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54 **Twisted slub yarn and apparatus and method of making the yarn.**

57 A novelty slub yarn is produced by combining a false twisted core yarn and effect yarn in an air jet. The average feed rate of the effect yarn exceeds that of the core yarn but the effect yarn feed rate is intermittently reduced and abruptly increased in a randomly timed manner to produce randomly distributed slubs 51 with circular filament coils 53. The feed rate changes are established by a path deviating device which increases and abruptly reduces the path length for the effect yarn with a rebound at the end of the path length reduction such that each slub 51 is closely followed by a small nub 54. In a modified embodiment the path deviating device reduces the core yarn path length as it increases the effect yarn path length and vice versa.

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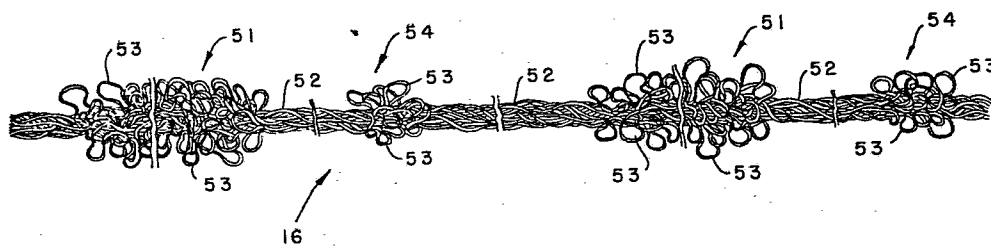


FIG.-3-

TWISTED SLUB YARN AND APPARATUS AND METHOD OF MAKING
THE YARN

This invention relates to a novelty yarn produced by combining a false twisted core yarn and a false twisted effect yarn in an air jet to supply a continuous, multi-filament slub yarn.

5 It is an object of the invention to provide an improved yarn and an apparatus and method for producing a novelty, multi-filament yarn. The invention is defined in the claims below.

10 The invention will be described in more detail, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of apparatus embodying the invention for producing a slubbed yarn,

15 Figure 2 is an enlarged view of the part of the apparatus employed to cause a deviation of the yarn path through the apparatus,

Figure 3 is a schematic representation of the yarn produced by the apparatus of Figures 1 and 2, and

Figure 4 illustrates a modification of the apparatus shown in Figure 2.

20 The apparatus of Figure 1 produces a novelty yarn composed of a core yarn 10 and an effect yarn 12. In the preferred practice of the invention, both yarns are continuous, multi-filament, partially oriented polyester yarns, but other partially oriented or fully oriented synthetic, continuous, multi-filament
25 yarns such as nylon, Dacron can be employed.

 The core and effect yarns 10 and 12 are combined in an air jet 14 to produce the slub yarn 16 which is delivered by take-up nip rolls 18 and 20 through a secondary heater 21 to a take-up roll 22. The core yarn 10 is delivered from a package 24
30 to a false twist zone by first delivery rolls 26 and 28. Second delivery rolls 30 and 32 draw the core yarn 10 as it passes through a primary heater 34 and a false twist device 36, illustrated schematically as friction discs, and supplies it to the air jet 14.

The effect yarn 12 is delivered from a package 37 to a false twist zone by first delivery rolls 38 and 40 and is drawn by second delivery rolls 42 and 44 as it passes through a primary heater 46 and a false twist device 48, again illustrated as friction discs. From the delivery rolls 42 and 44, the effect yarn 12 is delivered to the air jet 14 through a path deviation device 50 which operates in a manner hereinafter explained.

The speeds of the delivery rolls are selected to provide the desired result in the yarn produced. In the preferred practice of the invention, the speeds of the rolls 26, 28, 38 and 40 are such that speed of the effect yarn 12 being delivered thereby is greater than the speed of the core yarn 10. The speeds of the delivery rolls 30, 32, 42 and 44 are such that the delivery speed of the effect yarn 12 is greater than the speed of the core yarn 10. In the preferred practice, since partially oriented yarn is being run, the speeds of the rolls 30, 32, 42 and 44 are such as to draw the effect and core yarns. The speed of the delivery rolls 18 and 20 is such that the slub yarn 16 delivered therefrom is at a speed lower than the speed of either the core yarn 10 or the effect yarn 12, respectively, from the rolls 30 and 32 or 42 and 44.

