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APPARATUS FOR LOCALIZED DRAFT IN FILAMENTS AND YARNS

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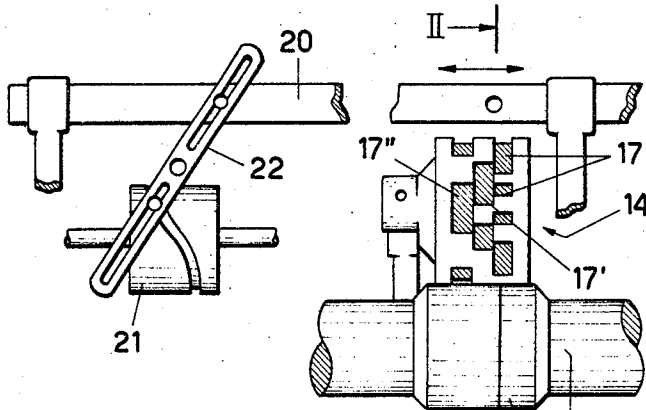
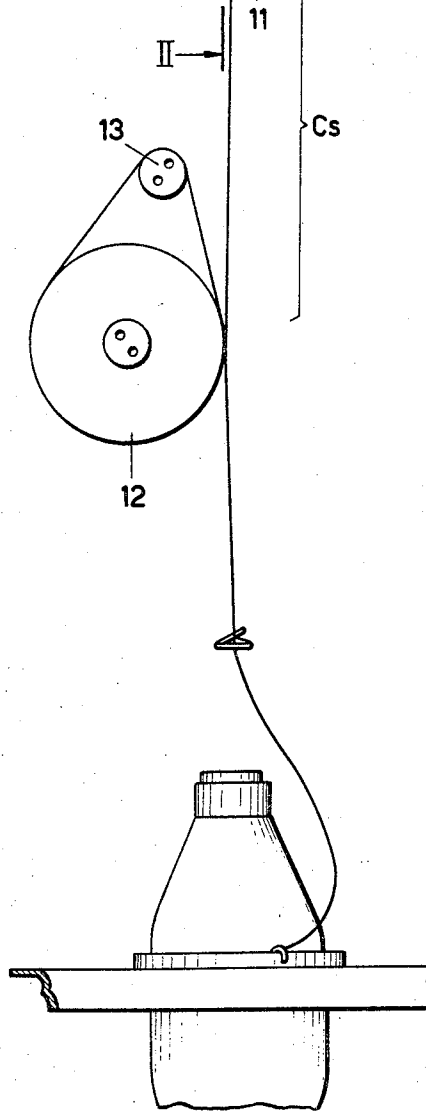


