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Esser et al.

[11] **3,924,398**

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[54] **METHOD OF AND APPARATUS FOR OPEN END SPINNING FROM STAPLE FIBERS**

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[21] Appl. No.: **517,522**

[30] **Foreign Application Priority Data**

Oct. 24, 1973 Czechoslovakia 7307-73

[52] **U.S. Cl.** **57/58.89;** 57/58.95; 57/101; 57/156

[51] **Int. Cl.²** **D01H 1/12**

[58] **Field of Search** 57/58.89–58.95, 56, 100, 57/101, 156

[56] **References Cited**

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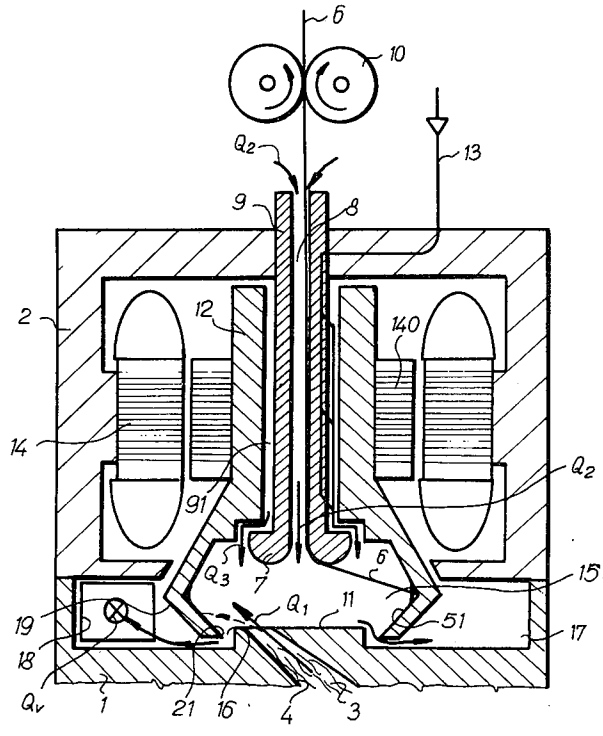
Primary Examiner—John Petrakes

[57] **ABSTRACT**

Method of and apparatus for open end spinning yarn from staple fibers in a rotary underpressure spinning chamber. The apparatus has a feeding channel for feeding fibers from a fiber opening mechanism merging into said spinning chamber through a stationary lid, and a yarn withdrawing element in the form of a hollow pin passing through the hollow shaft of the spinning chamber with a predetermined clearance oppositely to the lid of the spinning chamber engaging its front opening. The spinning chamber is mounted in an air lubricated bearing, lubrication air being blown into said clearance. The inner space of the rotary underpressure spinning chamber is subjected to three air flows, of which one is an air flow passing together with the fibers through the feeding channel, another air flow being fed from the ambiend atmosphere through the hollow pin for withdrawing the yarn, (6) and a further air flow being fed through the clearance between the hollow pin and the hollow shaft of the spinning chamber. Said air flows form a resulting air flow inside the spinning chamber preventing fiber losses and the wrapping of fibers about the yarn being formed therein, said resulting air flow escaping through an outlet slot between the stationary lid and the front margin of the spinning chamber into a collecting space.

