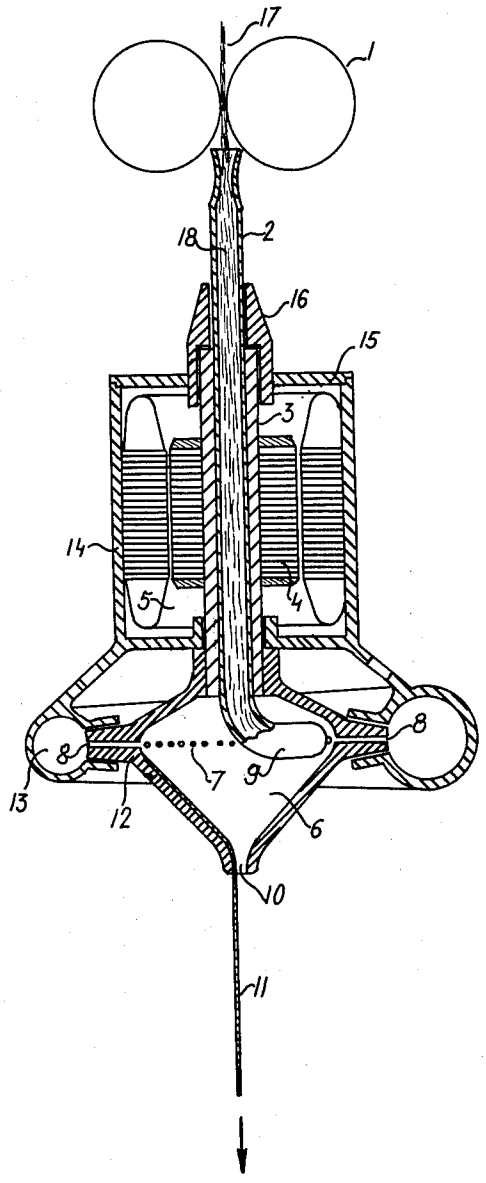
March 31, 1964 L. ČÍŽEK ET AL 3,126,697

APPARATUS FOR CONTINUOUS SPINNING OF FIBROUS TEXTILE MATERIALS

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FIG. 1.



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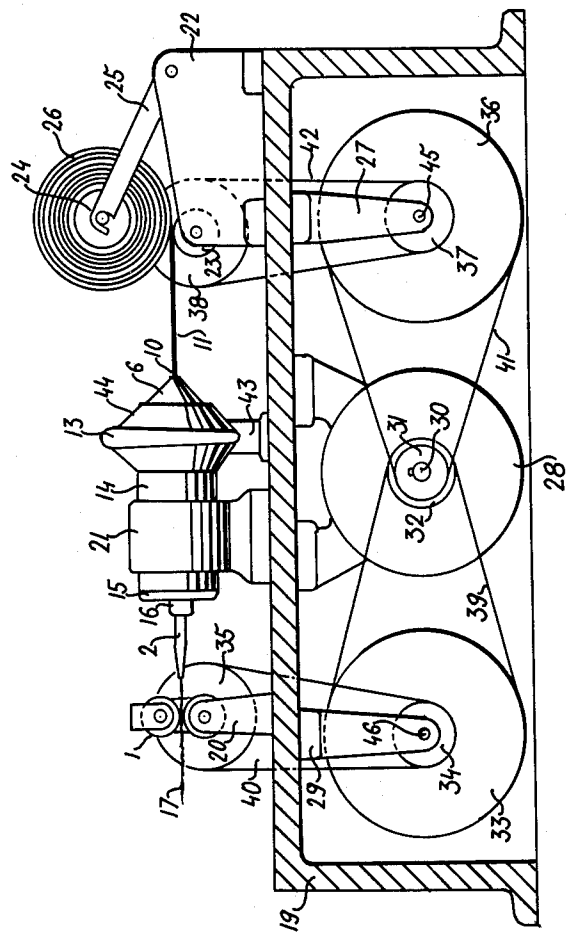


FIG. 2.

