

April 2, 1957

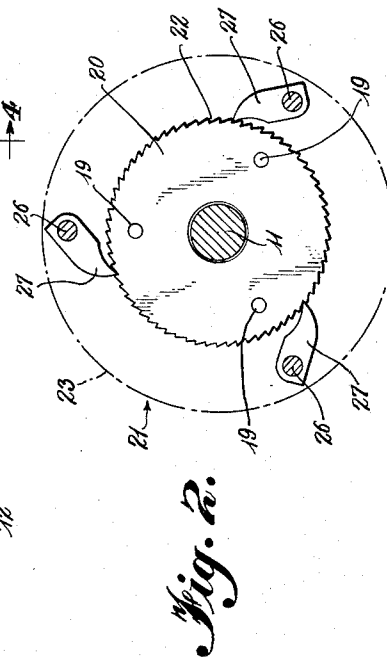
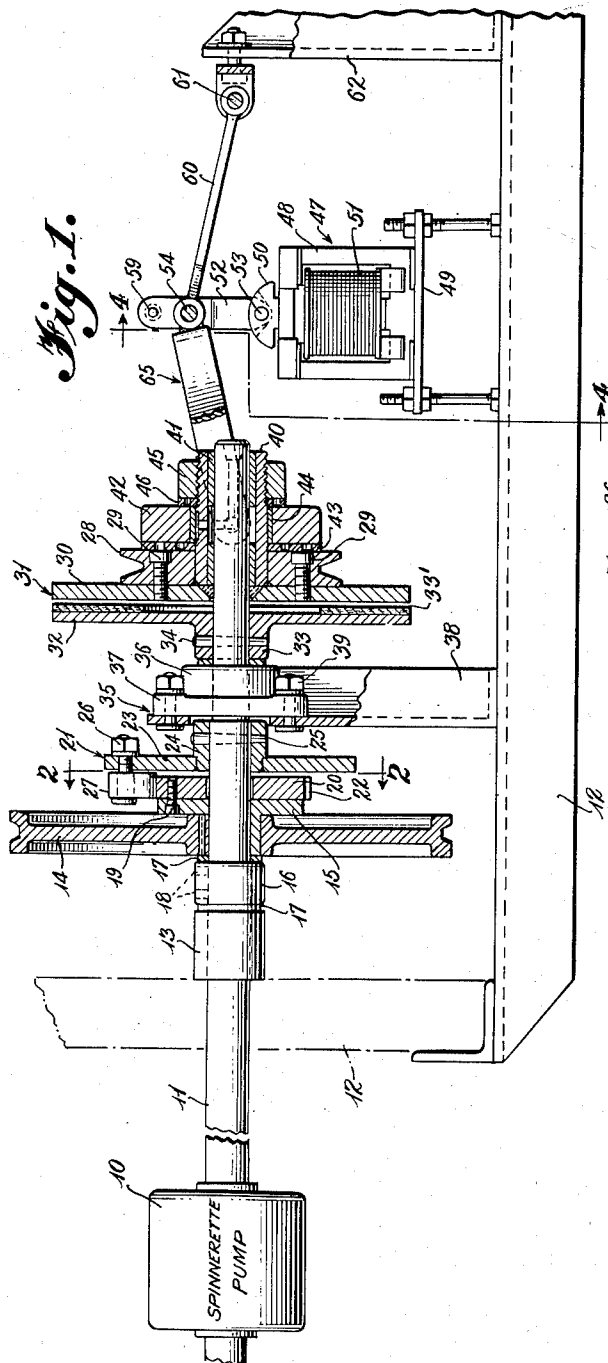
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2,787,221

APPARATUS FOR PRODUCING NUB YARN

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3 Sheets-Sheet 1



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Fig. 3.

