An essentially two-component propel-repel dispenser is disclosed for consumable materials such as lipstick or other cosmetic, toothpaste, ointment, marking pigment and similar paste masses, as well as encapsulated or pelleted materials. One component of the dispenser consists of an open-ended outer tubular casing having an internal thread. The other comprises a consumable-material supporting structure integrally molded of plastic and consisting of: a carrier threadedly received in the casing member and axially reciprocable toward and away from an open end of the casing member upon rotation relative to the casing; a base element forming a closure for the other end of the casing, confined therein for rotation but against axial movement; and a pleated torque-transmitting element integrally molded with, and interconnected at its opposite ends to, the base and carrier elements, the torque-transmitting element serving to impart rotational force from the base member to the carrier and being axially extensible and contractible by means of the pleating.
BACKGROUND OF THE INVENTION

This invention relates to improved propel-repel devices useful for dispensers of consumable products, and more particularly for dispensers of cosmetic materials such as lipstick or eyeshadow; also toothpaste, pharmaceutical ointment and similar applications involving a requirement for controlled incremental dispensing of a semi-solid or even relatively soft pasty material, as well as in pill or pellet form.

The typical lipstick dispenser of the propel-repel type used extensively heretofore is generally composed of at least three, and usually four or more, main components in addition to a cap or closure. These components are separately fabricated and involve considerable hand assembly to provide the final product. Apart from the cap, the main components comprise an outer tubular casing member, and a carrier or cup member for supporting the consumable mass within this casing and moving it axially thereof between retracted and extended positions. In addition, the typical arrangement includes a pair of sleeves or shells, one telescoped within the other, one having a spiral cam slot running helically about the sleeve axis, the other sleeve having a straight, axially-extending slot. These slots intersect in the telescoped condition of the sleeves, and the carrier is provided with a lug or camming member projecting laterally to extend through and be engaged by the margins of both slots at their point of intersection. By causing relative rotation to occur between the telescoped sleeves, a camming action is produced on the carrier lug to cause it to move the carrier axially, either upwardly or downwardly, within the casing. Finally there is usually also a separate base or finger member provided to impart relative rotation to one of the sleeves. A lipstick construction using all-metal components typical of the foregoing is shown, for example, in U.S. Pat. No. 2,720,966.

Some simplification and reduction in number of components has previously been achieved by integrating the outer casing member and one of the camming shells or sleeves, particularly by forming such integrated part of molded plastic which facilitates providing the spiral or axial cam slot directly on the inner wall of the casing member. Such an arrangement is typified by the device shown in U.S. Pat. No. 3,346,103.

In another form, by making one of the camming shells non-circular and employing a complementary non-circular carrier or elevator whereby such members are keyed against relative rotation, the axially slotted cam sleeve can be eliminated. Such an arrangement is illustrated in U.S. Pat. No. 3,533,689.

Attempts have also been made previously to eliminate the camming sleeves entirely by utilizing an axially extensible torque-transmitting element directly transferring rotary movement from a finger operated member to the carrier or cup member within the outer casing, causing such cup to be raised or lowered within the casing. Examples are found in U.S. Pat. Nos. 2,655,261, 2,626,048, 2,491,723, 2,491,122 and 2,491,721; also Swiss Pat. No. 249,508, published June 30, 1947. All of these are characterized by employment of a wire spring coil as the extensible-retractable torque-transmitting member. U.S. Pat. No. 2,818,973 and French Pat. No. 632,125 (published Dec. 3, 1929) illustrate still another approach utilizing a pleated or multiple hinged member as the torque transmitting element. Neither of the foregoing types of dispensers, however, have found much if any practical application. The wire spring form suffers from retraction of the lipstick mass due to compressibility of the spring when attempt is made to apply the lipstick, while the other torque-transmitting arrangements disclosed in the patents referred to above are mechanically complicated, require much hand assembly and are too expensive for practical commercial use.

