Dec. 11, 1962 M. KESSLER 3,067,900

SELF-VENTING PRESSURE-RELEASE SEALING CAP

Filed July 28, 1960

FIG. 1.

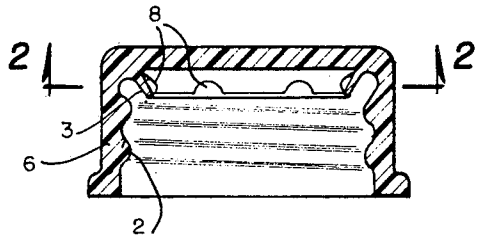


FIG. 3.

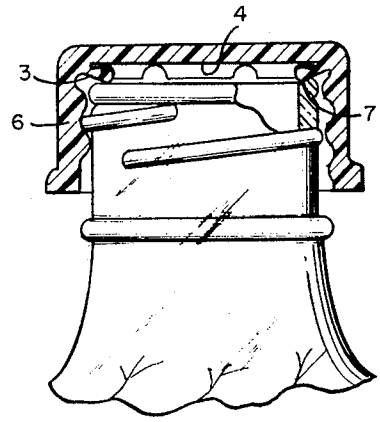


FIG. 2.

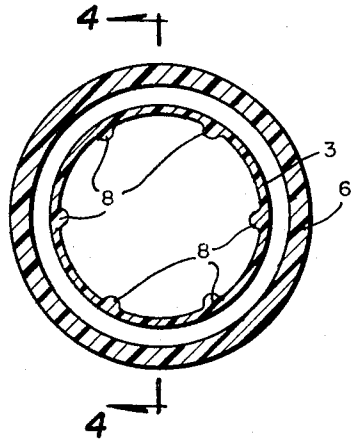


FIG. 4.

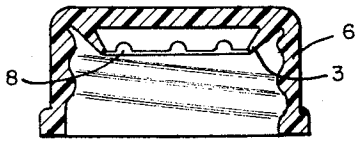


FIG. 6.

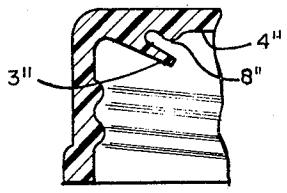
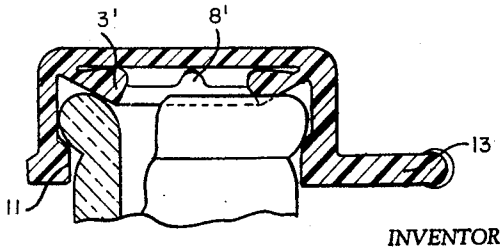


FIG. 5.



INVENTOR

Milton Kessler

BY Max L. Libman

ATTORNEY

United States Patent Office

3,067,900
Patented Dec. 11, 1962

3,067,900
SELF-VENTING PRESSURE-RELEASE SEALING CAP

Milton Kessler, 4535 Grove Drive, Youngstown, Ohio

Filed July 28, 1960, Ser. No. 45,978
4 Claims. (Cl. 215—56)

This invention relates to sealing caps such as are used for closure of bottles, screw-type metal cans, and the like and has for its primary object the provision of a unitary plastic cap providing a completely fluid-tight enclosure for such containers and which has the additional feature of being automatically self-venting for use with containers in which a dangerous gas pressure may be developed, whereby the cap automatically provides for venting for any excess gas when a predetermined pressure is attained.

Plastic caps, such as for example screw-type bottle caps, have come into wide-spread use. However, since the plastic cap must be made sufficiently rigid so that it can be tightly screwed down to provide a good fluid seal, the material of the cap interior which engages the lip of the orifice or pouring spout which it closes is necessarily too stiff and rigid to of itself provide a good fluid seal. It has therefore been the general practice to insert into the cap a disc of resilient material such as cork, cardboard, etc., and to face this disc with another disc of waterproof material such as metal foil or thin plastic. This enables the screw cap to be screwed down tightly enough so that the resilient material is compressed and forces the waterproof material into fluid-tight engagement with the lip of the container. This type of fabrication is obviously more expensive than a unitary molded bottle cap would be, and efforts have been made to provide a unitary plastic cap which is reusable, but yet forms a satisfactory liquid seal. My copending application, Serial No. 845,815, filed October 12, 1959, for Unitary Plastic Sealing Cap, shows such a cap, and the present invention is based upon the structure shown in that application, but with improvements which provide a new and useful function.