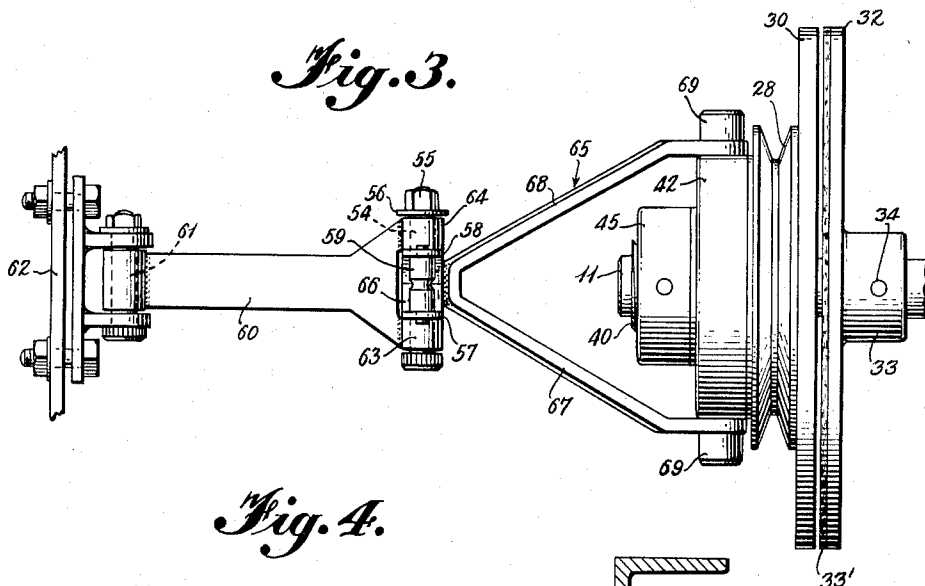


Fig. 4.

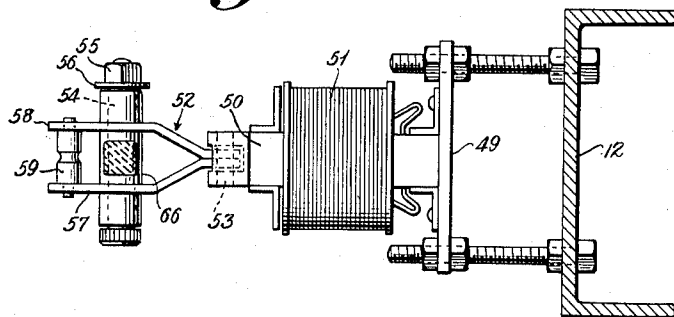
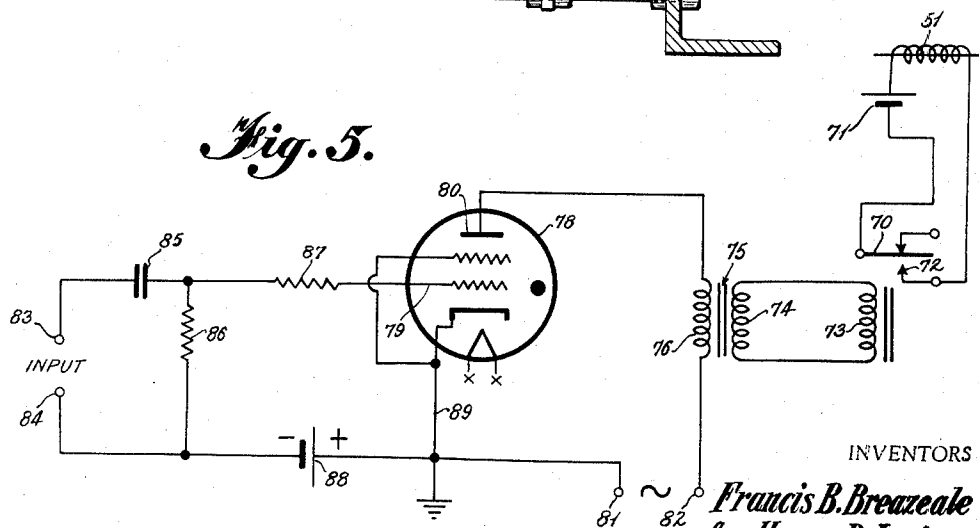


Fig. 5.



