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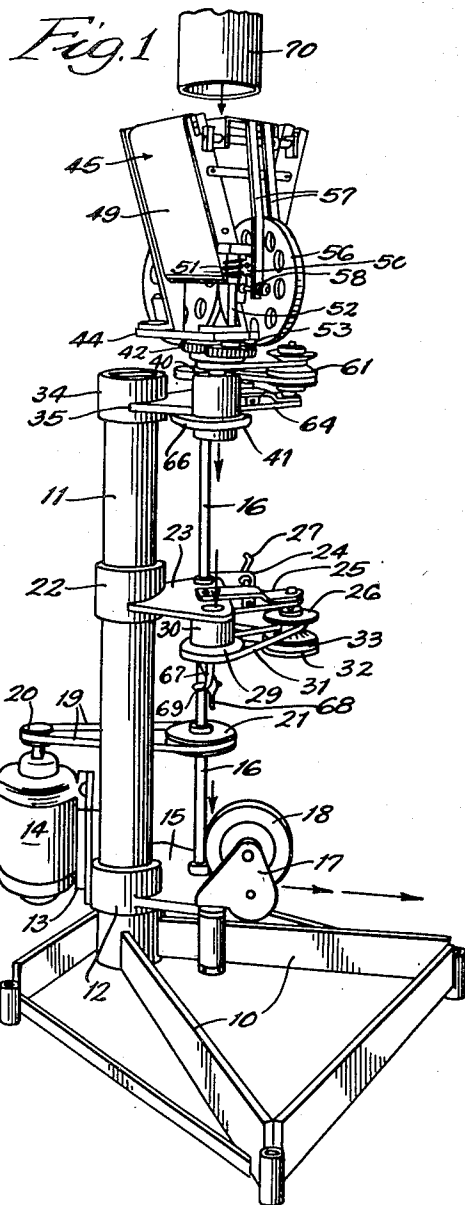
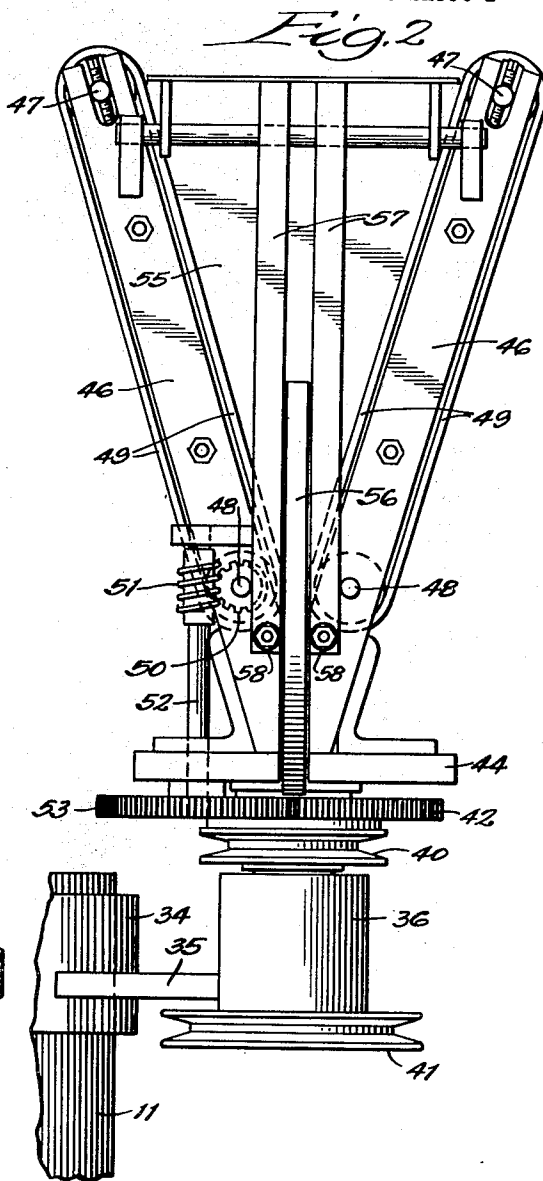
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FIBER SPINNING APPARATUS AND METHOD