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APPARATUS FOR CONTINUOUS SPINNING OF FIBROUS TEXTILE MATERIALS

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The present invention relates to spinning apparatus for continuous spinning of fibrous textile materials. More particularly the invention relates to an arrangement for spinning fibrous materials of the type utilizing a rotary spinning chamber and a feed or spinning tube opening into the spinning chamber and through which fibrous material is drawn to the collecting surface of the spinning chamber by reduced pressure or a pressure lower than atmospheric pressure, the said collecting surface of the spinning chamber being provided with suction holes communicating with channels for sucking air from the spinning chamber, and the fibrous material being spun in the spinning chamber and removed therefrom in the form of yarn.

A principal object of the present invention is to provide new and improved spinning apparatus requiring no external source for creating the reduced pressure.

An object of the invention is to provide a spinning arrangement which provides yarn of the desired quality from fibrous materials.

Another object of the invention is to provide a spinning arrangement which provides yarn from fibrous material, the yarn having great strength and high uniformity.

Known devices for the continuous spinning of fibrous materials of the type utilizing a spinning chamber have not yet been exploited industrially to a large extent because they cannot supply yarn of the desired quality. The principal drawback is non-uniformity; that is, the fibers are not aligned in the spinning chamber in the necessary and satisfactory parallel relationship before being twisted into yarn.

One of the new methods employed in continuous spinning arrangements of the above-mentioned type is pneumatic spinning which transports fibrous material as single fibers or groups thereof by means of air into a spinning chamber, tube or nozzle. The mixture of fibers and air passes into the spinning chamber through a stationary or rotary tube. An air stream produced by pressure difference brings the fibers into the rotary spinning chamber.

In a device of this type disclosed in United States Patent No. 2,808,697, the fibrous material is sucked on to the perforated largest circumference of the spinning tube, the so-called collecting surface, and it is then removed from this surface and twisted into yarn. The necessary reduced pressure for transporting the fibrous material at the required speed has to be created by a separate source for creating reduced pressure. This source for creating reduced pressure or pressure lower than atmospheric pressure has to be relatively strong, taking into account the losses caused by pessure leakage in the system.

Another known device employs ventilator blades provided on the spinning chamber to create the required reduced pressure. A disadvantage of this device resides in the fact that the speed of the spinning chamber is limited to a certain value determined by unbalance of the rotating mass. Construction, manufacture and operation of such a device is rather difficult and its dimensions are inconvenient.

The aforementioned disadvantages and drawbacks are eliminated in the spinning apparatus of the invention.

In accordance with one feature of the present invention, the spinning apparatus comprises a rotary spinning

housing forming a spinnnig chamber and rotating about its axis. The rotary spinning chamber has an inwardly directed collecting surface facing the axis of rotation and formed with a plurality of suction holes communicating with channels. The rotary spinning chamber has an inlet and an outlet opening formed therethrough.

A feed or spinning tube opens into the spinning chamber through the inlet opening. The spinning tube has coveniently a substantially elongated portion extending through the inlet opening into the rotary spinning chamber and it is also conveniently terminated by a nozzle-shaped end portion positioned in the rotary spinning chamber directed against the collecting surface and opening in the area of the suction holes in the collecting surface. Fibrous material is fed into the spinning chamber by a feed device. The channels associated with the collecting surface are so dimensioned and formed that during rotation of the spinning chamber a reduced pressure or pressure lower than the atmospheric pressure, is produced at the beginning of the spinning tube where the latter joins the feed device of the fibrous material.

Air is sucked through the suction holes and channels from the rotary spinning chamber while the latter rotates, and the fibrous material fed into the spinning tube is drawn out thereof into the spinning chamber and into contact with the collecting surface. A relative rotation between the rotary spinning chamber and the spinning tube can be created. The fibrous material is spun after it has been drawn into the spinning chamber. The spun fibrous material is removed in the form of yarn from the collecting surface through the outlet opening of the rotary spinning chamber.

