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(54) **Intermittently textured yarn.**

(57) False twisted synthetic yarn is produced by supplying a continuous multifilament yarn 10 from a supply package 12 through a heater 30 to a false twisting device 14. The supply of yarn to the false twist device is intermittently and randomly varied, for example by electromagnetically controlled tension disc apparatus 26, and the false twist device is preferably driven at a speed to produce a twist multiple between 250 and 450 in the multifilament yarn. The yarn is allowed to set after false twisting, for which purpose a secondary heater 37 may be employed, and the textured yarn is finally taken up on the package 42. The yarn produced may have variable molecular orientation, bulk, torque, twist and shrinkage along its length. It is especially useful in the production of velvet-type upholstery fabric and provides unusual visual effects owing to its variable dye affinity.

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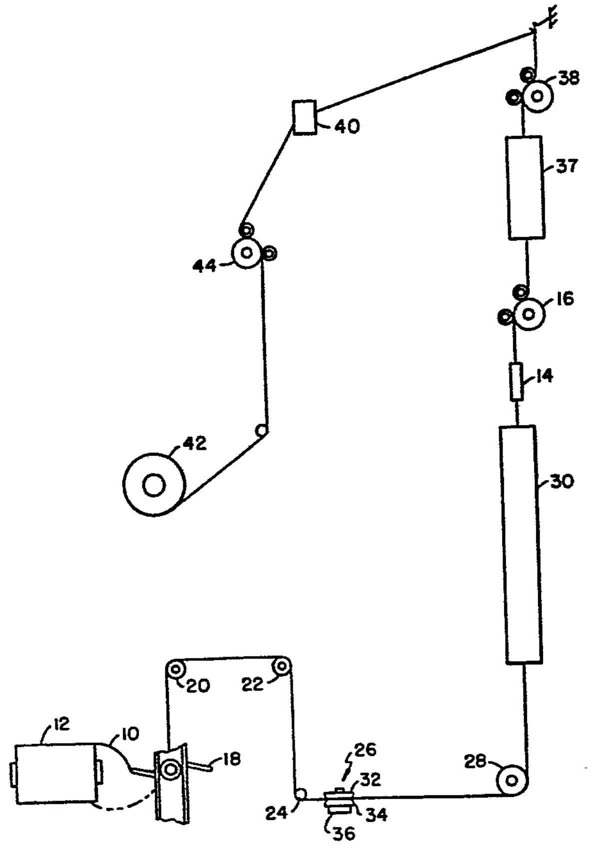

FIG. - 1 -

INTERMITTENTLY TEXTURED YARN

This invention relates generally to the employment of an electromagnetically actuated disc tension control to intermittently grasp and release a continuous filament synthetic yarn which is being processed downstream of the tension control.

It is an object of the invention to provide a yarn processing system which employs a disc tension control to randomly vary the tension of a yarn being processed in a yarn processing machine.

Other objects and advantages of the invention will become readily apparent as the specification proceeds to describe the invention with reference to the accompanying drawings, by way of example only, in which:

Figure 1 is an overall schematic representation of the new and novel system to produce a textured, continuous filament synthetic yarn;

Figure 2 is a partial perspective view of the yarn supply creel for the system shown in Figure 1;

Figure 3 is an exploded schematic view of the yarn tension disc device used in the system of Figure 1;

Figure 4 is a top view of the post of the yarn tension disc device of Figure 3;

Figure 5 is a side elevation view of the post shown in Figure 4;

Figure 6 is a schematic representation of the voltage control scheme for the yarn tension disc electromagnet;

Figure 7 is a circuit diagram for the electromagnet of the yarn tension disc device;

Figure 8 is a graphical representation of the voltage supplied to the electromagnet of the yarn tension disc device; and

Figures 9 and 10 represent a modification of the invention as shown in Figures 7 and 8, respectively.

Looking now to Figure 1, the overall system of Figure 1 will be explained to obtain the novel disclosed yarn. The system is directed to a method to produce a specially textured yarn by intermittently varying the draw of a continuous filament partially oriented, synthetic, multifilament yarn such as polyester. The multifilament yarn 10 is supplied from a supply package 12 to the false twist device 14 by the feed roll device 16. The yarn 10 from the package 12 successively, in its travel to the feed roll device 16, passes through the balloon control apparatus 18, over the guide members 20, 22 and 24 through the electro-magnetically controlled tension disc apparatus 26 and under the guide member 28 through the primary heater 30 and false twist device 14 to the feed roll device 16. The yarn 10 is intermittently and randomly drawn in the primary heater 30 by the intermittent hold back action of the disc tension apparatus 26. The discs 32 and 34 are intermittently and randomly drawn together and released on the yarn 10 by the action of the electromagnet 36 controlled by the varying voltage supplied thereto by a suitable voltage source which is varied by the action of a random signal generator.

