May 22, 1956 P. R. ZELL 2,746,079

DECORATIVE AND PRESSURE-RECEIVING BUTTON AND MANUFACTURE THEREOF

Filed May 29, 1952

Fig. 1

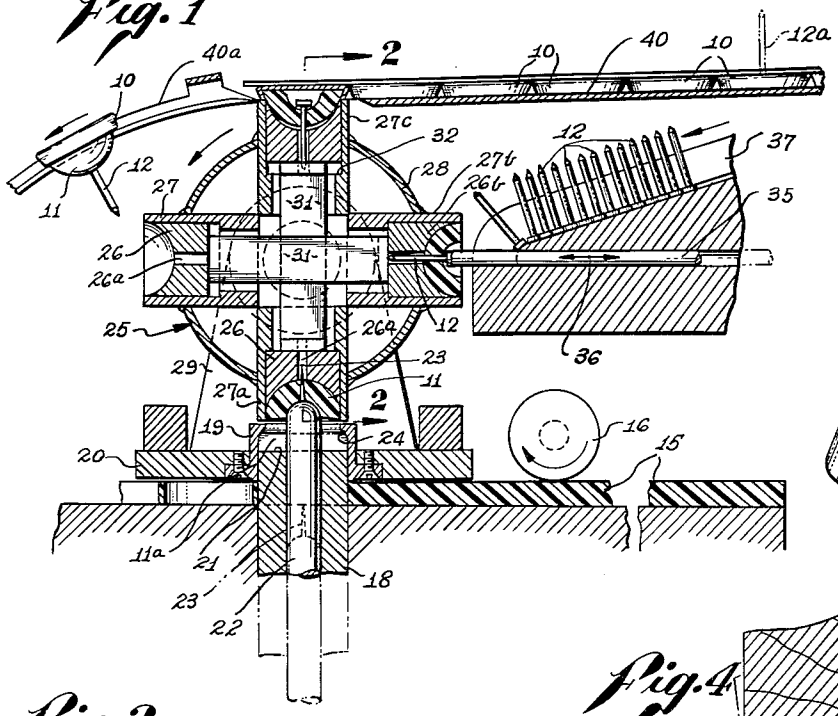

Fig. 3

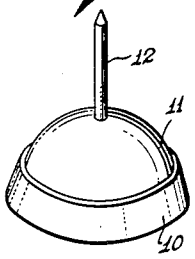

Fig. 2

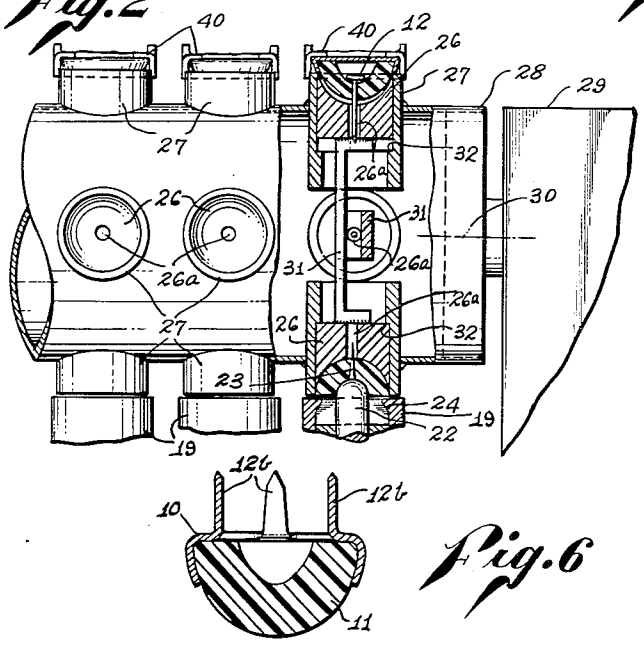

Fig. 4

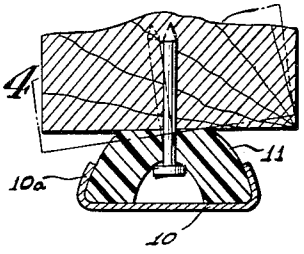

Fig. 5

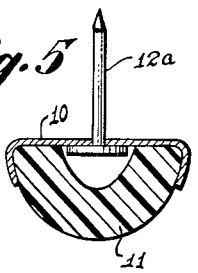

Fig. 6

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DECORATIVE AND PRESSURE-RECEIVING BUTTON AND MANUFACTURE THEREOF

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6 Claims. (Cl. 16—42)

