a restraining shell, is utilized to impart a forward component to the cap to force the latter against a rearwardly directed ledge or shoulder 25.

Since the peripheral rim 23 of the cap 13 is rounded, an arrangement is secured whereby radial expansive force of the cap tends to urge the cap forwardly as aforesaid, whereas if the rim 23 were to engage precisely the apex 28 of groove 14, the retaining force would be primarily radial and much of the forward thrust of the benefits obtained thereby would be lost, and the cap would then have some susceptibility to shift axially with respect to the knob.

When the cap assumes the position shown in FIGURE 5, the trailing peripheral segment 32 is likewise rocked or shifted from the less angular position of the peripheral edge position shown in FIGURE 4 to a more acute position wherein it is forced against the annular portion 31 of the shell, it being understood that the parts are dimensioned so that a premature engagement of these parts is avoided, since such an engagement is undesirable as detracting in a measure from the forward or axial thrust previously described.

It is important to emphasize that when the parts are finally positioned, the cap is maintained in stressed condition, the hoop strength of the shell serving to overcome the beam strength of the cap.

The provision in the rearward face 33 of the cap of groove 34 inwardly spaced from the periphery adds to the attractive appearance of the unit, and tends to camouflage the fact that the shell and cap are not integrally formed by leading the observer to believe that the junction of the cap and knob, like the groove 34, forming an almost undiscernible seam, is added for decorative purposes. It will be understood that additional grooves at inner radial points may be added to the outer face of the knob to increase its flexibility.

It will be readily recognized that the cap 13 may be provided with a push button, an axial bearing, a lock carrying mechanism, a tumbler lock or like expedient, with the intention to provide a lock having full operating functions.

Once the cap is properly seated in the groove of the knob shell, it cannot be removed therefrom without the exertion of extraordinary forces. Since any removal force must be exerted from the "inside" against the rear face 20 of the cap, such force tends to decrease the concavity of the cap, thereby forcing the periphery even more tightly against the groove in the knob shell.

It is important to note that by utilizing plastic, particularly that of the nylon type, Zytel as an example, a thickness of the edge and its formation is possible while still retaining resiliency to provide the rocking action in deflecting the center to give a diametrical reduction in size of the cap which assures peripheral stressed contact

which is not to be expected with cast metals without exceeding the elastic limit of the metal, or providing adequate peripheral seating by thin sheets of metal which will flex to permit seating as described.

Having thus described our invention and illustrated its use, what we claim as new and desire to secure by Letters Patent is:

1. A door knob assembly including a shank portion and a gripping portion comprising a hollow shell of plastic material set to rigidity for loads encountered in door knob operation, having an open outer end, an annular groove formed in the inner circumference of said shell adjacent said open end, said groove including an annular sloped cam shoulder portion in trailing position and a rearwardly directed ledge member in forwardly spaced relation to said cam shoulder portion, a concavo-convex end cap member of resilient plastic having a circular peripheral portion seated in said groove, the convex portion of said cap member being directed toward said shank portion, the diameter of said cap member, in the unstressed condition thereof, being greater than the diameter of said groove, whereby said cap member in the inserted position of the latter within said groove is maintained in stressed condition and assumes an increased concavo-convex posture with respect to the unstressed condition thereof, said periphery of said stressed cap being biased radially against said cam shoulder portion and coacting therewith to urge said cap member axially against said ledge member in stressed contacting relationship.

2. A door knob assembly including a shank portion and a gripping portion comprising a hollow shell of plastic material set to rigidity for loads encountered in door knob operation, having an open outer end, an annular groove formed in the inner circumference of said shell adjacent said open end, said groove including an annular sloped cam shoulder having radial and axial slope components and an inwardly extending retaining ledge in spaced relation to said shoulder, a concavo-convex end cap member of resilient plastic having a circular peripheral portion seated in said groove, the convex portion of said cap member being directed toward said shank portion, the diameter of said cap member in the unstressed condition thereof being greater than the diameter of said groove, whereby said cap member in the inserted position of the latter within said groove is maintained in stressed condition and assumes an increased concavo-convex posture with respect to the unstressed condition thereof, said periphery of said stressed cap being biased radially against said cam shoulder and coacting therewith to urge said cap member, axially against said ledge member in stressed contacting relationship.

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