Filed April 18, 1947

3 Sheets-Sheet 1



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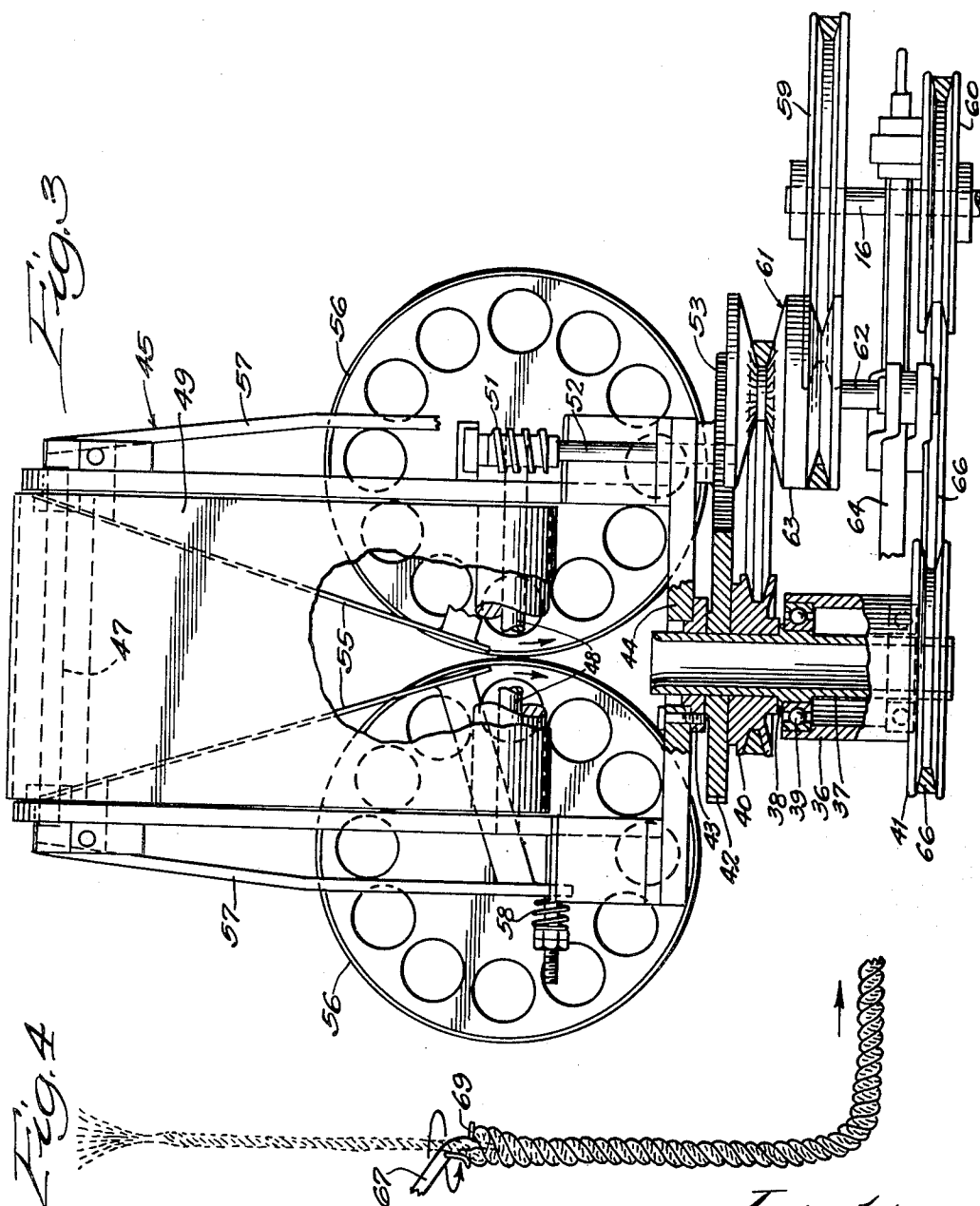
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