My invention relates generally to a plastic-metal article taking the general form of a button and suitable for use as a chair slide, push button, decorative button, or similar use wherein the article serves not only a structural or pressure receiving function, but in some cases a decorative function as well. This application is a continuation-in-part of my copending applications, Serial No. 129,736, entitled Furniture Slide, and Serial No. 129,737, entitled Furniture Slide and Method of Manufacture Thereof, said applications being filed concurrently on November 28, 1949, both now abandoned.

Buttons of the class described have, in the past, been constructed by molding the same in the finished shape, or by machining them out of solid stock. Such articles have the disadvantage that, if constructed of a hard plastic, they are subject to being broken, permanently deformed, or shattered by severe blows or pressure, and if constructed of a softer, nonbrittle material, they are subject to deformation by which they tend to become separated from the metal portion of the article. Also, if the article is to have a decorative function, it is usually necessary to individually and mechanically polish the plastic portions of the article before or after they are attached to the metal portions. Such an operation is expensive and time consuming.

With a general view to overcoming the aforesaid difficulties and providing additional advantages, it is a major object of the present invention to provide a plastic button-like article of the class described which can be quickly and readily fabricated from sheet plastic material.

It is another object of the present invention to provide apparatus for fabricating articles as described in the next preceding paragraph.

It is still another object to provide a button of the class described which is particularly suitable for use as a chair slide in that it is resiliently deformable to permit "self-leveling" of the legs of the chair to which it has been attached, and is yet inherently capable of returning to its original condition, due to a characteristic known as "plastic memory" or delayed elasticity.

It is still another object of the present invention to provide an article of the class described which can be quickly processed to produce a high gloss appearance without the necessity of the use of buffing, scrubbing, or other abrasive polish methods.

The foregoing and additional objects and advantages of the invention will be apparent from a consideration of the following description of certain presently preferred embodiments thereof, such consideration being given likewise to the attached drawings, wherein:

Figure 1 is an elevational sectioned view of apparatus embodying my invention for the construction of the plastic-metal objects above described;

Figure 2 is an elevational partially sectioned view of

the apparatus of Figure 1, taken on the line 2—2 therein;

Figure 3 is a perspective view of an article produced by the apparatus shown in Figures 1 and 2;

Figure 4 is an elevational partially sectioned view of the article of Figure 3 attached to the leg of a chair for use as a chair slide; and

Figures 5 and 6 are alternate forms of the article similar to that shown in Figure 3.

Referring to Figures 3 and 4, it will be seen that one presently preferred form of button comprising my invention consists in a bezel-like cup or base **10** into which is inserted and secured a hemispherical, hollow, plastic dome **11** through which extends an attachment nail or spike **12**. The dome **11** is composed of a plastic material originally in sheet form and stretched into its hemispherical form in order that the inherent stresses in the same when the shape illustrated in Figure 3 will be such that the dome, if deformed, will tend to return to its hemispherical shape when the deforming force has been removed. The just-described tendency to return to its original shape is quite pronounced in certain plastic materials, of which one is polyvinyl chloride of the following formula.

Material:	Parts by weight
Polyvinyl chloride resin	10
Tricresyl phosphate (plasticizer)	4 to 5

Such material has a Shore durometer hardness of about 90. Substantially less or substantially more plasticizer than the amount indicated produces a harder or softer end product and materially reduces the property of delayed elasticity.

It will be realized by those skilled in the art that other plastic materials also possess the characteristic of plastic memory or delayed elasticity, i. e., the characteristic of tending to return slowly to its original shape after deformation forces are removed.

