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CAPSULE WITH INTEGRAL LOCKING BAND

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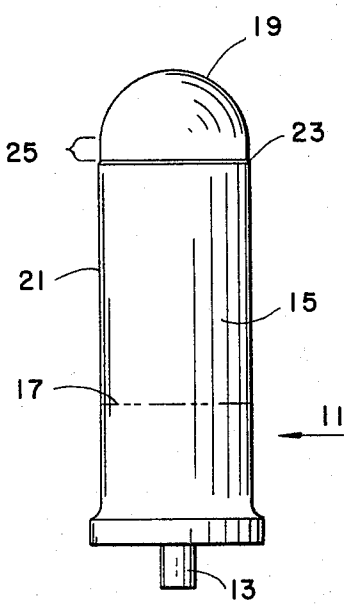

Fig. 1.

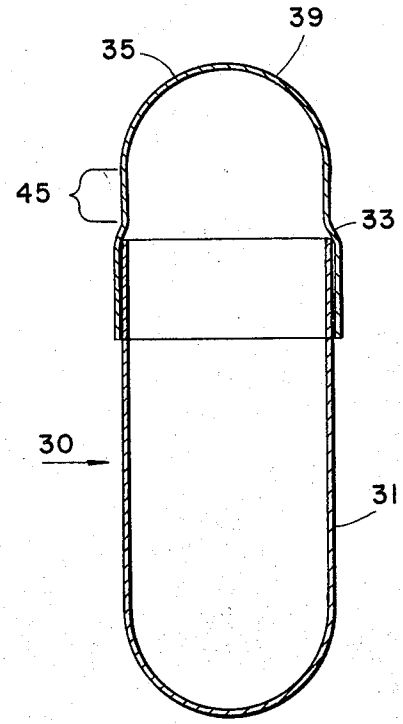

Fig. 2

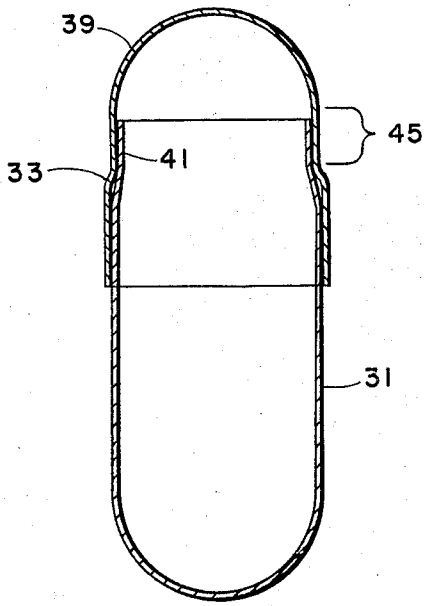

Fig. 3

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CAPSULE WITH INTEGRAL LOCKING BAND

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5 Claims. (Cl. 206—63.2)

This invention relates to a telescoping capsule commonly employed to contain pharmaceutical preparations, and in particular, to a capsule having a cap part so constructed as to provide a capsule which resists accidental separation.

Telescoping capsules of conventional type comprise a generally cylindrical or tubular cap part closed at one end and a generally cylindrical or tubular body part closed at one end. Both the cap and body parts are regularly tapered outwardly towards their open ends, and the diameters of the portions are so dimensioned that the inner diameter of the cap part near its closed end is slightly less than the outer diameter of the body part at its open end. The taper in the diameter of the cap and body parts customarily is of the order of .01 to .03 inch per inch of capsule cap or body length.

A taper in the capsule parts is necessary to permit the manufacture of the capsules in mass numbers of automatic machinery. In the manufacture of capsules a plurality of properly sized steel pins are dipped into aqueous gelatin, the adherent layer of gelatin is allowed to set and is dried, and the gelatin film which forms the cap or body part as the case may be, is pulled or stripped off the pin and cut to proper length. Were it not for the taper on the pin, the capsule part could not properly be stripped from the pin because the vacuum which would be created within it as it is being removed from the pin would hinder its removal and could even cause a partial collapse of the capsule part wall. As is obvious, a slight dislodgement of the capsule part from its position on a tapered pin permits air to seep between the capsule part and the pin and thus prevents the formation of a vacuum with its attendant disadvantages.