The combined yarn 16 (Fig 3) consists of slub sections 51, lean sections 52 and nubs 54. The slub sections 51 and the nubs 54 are denser than the lean sections and contain a plurality of substantially circular loops 53 having a diameter range of 0.076 mm to 0.25 mm. As will be explained the lengths of the slub sections and lean sections are random but the nubs will always be shorter than the slubs and closely adjacent thereto.

The slub sections 52 and nubs 54 are basically allowed to form by the path deviation device 50 which controls the path and consequently the velocity of the effect yarn 12. The core yarn 10 is supplied directly from the delivery rolls 32 into the entrance of the air jet 14 while the effect yarn 12 is supplied from the delivery rolls 42 and 44 through the guide members 56 and 58 then into the air jet. When the path deviation device 50 is not actuated the yarn 12 will pass straight downwardly through

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the guide members 56 and 58, as indicated by dashed lines in Fig 2 and then be directed into a conventional air jet 14 wherein it is commingled with the core yarn 10 to form yarn represented by the lean sections 52.

5 The yarn deviation device 50 consists of a rod 59 with a main portion 60 and a finger portion 62 perpendicular to the main portion 60. The rod is fixed to a gear 64 freely rotatable on a stub shaft 66 with the gear teeth in mesh with the teeth of a rack 68. The rack 68 is connected to the piston rod 70 of
10 an air cylinder 72 supplied air under pressure through a solenoid operated valve 74. The actuation of the solenoid valve is controlled by a random signal generator 76 of the type disclosed in US Patent Specification 4,160,359 which randomly supplies
15 pulses to the DC power supply 78 to cause power to be supplied randomly to the solenoid valve 74. When the solenoid valve is activated, air is supplied to the air cylinder 72 to move the piston rod 70 outwardly to the position shown in Figures 1 and 2 against the bias of a spring 80 to rotate the gear 64 clockwise to pivot the rod 59 to the right. When the rod 59 is thus pivoted,
20 the finger portion 62 contacts the effect yarn 12 and lengthens its path of travel. By lengthening the path of travel of the yarn 12 in this manner, the linear velocity of the effect yarn being supplied to the air jet 14 is reduced to about the linear velocity of the core yarn 10. When the solenoid valve
25 74 is de-energised, the air will be exhausted from the air cylinder 72 and the spring 80 will immediately rotate the rod in a counterclockwise direction, so releasing the yarn 12 between the guide members 56 and 58. When the yarn 12 is released the accumulated yarn loop 55 and the excess yarn therein is sucked
30 into the air jet and the filaments therein are expanded and allowed to curl into the substantially circular yarn loops 53 which are intermingled with the filaments of the core yarn 10 until the excess yarn in the loop 55 is taken up and the velocity of the core and effect yarns stabilizes and forms a lean section
35 52.

In the preferred practice of the invention, the spring 80 is so selected as to allow the rod 59 to bounce when it reaches the extreme left hand position (Figures 1 and 2) upon exhaustion of air from the cylinder 72 to form a small loop in the yarn 12, similar to the loop 55, and then when it comes to rest the smaller nub 54 will be formed in the combined yarn 16 in the same manner that the slub 51 is formed. This results in a yarn like that that is shown in Figure 3 having randomly and sequentially a slub portion 51, a lean portion 52, a nub 54 closely adjacent the slub portion 51, a lean portion 52 and a repeat of this sequence.