From the feed roll device 16 the textured yarn passes through the secondary heater 37 with very little overfeed since the speed of the feed roll device 38 is substantially the same as the feed roll device 16 and the crimp in the yarn is allowed to set. Depending on the amount of crimp contraction desired the secondary heater can be turned on at an appropriate temperature or off or by-passed and the overfeed varied from high to very little.

The feed roll device 38 is driven at a higher speed than the feed roll device 44 to overfeed the textured yarn through the air jet entangling device 40 to commingle and entangle the individual filaments of the textured yarn. From the feed roll device 38 the entangled, textured yarn is slightly overfed to the yarn take-up package 42 by the feed roll device 44.

Schematically in Figure 1, the yarn package 12 and the balloon control element 18 are shown as separate items but in actual practice a creel unit, designated 46 in Figure 2, is used. The creel unit 46 supports a plurality of packages

12 for a plurality of false twist spindle positions and is slid in and out of position relative to a multiple spindle false twisting machine. In Figure 2 a partial creel is shown supporting a pair of supply packages held on creel pins supported by creel pin support members 48 that are connected to the creel. Also connected to the creel is a horizontal separation plate 50 through which the yarn guide supports 52 project. A yarn guide 54 for each yarn package is connected thereto to guide the yarn 10 from the package 12 towards the guide member 20. Mounted on both sides of the horizontal separator plate 50 is a channel beam 56 between which is connected the balloon control apparatus or bar 18.The balloon of yarn from the creel is unusually erratic and violent due to the alternating take-off velocity and is therefore prone to entanglement if not controlled. As shown in Figure 2 the bar 18 prevents yarn 10 from the package 12 from forming a full balloon and getting entangled in and around various elements of the creel such as yarn guides 54. As shown in Figure 2, a second bar 18 is shown which is used for the same purpose for the yarn packages (not shown) on the opposite side of the creel unit 46.

Figures 3-5 show the electromagnetically controlled tension disc apparatus 26 in detail. The apparatus 26 basically consists of the electromagnet 36, the spring biasing member 60 of Teflon or other suitable material, the tension discs 32 and 34, the disc post 62 and the screw 63 to maintain the aforementioned element in operative relationship. The disc 32 is made from a magnetically attractable material such as a ferrous material while the disc 34 is manufactured from a non-magnetically attractable material. For reasons hereafter explained the post 62 has a slot 64 therein which is off set from the centerline of the post. Also for reasons hereinafter explained, it is desired to supply random, intermittent pulses of low and high D.C. voltage with a superimposed A.C. voltage to cause the discs 32 and 34 to close randomly and intermittently and to cause the discs to vibrate relative to one another and relative to the electromagnet 36. To accomplish this action the arrangement shown in Figure 6 and the circuit shown in Figure 7 are employed. Basically, the voltage to the electromagnet 36 is supplied from a control box 65 which receives voltage from an A.C. power supply 66, a high voltage D.C. power supply 68 and a low voltage D.C. power supply 70. Connected between the high voltage D.C. source 68 and the control box 65 is a random signal generator 72 of the type disclosed in U. S. Patent Number 4,160,359 which intermittently and randomly interrupts the voltage from the high voltage D.C. source to the control box 65. Located in each circuit to the electromagnet 36 is a diode 74 which only allows current to flow in one direction towards the electromagnet 36. Schematically represented in the high and low voltage D.C. circuit is an adjust switch or variable resistor 76 to adjust the D.C. voltage in the respective circuit.

As represented in the graph of Figure 8, the A.C. voltage from the source 66 supplies A.C. voltage continuously while the high D.C. voltage from the source 68 is interrupted randomly and continuously by the random signal generator 72. As indicated in the graph, this provides periods of high voltage 78 and low voltage 80 for different durations of time, as well as peaks 82 at times when the high voltage D.C. current is not being supplied and the A.C. current is at its positive peak on its cycle. The various lengths of the high voltage peak 78 represent periods when the yarn 10 is being held tightly between the discs 32 and 34 while the peaks 82 and the low voltage periods 80 represent periods when the voltage is low and the discs 32 and 34 tend to release the grip on the yarn 10 and vibrate as the yarn passes therethrough. At these times the spring biasing member 60 causes the discs to be urged upward and allows the frictional resistance between the discs 32 and 34 and between the disc 34 and the electromagnet 36 to be reduced so that the torque exerted by the yarn passing through the slot 64 of the post 62 will cause them to rotate more efficiently to provide the self-cleaning action. The vibration of the discs allows the discs to be rotated more easily so that the yarn passing through will subsequently clean out the finish deposited between the discs by the yarn.

