

March 25, 1958

W. P. TAYLOR, JR
FLEXIBLE MATERIAL PACKAGE

2,828,092

Filed March 26, 1953

5 Sheets-Sheet 1

Fig. 5.

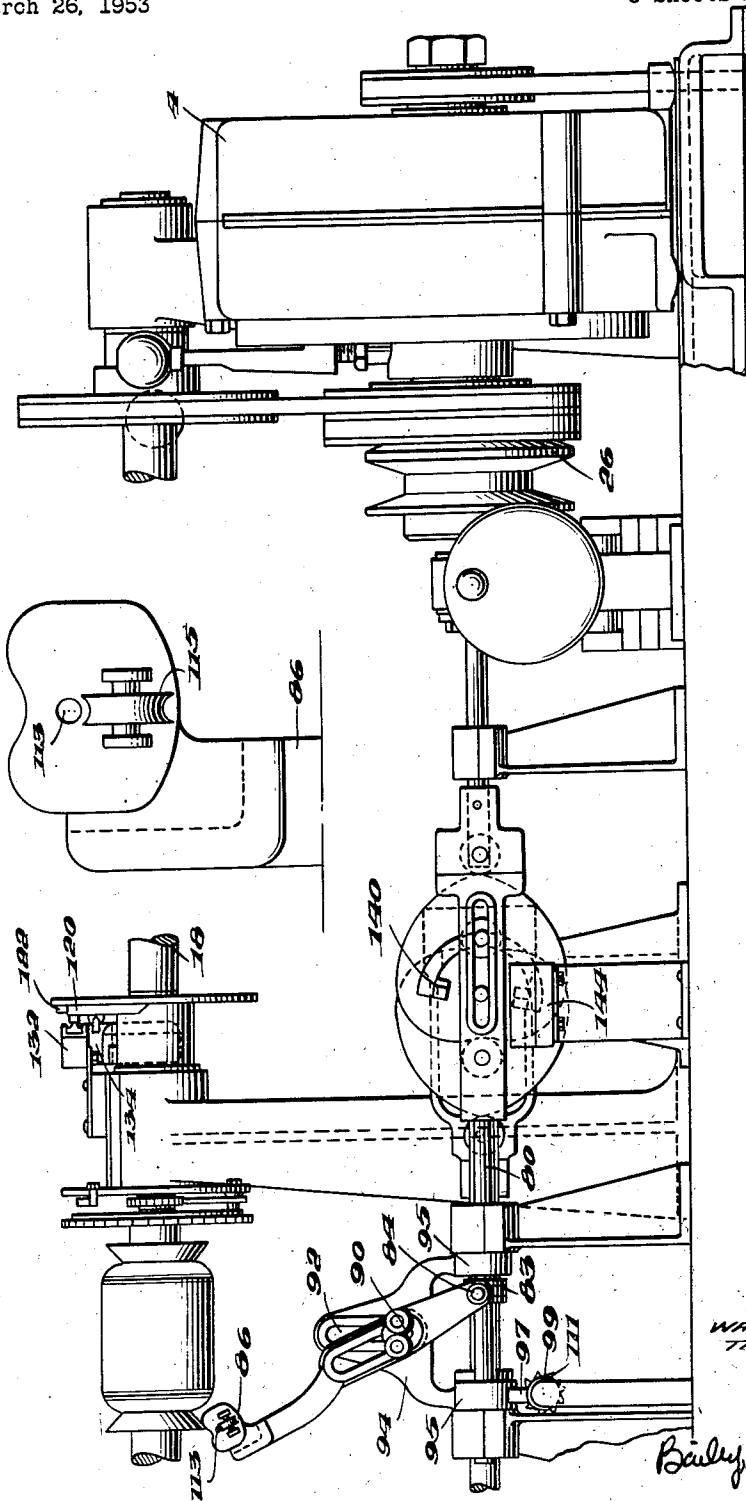


Fig. 1.

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Fig. 2.

