Sept. 21, 1965 R. NIKOLL 3,207,892

HOLLOW BODY EXHIBITING LIGHT EFFECTS

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Fig. 4

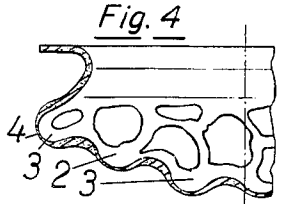

Fig. 16

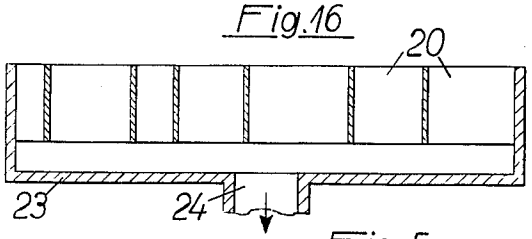

Fig. 1

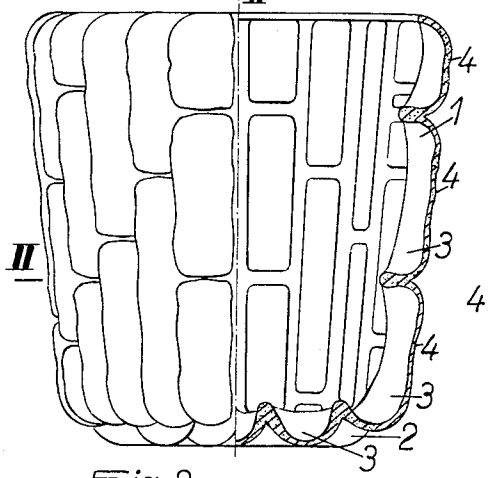

Fig. 3

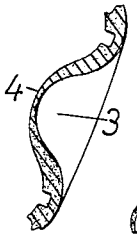

Fig. 5

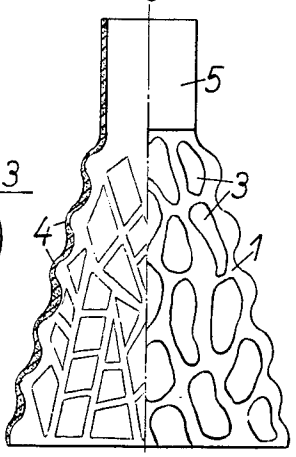

Fig. 2

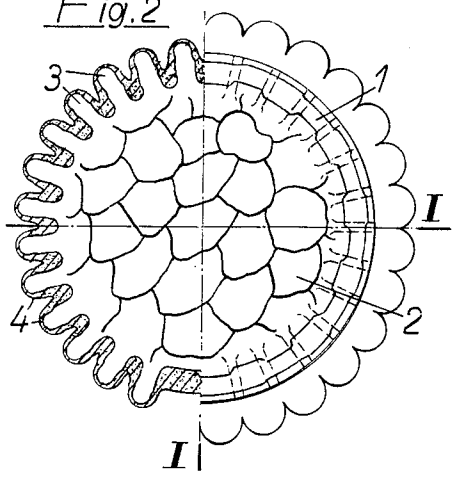

Fig. 6

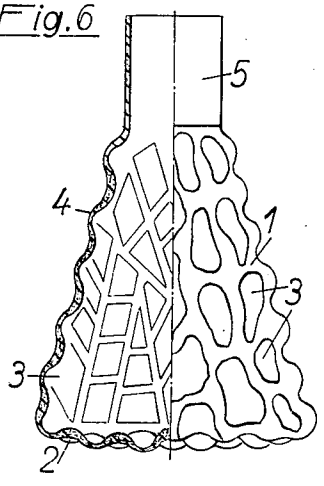

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Fig. 13

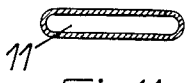


