United States Patent [19]

Yamada et al.

[11] **3,916,609**

[45] **Nov. 4, 1975**

[54] **DRAW-TEXTURING APPARATUS**

[75] Inventors: **Seibi Yamada**, Yokohama; **Kinyu Ishida**, Takatsuki, both of Japan

[73] Assignee: **Teijin Limited**, Osaka, Japan

[22] Filed: **Oct. 9, 1973**

[21] Appl. No.: **404,643**

[30] **Foreign Application Priority Data**

Oct. 11, 1972 Japan 47-116795

[52] **U.S. Cl.** ..... **57/34 HS**; 57/106

[51] **Int. Cl.** **D02g 1/02**

[58] **Field of Search** ..... 57/34 HS, 34 R, 36, 106, 57/90, 91, 157 TS

[56] **References Cited**

UNITED STATES PATENTS

3,070,948	1/1963	Tsuzuki	57/36
3,077,724	2/1963	Stoddard et al.	57/34 HS
3,165,881	1/1965	DeMoncuit et al.	57/34 HS
3,367,096	2/1968	Comer et al.	57/34 HS
3,448,571	6/1969	Tsuzuki	57/36
3,564,829	2/1971	Tsuzuki	57/36
3,638,411	2/1972	Tsugawa et al.	57/34 HS
3,708,970	1/1973	MacFarlane	57/157 TS

Primary Examiner—John Petrakes

Attorney, Agent, or Firm—Burgess, Ryan and Wayne

[57] **ABSTRACT**

Draw-texturing for synthetic fibers is efficiently carried out by means of a draw-texturing apparatus of a novel arrangement and construction wherein the draw-false-twisting body proper is arranged through and beyond an intermediate floor. Package supply means are located on said intermediate floor in opposing relation in the upper portion of said body proper. A first operational floor is formed between said package supply means and the upper portion of said body proper. Take-up means are placed on the apparatus base floor in opposing relation in the lower portion of said body proper and a second operational floor having yarn passages underneath is formed between the lower portion of said body proper and said take-up means.

15 Claims, 22 Drawing Figures

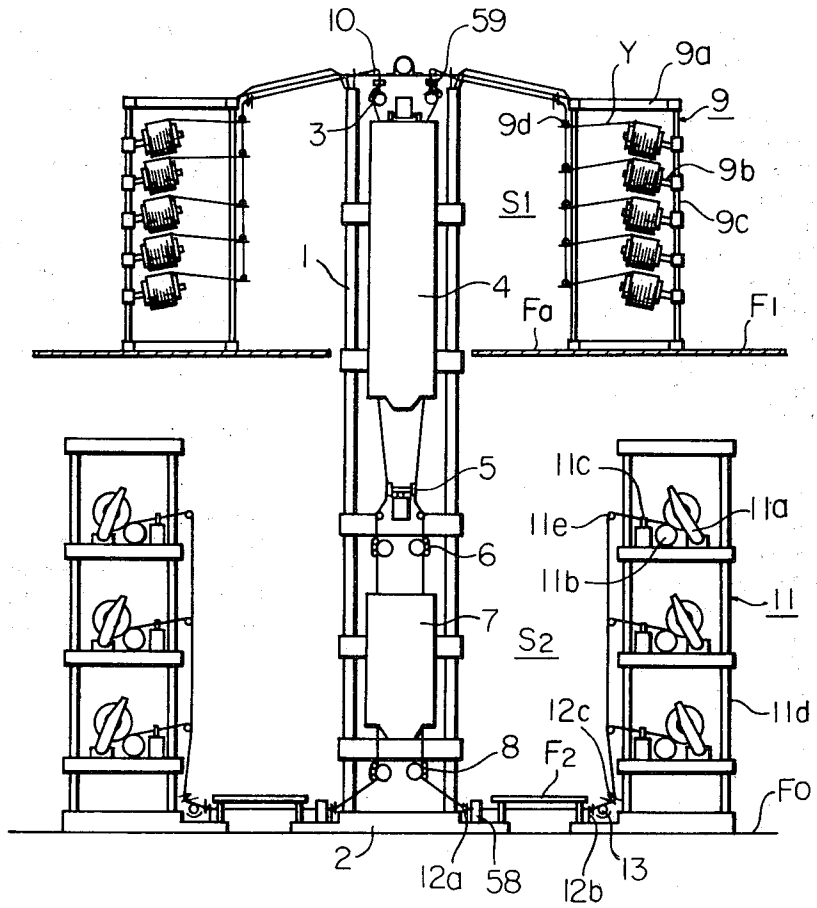


Fig. 1

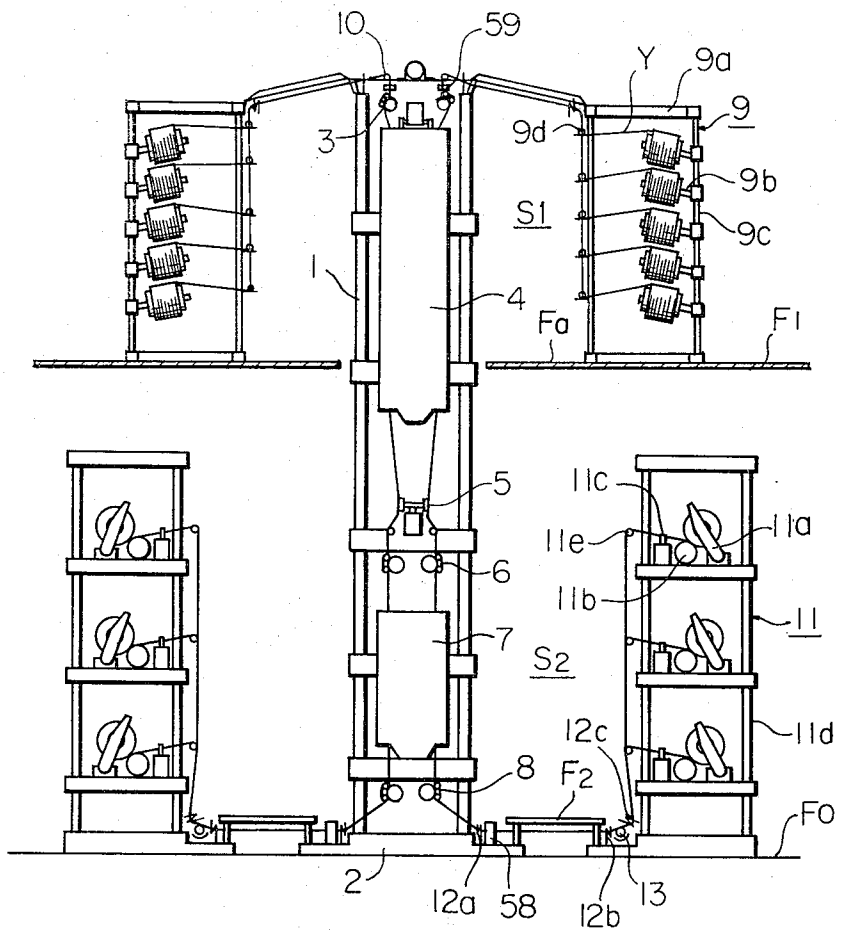

10
59
Y
9a
9
3
9d
9b
S1
9c
1
4
Fa
F1
5
11c
11e
11a
6
11b
11
7
S2
12c
11d
8
F2
Fo
2
12a
58
12b
13