The air jet 14 is a commercially available type and does not itself form a part of the invention other than that it accomplishes the desired result of combining the yarns as shown in Figure 3. The core yarn 10 and the effect yarn 12 are supplied into the air jet 14 through an entrance 82 and the combined yarn leaves through an outlet 84, partially encircles an air impact device 86 and is directed to the take-up roll 22 by the delivery rolls 18 and 20. Air under pressure is supplied to the air jet 14 via a conduit 88 into a pressure chamber 90 from whence it is directed against the yarns 10 and 12 through passages 92 and is ejected out of the outlet 84 against the air impact device 86. The device 86 acts to increase turbulence in the jet 14 to enhance the commingling of the yarn filaments and increase the velocity of the yarn through the air jet 14.

The following is an example of the production of a slub yarn in the manner hereinbefore described.

EXAMPLE

The core and effect yarns are both 190 denier, 68 filament, 56T, partially oriented polyester yarn. The resultant combined yarn is 270 denier polyester yarn having slubs in the range of 5 to 11.5 cm in length and nubs in the range of 0.6 to 1.9 cm in length.

The combined yarn is formed under the following parameters:

- 5 -

Effect yarn velocity from first
delivery rolls -
252 meters/minute

5 Core yarn velocity from first
delivery rolls -
216 meters/minute

Primary heater temperature -
207°C

10 Effect yarn velocity from second
delivery rolls -
409 meters/minute

Core yarn velocity from second
delivery rolls -
345 meters/minute

Stroke of end of rod 59 - 7.5 cm

15 Air pressure to air jet - 956 kPa

Random signal generator on for
about 0.15 to 0.30 seconds and off
for 0.02 seconds

Secondary heater off

20 Combined yarn velocity from take-up
rolls -
296 meters/minute

Combined yarn take-up velocity -
322 meters/minute

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Figure 4 is a modification of the yarn deviation device 50 of Figure 2 with like elements being denoted with the same reference numbers. The basic difference between the device of Figure 2 and Figure 4 is the use of an additional pair of guide members 57 and 59 for the core yarn 10. In Figure 4 both the core yarn 10 and the effect yarn 12 are threaded on the finger portion 62 of the rod 59. As the finger portion 62 is moved towards one or the other of the sets of guide members 56, 58 or 57, 59, the yarn, between the set of guide members to which the finger portion 62 is being moved towards, is being allowed to be taken into the jet at a high overfeed rate while the yarn between the other set of guide members is being supplied at a low overfeed rate as it accumulates yarn in the extended yarn loop.

As the finger portion 62 reciprocates back and forth, the above action reverses itself to provide a yarn from the air jet 14 which has a plurality of spaced short, fat slubs or nubs. As can readily be seen this system provides much larger relative overfeed rates at high throughput speeds. This is accomplished by the action of a low yarn overfeed rate in the yarn accumulation loop and a high yarn overfeed rate in the yarn loop being let off as the finger portion 62 moves toward the guide members for such yarn.

The following is an example of the production of a slub yarn made in accordance with the modifications of Figure 4.

EXAMPLE

The core and effect yarns are both 105 denier, 34 filament, 56T, partially oriented polyester yarn. The resultant combined yarn is 170 denier polyester yarn having slubs in the range of 0.95 to 1.9 cm in length and nubs in the range of 0.16 to 0.6 cm in length. The nubs can be six times larger in diameter than the main body of yarn.

The combined yarn is formed under the following parameters:

Effect yarn velocity from first
delivery rolls -
289 meters/minute

- 7 -

Core yarn velocity from first
delivery rolls -
241 meters/minute

5 Primary heater temperature -
200°C

Effect yarn velocity from
second delivery rolls -
433 meters/minute

10 Core yarn velocity from second
delivery rolls -
361 meters/minute

Stroke of rod 59 - 3.2 cm.