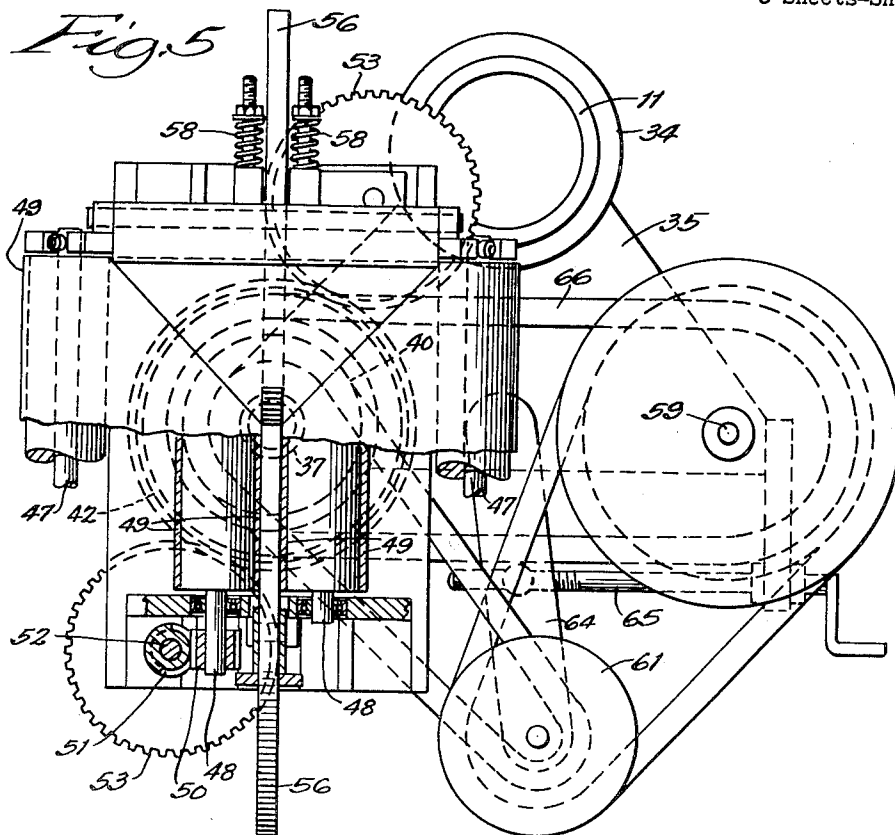
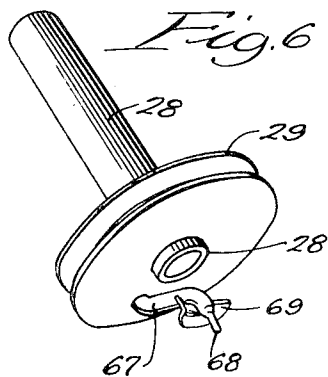
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FIBER SPINNING APPARATUS AND METHOD