The present invention affords a means of obtaining further substantial simplification in a dispensing device useful for the above-mentioned purposes, as well as providing unique features greatly expanding the field of use to which it can be put. Briefly and in general, the invention provides a propel-repel device composed of only two principal components its simplest form, apart from the usual cap or closure member. Since dispenser devices of the kind under consideration must generally be designed for one-time use only, serving principally as a means for conveniently packaging and supporting a material until consumed, at which time the whole dispenser is then thrown away, the cost of manufacturing and of assembling such dispensing devices is of great importance, and extensive efforts have been made to reduce costs wherever possible. Savings of small fractions of a cent become very significant since these dispensers are used in great quantities, numbering in the millions of units annually. Due to the use of fewer components and to reduction in assembly operations involved in producing a dispenser embodying the present invention, a significant cost reduction is realized.

Unlike prior propel-repel mechanisms which are limited in respect to designed torque or turning moment requirements to produce a given increment of axial movement of the carrier, the present invention makes entirely practical the provision of propel-repel mechanisms incorporating extremely low-pitch advancing means for the carrier member. Furthermore, considerably more latitude in design is afforded by the present invention, so that it is entirely practical to produce devices in which the torque moment needed for advancing or retracting a carrier member may be made to change at different axial locations of the carrier member within the casing.

Advantages are realized by the present invention in respect of prior devices of a generally similar type, due in large part to the discovery of a practical means of fabricating as one integral assembly components which have heretofore necessarily been made as at least three separate components. Not only is there achieved a reduction in number of parts and in the number of steps required to assemble them, but there is a consequent elimination of clearance tolerances between assembled parts heretofore required. Closer tolerance between the remaining parts is thus easier to maintain, making for "tighter" working assembly.

The present invention also has advantages in providing a propel-repel device which can be directly charged more readily than prior devices with the consumable material, for example a lipstick mass; that is, the mass can be poured while in molten state, directly into the dispenser and allowed to harden in place, rather than requiring the mass to be pre-cast and then separately inserted into the dispenser, thereby involving still another assembly operation.
Practical use of the invention also extends to such applications as writing instruments, e.g., marking crayons, chalk holders and the like, and to applications in light duty torque measuring; e.g., instruments. Further uses of the invention will become more apparent from the description which follows of certain embodiments incorporating the novel concept characterizing the invention. Several such embodiments are shown in the accompanying drawings, in which FIG. 1 is a cross-sectional view in side elevation of a lipstick container comprising a propel-repel dispenser and cover cap, the dispenser member being shown in retracted or non-retracting condition; FIG. 2 is a view like FIG. 1 but with the cover cap removed, the dispenser being here shown in dispensing condition; FIG. 3 is an end view in cross-section taken on line 3—3 of FIG. 2; FIG. 4 is an end view in cross-section taken on line 4—4 of FIG. 2; FIG. 5 is an end view looking down at the top of FIG. 2; FIG. 6 is a view in side elevation of the integrally formed inner elements of the dispenser, as view at 90° to the cutting plane, 3 in FIG. 2; FIG. 7 is a fragmentary view on an enlarged scale of the pleated torque-transmitting element of the dispenser; FIGS. 8 and 9 are side elevational views showing a modified lipstick, FIG. 8 being partly in section depicting the lipstick in covered position while FIG. 9 illustrates the stick in condition of use; FIG. 10 illustrates a further variant of the lipstick seen in FIGS. 8 and 9; FIGS. 11 and 12 are elevational views of further variants of the pleated torque-transmitting element of the novel dispensers; FIGS. 13 and 14 are elevational views in cross-section of two additional forms of dispensers useful for packaging toothpaste or ointment, for example, the dispenser of FIG. 14 being adapted for refilling by the consumer; FIG. 15 is a side elevational view in cross-section of a marking pencil incorporating the invention; FIG. 16 is a cross sectional view in side elevation of a form of dispenser, useful for storing pills and the like, which resists access to the contents by small children.

In the embodiment illustrated in FIGS. 1 through 6, a lipstick container 20 is composed of a closed-end tubular cap 22 within which a propel-repel dispenser 24 is telescoping-ly received. Cap 22 may be metal or plastic; the propel-repel dispenser, however, is molded plastic. Dispenser 24 consists of two members, one being an outer tubular casing 26 which is open at its opposite end, the other member comprising an integrally molded actuating structure, designated generally at 28, enclosed by the casing. Member 28 has three different sections or elements comprising a carrier 30, an end closure or base 32 and a pleated web 34 attached at its respective opposite ends to carrier 30 and base 32.

As noted above, structure 28 is a one-piece member, as molded, its configuration being specifically designed to enable this to be accomplished, as more fully discussed hereinafter.