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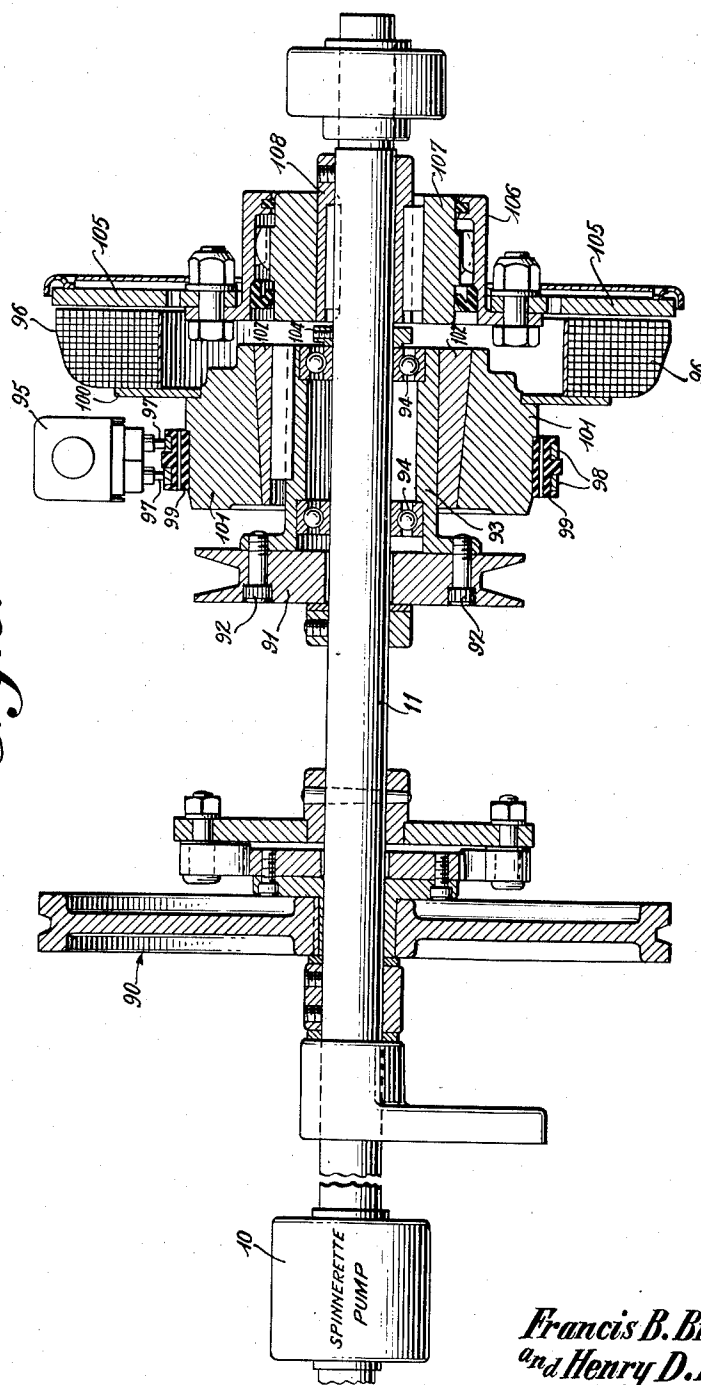
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Fig. 6.



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APPARATUS FOR PRODUCING NUB YARN

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7 Claims. (Cl. 103—35)

This invention relates to apparatus and method for the spinning of nub yarn, and more particularly to apparatus and method for controlling the operation of the pumps that feed the spinnerets for producing such yarn.