The reduced pressure created at the beginning of the spinning tube is preferably 10 to 100 mm. of a water column, and it can be adjusted in accordance with requirements by suitably selecting the dimensions of the various construction elements of the apparatus, more particularly of the spinning chamber, spinning tube, suction holes and suction channels, and the like, for example by suitably selecting the diameter of the spinning chamber, the number of the channels and their cross-section.

The beginning of the feed or spinning tube which joins the device for feeding the fibrous material into the spinning chamber may be preferably flattened or narrowed.

The spinning chamber may be located in a spiral housing for leading away the air.

One of the advantages of the apparatus of the present invention resides in the fact that the pressure or suction air which is produced by rotation of the chamber itself without any external reduced pressure source, for example, a ventilator, may also be exploited for various other purposes. The apparatus in accordance with the invention which does not require a special source for creating the necessary reduced pressure is substantially simpler than known devices of this type.

In order that the invention may be best understood and readily carried into effect, it will now be described with reference to the accompanying drawings, wherein

FIG. 1 is a longitudinal section of an embodiment of the spinning apparatus of the present invention; and

FIG. 2 is a view of spinning apparatus showing the drive and the winding on device.

Like elements in both figures are referred to by like reference numbers.

Referring now more particularly to FIG. 1, it is seen that the apparatus of the present invention for continuous spinning of fibrous materials in accordance with the invention consists of a device for supplying the fibrous material to be spun into a spinning tube. This supply or feed device includes a pair of supply rollers or cylinders 1. The supply device is followed by a spinning tube 2

which passes through a hollow shaft 3 of a rotor 4 of an electromotor 5.

In the illustrated example, the spinning tube 2 is terminated by a bent end 9 which opens into a spinning chamber 6. The elongated and bent end portion of the spinning tube 2 extends through an inlet opening of the spinning chamber 6. The spinning tube has at one end an input opening which is flattened to a narrowed configuration. The spinning tube has at its other or opposite end a nozzle-shaped end portion outlet opening positioned in the rotary spinning chamber directed against the collecting surface 7 of the spinning chamber, and opening in the area of the suction holes at the beginning of the suction channels 8.

The rotary spinning chamber 6 in the illustrated example is a rotational body mounted on the hollow shaft 3 and is formed by the envelopes of two cones with a common base. The collecting surface 7 is arranged at the place of the largest inner diameter of the spinning chamber. As already stated, the collecting surface communicates with suction channels 8 through suction holes. The described and illustrated shape of the collecting chamber may be modified in various manners, it may be, for example, cylindrical. The spinning chamber 6 is further provided with an outlet opening 10 through which the spun yarn is expelled from the spinning chamber.

The channels 8 are provided through the widened wall 12 of the rotary spinning chamber 6 and they open into a spiral chamber 13 provided with a non-illustrated outlet. The channels 8 may be arranged radially, or in different directions and non-parallel with the axis of rotation of the spinning chamber 6. It may be seen from FIG. 1 that the collecting surface 7 may be annular and covered by an annular portion or wall 12. The spiral chamber 13 is connected with a cover 14 of an electromotor 5. The cover 15 of the front bearing of this electromotor 5 is provided with a lug 16 to which is attached the feed or spinning tube 2.

It can be seen from the drawing that in this illustrated example a substantially conical portion of the chamber 6 extends from the annular portion 12 to the inlet opening on one side of the said annular portion, and another substantially conical portion extends from the said annular portion to the outlet opening on the other side of said annular portion 12.

Although the elongated end portion 9 of the spinning tube has been shown as bent, it should be understood that this is only a preferred embodiment which may be modified in various ways; the elongated end portion may also be straight. For good operation of the device, the elongated end should extend close to the collecting surface of the spinning chamber 6. However, the spinning tube may terminate at the entrance into the spinning chamber.