Fig. 2

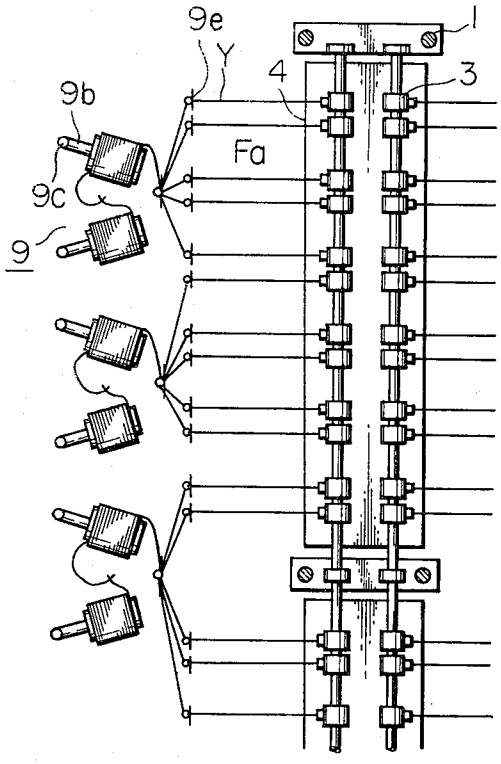


Fig. 3

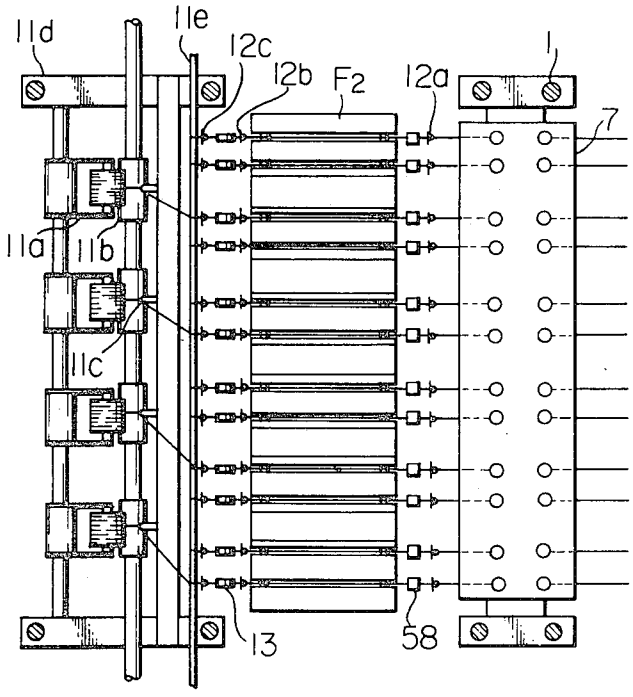


Fig. 4A

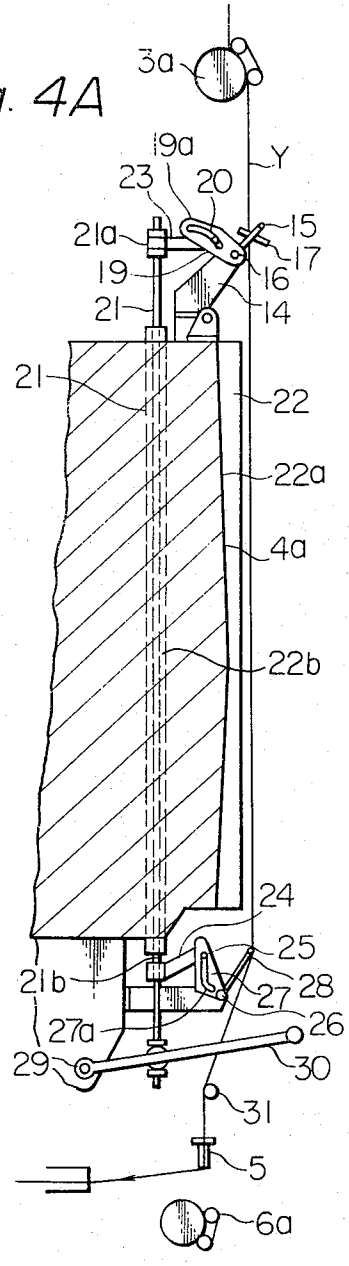

3a
19a
23
20
Y
21a
15
19
17
16
21
14
21
22
22a
4a
22b
24
25
21b
27
28
27a
26
29
30
31
5
6a

