Sept. 30, 1952 A. G. GROSS 2,611,904

SINK STOPPER

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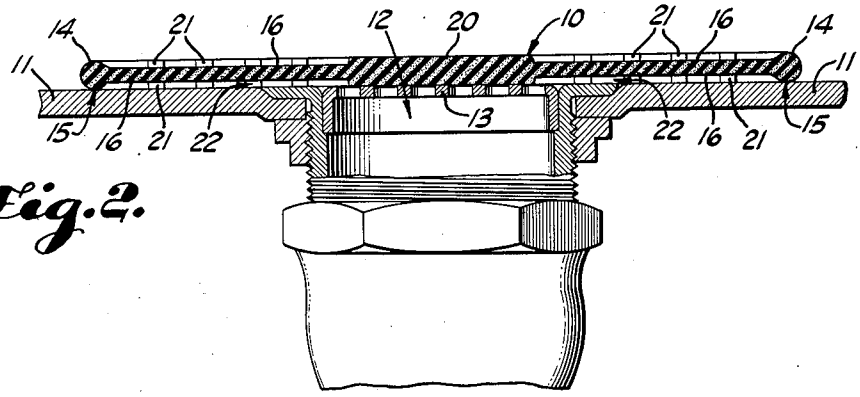


Fig. 2.

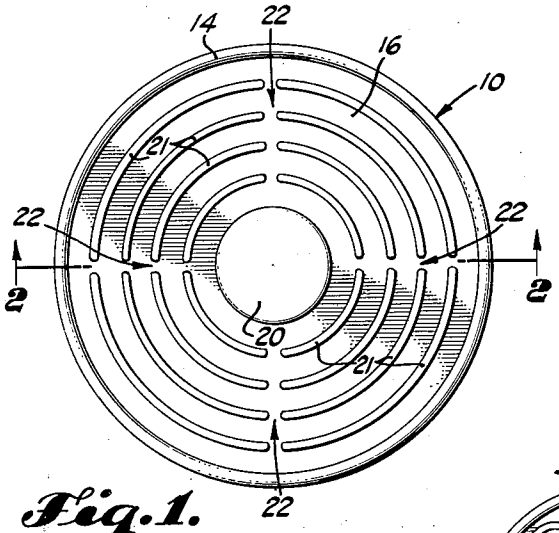
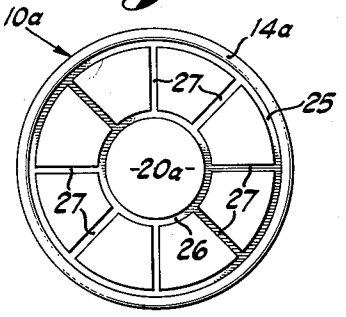


Fig. 1.

Fig. 3.



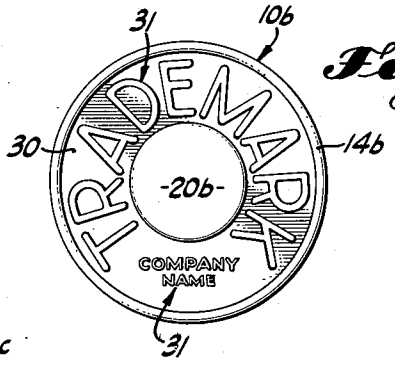


Fig. 4.

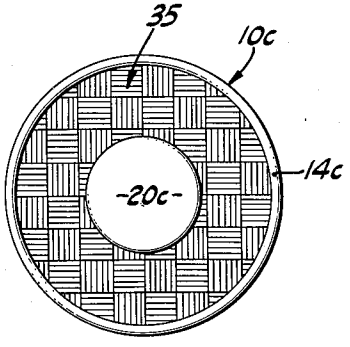


Fig. 5.

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SINK STOPPER

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4 Claims. (Cl. 4—293)

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The present invention relates to drain stoppers for kitchen sinks, tubs, and the like, wherein the drain opening is covered by a perforated strainer disk and is therefore not adapted to receive a conventional tapered plug stopper. More specifically, the invention is concerned with flat, rubber disk stoppers of the type which are adapted to be positioned over the strainer disk, and which are held in place by the pressure of the water standing thereon.