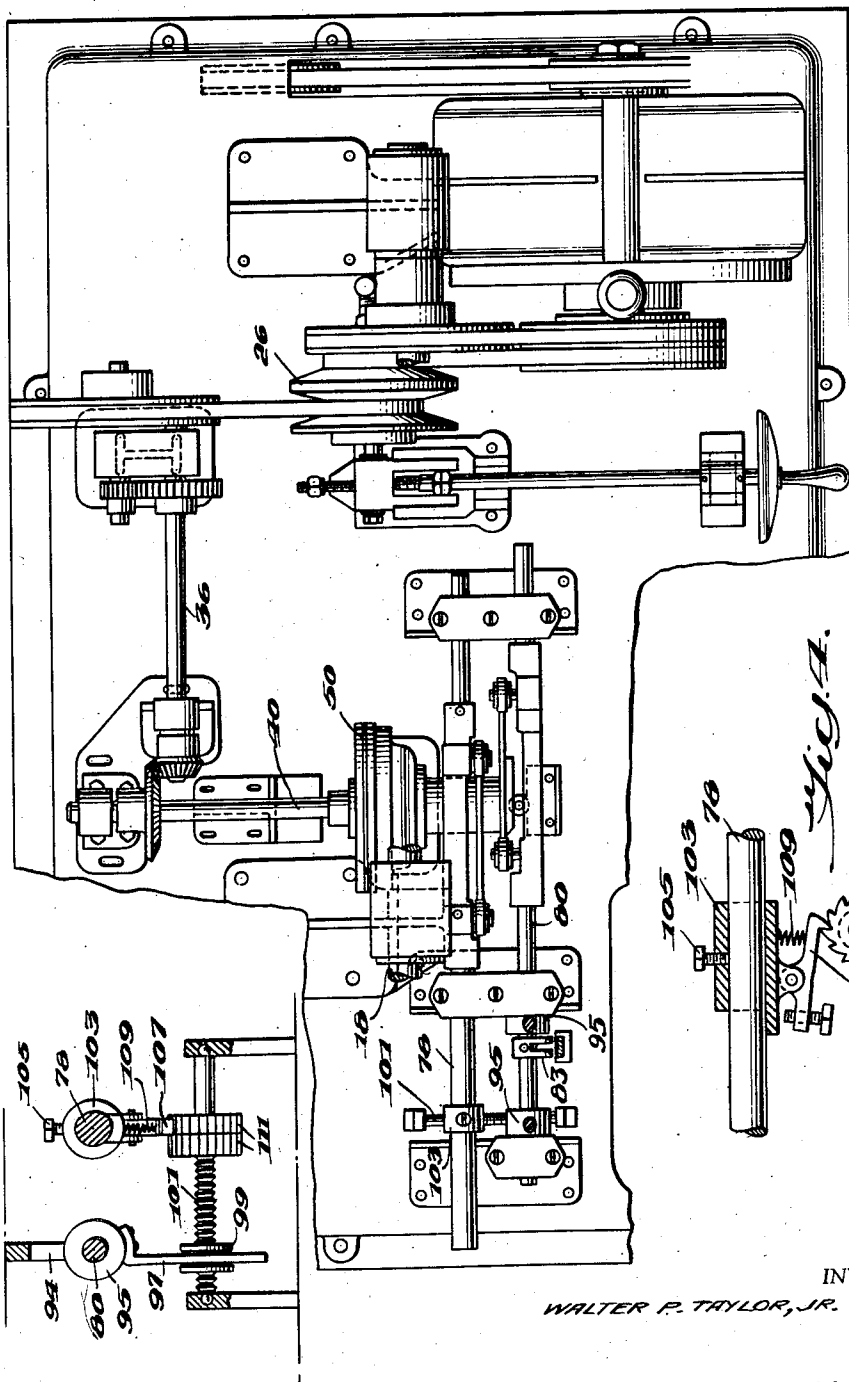


Fig. 3.

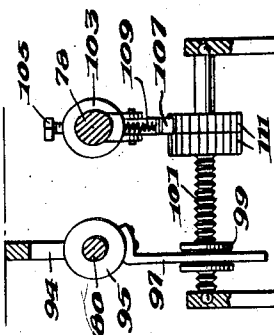
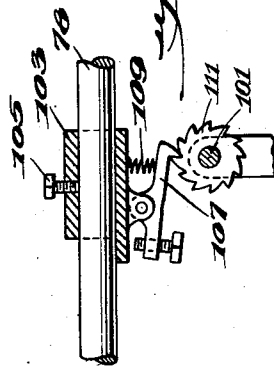


Fig. 4.