Some fluids which are sold at retail in sealed bottles have the characteristic of slowly developing pressure due to the generation of gas in the fluid. This is true, for example, of certain bleaching fluids, where the presence of minute impurities such as metal particles dissolved in the fluid, will slowly cause the generation of gas which can reach a dangerous pressure which may cause the entire bottle to explode. Another example is in the case of certain food products, where in the case of insufficient sterilization, decomposition may cause dangerous pressures to occur. For some such instances, there is a requirement that the cap or seal used be self-venting, i.e., it must release gas whenever the pressure exceeds a certain predetermined amount, so as to relieve the internal gas pressure and prevent the possibility of an explosion. This has heretofore required expensive and complicated mechanism. A major object of the invention is to provide an inexpensive, unitary, one-piece cap of homogeneous plastic material, which automatically accomplishes this function.

Another object of the invention is to provide a plastic sealing cap which maintains a constant predetermined sealing pressure under all conditions.

Sealing caps are commonly applied to the container by automatic bottling and capping machinery, and where screw-type caps are employed, the cap applying machinery must apply a certain torque to the cap, within relatively narrow limits, in order to insure adequate sealing. This is often difficult to achieve within the prescribed limits—too high a screw-down torque will often strip or damage the cap, while insufficient screw-down torque will not provide adequate sealing. It is another object of the invention to minimize this problem, by providing a screw-type

cap which is adequately sealed within a wide range of torques.

The specific nature of my invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment, as shown in the accompanying drawing, in which:

FIG. 1 is a cross section taken through the central axis of a cap according to the invention, showing the novel construction;

FIG. 2 is a sectional view taken on line 2—2 of FIG. 1;

FIG. 3 is a view similar to that of FIG. 1 showing the cap applied to a bottle and screwed down tightly;

FIG. 4 is a sectional view taken on line 4—4 of FIG. 2;

FIG. 5 is a sectional view of the invention applied to a snap-on type of cap; and

FIG. 6 is a sectional view of a modified form of the invention.

FIG. 1 is a sectional view showing the construction of the cap according to the invention. The cap has an entirely conventional exterior in configuration, and is screw-threaded internally as shown at 2. A sealing portion 3 consists of a thin-walled hollow conical frustrum or truncated cone having its base integrally joined to the cap at the interior junction of the flat top portion 4 and the tubular side wall portions 6 of the cap. The general construction is similar to that shown in my copending application previously referred to. Any suitable molding plastic may be used, such as a hard polyethylene or vinyl plastic, and the necessary resilience of the sealing element 3 is secured by making it sufficiently thin so that it is capable of proper resilient deformation to provide the necessary sealing force to press against the lip 7 of a bottle or other container (FIG. 2). On the upper side of sealing lip 3 there are provided a series of bosses or nodules 8, shown as six in number in the modification of FIGS. 1–3, and four in number in the modification of FIG. 5. The nodules are so proportioned that when the cap is screwed down a sufficient distance as shown in FIG. 3, the nodules come in contact with the under side of the top surface 4, after which the cap is essentially rigid, after which further pressure in screwing down the cap will have no further effect. This is particularly useful in connection with automatic capping machines, because it provides a very definite pressure point at which the customary torque-responsive mechanism can be actuated.

In the manufacture of certain bleaches, and other chemically-active ingredients, particularly such as react with metals, it often occurs that a small amount of metallic material finds its way into the fluid, and in the course of time, this generates gas, the pressure of which may reach dangerous proportions. I have found by test and experiment that a cap constructed as shown above can be made to vent such pressures within any useful range. For example, one requirement is for a venting seal which will vent at pressures of about three pounds per square inch. By selecting a proper thickness of sealing lip 3 consistent with the material used and the size of the cap, and a proper spacing of nodules 8, I have produced caps which, when screwed down tight as shown in FIG. 3, will consistently release a train of gas bubbles (demonstrated by holding the entire assembly under water) whenever the internal pressure, as indicated by an attached pressure gauge, is above three pounds. In this case, for a standard cap of approximately one inch diameter made of polyethylene, with six nodules, as shown in FIGS. 1–3, the average thickness of the sealing lip was in the order of $\frac{1}{32}$ inch, the cross section of the lip being somewhat tapered as shown in FIG. 4. It will be apparent that the dimensions will vary somewhat with the characteristics of the material used, but the selection of materials and proportions for each case is within the skill of the plastics designer and engineer. If a higher pressure range is required, a more

rigid plastic or greater lip thickness may be employed, but it has been found readily practicable to construct caps which will function within the required range (for one use) of about three pounds. I am not certain of the reason why the construction shown operates as it does, but have found that caps so constructed are remarkably uniform in their characteristics and consistent in performance.

FIG. 5 shows essentially the same construction as FIG. 1, except that the screw thread is replaced by conventional lip **11**, which cooperates with the customary out-turned lip **12** on the bottle to retain the cap in sealing position. The internal seal **3'** is the same in construction as previously described, and cooperates with the bottle mouth in the same fashion. A tab **13** may be provided to facilitate removal of the cap. This type of cap is simply pressed on by hand is usually made of somewhat softer and more resilient plastic composition than the screw-type caps shown above. It is usually employed as a replacement cap for the crimped metal caps such as are used on bottles containing soft drinks, beer, etc.

