July 19, 1938. H. DREYFUS ET AL 2,123,936

APPARATUS FOR THE TREATMENT OF ARTIFICIAL FILAMENTS

Filed Nov. 11, 1929

FIG. 1.

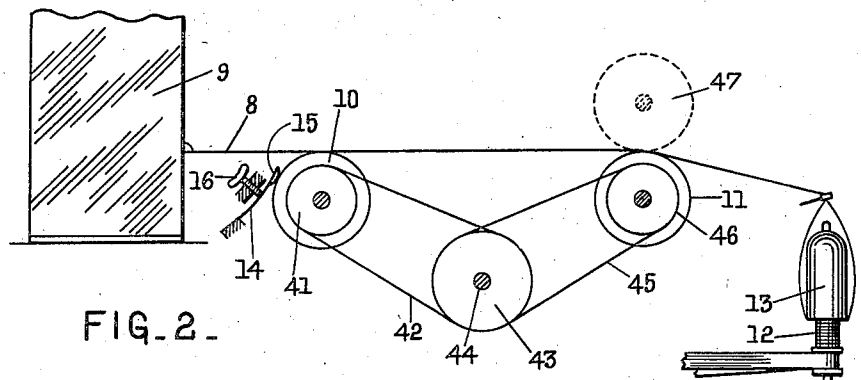


FIG. 2.

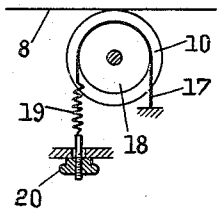


FIG. 3.

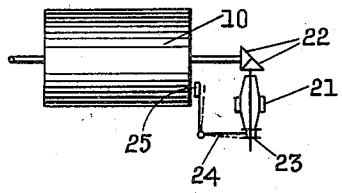


FIG. 4.

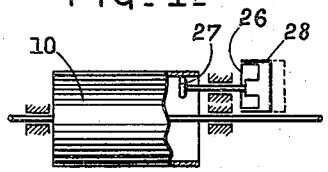


FIG. 5.

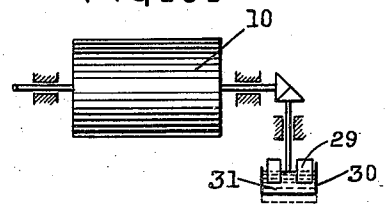


FIG. 6.

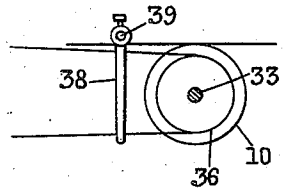
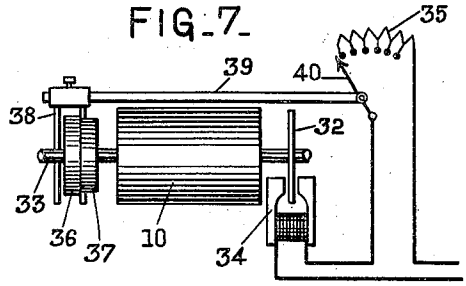


FIG. 7.



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APPARATUS FOR THE TREATMENT OF ARTIFICIAL FILAMENTS

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3 Claims. (Cl. 18—8)

This invention relates to the manufacture or treatment of artificial silk or other artificial threads or filaments.

The invention comprises a process and apparatus by means of which artificial filaments or threads (hereafter referred to as "filaments") may be stretched in a uniform manner and to any desired extent, the invention being applicable to the treatment of the filaments while the filaments are travelling, for instance, in the course of their manufacture, or during winding or rewinding operations.

According to the invention, a process for the manufacture or treatment of artificial filaments or threads comprises, as a continuous operation on the travelling filaments or threads, passing the filaments or threads round a roller, pulley, drum, or the like to which a "drag" or braking action is imparted, and applying sufficient stress to the filaments or threads to cause them to rotate the roller, pulley, drum, or the like, whereby the stress applied to the filaments or threads to enable them to overcome the "drag" or braking action effects a permanent extension of the filaments or threads.

The drag is preferably adjustable in amount so that the resistance to rotation of the roller, pulley, drum, or the like may be varied in accordance with the stress necessary to effect the required extension of the filaments. This stress will, of course, vary with the degree of extension to which they are to be subjected, the greater the extension to be imparted, the greater being the stress required for stretching a particular filament, and vice-versa. In the case of the treatment of fully-set or finished threads or filaments, the stress to be imparted will also vary with the initial strength of the threads or filaments.

The drag may be imparted in numerous ways. For instance, brake shoes, bands, or other friction means may be applied to the roller or the like or to a member fixed to or in driving connection with the roller or the like. Thus, a leaf-spring or a lever anchored at one end and bearing on the roller or the like at its other end may be employed, or weighted or spring-loaded cords or bands may pass round the periphery of the roller or the like or of a pulley in driving connection with the roller or the like. Likewise, a speed-operated braking device may be driven by or in connection with the roller or the like to oppose its motion and to provide the required drag. Thus, the roller or the like may drive a centrifugally-operated friction brake such, for example, as is used as a governor for gramophone or other clockwork motors, or an air-flyer or other fluid friction brake may be used. Similarly, a disc or other member driven against any suitably applied electro-magnetic resistance may serve to apply the drag.