Fig. 4B

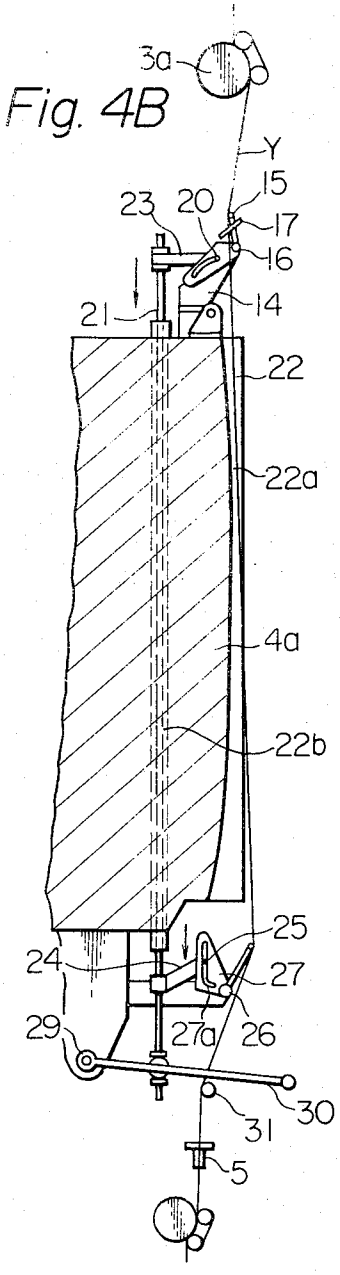

3a
Y
15
23
20
17
16
21
14
22
22a
4a
22b
25
24
27
29
27a
26
30
31
5

Fig. 4C

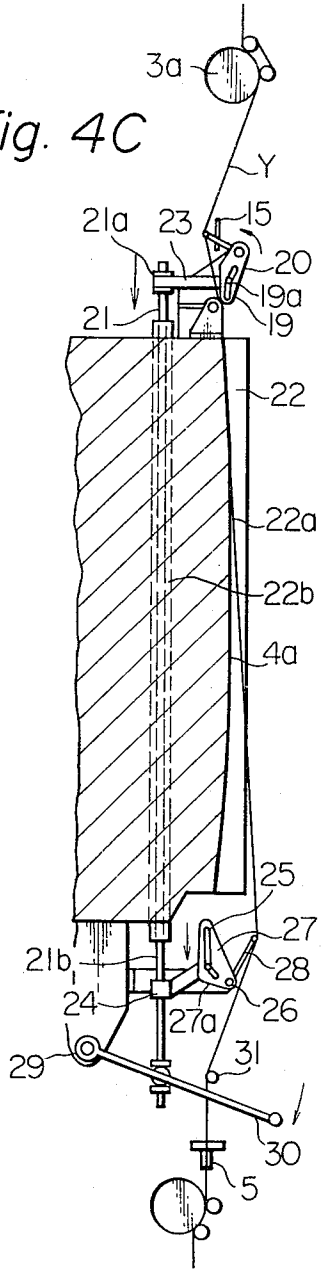

3a
Y
21a
23
15
20
19a
21
19
22
22a
22b
4a
25
27
21b
28
24
27a
26
29
31
30
5

Fig. 4D

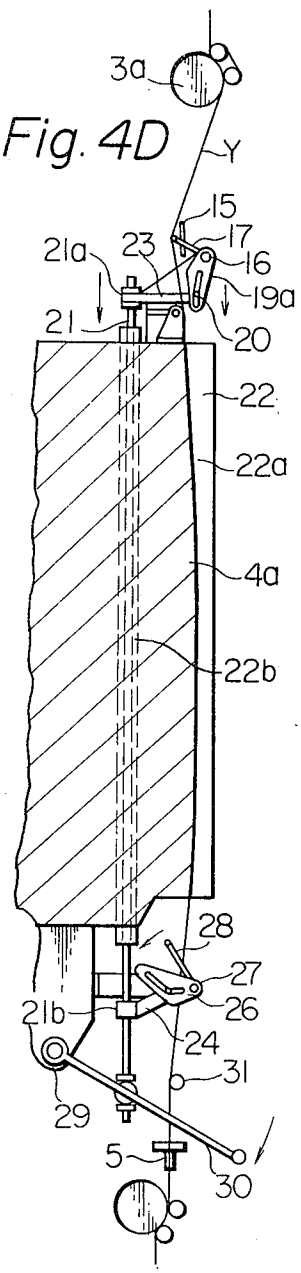

3a
Y
15
17
21a
23
16
19a
21
20
22
22a
4a
22b
28
27
21b
26
24
31
29
5
30

Fig. 4E

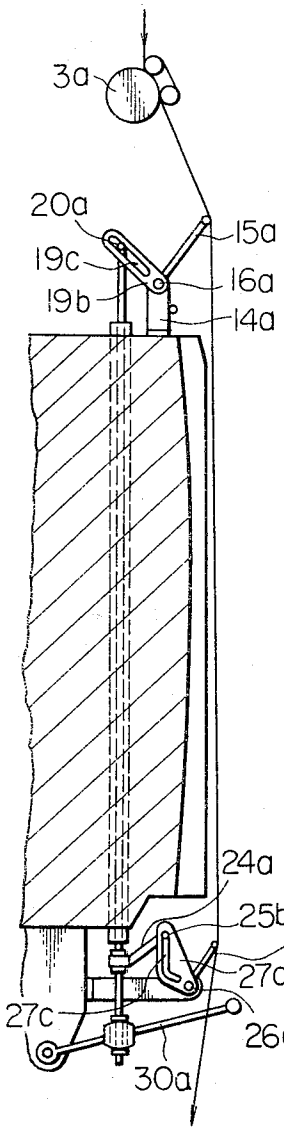


Fig. 5A

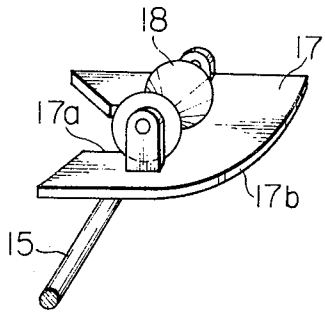


Fig. 5B

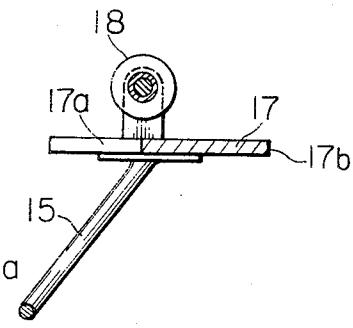


Fig. 5C

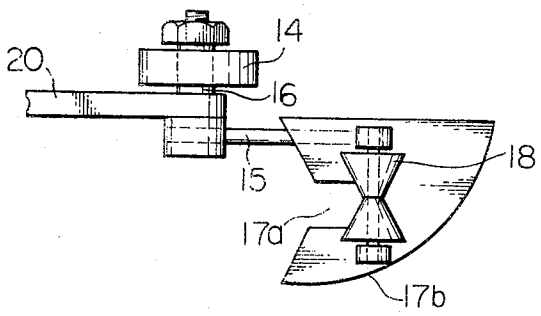


Fig. 6

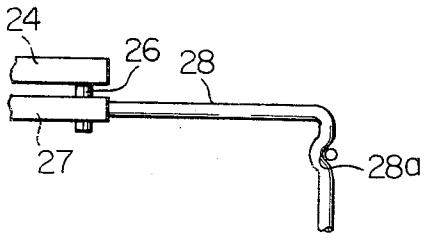


Fig. 7

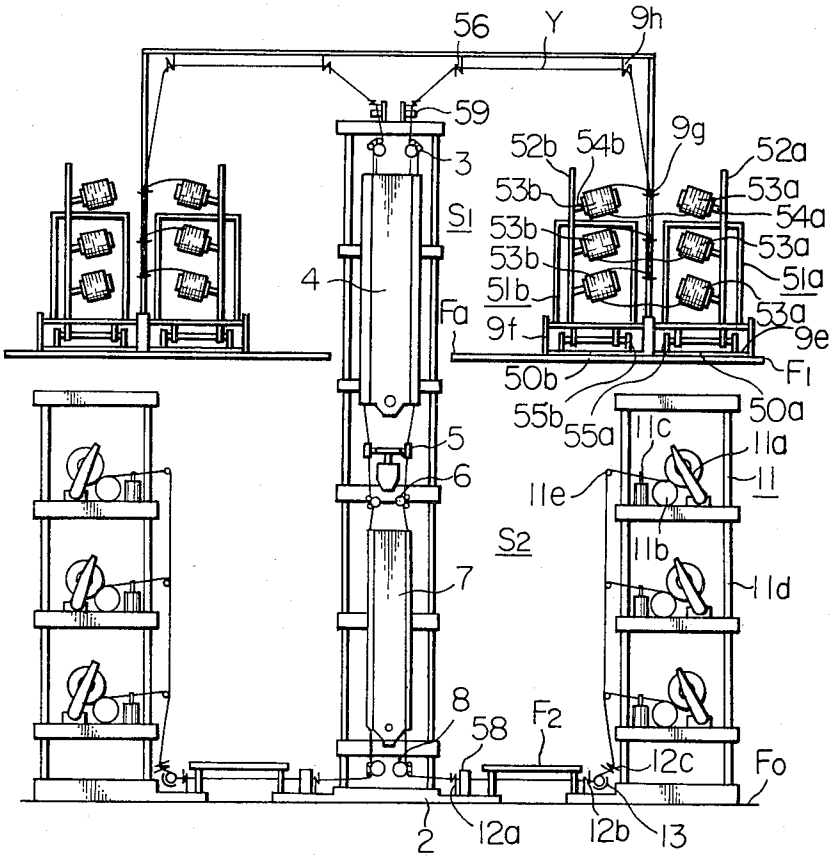

56
Y
9h
59
3
52b
54b
9g
52a
53b
53a
54a
S1
53b
53a
53b
51a
4
51b
53a
Fa
9f
9e
F1
50b
55b
55a
50a
11c
11a
5
6
11e
11
S2
11b
7
11d
8
58
F2
12c
Fo
2
12a
12b
13