Prior drain stoppers of this general type have usually been made with a smooth flat contact surface on the underside thereof which is adapted to seat against the bottom of the sink around the margins of the drain opening in a watertight sealing engagement. It has generally been believed desirable to have the entire bottom surface of the stopper disk lie flat against the bottom of the sink, on the assumption that all of the disk area lying flat against the sink bottom would be sealed thereto, and consequently subjected to water pressure. I have discovered that this is not the case, however, and that a smooth, flat-surfaced stopper disk tends to form a seal only along a relatively narrow marginal zone immediately adjacent the edges of the drain opening. It is only within the area enclosed by this sealing zone that the top and bottom surfaces of the disk are exposed to the pressure differential responsible for holding the stopper down against the sink bottom. This pressure differential results from the fact that the top surface of the disk is exposed to the water pressure, whereas the bottom surface of the disk, within the area bounded by the sealing zone, is exposed to the pressure prevailing in the drain opening. The area of the disk bottom lying outside of the sealing zone is cut off from the drain opening, and is therefore not exposed to the pressure therein; hence such outlying area has no pressure differential between its top and bottom surfaces, and is therefore ineffective. In other words, the stopper is held down against the drain opening by the weight of a column of water standing only above the circular area enclosed by the sealing zone, which is usually considerably less than the total area of the disk. The resistance of the stopper to lateral displacement is a function of the downward pressure applied thereto, which is directly proportional to the cross-sectional area of the column of water standing on the disk. Thus, the downward pressure obtained with prior smooth-surfaced stoppers is inadequate to resist accidental lateral displacement satisfactorily because of the relatively

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small effective area enclosed by the sealing zone; hence it has been common practice to provide one or more projections at the center of the stopper disk that are adapted to fit into holes in the strainer to secure the stopper in place. Alining these projections with corresponding holes in the strainer disk is sometimes difficult to do, and the use of such projections is generally unsatisfactory, although the only previously known expedient capable of preventing displacement of the stopper.

The primary object of the present invention is to overcome these difficulties by providing a drain stopper of the character described which is so constructed and arranged that the sealing engagement with the sink bottom occurs only at the outer periphery of the stopper, whereby the stopper is held down against the drain opening by a column of water covering the entire area of the stopper. This has the effect of greatly increasing the downward force applied to the sink stopper, as compared with conventional drain stoppers, and results in a considerable increase in the resistance of the stopper to lateral displacement with respect to the drain opening.

A further object of the invention is to provide a substantially flat rubber disk drain stopper having increased resistance to lateral displacement, by virtue of a skid-resisting tread formed in the bottom surface thereof.

The foregoing and other objects and advantages of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the preferred embodiment thereof, together with other selected embodiments showing various modifications of the invention, for which reference is had to the accompanying drawing, wherein:

Figure 1 is a bottom plan view of a sink stopper embodying the principles of my invention;

Figure 2 is a sectional view, taken along the line 2—2 in Figure 1, illustrating the manner in which the drain stopper cooperates with the sink bottom and drain opening;

Figure 3 is a bottom plan view of another form of the invention;

Figure 4 is a bottom plan view of another modification; and

Figure 5 is a bottom plan view of still another form of the invention.

Reference is had first to Figures 1 and 2 of the drawings, wherein the sink stopper of the invention is seen to comprise a relatively thin circular disk 10 of rubber or rubber-like plastic, which is

adapted to be placed on a sink bottom 11 to cover a drain opening 12. The drain opening 12 is usually covered by a perforated strainer plate 13 which is substantially flush with the sink bottom 11, and the disk 10 is preferably made sufficiently large in diameter to cover the strainer plate 13 and extend radially outward beyond the same for a considerable distance. In the drawings, both the top and bottom surfaces of the disk are shown as functional surfaces having configurations formed therein which cooperate with the sink bottom to accomplish the objects of the invention, as will be described in more detail presently, thereby enabling either side of the stopper to be placed face down on the sink bottom. However, it is also contemplated that the disk might be made with the bottom surface only serving as a functional surface, in which case the top surface would be ineffective, and the stopper would be operative only when right side up.

