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APPARATUS FOR THE MANUFACTURE OF VARIABLE DENIER YARN

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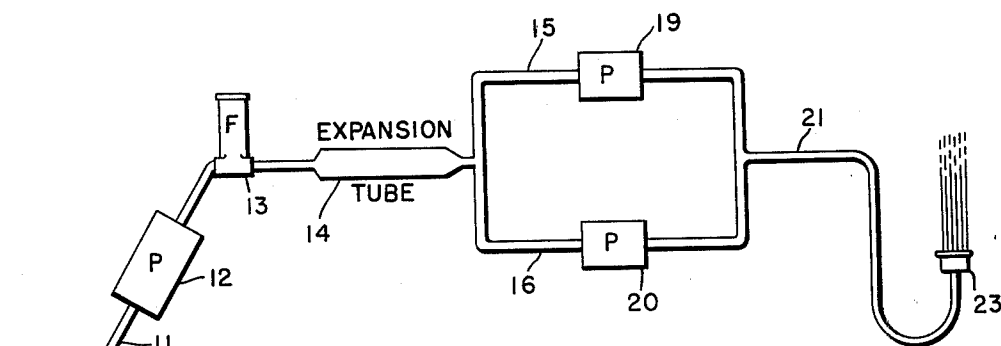


FIG. 1

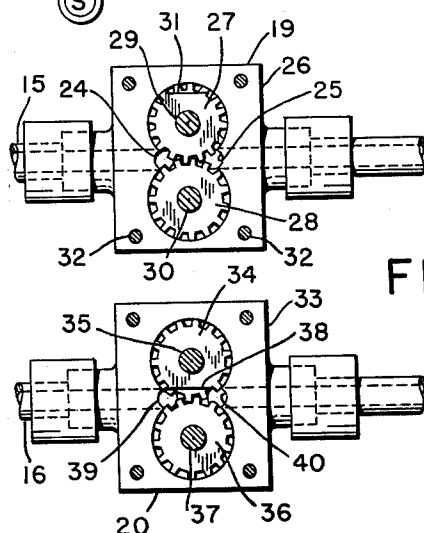


FIG. 2

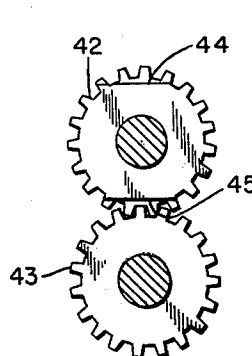


FIG. 3

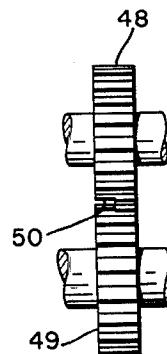


FIG. 4

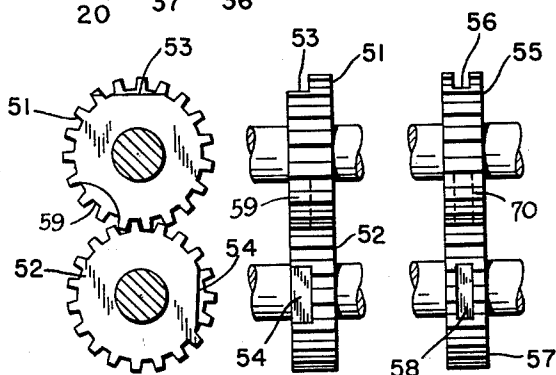


FIG. 5

FIG. 6

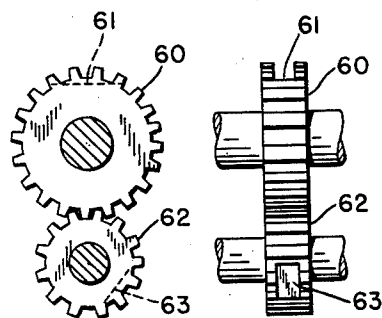


FIG. 7

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This invention relates to the production of variable 10
denier artificial yarn.

There is a general desire in the textile industry to provide different and unusual textile constructions to satisfy a demand by ultimate users. The continuous process method for producing artificial filaments readily lends itself to such purpose in that the yarn denier can be varied during its manufacture, particularly at the time of spinning. Methods have been proposed for varying the denier and generally many of these are directed to altering the feed of a yarn forming solution at the time of its passing through a spinneret. In these methods the quantity of a solution is varied through a pulsating motion. This is simply effected by mechanical means or electrical between the metering pump and the spinneret that will abruptly but regularly interrupt or change the quantity of flow of the solution to the spinneret. Since the action of these flow altering devices is repetitive the final physical appearance of the yarn, while altered, is still uniform in appearance, the increase in denier occurring, generally, at regular intervals. In using such yarn subsequent care must be exercised in spacing of the physical differences if an unusual fabric is to be produced.

