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APPARATUS FOR TREATING FILAMENTARY MATERIAL

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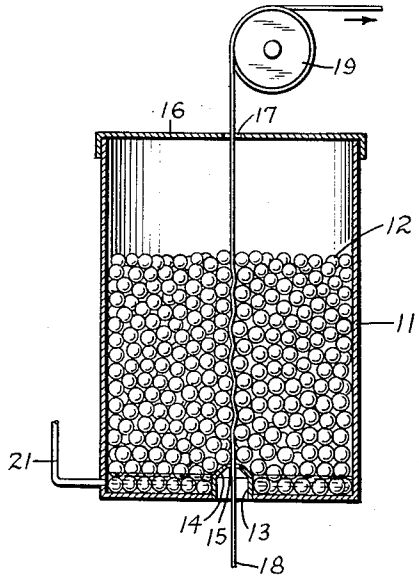


FIG.1.

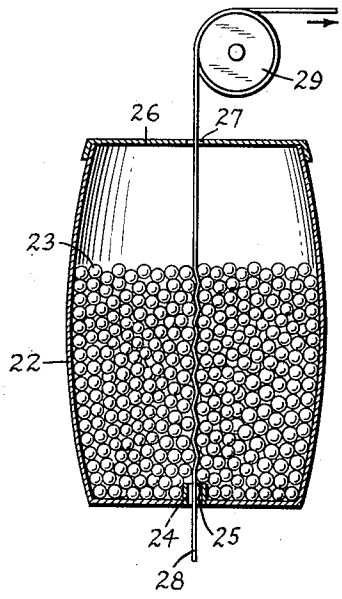


FIG.2.

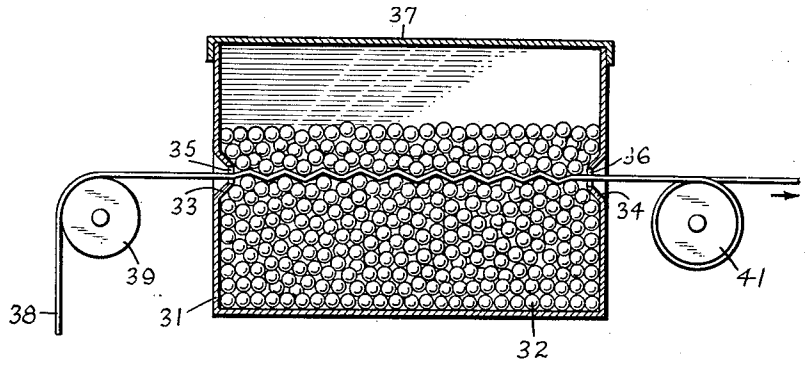


FIG.3.

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APPARATUS FOR TREATING FILAMENTARY MATERIAL

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1 Claim. (Cl. 118—33)

This invention relates to the handling of filamentary material and is more particularly concerned with a process and apparatus for tensioning and conditioning filamentary material.

In the handling of filamentary material, it is frequently necessary to apply a definite tension to the filamentary material, for example, when the said filamentary material is taken from one support and simultaneously wound onto another. There are two general types of apparatus that are employed to apply the desired tension to the filamentary material. In one type of tensioning apparatus, the filamentary material is passed into contact with a friction surface, which may comprise a pin, a disc, or the like, the friction between the filamentary material and the surface causing the development of a tension in the filamentary material. By varying the extent of contact between the filamentary material and the friction surface, or the force with which the filamentary material is urged against said surface, or the nature of said surface, or by varying any combination of these, it is possible to adjust the tension developed in the filamentary material to any desired value. This type of tensioning apparatus is not completely satisfactory in that it tends to damage and weaken the filamentary material because of the rubbing contact between said material and the friction surface.

In another type of tensioning apparatus, the filamentary material is passed around a rotating member in such a manner that the peripheral speed of the rotating member is substantially equal to the linear speed of the travelling filamentary material. To cause the development of a tension in the filamentary material a braking force is applied to the rotating member in any desired manner. While there is no rubbing contact in this type of tensioning apparatus between the filamentary material and any other surface, there is the danger, in the event of a break in the filamentary material, or in one of the filaments thereof, of said filamentary material or filament wrapping itself around the rotating member. Should this take place, there is the possibility that the tensioning apparatus will be damaged. In any event, the wrapping of the filamentary material or a filament thereof around the rotating member will necessitate the stopping and cleaning of the tensioning apparatus and the equipment in which it is employed. Not only do the two types of tensioning apparatus described above have certain operational disadvantages, but they are also relatively expensive to build and to maintain properly so that they will apply a uniform tension to the filamentary material at all times.