Air pressure to air jet - 830 kPa

15 Random signal generator on for about
0.02 to 0.06 seconds and off for 0.04
seconds

Secondary heater off

20 Combined yarn velocity to take-up
rolls -
287 meters/minute

Combined yarn take-up velocity -
332 meters/minute

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CLAIMS

1. A slub yarn characterised by a plurality of commingled, false twisted, multi-filament, continuous synthetic yarns having a plurality of slubs (51) spaced along the length thereof, each slub having a nub (54) closely adjacent thereto, the nubs having a length substantially less than the length of the slubs.
2. A yarn according to claim 1, characterised in that a plurality of the filaments in the slubs and nubs have substantially circular coils (53) therein.
3. A yarn according to claim 1 or 2, wherein the slubs and nubs are randomly spaced along the yarn.
4. A slub yarn characterised by a plurality of commingled, false twisted, multi-filament, continuous synthetic yarns having a plurality of slubs (51) spaced along the length thereof, each of the slubs having a plurality of the filaments (53) therein in a substantially circular configuration.
5. A method of making a slub yarn from a core yarn and an effect yarn, characterised by the steps of feeding the core yarn and the effect yarn to a tangling zone to form a composite yarn in the tangling zone, the average feed rate of the effect yarn exceeding that of the core yarn and the composite yarn being withdrawn from the tangling zone at a rate which is lower than the feed rate of the core yarn, and intermittently reducing and abruptly increasing the rate of the effect yarn relative to the core yarn by intermittently increasing and abruptly reducing the length of the effect yarn path, so as to form slubs in the composite yarn in the tangling zone.
6. A method according to claim 5, characterised in that the core yarn rate is constant and the effect yarn rate is reduced down to and increased from the core yarn rate.

7. A method according to claim 5, characterised in that the core yarn rate is increased and reduced while the effect yarn rate is reduced and increased respectively.
8. A method according to claim 5, 6 or 7, characterised in that, after the sudden reduction of the yarn path of the effect yarn, the path is allowed to momentarily increase and then decrease to cause a nub to be formed in the composite yarn in the tangling zone adjacent the slub just formed.
9. A method according to any of claims 5 to 8, characterised in that the core and effect yarns are false twisted prior to their supply to the tangling zone.
10. A method according to any of claims 5 to 9, characterised in that the core and effect yarns are partially oriented yarns and are drawn prior to supply to the tangling zone.
11. A method according to any of claims 5 to 10, characterised in that the intermittent increases and decreases are effected randomly.
12. Apparatus for making a slub yarn, characterised by means arranged to supply an effect yarn and a core yarn through false twist devices (36, 48) an air jet yarn entangling device (14) and a yarn path deviating device (50) arranged to increase and decrease the path of the effect yarn intermittently between the false twist device (48) and the air jet device (14), the yarn path deviating device comprising a pivotally mounted arm (60) with its distal end (62) in contact with the yarn, and an actuator (70, 72) which pivots the arm to and fro in a random manner.
13. Apparatus according to claim 12, characterised in that the arm (60) is attached to a gear (64) and the actuator comprises a reciprocating rack (68) engaging the gear.

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14. Apparatus according to claim 13, characterised in that the actuator comprises an air operated cylinder (70), the rack (68) being connected to the piston rod thereof.

15. Apparatus according to claim 14, characterised in that air is supplied to the cylinder through a solenoid actuated valve (72) the solenoid being energized by pulses supplied by a random signal generator.

16. Apparatus according to any of claims 12 to 15, characterised in that the actuator (70, 72) is single acting and the arm (60) is spring biased to an inoperative position.