Looking now to Figures 9 and 10 an alternate scheme is shown to enhance the rotation of the discs 32 and 34. In Figures 9 and 10, elements therein which are the same in Figures 1-8 are indicated by the same reference number. The basic modification shown in Figures 9 and 10 is the inclusion of a timer 100 in the low voltage D.C. circuit to momentarily cut-off the current flow in the D.C. circuit to the electromagnet 36 to allow the A.C. voltage to peak as indicated in Figure 10. It is understood that the current in the A.C. circuit is flowing continuously in order to obtain the result shown in Figure 10. During periods when the timer 100 has the low voltage D.C. circuit open and the random signal generator 72 has the high voltage D.C. circuit open, only half-wave rectified A.C. voltage is applied to the coil as shown in Figure 10. This will momentarily upset the tension of the yarn, but enhances the rotation of the discs 32 and 34.

Alternatively, the wall 84 defining one portion of the slot 64 can be eliminated and replaced by an upstanding guide member, not shown, which will serve to confine the yarn path to a path offset from the centerline of the post 62.

In the preferred form of the invention the spring biasing member 60 is of a diameter greater than the inner, internal diameter 85 and less than the inner, external diameter 86 of the lower tension disc 34 so that it is curved downward at its extremities when the discs 32 and 34 are pulled towards the electromagnet 36. Conversely, when the voltage to the electromagnet is reduced, the upward force exerted due to the bias of the member 60 urges the discs upward.

As described briefly before, it is desired to cause the tension discs 32 and 34 to rotate in order to dissipate the finish deposited therebetween by the yarn 10. As described above, the discs 32 and 34 are free to rotate on the post 62. To further enhance this rotation, the slot 64 is located off center of the centerline of the post so that the yarn passing between the discs 32 and 34 will exert a torque thereon. Furthermore, since yarn 10 is located in the slot 64 between the discs 32 and 34, the yarn cannot jump out from between the discs and have to be rethreaded. Further, such location of the yarn in the slot prevents uncontrolled texturing and lessens the tendency for yarn breaks.

In the form described hereinabove the preparation of a single end of multifilament synthetic yarn is described but, depending on the ultimate use of the yarn produced, a plurality of yarns can be interlaced or commingled in the air jet 40. Examples of such yarn are set forth below.

EXAMPLE 1

Two ends of a 240 denier, 68 filament DuPont 56T polyester yarn were processed as described above and entangled or interlaced in the air jet 40 to provide a 2/150/68 yarn with an actual denier of 321. The elongation was 51% with a crimp contraction of 1%. The operating conditions were as follows:

False Twist Spindle Speed	-	96000 RPM
Yarn Speed through Spindle yards/minute	-	117
False Twist turns/inch	-	23
Twist Multiple	-	306
Direction	-	"S"
Yarn Overfeed Through Heater 37	-	By-passed
Yarn Overfeed Through Air Jet	-	4.0%
Yarn Overfeed to Take-Up	-	1.7%
Temperature of Heater 30	-	180°C
Temperature of Heater 37	-	Off
High Pre-Spindle Tension Average	-	50 grams
Low Pre-Spindle Tension Average	-	12 grams

The yarn thus produced has a very low crimp contraction with high luster and intermittent character.

EXAMPLE 2

Two ends of a 220 denier, 54 filament DuPont 693T polyester yarn were processed and entangled in the air jet 40 to provide a 2/150/54 yarn with an actual diameter of 328 denier. The elongation was 48% with a crimp contraction of 1.8%. The operating conditions were as follows:

False Twist Spindle Speed	-	129000 RPM
Yarn Speed through Spindle	-	128
yards/minute		
False Twist	-	28
turns/inch		
Twist Multiple	-	359
Direction	-	"S"
Yarn Overfeed through Heater 37	-	0
Yarn Overfeed through Air Jet	-	4.0%
Yarn Overfeed to Take-up	-	1.7%
Temperature of Heater 30	-	180°C
Temperature of Heater 37	-	190°C
High Pre-Spindle Tension Average	-	50 grams
Low Pre-Spindle Tension Average	-	16 grams

The yarn produced has a low crimp contraction with very high luster and intermittent character.