A lipstick mass (not here shown) is normally disposed in carrier 30 which is slideable within casing 26 between an extended position, as shown in FIG. 2, to expose the lipstick mass at the open end of the dispenser for normal use, and a retracted position, as seen in FIG. 1, illustrating the stored condition of the lipstick mass for its protection during periods of nonuse. Carrier 30 is dimensioned to make a close sliding fit within casing 26, and the adjacent walls of the carrier and casing are formed to provide mutually engaging screw means which, in the specific illustration, consists of a raised helical thread 36 on carrier 30 and a mating helical groove 38 in the inner wall of casing 26, extending axially therealong intermediate its ends. Rotation of carrier 30 relative to casing 26 causes axial shifting of the carrier to take place.

Base 32 is a cylindrical member whose side wall is stepped to form an upper annular shoulder 40 and a lower annular shoulder 42. See FIGS. 2 and 6 more specifically. Adjacent upper shoulder 40, the wall is peripherally recessed at 44 to provide a retaining groove, Casing 26 sits on shoulder 40 and is formed at its adjacent end with an internal peripheral flange or lip 46 which engages groove 44, permitting base 32 to be rotated relative to the casing. Lip 46 and retaining groove 44 are so dimensioned that their margins overlap forming an interference fit resisting axial separation under normal use.

Rotary motion of base 32 relative to casing 26 is transmitted to carrier 30, to cause it to be raised or lowered by the aforesaid screw engagement within the casing, by means of pleated web 34. This web has substantial resiliency in the axial direction, thereby permitting extension or contraction corresponding to the position of carrier 30 along the axis of the dispenser. However, web 34 has substantial rigidity in respect of torque moments applied in planes perpendicular to its axis. Such rigidity is a function of the width and thickness of the web, the number of folds or legs, as well as the material of which it is molded.

Details of the web construction are seen more especially in FIGS. 6 and 7. It consists of a series of accordion folded legs 33 interconnected by knees 35. Each of legs 33 is a generally flat rectangle of uniform thickness in its middle portion, tapering at each of its ends to merge into a curved knee of reduced thickness. The as-molded condition of structure 28 may be in extended, contracted or intermediate position; it is presently preferred to mold it in the condition corresponding to its maximum extension within casing 26, as seen in FIG. 2. From this, web 34 is collapsible upon screwing carrier 30 down within casing 26 so that the included angle between adjacent legs 33 approaches 0°, as permitted by flexing of knees 35 and tapering of legs 33.

In order to enable structure 28 to be molded as an integral unit of the three elements or sections, the point of attachment of each end of web 34 to the respective carrier 30 or base 32 is designed to occur at locations on the mutually confronting faces 29 and 31 of those respective elements which are axially below and above any peripherally enclosing walls or projections on those elements. While it will be noted that each of carrier 30 and base 32 have two bosses 48, 48 and 50, 50, respectively on their confronting faces which projecting axially below and above the points of juncture of web 34 with those elements, the bosses are of short circumferential extent. Thus a split type injection mold, which can be parted along a plane whose projection appears as line A—A in FIGS. 3 and 4, can be used to form the external surfaces of structure 28 in fully integrated con-
tion. Reciprocable core pins introduced axially from each end of the mold prior to injection of plastic resin form the interior surfaces of carrier 30 and base 32, and these pins are withdrawn when the mold is opened in order to release the molded structure.

Basses 48 and 50 serve a number of purposes. First of all, they provide additional bearing or guide surfaces on carrier 30 against the inner wall of casing 26, giving greater axial stability to the carrier and reducing any tendency it may have to wobble within the casing. The bosses also provide stops limiting the collapse of web 34 in the fully retracted condition of the dispenser (FIG. 1). Bosses 48 and 50, serve additionally to protect web 34 against undue torque stress and possible rupture, should base 32 continue to be turned after the limiting position is reached. If this occurs, the axially disposed faces 49 of bosses 48 will abut against the corresponding faces 51 of bosses 50 in the collapsed condition of web 34. Continued turning moment applied to base 32 is then transmitted directly to carrier 30 by the abutting faces, rather than by web 34.