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UNITED STATES PATENT OFFICE

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FIBER SPINNING APPARATUS AND METHOD

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18 Claims. (Cl. 57—23)

1 This invention relates to fiber spinning apparatus and to a fiber spinning method. The invention is particularly applicable and useful in connection with the spinning of hair into a twisted rope structure.

It has been the practice for many years to form hair, such as hog, cattle, and other hair, etc., by hand into long strands, to twist the strands to form tight coils, and then to subject the coiled material while secured in coiled form to certain treating operations which give the hair a curled or twisted set. The process is laborious, expensive, and requires highly skilled employees. Even with a high degree of skill, the twisted body is often dropped or broken and the entire spinning job has to be redone.

An object of the present invention is to provide a new means and method for performing the spinning operation so that greater accuracy can be obtained and a more uniform product produced. A further object is to provide means for spinning the product with a high rate of output and with a better quality product as regards the twisting or set given to the hair fiber. Other specific objects and advantages will appear as the specification proceeds.

The invention is illustrated in connection with specific apparatus shown in the accompanying drawings, in which—

Figure 1 is a perspective view of apparatus embodying our invention; Fig. 2, an enlarged side view of a portion of the rotatable hopper structure; Fig. 3, a front view in elevation of a portion of the hopper structure and the drive means therefor; Fig. 4, a side view in elevation of the fiber in the process of being formed into a fiber strand and then being coiled; Fig. 5, a top plan view, a portion of the apparatus being broken away to show a belt drive mechanism in section; and Fig. 6, a perspective view of the coiling device employed.

In the illustration given, 10 designates a base having a tubular collar receiving a standard 11. The standard 11 carries near its bottom a collar 12 on which is mounted a bracket 13 supporting the motor 14.

The collar 12 also supports a bearing plate 15 in which is rotatably mounted a drive shaft 16. Mounted upon plate 15 also is a supporting member 17 on which is rotatably mounted a take-off wheel 18. The motor 14 drives shaft 16 by means of the belt 19 which engages a pulley 20 on the motor shaft and pulley 21 on the drive shaft.

The standard 11 is provided with a second fixed collar 22 provided with a plate 23. The plate 23

2 provides a bearing for the drive shaft 16 and is equipped with an outwardly-extending bracket 24. A pivoted arm 25 provides a bearing for the pulley 26, and a screw handle 27 provides a means for adjustably moving the support for the pulley. A coiling tube 28 provided with a pulley 29 is rotatably mounted in a sleeve bearing 30 affixed to the support plate 23. The pulley 26 is carried by a shaft provided with another pulley 32, and the latter pulley is driven by a belt 33 engaging a pulley carried by the drive shaft 16. Thus the drive shaft 16 drives pulley 22 and thereby pulley 26 while pulley 26, in turn, drives through belt 31 the pulley 29.

Above collar 22 on standard 11 is a top collar 34 provided with a laterally-extending plate 35. Upon plate 35 is mounted by suitable bearings, rotatable mechanism for supporting a hopper together with drive means for the rotatable structure. The plate 35 is preferably formed integrally with a bearing casing 36, as shown more clearly in Fig. 2. Within the bearing casing 36 is mounted a rotatable tube 37 having an integral flange 38 resting upon the bearing 39. The tube 37 is provided at its upper side with a rotatable pulley 40 and at its lower end with a fixed pulley 41. Fixed upon the pulley 40 is a gear 42. Above the gear 42 and fixed upon tube 37 is a flange 43. The flange 43 secured to the shaft 37 is secured by screws or other means within the bottom wall 44 of the rotatable hopper 45.

The rotatable hopper 45 may be of any suitable construction and formed of any suitable materials. Its purpose is to receive fibers and to feed them downwardly and inwardly to form a strand, the strand being twisted to provide a rope-like body at the point of exit from the hopper. In the illustration given, the hopper comprises a frame 46, somewhat V-shaped in contour and upon which are mounted the upper rollers 47 and the lower rollers 48. The rollers 48 carry belts 49 which feed the hair inwardly toward a central point. The shafts or rollers 48 are preferably provided with worm gears 50 driven by the vertical worms 51. The worm 51 is mounted upon a shaft 52 fixed at its bottom to a gear 53 mounted on the shaft. The shaft 52 is rotatably mounted within the bottom wall 44 of the hopper, and the gear 53 meshes with the drive gear 42 of tube 37.

The hopper, in addition to having the inwardly-inclined belts 49 for drawing the fibers downwardly toward a central point, has inwardly-turned side walls 55 which direct the fiber toward a central point in the hopper. The side walls or slide plates 55 are slotted to receive the two nar-

row spring-loaded wheels 56, shown best in Figs. 1, 2 and 3. The wheels 56 are rim-driven through friction with the feed belts 49, as shown best in Figs. 2 and 5. The wheels are guided between the spaced metal straps 57 which are supported by springs 58, as shown more clearly in Figs. 1 and 2. It will be understood that the wheels 56 may be driven by any other suitable means.