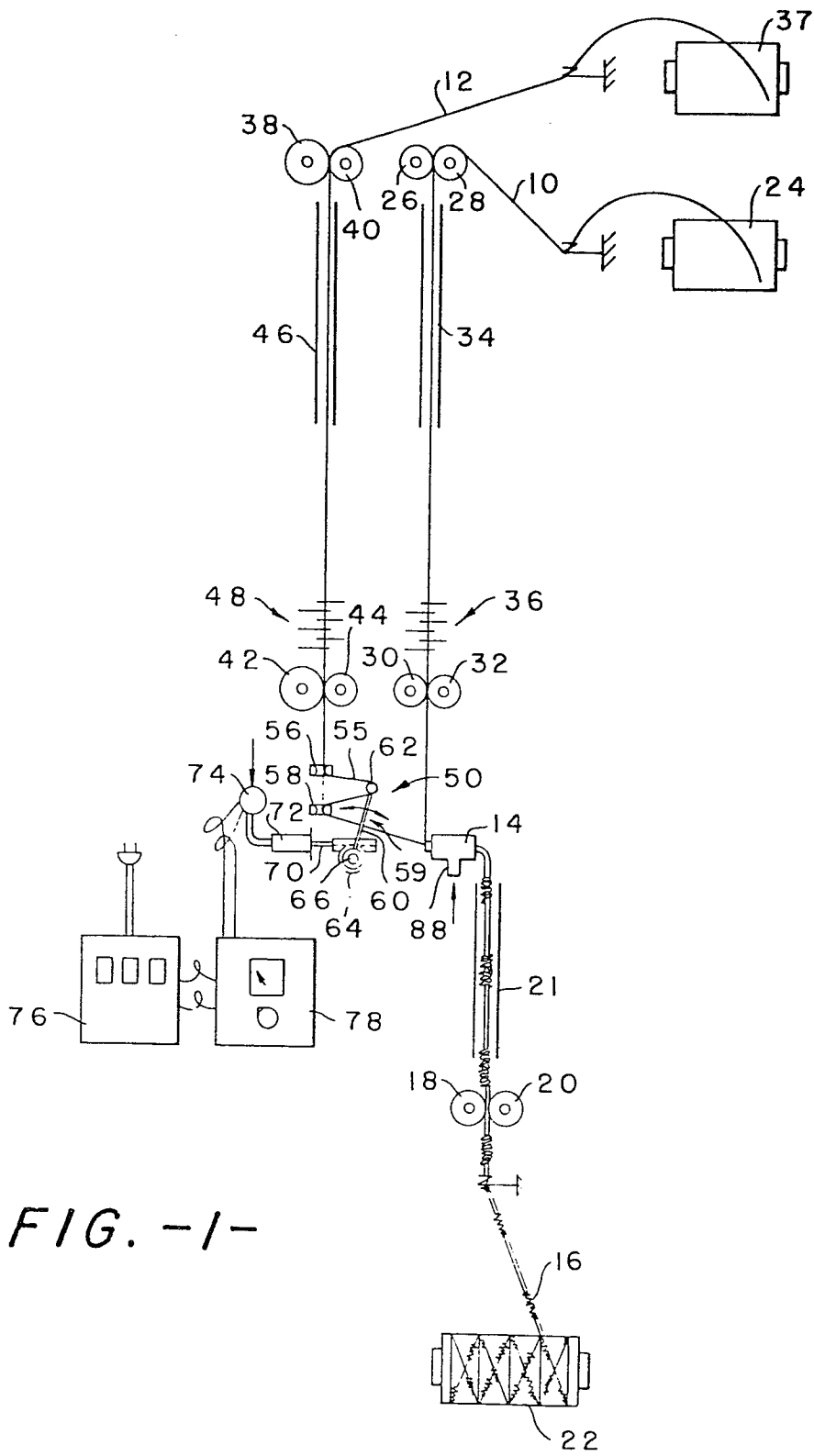


FIG. -1-