Nub yarn is sometimes called thick and thin yarn. It is characterized by a thin portion termed the base denier and is followed by a relatively short and thick portion many times the base denier in weight per unit length. These thick portions are called the nubs. Production of nub yarn has been met with two main difficulties. The first difficulty is that of placing the nubs (thick portions) along the length of the yarn in such a manner that when the yarn is put into a fabric as the filling, no periodic pattern in the cloth is visible to the eye under normal conditions of weaving. The second difficulty is that of making the thick portions large and distinct enough while still being short with respect to the length of the thin portions.

It is therefore an object of this invention to provide an apparatus that will overcome the foregoing difficulties.

More particularly, it is an object of this invention to provide a novel means of controlling the operation of a viscose pump so as to produce a very high quality nub yarn.

A still further object of this invention is to provide a relatively simple and inexpensive apparatus which may be used to convert an entire viscose spinning machine into a machine for producing nub yarn.

The invention will be described with particular reference to the production of viscose nub yarn, although it will be apparent that it is applicable to the manufacture of any thick and thin synthetic yarns made by extruding a liquid through a spinneret or the like. As is well known, viscose yarn is made by extruding viscose solution from spinnerets into chemical baths which treat the extruded threads. The denier of these threads can be controlled by controlling the speed of operation of the spinneret pump. This pump feeds the viscose from its source of supply to the spinneret. The pump is set at a certain speed to produce the base denier and if at any time it is desired to increase the denier the pump is speeded up. In this manner, the amount of material per unit time fed to the spinneret determines the denier. The means by which this pump control is obtained in accordance with this invention is broadly as follows.

The pump has two speed drives, a low-speed drive and a high-speed drive. The low-speed drive operates the pump at a proper speed to produce the base denier, the high-speed drive at the proper speed to produce the nubs. These two drives control the operation of the pump according to a predetermined pattern. If, for example, both drives control the pump alternately and for the same amount of time, a yarn having approximately equal thick and thin portions is produced. The two drives are connected to the pump shaft, the pump being of the conventional type such as a gear pump. The low-speed drive is connected to a clutch whose faces engage, and

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therefore provides drive to the shaft only when the shaft speed is below the speed of the low-speed drive. If the shaft speed is greater than the speed of the low-speed drive, this low-speed clutch slips to provide free wheeling of the clutch. The shaft speed is greater than the speed of the low-speed drive when the pattern control cuts in the high-speed drive. The high-speed drive is connected to the pump shaft through a clutch whose faces engage, and therefore provides high-speed drive to the shaft, when the pattern control so dictates. By connecting the two drives to control the speed of the shaft driving all the viscose pumps on at least one entire side of a conventional viscose spinning machine a large production of nub yarn with a minimum alteration in equipment is made possible.

The foregoing objects of the invention and others will be apparent from a detailed description of the accompanying drawings.

Figure 1 is a longitudinal view partly in section of the apparatus constructed in accordance with this invention employing a friction clutch as the high-speed clutch;

Figure 2 is a view taken along line 2—2 of Figure 1;

Figure 3 is an elevational view of the toggle connection between the high-speed clutch and a part of the pattern control;

Figure 4 is a view taken along line 4—4 of Figure 1;

Figure 5 is an electronic circuit diagram of the electronic pattern control; and

Figure 6 is a view similar to Figure 1, disclosing another embodiment of the invention employing a modified magnetic friction clutch.