Fig.1



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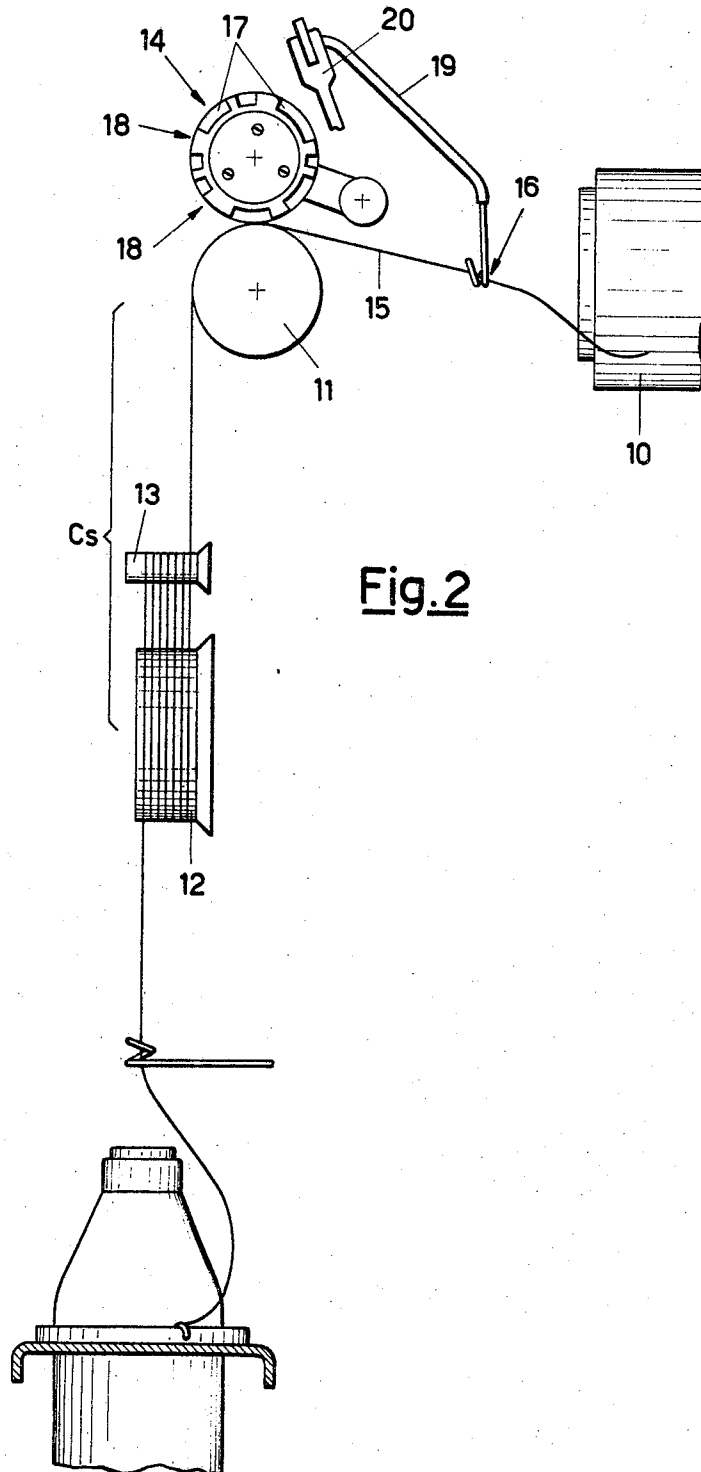
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Fig. 3