The spiral casing 13, the suction holes and suction channels 8 function to suck air through the suction holes from the rotary spinning chamber 6 so as to draw the fibrous material fed into the spinning tube 2 through the nozzle-shaped end portion 9 of the spinning tube into the spinning chamber and into contact with the collecting surface 7.

The various values, such as the diameter of the rotary spinning chamber 6 and its speed of rotation are preferably in a set ratio to the cross-section of the channels 8 and to the length and to the number of said channels so that the rotation of the spinning chamber 6 creates at the opening of the spinning tube 2 in said spinning chamber a lower than atmospheric pressure or reduced pressure within the range from 10 to 100 mm. of a water column, preferably 30 mm. For example, a spinning chamber rotating at a speed of 20,000 revolutions per minute is provided with 70 channels with a diameter of 1 mm. and a length of 7 mm. The diameter of this spinning chamber is 40 mm. In another spinning chamber with a diameter of 30 mm. rotating at a speed of 30,000 revolutions per minute, the length of the channels is 8 mm., their diameter being 0.8 mm., and their number being 70.

Other constructions and modifications are of course possible within the scope of the invention, but in any case it is necessary to meet the condition that a reduced pressure of 10 mm. has to be reached.

In FIG. 1, the fibrous material supplied into the spinning tube 2 by the rollers 1 is designated by the reference number 17. The electromotor 5 may be an A.C. motor of the normal type operating at a frequency higher than 50 cycles.

The device can be arranged in such a manner that the circumferential speed of the collecting surface 7 with the suction holes and the channels 8 for leading away the suction air is larger than the rate of flow of air current in the spinning tube 2. The rate of flow of air current in the spinning tube 2 may also be larger than the rate at which the fibrous material is supplied, this rate being determined by the circumferential speed of the pair of supply rollers or cylinders 1.

The spinning arrangement of the present invention operates in the following manner:

Rotation of the spinning chamber 6 with the channels 8, which are suitably dimensioned, as stated hereinbefore in the two examples illustrated, creates in the spinning chamber a reduced pressure which produces an air current in the spinning tube 2. The fibrous material 17 or fibers are supplied to the spinning arrangement by feed rollers 1. After being released from the grip of these rollers, the fibers are carried by the air current and transported in dispersed condition 18 through the nozzle-shaped end portion directly to the collecting surface 7 of the spinning chamber 6.

Due to the fact that the spinning tube 2 is flattened or narrowed at its inlet end, the air current is increased at this place, and this secures better separation of the various individual fibers. The fact that the nozzle-shaped end portion of the spinning tube 2 opens on the collecting surface 7, for example, in a bent configuration as shown in FIG. 1 in the direction of rotation of the rotary spinning chamber, or radially on said collecting surface, insures that the fibers are positioned on the collecting surface 7 in one direction. Thus a great number of parallel fibers is obtained.

The parallel arranged spun fibers are then drawn from the collecting surface 7 in the form of yarn 11, in a known manner, and they are finally removed from the spinning chamber through the outlet opening 10. The yarn 11 is then reeled on a winding up device, shown in FIG. 2. The suction air created by rotation of the spinning chamber 6 is drawn away by the spiral casing 13.

Although in the illustrated example of an embodiment of the invention, the spinning chamber is driven by an electromotor, another suitable type of driving device may equally be used, for example, a driving belt and the like.

FIG. 2 is a view of the spinning apparatus with the drive and the winding-on device. In the apparatus shown in FIG. 2, the various components are arranged on and inside a housing 19. A holder 20 for the supply rollers or cylinders 1 and a pulley 35 are fastened to the top of the housing 19. Another holder 21 is provided for the cover 14 with a bearing cover 15 fitted with a lug 16 for supporting the spinning tube 2. Connected to the cover 14 is the spiral casing 13 with an exhaust branch 43 and a front cover 44 from which projects the spinning housing 6 with the outlet opening 10 for the delivery of the yarn 11.