This arrangement not only prevents misuse and rupture of the device by the user, but is useful also in the course of initially inserting structure 28 in casing 26. During assembly, cup 30 is first inserted into the lower lipped end of casing 26, and forced over lip 46 to move it into position to effect engagement of thread 36 with groove 38. Forcing of the cup past lip 46 is facilitated by turning the cup, and the positive clutch engagement effected by abutment of the respective pairs of bosses 48, 50 in the collapsed condition of web 34 allows such turning movement to be applied to the carrier by the base without subjecting the web to unnecessary torque stresses. Once carrier 30 is properly engaged in the casing, base 32 can then be snapped into position causing interlocking of lip 46 and groove 44.

 Provision is made at the outer end of casing 26 for preventing inadvertent travel of carrier 30 beyond the limiting position. This can be conveniently done by interrupting helical groove 38 short of the end of the casing, or by curling or lipping the casing inwardly to act as a stop against which the rim of the carrier abuts in the extended position.

Typically the interior of carrier 30 is formed with ribs 52 which serve to grip the pomade or other paste mass to be dispensed. This is conventional, as in the provision of friction ribs 54 on the wall of base 32 above shoulder 42 to help retain cap 22 on the dispenser.

In-place casting or molding of the paste mass is made more practical in dispensers of this invention because of the elimination of clearances needed between telescoped sleeves of the prior devices. That is, the dispenser is substantially more "liquid tight" and the inner working members of the propel-repel mechanism do not become coated with molten pomade due to such clearances and the leakage around carrier 30 that this allows.

For purposes of further illustration, details of the construction of a preferred practical embodiment of the lipstick device will now be given.

Materials of choice for the cap 22 are light gauge metal or plastic and are not critical. For casing 26, "DELRIN," trade name of D. I. Du Pont de Nemours & Co. for polyoxymethylene type acetal resins are suitable. For integrated assembly 28 the presently preferred materials are "DELRIN," or "Celcon," the latter being the tradename of an acetal resin produced by Celanese Corporation of America. Polypropylene polymers are also suitable.

In a lipstick of typical size, outer sleeve or casing 26 will be about 0.620 inch in external diameter and its maximum wall thickness in the threaded area about 0.042 inch. Depth of thread groove 38 may be about 0.016 inch, which is also the approximate radial depth of lip 46 at the lower or unthreaded inner end of the casing.

Carrier 30 for such a casing will have an approximate external diameter of 0.535 inch, with a thread height of about 0.012 inch. A desirable thread pitch is approximately two threads per inch for lipstick applications, and preferably thread 36 comprises slightly more than one full turn. Base 32 is dimensioned to conform its body diameter below shoulder 40 to that of casing 26 to make a smooth, continuous external wall contour. The stepped upper body portion of the base is undercut about 0.012 inch adjacent shoulder 40 to form groove 44. Each of legs 33 of web 34 is about 0.250 inch wide by 0.500 inch long, and 0.025 inch thick at its central portion, tapering at each end where it joins knee 35 to a thickness of about 0.012 inch. Referring to FIG. 7, the taper is effected at the inside or back side of the knee, being at an angle A to the perpendicular bisector of the knee which is from about 15° to 20° where the leg angle B is about 30°. In the as-molded position the included angle C between adjacent legs is about 60°, which produces a pleated web having 5 legs intermediate the carrier and base members.

A modified form of lipstick is shown in FIGS. 8 and 9 illustrating a further simplified, lower cost, embodiment of the invention. Container 120 again includes a cap 122 which in this instance encloses only the upper portion of dispenser sleeve 126. The wall of cap 122 is internally counterbored at 121, while the upper end of sleeve 126 is correspondingly reduced in diameter at 127 to provide a telescoping fit between the members. Sleeve 126 is threaded internally at 138, and is provided with an internal peripheral groove 146 adjacent its lower, a non-dispensing end, which serves as part of a retaining means. Integrated structure 128 comprises carrier 130 supporting a lipstick mass L, a base 132 and pleated web 134 interconnecting the carrier and base. Threads 136 on carrier 130 are received in thread grooves 138 formed in the wall of casing 126, whereby rotation of the carrier relative to the casing produces axial movement of the lipstick L. Base 132 is formed with a peripheral rib 144 which is snapped into and forms a free turning engagement with groove 146, permitting base 132 to be rotated relative to the sleeve but resisting axial separation from it.