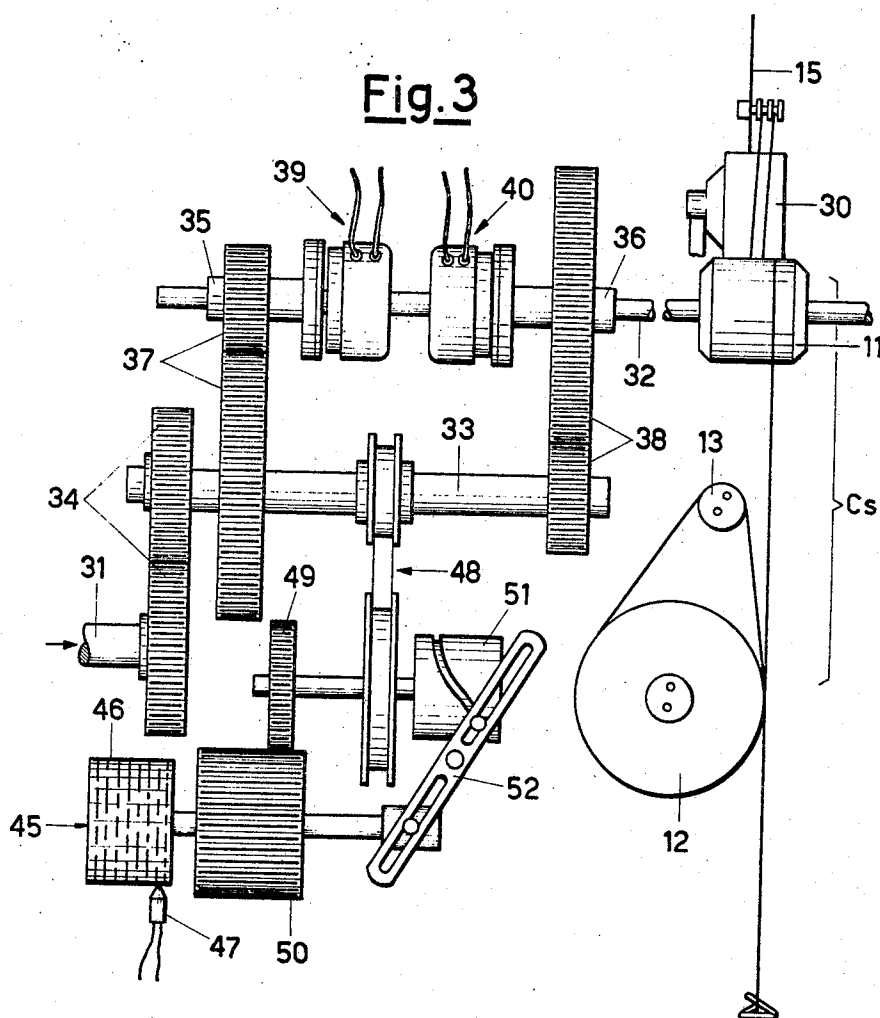
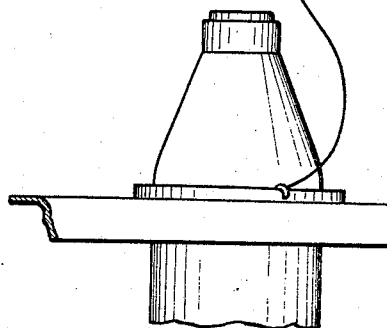
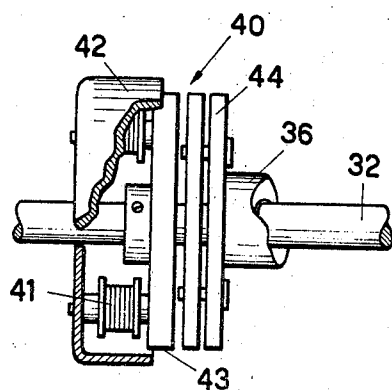


Fig.4



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APPARATUS FOR LOCALIZED DRAFT IN FILAMENTS AND YARNS

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9 Claims

ABSTRACT OF THE DISCLOSURE

Yarns are produced having variations in diameter in sections of varied lengths and varied intervals under programmed control by imparting, during drawing of the yarns, variations of considerable magnitude to the counter-tension upstream of the drawing member. For this purpose the thread-pressing roller, which cooperates with the feed rollers, that feed the yarn to the drawing field, may be grooved on its periphery with grooves of varying angular length to vary the tension on the yarn, or the surface speed of the feed roller set may be varied.

This invention relates to a method for the production of filaments and yarns having a variable cross-sectional area in successive fractions, according to a preselected program of variations and/or intervals, which differ from one another, of the drafting action imparted to said yarn.

This invention also relates to the devices for variably drawing, according to a preselected program and more particularly with instantaneous variations, for treating and processing yarns and filaments, more particularly of a synthetic nature, such as filaments and yarns made of polyamide, polyester and like fibres.

It is known that for some particular industrial applications of synthetic, continuous textile filaments and yarns, such as for example in the production of the so-called "flamed" fabrics, yarns are employed which, in the different successive fractions of their length have different diameters, these being obtained by varying the spinning conditions. Said application is limited, up to now, to the rayon field.

These known filaments and yarns are subject, however, to drawbacks and, more particularly, a fabric produced with them is liable to take permanent dimensional deformations and, at any rate, it exhibits uncontrollable dimensional instability phenomena.

It has been ascertained by the present applicant that these detrimental phenomena are mainly due to the fact that the variations of cross-sectional area and thus of resilient and permanent stretchability of the known yarns are reproduced at predetermined and uniform intervals along the yarn's length. Furthermore, the transition between adjacent sections having different cross-sectional area takes place in a gradual manner. These conditions are conducive to a substantial regularity of the distribution of the several sections having different diameters throughout the lattice-like structure of the fabric, wherein zones are thus formed in which the adjacent or nearby yarns have prevalently a maximum or a minimum thickness, thus giving rise to a dimensional instability of the fabric, due to the localized concentration of its component which have differential dimensional and mechanical strength characteristics.