There is also provided a winding-on device 22, and a driving and distributing cylinder 23, a holding down arm 25, a roll 24 which carries the wound up material 26, and a driving pulley 38. Inside the housing 19 is an electromotor 28 and holders 27 and 29 for shafts 45 and 46. Pulleys 31, 32 are mounted on motor shaft 30, pulleys 36, 37 are mounted on shaft 45, and pulleys 33, 34 are

mounted on shaft **46**. The driving belts are designated with the reference numbers **39**, **40**, **41** and **42**.

The apparatus illustrated in FIG. 2 is driven by the electromotor **28**. The driving moment of this motor is transferred from the motor shaft **30** through pulley **32**, belt **39**, pulley **33**, shaft **46**, pulley **34** and belt **40** to the pulley **35** of the supply or feed rollers **1**, further through pulley **31**, belt **41**, pulley **36**, shaft **45**, pulley **37** and belt **42** to the pulley **38** of the driving and distributing cylinder **23** of the winding device **22**.

It should be noted from FIG. 1 that the spinning chamber is driven by a separate electromotor placed inside the cover **14**. The fibrous material is supplied by supply cylinders **1** to the spinning tube **2**, and the fibers are drawn through this tube to the spinning chamber by means of the air current generated by the spinning chamber itself, while it is being rotated, due to the proper construction and length of the channels **8**, as explained with reference to FIG. 1. In the spinning chamber, the fibrous material is positioned in the aforedescribed manner, and after having been spun into twisted yarn, it is removed through the outlet opening **10** to the winding-on device **22**. The driving and distributing cylinder **23** distributes the yarn **11** on the wound on material **26** held down by the arm **25**.

Without further explanation, the aforegoing description of an embodiment of the present invention reveals, so fully the main features of the invention that others, skilled in the art, may by merely applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention. Such adaptations should and are therefore intended to be comprehended within the meaning and range of equivalence of the following claims.

What we claim is:

1. In a spinning arrangement, in combination,
a rotary spinning chamber rotating about its axis, said rotary spinning chamber having an inwardly directed annular collecting surface facing said axis and formed with a plurality of suction holes therein communicating with suction channels passing through the wall of said spinning chamber, and said rotary spinning chamber having an inlet opening and an outlet opening formed therethrough and communicating with the outer space;
a spinning tube extending through said inlet opening into said rotary spinning chamber and facing said collecting surface;
means for feeding fibrous material into said spinning tube;
said suction channels being dimensioned so as to create a reduced pressure in the spinning tube while the spinning chamber is rotating so as to draw said fibrous material fed into said spinning tube through said tube into said spinning chamber and into contact with said collecting surface;
means for creating relative rotation between said rotary spinning chamber and said spinning tube thereby spinning said fibrous material after it has been drawn into said spinning chamber; and
means for removing said thus-spun fibrous material in the form of yarn from said collecting surface and through said outlet opening of said rotary spinning chamber.

2. In a spinning arrangement, in combination,
a rotary spinning chamber rotating about its axis, said rotary spinning chamber having an inwardly directed collecting surface facing said axis and formed with a plurality of suction holes therein, and said rotary spinning chamber having an inlet and an outlet opening formed therethrough and communicating with said rotary spinning chamber;
a spinning tube opening into said rotary spinning chamber having at one end an input opening and at its other end an outlet opening positioned in said rotary spinning chamber directed against said collecting surface and opening into the area of said suction holes in said collecting surface, said input opening being flattened to a narrow configuration;
means for feeding fibrous material into the input opening of said spinning tube;
suction channels communicating with said suction holes on said collecting surface and extending through the wall of said spinning chamber for sucking air through said suction holes from said rotary spinning chamber so as to draw said fibrous material fed into the spinning tube through the outlet opening into the spinning chamber and into contact with said collecting surface;
means for creating relative rotation between said rotary spinning chamber and said spinning tube thereby spinning said fibrous material after it has been drawn into said spinning chamber; and
means for removing said thus-spun fibrous material in the form of yarn from said collecting surface through said outlet opening of said rotary spinning chamber.