Referring to Figures 1 and 2, numeral 10 identifies a spinneret pump. The source of viscose is not shown, nor is the spinneret fed by this pump. The pump shaft 11 is operatively connected to the pump 10 and any number of additional pumps (not shown) and is mounted to the supporting frame 12 by the stationary bearing 13. The pulley wheel 14 is rigidly mounted to the hub member 15. The hub 15 is mounted for free rotation about the shaft 13. The wheel 14 is spaced from the bearing 13 by spacing collar 16 and spacing ring 17. The collar 16 is mounted to the shaft by set screws 18. A motor (not shown) drives the pulley wheel 14 by a V belt (not shown). The wheel, in turn, drives the hub 15. The hub is mounted by screws 19 to the clutch face 20 of the low-speed clutch 21. The clutch face 20 has a series of marginal teeth 22. The other clutch face 23 of the low-speed clutch 21 is rigidly mounted to the hub member 24 which, in turn, is fixed by pin 25 to shaft 11. At spaced points on the outer end of the face 23 are mounted by nut and bolt assemblies 26, a series of pawls 27. When the only drive applied to the pump 10 is through the low-speed drive mechanism, clutch face 20 rotates clockwise as shown in Figure 2. The pawls 27 lock in the teeth 22 and rotate the face 23. This drives the shaft 11 and the pump 10 at the low-speed rate.

The high-speed drive is obtained through a motor (not shown) a V-belt driven thereby (also not shown), the belt being mounted to the wheel 28. The wheel 28 is rigidly mounted by screws 29 to the stainless steel clutch face 30 of the high-speed clutch assembly 31. Normally the face 30 is disengaged from the other face 32, which face 32 includes a cork ring 33' mounted thereon. The face 32 is rigidly mounted to the hub 33, which, in turn, is mounted by pin 34 to the shaft 11. Between the hubs 24 and 33 is a thrust box 35 composed of bearing 36 and housing 37. The housing is mounted to the frame 12 by standard 38 and bolt and nut assemblies 39.

The high-speed drive motor rotates the wheel 28 clockwise but this wheel is rotatable about the shaft 11 when the clutch faces 30 and 32 are disengaged. However,

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when the faces are engaged, face 32 drives the shaft 11 thru hub 33 and pin 34 at a speed determined by the high-speed motor. It must be remembered that prior to engagement of the faces 30 and 32 the shaft is being driven by the low-speed drive thru clutch 21. Now, however, with faces 30 and 32 engaged, clutch face 23 rotates faster than clutch face 20, the pawls 27 then slip over the teeth 22, and the high-speed drive takes over. When the faces 30 and 32 are again disengaged, the shaft 11 is driven only by the low-speed drive and therefore pawls 27 remain engaged in teeth 22 as previously described. During the high-speed drive cycle the nubs are produced, while during the low-speed drive cycle the base denier is produced. The next step is, then, the means of controlling the engagement and disengagement of the clutch faces. For this reference is made to Figures 1, 3 and 4.

The wheel 28 is rigidly mounted to the sleeve 40. This sleeve, in turn, is mounted to the shaft 11 thru bearings 41. The wheel 28 is rotatable about the shaft 11 while the faces 30 and 32 are disengaged. A toggle yoke ring 42 is spaced from the wheel 28 by a space ring 43 and rotatably mounted to sleeve 40 thru bearings 44. This ring does not rotate with the wheel 28 and its associated parts. A nut 45 is screw-threaded to sleeve 40 and bears against the ring 42 thru the spacer ring 46. The entire assembly, that is face 30, wheel 28, sleeve 40, nut 45 and yoke ring 42, with their bearings and spacing rings, is free to move longitudinally a limited amount along the shaft 11. In the position as shown in Figure 1, this assembly above described is at its normal right-hand position whereby faces 30 and 32 are disengaged. Engagement of these faces is obtained by the operation of the solenoid 47.