According to the invention, it has been made possible, in quite a surprising way, to do away with said shortcomings, dimensionally stable fabric being thus obtained,

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according to the basic idea of imparting to the yarn localized draft variations which are distributed according to a preselected program in which the diameter variations sequentially follow along sections of continually varied lengths and intervals, with a considerably extended cyclically programmed pattern.

By so doing, it is virtually impossible, even regarding the matter from a merely statistical standpoint, that the fabric exhibit areas in which there are considerable clusters of filament sections having equal diameters.

According to a further important feature of this invention, the variations of the draft conditions, programmed as aforesaid, are obtained by instantaneously imparting a variation of a considerable magnitude to the counter-tension upstream of the drawing member, so as to induce substantially instantaneous variations of said counter-tension and under the most favourable conditions in order that the desired effects may be obtained.

Said sudden and programmed variations of the counter-tension are obtained, with the inventive device, by acting upon the means which feed the yarn to the drawing field, means which, as a general rule, comprise a set of rollers which cooperates with a thread-pressing roller. The variation of the counter-tension can be obtained either by suddenly varying the factors which determine the pressure of the thread on the roller set so as to obtain a corresponding variation of the spatial velocity of the thread at the beginning of the drawing field due to the variation of the adherence between the thread and said roller-set, or, as an alternative, by suddenly varying the surface speed of said roller set.

In the former case, the thread pressing roller could have, formed on its surface of contact with the thread, a sequence of notches arranged at different angular intervals and having, in turn, different angular widths. When said notches come in a position opposite to the roller-set, the adherence of the thread thereto is suddenly discontinued, the result being a variation (in practice total interruption) of the counter-tension and thus of the instantaneous drawing conditions. For increasing the amplitude of the programmed variation cycle, the thread-pressing roller could have different sets of notches in its several peripheral areas placed in side-by-side relationship, and the device could comprise a means for displacing the thread (e.g. a thread guide cyclically moved by a cam) so as to subject the thread to the action of the several areas sequentially, thus obtaining a cycle which comprises the whole set of variations formed by the summation of the sets due to the distribution of the notches in each and every area.

In the second case, the set of rollers which feeds the thread to the drawing field could be actuated, for example, through a drive-transfer mechanism comprising devices for varying the ratio between the driver and the set of rollers, clutching and clutch shifting means adapted to establish under control the drive transfer according to the different ratios, and a programming mechanism which determines the programmed cycle for the actuation of said clutching and clutch shifting means.

A detailed description of examples of the invention will follow, these being shown, limited to the essential characteristic component parts of the device, in the figures of the accompanying drawings, wherein:

FIGURE 1 is a diagrammatic showing of a first embodiment of the drawing device having a pulsatory action programmed according to the invention.

FIGURE 2 shows the same device in cross-sectional view taken along the line II—II of FIG. 1.

FIGURE 3 shows, in a similar diagrammatic way, a second embodiment of the device in its essential component parts, and

FIGURE 4 is a detail view of a clutching and clutch shifting means which can be used in said second embodiment.

In the embodiment shown FIGS. 1 and 2, the continuous filament, coming from a suitable orientation means, an example of which is the roll 10 (FIG. 2) is fed to a drawing field C_s which is formed, according to the conventional arrangement of parts, between a feeding roller set 11 and a drawing roller 12, the adherence of the filament on said roller 12 being obtained in a known manner, by causing the filament to be wrapped for a plurality of spirals therearound and around an auxiliary guiding roller 13. The roller set cooperates with a thread-presser roller, generally indicated at 14, whose features will be illustrated hereinafter, while the position of arrival of the thread 15 between the roller set 11 and the thread 14 is defined by a thread-guide 16.