3. In a spinning arrangement, as claimed in claim 2, wherein the end portion of the said spinning tube facing said collecting wall is nozzle-shaped.

4. In a spinning arrangement, in combination,
a rotary spinning chamber rotating about its axis and having an inwardly directed annular collecting surface facing said axis and formed with a plurality of suction holes therein, and said rotary spinning chamber having an inlet opening and an outlet opening formed therethrough and communicating with said rotary spinning chamber;
a spinning tube having a substantially elongated portion extending through said inlet opening into said rotary spinning chamber, said spinning tube having at one end an input opening and at its opposite end a nozzle-shaped end portion outlet opening positioned in said rotary spinning chamber directed against said collecting surface and opening in the area of said suction holes in said collecting surface, said input opening being flattened to a narrow configuration and said nozzle-shaped end portion extending close to the collecting surface;
roller means for feeding fibrous material into the input opening of said spinning tube;
suction channels communicating with said suction holes in said collecting surface and extending through the wall of said spinning chamber for sucking air from said rotary spinning chamber and so dimensioned that a reduced pressure is created in the said suction tube while the said rotary spinning chamber rotates, so as to draw said fibrous material fed into said spinning tube through said nozzle-shaped end portion thereof into said spinning chamber and into contact with said collecting surface;
means for creating relative rotation between said rotary spinning chamber and said spinning tube thereby spinning said fibrous material after it has been drawn into said spinning chamber; and
means for removing said thus-spun fibrous material in the form of yarn from said collecting surface through said outlet opening of said rotary spinning chamber.

5. In a spinning arrangement, in combination,
a rotary spinning chamber rotating about its axis, said rotary spinning chamber having an inwardly directed annular collecting surface facing said axis and formed with a plurailty of suction holes therein, and said rotary spinning chamber having an inlet opening and an outlet opening formed therethrough and communicating with said rotary spinning chamber, said rotary spinning chamber having a configuration

tapering down from an annular portion covering the annular collecting surface of said spinning chamber to said inlet opening on one side, and to said outlet opening on the other side thereof;

a spinning tube having a substantially elongated portion extending through said inlet opening into said rotary spinning chamber and having a nozzle-shaped end portion positioned in said rotary spinning chamber directed against said collecting surface and opening in the area of said suction holes in said collecting surface;

means for feeding fibrous material into said spinning tube;

suction channels communicating with said suction holes in said collecting surface and extending through the wall of said spinning chamber for sucking air from said rotary spinning chamber and so dimensioned that a reduced pressure is created in said suction tube while said rotary spinning chamber rotates, so as to draw said fibrous material fed into said spinning tube through said nozzle-shaped portion thereof into said spinning chamber and into contact with said collecting surface;

means for creating relative rotation between said rotary spinning chamber and said spinning tube thereby spinning said fibrous material after it has been drawn into said spinning chamber; and

means for removing said thus-spun fibrous material in the form of yarn from said collecting surface through said outlet opening of said rotary spinning chamber.

6. In a spinning arrangement, in combination,

a rotary spinning chamber rotating about its axis, said rotary spinning chamber having an inwardly directed annular collecting surface facing said axis and formed with a plurality of suction holes therein, and said rotary spinning chamber having an inlet opening and an outlet opening formed therethrough, said rotary spinning chamber having an annular portion covering the annular collecting surface of said spinning chamber, a substantially conical portion extending from said annular portion to said inlet opening on one side of said annular portion, and a substantially conical portion extending from said annular portion to said outlet opening on the other side of said annular portion,

a spinning tube having a substantially elongated portion extending through said inlet opening into said rotary spinning chamber and having a nozzle-shaped end portion positioned in said rotary spinning chamber directed against said collecting surface and opening in the area of said suction holes in said collecting surface;

means for feeding fibrous material into said spinning tube;

suction channels communicating with said suction holes in the collecting surface and extending through the wall of said spinning chamber and so dimensioned that a reduced pressure is created in said suction tube while said spinning chamber rotates, so as to draw said fibrous material fed into said spinning tube through said nozzle-shaped portion thereof into said spinning chamber and into contact with said collecting surface;

means for creating relative rotation between said spinning chamber and said spinning tube thereby spinning said fibrous material after it has been drawn into said spinning chamber; and

means for removing said thus-spun fibrous material in the form of yarn from said collecting surface through said outlet opening of said rotary chamber.