This solenoid 47 is encased in a housing 48 which is mounted to a platform 49. This platform is mounted to the frame 12. The solenoid includes a movable core whose head is indicated as 50. This core is normally (no current in solenoid) biased in its upward position as shown in Figure 1. When, however, current flows in coil 51 of the solenoid 47, the core is attracted downwardly by the magnetic force set up. To take advantage of this downward movement of the core, a member 52 is mounted by a pin 53 in a concave slot in the head 50 of the movable core. A pivot pin 54 is mounted about the middle of the member 52. This pin is held in place by nut 55 and washer 56 mounted to its threaded end. As shown in Figures 3 and 4, the member 52 is actually divided at one end into two branched sections 57 and 58 which are biased away from each other by spacer pin 59. One link 60 of the toggle is mounted at one end to a pivot pin 61 which in turn is supported from the bracket 62. At the other end the link has two integral pivot sleeves 63 and 64 which are mounted for rotation about the pivot pin 54. The other link 65 is mounted at one end by integral pivot sleeve 66 to the pivot pin 54. The other end is composed of integral bars 67 and 68 which are mounted at spaced points on the toggle yoke ring 42 by nut and screw assemblies 69.

The operation of this solenoid toggle assembly is as follows: When current is caused to flow in coil 51 of the solenoid 47, the movable core thereof is attracted downwardly. This in turn pulls the member 52 downwardly. Links 65 and 60 pivot about the pivot pin 54, forcing the toggle yoke ring 42 to the left and engaging clutch faces 30 and 32. This connects the high-speed drive to the shaft 11. When current is removed, the core returns to its normal position, retracting links 65 and 60 and therefore toggle yoke ring 42 to disengage faces 30 and 32. From this it is apparent that the control of current in coil 51 of the solenoid is of greatest importance. For an appreciation of this control, reference is now made to Figure 5.

In Figure 5 the lever 70 is normally biased in the position as shown, that is, in which there is an open circuit

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between the current source, shown as a battery 71, and the coil 51. When, however, this lever is in its downward position, that is, in contact with switch contact point 72, the coil is energized by current from source 71. This is the moment at which the solenoid core moves downwardly and causes the engagement of clutch faces 30 and 32. The operation of lever 70 is controlled by the current in relay coil 73. Current will flow in coil 73 when current flows in the secondary 74 of the transformer 75. Current in coil 73 moves lever 70 from its normal position as shown to a position in contact with switch contact point 72. Current in the secondary 74 flows whenever there is current in the primary 76. Primary 76 is in the plate circuit of Thyatron tube 78. As is the characteristic of such gas tubes, once tube 78 is fired by a positive pulse on the grid 79, the grid loses control of the tube current. The only way the tube can be quenched is by the loss of plate voltage on plate 80. The plate voltage supply enters between posts 81 and 82 and is alternating current normally 110 volts, 60 cycles. The grid is supplied with a grid voltage supplied at posts 83 and 84. Post 83 may be a pickup on a wire recorder. The desired pattern to be used to control the operation of the solenoid is put into the tape of the wire recorder. A numerical table is prepared representing the desired configuration of nubs and spaces on the yarn. The recorder is then set up to record normally except that the tape puller's speed is reduced drastically to about $\frac{1}{10}$ th the normal speed. A relatively low frequency signal, that is about 60 cycles, is supplied to the recorder. This 60 cycle input to the recorder is then interrupted at timed intervals according to the numerical tables. For instance, the input may be allowed to continue for four seconds and then be cut off for twenty seconds. When the tape is completed it is wound into a storage reel of the continuous tape mechanism and the ends spliced together so that it may be run continuously thru the tape puller. The tape is played back while running at normal speed. The resultant output from the recorder is a series of signal pulses whose frequency is 40 times the recording frequency, for this example about 2400 cycles per second, and whose pulse duration is $\frac{1}{10}$ of a second and pulse repetition rate is one pulse about every $\frac{1}{10}$ of a second. The interruption of the signal may be random interruptions and thereby produce a pattern of random signals.