Fig. 11

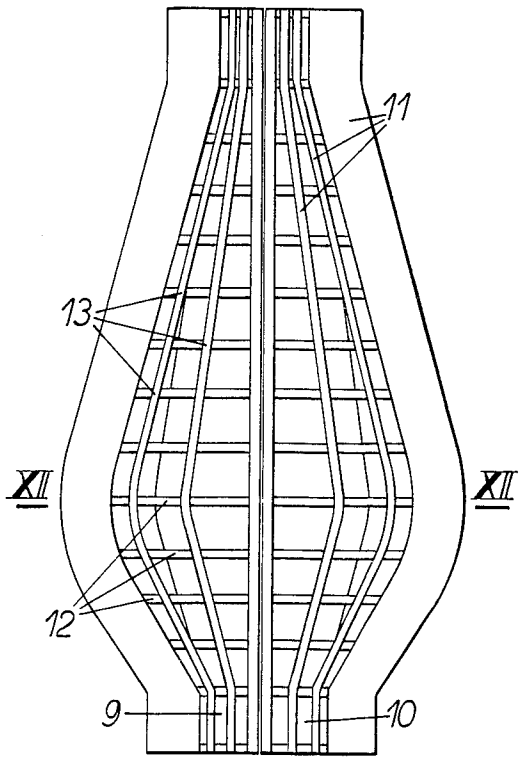


Fig. 12

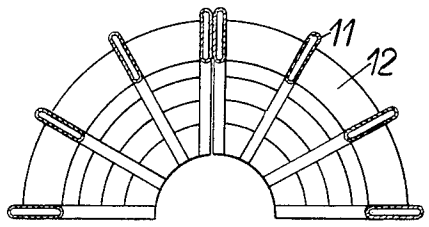


Fig. 7

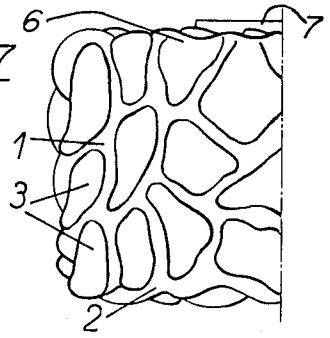


Fig. 8

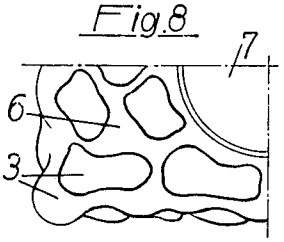


Fig. 9

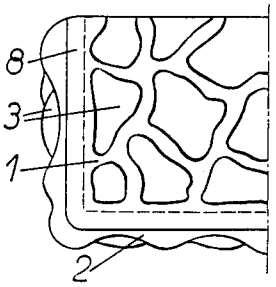
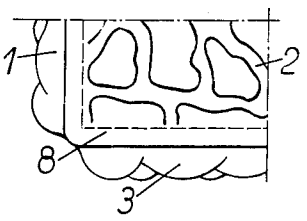


Fig. 10



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HOLLOW BODY EXHIBITING LIGHT EFFECTS

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Fig. 14

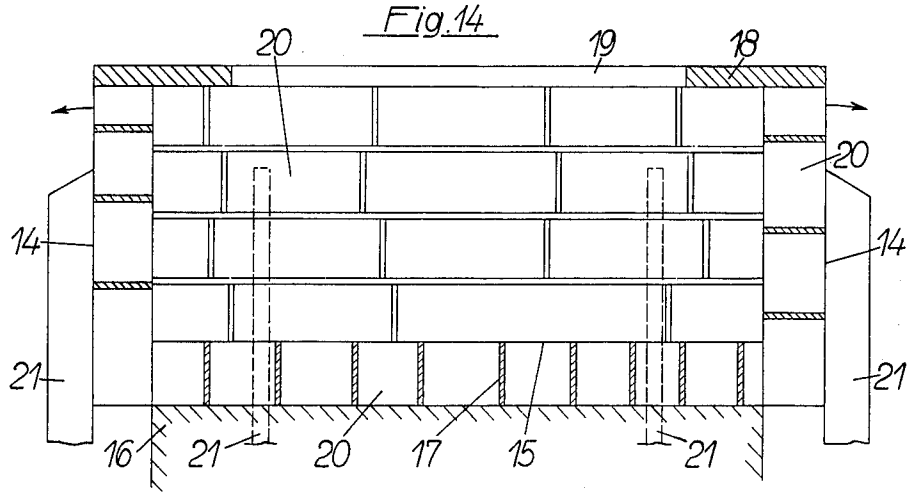
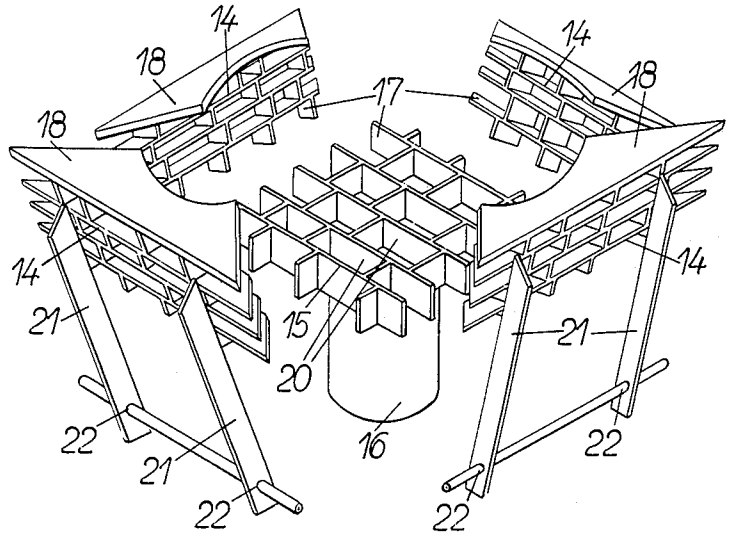