Whatever the form of braking device employed, it is preferable to provide it with means for adjusting the braking action of the roller or the like, and, while the invention is not restricted to the employment of any particular type of brake or adjusting means therefor, it is preferred that adjustment can be effected during the operation of the stretching apparatus.

If necessary, the "drag" roller or the like may be provided with positive driving means for the purpose of putting it into motion at the commencement of the stretching operation. By these means, excessive loading of the filaments due to overcoming the inertia of the roller or the like is overcome, and starting up of the operation is facilitated. When the requisite speed has been attained, the positive drive is cut out, preferably gradually, the filaments take over the driving of the roller or the like, and stretching of the filaments is effected, as described above. During such starting operation, the drag or braking may be rendered non-effective, so that on the drive of the rollers being transferred from the positive driving means to the filaments, little stress is imparted to the filaments, the brake then being applied until the requisite drag is opposing the motion of the roller or the like. The brake may, however, be controlled automatically from the control for the positive driving means, so that the brake is applied, preferably gradually, on or during the removal of the driving means. A friction or other clutch, fast and loose belt pulleys, or other suitable means may be employed to put the positive driving means into and out of operation.

It is desirable in some cases, for example, where only comparatively small amounts of drag are required to enable the filaments to be stretched, to have the roller or drum very freely mounted, and in such cases, ball or roller bearings may advantageously be employed for the spindle or shaft of the roller or drum.

While the braking means employed may be such as to oppose fluctuations in the speed of the roller or the like, it may also be desirable to use a roller or the like of such mass that its inertia exerts a steadying effect on the speed for the purpose of ensuring that the stretch is imparted in a uniform manner over the whole

length of the filaments. In order to overcome difficulties which might arise in starting up owing to the inertia of the roller or the like, and particularly in the treatment of comparatively slight filaments or threads, positive driving means such as those described above are preferably used in conjunction with the roller or the like.

Any convenient means may serve to impart to the filaments the traction by which they are drawn over or round the drag roller or the like. A suitable means comprises a further roller or drum round which the filaments pass on their way to a collecting device such as a reeling, winding, or twisting and winding device. Smooth nipping rollers or toothed, corrugated or roughened rollers between which the filaments pass on their way to the collecting device may also be used. The tension exerted on the filaments by winding or twisting and winding devices may also serve to apply the necessary stress to the filaments, the filaments in this case passing directly from the drag roller or the like, with or without the interposition of thread guides, to the winding or twisting and winding device.

When positive driving means are employed to start up the drag roller or the like, the driving means are conveniently driven from or by the same driving means as the traction device, any suitable speed ratio being adopted. Generally, the maximum peripheral speed of the drag roller or the like will not be greater than and is preferably somewhat less than the peripheral speed of the traction device.

If desired, two or more drag rollers may be arranged to intercept the filaments on their way to the traction device, each drag roller preferably being adjustable as to peripheral speed independently of the other roller or rollers by means of braking devices such as those described above. By these means the stretch may be imparted in stages and to any desired amount in each stage. Further, additional traction devices may be employed to impart still further stretch to the filaments after they have left the first traction device.

The process and apparatus according to the invention are applicable to the treatment of filaments during any suitable stage of their manufacture, whether continuously with their production by the dry or evaporative method or by the wet or coagulation method, or subsequently to their production by either of these methods. The treatment may thus be applied to filaments during hank-to-bobbin, bobbin-to-bobbin, or other winding or rewinding operations.

The invention is particularly applicable to the treatment by stretching of filaments of cellulose acetate or other derivatives of cellulose produced by the dry or evaporative method, and it may be employed to carry out the process of stretching such filaments continuously with their production by the dry or evaporative method and while the filaments are in a semi-solid or plastic condition by reason of residual solvent contained in the filaments, as described in our co-pending British application No. 37,631/28 or our corresponding U. S. application S. No. 410,776 filed Nov. 30, 1929 which has become Patent 1,935,203. The invention may also be employed in connection with the stretching of filaments of cellulose acetate or other derivatives of cellulose beyond their elastic limit, whether or not the filaments have been treated with substances that facilitate the stretching, as described in U. S. application S. No. 378,684 filed 16th July, 1929.

When the invention is applied to the stretching of filaments in the course of their production, and particularly during their production by the dry or evaporative method, the braking action exerted on the drag roller which first receives the extruded filaments may be so adjusted that the said drag roller has a peripheral speed greater than the speed of extrusion of the filaments. The filaments are thus subjected to stretching in their passage from the spinning orifices to the drag roller, in addition to the stretching effected between the drag roller and the traction device.

The method of carrying the invention into effect will now be described in greater detail with reference to the accompanying drawing, but is to be understood that the following description is given by way of example only and is in no way limitative.