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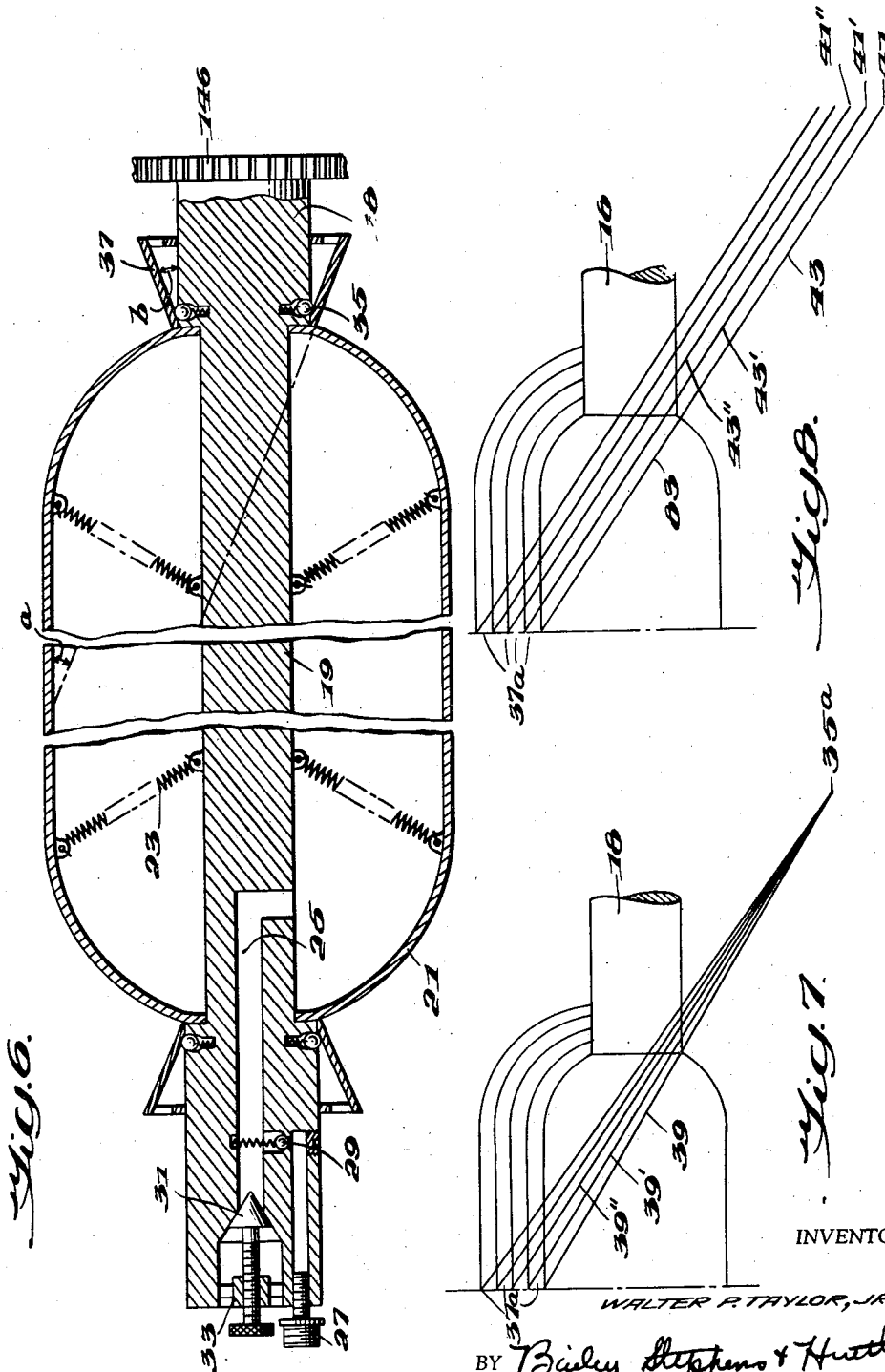
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Fig. 9.