The taper also has other useful functions. When the body part is fully inserted in the cap part, the taper in the cap imparts a degree of wedging engagement with the oppositely tapered body part, thereby reducing the tendency of the cap and body to separate. Additionally, the difference in size of the open end of the cap and the open end of the body resulting from the taper in the cap provides a degree of clearance which makes the assembly of the cap and body parts a less critical operation than would be the case were there no clearance.

However, telescoping capsules of conventional construction have the decided disadvantage of being readily separable. Thus it not infrequently happens that even after the capsules have been filled and placed in containers for distribution to the ultimate user, one or more capsules may separate and spill their contents, thus rendering the remainder of the capsules in the container unsightly and frequently unpalatable. Because of the oppositely tapered configuration of the joined cap and body capsule parts, even a slight separation or displacement of the serves to release the body from its wedging enagement with the cap thereby increasing the ease and likelihood of complete separation and consequent spillage of the capsule's contents.

To avoid this unwanted separation, various expedients have been employed or propsed. Separation has been eliminated by sealing the parts together with a gelatin band. Although this method is effective, it adds materially to the cost of production. It has also been proposed to construct the cap of the capsule with an internally constritced portion so that as the bottom part of the capsule is inserted into the cap the open end of the tapered body is forced past the construction to provide a secure engagement of the parts (see U.S. Patent No. 525,845). Although this type of capsule cap construction can doubtlessly reduce accidental separation, it not adaptable to fabrication on automatic capsule machinery, for in addition to the resistance of stripping which would be encountered from vacuum as above noted, the constricted portion of the cap would greatly add to the difficulty of removal of the cap part from the pin.

The invention described herein provides a separation-resistant capsule which does not require a banding operation or a constriction. It furthermore does not rely on the customary ineffective wedging principle.

By this invention there is provided a separation-resistant capsule comprising a conventional body part and a novel cap part with a cylindrical portion adjacent to the closed end of the cap, which extends approximately one-sixth the length of the cap and is of a diameter somewhat smaller than the outer diameter of the open end of the body part with which the cap is to be joined. The press fit produced upon the joining of the cap and body parts provides a strong gripping action which resists separation of the parts.

It is, therefore, one object of this invention to provide a new and improved capsule which avoids accidental separation after filling with medicament.

A further object of this invention is to provide a new and improved capsule cap part which is readily manufactured on automatic capsule manufacturing machinery.

A further object of this invention is to provide a capsule which may be readily shipped empty and in assembled form, subsequently disassembled and filled, and then reassembled in a locked condition by conventional methods without incurring substantial expenses or requiring extra equipment.

Other objects and advantages will be apparent upon reading the specification in connection with the drawings in which:

FIG. 1 is a front view in elevation of a pin of the type used for producing a cap forming a part of the capsule of this invention;

FIG. 2 is a view in cross-section taken through the center of a capsule with a cap produced by the pin of FIG. 1 which is assembled but not locked; and

FIG. 3 is a view in cross-section of the capsule in FIG. 2 and in its locked position.

Referring to FIG. 1, a cap-forming pin **11** is illustrated which can be made of stainless steel. This pin **11** is of such size as to produce a cap for a size number 1 capsule and is described below with the dimensions suitable for the production of that size of capsule. However, the principles involved in this invention are applicable for making a variety of sizes of capsules, provided that the specified dimensions are changed proportionately.

Pin **11**, which is about 1.25" long, has a spindle **13** which is customarily fastened to an unillustrated mounting, along with a plurality of other like pins. Extending from the spindle is a generally cylindrical portion **15** with a diameter of .2678" at an imaginary line **17** corresponding to the open end of the cap to be formed. The pin is convergently tapered toward its rounded nose by a taper of about .012 inch per inch. In other words, the diameters of the pin at two points one inch from each other would differ by 0.12 inch. Interrupting the smoothly tapered wall **21** of the pin **11** is a beveled shoulder **23**. The shoulder **23** is beveled from the wall **21** at an angle of 15 degrees with respect to the pin's axis, although this angle is not critical and can be varied substantially. The beveled shoulder **23** is about 0.009" long. A cylindrical non-tapered wall portion of the pin

which may be referred to as the locking band die surface **25** extends from the beveled shoulder parallel to the longitudinal axis of the pin. The diameter of the locking band die surface is 0.2598" and the length of the locking band **25** including the beveled portion is 0.056". The end of the pin can be terminated in a conventional manner with a closed hemispherical end having a radius of .1324", or with a rounded end of compound curvature.