In the drawing:

Figure 1 is a side elevation of an apparatus for carrying out the invention continuously with the production of artificial filaments by the evaporative method, and

Figures 2–7 show modifications of details of the apparatus shown in Figure 1.

In Fig. 1, which shows the application of the invention to the treatment of filaments e. g. cellulose acetate filaments, continuously with their production, filaments **8** issuing from the spinning cell **9** are passed around a "drag" roller **10** and proceed therefrom to a stretching roller **11**, being finally wound on a bobbin **12** by means of a cap-spinning device **13**. "Drag" or braking action is imparted to the roller **10** by means of a leaf-spring **14**, a friction pad **15** on which bears against the periphery of the roller. The portion of the roller **10** engaged by the pad **15** may be covered with leather, fabric, or the like to increase the braking effect of the pad. Adjustment of the braking action is afforded by means of a thumb-screw **16** which is arranged to press the pad **15** more or less strongly on the roller **10**.

In Fig. 2, a cord or band **17** is arranged to pass round a pulley **18** (or, if desired, round the roller **10**), one end of the cord or band being anchored, while the other is secured to a spring **19**, by means of which the necessary tension is imparted to the cord or band. A wing nut **20** enables the tension to be adjusted.

Fig. 3 shows the use of a centrifugal governor for the purpose of braking the roller **10** and maintaining its speed constant. The governor **21** is driven by gears **22** at a speed equal or proportional to that of the roller **10**, the moving end **23** of the governor operating a bell-crank lever **24** so as to press a brake-shoe **25** carried by an arm of the lever **24** against the end of the drum **10** with a pressure that varies in accordance with the speed of the drum.

In Fig. 4, an air-brake **26** is driven by a friction pulley **27** bearing against the inner periphery of the drum. If desired, the braking action may be varied by arranging for the brake to rotate inside a casing **28** which is movable axially to enclose the brake to a greater or less extent, as shown in dotted lines.

Fig. 5 shows a similar arrangement to that illustrated in Fig. 4, a brake **29** driven by gears from the roller **10** being arranged to rotate in a casing **30** containing any suitable liquid **31**. The casing **30** is adjustable vertically as shown in dotted lines to enable the braking to be adjusted.

Figs. 6 and 7 show an end and side elevation respectively of an arrangement which may be

employed to control the speed of the roller 10 magnetically. A disc 32 is secured to a shaft 33 on which the roller 10 is mounted, and a magnet 34 is so arranged that the disc 32 rotates between it poles. With this arrangement, a braking action exactly proportional to the speed of rotation of the drum 10 is applied to the disc 32. Intensity of the braking action may be varied by moving the magnet inwards or outwards with respect to the shaft 33.

In the form illustrated, an electro-magnet is employed, a rheostat 35 being provided to vary the braking power of the magnet. Means are also shown for driving the roller 10 positively on starting up, fast and loose pulleys 36 and 37 being mounted on the shaft 33. A belt fork 38, which is used to shift the belt from the fast to the loose pulley is connected by means of a rod 39 to the controlling arm 40 of the rheostat 35 so that the resistance in the circuit of the electro-magnet 34 is cut out gradually as the positive drive is removed from the roller 10.

Positive means for driving the roller 10 when starting up are also shown in Fig. 1, a pulley 41 being mounted on the shaft of the roller 10 and driven by a belt 42 and a pulley 43 mounted on a shaft 44 from which the stretching roller 11 is also driven by means of a belt 45 and a pulley 46. A clutch or a fast-and-loose pulley device is used to disconnect the positive drive from the roller 10 when the roller has acquired the requisite speed. Instead of applying the stretch to the filaments 8 by passing them round the roller 11, they may be nipped between the roller 11 and a further roller 47. These two rollers may, moreover, be corrugated, toothed, or roughened to assist their nipping action.

What we claim and desire to secure by Letters Patent is:—

1. Apparatus for the treatment of artificial filaments comprising a roller round which the filaments are caused to pass, means for applying stress to the filaments to cause them to rotate the roller and an electro-magnetic braking device for applying to said roller a drag resisting such rotation and substantially independent of the stress that is being applied to the filaments but depending upon the rate of rotation of the roller whereby the filaments are permanently extended, and means for positively driving the roller at the beginning of the operation.

2. Apparatus for the treatment of artificial filaments comprising a roller round which the filaments are caused to pass, means for applying stress to the filaments to cause them to rotate the roller, means for applying to said roller a drag resisting such rotation and independent of the stress in the filaments whereby the filaments are permanently extended, and means for positively driving the roller at the beginning of the operation.

3. Apparatus for the treatment of artificial filaments comprising a roller round which the filaments are caused to pass, means for applying stress to the filaments to cause them to rotate the roller, means for applying to said roller a drag resisting such rotation and independent of the stress in the filaments whereby the filaments are permanently extended, and means for positively driving the roller at the beginning of the operation, said driving means being adapted to render inoperative the torque applying means at the beginning of the operation.

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