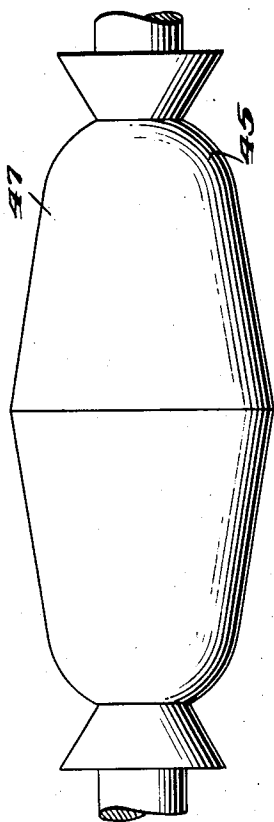


Fig. 10.

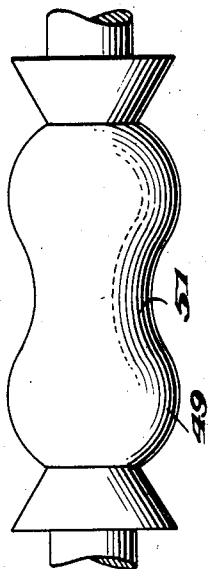


Fig. 11.

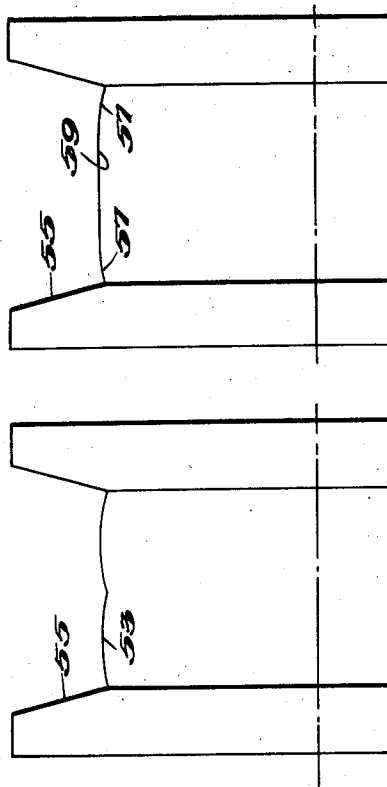
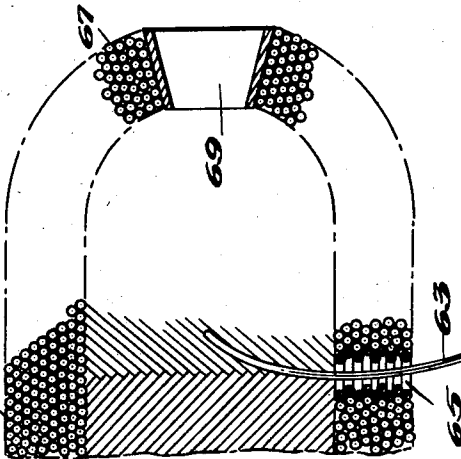


Fig. 12.



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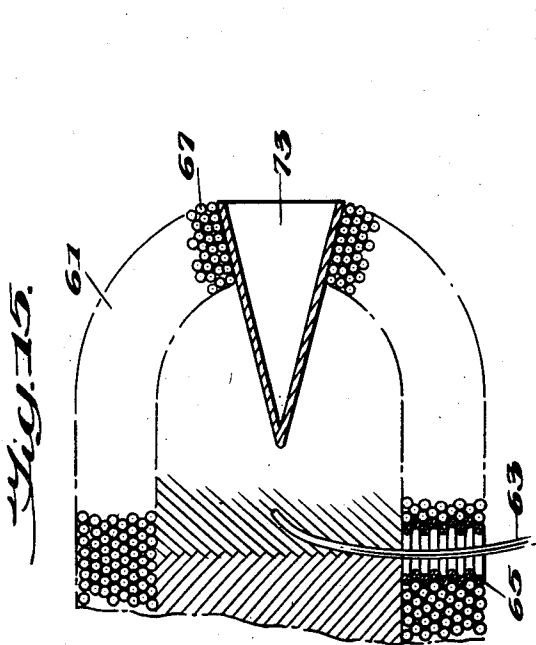
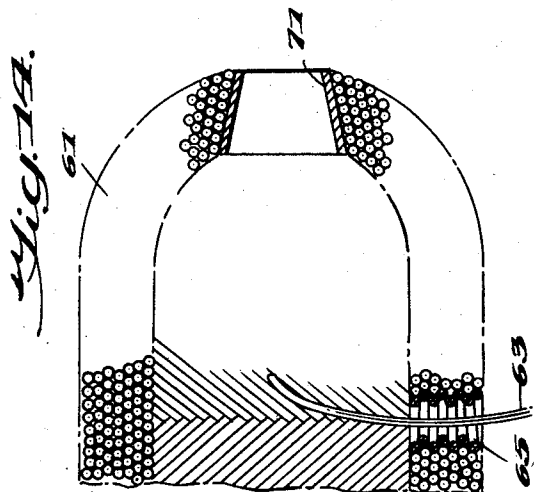