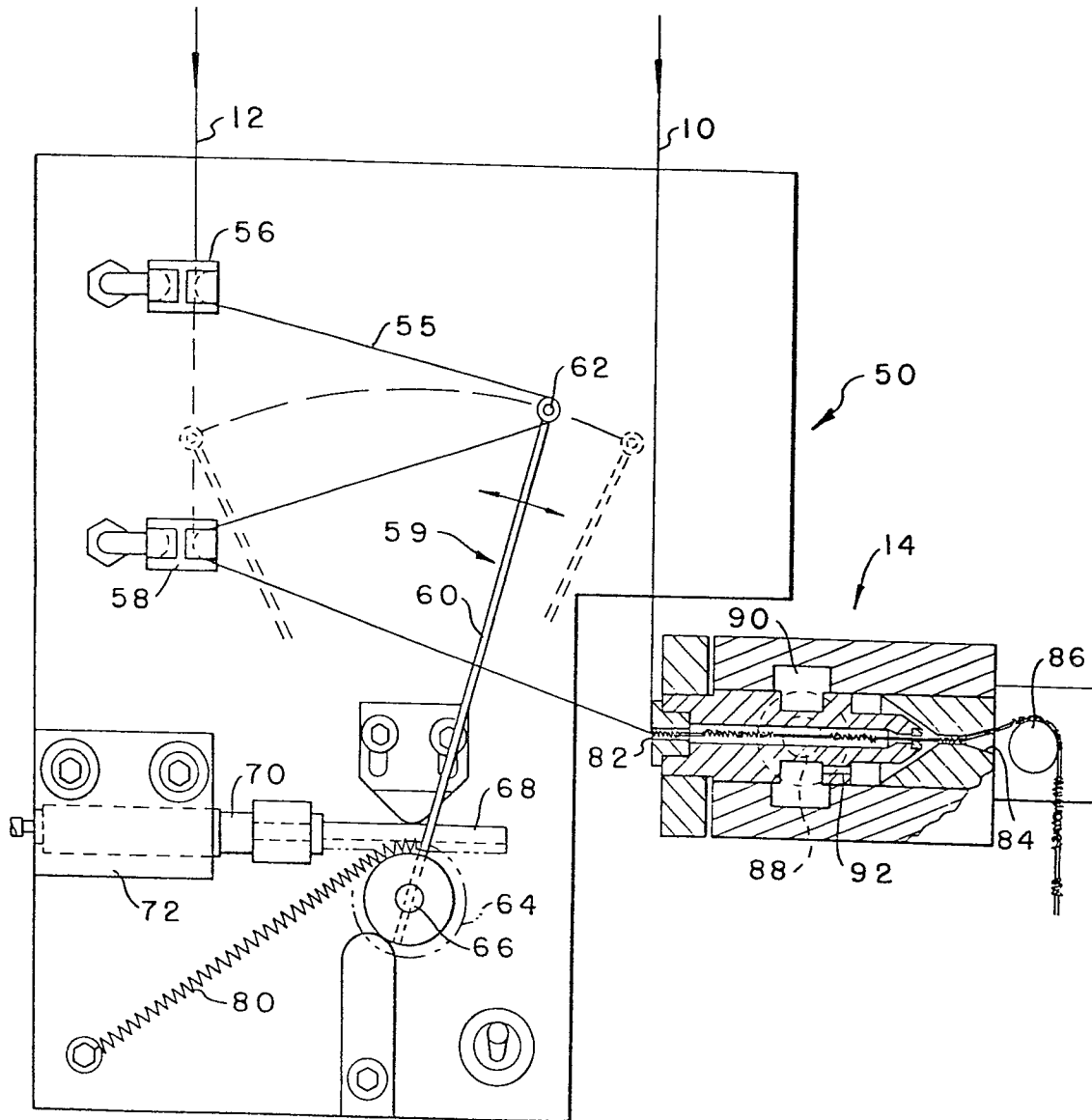


FIG. -2-

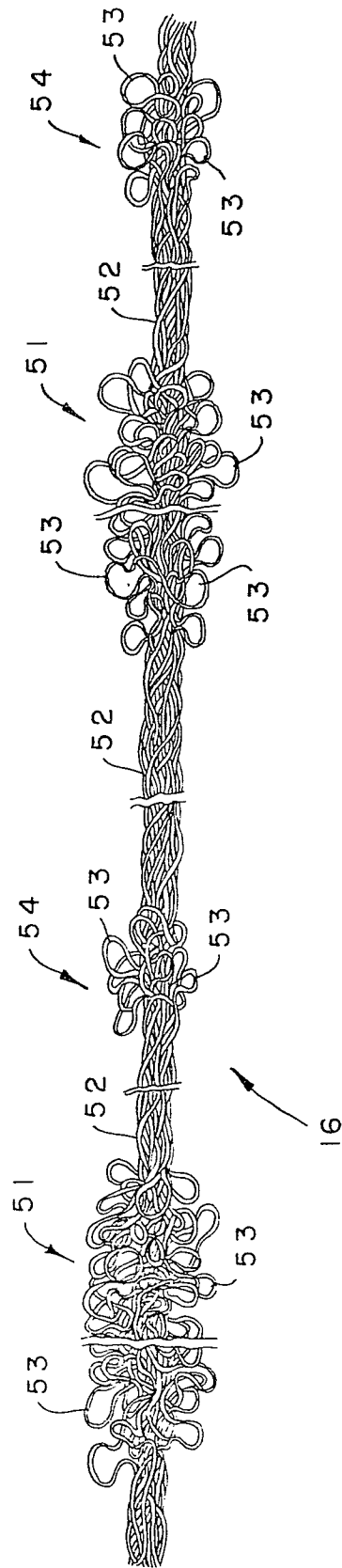