Fig. 8

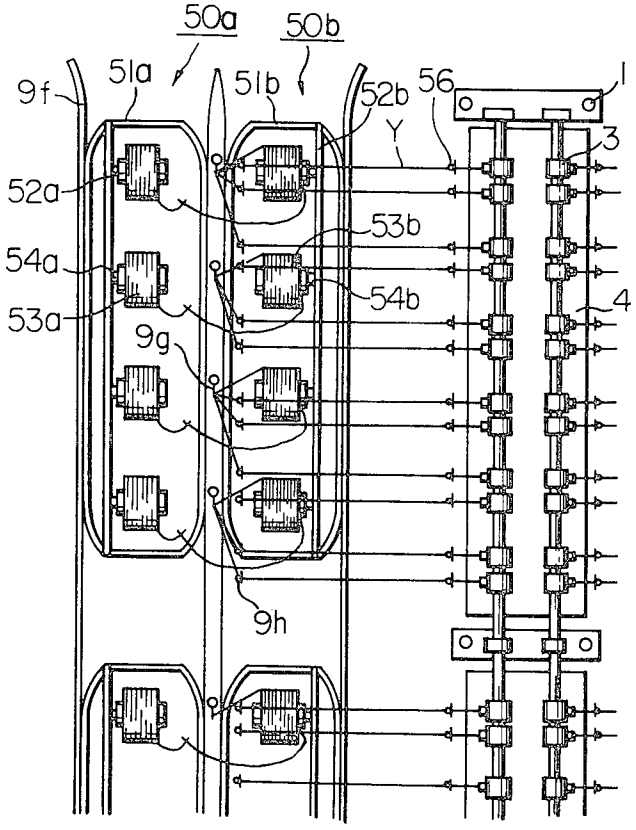


Fig. 9

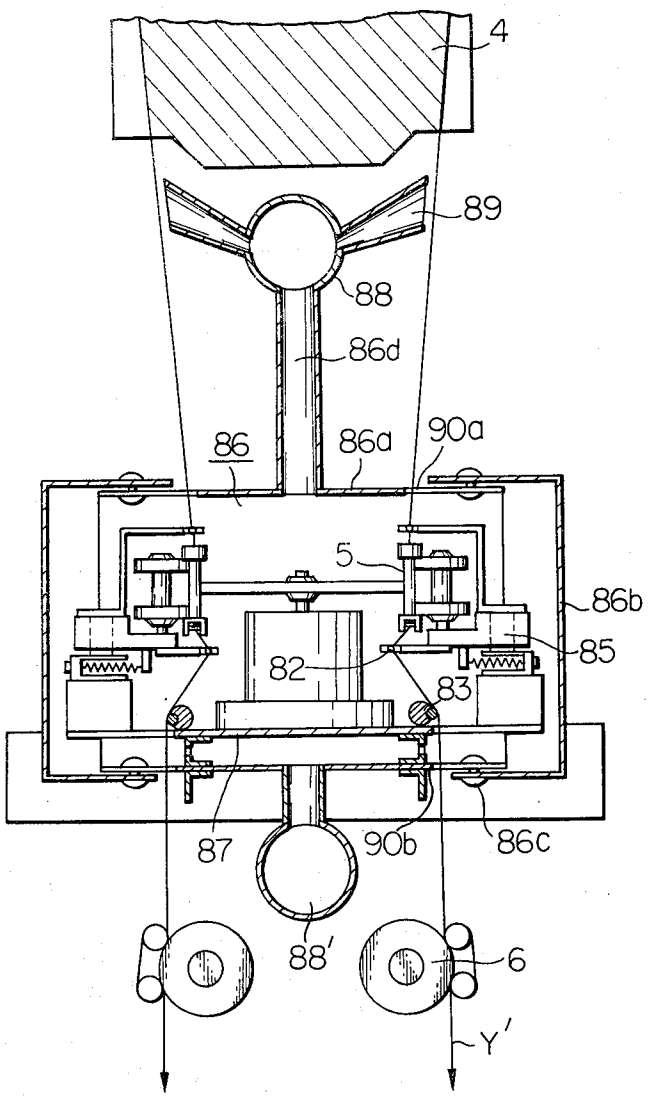


Fig. 12A

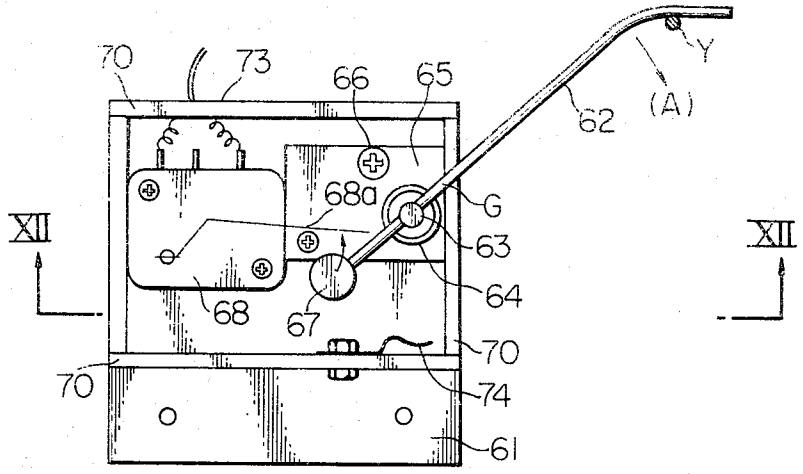


Fig. 12B

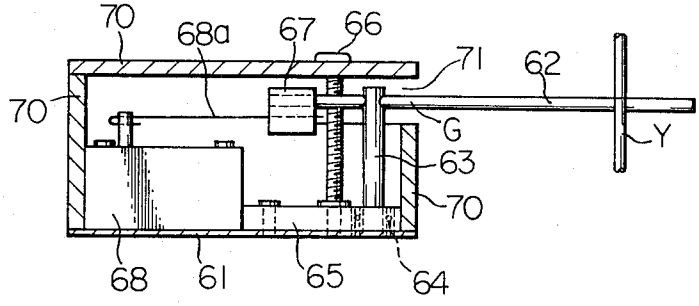


Fig. 10

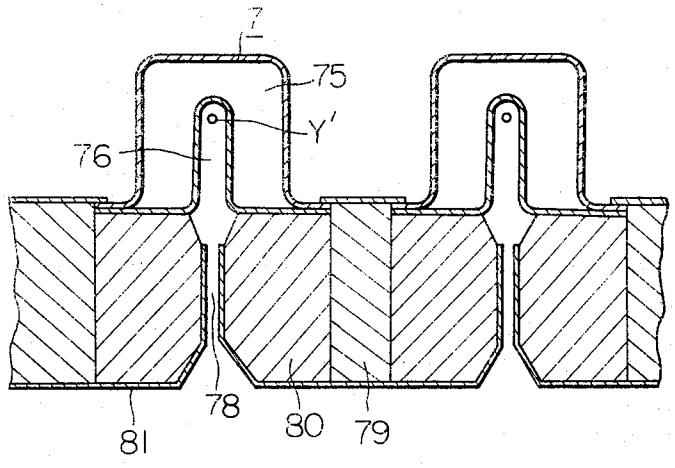


Fig. 11A

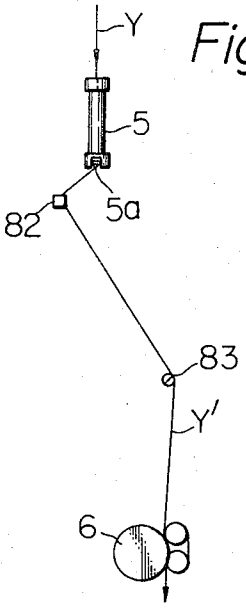


Fig. 11B

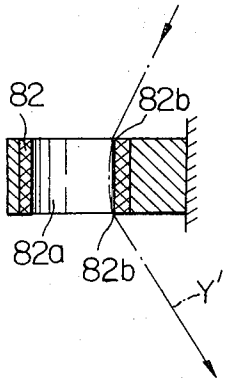


Fig. 13A

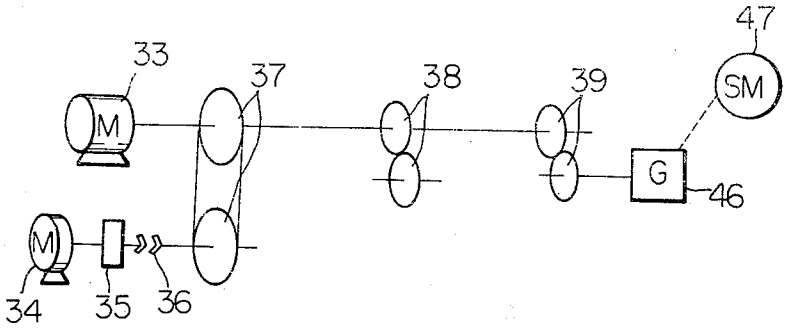
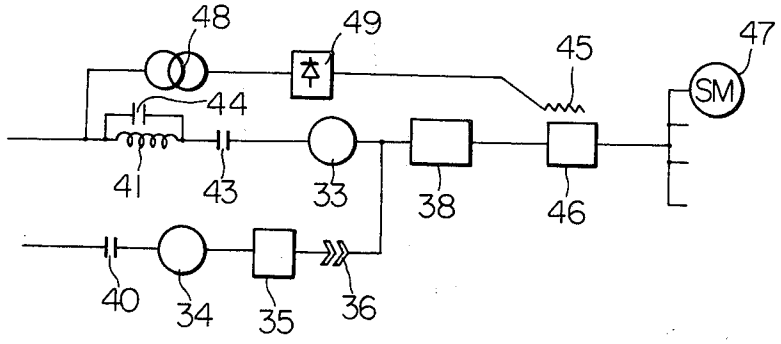


Fig. 13B



DRAW-TEXTURING APPARATUS

SUMMARY OF THE INVENTION

The present invention relates to a draw-texturing apparatus of a novel arrangement and construction, adapted for use in producing false-twisted bulky yarns directly from undrawn yarns of synthetic fibers. (The term "undrawn yarns" as used herein is defined as including partially drawn yarns.)

Recently, in an attempt to reduce production costs, bulky yarns are being produced directly from undrawn yarns of synthetic fibers by concurrently drawing undrawn yarns and false-twisting the same. The apparatus to practice such a method, i.e., the draw-texturing apparatus, in general comprises three parts: (i) package supply means, mounting yarn packages thereon; (ii) draw-false-twisting section, composed of supply rollers adapted to supply undrawn yarns to a draw-false-twisting portion, a first heater, false-twisting means, a first delivery roller adapted to draw or stretch yarns, said first delivery roller having a peripheral speed greater than that of said supply roller, a second heater, a second delivery roller, etc., and; (iii) take-up means adapted to take up yarns around the surface of bobbin.

A simple vertical arrangement of such three parts, i.e., package supply means, draw-false-twisting section and take-up means, will result in an increase in the height of an apparatus and, consequently, in extreme difficulties with the yarn threading-up operation. To avoid such difficulties, it has been a general practice to provide a simple false-twisting machine, as disclosed in U.S. Pat. No. 3,165,881, of such a construction that the body proper of the apparatus is in an opposing relation to the package supply means and take-up means. With such an arrangement yarns are introduced from the upper and lower portions of the apparatus into the package supply means and take-up means opposing the body proper of the apparatus. However, such a draw-texturing apparatus still has a height greater than that of the conventional simple false-twisting machine and difficulties with the threading-up operation remain. As a result, there is a demand for improvements which will simplify the threading-up operation and associated operations required for the draw-texturing apparatus.

It is accordingly the principal object of the present invention to provide a draw-texturing apparatus, adapted for practical use, which can avoid the shortcomings encountered with the aforesaid threading-up operation and other associated operations required for the conventional draw-texturing apparatus.

According to the present invention, there is provided for attaining the aforesaid object a draw-texturing apparatus comprising: a body proper extending from the apparatus base floor through and beyond an intermediate floor; package supply means located on said intermediate floor in opposing relation to the upper portion of said body proper; a first operational floor between said package supply means and the upper portion of said body proper; take-up means placed on said base floor in opposing relation to the lower portion of said body proper; a second threading-up operation floor positioned between said take-up means and the lower portion of said body proper, and; yarn passages leading from the underside of said threading-up operation floor to the take-up means. Furthermore, for achieving a smooth but rapid operation in the actual threading-up operation, there are provided, in addition, yarn passage

control means and an automatic adjusting means for the operational speed during the threading-up operation, which result in increased practical advantages for the apparatus of the present invention. In addition, as described hereinafter, in the preferred embodiments of the present invention, there is provided a heater of a special construction adapted for ready use in the threading-up operation as well as for enhancing the heating effect, yarn breakage detecting means and an auxiliary reverse twist member to increase the twisting effect.

The above and other objects and features of the invention will be clear from reading of the ensuing specification of the invention with reference to the accompanying drawings, although additional modifications and improvements can be readily anticipated by those skilled in the art. Such modifications and improvements may fairly be presumed to be within the scope and purview of the invention, as far as such modifications follow the spirit of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a draw-texturing apparatus of the present invention;

FIG. **2** is a plan view of the draw-texturing apparatus of the invention showing the portion above the intermediate floor of FIG. **1**;

FIG. **3** is a plan view of the draw-texturing apparatus of the invention, showing the lower portion thereof;

FIGS. **4A, 4B, 4C** and **4D** are side elevational views of an embodiment of the threading-up device for use in the draw-texturing apparatus of FIG. **1** or FIG. **7**;

FIG. **4E** is a side elevational view of another embodiment of the threading-up device for use in the draw-texturing apparatus of FIG. **1** or FIG. **7**;

FIGS. **5A 5B** and **5C** are a perspective view, a partially broken side-elevational view and a plan view, respectively, of the yarn guiding member of the threading-up device as shown in FIGS. **4A** to **4D**;

FIG. **6** is a plan view of a yarn guiding rod of the threading-up device shown in FIGS. **4A** through **4D**;

FIG. **7** is a side elevational view of another draw-texturing apparatus of the invention;

FIG. **8** is a plan view of the draw-texturing apparatus of FIG. **7** showing the portion thereof above the intermediate floor;

FIG. **9** is a side-elevational view, partially broken, of the detailed construction of the false-twisting portion of the draw-texturing apparatus of FIG. **1** or FIG. **7**, a sound proof cover and an air-discharging mechanism thereof;

FIG. **10** is a cross-sectional plan view showing the construction of the second heater used in the draw-texturing apparatus shown in FIG. **1** or FIG. **7**;

FIG. **11A** and FIG. **11B** are side-elevational views of an auxiliary reverse twist member located immediately downstream of a false-twisting spindle of the draw-texturing apparatus of FIG. **1** or FIG. **7**, and an enlarged side-elevational view of a tubular guide of said member;

FIG. **12A** and FIG. **12B** are a front view and a cross-sectional view, respectively, (taken along the line XII—XII of FIG. **12A**) of the yarn-breakage detecting means used in the draw-texturing apparatus of FIG. **1** or FIG. **7**;

FIG. **13A** is a diagram of a drive means adapted for the draw-texturing apparatus of FIG. **1** or FIG. **7**, and;

FIG. **13B** is a block diagram of the drive means shown in FIG. **13A**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **1**, **2** and **3**, shown by **1** is a frame of the body proper extending upwardly from a basic frame **2** located on a base floor Fo, with the upper portion of said frame protruding above the intermediate floor F1 located above said base floor Fo.

The body proper of the apparatus of the invention consists of supply rollers **3** supported on the transverse frames mounted horizontally on said frame **1**, a first heater **4** of contact type, two false-twisting means **5** such as false-twisting spindles, two first delivery rollers **6**, a second heater **7** of noncontact type, two second delivery rollers **8**, being disposed on said frame **1**. Such an arrangement does not present a substantial change in construction from the conventional simple false-twisting machine. However, since the first heater **4** as well as the second heater **7** have lengths greater than 1 meter, and a cooling zone of a length of 0.5 to 1 meter is necessary between the first heater **4** and the false-twisting means **5**, the height of the apparatus will be about 5 meters, when measured from the set-up floor Fo to the top of the apparatus. The false-twisting means may include, for example, a false-twisting spindle unit, friction twist type false-twisting unit and fluid jet type false-twisting unit.