Fig. 18.

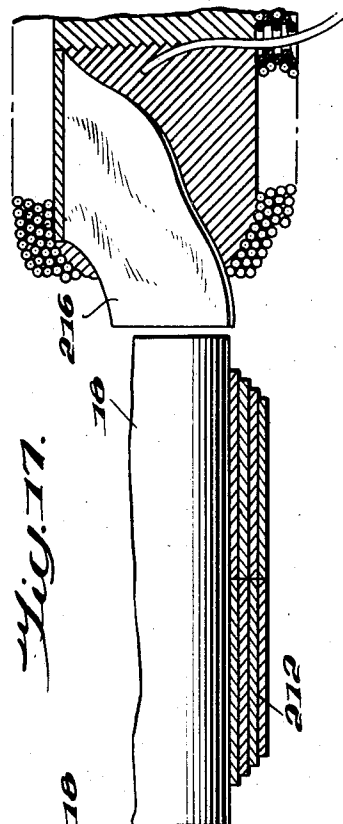
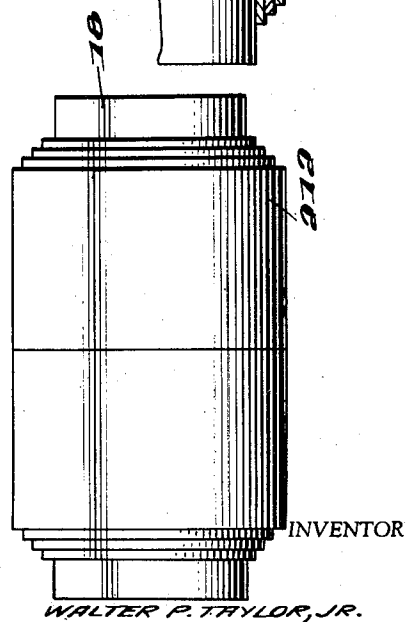


Fig. 16.



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FLEXIBLE MATERIAL PACKAGE

Walter P. Taylor, Jr., New York, N. Y.

Application March 26, 1953; Serial No. 344,875

14 Claims. (Cl. 242—161.1)

The invention relates to the winding of flexible material, and includes a method of winding, a machine for carrying out the method and a package. The application is a continuation-in-part of my prior Patent No. 2,634,922, granted April 14, 1953.

In my prior application just referred to, as well as in my Patent No. 2,634,923, granted April 14, 1953, I have shown a package of flexible material wound in coils, each of which forms at least one figure 8, with a hole through the body of the package through which the inner end of the material is led out. This results in equalization of twist and prevents kinking and snarling of the material.

The primary object of the present invention is to provide an improved package of this type, which is sturdier, more self-supporting and more foolproof than those previously described.

Another object of the invention is to provide a process for winding such a package.

Still another object of the invention is to provide an improved machine for winding such a package, this machine being in general similar to that shown in the Patent No. 2,634,918, April 14, 1953.