It is also frequently desirable in the handling of filamentary material to apply a lubricant or other liquid conditioning agent thereto. The apparatus employed to apply the conditioning agent, to be satisfactory, should apply the conditioning agent to the filamentary material uniformly. It should also permit the quantity of conditioning agent applied to the filamentary material to be adjusted over a wide range. While there have been many types of apparatus proposed for applying a conditioning agent to filamentary material, they have not been completely satisfactory in these respects, particularly where it is desired to apply extremely small quantities of the conditioning agent to the filamentary material. There is a tendency for the filamentary material to pick up an excess of conditioning agent which must be removed therefrom by the use of wiping devices or the like. Heretofore,

when it has been desired both to tension a filamentary material and to apply a conditioning agent thereto, it has been the practice to employ a separate apparatus for each purpose in order to permit the tension and the amount of conditioning agent applied to be controlled readily. The use of two pieces of apparatus increases the cost of the equipment in which the filamentary material is handled and the expense of such handling.

It is an important object to provide a process and apparatus for handling filamentary material which will be free from the foregoing and other difficulties and which will be especially simple in construction and efficient in operation.

A further object of this invention is to provide a process and apparatus for applying a tension to a filamentary material which will maintain a uniform tension on said material without damaging or weakening the filamentary material.

Another object of this invention is to provide a process and apparatus for applying a conditioning agent to a filamentary material with a high degree of uniformity.

A still further object of this invention is to provide a process and apparatus for simultaneously tensioning and applying a conditioning agent to a filamentary material.

Other objects of this invention, together with certain details of construction and combinations of parts, will be apparent from the following detailed description and claim.

According to the present invention, tension is applied to the filamentary material by passing the said filamentary material through a mass of rotatable elements such as spherical balls, pellets, or the like. As the filamentary material passes through the mass of balls, a tension will be applied to the filamentary material because movement of said material through the mass tends to cause rotation of the balls, and the resistance of the balls to rotation effects the application of tension to the filamentary material. A further tension will be applied to the filamentary material because of its frictional contact with the balls. However, the degree of such frictional contact will be quite small since any increase in such frictional contact will cause the balls to rotate. As a result, the frictional contact will not rise to a value where it will damage and weaken the filamentary material.

The degree of tension applied to the filamentary material may be readily varied by altering the length of the path of the filamentary material through the mass of balls, the density of the balls, the volume of the mass of balls and the diameter of the balls. Since all these factors may be easily controlled it is possible through the use of the apparatus of this invention to obtain a wide range of tensions in the filamentary material.

As the filamentary material passes through the mass of balls, a liquid conditioning agent, such as a suitable lubricant, may be applied thereto with a high degree of uniformity. Such application may be effected readily by providing means for applying the conditioning agent to the mass of balls whereby the balls will carry the conditioning agent to the filamentary material. The application of the conditioning agent to the mass of balls may be carried out by dripping or spraying the conditioning agent onto the balls or by providing a pool of conditioning agent in which the lower portion of the mass of balls rests. The rotation of the balls caused by the passage of the filamentary material therethrough will act to distribute the conditioning agent over the balls and thereby bring the conditioning agent to the filamentary material. The balls will also act to wipe any excess of conditioning agent from the filamentary material. In this way, extremely small quantities of conditioning agents, as well as larger quantities of such agents, may be applied to the filamentary material with a high degree of uniformity.

In carrying out the invention, the mass of balls may be positioned in a container provided with apertures whereby the filamentary material may be entered into and led out of said container. The apertures, advantageously, have a diameter less than the diameter of the balls whereby the balls will not fall therethrough. The filamentary material is led through the container, passing through the mass of balls therein whereby the desired tension is applied thereto. The balls may all be of the same size or they may be of different sizes. When the balls are all of the same size, there is the possibility that the balls will fall into a uniform arrangement having channels extending therethrough through which the filamentary material may pass with a minimum degree of contact with the balls. In such a case, little or no tension will be applied to the filamentary material. To avoid this possibility, the walls of the interior of the container may be given an irregular contour whereby the balls in successive layers cannot lie in the same pattern. For example, the container may be shaped as a barrel, cone, or other figure so that the distance from one wall of the container to the other will vary from point to point. Similarly, the interior of the container walls may be roughened as by corrugations, screw threads or the like to achieve the same result.