Represented by **9** is a package supply means having pegs **9***b* mounted on the frame body **9***a* located on the intermediate floor F1, each peg **9***b* being adapted to hold a yarn package thereon. The pegs **9***b* are rotatably mounted on a vertical frame **9***c*, such that, upon replacing a yarn package, the peg **9***b* is rotated to the rear of the frame, thus permitting the yarn replacement from behind the frame.

The space S1 defined between the upper portion of the body proper and the package supply means **9** is utilized for the first threading-up operation, and the intermediate floor F1 contained therein is used as a first threading-up operation floor F*a*. Accordingly, the undrawn yarn Y which is being withdrawn from the respective yarn packages housed in the package supply means **9**, is led into a yarn guides **9***d* and **9***e* provided in the front and upwardly of the package supply means **9**, then through the upper portion of the operational space Sl into a supply guide **10** of the body proper and then to the supply roller **3**. There is provided a yarn cutter **59** between the supply guide **10** and supply roller **3**.

Take-up means **11** are located on the apparatus base floor Fo in opposing relation to each other in the lower portion of the body proper. The take-up means comprises, on a frame **11***d*, bobbin holders **11***a* adapted to hold the take-up bobbins thereon, friction rollers **11***b* of a line shaft system, which rollers **11***b* are adapted to friction drive take-up packages, and traverse guides **11***c* adapted to transversely pay out yarns thereover. Take-up units are arranged in two or three stages. The threading-up operation of yarns around each takeup unit is carried out from the front of the take-up unit in the second threading-up operational space S2 defined between the lower portion of the body proper and the take-up means **11**, while the removal of the complete package, i.e., so called doffing, is accomplished from the rear of the take-up means.

Located in the second threading-up operational space S2 is a second threading-up operation floor F2. The yarn passage or route leading from the second delivery roller to the take-up means **11** is located beneath the said operation floor F2. Accordingly, yarn guides **12***a* and **12***b* are placed adjacent to and under the operation floor F2, whereby the yarn is led from the second delivery roller, past the guides **12***a* and **12***b*, and then upwardly from said guide **12***b* into the inlet guide **11***e* of each take-up unit. **12***c* is a yarn guide. The yarn is then transversely paid out by the traverse guide **11***c* to thereby form a package. There is provided a yarn-breakage detecting means **58** between guides **12***a* and **12***b*. Slits are formed onto the operation floor F2 to provide the yarn passage permits the smooth threading-up operation above said operation floor. (In FIG. **1**, **13** represents an oiling means.) Likewise, the yarn passage leading from the package supply means **9** to the supply roller **3** is provided above the first threading-up operation floor F*a*, thereby permitting smooth and quick operation in the first threading-up operation space S1.

The draw-false-twisting units are provided for the draw-texturing apparatus on the opposite sides of the body proper thereof along the length of said body proper. Likewise, pegs on the package supply means and take-up units are provided, corresponding to said draw-false-twisting units, along the length of said package supply means and the frame of the take-up means.

In the threading-up operation in the aforesaid draw-texturing apparatus, an operator on the first operation floor Fa draws a yarn from the yarn package on the package supply means **9** and then introduces the same, in turn, through the guide **9***d*, supply guide **10**, supply roller **3** and first heater **4** to the underside of the operation floor F*a*. The yarn thus withdrawn is introduced by another operator on the operation floor F2 in the second threading-up operation space S2 into the false-twisting means **5**, first delivery roller **6**, second heater **7**, second delivery roller **8**, past the guides **12***a* and **12***b* and then around the bobbins of respective take-up units, thus completing the threading-up operation. Alternately, the yarn drawn from the yarn package on the package supply means **9** may be introduced through the guide **9***d* and, by an arrangement similar to the apparatus described above, through the underside of the operation floor F*a* to the supply guide **10**.

However, during the threading-up operation, if the undrawn yarn is brought into direct contact with the first heater, the yarn will be broken easily. To obviate such a shortcoming, there is provided a special threading-up means.

According to the draw-texturing apparatus of the invention, the neck point will be positioned on the twist-setting heater. In general, the twist-setting heater is heated to an extremely high temperature (in the case of polyester fibers, the temperature will be raised to about 200°C), such that, if the undrawn yarn contacts the heater, the yarn will be thermally deteriorated, leading to immediate breakage. In case the yarn is stretched or drawn at such a high temperature imparted by the heater, after the drawing operation has been commenced, there will result a short contacting duration of the undrawn yarn with the heater even if the yarn happens to contact the hot heater, while the yarn ahead of the neck point only remains heated to the drawing temperature. On the other hand, although the yarn will be heated to the twist-setting temperature downstream of the neck point, drawn-false-twisting may be carried out

without any trouble, because the yarn has been already drawn. Conversely, at the time of the threading-up operation, because of handling an undrawn yarn, difficulties will be encountered with the threading-up operation, i.e., if the yarn happens to contact the hot heater inadvertently, the yarn will be broken quite readily. Accordingly, the inventors made many approaches to avoid such difficulties experienced with the threading-up operation and, as a result, they have discovered the method, wherein at the time of the threading-up operation, the undrawn yarn is spaced apart from the heater to thereby start the drawing, after which the yarn is brought into contact with the heater.

A detailed description will now be presented of the threading-up device which is designed to attain the aforesaid object, and the threading-up method used for said device, with reference to FIGS. **4A, 4B, 4C** and **4D.** Throughout these figures, parts similar to those shown in FIGS. **1** through **3** are designated by the same respective reference numerals. In these figures, **3***a* is a supply roller of an apron type; is **4a** a first heat-treating heater of a grooved type; **5** is a false-twisting means which is shown in this case as a false-twisting spindle; and **6***a* is a first delivery roller of an apron type. The first delivery roller **6***a* rotates at a peripheral speed greater than that of the supply roller **3***a* for drawing the yarn. The peripheral speed ratio of the first delivery roller to the second delivery roller is preferably from 1.3 to 3.0. A rocking element **15** is pivoted at a pin **16** on a block **14** mounted fixedly on the grooved type heater **4***a*. A cam **17** is fixedly mounted on the rocking element **15,** being formed, at the front edge thereof, with a yarn engaging notch **17***a* and, at the rear edge thereof, with an arcuate face **17***b* integral with said front edge, as shown in FIGS. **5A, 5B** and **5C.** When the rocking element **15** rocks about the pin **16,** being located between the supply roller **3***a* and the first heater **4***a* of the grooved type, then the cam **17** rocks in the direction of the groove of the first heater **4***a*. A yarn guide roller **18** is mounted on the surface of the cam **17.** There is provided a lever **19** mounted fixedly on said rocking element **15** formed with an elongated L-shaped grooved cam **19***a*, into which there is loosely fitted a cam follower **20.** A rod **21** extends through an elongated hole **22***b* provided through the first heater, said rod **21** being adapted to move vertically through said hole **22***b*, with said cam being rotatably mounted via an arm **23** on the top end **21***a* thereof. Affixed to the lower portion **21***b* of the rod **21** is an arm which rotatably supports a cam follower **25,** while the cam follower **25** is loosely fitted in an L-shaped grooved cam **27***a* provided in the arm **27** adapted to rotate about the pin **26.** A guide bar **28** is fixed to an arm **27.** The guide bar **28** is formed with an L-shaped portion at the tip thereof, as shown in FIG. **6,** and the bent tip portion has therein a recessed portion **28***a* for engagement with the yarn, said recessed portion **28***a* being adapted to rock about the pin **26** like the aforesaid cam **17.** The rod **21** is supported at its lower end portion by an operating lever **30** which is rotatably supported by the pin **29** projecting from the body proper provided with the grooved type heater **4***a*, whereby the rod **21** is moved upwardly or downwardly by means of said operating lever **30,** and the cam follower **20** and **25** move vertically as the rod **21** moves vertically. As shown in this embodiment, when the operational lever **30** is moved upwardly, the upper cam follower **20** will be positioned on the side of the pin **16** of the inverted L-shaped grooved cam **19***a*, while the portion of the L-shaped grooved cam **27***a* of an arm **27** ahead of the bending point and averted from the pin **16** will be positioned in parallel with the rod **21.** The cam follower **25** is positioned in the furthermost position from the pin **26** in the grooved cam **27***a*.

Subsequently, as shown in FIGS. **4B** and **4C,** when the operational lever **30** is lowered, the forward portion of the inverted L-shaped groove from the bending point of the inverted L-shaped grooved cam **19***a*, in which the upper cam follower **20** is loosely fitted, will be aligned in parallel with the rod **21,** before the lower can follower **25** has reached the bending point of the L-shaped grooved cam **27***a*, and the cam follower **20** will be positioned in said portion of the grooved cam in parallel to said rod **21.** Then, when the operational lever **30** is further lowered, the cam follower **25** will go beyond the bending point of the grooved cam **27***a*, as shown in FIG. **4D.** Although not shown in the drawings, it is preferable that the lever **30** is stepwisely operated with a locking member provided therewith.