Fig. 15



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3,207,892

HOLLOW BODY EXHIBITING LIGHT EFFECTS

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Claims priority, application Austria, June 1, 1960, A 4,180/60; Apr. 14, 1961, A 2,987/61
3 Claims. (Cl. 240—10)

This invention relates to a hollow blown body, particularly a cover for light sources.

Such hollow bodies, which are used for example in the lighting fixture industry or as vases or the like, have in most cases only a shallow surface profile, which is formed, for example, with the aid of suitable templates, during the manufacture of the body, and which imparts to the body the characteristics of pressed glass. The light diffusing effect of these known glasses, which as a result of their manufacture have a fire finish only on one side, is unsatisfactory and their light effects are not very impressive. An excellent gloss, which is characteristic of high-grade glass, can be obtained, however, if the wall of the body is provided according to the invention at least in part with bulges which are directly blown out of the material and have a fire finish on both sides. In such hollow bodies, the light effects are enhanced according to the invention if the bulges have in their protruding portion, particularly adjacent to the apex, a smaller wall thickness than other parts of the wall to promote the diffusion of light.

The light effects which can be achieved with such design can be obtained in a hollow body having a shell and a bottom if, according to the invention, at least the bottom is provided with unilaterally protruding bulges. If such hollow bodies have wall portions meeting along edges and are, for example, of prismatic shape, marginal portions along these edges may be kept free of budges according to a feature of the invention.

The invention provides further a process of manufacturing such hollow bodies, particularly of high-grade glass, by blowing the material in a deformable state in a hollow mold.

According to known methods, a skeleton mold apertured according to the patterns to be formed is placed in a plain or patterned hollow mold and a glass bulb is introduced into said skeleton mold and is blown until it conforms to the wall of the outer hollow mold. In these known processes, any hollow mold will permit a relief-like deformation only to a certain extent because the outside wall of the resulting hollow body has the shape of the hollow mold to which it was applied when being blown and exhibits the profile due to the inserted skeleton. This means that a separate skeleton mold is required for each degree of deformation. Moreover, such hollow bodies do not have a fire finish on both sides because their outside surface must contact the surface of the hollow mold during manufacture. For this reason, the appearance and light-diffusing effect of such glasses are not deemed satisfactory.

In another known process, which serves mainly to manufacture decorative vases or like articles, an inner lining, for example, of glass, is blown into an apertured metal sleeve so that the lining extends partly through the apertures, in the sleeve and is inseparably connected to it to form a compound body.

Hollow bodies which consist only of blowable material, such as glass, and which have a wall of variegated shape, a fire finish on both sides and excellent light-refracting and light-diffusing properties, can be obtained if, according to the invention, the bulges in the hollow body are formed by freely bulging the material out of local apertures of the hollow mold, the degree of deformation depending only on the selection of the parameters which

determine the deformation. Finally, the hollow mold is separated from the finished hollow body while the integrity of the latter is maintained.

Apparatus for carrying out this process consists, according to the invention, of a hollow mold, which is formed at least in a part of its wall with local apertures which permit of a free outward bulging of wall portions of the hollow body.

According to other features of the invention, the hollow mold is a composite of shell and bottom parts, and formed at least in its bottom part with local apertures which permit a free outward bulging of wall portions of the hollow body. The shell part of the hollow mold may be arranged to be separable from its bottom part formed with local apertures. Alternatively, the shell and bottom parts of the hollow mold may be composite and adapted to be composed to form a complete hollow mold. According to one feature of the invention, the hollow mold comprises a composite top plate, which is formed with an aperture and each component of which is connected to an element of the shell part of the hollow mold and together with said elements of the shell part is pivotally movable relative to the bottom plate.

According to further features of the invention, the hollow mold comprises a gridlike skeleton mold, which consists of metal rods. These may be undulated in their longitudinal direction and may have an elongated cross-section, the longitudinal direction of which extends substantially transverse to the wall formed by said skeleton. The rods may also be hollow and adapted to conduct a heat transfer fluid. Such hollow molds or at least parts thereof may be adapted to be heated if the hollow rods accommodate electrical heating elements or the rods themselves consist of resistor material, in which heat is generated when the rods are subjected to an electric current. It is also within the scope of the invention to interconnect the metal rods so as to form quadrangular, substantially rectangular cells. It is further contemplated according to the invention to design the apertured wall of the hollow mold or apertured portions thereof as wall portions of a suction chamber.