It can readily be seen that the described apparatus and method provides a randomly, intermittently textured, continuous multifilament synthetic yarn which along its length has variable molecular orientation, bulk, torque, twist and shrinkage. The produced yarn has a low crimp contraction and a high luster. This yarn is especially useful in the fabrication of a velvet-type upholstery fabric and provides unique visual effects due to its variable dye affinity.

CLAIMS

1. Method to produce a false twisted, continuous multifilament synthetic yarn comprising the steps of: supplying a continuous multifilament yarn from a supply package through a heater to a false twisting device, intermittently and randomly varying the supply of yarn to the false twisting device, driving the false twist device at a speed to produce a twist multiple between 250 and 450 in the multifilament yarn, allowing the yarn to be set after false twisting and taking up the false twisted yarn.

2. The method of claim 1 wherein the false twisted yarn is entangled in an air entanglement device prior to take-up.

3. The method of claims 1 or 2 wherein the false twist device is driven at a speed to produce a twist multiple in the yarn between 250 and 450.

4. Method to produce a false twisted, multifilament synthetic yarn comprising the steps of: supplying a continuous multifilament yarn from a supply package through a heater to a false twisting device, intermittently and randomly varying the tension of the yarn in the heater between a high range of 0.21 to 0.60 grams per denier and a

low range of 0.06 to 0.21 grams per denier, driving the false twist device at a speed to produce a false twist in the multifilament yarn, allowing the yarn to set after false twisting and taking up the false twisted yarn.

5. The yarn produced by the methods of claims 1, 2, 3, or 4.

6. Apparatus to produce a false twisted multifilament yarn comprising: yarn creel means, a false twist device, a heater means located between said yarn creel and said false twist device, a disc type tension means located between said heater means and said yarn creel means to intermittently and randomly vary the flow of yarn from said creel means to said false twist device, a first means to supply yarn from said yarn creel means to said false twist device, a second means to cause said tension means to randomly vary the supply of yarn to the false twisting device, driving the false twist device at a speed to produce a twist multiple of between 250 and 450 in the multifilament yarn, and a third means to supply false twisted yarn from said false twist device to a take-up means to take-up the false twisted yarn.

7. The apparatus of claim 6 wherein an air jet commingling means is located between said third means and

the take-up means to commingle the filaments of the yarn false twisted in said false twist device.

8. The apparatus of claims 6 or 7 wherein a bar member is mounted on said yarn creel between said creel and said false twist device to prevent the yarn from said creel from forming a full balloon path.

9. The apparatus of claims 6 or 7 wherein said disc type tension means includes an electromagnet, a post member operably associated with said electromagnet, a first metallic disc member mounted on said post, a second metallic disc member mounted on said post adjacent said first disc member, a D.C. circuit supplying D.C. voltage to said electromagnet and means supplying A.C. voltage to said electromagnet to periodically allow said first and second disc members to move relative to one another and relative to the electromagnet.

10. The tension device of claim 9 wherein said D.C. circuit includes a high voltage source and a low voltage source and a means to periodically interrupt the high voltage source.

11. The tension device of claim 10 wherein said A.C. voltage is intermediate of the high and low D.C. voltage.

12. The tension device of claims 9, 10, or 11 wherein said post member has a slot therein offset from the centerline of said post.

13. The tension device of claims 9, 10, 11, or 12 wherein a spring biasing member is mounted on said post between said electromagnet and said discs to exert an upward force on said discs.

14. The apparatus of claim 13 wherein said discs are dish shaped with the bottom disc curving downward, said spring biasing means conforming to the internal shape of said bottom disc and having a diameter less than internal outer diameter of said bottom disc but greater than the internal inner diameter of said bottom disc whereby said spring biasing means is curbed downward by said bottom disc when voltage is applied to said electromagnet.

15. The apparatus of 9, 10, 11, 12, 13, or 14 wherein the A.C. is supplied continuously and said D.C. circuit includes a means to momentarily interrupt the flow of direct current to said electromagnet.