Any suitable means for driving the tube 37 may be employed. In the illustration given, the drive shaft 16 is provided at its top with a pulley 59 and spaced therebelow with a second pulley 60. A change speed pulley 61 is mounted on an auxiliary shaft 62. The change speed pulley 61 is provided with a shiftable inner pulley member 63 which may be moved laterally to change the speed ratio between the pulley 59 and the pulley 40 rotatable on shaft 37. Since this structure is well known, a detailed description is believed unnecessary. The shaft 61 is mounted upon a pivotally-supported arm 64, and the arm 64 is adjustable by means of the handle-equipped screw member 65, as shown more clearly in Figs. 3 and 5. Pulleys 41 and 60 are connected by belt 66.

The coiling structure may be of any suitable form or construction. In the illustration shown best in Fig. 6, we provide a horn 67 secured to one side of the pulley 29 and extending inwardly into alignment with the hollow shaft 28. The horn 67 is provided with a downwardly-extending tip or projection 68. Above the tip 68 is an inclined vane 69 which aids in the removal of the coiled rope as it is being formed upon the horn 67.

Any suitable means for feeding the hair or other fibers to the hopper may be employed. In the illustration given, we provide simply an inlet chute 70. It will be understood that the chute or delivery pipe may lead from any suitable device from which fibers are delivered in separated condition for feeding to the machine. For example, if desired, the hair may be supplied to a fiber device equipped with card and brush rolls of well known construction which will deliver properly combed hair in separated condition for feeding to the spinning machine. The hair will then be guided down a pipe or chute 70 to the hopper. It is important that the hair be delivered in separated condition and not in clumps to the rotating hopper.

Operation

In the operation of the machine, the separated fibers are delivered at a desired rate through pipe 70 to the rotating hopper 45. The hopper, with its arrangement of two belts and the two gathering plates or sides, forms in effect an equal-sided pyramid with the apex downward. The belts are driven by the main drive shaft through the pulley 59, intermediate pulley 61, and the gear-equipped pulley 40. The worms are driven by the gears 53 and drive gear 42. The drive gear 42 drives the shaft gears 53 by virtue of relative rotation of the drive gear with respect to the rotation of the frame carrying the feed belts.

The feed hopper is driven by tube 37 equipped with the pulley 41. It will be understood that the feed hopper may be rotated at various speeds depending upon the material being fed to it and the diameter of the rope to be made. For example, the feed hopper may be rotated at 500 revolutions per minute or more at a strand rate of $\frac{3}{8}$ " to $\frac{1}{2}$ " per revolution depending on the diameter of the rope made.

The hair, fed downwardly by the belts and compacted through the action of the side plates and further by the rimmed ribbon wheels 56,

is formed by the twisting action of the hopper into a tightly compacted strand. This strand passes through the rotating coil means 67 and is thereupon coiled tightly into the form shown in Fig. 4—a coiled rope.

The speed of rotation of the hopper which in a typical case might be 500 R. P. M., imparts not only the total twist to form the fibers into a strand, but also provides the additional revolutions to form the strand into a coiled rope. The allocation of the twisting action between strand formation and coil formation is governed, however, by the speed of rotation of coiling means 67; that is, the coiling means controls to what degree the twisting action is dissipated in coiling the strand as a whole rather than in twisting the individual fibers into the strand.