The invention will be explained more fully hereinafter with reference to illustrative embodiments shown in the accompanying drawings, in which

FIG. 1 is a diagrammatic elevation view showing a first embodiment of the body according to the invention, partly in a sectional view taken on line I—I of FIG. 2.

FIG. 2 is a top plan view of the body, partly in a sectional view taken on line II—II of FIG. 1.

FIG. 3 is an enlarged transverse sectional view showing the unilaterally protruding bulge.

FIG. 4 is a longitudinal sectional view showing a portion of a second embodiment of the body.

FIG. 5 is an elevation view showing a third embodiment, one half of which is shown in longitudinal section.

FIG. 6 is an elevation view showing a fourth embodiment, one half of which is shown in longitudinal section.

FIG. 7 is an elevation view showing a portion of a prismatic hollow body.

FIG. 8 is a top plan view showing this body.

FIG. 9 shows a modified form of a body as shown in FIG. 7.

FIG. 10 is a top plan view showing the body of FIG. 9.

FIG. 11 is a diagrammatic elevation view showing one half of a four-part skeleton mold.

FIG. 12 is a sectional view taken on line XII—XII of FIG. 11.

FIG. 13 is an enlarged sectional view showing a hollow grid rod.

FIG. 14 is a longitudinal sectional view showing a composite, prismatic hollow mold.

FIG. 15 is a perspective view showing the hollow mold of FIG. 14 in a somewhat opened condition.

FIG. 16 is a diagrammatic view showing a part of the hollow mold in conjunction with a suction chamber.

The hollow body shown in FIGS. 1 and 2 and preferably made from glass consists of a shell part **1** and a base part **2**. Both parts are provided with unilaterally protruding bulges **3** having a fire finish on both sides. As is shown in FIG. 3, the wall thickness of the protruding part may be varied so that the bulge has substantially the light-diffusing effect of a divergent lens. The provision of the regularly or irregularly distributed, unilaterally protruding bulges **3** in the shell part **1** and the base part **2** results in a considerable increase in the light effects. For this reason, such hollow bodies are particularly suitable as cover bowls or, as shown in FIG. 1, as cups for chandeliers or ceiling lamps. Particularly in the latter case, it may be sufficient to provide the unilaterally protruding bulges **3** only in the base part **2** of the body, as is shown, e.g., in FIG. 4. As is also apparent from FIG. 4, the size and shape of the bulge need not be equal for all bulges, but may be varied. For instance, most of the bulges **3** in the shell part **1** are elongated whereas those in the base part **2** have the shape of a dome. FIG. 5 shows a hollow body in the shape of a truncated cone, which is adjoined at its small end by a cylindrical part **5** and which does not have a bottom part. In this case, only the frusto-conical shell part **1** has irregular bulges **3**. The hollow body shown in FIG. 6 differs from the one in FIG. 5 in that it has a bottom part **2** formed with bulges **3**. FIGS. 7 and 8 show a prismatic hollow body which has a top wall portion **6** having a central aperture **7** and also formed with unilaterally protruding bulges **3**. In the prismatic hollow body shown in FIGS. 9 and 10, marginal portions **8** are free of unilaterally protruding bulges **3** along the edge where the wall portions meet. A hollow body having such edges can easily be cut along the edges to form a plurality of flat or curved plates provided with bulges. Such plates can then be assembled to form configurations which cannot be made or can be made only wtih difficulty in one piece. Such configurations may be used to provide covers for light sources having a large size.

FIGS. 11 and 12 show an apparatus for manufacturing a hollow body according to the invention. The figures show one half of a four-part skeleton mold having a gridlike shell. The half mold is composed of two parts **9, 10**. The grid elements **11, 12** of the shell have an elongated cross-sectional shape and consist in most cases of metal rods 1–4 mm. thick. As is shown on a larger scale in FIG. 13, the rods **11, 12** are hollow and are adapted to conduct a fluid. The metal rods **11, 12** are arranged in two sets, which intersect substantially at right angles. The rods **12** extend in planes which are at right angles to the axis of the hollow mold. The rods **11** extending substantially in the longitudinal direction extend with the longitudinal direction of their cross-section radially with respect to the longitudinal axis of the skeleton mold and one narrow face of these rods faces the longitudinal axis of the mold (FIG. 12). The grid rods **11, 12** contacting at point **13** are interconnected, for example, by spot welding. In the example shown, the metal rods **11, 12** may be flat in their longitudinal direction or may be undulated. In any case, the grid elements must be of sufficient size to withstand the internal superatmospheric pressure required for the desired degree of deformation of a blown material having a certain viscosity. The grid elements might also have a square or circular cross-section, if desired. It would be sufficient to replace the metal rods having an elongated cross-section by wires of sufficiently large size.