For the threading-up operation, as shown in FIG. **4A,** the operational lever **30** is positioned in the uppermost position, with the cam **17** and a guide lever **28** being spaced apart from the first heater **4***a*, and then undrawn yarn Y is past through the outside of the guide bar **28,** rather than being held with the supply roller **3***a*, then through the guide **31** and around the false-twisting spindle **5** free from its driving force, after which the yarn end is sucked into the aspirator, and then the yarn is held by the supply roller **3***a*. As the yarn Y is being sucked into the aspirator, the slack on the yarn between the supply roller **3***a* and the guide bar **28** will be eliminated, so the yarn Y will slide on the rear arcuate portion **17***b* of the cam **17** and eventually engaged in the yarn engaging notch **17***a* provided in the front edge thereof. With such an arrangement, if the operational lever **30** is lowered, then the rod **21** will be lowered, whereby the upper cam follower **20** will be lowered. sliding through the grooved cam **19***a*, and the cam **17** will be rotated about the pin **16** in a counterclockwise direction. As a result, the yarn positioned above the first grooved heater **4***a* will become close to the heating surface **22***a* through the slit in the housing **22** of the heater, thereby being heated by the heater to a drawable state.

Subsequently, the yarn will be urged against the false-twisting spindle for commencing the draw-false-twisting operation, simultaneously with the threading-up operation of the yarn around the first delivery roller **6***a*.

As has been described hereinbefore, the first delivery roller **6***a* rotates at a peripheral speed greater than that of the supply roller **3***a*. However, since the yarn Y between the rollers **3***a* and **6***a* is heated by the grooved type heater **4***a*, there are formed neck points on the yarn Y at the portion thus heated and in this manner the yarn is drawn or stretched. At this time, however, the grooved cam **27***a*, in which the lower cam follower **25** is loosely fitted, is aligned in parallel to the rod **21,** while the guide bar **28** maintains the initial condition.

As shown in FIG. **4C,** when the operating lever **30** is further lowered, the cam **17** is rotated to a further extent, with the grooved cam **19***a* being aligned in parallel with the rod **21,** although the grooved cam **27***a* is maintained in a parallel relation with the rod **21** and the guide bar **28** is maintained stationary. During this time, the cam **17** slowly urges the yarn Y against the upper portion of the heating surface **22***a* of the grooved type

first heater 4*a*. The yarn Y has been already drawn as has been described, whereby the yarn will not be subjected to breakage, even if it contacts the first heater 4*a*, and thus it is further heated so as to set the neck points.

When the operating lever **30** is lowered to the position shown in FIG. **4D**, i.e., the lowermost portion thereof, the tip of the grooved cam **19** becomes aligned in parallel with the rod **21**, while the cam follower **20** only slides through said grooved cam **19** and the cam **17** is maintained stationary. On the other hand, when the lower cam follower **25** goes beyond the bending point of the grooved cam **27***a*, then the guide bar **28** rotates in a counterclockwise direction about the pin **26** to thereby urge to the heating surface of the heater the yarn which is positioned under the grooved type heater 4*a*. Thus, the yarn may be heated completely by the heater and drawn between the supply roller **3***a* and the first delivery roller **6***a*, with the result that the twists imparted by the false-twisting spindle **5** are set.

While the description has been given to the embodiment, wherein the moving phase of the cam **17** is ahead of that of the guide bar **28** and thus the yarn Y is urged against the upper portion of the first heater of a grooved type, after which it is urged against the lower portion thereof, the guide bar **28** may be positioned ahead of the cam **17** in the moving phase, by suitably selecting the configurations of the cam followers **20** and **25** plus the grooved cams **19***a* and **27***a*.

As is apparent from the foregoing description, according to the threading-up device used in the draw-texturing apparatus of the present invention, there is provided a cam having a yarn engaging notch in the front edge thereof and an arcuate face integral with the front edge of said cam, such that when the yarn is positioned in the engaging notch, then there will be no slack on the yarn, as the yarn is being transferred from the supply roller to the aspirator. On the other hand, due to the tension exerted thereon, the yarn slides on the arcuate face of the cam and is maintained in the yarn engaging notch automatically, thus leading to the easy but positive engagement of the yarn. According to another aspect of the invention, said cam is provided between the supply roller and the heat treating heater, and the yarn guide is provided between the heat treating heater and the false-twisting means in such a manner that the cam and yarn guide shift in a direction perpendicular to the yarn passage by adjusting the timing thereof. Thus, the drawback of the conventional draw-texturing apparatus being accompanied with the frequent yarn breakage may be avoided with ease and without skill, yet in a short time period, thereby resulting in greatly reduced man power and improved availability and hence increased productivity.

According to another embodiments of the threading-up device as shown in FIG. **4E**, the threading-up operation can successfully be carried out in similar manner to that of the threading-up device of the above-mentioned type. In the threading-up device of the type shown in FIG. **4E**, when the operational lever **30***a* is lowered, a rocking element **15***a* pivoted at a pin **16***a* on a block **14***a* and a lever **19***b* mounted fixedly on said rocking element **15***a* formed with an I-shaped grooved cam **19***c* are rotated about the pin **16** in a counterclockwise direction. As a result, the yarn comes into contact with the heating surface of the first heater. Also, a simpler threading-up device can successfully be utilized with the draw-texturing apparatus of the present invention. For example, a rod elongated from the upper end to the lower end of the first heater is mounted rotatably about the axis of the rod. To the rod, guide bars are fixedly provided at a right angle to its axis at the upper and lower end portions of the heater. Thus, the yarn may be caused to contact the heating surface of the first heater by the rotation of the guide bars from the outer side to the inner side of the groove of the heater.

Further, in the draw-texturing apparatus of the present invention, a roller having a rough surface is utilized for the supply roller for introducing the undrawn yarn to the draw-false-twisting section. The yarn outlet of the aventurine surface supply roller is directed downward, whereby the winding of the yarn around the supply roller can be prevented at the occasion of yarn breakage. In this embodiment, an acceptor for waste yarn may be provided in opposing relation to the lower portion of the heater 4*a*.

The draw-texturing apparatus of the present invention described thus far can successfully prevent yarn breakage due to the threading-up operation of the undrawn yarn Y, by adopting the threading-up device of a special type, as has been described. However, it still fails to prevent yarn breakage completely. Thus, to solve this problem, studies have been made by the inventors, which led to the discovery that the best result may be obtained by reducing the operational speed of the draw-texturing apparatus to a speed lesser than the normal operation speed thereof at the time of the threading-up operation. According to another aspect of the invention, there is provided a novel drive control system adapted for use in the draw-texturing apparatus, which has excellent practical advantage. More particularly, the draw-texturing apparatus of the invention includes a main electric motor adapted to drive the yarn advancing system and an electric motor adapted to drive the false-twisting system via a generator connected to said main electric motor. In addition to said main electric motor adapted for driving the yarn advancing system, there is provided an auxiliary electric motor, which allows the draw-texturing apparatus, upon starting the operation, to be operated at low speed. After the completion of the threading-up operation, the speed of the main electric motor may be increased gradually, by the cushion starting circuit for the main electric motor drive circuit, when the auxiliary electric motor is switched to the main motor.

It is preferable that the speed V (m/min) referred to as a low speed herein be in the range of $5 \leqq V \leqq 80 - De/5$ (wherein De denotes the denier of the yarn, after the yarn has passed through the false-twisting means). As shown in FIG. **4B**, at the time of the threading-up operation, the yarn is so maintained as to keep it away from the heat treating heater, so that the neck points will not be concentrated at one point but spread throughout the length. Hence the incomplete draw-false twisted yarn will pass through the false-twisting means, with the accompanied yarn breakage caused due to the varying tension on the yarn during the yarn processing. When the velocity exceeds $80 - DE/5$, such a phenomenon will become appreciable. As shown in FIG. **4C**, in case the draw-false twisted yarn is shifted onto the heat treating heater, the positions of the neck points will vary over the length of the yarn to a great extent, thus increasing the possibility of the incomplete draw-false twisted yarn contacting the heat treating heater directly, whereby the portion contacting said heater will be thermally deteriorated at the heat treat-

ing heater, resulting in yarn breakage. On the other hand, in case the velocity V is less than 5, there will be little possibility of yarn breakage, although the velocity of the travelling yarn will become too low, thereby resulting in extremely poor efficiency due to the excessive time required for the threading-up operation.

Under such circumstances, after the draw-texturing operation or draw-false-twisting operation has been commenced, the draw-texturing apparatus is automatically switched to the main electric motor being adapted for use in the normal operation (high speed operation), by using a switching means or timer, and the gradual increase in speed of the apparatus is permitted by a cushion starting circuit provided in the driving circuit of the main motor. In this way, the electric motor for use in driving the false-twisting means can follow the normal speed operation, reducing the yarn breakage phenomenon during the speed increasing process. According to experiments, an increase in the speed of over one second, preferably over 2 seconds, will bring about less of a possibility of yarn breakage, regardless of the gage of the yarn (50 to 150 denier) or the number of twists (2500 to 3500 twists/meter).