Formed around the outer peripheral edge of the disk 10 is an annular sealing lip 14 which may take the form of a round bead, as shown, or any other suitable cross-section. This sealing lip 14 is adapted to seat on the sink bottom 11 at 15, forming a continuous circular seal near the periphery of the disk, at a considerable distance radially outward from the margins of the drain opening 12. In order to prevent the formation of a continuous seal at any point within the area bounded by the sealing lip 14, I provide means for venting the enclosed area to the drain opening 12. This has the effect of exposing substantially the entire bottom surface of the disk to the pressure prevailing in the drain opening, which is usually atmospheric pressure or less. Hence, the entire area of the disk is exposed to the pressure differential obtained on both sides thereof, and the disk is held down against the sink bottom by a vertical pressure equal to the weight of a column of water of the same diameter as the disk.

Venting the under side of the disk to the drain opening may be accomplished by any of several methods, the preferred method being shown in the embodiment of Figures 1 and 2, wherein the sealing surfaces are formed with shallow recesses 16 extending from the inner edge of the sealing lip in toward the center of the disk. The recess 16 may cover the entire area of the disk bounded by the sealing lip 14, or, as shown in the drawing, it may terminate at a raised circular boss 20 in the center of the disk, which is adapted to bear on the strainer plate 13. Projecting from the bottom of the recessed areas 16, concentric with the center of the disk, is a plurality of radially spaced, circular ridges 21 which are broken at intervals to form radial channels 22. The ridges 21 hold the recessed area 16 out of contact with the sink bottom 11 or the marginal flange of the drain opening, and the channels 22 vent the spaces between adjoining ridges 21 to the drain opening 12. The outer surfaces of the ridges 21 and boss 20 may be flush with or lie slightly below the plane of the outer surface of the sealing lip.

Another embodiment of the invention is illustrated in Figure 3, wherein parts that are similar to those described in connection with the preceding embodiment are given the same reference numerals, with the suffix *a*.

In this form of the invention the bottom surface of the disk 10*a* is substantially flat and has a circular outer channel 25 formed therein a short distance in from the outer peripheral edge of the disk. The narrow strip of disk lying beyond the channel 25 forms the sealing lip 14*a* which is adapted to form a seal with the bottom of the sink at a distance spaced radially outward from the margin of the drain opening thereof. A circular inner channel 26 is also formed in the underside of the disk concentric with the outer channel 25; said inner channel being disposed to overlie the drain opening 25 when the stopper is in use. Connecting the outer channel 25 with the inner channel 26 is a plurality of angularly spaced, radially extending channels 27. The channels 25, 26 and 27 serve to vent the underside of the disk to the drain opening, and thereby prevent the formation of a continuous seal except at the line of contact of the sealing lip 14*a*.

Another form of the invention is illustrated in Figure 4, and in this embodiment, parts that are similar to those previously described are given the same reference numerals with the suffix *b*.

The bottom surface of the disk 10*b* is recessed at 30 from the inner edge of the sealing lip 14*b* in toward the center of the disk, terminating at its inner edge in a central, raised boss 20*b*. A plurality of raised letters 31 may be formed on the recessed area 30, presenting either a trademark, or the company name of the manufacturer, or both, substantially as shown. In this case, the raised letters prevent the recessed area from lying flat against the sink bottom and also serve to vent the underside of the disk to the drain opening 12, so that the disk is prevented from forming a seal except at the line of contact of the sealing lip 14*b*.

Figure 5 shows still another embodiment of the invention, wherein the underside of disk 10*c* is formed with a rough-textured surface 35 between the annular sealing lip 14*c* and central boss 20*c*. The textured surface 35 may be similar to that shown, or it may simulate any other desired surface; the only requisite being that minute connecting passages be provided which serve to vent the underside of the disk from the inner edge of the sealing lip to the drain opening, so as to prevent the formation of a seal except at the line of contact of the sealing lip.

