ABSTRACT: A package for storing resilient elements such as automotive springs, foam pads or hair rollers, stacked one upon the other, in which a container is provided at one end with a member which supports and prevents passage of the element to be stored, and at the other end with an interior lipped edge which permits passage of the element. The elements are held in compressed configuration by a flexible, distortable cup that is shaped such that its top edge abuts the lip of the container, thus causing closure of the container. To remove the resilient element, pressure is applied to one side of the upper edge of the cup so as to tilt and distort the cup, permitting its removal. The spring tension under which the resilient elements are stored then forces them out of the container. The principle is also applied to the storage of non-resilient elements under spring pressure.
The invention concerns packages for storing resilient elements or nonresilient elements under spring pressure.

The prior art
There are many prior art devices which permit efficient storage of resilient elements (such as inner springs cushions, automotive springs, foam pads, and the like), wherein the elements are stacked one upon the other and then compressed; but the mode of engagement and disengagement of capping or locking members designed to maintain the resilient elements in their compressed position is often inconvenient and even unsafe. For example, when such resilient elements are maintained under compression by a lid fitting over the container, or by straps or clamps, considerable care must be taken to prevent the resilient elements from being forced out of the container in an uncontrollable manner when the lid, strap or clamp is loosened, so as to avoid personal injury or inconvenience. Furthermore, means for guaranteeing safety in disengaging capping or locking members often are of such dimensions and intricacy of design as both to reduce the convenience of storage and to add substantially to the expense of manufacturing the containers. Similar problems are encountered in the storage of nonresilient objects under spring pressure.

Summary and objects of the invention
Accordingly, an object of this invention is to provide a package for resilient elements from which such elements may be removed or reinserted, conveniently and quickly, without danger of personal injury due to uncontrollable expulsion of the resilient elements from the container. A further object of the invention is to provide a package for nonresilient elements under spring pressure. An additional object is to provide such packages which are simple in design and economical to manufacture. These and other objects, features and advantages will be apparent from the following description.

In summary, the package of the invention comprises a hollow container and a restraining member, the container having an opening and being shaped to receive a plurality of elements, at least one of which is resilient, stacked therein one upon another. The container has means adapted to support and to prevent passage of said elements out of said container, and the opening of said package has an interior lip adapted to permit passage of said elements, but not of the restraining member, when the member is in a nondistorted configuration. Typically, the restraining member comprises a cup of flexible, distensible material having walls sloping inwardly from top to bottom such that when the cup is in a nondistorted configuration it may be positioned within the container with its top abutting the lip to prevent passage of the elements. The cup is thereafter easily disengaged, however, by applying pressure on one edge, thereby permitting the elements to be removed from the container.

The attached drawings, which exemplify the invention by illustrating preferred embodiments, include:
FIG. 1, a fragmentary perspective view of a package in accordance with this invention, having resilient elements contained therein and emerging therefrom;
FIGS. 2, 3 and 4, fragmentary vertical sections of the same package, showing successive steps in the engagement of a restraining member of the invention;
FIG. 5, a side elevational view, with parts sectioned for clarity of illustration, of the same package, fully loaded, and a restraining member shown in engaged and engaged positions relative thereto;
FIG. 6, a similar view of the same package, showing restraining members in fully engaged position and resilient elements in storage therein;
FIG. 7, a similar but fragmentary view of the same package, showing the first step in the disengagement of a restraining member;
FIGS. 8, 9 and 10, vertical sections of the same package, showing successive steps in the disengagement of a restraining member;
FIG. 11, a vertical section of another package in accordance with this invention, having nonresilient elements such as cans contained therein;
FIG. 12, a vertical section of still another package in accordance with this invention, having nonresilient elements such as golf balls contained therein;
FIG. 13, an elevational view of a single golf ball and a single restraining member from the package of FIG. 12, and
FIGS. 14 and 15, vertical sections of alternative forms of containers for use with the embodiments of FIGS. 11 through 13.