In FIGS. **13A** and **13B**, **34** is an auxiliary electric motor; **35** is a reduction gear means; **36** is a one-way clutch, by **34** an auxiliary electric motor; and by **37** is a pulley means to transmit the power from the auxiliary electric motor **34** to gear mechanisms **38** and **39.** Designated by **40** are contacts of a switch adapted to start or stop the auxiliary electric motor **34.** A reactor **41** is provided in the drive circuit for the main electric motor **33,** thus presenting one example of the cushion starting circuit. Represented by **44** are contacts of the switch means which is adapted to short-circuit the reactor **41** and open the cushion starting circuit, after the completion of the cushion starting (after completion of increasing the speed). Shown by **46** is a generator adapted to drive the motor **47** which is to drive the false-twisting system, said generator being connected to the gear **39.** In this embodiment, **46** is an alternating current generator and **47** is a synchronous motor. At the time of starting the operation of the draw-texturing apparatus, operation of the operating button (not shown) causes the switching means (not shown) to be actuated to thereby close the contacts **40.** (at this time, the contacts **40** are open). Then the auxiliary electric motor **34** for low speed starts its rotation to thereby advance the yarn (not shown) via reduction gear means **35,** one way clutch **36** and gear **38,** while driving generator **46** via a gear **39,** so that the motor **47** may be driven at low-speed due to the electro-motive force produced. During the time the apparatus is driven at low-speed, the threading-up operation is thus carried out. After completion of the threading-up operation, when the operating button (not shown) is depressed, the switching means (not shown) will be actuated to thereby close the contacts **43** (at this time, the contacts **40** are open), while the main electric motor starts its rotation, thereby increasing the speed of an advancing yarn and a false-twisting, thus reaching the normal speed. In this respect, since the reactor **41** is incorporated in the drive circuit of the main electric motor **33** according to the present invention, there is no sharp increase in the speed of the main electric motor **33,** thereby the cushion starting is effected. After reaching the normal speed, the contacts **44** will be closed by means of a timer (not shown) and the reactor **41** will be short-circuited. This permits normal operation without yarn breakage in the draw-texturing apparatus. As shown in embodiments, if the field electric power source is incorporated upstream of the contact **43,** then the generator **46** keeps producing a output, even after the contacts have been brought into an open position at the time the motors are stationary. As a result the motor **47** will be reduced in speed in a regenerative braking fashion in cooperation with the drawn yarn, thereby causing no yarn breakage and making it possible to concurrently start the operation of the apparatus without further threading-up after exchange of the empty bobbin for the wound bobbin.

According to the present invention, there is little or no possibility of yarn breakage at the time of starting the draw-false-twisting, nor yarn breakage when the yarn is shifted onto the heat treating heater or at the time of increasing or decreasing the speed. Therefore, the efficiency of the threading-up operation will be materially improved with the resultant improved availability of the draw-texturing apparatus. In addition to this, the amount of waste yarn produced at the time of the threading-up operation may be reduced to a great extent, due to the low-speed threading-up operation.

The reactor is used as a cushion starting circuit in the embodiment of the invention. However, naturally other known circuits may be used in place thereof.

FIGS. **7** and **8** show the other preferred embodiment of the draw-texturing apparatus of the invention. The mechanical construction of the apparatus in this embodiment is very similar to that shown in FIGS. **1, 2** and **3,** except for the intermediate floor. Accordingly similar parts are shown by the same reference numerals used in the first embodiment. To avoid duplicate description, the following description will be focussed on the difference between the two embodiments of the invention.

In general, the undrawn yarn packages with yarns being spun from a spinning machine, are mounted on creel trucks, and the trucks thus loaded with the packages are transferred to the draw-texturing process. With the apparatus shown in FIGS. **7** and **8,** the creel trucks with undrawn yarn packages mounted thereon are transferred on to the aforesaid intermediate floor, and then the creel trucks are placed, in fact, at given positions on the intermediate floor, while the undrawn yarns are respectively supplied in this condition to the supply rollers on the draw-texturing apparatus. For this purpose, there are provided truck transferring passages located in opposing relation to each other on the aforesaid intermediate floor but in the upper portion of the draw-texturing apparatus. Furthermore there are provided yarn passages leading to the supply rollers above said truck transferring passages, with the first threading-up operation floor being formed between said truck transferring passages and the upper portion of the body proper of the apparatus. In addition, there are provided take-up means on the base floor in opposing relation to each other in the lower portion of the apparatus, with the second threading-up operation floor being provided between said take-up means and the lower portion of the body proper of the draw-texturing apparatus. There are provided yarn passages leading to the take-up means underneath the second threading-up operation floor.

Although no essential technical difference is present as compared with the first embodiment, a considerable savings in man power is realized in that the creel trucks carrying the yarn packages are transferred onto the op-

erational floors.

As shown in this embodiment, there are provided truck transferring passages **50***a* and **50***b* on the intermediate floor **F1**. Said passages **50***a* and **50***b* comprise running boards **9***e* and side guides **9***f* adapted to govern the position of a truck. Shown at **51***a* and **51***b* are creel trucks which are provided with pegs **54***a* and **54***b* in stages, said pegs being adapted to hold the yarn packages **53***a* and **54***b* thereon, while said trucks are provided with wheels **55***a* and **55***b* on the underside thereof which run on said running boards. In this embodiment, there are provided two routes of truck transferring passages **50***a* and **50***b*. Provided between said transferring passages are yarn drawing guides **9***g* corresponding to the packages, respectively, and there is provided guides **9***h* above said yarn packages. The first space **S1** defined between the upper portion of the body proper and the truck transferring passages **50***a* and **50***b* is used for the first threading-up operation space, and a portion of the intermediate floor **F1** directly under the first space **S1** is used as the first threading-up operation floor **Fa**. As a result, the undrawn yarn Y, which is being withdrawn from the respective yarn package mounted on the creel trucks adapted to be transferred on the truck transferring passages **50***a* and **50***b*, is led through the yarn drawing guides **9***g* provided midway of said both truck transferring passages, and then through the yarn guide **9***h* which is provided above the truck transferring passages, then above the operational space **S1**, then into the supply guide **56** on the body proper of the apparatus and eventually to the supply roller **3**. Then, the transfer tail of the yarn package **53***b* mounted on the truck **51***b* is tied up with the end of the yarn from the yarn package **53***a*. After the yarn is withdrawn from the respective yarn package **53***b*, the respective yarn package **53***a* mounted on the truck **51***a* will also be transferred. When the yarn on said yarn package is all paid out, then another truck carrying a full yarn package thereon is transferred in place of the former truck, thus repeating the operation as has been described before.

In another assembly of the present apparatus, a single route for creel truck transferring passage may be provided. In this embodiment, when the yarn supply package becomes empty, the apparatus is stopped, another truck carrying a full yarn package thereon is transferred to the place of the former truck, the end of the yarn already in the apparatus is tied up with the end of the yarn from the yarn package on the newly supplied creel truck, and then, the operation of the apparatus is started again.

As is apparent from the foregoing description, according to the draw-texturing apparatus of the invention, particularly with reference to the supply means for undrawn yarn package and threading-up means, the threading-up operation in the draw-texturing apparatus can be accomplished in a highly economical manner without any trouble. It should be noted that, like the other draw-texturing apparatuses, the embodiments shown herein use a yarn breakage detecting means **58** which is located upstream of the yarn passage between the yarn guides **12***a* and **12***b* located underneath the base floor **F2**. Another attempt is that there is provided a special type yarn guide in the close vicinity and downstream of the yarn passage with respect to the false-twisting spindle **5**, in an attempt to certainly effect the reverse twisting of the multi-filaments. The second heater of a special design is provided for this purpose, thereby attaining the improved capability of the draw-texturing apparatus. According to a still further aspect of the invention, there is provided a cover of a special design for sound proofing, since there tends to be developed noise due to the rotation of the spindles during the high speed rotation of the false-twisting spindles, thereby improving the operational conditions.

FIGS. **12A** and **12B** show the yarn breakage detecting means as used in the draw-texturing apparatus of the invention. The yarn breakage detecting means shown herein permits the positive operation without imparting damage to the yarn having a lesser tensile strength, and includes a yarn breakage detecting lever **62** on a base plate **61**. Said lever **62** has a shaft **63** rotatably journaled in a bearing **64**. Attached to the rear end of the yarn breakage detecting lever **62** is a weight **67** of a cylindrical shape provided in a manner that the center of gravity of the lever **62** is located at the point G off-set from the rotational center of the lever **62**.

This arrangement in turn creates a rotational moment exerted on the lever **62** in a direction shown by an arrow (A). However, in a condition where the yarn Y is in contact with the underside of the tip of the lever **62**, immediately upstream of the take-up means, the lever **62** will undergo an upward force in the range of **1** to **2***g* due to the tension existent on the yarn Y, whereby the lever **62** is maintained in equilibrium. On the other hand, secured with a screw to the base plate **61** is a micro-switch **68** with a lever **68***a*, of a type of which can be actuated by the rotation of the lever at a certain angle, which is commercially available. The relative position of the micro-switch **68** to the yarn breakage detecting lever **62** is such that, in the normal condition, the weight **67** at the rear end of the lever **62** is located a distance apart from the tip of the lever **68***a* of the micro-switch **68** (the above distance is preferably as great as possible), and that the weight **67** will be brought into contact with the tip of the lever **68***a* only when the lever **62** is rotated in the direction of an arrow (A) from the balanced position.

Secured with nuts and bolts to the cover **70** of a transparent acrylic plate is a retainer **74** of a leaf-spring which is adapted to tightly hold the weight **67** in position when the lever **62** is rotated manually in a counterclockwise direction, in the case of the threading-up operation or in the case of resetting after yarn breakage detection.

Under the normal condition, the yarn breakage detecting lever **62** is maintained in contact with the travelling yarn under small pressure, by virtue of the adjustment of the weight **67**, thereby avoiding the likelihood of occurrence of fluff. Upon occurrence of the yarn breakage, the yarn breakage detecting lever **62** will rotate due to the moment in a direction of an arrow (A), and when the extent of the rotational movement becomes large, the weight **67** will impinge on the tip of the lever **68***a* of the micro-switch **68**, thereby overcoming the spring force so as to rotate the lever **68***a*, while actuating the micro-switch **68**. This in turn operates the yarn cutter provided upstream of the supply roller **3** in such a manner that the supply of the yarn is interrupted to prevent the winding of the yarn around the roller. The cutter referred to above may be of a type that is adapted to be operated by a solenoid.