In this instance, base 132 is completely recessed within the lower end of sleeve 126. Access to it for the purpose of turning it to produce axial extension or retraction of the lipstick mass is effected by means of a keying arrangement provided on cap 122. For this purpose, the cap is formed at its closed end with a polygonal boss 123, while base 132 is recessed at its underface to provide a correspondingly formed socket 131. As shown in FIG. 9, the cap is removed from its normal enclosing position at the dispensing end of the device and is coupled to the base by keyed interfitting of the boss and socket to provide a means of turning the base relative to the casing. The dispenser here shown is particularly suited to applications where it is desired to pre-
vent or at least minimize accidental or unauthorized actuation of the dispenser.

FIG. 10 illustrates another lipstick, varying from that shown in FIGS. 8 and 9 only in respect of the keyed interfit between the cap and base members for operating the stick. In this instance, cap 222 is formed at its upper end with a polygonal recess or socket 223, while the base operating member is provided with an axially projecting polygonal boss 231 adapted to fit in socket 223.

The forms of lipstick shown in FIGS. 8 through 10 are particularly adapted for use as refill cartridges in an outer casing of relatively expensive, decorative design, which because of its expense is intended to be used repetitively. However, the devices shown in these figures can, as seen, be used by themselves without the permanent case.

As noted above, the torque characteristics of the dispensing device can be modified by changing the design of the pleated torque-transmitting web. FIGS. 11 and 12 illustrate several modifications that are possible. In FIG. 11, web 334 is of progressively decreasing width from bottom to top, while in FIG. 12, pleated web 434 is of hour glass configuration. The torque-transmitting characteristics of such members will be nonuniform between fully retracted and extended positions, such variation being desirable for instance to minimize forced overtravel of the carrier, or to compensate for difference in resistance to rotational force required to actuate the dispenser depending on the particular position of the carrier axially of the casing.

Other applications of the invention are illustrated in FIGS. 13 and 14 in which dispensers are designed more particularly for such materials as toothpaste, cream, ointments and similar soft paste masses. In FIG. 13 the dispenser comprises a casing 526 reduced at its upper end to provide a neck 527. The exterior of the neck is threaded and receives a screw closure cap 522 typical of conventional collapsible toothpaste tubes. The interior of casing 526 is grooved at 538 to provide helical threads extending throughout the major axial length of the casing, and a piston 530, having external threads 536, is received in and threadedly engages the casing. The carrier element or piston 530 is part of an integrated molded plastic actuating structure designated generally at 528 which also includes a base operating member 532 and a pleated torque-transmitting web 534, generally similar to the corresponding elements previously described. Again, base 532 and casing 526 are provided with cooperating retention means, 544, 546, to permit rotation of the base relative to the casing but resisting axial separation. In this embodiment, the pitch of threads 536 and corresponding grooves 538 will normally be substantially lower than that employed in the lipstick previously described, in order to facilitate accurate dispensing of small increments of the consumable paste material. The invention is readily adaptable to utilizing such low pitch threaded advancement of piston 530.

The device shown in FIG. 14 is essentially similar but is adapted to be repeatedly refilled by the user. This is effected by provision of an intermediate closure or adapter member 521 which is threadedly received on the upper end of casing 526, and which in turn supports a threaded cap 522 for closing the outlet or dispensing orifice in the neck of the adapter. Removing adapter 521 provides access to the interior of the dispenser, which may simply be recharged by inserting a self-contained refill cartridge, i.e. a readily rupturable sack containing the material to be dispensed; or simply by packing the opened end of the dispenser with material.

Still another embodiment is illustrated in FIG. 15 in which a marking device 620 is shown. The device consists of a tubular casing 626 having at its upper end a tip 621 threadedly received in the end of casing 626 and provided with a central orifice 623 through which a marking lead M is projected. Propulsion of the lead from the dispenser is effected by an integrally molded plastic actuating structure 628 comprising a lead gripper 630, an operating base 632 and a pleated web 634. Gripper 630 is threadedly mated with the threads in casing 626, while base 632 and casing 626 are suitably formed to provide interengaging dent means 644, 646 permitting the base to be rotated but resisting axial separation from the casing.