Detailed description of the preferred embodiments
As illustrated in FIG. 1, a hollow cylindrical container 10, formed of a material such as heavy cardboard, is adapted to receive several generally cylindrical resilient elements 30, all supported axially therein, and of the same size and shape. These elements might be metal springs 31 coiled helically and covered with a netting of plastic threads 33, for use as women's hair-curler forms. Such hair curlers are used by women in such quantities that the space they occupy can be a problem when the curlers are packed for travel or even stored at home. But the bulk of these hair curlers can be drastically reduced by axial compression. The package of FIGS. 1-10 retains such curlers, or other resilient objects, in a compressed and therefore compact condition, yet releases them safely when they are removed for use.

The container 10 is provided with a metal upper rim 11 crimped thereto, and the rim is formed with an interior lip 12. A plurality of circular restraining members 20 are interspersed between the resilient elements 30, each member 20 being manufactured of a flexible, distensible material such as polyethylene, polyvinyl chloride and the like, and having a cuplike shape with walls 22 sloping radially inwardly from top to bottom. These walls are of dimensions such that when the restraining member or cup 20 is inserted axially into the container 10 in the position and manner illustrated by FIGS. 2 through 4, the upper edge 21 of the member will 22 deforms radially inwardly (see arrow 27 in FIG. 3) as it slips past the rim 11, and thereafter expands radially outwardly into engagement with the lower lip 12 as indicated by arrow 25 in FIG. 4. In contrast, the lower edge 23 of the cup 20, having a smaller diameter than the upper edge 21, can move freely past lip 12 as seen in FIG. 2.

Each restraining cup 20 also includes a horizontal, diametrically extending web forming a floor 24 which restrains the vertical movement of resilient curlers 30. As is apparent from FIGS. 1 and 2, whenever any cup 20 is pressed down against one or more resilient curlers 30 and cups 20, which are already within the container 10, the latter are forced farther down into the container until the edge 21 of the new cup 20 engages lip 12. Thus does the latest restraining cup 20 to be inserted into the container 10 always cooperate with the container to form a stable closure for all members 20 and 30 previously inserted. Each cup 20 is forced downwardly (see arrow 29 of FIG. 2) into container 10 against the urging of the spring curlers 30 already inside the container. Thereafter, despite the continued upward urging (arrow 19 of FIG. 4) of one or more curler springs 30 in the container 10, the upper edge 21 engages lip 12, thereby locking the cup 20 in place, and imprisoned in the container 10 all previously inserted curlers 30 and the cups 20 interspersed between them.

FIG. 5 demonstrates how each successive restraining cup 20 can be pressed axially into stacking relationship with previ-
ously inserted cups 20 and resilient curlers 30, by simply pressing down approximately in the center of the cup 20 with one finger 17. It also illustrates the space-saving manner in which the curlers 30 are compressed axially against a metal floor 13 which is cramped to the lower end of container 10.

In FIG. 6 the container 10 is depicted with a full load of stored resilient curlers 30 and restraining cups 20 interpersed therewith, topped by a removable cover 35 of plastic or similar material, which makes a friction or snap fit about the rim 11.

The resilient curlers 30 may be easily disengaged and removed from the container 10, as shown in FIG. 7, by exerting slight downward pressure (arrow 37) with one finger 17, at any location radially displaced from the center of the topmost cup 20. When this is done, the resilient curlers 30 within the container 10 are compressed eccentrically below the cup 20, permitting the cup to tilt as seen in FIG. 7. As the cup tilts, its upper edge 21 moves radially inwardly (arrow 45) far enough to disengage from the lip 12 of rim 11 at a location diametrically opposite the point of finger pressure. Such disengagement frees the uppermost cup 20, which then escapes from the container 10 by a sequence of steps illustrated in FIGS. 7 through 10 respectively: As the cup tilts, it "aims" one of its curved sides 22 obliquely upward toward the top of the container, one side of it emerges at point 47 (FIGS. 7 and 8), and a portion of the cup strikes the rim 11 at points 43 (FIG. 8). Then, although edge 21 strikes the rim 11, the tilted orientation of the cup prevents it from engaging the lip 12. Instead, the walls 22 present their curved side surface to the rim 11 in such a way that the walls 22 can past the rim 11, deforming elastically in the process, as indicated by arrow 41 in FIG. 9. The cup, squeezed through the restricted opening of rim 11. As a result, the cup 20 slips entirely out of the container 10, as seen in FIG. 10. This releases the immediately underlying resilient curler 30, permitting it to be removed from the container 10. One important function of the cup 35, depicted in FIG. 6, is to prevent unintentional insertion of an object into the open top of the container 10, which might accidentally perform the release operation just described.