Due to the unitary one-piece construction described above, a homogeneous cap can be inexpensively fabricated by automatic production methods as shown in my copending application, Serial No. 30,609, filed May 20, 1960, for Method of Making Unitary Plastic Sealing Cap, at a lower cost than has heretofore been possible. The necessity for using a multi-piece cap construction is obviated, and a cap having very superior sealing qualities is obtained.

FIG. 6 shows a modification of the invention in which the sealing lip **3''** is of exactly the same construction as described in my copending application, Serial No. 845,815, above referred to, i.e., without the nodules or bosses 8 show in FIGS. 1–3. However, a corresponding nodule 8'' is placed at a spaced series of points on the under side of surface **4''** to achieve the same result as described above. It is obvious that when the cap is screwed down the sealing lip **3''** presses against the nodules **8''**.

While I am not certain of the reason why the construction shown operates as it does, I believe that the explanation lies in the non-uniform deformation of sealing lip 3, which results from it being effectively thick at some portions and thin at others around its circumference. This would appear to cause the sealing pressure at some points around the circumference to be so light that as the gas pressure rises, the gas can force its way out at these points. In other words, by virtue of the non-uniformity of the sealing lips, some portions of the sealing lip take the major portion of the strain as the cap is tightened, while intermediate portions seal with a relatively light pressure, and at these latter portions the gas can escape when it builds up sufficient pressure to overcome this relatively light sealing pressure. This is supported by the observed fact that when the cap (e.g., the one-inch cap previously described) is lightly tightened with the fingers, it will seal the gas up to about one pound pressure, and as the internal pressure rises above one pound per square inch, the gas begins to escape; however, if the cap is tightened more firmly, the gas does not begin to escape until the pressure arises to above a higher level, for example, three pounds pressure. No matter how tightly the cap is screwed down, with the one-inch cap described, the pressure cannot build up to more than approximately five pounds before the gas begins to escape. At this point, it would appear that the nodules or thickened portions **8** are resisting further pressure, probably by engaging the top of the cap as shown in FIG.

3; further torque exerted on the cap will only cause the thread engagement to fail, which occurs when excess torque is applied. However, it should be noted that effective venting occurs, although at lower pressure, even when the cap is not fully tightened; it is therefore apparent that the described venting and liquid sealing action occurs (although at a lower gas pressure) even though the nodules 8 are not engaged with the top 4, and I do not mean to be limited by any particular theory of operation.

The novel cap here described is not only very superior to conventional caps in ordinary use, but is very effective to vent gas wherever there is danger of high pressure building up within the container, before the pressure can rise to the dangerous level. The pressure at which venting occurs will, of course, vary with the construction and plastic material of the cap, but I have found it entirely feasible to make a seal which will vent a range of approximately 3–5 pounds pressure. This range of pressure assures that the seal will be adequate to meet the commercial specifications for a bottle seal, since it is equally undesirable that the seal should be too loose, which might permit the bottle liquid to leak out under normal conditions of storage and handling.

While I have shown the invention as applied to a glass bottle, it will be apparent that it is equally applicable to metal containers having screw-type pouring spouts, such as gasoline and oil cans, etc.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of my invention as defined in the appended claims.

I claim:

1. A one-piece homogeneous plastic cap for bottles and the like, said cap having a side-wall portion providing a generally tubular hollow space closed at one end by a top portion, and a thin flexible sealing portion for resilient sealing engagement with the lip of a pouring spout to be closed by said cap, said sealing portion extending integrally from the interior surface of said cap for part of the distance toward the central axis of said tubular space, said sealing portion being in the shape of a hollow truncated cone having a decreasing transverse diameter in the direction away from said top portion, and a series of spaced nodules between said upper side and the inner surface of the top portion dimensioned to permit the sealing portion to flex a limited distance toward said inner surface.

2. The invention according to claim 1, said nodules being equally spaced from each other.

3. The invention according to claim 2, said spaced nodules being integral with said sealing portion and on the upper side thereof.

4. The invention according to claim 2, said spaced nodules being integral with the top portion of the lower side thereof, and extending part of the way toward said sealing portion.

References Cited in the file of this patent

UNITED STATES PATENTS

2,789,719	Wheaton	Apr. 23, 1957
2,953,272	Mumford et al.	Sept. 20, 1960

FOREIGN PATENTS

62,853	France (Addition to No. 1,054,118)	Feb. 16, 1955
1,187,260	France	Mar. 2, 1959