The feeding roller set 11 is actuated by moving and drive-transfer means (not shown), so that its surface speed is in a predetermined ratio with respect to the surface speed of the drawing roller 12, so as to obtain the desired stretch of the thread within the drawing field C_s , said ratio, which determines the drawing ratio, being, in turn, determined, in known manner, consistently with the characteristics of the thread and of the drawing effects desired.

In the embodiment illustrated herein, the variations of the diameter of the thread are obtained by suppressing, or at least markedly reducing, according to a programmed sequence including times and intervals, which are reproduced only when a composite programmed cycle has been completed, the conditions of adherence of the thread 15 to the set or rollers 11 thus annulling or at least strongly reducing the counter-tension applied upstream of the drawing field C_s .

Such an action is obtained by forming on the outer surface or contour of the thread-presser roller 14 at least one set of notches generally indicated at 17 in FIGS. 1 and 2, which, when they are in front of the surface of the roller set 11, suppress the conditions which determine the adherence of the thread to said set of rollers, said conditions being conversely restored as the lands or intervals 18 come into position.

Thus, for each revolution of said thread-presser roller 14, the conditions of adherence of the thread to the set of rollers and thus the counter-tensions, are annulled or strongly reduced and are restored according to the cycle determined by the number and the angular width of the notches 17 and the lands 18, whose angular widths are sequentially different and variable according to a preselected program.

Furthermore, in order to achieve versatility of said program, i.e., to vary the number of variations which are reproduced in the sequence of the resulting stages of suppression and restoration of the conditions of adherence between the roller set and the thread, said thread presser roller has, as shown by way of example on FIG. 1, a plurality of cylindrical areas placed in side-by-side relationship, each of which comprises its own set of notches 17' and 17'', these being variable, in turn, according to a preselected program on the outer surface of said roller. The thread-guide 16 aforementioned is carried by an arm 19 and the latter is connected to a movable structure 20 which can be controllably displaced in a programmed manner, for example by a cam 21 which is rotated at a speed of its own, capable of being programmed by a control member: the latter can be the same as for the set of rollers 11 or an independent control member, cooperating with a slotted link 22 so that the thread 15 is caused sequentially to pass over several points along the generating lines of said set of rollers 11 and said roller 14 under the action of the several different areas in said notches 17, 17' and 17''.

A program can thus be obtained extending through a very wide cycle of different actions of intermission

and restarting of the counter-tension, said cycle comprising the composite of all the sequence which are individually determined by the distribution of the lands and the grooves in the several adjacent areas of the thread-presser roller, further variations being potentially obtained by suitably modifying the amplitude and/or the sequences of the traversing movements imparted to said thread-guide 16 so as to obtain a number of combinations when switching from one to another of the several areas engraved on the thread-presser roller in the switching sequence of the thread under the action of one of said areas or another.

In the embodiment shown in FIGS. 3 and 4, the programmed variation of the drawing conditions is obtained by acting upon the feed of the drawing field C_s which is also defined by the interval between a feeding set of rollers 11, cooperating with a thread-presser roller 30, and a drawing roller 12 cooperating with a guiding roller 13 as aforesaid.

In this embodiment, however, the thread 15 is obtained under conditions of constant adherence to said set of rollers 11, but the surface speed thereof is varied according to a preselected program so that the interruption section of FIGS. 1 and 2 is replaced by a programmed variation of the speed at which the thread is fed at its input to the drawing field.

Said programmed variations of the surface speed of the set of rollers 11 are obtained for example by inserting between the mainshaft 31 of the drawing device and the shaft 32 which actuates the set of rollers, a mechanical gear capable of introducing programmed variations of the gear ratio.

For example such a mechanical gear comprises a driving shaft 33 actuated by the mainshaft 31 for example through a couple of gears 34, and two tubular driven shafts 35 and 36, idly rotatable about the shaft 32 which actuates the set of rollers, at different speeds, they being connected to said driving shaft 33 by means of two independent couples of gears 37 and 38, respectively, having different gear ratios. The variation of the speed of the set of drawing rollers 11 is obtained by alternately connecting, according to a preselected program, the shaft 32 to either tubular shaft 35 and 36, by for example, two electromagnetic clutches 39 and 40, respectively.