The container may also be provided with means for bringing a conditioning agent into contact with the balls at a point removed from the filamentary material. For example, the conditioning agent may be introduced into the container through a conduit to form a pool in the base of the container from which it is carried into contact with the filamentary material by the rotation of the balls. Similarly, the conditioning agent may be dripped or sprayed onto the mass of balls in the container and will be carried into contact with the filamentary material by the rotation of the balls.

Preferred embodiments of this invention are shown in the accompanying drawing wherein:

Fig. 1 is a cross-sectional view of one form of the invention,

Fig. 2 is a cross-sectional view of a modified form of the invention, and

Fig. 3 is a cross-sectional view of another modified form of the invention.

Referring now to the drawing, the reference numeral **11** designates a container which is partially filled with a mass of balls **12**. The base of the container **11** is provided with an inwardly projecting sleeve **13** whose innermost end **14** is tapered inwardly to provide an aperture **15** of a diameter smaller than the diameter of the balls **12** to prevent said balls from dropping through said aperture. The container **11** is provided with a cover **16** having an outlet aperture **17** therein. A filamentary material **18**, from any suitable source (not shown), to which it is desired to apply tension, is entered into the container **11** through the aperture **15** and leaves the said container through the aperture **17**. The filamentary material **18** then passes over a roll **19** which guides the said material to a suitable take-up device (not shown). The container **11** is also provided with a conduit **21** by means of which a conditioning agent, such as a lubricant, may be entered into said container to form a pool whose lower surface is below the upper end of the sleeve **13**. As the filamentary material **18** passes through the container **11**, a tension is applied thereto and it is uniformly lubricated.

Fig. 2 shows a tension device of modified construction, comprising a barrel shaped container **22** receiving therein a mass of balls **23**. The base of the container **22** is provided with an inwardly projecting sleeve **24** forming an aperture **25** having a diameter smaller than the diameter of the balls **23** to prevent said balls from dropping through the aperture. The container **22** is also provided with a cover **26** having an outlet aperture **27** therein. A filamentary material **28**, from any suitable source (not shown), to which it is desired to apply tension, is entered into the container **22** through the aperture **25** and leaves the said container through the aperture **27**. The filamentary material **28** then passes over a roll **29** which guides the said material to a suitable take-up device (not shown). As the filamentary material **28** passes through the container **22** a tension is applied thereto. Because of the barrel shape of the container **22**, there is no possibility that the balls **23** will become arranged in a regular pattern and form a channel through which the filamentary material **28** could pass freely and without contacting the balls **23**.

Fig. 3 shows another tension device of modified construction for applying tension to a filamentary material moving in a horizontal path, comprising a container **31** having positioned therein a mass of balls **32**. The side walls of the container **31** are provided with inwardly projecting tapered sleeves **33** and **34** forming apertures **35** and **36**, respectively, which apertures have a diameter smaller than the diameter of the balls **32** to keep the said balls from dropping through the apertures. The container **31** is closed by means of a cover **37**. A filamentary material **38**, to which it is desired to apply tension, is drawn from any suitable source (not shown) over a guide roll **39** and enters the container **31** through the aperture **35**. The filamentary material **38** leaves the container **31** through the aperture **36** and passes around a positively driven godet roll **41** from which it goes to a suitable take-up device (not shown).

While the filamentary material has been shown as following a tortuous path through the mas of balls, it is to be understood that this showing is primarily diagrammatic and the path of the filamentary material will be substantially straight, particularly at high tensions.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of my invention.

Having described my invention, what I desire to secure by Letters Patent is:

Apparatus for treating a travelling filamentary material, said apparatus comprising a container having an upwardly projecting sleeve in its base, a mass of spherical balls of different sizes in said container whereby the said balls will not form channels through which the filamentary material can pass without contacting the balls, all of said balls having a diameter larger than the diameter of the opening of said sleeve, means for supplying a conditioning agent to the bottom of said container to a depth less than the height of said sleeve whereby a small proportion of the spherical balls receive conditioning agent directly, and means for guiding the filamentary material upwardly through said sleeve, into and through said mass of spherical balls in said container and out of said container, the construction and arrangement being such that the filamentary material passing through said mass of spherical balls causes said spherical balls to rotate thereby to distribute the conditioning agent upwardly from the balls directly in contact with the conditioning agent to the balls that are not directly in contact with the conditioning agent and contact the filamentary material so that the filamentary material has simultaneously applied thereto tension and conditioning agent.

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