7. In a spinning arrangement, as claimed in claim 6, said means for creating relative rotation between said rotary spinning chamber and said spinning tube comprising a hollow shaft on which is mounted said rotary spinning chamber and through which extends said spinning tube which is stationary.

8. In a spinning arrangement, in combination,

a rotary spinning chamber rotating about its axis having an inwardly directed collecting surface facing said axis and formed with a plurality of suction holes therein, said rotary spinning chamber having an inlet opening and an outlet opening formed therethrough and communicating with said rotary spinning chamber, said rotary spinning chamber having a configuration tapering down from the central portion covering said collecting surface of said spinning chamber to said inlet opening on one side and to said opening on the other side thereof;

a spinning tube opening into said rotary spinning chamber, said spinning tube having at one end an input opening and at its opposite end an end portion outlet opening positioned in said rotary spinning chamber, said input end of said spinning tube being flattened to a narrow configuration;

means for feeding fibrous material into the input opening of said spinning tube;

suction channels communicating with said suction holes in the collecting surface and extending through the wall of said spinning chamber and so dimensioned that while the said spinning chamber rotates, a reduced pressure is created in said spinning tube so as to draw said fibrous material fed into said spinning tube through the outlet opening thereof into said spinning chamber and into contact with said collecting surface;

means for creating relative rotation between said spinning chamber and said spinning tube thereby spinning said fibrous material after it has been drawn into said spinning chamber; and

means for removing said thus-spun fibrous material in the form of yarn from said collecting surface through said outlet opening of said rotary spinning chamber.

9. In a spinning arrangement, in combination,

a rotary spinning chamber with an inwardly directed collecting surface facing the axis of rotation of said spinning chamber and an inlet and an outlet opening formed therethrough;

a spinning tube opening into said rotary spinning chamber and having an elongated portion extending through said inlet opening in the said spinning chamber;

means for feeding fibrous material into said spinning tube;

suction channels communicating with suction holes provided on the inwardly directed surface of said spinning chamber so as to draw said fibrous material fed into said spinning tube through said tube into said spinning chamber and into contact with the inwardly facing surface of the spinning chamber thus forming a collecting surface;

means for creating relative rotation between said rotary spinning chamber and said spinning tube thereby spinning said fibrous material into yarn after it has been drawn into said spinning chamber; and

means for removing said spun fibrous material from said collecting surface through the outlet opening in said spinning chamber.

10. In a spinning arrangement, in combination,

a rotary spinning chamber with an inwardly directed collecting surface facing the axis of rotation of said spinning chamber and an inlet and an outlet opening formed therethrough;

a spinning tube opening into said rotary spinning chamber and having an elongated portion extending through said inlet opening in the said spinning chamber;

means for feeding fibrous material into said spinning tube;

suction channels communicating with suction holes provided on the inwardly directed surface of said spinning chamber so as to draw said fibrous material fed into said spinning tube through said tube into said spinning chamber and into contact with the inwardly facing surface of the spinning chamber thus forming a collecting surface, said spinning tube having a substantially elongated portion extending through said inlet opening into said rotary spinning chamber with a nozzle-shaped end portion positioned in said rotary spinning chamber directed against said collecting surface and opening in the area of said suction holes in said collecting surface;

means for spinning the fibrous material into yarn inside said spinning chamber; and

means for removing said spun fibrous material from said collecting surface through the outlet opening in said spinning chamber.

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