It will be readily appreciated that, as the uppermost cup escapes, it is propelled upwardly by the concomitant expansion of the resilient curler 30 immediately thereafter. But FIG. 7 illustrates why this situation does not produce an explosive, uncontrolled escape of either the cup 20 or curler 30.

The user's finger 17, which must be in the illustrated position in order to initiate the described release procedure, engages the crotch formed at the intersection of the wall 22 and floor 24 of the cup 20. This engagement restrains the cup, which in turn restrains the expansion and escape of the curler 30. The result is that the uppermost cup and curler escape only at the speed at which the user deliberately withdraws his finger 17 after unlatching the cup 20.

All the restraining cups 20 and resilient curlers 30 stacked in the container 10 may be removed, one by one, in the same manner. But as each restraining cup in turn is removed, the next one therebelow follows it upwardly, and engages the lip 12. This prevents any of the resilient curlers except the uppermost one from popping one from popping out of the container 10 when the uppermost one is removed. Thus the lower curlers do not fly out of the container, but are controllably retained therein. They can be safely removed in sequence, as desired, by repeating the extraction operation (FIGS. 7-10) for each cup 20 in succession.

The containers of this invention are not restricted to any particular dimensions or cross-sectional geometry; but may be cylindrical, square, hexagonal, or any shape suitable for storing resilient elements. Likewise, the shape of the container may or may not coincide with the shape of the resilient elements to be stored, and resilient elements of various sizes and shaped may be enclosed simultaneously within the same container.

It will be evident from the attached drawings that the hollow above the floor 24 of the uppermost cup 20 may provide storage space for small items such as hair pins, with the cap 35 serving to retain the hair pins within the container 10. In addition, the cups 20 are designed for nesting one within the other, first nest when different numbers of hair curlers 30 are stored, any excess cups 20 may be conveniently stored in the container 10, in nested relationship with any of the other cups 20. It will also be appreciated that this package may hold hair rollers of different lengths and diameters, up to the maximum size of the container 10.

The invention is not limited in its application to the packaging of resilient objects, such as the hair curlers illustrated in FIGS. 1 through 10. It is applicable also to the packaging of substantially nonresilient objects, such as beer cans, golf balls, etc., which are packed in a container having a feeding spring which delivers the contained objects one by one to the container opening.

In this connection, the invention is an improvement over the type of package illustrated in U.S. Patent No. 3,263,806, concerning a tall cylindrical container having thermally insulated walls and a compressible coil spring, the container being adapted to hold a plurality of objects in axially stacked relationship, so that the spring delivers one at a time to the container opening. The thermal insulation makes it particularly suitable for carrying cold beverage bottles.

The Ring structure is subject to the difficulty that a bottle may be expelled violently, or more than one bottle may be expelled at a time, unless the feed spring is perfectly designed. Moreover, any such design is applicable only to objects of a given weight, so that a different spring is required if objects of any other weight are put in the container. In accordance with the present invention, however, packages of the type exemplified by FIGS. 11 and 12 may be designed for safe, one-by-one release of the contained objects, without the need for critical spring force calculations, and regardless of the weight of the contained objects.