A familiar analogy to this division of twist between strand and coil is the behavior of a rubber band when it is extensively twisted. It will be recalled that after it has been twisted a large number of times, such a rubber band exhibits a tendency to form coils rather than to tighten further the twisting of the individual strand. That action occurs with the present invention, and the number of coils formed per unit length in the rope which is the end product of the operation of our machine is governed by the speed of rotation of coiling member 67, it being assumed that the rate at which the rope is passed under the guide roller 18 is constant. Thus, while the coiling member 67 does not, in the strict sense, accomplish any twisting action in its own right, it does play an important role in governing the characteristics of the rope produced by our machine. Normally a very tightly coiled rope is desirable, and, in that event, it is desirable to rotate member 67 at a fairly substantial rate of speed, such as 40 to 60 R. P. M. After the rope has been formed by our machine and has passed under guide roller 18, it may be carried to any desired destination; usually it will be wound on a spool or spindle. It will of course be understood that the means employed to carry the rope onward from guide roller 18 must not place the rope under heavy tension, since proper formation of a coiled rope by the coiling member 67 requires that the tension on the strand below member 67 be less than that existing above it.

Details of operation may vary according to the type of hair being fed to the machine; this may affect the optimum speed of rotation of both the hopper and the coiling member.

In the operation of our machine, we have found that the vane and horn of the coiling means provide uniform tension on the twisted hair strand above. If desired, supplemental tension-maintaining means, such as a pair of feed pulleys mounted on the top of the coiling means and rotating with it, may be employed.

While the apparatus illustrated shows mechanism for changing the relative speed of the various driven parts, it will be understood that any suitable devices for this purpose may be employed so that the speeds of the various operative devices may be widely varied to meet the requirements of different types of fibers, etc.

Heretofore in hand spinning, it has been considered impossible to spin uniform rope from hog hair. In order to form such a rope, it has been necessary to add to the hog hair at least 10% of other hair, such as cattle hair. The new machine permits the spinning of 100% hog hair, while at the same time producing a much more

uniform rope and one of higher grade. The apparatus permits the spinning of all grades of hair from 100% hog hair to 100% cattle or horse mane, together with any desired proportions of the foregoing fibers or similar fibers.

While in the foregoing specification, we have described the apparatus and steps of the process in considerable detail for the purpose of illustrating one embodiment of the invention, it will be understood that such details may be varied widely by those skilled in the art without departing from the spirit of our invention.

We claim:

1. In fiber spinning apparatus, a frame, a hopper mounted therein, means for rotating a portion of the fibers in the hopper to form a fiber strand, and means for rotating the strand at a different rate of rotation to the rate of rotation of said hopper to form said strand into a rope body.

2. In fiber spinning apparatus, a frame, a hopper rotatably mounted therein, means for rotating said hopper to form a fiber strand, and means disposed below said hopper for rotating the fiber strand at a rate of rotation slower than that of said hopper to twist said strand into a rope-like structure.

3. In fiber spinning apparatus, a frame, a hopper rotatably mounted therein, means for rotating said hopper to form a fiber strand, and means disposed below said hopper for rotating the fiber strand at a rate of rotation slower than that of said hopper to form said strand into a rope-like structure having a spiral shape.

4. In fiber spinning apparatus, a frame, a hopper rotatably mounted thereon and adapted to receive hair, means within said hopper for feeding said hair downwardly toward a restrictive exit, and means below said exit for receiving said hair and resisting the rotation thereof by said hopper to form a twisted strand of said hair.

5. In fiber spinning apparatus, a frame, a hopper rotatably mounted thereon and adapted to receive hair, means within said hopper for feeding said hair downwardly toward a restrictive exit, and means below said exit for receiving said hair and resisting the rotation thereof by said hopper to form a twisted strand of said hair, and an eccentrically-mounted horn member mounted intermediate said hopper and said resisting means for engaging said strand and forming the same into a spiral body.

6. In fiber spinning apparatus, a frame, a hopper rotatably mounted thereon, and adapted to receive fibers, belt means within said hopper for feeding said fibers downwardly, guide means cooperating with said belts for directing said fibers toward a central narrow exit, and means below said exit for receiving the fiber strand thus formed and resisting the rotation of said strand by said hopper to form a twisted rope-like structure of said fibers.