A further object of the invention is to provide a method and machine for laying up successive layers of coils on a spindle with the corresponding bights of the coils of successive layers lying in substantially parallel planes. In the ordinary package, formed by relative movement between a source of supply and a rotating spindle, the distance between the guide and the spindle axis being kept constant, the bights of the coils of successive layers lie in planes which converge at a point close to the spindle axis. This produces extra length in each loop which causes piling up at the end edges of the package. The package so formed lacks endwise stability, and the pile-up produces needless bends in the flexible material. In such a package there is some danger that the coils may shake loose endwise before their turns come in the payout, which can interfere with the coil being withdrawn and thus prevent proper withdrawal of the flexible material.

I have found that these disadvantages can be greatly reduced by having the bights of corresponding coils in successive layers lying in parallel planes. To produce this effect, I provide means for varying the distance between the guide and the spindle axis from layer to layer in such a way as to produce the desired effect. In a machine in which the spindle axis is fixed and the guide moves back and forth along the spindle, this is accomplished by moving the guide closer to the spindle axis as successive layers are wound on the spindle.

I have also found that it is desirable to have the ends of such a package in spherical form. This increases the stability and self-supporting qualities of the package, since it is like a ball in which each loop or coil holds the ball formed by previous coils, and since it distorts the flexible material to as small a degree as possible. Such a package can be wound under low pressures, which is especially desirable with wire.

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A further object of the invention is to provide a novel type of spindle on which packages of this type can be wound.

This spindle also provides for the end edges of successive layers to be formed at progressively varying distances from the axis of the package, preferably approaching a cone whose apex points towards the longitudinal center of the package. A support of a shape to support these end edges may also be provided in the completed package. This arrangement also reduces to some degree the pile-up at the ends and improves the stability and payout.

Further objects and advantages of the invention will appear more fully from the following description, especially when taken in conjunction with the accompanying drawings which form a part thereof.

In the drawings:

Fig. 1 is a front view of a machine for carrying out the invention;

Fig. 2 is a top plan view thereof;

Fig. 3 shows in side elevation, from the right in Fig. 1, the mechanism for changing the distance of the guide from the spindle;

Fig. 4 is a detail front view of the pawl and ratchet mechanism of Fig. 3;

Fig. 5 is an enlarged view of the guide head;

Fig. 6 shows in cross-section a spindle adapted for winding packages according to the invention;

Figs. 7 and 8 are explanatory diagrams;

Figs. 9 to 12 show in side elevation modified forms of the spindle;

Figs. 13 to 15 are cross-sections through packages made in accordance with the invention;

Fig. 16 shows in side elevation a system of producing packages in accordance with the invention;

Fig. 17 is a fragmentary view of Fig. 16 with parts in section; and

Fig. 18 is a cross-section through a package produced by the arrangement of Figs. 16 and 17.

The construction and operation of the machine are in most respects similar to that shown in the Taylor and Whipple Patent No. 2,634,918 referred to above. Part 4 through ratio changing device 26 drives shafts 36, 40 which cause reciprocation of rods 78, 80 alternately in opposite directions. Part 4 also drives spindle shaft 18. Cams 120, 122, 140 at periodic intervals operate to disengage clutch 50 in the connection from the motor to rods 78, 80 so that motion of these rods is stopped for a predetermined time. This stopping forms the opening through the body of the package through which the inner end of the flexible material can be withdrawn.

The present machine differs from that shown in the Taylor and Whipple Patent No. 2,634,918 in the mounting and control of the guide for the flexible material and in the spindle, although both these changes are not necessarily used at the same time.

Guide carrier 86 is reciprocated by pivot 84 carried by collar 83 secured on reciprocating rod 80. It pivots on pin 90 adjustable in slot 92 of member 94. Member 94 is mounted by collars 95 to turn on rod 80. It has a downward extension 97 engaging a groove in nut 99 and holding the nut against rotation. Nut 99 is threaded on a turnable worm shaft 101.

Rod 78 carries a member 103 held in position by set screw 105 so that it can be removed and reversed on the rod. This carries a pivoted pawl 107 pushed by spring 109 into engagement with one half or the other of a wheel 111, the two halves of the wheel having oppositely directed ratchet teeth thereon. This wheel is fixed on shaft 101.

At its upper end (Fig. 5), arm 86 has a hole 113 for

the flexible material which is guided to this hole by a wheel 115.

A spindle for use on this machine is shown in detail in Fig. 6.