Since the material of the plastic dome **11** was originally flat, it tends to return to a flat condition, that is, the outer peripheral edges tend to move outwardly and thus continuously force themselves snugly into the overhanging walls of the bezel base **10**.

Apparatus for punching the material of the dome **11** from a sheet, forming it into the hemispherical shape, and inserting it into the base cup **10** is illustrated in Figures 1 and 2. The sheet material from which the plastic domes **11** are formed is indicated at **15** in Figure 1. This sheet material is intermittently advanced to the left by a feed roller **16**, the sheet **15** sliding along a platen or table **17**, and is fed between a punch **18** mounted in the table **17** and an overlying die **19** supported in a fixture **20** extending across the sheet **15**. Actually there are a plurality of punches arranged and mounted for concurrent operation in conventional manner. A description of one punch will suffice for the present purposes of disclosing the invention, however.

The punch **18** is arranged and adapted to move upwardly through the die **19**, thus punching out a flat disc **11***a* of the plastic material of the sheet **15**, which disc rests on the upper end of the punch in the position indicated in dotted line at **21** in Figure 1. It will be realized, of course, that the feed roller **16** is momentarily stopped by control means (not shown) during the operation of the punch **18**. Such intermittent feed apparatus being well known in the art of punch press design and operation, a further detailed description thereof is deemed unnecessary herein.

With the punch **18** at rest at the top of its stroke, the disc **11***a* of plastic material in the position **21** is thereafter formed into its hemispherical shape by the operation of an upwardly moving ram **22** coaxially positioned with-

in the punch **18**. The ram **22** is rounded at its upper end as shown, and may if desired be provided with a perforating needle **23** whereby to perforate the dome **11** to receive the spike **12** in a later assembly operation to be described. Since sequentially operating punches and the like are known in the art, it is deemed unnecessary herein to describe in detail the mechanisms for moving and synchronizing the punch **18** and the ram **22**.

The operation of forming the disc **11***a* into the dome **11** is accomplished by forcing the disc from its position on top of the punch **18** upwardly through an inwardly tapered upper bore portion **24** of the die **19**. After leaving the die **19**, the disc is forced upwardly into an inserting fixture indicated generally at **25**, coming to rest in a supporting cup **26**. The cup **26** has a central aperture **26***a* formed therein to clear the perforating spike **23**, if the latter is employed.

The inserting fixture is comprised of a plurality of tubular barrels **27**, all secured in a transverse rotary supporting drum **28** which is in turn mounted for rotation in journal bearings **29**. The transverse axis **30** of the supporting drum **28** is arranged immediately above the vertical axis of the punch and die **18—19** so that successive rotations of the drum **28** move the barrels **27** one after another into alignment with the vertical axis of the punch and die. Successive operational stations of the barrels **27** are designated **27***a*, **27***b* and **27***c* in the drawings. The operational control mechanism (not shown) is so synchronized as to place a successive one of the barrels **27** above the punch and die **18—19** with each stroke of the latter.

Within each barrel **27** is slidably supported one of the receiving cups **26**, pairs of such cups being secured together by a connecting bar **31** so that upward movement of one of the cups **26** (located at the lower station **27***a*) as a result of receiving the upwardly moving hemispherically formed disc **11** moves the diametrically opposite cup upwardly to eject the dome **11** from the uppermost barrel **27** (at station **27***c*). In Figure 2, it will be noted that the connecting bars **31** of two pairs of barrels **27** are laterally offset so as to clear each other. The barrels **27** are formed with internal shoulders as indicated at **32**, so as to limit the aforesaid ejecting movement of the cups **26**.

The direction of rotation of the supporting drum **28** is anti-clockwise, as viewed in Figure 1, whereby the dome-containing barrel **27** falls in an intermediate horizontal station **27***b* at the time the lowermost barrel is positioned at station **27***a* to receive a dome **11** thrust upwardly by the ram **22**. A spike **12** is forced into the dome **11** which is positioned at the intermediate station **27***b* by a laterally moving magnetized ram **35**, which moves reciprocally as indicated by the arrow **36**, in synchronism with the intermittent rotation of the drum **28**. Spikes **12** are fed down a stripping chute **37** in conventional manner, and one of the spikes **12** is picked up by each stroke of the ram **35**, the forward end of which is magnetized so as to support the spike and thrust it outwardly through the perforation in the top of the dome **11**. The resiliency of the dome **11** and the fact that it is compressed into the barrel **27** causes it to seize the spike **12** and separate the same from the ram **35** when the latter is withdrawn.