The package of FIG. 11 is particularly designed to carry a plurality of tin cans 130, stacked axially one upon the other for convenient carrying, and storage in a minimum of floor space. A container 110 for the stacked cans is formed of a thermally insulating material, assuming the cans 130 contain cold beverages or the like. The container is provided with a thermally insulated transverse bottom member 113, and a helically coiled feed spring 131 which reacts against the bottom member to provide an upward biasing force upon a pusher member 133 in the form of a shallow cylindrical cup which moves vertically in the interior of the container 110, piston fashion. The pusher member serves as a buffer to prevent the lowermost can 130 from becoming entangled in the feed spring 131.

Interspersed between adjacent cans 130 are a plurality of restraining members 120, the uppermost one of which cooperates with an interior lip 112 of a rim 111 surrounding an opening at the upper end of the container 110. Each of the restraining elements is generally cup-shaped and circular in cross section, and includes a rounded bottom web 124, an upwardly facing conically slanted wall 122, and a horizontal annular flange 125 which joins the upper edge of the bottom member 124 to the lower edge of the conical wall 122. The wall 122 has an upper edge 121 which engages the interior lip 112.

The spring 131 forces the pusher 133 and all of the cans 130 and their interspersed restraining members 120 upwardly toward the top opening of the container 110. However, the upper edge of the uppermost restraining member 120 engages the interior lip 112 to prevent its exit, and the exit of all objects therebelow. When the uppermost can 130 is withdrawn a single can 130, he can do so in the manner described above, by pressing downwardly at an eccentric location on the uppermost restraining member 120. The curvature of the rounded bottom member 124 at this time allows the restraining member 120 to roll over the flat upper surface of the can 130, resulting in rocking, tilting movement which dislodges the edge 121 from the interior lip 112, and permits deformation and withdrawal of the uppermost restraining member 120 in
the manner which is familiar from the discussion of the preceding FIGS. The walls 122 of the restraining members 120 are, of course, deformable radially inwardly, which permits such withdrawal. It also permits initial insertion past the rim 111 and into the interior of the container 110, after which the walls 122 snap radially outwardly to engage the interior lip 112.

A cap 135 is placed over the top of the container 110 after it is fully loaded, to prevent accidental disengagement of the uppermost restraining member 120. The cap may also be a thermally insulated member, if the temperature of the contained objects 130 is important.

A change in the configuration of the restraining members allows the invention to be used for storage of differently shaped non-recessed objects, such as golf balls 230, stored in the package of FIG 12. Here the package comprises a container 210 having a bottom closure element 213 and a feed spring 231 which reacts against that closure element. A pusher member 233 is biased upwardly through the interior of the container 210, piston fashion, and serves to prevent the golf balls 230 from becoming wedged in the interior of the feed spring 231. Releasing members 220 are interposed between adjacent golf balls 230, and each such member comprises a concave bottom web 224, designed to nest compactly against the convex upper surface of the golf balls. They also comprise an upwardly extending conically slanted wall 222 joined to the periphery of the bottom web 224. The upper edge 221 of the wall 222 is designed to engage with the interior lip 212 of a rim 211 which surrounds an upper opening of the container 210. The wall 222 is resiliently deformable radially inwardly to permit insertion of the restraining members 220, after which they snap radially outwardly into engagement with the lip 212.

In order to understand how the golf balls are withdrawn, the reader will note that the radius of curvature of the bottom members 224 is somewhat less than the radius of curvature of the contact surface of the golf balls 230. This permits the uppermost restraining member 220 to be rocked, by eccentric finger pressure, relative to the uppermost golf ball 230, as seen in FIG. 13. This dislodges the upper restraining member edge 221 from the lip 212 at a location diametrically opposite the pressure location, after which the uppermost restraining member 220 is deformed and withdrawn in the manner described above in connection with the preceding FIGS.

The advantage of the packages illustrated in FIGS. 11 and 12 is that after the uppermost restraining member 120 or 220 is removed, the feel spring 131 or 231 raises the uppermost tint can 130 or golf ball 230 above the level of the top opening of the container 110 or 210, so that it can be manually grasped and lifted. Further, the advance of the stack of contained objects is terminated when the next uppermost restraining member 220 or 230 comes into engagement with the interior lip 112 or 212. Thus only one object is dispensed at a time. In addition, the pressure of the user's hand upon the uppermost restraining member 120 or 220, as he dislodges and withdraws it, prevents violent expulsion of even one stored object 130 or 230.