Said electromagnetic clutches can be made in a conventional way and comprise, as shown in FIG. 4, electromagnets 41 carried by a cupped drum 42 and capable of inducing, when energized, a drive-transferring relationship between components 43 keyed to said shaft 32 and components 44 solid with the respective tubular shaft 36 (or 35, respectively).

Programming the alternation of the connection of the shaft 32 with either parallel drive transferring member as formed by said gearing 37 and 38, is obtained by programmed energization and de-energization of the electromagnetic clutches 39 and 40 by a programming device.

This device, in turn, can be steered by programming means adapted to allow for the development and the cyclical repetition of an extended program in the sequence of variable intervals between the different driving connections and speeds of the set of rollers.

Said programming means can include for example a drum 45 on whose peripheral surface 46 superficial marks are provided adapted to vary the reflection or transmission characteristics of light impinging on said drum so that the alternate passage of said marks past a light-sensitive device such as a photocell or photo-resistor 47 induces the alternate energization of said means and the delivery of an electric signal which pulsates in attunement with the desired program, and which, suitably amplified, is utilized for the desired alternately programmed control of the electromagnetic clutches 39 and 40.

Said programming drum 45 can be actuated by the same driving means, for example by the mainshaft 33,

via a belt or roller chain 48 and gears 49 and 50. The program determined by said drum can be, in turn, developed in a very prolonged cycle by arranging on the surface 46 of the drum a plurality of programming marks spread over several zones arranged in side by side relationship and capable of sequentially going past the photo sensitive means 47. For example, the programming drum 45 can alternately be displaced in the axial direction for example by means of a cam 51 and a slotted link 52 so that its several mark-bearing zones may come sequentially and cyclically past the photo sensitive member 47, this latter member being also susceptible of being displaced by the means described above or otherwise in front of the programming drum.

Obviously, programming the alternation of the clutching and clutch shifting of the points 39 and 40 could be determined also by other programming means, for example by employing one or more cam profiles cooperating with followers, these latter acting in turn on electric switching means which, either directly or via suitable relays, control the input circuits of said clutches. Also, the sequence of action of the several cams or the different zones of the programming means could also be varied so as to obtain a cycle including the composite of all the program settings or also a combination of several programs, said programmed action being possibly repeated until all of the possible combinations of the program settings aforesaid have been exhausted.

Moreover, said program settings could be selected so that the alternations between the conditions of variable speed in feeding the drawing field, or programmed intermittent discontinuance of the counter-tension, in the embodiment of FIGS. 1 and 2, are reproduced in times which are different with respect to the feeding speed of the thread for the adaption of the device to the treatment of threads of different nature, compositions and/or denier count, as well as to the production of fabrics exhibiting different features. For example, said variations could be obtained by varying the speed of the programming members, for example by varying the gear ratio 48 (FIG. 3), with respect to the speed of actuation of the set of rollers which feeds the drawing field.

A few non-limiting examples of the invention will be given in the following, since the invention can be practiced also with different systems provided they are adapted to obtain, during the thread processing, variations of the instantaneous drawing ratio thereof.

In the embodiment of FIGS. 1 and 2, wherein a non-drawn yarn having a count of 600/16 has been treated, a mechanical drawing ratio between the feeding set of rollers and the drawing cylinder of 1:3.75 has been adopted, by imparting to the thread 15 a tension of 10 gms. by means of the thread guide 16. On the thread presser roller 14 a program setting has been adopted, distributed along three equatorial zones containing "lands" and "grooves" in a substantial distribution, one of which contains 6 grooves, the second 8 grooves and the third 3 grooves. The variation of the count of the thread which has undergone the pulsatory draft according to the invention is of about $\pm 40\%$ with respect to the average count of the thread, as drawn, which is 210/16 corresponding to 13 deniers per filament. The complete period of the oscillations undergone by the thread guide and controlled by the cam shown at 21, FIG. 1, is of about 2 minutes. The circumferential length of the equatorial zones on which the grooves have been formed is of 270 mms.