In each of the foregoing embodiments, the basic principle is the same. An annular sealing lip is provided around the outer periphery of the disk, which is adapted to form a seal with the sink bottom at a considerable distance radially outward from the drain opening 12. The entire area of the disk enclosed within the sealing lip is then vented to the drain opening so as to prevent the formation of a continuous seal except at the line of contact of the sealing lip. This insures that the entire area of the drain stopper will be exposed to the pressure difference resulting from the weight of a column of water standing on the top surface of the disk, giving the maximum vertical pressure obtainable on the stopper to hold the same down against the sink bottom and drain opening. The increased water pressure on the sink stopper gives the latter increased resistance to lateral displacement, thereby eliminating the need for a centering plug which has heretofore been provided for the purpose of engaging in the holes of the sink strainer 13 to prevent displacement of the stopper. Additional resistance to lateral displacement of the stopper is also provided by the anti-skid tread effect produced by the channels or ridges of the several embodiments.

While I have shown and described in considerable detail certain selected embodiments of the invention, it is to be understood that such de-

tails are not restrictive, and that various changes may be made in the shape and arrangement of the several parts without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A drain stopper comprising a substantially flat disk of rubber-like material, raised sealing means adjacent the outer periphery of said disk adapted to form a seal with the bottom of a sink at a distance radially outward from the margin of the drain opening thereof, and means for preventing the formation of a continuous seal between the underside of said disk and said sink bottom at any point except at said sealing means, said means comprising raised sink-engaging elements formed on the area of said disk inside said raised sealing means, and air passageways between said elements extending from said sealing means inward to the disk area overlying said drain opening whereby the total head of water over the entire area of the stopper will exert a downward force upon the stopper to preclude slipping thereof with relation to the drain opening.

2. A drain stopper comprising a relatively thin, substantially flat disk of rubber-like material, and an annular sealing lip formed on said disk adjacent the outer periphery thereof, said sealing lip being adapted to cooperate with the bottom of a sink at a distance outwardly from the margin of the drain opening thereof to form a seal, the underside of said disk within the area bounded by said sealing lip being formed with a plurality of channels extending from said sealing lip in toward the center of the disk, said channels serving to vent the underside of said disk to said drain opening so as to prevent the formation of a continuous seal between said disk and said sink bottom except at the line of contact of said sealing lip whereby the total head of water over the entire area of the stopper will exert a downward force upon the stopper to preclude slipping thereof with relation to the drain opening.

3. A drain stopper comprising a relatively thin, substantially flat disk of rubber-like material, an annular sealing lip formed on said disk adjacent the outer periphery thereof, said sealing lip being adapted to cooperate with the bottom of a sink at a distance outwardly from the margin of the drain opening thereof to form a seal, the underside of said disk being recessed for an appreciable distance from said sealing lip in toward the center of the disk, and a plurality of interrupted projections raised from the surface of said recessed area, said projections serving to prevent said recessed area from lying flat against said sink bottom and forming a series of connected passageways extending from said sealing lip in toward the center of said disk, whereby the underside of said disk is vented to said drain opening and is prevented from forming a continuous seal except at the line of contact of said sealing lip in such manner that the total head of water over the entire area of the stopper will exert a downward force upon the stopper to preclude slipping thereof with relation to the drain opening.

4. A drain stopper comprising a substantially flat disk of rubber-like material, a continuous sealing ridge on the underside of said disk adapted to form a seal with the bottom of a sink around the drain opening thereof, said sealing ridge defining a substantial disk area extending outside and entirely around the margin of said drain opening, and a non-sealing area on the underside of said disk between said ridge and an inner disk area which overlies the drain opening comprising a plurality of raised sink-engaging elements and intervening air passages extending from said ridge to said inner disk area, whereby the total head of water over the entire area of the stopper will exert a downward force upon the stopper to preclude slipping thereof with relation to the drain opening.

ARTHUR G. GROSS.

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