This pulsing output is that which is picked up by post 83. The condenser 85 and resistor 86 have such a time constant that the grid receives thru the grid leak resistor 87 practically a square pulse of $\frac{1}{10}$ of a second in duration. The grid bias is, of course, obtained by battery 88. The cathode 89 is grounded. If the frequency of the plate voltage is 60 cycles per second, then during the $\frac{1}{10}$ second interval that the pulse is on the grid, the tube will fire 6 times and produce 6 pulses of current in its plate circuit. These current pulses are coupled to relay coil 73 and operate the lever 70. The rapidity of the pulses and the inertia of the lever permit the lever to remain in its position in contact with point 72 all during the $\frac{1}{10}$ second pulse interval. During the remaining $\frac{1}{10}$ second, when there is no output from tube 78, the lever 70 returns to its normal position.

The solenoid acts accordingly, that is, during the $\frac{1}{10}$ of a second interval it forces the engagement of clutch faces 30 and 32 to connect the high-speed drive to the shaft 14. During the $\frac{1}{2}$ second interval between pulses it releases the clutch faces 30 and 32 to allow the low-speed drive to take over. The result is a high viscose output from the pump for $\frac{1}{10}$ of a second to produce the nub, and a low viscose output from the pump for $\frac{1}{2}$ of a second to produce the base denier.

The tape may be made to give any desired pattern. The figures quoted above are only by way of example.

The embodiment above described uses a friction clutch, the features of which are not per se a part of this invention. The next embodiment employs a magnetic fric-

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tion clutch of the conventional type. Specifically, the type used is a Warner clutch size 1225. Referring to Figure 6, the parts of the low-speed drive indicated by numeral 90 are the same as described in Figure 1. The high-speed drive consists of a V-belt pulley wheel 91 mounted to the shaft 11 for free rotation thereabout. The wheel 91 is mounted by screws 92 to a sleeve 93 supported on bearing assemblies 94 to the shaft 11. In place of the solenoid 51 of the friction clutch embodiment, there is inserted a means 95 to impress the output current of the electronic system of Figure 5 onto the coils 96. This means includes brushes 97 to apply the current to rings 98. These rings are imbedded in an annular insulating member 94. Wires (not shown) connect these rings to the coils 96. The coils are mounted to an annular plate 100 which, in turn, is mounted to an annular member 101. This latter member 101 is press fit to a sleeve 102. The sleeve 102 is keyed to the sleeve 93. The spacer ring 104 holds this coil assembly in position on the shaft 11. The entire coil assembly freely rotates about the shaft 11 and will not drive the shaft until the coils are energized and draw the coil clutch face and the clutch face 105 together. The coil clutch face is composed of some magnetizable material mounted on the face of the coil 95 to form a suitable clutch face. Face 105 is also composed of some magnetizable material. This latter clutch face 105 is mounted to a sleeve 106 which is, in turn, splined to a sleeve 107. The sleeve 107 is keyed to the sleeve 108 which is, itself, keyed to the shaft 11. The spline arrangement permits the sleeve 106 and therefore the clutch face 105 to slide axially of the shaft 11.

When the lever 70 of Figure 5 is attracted to contact point 72 by the firing of the gas tube 78, current energizes coils 96 and attracts by magnetic force the clutch face 105 to engagement with the clutch face arranged on the outer side of the coils 96. The faces remain engaged until the lever 70 moves back to its normal position. They are then separated by face 105 moving to the right where it is normally biased. The operation of the high-speed drive and low-speed drive in controlling the spinneret pump 10 is exactly the same in the magnetic clutch embodiment as in the friction clutch embodiment.

It has been found that either of the above embodiments of the invention may be adapted to control the speed of the shaft driving the pumps for at least one entire side of a conventional viscose yarn spinning machine (about 114 spinnerets). Of course, it will be apparent that a single tape carrying the desired pattern may be used to control a plurality of spinning machines altered according to one of these embodiments.

A typical operation will employ the following specific values:

Base denier.....	40.
Average denier.....	150.
Spinning speed.....	35 meters per minute or approximately 1380 inches per minute.
Approximate average nub length	2½ inches.
Approximate distance between nub peaks.....	13.5 inches.
Base pump shaft speed.....	4.75 R. P. M.
Additive pump shaft speed	172 R. P. M.