Spindle shaft 18 has a section 19 of reduced cross-section. Secured against the flanges at the ends of section 19 are the edges of an inflatable member 21 formed of flexible, airtight but non-stretchable material such as canvas impregnated with rubber. Two end parts of this member are of hemispherical form, while the intermediate part is a cylinder joining the two spheres. Tension springs 23 connected between member 21 and shaft section 19 help in collapsing the member so that a package wound on it can be withdrawn from the spindle.

Member 21 can be inflated by air introduced through a passage 25 formed in the spindle. The air is introduced through a hose connection 27 and check valve 29. It can be released by opening valve 31 threaded in spider 33.

Spindle 18 also has just beyond the ends of section 19 spring ball catches 35. These serve for releasably holding against the ends of form 21 conical forms 37, the use of which will be described below.

In laying up a package on such a spindle, the bights of the coils will lie in planes such as that represented by the dot-and-dash line in Fig. 6 which runs through the center of the spherical end portion and through the crossover point on the periphery of the spindle. Angle a between this plane and the longitudinal axis of the spindle should be equal to the angle of conicity b of the cones 37.

Fig. 7 shows the formation of a package with the machine shown in the Taylor and Whipple application, but with rounded ends such as would be formed on the spindle of Fig. 6 but without the conical end portions. In Fig. 7, 35A represents the furthest point of guide travel towards the right, and 35A represents successive layers each formed of a plurality of coils, each coil forming at least one figure 8 and with the crossovers of successive coils being angularly displaced around the package.

The bight of each coil will lie substantially in a plane which is defined by the line connecting the crossover to the point 35A. Such planes are represented in Fig. 7 by lines 39, 39', 39'', and it is of course apparent that all these planes will converge at point 35A. The first line 39 preferably passes through the meeting point of the spherical portion of the spindle with the straight portion and also through the center of the spherical portion.

It will be noted, then, that successive lines 39, 39', intersect the spindle at closely spaced points, the distance between which is less than the thickness of each layer. The flexible material will then run partly around the spindle, and will not reverse immediately as it should for an ideal wind.

In Fig. 8, it will be assumed that the points 41, 41', 41'' represent the furthest movement of the guide to the right in the formation of corresponding coils of successive layers 37A. Lines 43, 43', 43'' then represent the planes of the coils of successive layers, and it will be noted that these planes are parallel.

In this arrangement, the successive intersections of lines 43, 43', with the spindle are spaced further apart than in Fig. 7, as a result of which the flexible material reverses immediately and an excess of material is not built up at the ends of the package.

This winding is accomplished by the machine above described in the following manner.

During each reciprocation of the guide 86, rod 80 moves in one direction and rod 78 in the other direction. Once in each complete reciprocation, pawl 107 on rod 78 will engage ratchet wheel 111 and will impart a slight turning movement to shaft 101, thus moving nut 99 along the shaft and swinging frame 94 so as to advance the guide slightly towards the spindle. The number of ratchet teeth and the thread pitch of screw 101 are so chosen as to

give the desired advance, which may substantially equal the rate of increase in the radius of the package as successive layers are formed.

For some types of winding, where the largest layers are laid first, it may be desirable to move the guide progressively away from the spindle. This may be done by reversing pawl carrier 103 on rod 78 and adjusting it to engage the other set of ratchet teeth on wheel 111.

Fig. 9 shows a modified shape of spindle. The ends 45 are formed as portions of spheres, but are joined by a trunk 47 in the form of two conical frustums meeting at the center of the cone.

In Fig. 10, the spherical end portions 49 are joined by a reversely curved central portion 51.

Instead of a long, relatively thin spindle, some windings may be better formed on a relatively short, thick spindle. Fig. 11 shows half of such a spindle, formed of two partly spherical sections 53 and with conical end supports 55. In the spindle of Fig. 12, spherical parts 57 are connected by a slightly bowed cylindrical portion 59.

Fig. 13 shows a package of material wound in accordance with the invention on the spindle of Fig. 6. The flexible material is indicated at 61. The inner end 63 of the flexible material is led out through hole 65.