Across the top of the fixture **25** is a feed chute **40** through which a plurality of the bezel bases **10** is fed to the left by gravity feed or other suitable conventional means, a detent (not shown) being provided to catch and releasably hold a base **10** in a position of alignment above the uppermost barrel station **27***c*. The minimum diameter of the inwardly sloping walls **10***a* of the base **10** is approximately equal or slightly larger than the internal diameter of the barrel **27**. Thus when the dome **11** is ejected upwardly from the barrel **27**, it moves into the aligned base **10** and the resiliency of the dome **11** expands it outwardly into the base **10**, holding it securely therein. The next successive 90° rotation of the drum **28** carries the finished article **10—11—12** along a curved portion **40***a* of the track **40**, due to the fact that the dome **11** and the spike **12** still remain partially engaged with the cup **26** even after the dome **11** has been inserted into a base **10**. As the article moves along the curved track **40***a*, however, it is gradually withdrawn from the cup **26** and discharged from the chute **40**.

In some cases, an alternative form of pressure-receiving button is desired, such as shown in Figure 5, wherein the spike **12***a* instead of being supported in the dome **11**, is supported in a central aperture in the base **10**. Such a central aperture in the base **10** may be made slightly smaller than the shank of the spike **12***a* so that when the latter is driven in, it will be held in place frictionally. Spikes **12***a* are assembled with bases **10** in conventional fashion prior to feeding the bases **10** along the chute **40**. Thus the spikes extend upwardly as indicated in dotted line in Figure 1. When articles of the type shown in Figure 5 are assembled with the apparatus shown in Figure 1, an alternative type of forming ram **22**, having no spike **23** thereon, is employed, and thus the domes **11** are not perforated as they are pressed into place in the cup **26**. For similar reasons, the operation of the spike inserting ram **35** is discontinued during the assembly of articles of the type shown in Figure 5.

Buttons of the type shown in Figure 6, wherein the attachment spikes **12***b* are integrally formed from the material of the base **10** itself, are assembled by the same series of operations as just described in connection with the form shown in Figure 5.

After the articles are discharged from the chute **40***a*, the dome **11** may be quickly polished by subjecting the same to a gas flame momentarily. Such brief exposure to the heat of a flame fuses a very shallow surface layer of the dome **11**, and due to the fact that such surface layer is under tension due to the forming operation above described, the material when thus heated spreads and smooths out to form a very high gloss finish, equal or superior to that which can be achieved by forming the same in polished molds, or by polishing it abrasively after it is formed.

The stresses trapped in the dome **11** due to the forming operation and the fact that it is subsequently inserted and held in the base **10**, have the additional advantage that the interior or internal portions of the dome are under compression whereas the outer skin is in tension. A dome of this type is much superior to a solid molded dome from the standpoint of resiliency as when used as a chair slide, and also the tendency to return to its hemispherical shape when deformed due to the weight of a chair as shown in Figure 4, is enhanced.

The behavior of the dome **11**, when subjected to deforming forces, is quite curious. If such forces are applied and released suddenly, as by a hammer blow, the material behaves similarly to rubber, that is, it deforms resiliently and quickly returns to its initial shape. On the other hand, if a force is applied and remains applied over an appreciable period of time, the material first yields resiliently to an amount proportional to the force and thereafter gradually deforms further at a relatively slow rate. When the deforming force is removed, the plastic material does not instantly return completely to its initial shape. Instead it springs back by an amount approximately equal to its initial deformation and thereafter, over an extended period of time, it creeps back toward its original shape. While the polyvinyl chloride material previously described has a tendency to behave in the manner just described when it is in its normal sheet form, such tendency is greatly increased when the material is mechanically preconditioned, that is, formed under pressure and held in its stressed shape as herein described.