7. In fiber spinning apparatus, a frame, a hopper rotatably mounted thereon and adapted to receive fibers, wheel means oppositely disposed to each other for guiding fibers within a compact strand at the point of exit from said hopper, and means below said exit rotating at a lower speed than said hopper for receiving said strand and forming with said hopper a twisted rope of said fibers.

8. In hair spinning apparatus, a frame, a hopper rotatably mounted on said frame and adapted to receive hair, a pair of inwardly-inclined belts for guiding the hair downwardly toward the bot-

tom of said hopper, gathering plates extending inwardly between the belts to guide the hair toward a central part of the hopper, rotatably-mounted wheels extending through slots in said

gathering plates and being driven for feeding the hair from the exit of said hopper, means for rotating said hopper, means for rotating said belts, and means below said hopper and driven at a different rate of rotation for forming into a coiled rope the strand of hair leaving said hopper.

9. In hair spinning apparatus, a frame, a hopper rotatably mounted on said frame and adapted to receive hair, a pair of inwardly-inclined belts for guiding the hair downwardly toward the bottom of said hopper, gathering plates extending inwardly between the belts to guide the hair toward a central part of the hopper, rotatably-mounted wheels extending through slots in said gathering plates and being rim-driven by said belts for feeding the hair from the exit of said hopper, means for rotating said hopper, means for rotating said belts, and means below said hopper and driven at a different rate of rotation for forming into a coiled rope the strand of hair leaving said hopper, said last-mentioned means including a laterally-extending horn.

10. In fiber spinning apparatus, a frame, means for forming fiber into a twisted strand, and means receiving said twisted strand and adapted with a laterally-extending horn engaging said strand and rotating the same to form a spiral rope of said strand.

11. In fiber spinning apparatus, a frame, means for forming fiber into a twisted strand, and means receiving said twisted strand and provided with a laterally-extending horn engaging said strand and rotating the same to form a spiral rope of said strand, said last-mentioned means including a guide vane for removing the spiral rope from said horn as new spirals are formed.

12. In fiber spinning apparatus, mechanism for forming a fiber strand, and a rotatably-mounted member apertured to receive said strand, said rotatably-mounted member being provided on its underside with a horn extending inwardly into axial alignment with the aperture of said member, said horn having a downwardly-extending tip portion in alignment with the aperture of said member.

13. In fiber spinning apparatus, mechanism for forming a fiber strand, and a rotatably-mounted member aperture to receive said strand, said rotatably-mounted member being provided on its underside with a horn extending inwardly into axial alignment with the aperture of said member, said horn having a downwardly-extending tip portion in alignment with the aperture of said member, said horn being provided with a spiral guide forcing the coiled material gathering on the end of said horn off the end of said horn.

14. In combination, means for receiving fibers and forming a central fiber strand, a rotatably-mounted member equipped with an inwardly-extending horn for receiving the strand to form the same into a spiral rope, and means for rotating said rotatable member.

15. In combination, a frame, a rotatably-mounted hopper for receiving fibers and forming a fiber strand, and a rotatable member mounted in said frame at a spaced distance from said hopper and adapted to receive said strand, said rotatable member being equipped with an inwardly-extending horn member adapted to en-

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gage said strand and to form the same into a spiral rope.

16. In a process for spinning fibers, the steps of gathering fibers and rotating them to form a strand, and gathering the strand at another point and rotating it at a different speed of rotation to form said strand into a coiled rope. 5

17. In a process for spinning fibers, the steps of converging fibers into a narrow strand while twisting the strand and advancing the same, engaging the rotating strand as it advances and rotating the same strand at a slower speed of rotation to turn the twisted strand upon itself to form a spiral rope. 10

18. In a process for spinning hair into rope 15 form, the steps of collecting separated hair substantially free of clumps in a body, advancing the body to form a constricted fiber strand, rotating the strand while advancing the same, and forming the strand into a spiral body as it advances, said spiral-forming step being at a slower rate of 20

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rotation than said first-mentioned rotation of said hair strand.

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