What have been disclosed are two specific embodiments of the present invention. Other embodiments apparent to those skilled in the art from the teachings herein are contemplated to be within the spirit and scope of the following claims.

What is claimed is:

1. Apparatus for spinning viscose nub yarn that comprises a pump for pumping viscose to spinnerets for said yarn, said pump having a shaft operatively connected thereto, means providing a plurality of signal pulses, a

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low-speed drive and a high-speed drive, an overrunning clutch operatively connecting said low-speed drive to said shaft, a second clutch having two normally disengaged clutch faces, one clutch face thereof being positioned to free-wheel about said pump shaft, means to connect said high-speed drive to said one face thereof, the other clutch face thereof being mounted for axial movement only on said pump shaft, and means including an electromagnet operatively associated with said pulse providing means and responsive to said signal pulses periodically to move said clutch faces axially to engagement operatively to connect said high-speed drive to said pump shaft.

2. Apparatus as claimed in claim 1 further characterized in that said second-clutch-face moving means comprises a magnetic coil mounted to one clutch face, the other clutch face being made of a magnetizable material.

3. Apparatus as claimed in claim 1 further characterized in that said last named means includes a Thyatron tube having a relay coil in the plate circuit thereof and having an alternating current plate supply connected to the plate thereof, and a normally-open circuited relay switch operatively connected to said relay coil, a source of electrical current, means to connect said source thru said switch to said coil and means to fire said Thyatron periodically to cause said relay coil to close said relay switch to energize said coil.

4. Apparatus for spinning viscose nub yarn that comprises a pump for pumping viscose to spinnerets for said yarn, said pump having a shaft operatively connected thereto, means providing a plurality of signal pulses, a low speed drive and a high speed drive, an over-running clutch operatively connecting said low speed drive to said shaft, a second clutch having normally disengaged drive establishing elements, one of said elements being keyed to said shaft and the other being mounted to turn freely on said shaft, means to connect said high speed drive to drive said other element and means including an electromagnet operatively associated with said signal pulse providing means and responsive to said signal pulses to connect said clutch elements in mutual driving relation.

5. Apparatus as claimed in claim 4 in which the last named means includes a Thyatron tube and an alternating current plate supply connected to the plate thereof, a relay coil connected to the plate circuit and a normally open relay switch operatively connected to the relay coil, a source of electric current, means to connect said source through said switch to the electromagnet, the means for providing a plurality of signal pulses causing said Thyatron periodically to fire thereby to cause said relay coil to close said relay switch to energize said electromagnet thereby to cause connection of the clutch elements in mutual driving relation.

6. Apparatus as claimed in claim 4, further characterized in that the electromagnet of said last named means includes a movable core therein, a toggle comprising two links pivotally mounted to a pivot pin, means to connect said core to said pivot pin, one of said links being pivotally mounted at the end opposite said pivot pin to a rigid frame, the other link being mounted to the end opposite the pivot pin to said other clutch element, a Thyatron tube having a primary of a transformer in the plate circuit thereof and having an alternating current plate supply connected to the plate thereof, a relay coil connected to the secondary of said transformer, a normally open relay switch operatively connected to the relay coil, a source of electric current, means to connect said source through said switch to the coil of said electromagnet, the pulse providing means firing said Thyatron periodically to cause said relay coil to close said relay switch to energize said electromagnet thereby to connect said clutch elements in mutual driving relation.

7. Apparatus as claimed in claim 4 further characterized in that the electromagnet of said last named means includes a movable core therein, a toggle comprising two

links pivotally mounted to a pivot pin, means to connect said core to said pivot pin, one of said links being pivotally mounted at the end opposite to the pivot pin to a rigid frame, the other link being mounted to the end opposite the pivot pin to said other element, so that when the electromagnet responds to the signal pulses it causes said core to pivot said links and thereby force said second clutch face into engagement with said first clutch face.

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