With this yarn breakage detecting means, the yarn breakage detecting lever **62** is normally disconnected mechanically from the micro-switch **68**, such that there will be no malfunctioning such as the actuation of the micro-switch, even if the yarn breakage detecting lever

62 is displaced vertically to some extent due to variation in the tension of the travelling yarn Y.

FIG. 10 illustrates the construction of the second heater of the draw-texturing apparatus of the invention. As shown, the second heater is of a slit type and for uniformly heating the filaments of the yarn in without contacting the yarn, with a pipe 75 serving as the passage of heating medium such as Dourtherm. Said pipe extends along the yarn passage, while a yarn heating groove 76 of a U-shape is defined in front of the pipe 75, said groove 76 presenting a yarn travelling space. In this respect, the groove 76 should form a part of the pipe 75, and the dimensions of the groove should be 3 to 15 mm in width and 5 to 30 mm in depth. Provided in front of the pipe 75 is a slit 78 communicating the heating groove 76 with the exterior, said slit running in the direction of the yarn passage, shielded with the heat-insulating materials 79 and 80 made of asbesto or the like. Shown at 81 is a cover provided over the heat insulating materials. The width of the aforesaid slit 78 should preferably be 3 mm, because of the advantage of the heat preserving effect and operational efficiency. The portion of the slit 78 open to the exterior should preferably be divergent. Accordingly, the yarn may be introduced with ease into the slit without any particular aid. In other words, the yarn may be readily introduced into the slit 78 in the second heat treating heater 7. The upper and lower portions of the pipe 75 are each connected via a pipe (not shown) with the heat medium supply pipe (not shown) provided in the lengthwise direction of the apparatus. The circulation of the heat medium through such pipes for heating the closed yarn travelling space 76 maintains at a uniform temperature the spaces (within the slits) provided for respective units, so that the false twisted yarn Y' may be heated without incurring non-uniform heating among the filaments, thus giving uniform elastic elongation and the consequent high quality of products.

As is known in general, in the case where the yarn passed through the false-twisting spindle is heated at the second heater in the draw-texturing apparatus, if the respective filament, constituting a yarn, is not well reverse twisted, a tight spot may be formed, impairing the quality materially. According to the draw-texturing apparatus of the invention, there is provided, as has been described hereinbefore, an annular yarn guide 82 adapted for use in the special reverse-twisting. Said yarn guide 82 being provided at a position within 1 to 10 mm, preferably 2 to 5 mm, downstream of a false-twisting pin 5*a* of a false-twisting spindle 5, between the false-twisting spindle 5 and the first delivery roller 6. As shown in FIGS. 11A and 11B, the yarn guide 82 is positioned in such a manner that a bent portion is formed at the guide rod 83 which is located upstream of the false-twisting spindle 5 as well as the first delivery roller 6, being biased from the axial line of the spindle. The yarn guide 82 is formed with a guide through-hole having at least one sharp edge 82*b* adapted to contact the yarn. When the yarn Y' passes through the yarn guide 82 along the aforesaid yarn passage, it has been found that the respective filaments may be separated in a satisfactory manner.

FIG. 9 illustrates the sound proof cover at the false-twisting spindle portion of the draw-texturing apparatus of the invention. As is clear from the drawing, the sound proof cover 86 covers false-twisting spindle 5; auxiliary reverse twisting means, consisting of annular guide 82 and yarn guiding rod 83, and; a drive means 85 of the false-twisting spindle 5. The sound proof cover 86 comprises horizontal covers 86*a* consisting of two sheets, upper and lower, extending in parallel with the length of the apparatus but along the center line thereof, and a front cover 86*b* pivotable about the pin 86*c* secured to the horizontal cover 86*a*. Said cover 86*b* separately covers the front face of the respective spindles in the false-twisting portion. The air within the sound proof cover 86 and the oil mist accompanying the yarn may be discharged to the exterior from the air discharge pipe 88, through an air discharge pipe 86*d* and through the discharge port 89. The sound proof cover 86 is fixedly mounted on the bracket 87 on the apparatus, as shown. There are provided notch portions 90*a* and 90*b* in close vicinity of the engaging portion of the horizontal cover 86*a* and the front cover 86*b*. In addition, cooled air may be introduced into the sound proof cover through a cooling air pipe 88'. The sound proof cover thus constructed or arranged is designed so as to enclose the noise source therewith, thus presenting excellent sound proof effect with the resultant improved operational conditions.

What is claimed is:

1. A draw-texturing apparatus for synthetic fibers of the type comprising a supply roller supplying an undrawn yarn, a draw-false-twisting body proper which comprises a first heater, a false-twisting means for imparting twist to the yarn, a first delivery roller rotating at a peripheral speed greater than that of the supply roller and drawing and supplying the yarn, a second heater and a second delivery roller advancing the yarn to a take-up means, the improvement comprising an intermediate floor, said body proper being arranged through and beyond said intermediate floor, package supply means located on said intermediate floor in opposing relation in the upper portion of said body proper, a first operational floor formed between said package supply means and the upper portion of said body proper, an apparatus base floor, take-up means placed on the apparatus base floor in opposing relation in the lower portion of said body proper and a second operational floor provided with yarn passages underneath formed between the lower portion of said body proper and said take-up means.

2. A draw-texturing apparatus according to claim 1 further comprising truck transferring passages mounted on said intermediate floor, wherein said package supply means is composed of creel trucks conveyed on said truck transferring passages.

3. A draw-texturing apparatus according to claim 1 further comprising a threading-up device containing two interconnected movable yarn guide members one each of which is provided at the upper and lower end portions of said first heater, whereby said yarn guide members are adapted to move simultaneously due to the interconnection therebetween.

4. A draw-texturing apparatus according to claim 3 wherein said threading-up device consists of an upper yarn guide means for introducing a yarn to said first heater and a lower yarn guide means for introducing the yarn to said false-twisting means, said upper yarn guide means comprising a block mounted fixedly on said body proper, a first yarn guide member pivoted on said block, and a yarn controlling member for transferring said first yarn guide member successively from a rest position, to a preparing position and to a normal operating position, said lower yarn guide means comprising a block mounted fixedly on said body proper, a

second yarn guide member pivoted on said block and a second yarn controlling member for transferring said second yarn guide member from a rest position to a normal operating position, an actuation rod provided in a substantially upright condition connecting said first and second yarn controlling members for simultaneously actuating said first and second yarn controlling members, said actuation rod being transferable from a rest position successively to a first, second and third positions for displacing solely said first yarn guide member to the guide position thereof by transferring said actuation rod to said first position and for displacing solely said first yarn guide member to the normal operating position thereof by transferring said actuation rod to said second position and for displacing solely said second yarn guide member to the normal operating position by transferring said actuation rod to said third position while said first yarn guide member is retained at the normal operating position.

5. A draw-texturing apparatus according to claim **1** wherein the driving system of said apparatus comprises a main electric motor for driving the yarn advancing system a second electric motor for driving the false-twisting system, and a generator mechanically connected to said main motor for providing electric current to said second electric motor.

6. A draw-texturing apparatus according to claim **5** wherein said driving system comprises an auxiliary electric motor, for use at the time of the threading-up operation mechanically coupled in parallel with said main motor.

7. A draw-texturing apparatus according to claim **6,** further comprising current limiting means connected in series with said main motor for reducing the speed of said main motor after said threading-up operation and during a starting -up operation, and switch means connected in parallel with said current limiting means for bypassing said current limiting means following the starting-up operation.

8. A draw texturing apparatus according to claim **5,** wherein the generator comprises a field winding, the apparatus further comprising means for providing a field electric current to said field winding independently of the flow of electric current to said main motor, whereby said generator operates as an electric braking system in response to the deenergization of said main electric motor.

9. A draw-texturing apparatus according to claim **1** wherein said supply roller positioned at the upper portion of said body proper is a roller provided with a rough surface.

10. A draw-texturing apparatus according to claim **1** further comprising a yarn breakage detecting means between said second delivery roller and said take-up means, for providing a yarn breakage signal and means for stopping the supply of the undrawn yarn from said package supply means in response to the signal from said yarn breakage detecting means at the time of yarn breakage.

11. A draw-texturing apparatus according to claim **1** wherein said first heater is of contact type and said second heater is of noncontact type.

12. A draw-texturing apparatus according to claim **11** wherein said second heater is provided with a passage pipe for a heating medium extending along the yarn passage, while a yarn heating groove of U-shape section is defined in front of said passage pipe and the front side of said passage pipe is covered by heat-insulating material, said heating groove is communicated to the exterior by a slit running in the direction of said yarn passage.

13. A draw-texturing apparatus according to claim **1** wherein said false-twisting means comprises a false-twisting spindle having a pin and further comprising, between the pin of said false-twisting spindle and said first delivery roller, an annular yarn guide at a position within 1 to 10 mm downstream of said false-twisting pin eccentrically from the axis of said false-twisting spindle and a guide rod at a position downstream of said annular guide.

14. A draw-texturing apparatus according to claim **1** further comprising a sound proof cover surrounding said false-twisting means and an air suction and discharge pipe connected to said sound proof cover.

15. A draw-texturing apparatus according to claim **1,** further comprising a yarn passage at the upper portion of said package supply means for leading yarn therefrom to said supply roller.

* * * * *