The above-described attributes are particularly useful in a chair slide in that if four of the articles are secured to the bottoms of the legs as shown in Figure 4,

several advantages accrue. First of all, if the legs are not exactly vertical but slightly sloped, the chair slides **10—11—12** can, over a period of time, tilt so as to accommodate themselves to a level surface as indicated by the phantom line in Figure 4. Furthermore, if one of the four legs of a chair is slightly too long or slightly too short, the creep or slow deformation of the material under pressure permits a self-leveling action in that even a relatively small force such as the weight of a chair, if applied over a long enough period of time, will cause the slow deformation of the plastic in an amount sufficient to make up for most small discrepancies in the lengths of chair legs or the surface on which the same rest. Such self-leveling action usually takes a matter of hours, and after the chair has reached a level position in which all four legs bear substantially equally, the buttons or slides additionally serve a cushioning purpose in that they behave resiliently when sudden loads are applied as by a person sitting in the chair.

The rubber-like character of the material when subjected to sudden blows also makes it possible to drive the spike **12***a* of the article shown in Figure 5 by merely striking the top of the dome **11**. Such sudden blow on the dome **11** flattens the same and the force is transmitted to the spike **12***a*, the latter having a somewhat larger head than the spike **12**, whereby to receive the blow without damaging the plastic material of the dome **11**. The slide shown in Figure 6 is driven in a similar fashion.

While the plastic-metal article has been described in connection with a specific application as a chair slide or furniture supporting member, it is also useful in other applications such as the bumpers employed to cushion the shock of a closing door, or in ornamental push buttons and other buttons wherein a highly polished, but shatterproof gloss surface is desired. In addition to the glossy finish which is achieved by the process above described, the metal-plastic button members constructed according to the present invention have the advantage that the plastic portion always remains tightly secured in the base **10** whereas similar articles constructed of hard molded plastic tend to become loose and rattle due to shrinkage of the plastic portion.

While the device shown and described is fully capable of achieving the objects and providing the advantages hereinbefore stated, it will be realized that it is capable of some modification without departure from the spirit of the invention. For this reason, I do not mean to be limited to the form shown and described, but rather to the scope of the appended claims.

I claim:

1. A resilient yieldable button comprising: a body of plasticized thermoplastic resin deformed to place a surface layer thereof in tension, said layer being fused and reset to gloss the same; and a rigid base member secured to said body to hold the same in said deformed condition and with said surface layer exposed.

2. A resilient yieldable button comprising: a body of polyvinyl chloride plasticized to a Shore durometer hardness of approximately 90 and deformed to place a surface layer thereof in tension, said layer being fused and reset to gloss the same; and a rigid base member secured to said body to hold the same in said deformed condition and with said surface layer exposed.

3. A resilient yieldable button comprising: a hemisphere of plastic material having the property of delayed elasticity, said hemisphere being cold formed from a flat disc whereby to internally stress the same; and a rigid base member secured against the flat side of said hemisphere to hold the same in its hemispherical shape against the force of said internal stress.

4. A resilient yieldable button comprising: a hemisphere of polyvinyl chloride resin plasticized with tricresyl phosphate to a Shore durometer hardness of approximately 90, said hemisphere being cold formed from a flat disc whereby to internally stress the same; and a rigid base member secured against the flat side of said hemisphere to hold the same in its hemispherical shape against the force of said internal stresses.

5. A resilient yieldable button comprising: a hemispherical body of plastic material having the property of delayed elasticity, said body being prestressed to urge the same to flatten if not restrained and a convex surface of said body being exposed to receive externally applied pressure; and a rigid base member secured to said body to restrain the same against said flattening urged by said prestressing.

6. A resilient yieldable button comprising: a hemisphere of polyvinyl chloride resin plasticized with tricresyl phosphate to a Shore durometer hardness of approximately 90, said hemisphere being cold formed from a flat disc whereby to internally stress the same; a rigid cup member embracing the margin of said hemisphere to hold the same in said hemispherical shape against the force of said internal stress; and an attachment spike embedded in said hemisphere and extending from the apex thereof.

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