Desired appearances of the final yarn should contain obviously sharp variations in denier and in their position in the yarn rather than merely thickened portions which tend to blend in during construction providing for little, if any, distinctiveness. The applicant has found, as subsequently described, an improvement in apparatus over methods herein mentioned which provides for artificial filaments of uneven denier where the spacing evenness or unevenness is sharply apparent.

This invention provides for an installation wherein a gear pump adapted to act as a valve means is positioned in a spinning solution line, also containing a pressure means, which upon rotation intermittently forwards additional volumes of solution giving pronounced denier increases in each filament spun. More specifically, the aforesaid variable denier yarn is produced by a gear pump having its meshing gears altered in a manner permitting sudden additional solution flows which are quickly effected by means of a preceding pressure chamber.

The valve action of gear pumps can be advantageously utilized in a divided solution line where a gear pump is positioned in each divided section. The drive of the gear pumps, in such instance, can be arranged so that the pumps run on independent cycles of operation.

This invention will be more thoroughly described in connection with the accompanying drawing, where:

FIGURE 1 represents in schematic form the use of two pumps, acting as valves, in a solution feed line for varying the ultimate yarn denier at different intervals along its length;

FIGURE 2 is a detail of the denier varying pumps P of FIGURE 1;

FIGURES 3, 4, 5, and 6 show alternate constructions of the valve gears of the pumps of FIGURE 2;

FIGURE 7 represents a further variation in construction of a single pump adapted to vary denier at different intervals along the produced yarn length.

As shown in FIGURE 1 of the drawing a standard apparatus utilized in the viscose spinning process is altered by the interjection of an expansion tube or chamber, a

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divided conduit, if desired, in each section of which there is positioned a gear pump, then a common outlet for said divided section having a spinneret at the end. Viscose under pressure is supplied through a common header 10 and tube 11 to an initial or primary metering or spin pump 12 which forwards a measured amount of a spinnable solution through a filter 13, into and through the expansion tube 14 of resilient material, into divided tubes or sections 15 and 16. The tubes or sections 15 and 16 contain gear pumps 19 and 20 respectively. Gear pumps 19 and 20 are similar to gear pump 12 with the exception of the shape of the gears. Their outflow is joined in the common outlet tube 21 which is then extruded through a spinneret 23 to form a varied denier yarn. The outflow from the expansion tube can also be directed through a single pump, 19 or 20, to outlet 21.

Variation in the yarn denier is effected by means of a particular alteration of the gears of the pumps 19, 20. In FIGURE 2 the gear pump 19 comprises a housing 26 having a recess or chamber in which are contained gears 27 and 28. Viscose is admitted into the chamber through inlet opening or port 24, measured, then forwarded through outlet port 25. In pumps of this type, commonly used in the fiber spinning industry, power is applied to either shaft 29 or 30, and the one rotates the other since they are in mesh. The upper gear 27, advantageously, is partly cut away, the cut 31 being of such size to permit a sudden additional surge of a desirable quantity of viscose to be forced through when the section 31 rotates around to mesh with gear 28. The cuts in the gears are made in a manner so as to always have gear teeth in meshing relation.

Similarly, the bottom pump 20 operates in a like manner. Gears 34, 36 mounted on shafts 35, 37 measure and forward viscose from inlet 39 to outlet port 40. Once per revolution an additional measured amount is forced through the cut 38 in the gear 34. The added quantities of viscose from each pump are forced cyclically out of the spinneret 21 at changing intervals. A variation in denier periodicity is thus had. The denier of the thickened portions can also be varied by a difference in size of the cuts 38 in gear 34 of the lower pump cut 31 in gear 27 of the upper pump.