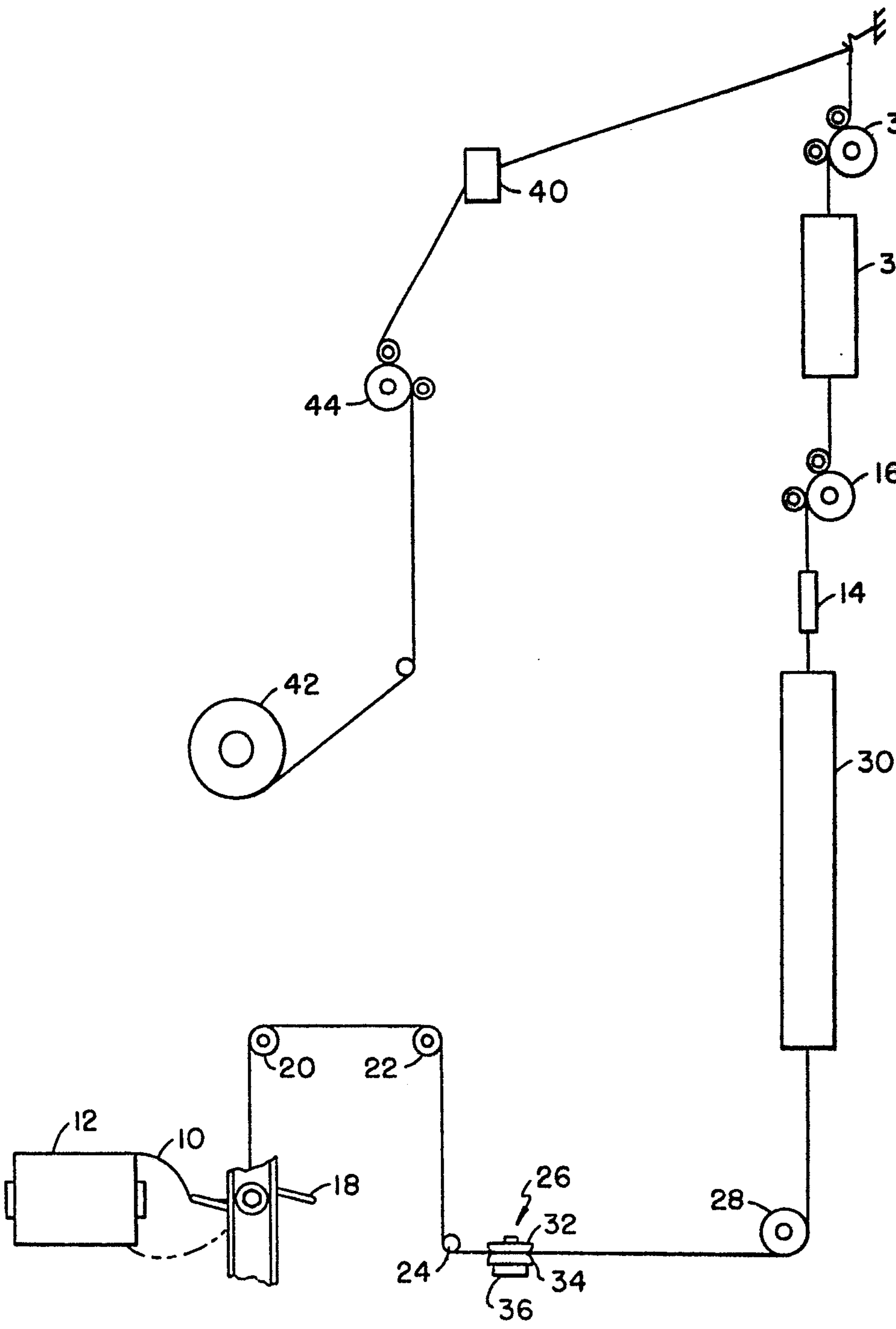

FIG. - 1 -

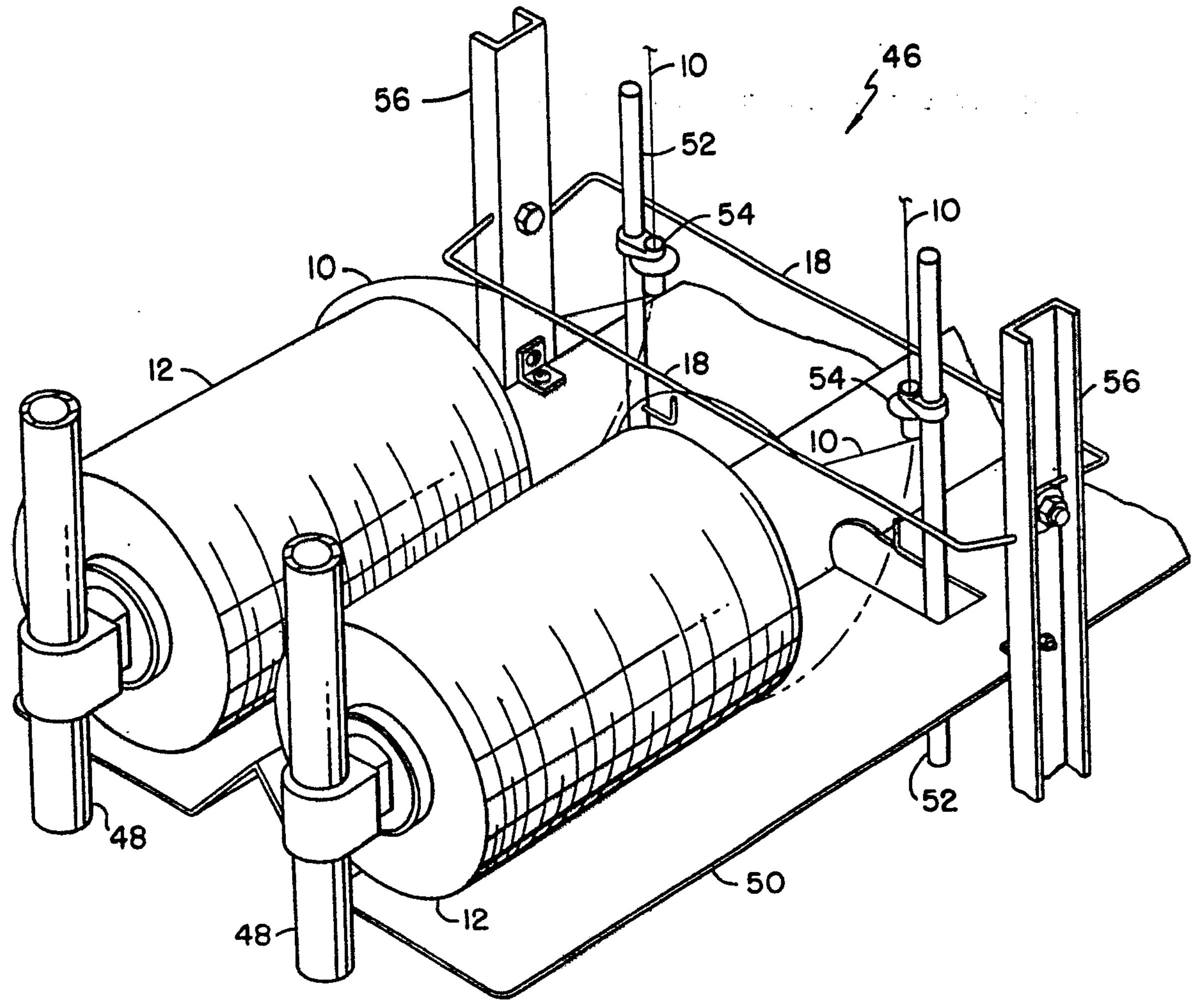

FIG. -2-

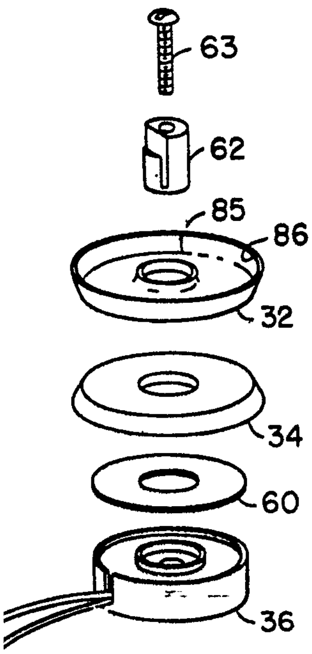