In the embodiment of FIGS. 3 and 4, a nondrawn thread having a count of 600/16 is treated, with a mechanical drawing ratio between the set of rollers and the drawing roller of 1/3.4. On the drum 46, having a diameter of 150 mms., 20 adjacent equatorial zones have been engraved, each containing a number of opaque marks, statistically distributed, ranging from 20 to 40. The width of the programming stripe of the drum which contains

the 20 equatorial zones is 100 mms. The period of oscillation undergone by the drum 45 and induced by the cam 51 is 5 minutes. The variations of the speed of the feeding set of rollers, imposed by the pair of gears 37 and 38 is of $\pm 40\%$. The corresponding variations of the count of the drawn thread obtained were of the order of $\pm 30\%$ of the average count of the same drawn thread, which is 210/16 corresponding to 13 deniers per filament.

For the foregoing, it can be appreciated that the invention permits obtaining drawn threads of synthetic fibers having a count variable from $\pm 40\%$ to -40% of the average count when the latter has a value of about 13 deniers per filament. Said variations, however, are obtained also with higher or lower counts per filament, for example, with counts between 3 deniers per filament and 20 deniers per filament, by imparting wider variations of speed to the feeding set of rollers for drawing according to the embodiment of FIGS. 3 and 4, or by decreasing the tension of the thread 15 with the aid of the thread guide 16 according to the alternative embodiment (FIGS. 1 and 2). Good results have been obtained also with threads of 6 deniers per filament: as a matter of fact count variations of $\pm 40\%$ have been obtained with a thread having an overall count, after drawing, of 70/12 corresponding to 6 deniers per filament, approximately.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for continuously drawing filaments and yarns, comprising

feeding members at the input end of a drawing field, drawing means at the output end of said field, means for actuating the feeding members to feed the work to said drawing means, and means associated with said feeding members adapted to vary, according to a preselected program, the rate at which the work is fed by said feeding members into said field.

2. Apparatus as defined in claim 1, wherein said feeding means comprises a set of feed rollers, and

having means for the programmed variation of the surface speed of said set of feed rollers.

3. Apparatus as defined in claim 2, wherein said set of feed rollers are driven by means comprising

a mainshaft, two driven members, a second shaft for driving said set of feed rollers,

at least two different drive transfer means connecting at different gear ratios, respectively, said mainshaft to said two driven members, and means for selectively coupling either of said driven members to said second shaft.

4. Apparatus as defined in claim 3, wherein said coupling means comprises two electromagnetic clutches, and having programming means for determining the alternate actuation of said two clutches.

5. Apparatus as defined in claim 4, wherein said programming means comprises means for generating a pulsating electric signal for activating and deactivating said clutches.

6. Apparatus as defined in claim 5, wherein said signal generating means comprises photosensitive means, and

a traveling surface having different reflecting zones, and

means for moving said surface past said photosensitive member.

7. Apparatus as defined in claim 1 wherein

said feeding members comprise a set of rollers positioned to engage the work between them and to feed the work forward as they rotate, and

at least one of said set of rollers is a thread presser roller,

said thread-presser roller having on its peripheral sur-

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face alternate lands and cavities angularly spaced around said surface from one another so that as said cavities go past the position of tangency with another of said feed rollers, the adherence of the work to said set of feed rollers is temporarily reduced, said reduction being cyclically repeated according to the program defined by the distribution of said cavities over said peripheral surface.

8. Apparatus as defined in claim 7, wherein said cavities are of different angular width and spacing.

9. Apparatus as defined in claim 7, wherein said thread-presser roller has a plurality of zones of cavities arranged in mutual side-by-side relationship, the different zones having, respectively, differently arranged cavities, and having

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moveable thread guiding means for alternately guiding the work between said set of feed rollers and any one of said zones.

References Cited

UNITED STATES PATENTS

3,212,158	10/1965	Kasey	-----	28—71.3	X
3,343,207	9/1967	Mottern et al.			

10 LOUIS K. RIMRODT, Primary Examiner

U.S. Cl. X.R.

264—290