Since the degree of the deformation of the blowable material depends, in connection with the invention, only on the selection of the parameters which control the deformation, such as the value of the internal overpressure applied, the temperature distribution, and the viscosity of the deformable material, a plurality of different types of hollow bodies can be made even with a single skeleton mold.

The apparatus shown in FIGS. 14 and 15 serves for the manufacture of a prismatic hollow body according to the invention. The mold consists of four shell elements **14** and a bottom plate **15** carried by a ram **16**. The shell elements **14** and the bottom part **15** are composed of flat metal rods **17** placed on edge and combined in a cellular structure. The shell is provided at its top with a diagonally divided plate, the elements **18** of which are firmly connected each to a shell element **14** of the hollow mold. The top plate is formed with an opening **19**, through which the deformable composition is introduced in the form of a bulb into the hollow space to expand under the influence of an internal superatmospheric pressure. To apply such superatmospheric pressure, the bulb may either be inflated through the pipe by which it is carried or the pipe may be tightly introduced into the mold, which is surrounded by an enclosure, which is then evacuated. In both cases the resulting hollow body expands. This deformation finds a geometric limit only at the rods of the grid whereas the material can bulge freely in the cells **20** of the skeleton mold. As is shown in FIG. 15, the shell elements **14** are mounted with the aid of support arms **21** and pivots **22** so that they are pivotally outwardly movable so that the hollow mold can be separated from the completely blown body without damage to the latter. The bottom plate **15** might also consist of several elements, each of which is firmly connected to a shell elements so that all bottom and shell elements can be combined to form an integral hollow mold.

In the apparatus diagrammatically shown in FIG. 16, a certain part of the hollow mold, e.g., the bottom part thereof, forms a wall of a suction chamber **23**. The internal overpressure which causes the bulging of the deformable material is caused by the evacuation of the suction chamber **23** through the opening thereof.

Materials suitable for hollow bodies according to the invention include transparent, colorless or colored and coated glasses, as well as translucent homogeneous or coated glasses and all plastics which can be shaped by similar methods and have equivalent optical properties. The light effects due to the refraction or/and diffusion of light can be varied in many ways by giving the bulges an appropriate shape and arrangement. More particularly, where translucent materials are employed, it is possible to promote the transmission of light through the marginal portions of bulges.

The wall thickness of the bulges may be controlled by a control of the temperature of the rods of the skeleton mold.

I claim:

1. A hollow body comprising a wall of blown material, said wall including, at least in part, integral blown hollow bulges producing an undulating portion for said wall, said bulges having opposite surfaces and having a fire finish on both surfaces, each said bulge having a smooth continuous profile which is effective to modify light emanating from within the body to produce zones of localized increased diffusion, at least some of said bulges having an irregular thickness, the latter bulges each including a portion of maximum projection which is of reduced thickness, each of the latter bulges tapering in thickness towards said portion of maximum projection to produce a divergent lens effect and intensification of the localized diffusion.

2. A hollow body comprising a wall of blown material, said wall including, at least in part, integral blown hollow bulges producing an undulating portion for said wall, said bulges having opposite surfaces and having a fire finish on both surfaces, each said bulge having a smooth continuous profile which is effective to modify light emanating from within the body to produce zones of localized increased diffusion, at least some of said bulges having an

irregular thickness, the latter bulges each including a portion of maximum projection which is of reduced thickness, each of the latter bulges tapering in thickness towards said portion of maximum projection to produce a divergent lens effect and intensification of the localized diffusion, said wall comprising a bottom portion and a shell portion, said bulges being in said bottom portion.

3. A hollow body comprising a wall of blown material, said wall including, at least in part, integral blown hollow bulges producing an undulating portion for said wall, said bulges having opposite surfaces and having a fire finish on both surfaces, each said bulge having a smooth continuous profile which is effective to modify light emanating from within the body to produce zones of localized increased diffusion, at least some of said bulges having an irregular thickness, the latter bulges each including a portion of maximum projection which is of reduced thickness, each of the latter bulges tapering in thickness towards said portion of maximum projection to produce a divergent lens effect and intensification of the localized diffusion, said body having an edge, said wall including

marginal portions which extend along said edge and are free of said bulges.

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