The embodiment of FIGS. 12 and 13 is particularly well adapted to the packaging of fragile objects, such as Christmas ornaments, eggs, and the like, if the cross section of container 210 is elliptical, egg shaped, or any other appropriate configuration. In that type of application, the force exerted by the spring 231 would be insufficient to crush the objects, but would serve to keep them under enough pressure to prevent them from moving axially of the container 210, thus protecting them from damage. The objects may be removed from the container one at a time in a controlled manner, and after each one is taken out the spring 231 moves up to protect the remaining objects in the same manner.

FIGS. 14 and 15 show that the approach of FIGS. 11 through 13 can be carried out with a feed spring which is not contained within the package. If the walls of a container 310 or 410 are made so that they can be axially foreshorted, as for example by using a bellows configuration 310.1 or 410.1 which extends over all or part of the container's axial extent, then the upward feeding of golf balls 230 and their interpersed restraining cups 220 may be accomplished without placing a feed spring within the interior of the container. The spring may be arranged externally to pull or push upwardly on the container floor 313. For example, a spring can be mounted below the container floor, or it may helically surround the walls 310, 310.1 and hook under the container floor. Preferably, however, a helical metal spring 331 is embedded within the folds of the bellows walls 310.1, thus making a resilient bellows and feed spring assembly out of the elements 310.1 and 331. The structure of FIG. 14 is best manufactured by forming the container 310 of a moldable plastic material, and molding it about the spring 331. A preferred plastic material for this application is linear polypropylene, selected for its resistance to flexure in the bellows folds, although rubber may also be satisfactory. It is also possible that, at least for some applications, the plastic bellows 310.1 may in itself have enough resilience to serve the feed spring function, without using a metal spring at all. In FIG. 15 the latter approach is carried out using a container 410 which is made of a metal with high flexure resistance, such as phosphor bronze, and is formed with an inherently resilient bellows 410.1 covering all or part of the axial extent thereof.

It will now be realized that, in each of its embodiments, the present invention provides a convenient and compact package for elements which are stored under spring pressure, a package from which these elements can be withdrawn one at a time in a manner which is safe, controlled, and convenient.

In view of the foregoing description it will be apparent that the invention is not limited to the specific details set forth therein for the purposes of illustration, and that various other modifications are equivalent for the stated and illustrated functions without departing from the spirit and scope of the invention.

I claim:

1. A package for storing elements, said package comprising the combination of: a hollow container and a restraining member; said restraining member having a shape such as to define an axial direction and a radial direction, and being resiliently radially compressible; said container having an opening, and being shaped to store a plurality of elements, including said restraining element, all of said stored elements being arranged in substantial alignment within said container, and at least one of said elements other than said restraining element being resiliently compressible in the direction of said alignment; the opening of said container having an interior lip adapted to permit passage of at least one of said stored elements, but not of said restraining member when said restraining member is not radially compressed; said restraining member having a geometry such that when said member is not radially compressed and is positioned within said container driven into abutting said opening and said resilient stored element, and is driven into abutting engagement with said interior lip of said container said restraining member responds by aligning itself axially with the direction of alignment of said other element or elements stored in said container; said restraining member being sufficiently rigid in the axial direction to resist deformation in response to axial compression against said container lip whereby to prevent passage through said container opening of any elements stored on the opposite side of said restrained element when said opening; said member being removable by pressure to misalign the axis of said restraining member relative to the direction of alignment of said stored elements; said restraining member then being sufficiently radially compressible against said container lip by the force of one or more of said resilient elements stored in compression on said opposite side thereof to release said lip engagement whereby to permit said restraining member to pass out of said container opening, wherein at least one of said elements stored on said opposite side of said restraining member is removable from said container.
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2. The package of claim 1 in combination with a plurality of resilient elements and a restraining member positioned between said elements and said container opening; said resilient elements being compressed within said container so as to force said restraining member against said interior lip for engagement therewith.