FIG. -3-

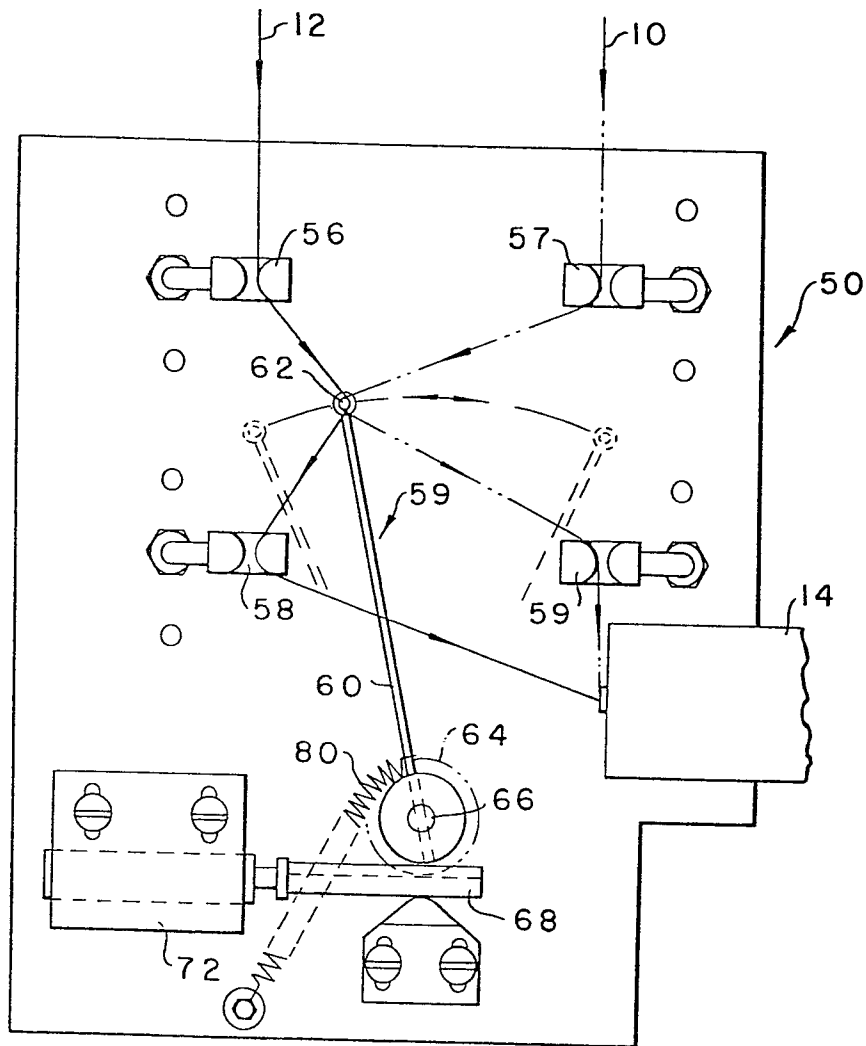


FIG. -4-