This package has the surface of the end edges 67 of the successive layers in the form of a conical frustum whose apex is directed inwardly. This shape in and of itself improves the stability of the package. However, it may be desirable to apply a small amount of adhesive to these surfaces to improve the stability. Also, I may insert into the end of the package a conical support 69 which may be of metal, carboard, wood or any other suitable material. This may, if desired, have on its surface a slightly adhesive material to hold it in place and to prevent undesired movement of the flexible material.

With these arrangements, the likelihood that any coil will be displaced before its proper turn comes in the withdrawal is greatly reduced, and the stability of the package is increased.

Instead of directing the apex of the cone towards the center of the package, it may be directed away from it as shown in Fig. 14. Here again adhesive or a frusto-conical support 71 or both may be used.

Fig. 15 shows a package like that of Fig. 13 except that the support 73 extends into the package and may be a full cone if desired.

In the production of such a package, the procedure illustrated in Figs. 16 to 18 may be advantageous. In these, the spindle 18 is first supplied with one or more layers of tape or ribbon 212, which may be of a portion of the width of the spindle, as shown, or may be of the full width of the spindle, and may be applied circumferentially around it. The package is then wound on this tape, and the package and tape are removed from the spindle. The inner end 216 of the tape is pulled out through the core opening before use, leaving the finished package ready for the withdrawal of the inner end of the flexible material through the radial hole therein.

This method can be used either for a "half-wind" package or for packages of a higher number of winds. The result is that there is a crossing over of the coils and the package has a rounded end, as shown in Fig. 18. This formation in no way reduces the effectiveness of the withdrawal, and has the advantage of adding to the self-sustaining properties of the package.

The present invention is applicable both to packages formed as shown in the prior applications referred to above and to those formed in other ways, as for example in the manner shown in my applications S. N. 344,875 and 344,876, both filed March 26, 1953. The packages may also utilize some or all of the improvements described in my applications S. N. 344,872, 344,873, and 344,874, filed March 26, 1953.

The invention is applicable both to resilient or relative-

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ly flexible materials, such as wire, cable and tubing as well as to textiles such as yarn, thread, cord or rope.

While I have described herein some embodiments of my invention, I wish it to be understood that I do not intend to limit myself thereby except within the scope of the claims hereto or hereinafter appended.

I claim:

1. A package of flexible material having an annular core space around which the material is wound in a body and an opening into such core space through the body of the package through which the inner free end of the material can be drawn out, said package being formed of a plurality of layers of coils each forming at least one figure 8, the planes of the loops of the coils in successive layers forming substantially a constant angle with the longitudinal axis of the core space.

2. A package as claimed in claim 1, the end portions of each layer being turned inward toward the axis of the core space.

3. A package as claimed in claim 2 in which said end portions are in the shape of portions of a sphere.

4. A package as claimed in claim 3, the outer edges of successive layers being at progressively varying distances from the axis of the core space.

5. A package as claimed in claim 4 in which the outer edges form a substantially frusto-conical surface.

6. A package as claimed in claim 5 in which the apex of said surface is towards the center of the package.

7. A package as claimed in claim 1, the outer edges of successive layers being at progressively varying distances from the axis of the core space.

8. A package as claimed in claim 7 in which the outer edges form a substantially frusto-conical surface.

9. A package of flexible material having an annular core space around which the material is wound in a body and an opening into such core space through the body of the package through which the inner free end of the material can be drawn out, said package being formed

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of a plurality of layers of coils each forming at least one figure 8, the end portions of each layer being turned inward toward the axis of the core space.

10. A package as claimed in claim 9 in which said end portions are in the shape of portions of a sphere.

11. A package as claimed in claim 9, the outer edges of successive layers being at progressively varying distances from the axis of the core space.

12. A package of flexible material having an annular core space around which the material is wound in a body and an opening into such core space through which the inner free end of the material can be drawn out, said package being formed of a plurality of layers of coils each forming at least one figure 8, the outer edges of successive layers being at progressively varying distances from the axis of the core space, the outer edges of the package forming substantially frusto-conical surfaces.

13. A package as claimed in claim 12 having a piece secured in each end provided with a surface engaging the outer edges of the layers.

14. A package as claimed in claim 13 in which said piece is an inwardly directed cone.

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