FIG.-3-

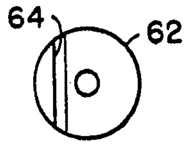

FIG.-4-

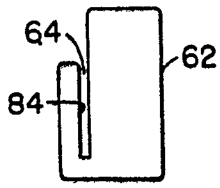

FIG.-5-

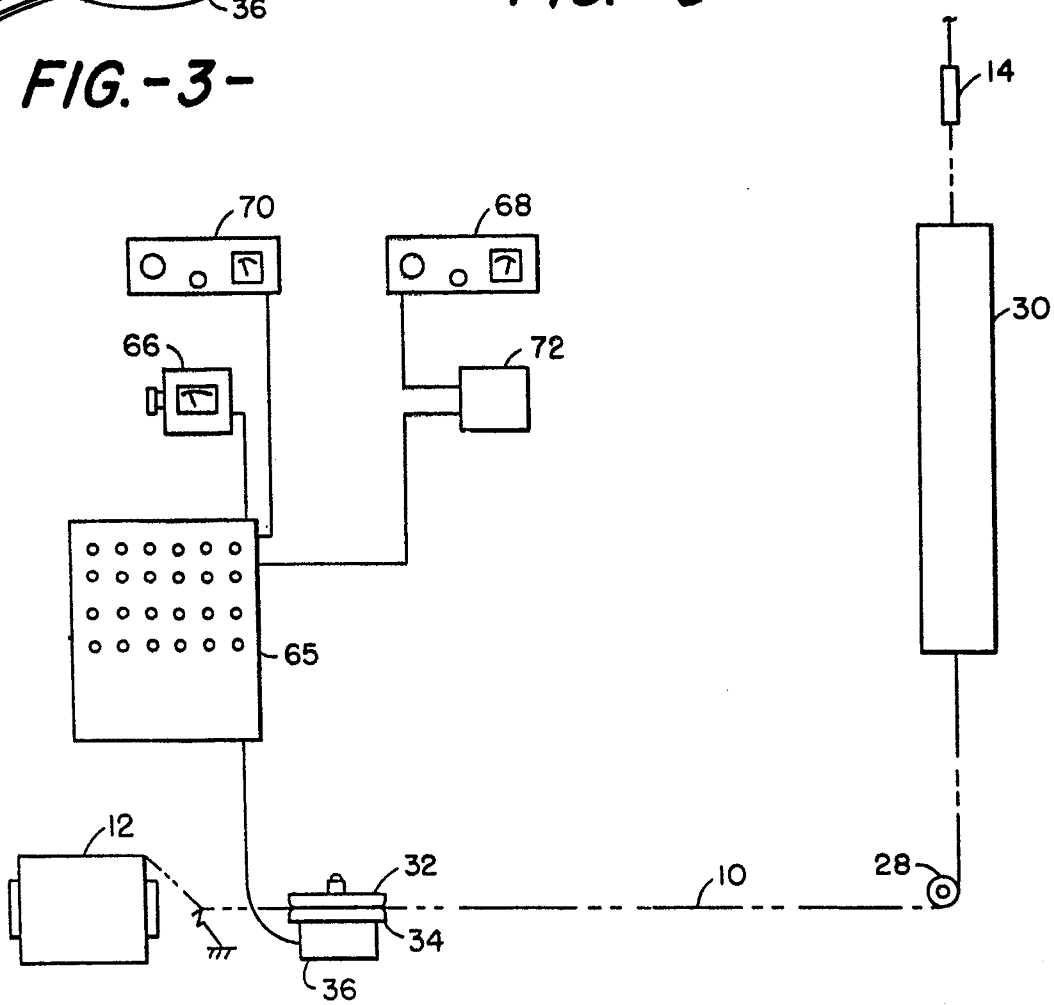

FIG.-6-

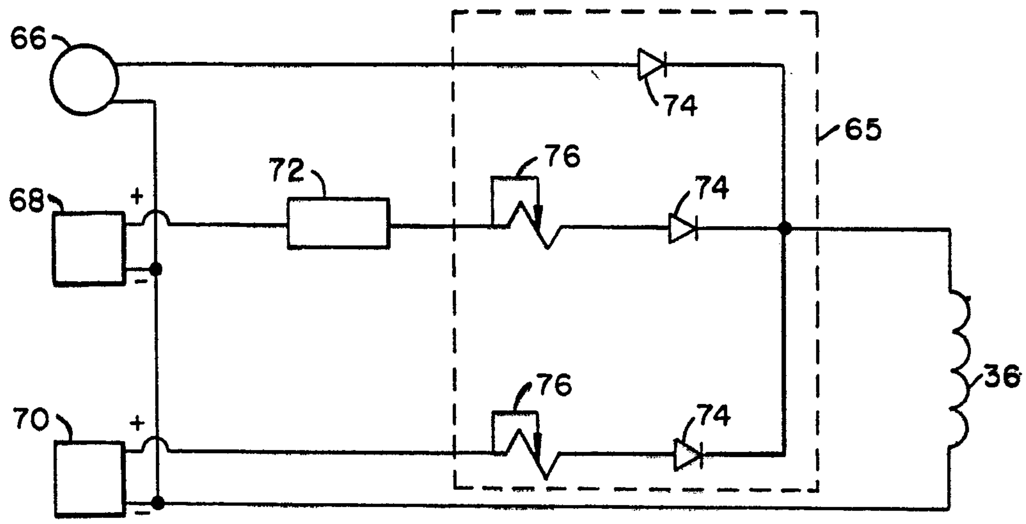
66
74
65
72
76
74
68
+
−
36
76
74
70
+
−