The dispenser illustrated in FIG. 16 is generally similar in construction to that shown in FIG. 8, but is specifically designed to store and dispense pills, capsules or pellets in a manner that renders access to the contents by small children virtually impossible. In this instance, dispenser 720 consists of an open-ended tubular casing 726 having a cap 722 telescopically received over its dispensing end. The device also includes the integrated assembly of carrier or elevator 730 and pleated web 734 interconnecting the two. Carrier 730 is provided with thread means 736 which engage helical groves 738 in the wall of the casing so that turning the carrier relative to the casing causes axial movement. Again the carrier is turned by torque transmitted to it from end closure 732 by pleated web 734. In order to substantially eliminate the possibility that a small child might be able to operate the device, end closure 732 is completely recessed within casing 726 and can be turned only by engagement of some member, such as key 723 formed on the closed end of cap 722, in a mating socket 721 of the base or end closure member. In addition, casing 726 is provided at its outlet or dispensing end with small resilient protruberances 762 spaced circumferentially of the mouth and blocking release of the pellets or pills P. Only by elevating carrier 730 is it possible to force the pellets past the restraining protruberances.

It will be apparent from the specific illustrations that many modifications are possible within the scope of the invention. In this connection the following can be mentioned. Depending on the type of plastic used in molding the integrated carrier, end closure and interconnecting web structure, the web member as-molded may or may not be pleated or folded. Where polypropylene is used, it will generally be preferable to mold in the folds or pleats; but if nylon (polyamide) is used, for example, the pleats will be formed after molding. It is possible also, particularly in larger dispensers that two or more webs may be arranged in tandem to increase the torque capacity of the device. Also the configuration of the pleating of the web structure may vary from the straight transverse folding as shown to more elaborate folded arrangements. Likewise, the configuration of the projecting bosses on the respective carrier and base elements can be varied, as by forming them in the shape of segments of the circle defined by the side wall of the base member. The principal consideration here is that lateral access to the pleated web be maintained at the junctions to the respective carrier and base elements, that is, no peripherally encircling formation.
should be incorporated on the carrier and base members which so enclose the terminal portions of the pleated web as to make it impossible to mold the web integrally with the elements. The configuration of keying element on the cap and accepting socket in the end closure may of course take many forms, as may the arrangement for locking the consumable material to the carrier or restraining its egress from the mouth of the dispenser. The claims are accordingly intended to cover all such modifications and equivalents as the prior art will permit.

What is claimed is:

1. A propel-repel mechanism for shift-ing a carrier element longitudinally of an elongated casing member upon relative rotation between them, said mechanism comprising a two-component combination of
   a. an open-ended tube constituting said casing member, said tube having thread means along its inner wall and retaining means adjacent a first open end; and
   b. a molded plastic, integrally formed, actuating structure enclosed by said casing and comprising said carrier element, a base element and a torque transmitting element integrally connecting said carrier and base elements;
   said carrier element making a close sliding fit in said casing and having thread means engaged with those of said casing;
   said base element making a close rotatable fit within said first end of said casing and having retaining means engaged with those of said casing and resisting axial shifting of said base element relative to said casing;
   said torque transmitting element being a substantially flat web pleated transversely of the casing axis to form a plurality of accordion folds, and being molded at its respective ends to merge integrally into confronting faces of said carrier and base element at locations thereon which are axially beyond any peripherally enclosing formations of said carrier and base elements.

2. A dispenser as defined in claim 1, wherein said pleated element as molded is in axially extended condition.

3. A dispenser as defined in claim 1, wherein said pleated element is a flat web varying in width along its length.

4. A dispenser as defined in claim 1, wherein at least one of said carrier and base elements is formed, on a surface confronting the other element, with an axial projection which acts as a stop to prevent further collapse of said pleated web when said projection abuts said confronting surface.

5. A dispenser as defined in claim 4, wherein each of said carrier and base elements is provided on its mutually confronting surface with an axial projection.

6. A dispenser as defined in claim 5, wherein said projections are formed with axially disposed surfaces which substantially abut each other when said web element is collapsed.

7. A dispenser as defined in claim 1, wherein said casing is necked at its dispensing end to form an outlet of reduced size relative to the diameter of said casing.

8. A dispenser as defined in claim 1, which further includes an adapter member removably fitted to the dispensing end of said casing, said adapter being formed to provide a dispensing outlet of reduced size relative to the opening at the dispensing end of said casing.