The surge or required additional pressure on each pump 19, 20 is provided by the expansion tube 14. The initial feed pump 12 maintains an excess feed volume and pressure on the line and, of course, on the pumps 19 and 20. The combined flow of pumps 19 and 20 is desirably less than that of the basic pressure pump 12 and is equalized only with the additional flows through their cut away portions. The excess is stored in the expansion tube 14 until either of the gears 27 or 34 present their cut away sections 31, 38 at their correct positions during rotation. The built up pressure at once forces additional amounts of viscose through the gear cuts, adding desirable quantities to the regular flowing stream to periodically increase the yarn diameter. Furthermore, the gears 27, 28 are driven at a rate that varies from the rotation of gears 34, 36 so as to provide for variation in their output giving a yarn containing variable denier at random intervals along a length of yarn.

The aforesaid manner for intermittently increasing the denier of a yarn during spinning can be limited to a single pump, if desired. In FIGURE 3 there is shown a single gear 42 cut in at least two spaced places such as on opposite sides. A cut 44 is shown at the top of gear 42 while the second cut 45 is placed oppositely. The cuts 44 and 45 can vary in size, including depth and width, depending on the denier differences required in the final yarn. Again where the frequency of enlarged portions need not be regular the cuts can be more closely spaced; or only one of the gears 48 need be cut as shown in FIG-

FIGURE 4. The cut section 50 of gear 48 will allow such additional amount of viscose through the pump as required when that section meshes with the bottom gear 49.

Depending upon depth of cut and position the frequency of the thickened portions can be varied through the provision of at least two unevenly circumferentially spaced apart cut-away portions in the circumference of one gear where none would be diametrically opposite the other for desired final effects. FIGURE 5 shows cut sections 53 on gear 51 and 54 on gear 52 at about 90° positions. This arrangement will provide for a yarn having two thickened sections close to each other and a longer interval of normal denier. The arrangement obviously can be varied as desired. Also, an additional cut such as at 59 can be made in either gear 51 or 52. The cuts 53, 59 and 54 can be further varied in size and position but none being diametrically positioned relative another in the same gear so long as sufficient gear teeth are had for continuous meshing contact. The cuts can be made in the side of the gears as in FIGURE 5 or they can be made at mid-point of the length of the gear teeth, as shown in FIGURE 6. In FIGURE 6, gear 55 has cuts 56 and 70 at about the mid-point and so has gear 57.

The irregular intermittent denier variation in a single yarn can be obtained, also, by means of a single pump if the gears have a different number of teeth, or are of different diameter, or both, as shown in FIGURE 7. In FIGURE 7 the pump gears 60 and 62 are constructed of different diameters, they also have different numbers of teeth. The upper gear 60 has a cut 61, within its width, while the smaller gear 62 has cut 63, also in its width. Upon rotation predetermined additional volumes of viscose will pass through at irregular intervals creating for a substantial length of yarn a pattern that will not reappear except for long intervals that are hardly noticeable.

This invention has been described more particularly in connection with viscose spinning solutions but obviously it is not limited thereto. Generally all spinnable substances capable of being extruded by means of gear pumps are included in the scope of the invention. Examples of such are cellulosic derivative solutions, e.g. cellulose acetate, nitrocellulose, cellulose propionate; also synthetic high polymer solutions and others capable of filament forming.

What is claimed is:

1. A gear pump for producing variable denier yarn comprising, a housing having inlet and outlet ports, a pumping chamber in the housing, a pair of intermeshing externally toothed pumping gears in continuous tooth registering peripheral contact positioned in the chamber and being adapted to receive a yarn forming solution from said inlet and forward it through said housing outlet port, and one of said gears having at least two unevenly circum-

ferentially spaced apart cut-away portions in the gear circumference where none would be diametrically opposite the other and extending circumferentially through at least one tooth but less than through all intervening teeth between the cut-away portions, leaving sufficient whole tooth depth in the cut-away portions for continuous tooth registration, the cut-away portions permitting the by-pass of additional amounts of a yarn forming solution to the normal flow forwarded by said gears.

2. The gear pump of claim 1 where one of the gears has a different number of teeth.

3. A gear pump for producing variable denier yarn comprising, a housing having inlet and outlet ports, a pumping chamber in the housing, a pair of intermeshing externally toothed pumping gears in continuous tooth registering peripheral contact positioned in the chamber and being adapted to receive a yarn forming solution from said inlet and forward it through said housing outlet port, and one of said gears having a different number of teeth and each has one cut-away portion in its circumference extending circumferentially through at least one tooth but less than through all leaving sufficient whole tooth depth in the cut-away portion for continuous tooth registrations, the cut-away portion permitting the by-pass of additional amount of a yarn forming solution to the normal flow forwarded by said gears.

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