FIG. -7-

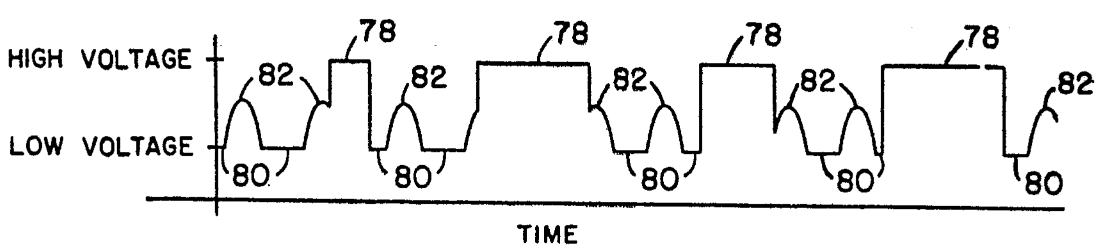
HIGH VOLTAGE
LOW VOLTAGE
78
78
78
78
82
82
82
82
82
80
80
80
80
80
TIME

FIG. - 8 -

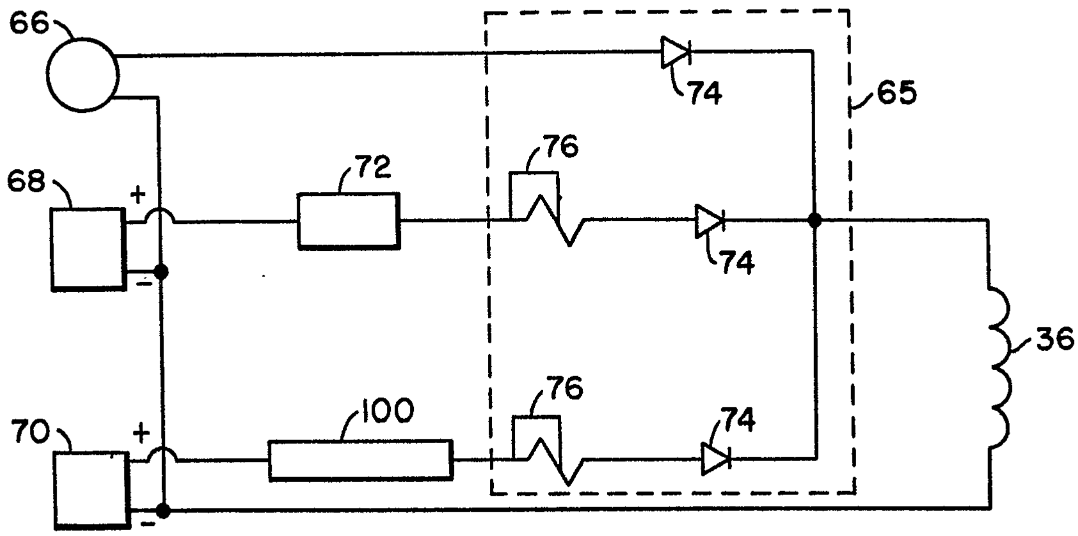
66
65
74
68
76
72
74
36
70
76
100
74

FIG. - 9 -

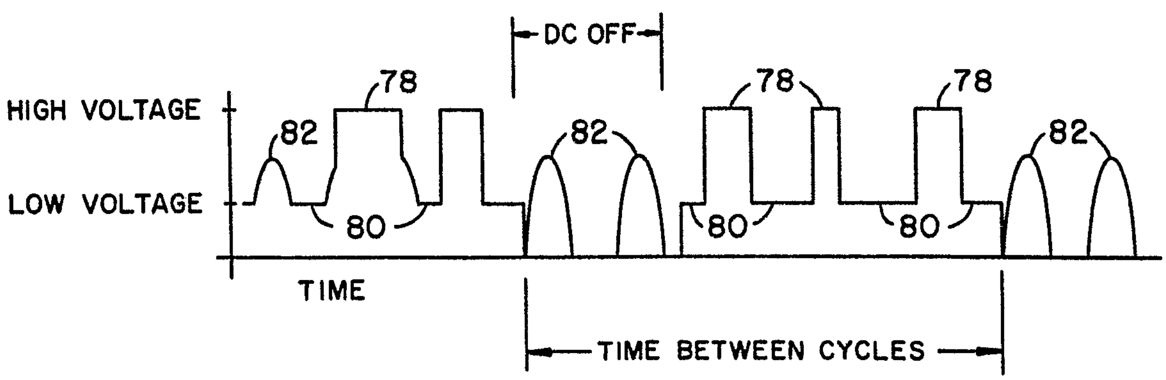
DC OFF
HIGH VOLTAGE
LOW VOLTAGE
78
82
80
TIME
TIME BETWEEN CYCLES

FIG. -10-