The length of the pin is about 1.5", but the length is not critical, it being only necessary to have a pin of sufficient length to permit the formation of a cap part which is about 0.38" to 0.39" long. The proper cap length is provided by a standard trimming apparatus embodied in the capsule-making machine.

A capsule-forming pin for the body part of the capsule **31** is not shown in the drawing since such is of conventional design. For a number 1 size capsule the pin is tapered in the customary manner and is so dimensioned that it will produce a body part which after trimming will have a length of 0.64" to 0.68", and an inner diameter at the above distance from its rounded, closed end of 0.2571", and bearing in mind the thickness of the capsule wall, will have an outer diameter at its open end of 0.2650".

FIG. 2 illustrates an assembled capsule **30** in an unlocked position. It is in this position that the empty capsule is shipped to the filler of the capsule. Attention is directed to the manner in which the open end of body **31** butts against the beveled shoulder **33** on the inner surface of cap **35**. Accidental assembly of the capsules into a locked position during their manufacture is not likely since beveled shoulder **33** provides a positive reference point and some degree of force is required to move the end of the body part past the shoulder.

After a capsule body part has been filled, for example, with a medicament, it is assembled with the novel cap part of this invention by forcing the body into the cap beyond the position illustrated in FIG. 2 to a locked position which is shown in FIG. 3. In fully locked position the end of the body **31** butts against the end of the cap **35** at the point where the hemispherical end-wall **39** begins. The wall portion **41** of the body extending beyond the beveled shoulder is in full contact with the area of the cap referred to as locking band **45**. Instead of a mere point or line contact between the body and cap, which can provide only a moderate degree of resistance to separation, the full surface of the cap's locking band **45** is compressively engaged in contact with a sizable area of the body. Furthermore, inasmuch as the open end of the body is slightly compressed at its end when fully extended into the cap, locking portion **45** of the cap is complementarily bowed or sprung out because of the taper on the body part. Thus, a tight engagement of the capsule parts results. Unlike the resistive action obtained from the oppositely disposed wedging surface engagement encountered in the customary capsule, a partial displacement of the cap and body parts does not result in the complete loss of locking engagement, but merely reduces the area of contact between the cap and body parts, and so diminishes the locking action only a slight degree.

In certain sizes of capsules, it is possible that a more secure engagement of cap and body parts may be obtained by assuring escapement of any air that might be entrapped and compressed within the cap and body when they are forced together. The capsule illustrated in FIGS. 2 and 3 does not normally encounter such a problem since the small amount of air which may be compressed within the cap and body is insufficient to overcome the resistive force occurring between the cooperating parallel locking areas of the band and cap. Should such a problem of air compression occur in any size of capsule, locking band **45** may be provided with one or more axially extending grooves to vent such amount of air as might be compressively entrapped within the capsule during the joining operation.

While only one embodiment has been illustrated and described, it is apparent that additional embodiments may be developed utilizing a parallel locking band in a capsule cap part without departing from the spirit of this invention and the scope of the appended claims.

We claim:

1. A separation-resistant capsule comprising a body telescopically engaged in a cap, said body having a closed end wall and a side wall having a generally cylindrical open-end portion, said cap having an end wall and a generally cylindrical side wall with means for selectively maintaining said body in first and second positively defined telescoped positions, said means comprising a substantially circumferential internal recessed portion of said cap side wall connected between said cap end wall and by a shoulder to the remainder of said cap side wall, said recessed portion being parallel to the axis of said capsule, the inner surfaces of said cap having a diameter as measured progressively toward said open-end portion always being at least as great as the diameter at a preceding point to permit the cap to be readily separated axially from a conforming internal support, said body in its first position having its open-end portion butted against the recessed portion of said cap wall and in close contact with said cap side wall, said body in its second position having its open-end portion compressed to a decreased diameter and butted against said cap end wall in compressed engagement with the recessed portion of said cap side wall.

2. A capsule according to claim **1** in which said body and cap are formed from a gelatin composition.

3. A capsule according to claim **1** in which the recessed portion of said cap side wall is connected to the remainder of said cap side wall by a beveled shoulder.

4. A capsule according to claim **1** in which the recessed portion of said cap side wall is approximately one-sixth the length of said cap.

5. A capsule according to claim **3** in which the beveled shoulder forms an angle of 15 degrees with the axis of the capsule.

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