3. The package of claim 2 wherein said resilient elements are hair rollers; and said restraining member is a cup adapted to receive hair pins.

4. The package of claim 3 wherein there are a plurality of said restraining members interspersed between said hair curlers.

5. The package of claim 1 wherein said container is adapted to receive a capping element over said opening.

6. The package of claim 1 wherein said restraining member has a cuplike configuration including a transverse member for restraining said resilient element; a wall upstanding from the periphery of said transverse member and tapering radially outwardly; said wall being resiliently flexible radially inwardly; and the largest diameter of said tapered wall being sized to enter said container opening by passing said interior lip with radially inward deformation, and thereafter to spring radially outwardly into engagement therewith.

7. The package of claim 6 wherein the dimensions of said interior lip and said largest wall diameter are such that tilting pressure on said restraining cup member at one eccentric location displaces said wall thereof radially from said engagement with said interior lip at a diametrically opposite location; and said wall when tilted and disengaged is able to slip out of said container past said interior lip.

8. The package of claim 7 wherein said container, interior lip and restraining cup member all have a curved cross-sectional shape; and said cup member, when tilted, presents a radially outwardly facing convex surface to said interior lip, and is deformable, whereby to cam past said interior lip for disengagement therefrom.

9. The package of claim 1 in combination with at least one restraining member and one resilient element; said package being adapted to store at least one substantially nonresilient element between said restraining member and said resilient element; said resilient element being compressible relative to said supporting means, and arranged to bias said nonresilient element toward said opening to force said restraining member against said interior lip for engagement therewith.

10. The package of claim 9 wherein a surface of said restraining member which overrides a surface of said nonresilient element, when both are in said container, is so shaped, in relation to the shape of said nonresilient element surface, as to permit rocking of said restraining member relative to said nonresilient element for disengagement of said member from said interior lip.

11. The package of claim 4 wherein said restraining members are adapted to nest one within another.

12. A package for storing elements, said package comprising the combination of: a hollow container and a restraining member; said restraining member having a shape such as to define an axial direction and a radial direction, and being resiliently radially compressible; said container having an opening, and being shaped to store a plurality of elements including said restraining element, all of said stored elements being arranged in substantial alignment within said container; said container having means to bias any of said elements contained therein toward said opening; the opening of said container having an interior lip adapted to permit passage of at least one of said stored elements, but not of said restraining member when said restraining member is not radially compressed said restraining member having a geometry such that when said member is not radially compressed and is positioned within said container between said opening and said resilient stored element, and is driven into abutting engagement with said interior lip of said container said restraining member responds by aligning itself axially with the direction of alignment of said other element or elements stored in said container; said restraining member being sufficiently rigid in the axial direction to resist deformation in response to axial compression against said container lip whereby to prevent passage through said container opening of any elements stored on the opposite side of said restraining member from said container opening; said member being removable by pressure to misalign the axis of said restraining member relative to the direction of alignment of said stored elements; said restraining member then being sufficiently radially compressible against said container lip by the force of said biasing means to release said lip engagement and allow said restraining member to pass out of said container opening, whereby at least one of said elements stored on said opposite side of said restraining member is removable from said container.

13. The package of claim 12 wherein said biasing means is a resilient member acting to bias said supporting means toward said opening.

14. The package of claim 13 wherein said resilient member is a bellows formed integrally with the walls of said container, and having a tendency to contract in a manner to shorten said container.

15. The package of claim 1 wherein said restraining member has a concave configuration including a bottom for restraining said resilient element and a periphery tapering radially outwardly; said periphery being resiliently flexible radially inwardly; and the largest diameter of said periphery being sized to enter said container opening by passing said interior lip with radially inward deformation, and thereafter to spring radially outwardly into engagement therewith.

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