9 Claims, 2 Drawing Figures



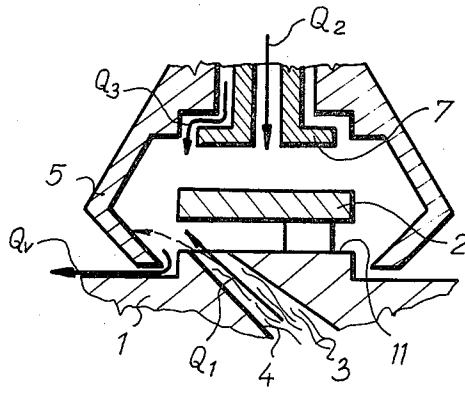

Q_2
Q_3
7
5
20
Q_v
1
Q_1
4
3
11

Fig -2

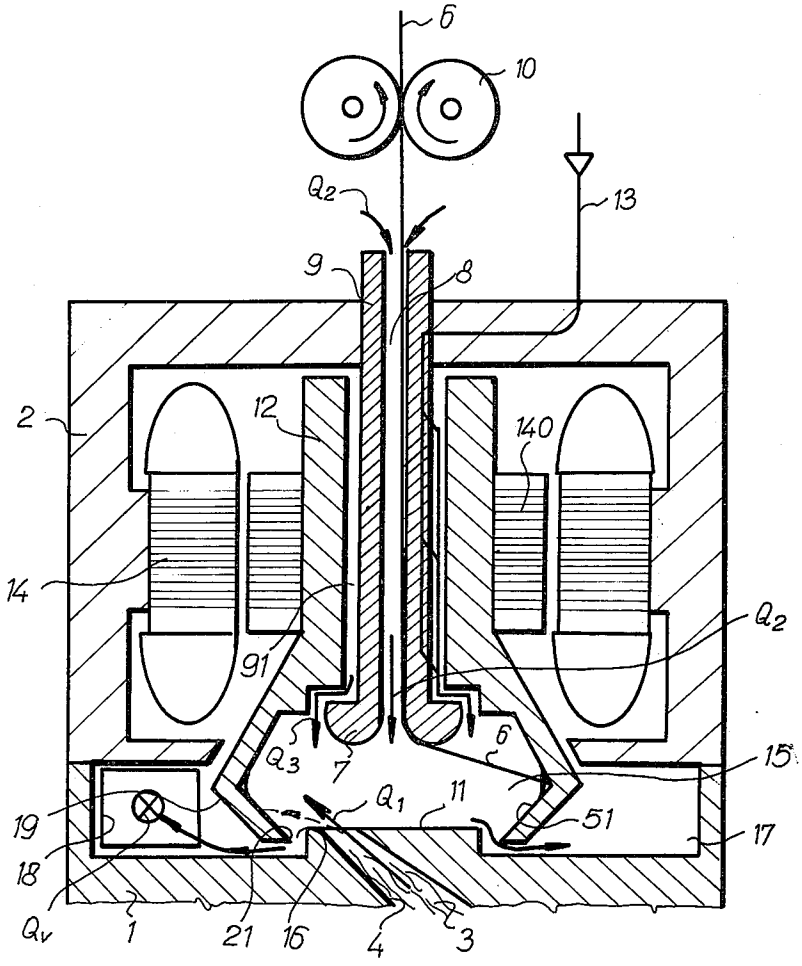

6
10
13
Q_2
9
8
2
12
140
14
Q_2
91
Q_3
7
6
15
Q_1
11
19
51
17
18
Q_v
1
21
16
4
3

Fig -1

METHOD OF AND APPARATUS FOR OPEN END SPINNING FROM STAPLE FIBERS

The present invention relates to a method of and an apparatus for open end spinning yarn from staple fibers in a rotary underpressure spinning chamber, which is mounted in an air-lubricated bearing, and into which there opens a feeding channel for feeding fibers from a fiber opening mechanism through a stationary lid. On the side opposite to the lid engaging the opening, there is located a yarn withdrawing element in the form of a hollow pin, the pin passing through the hollow shaft of the spinning chamber with a predetermined clearance.

Spinning devices for open end spinning yarn by means of a rotary underpressure spinning chamber which are known at present prevailingly use a structure in which the means for feeding the fibers and the means for yarn withdrawal are situated at the same side of the spinning chamber. This structure has the disadvantage, upon increasing the speed of the spinning chamber, that it requires a reduced diameter thereof, thus causing considerable difficulties with regard to space. Perhaps the most important of such difficulties is the maintaining of the cross section of the feeding channel for feeding separated fibers, such cross section markedly affecting the rate of fiber flow.

Devices are known which use fiber feeding and yarn withdrawal means located at mutually opposite sides of the spinning chamber. In such construction, however, an overpressure spinning chamber is used together with a fiber opening mechanism operated on the principle of a pneumatic ejector. Furthermore, a design is known in which the fiber feeding means is situated on the axis of the spinning chamber, opposite to the withdrawing opening. This design is based upon the forming of a curtain for separating the spaces for feeding fibers and withdrawing yarn, said curtain being formed by the action of oppositely directed air flows. It is obvious that the quantities of flowing air from oppositely located channels are not equivalent, and that therefore a perfect separation of the fiber feeding and yarn withdrawing spaces cannot be obtained.

In most of the devices hitherto known, so-called drilled fans are used, of which the inlet holes are located inside the spinning chamber apart from the collecting surface, on the collecting surface, or near the front of the spinning chamber. The disadvantage of those devices consists in their difficult manufacture and in the repeated plugging of the holes by impurities and fine dust which are entrained with the fibers.

Furthermore, spinning units are known in which the air flow enters through the fiber feeding channel from the fiber opening mechanism and through the channel for withdrawing yarn, said channels being situated at the front side of the spinning chamber, while the air from the spinning chamber escapes through a slot or collar at the margin of the front opening of the spinning chamber. Such devices have difficulties with reliable separation of fibers from the air flow to the collecting surface of the spinning chamber, and further in entraining not separated fibers apart from the spinning chamber. In all said devices, an antifriction bearing mounting of the spinning chamber is used.

The above disadvantages of the prior art are mitigated by the method of and the apparatus of the present invention for open and spinning yarn from staple fibers. The apparatus has a rotary underpressure spinning chamber mounted in an air lubricated bearing, a feeding channel for feeding fibers from a fiber opening mechanism merging into said spinning chamber through a stationary lid and, at the side located opposite to the lid of said spinning chamber, engaging its front opening; a yarn withdrawing element in the form of a hollow pin is situated which passes with a certain clearance through the hollow shaft of the spinning chamber, lubricating air being fed into said clearance.

In carrying out the method according to the present invention in the inner space of the rotary underpressure spinning chamber three air flows are joined i.e. (a) the air flow coming together with the fibers through the feeding channel, (b) the air flow coming from the ambient atmosphere through the hollow pin for withdrawing yarn, and (c) the air flow fed through the clearance between the hollow pin and the hollow shaft of the spinning chamber. Said air flows form a resulting air flow inside the spinning chamber preventing fiber losses and the wrapping of fibers about the yarn being formed. The resulting air flow escapes through an outlet slot between the lid and the front margin of the spinning chamber into a collecting space.

A further feature making possible the achieving of favorable conditions is that the flow rates in the separate air flows are made to have a mutual relation given by the range

$$Q_V : Q_1 : Q_2 : Q_3 = 100\ (70+90) : (2+20) : (1+20),$$

of which Q_V is the rate of air flow excaping through the outlet slot, Q_1 is the rate of air flow in the feeding channel, Q_2 is the rate of air flow in the hollow pin, i.e. in the yarn withdrawing channel, and Q_3 is the rate of air flow passing through the clearance between the hollow pin and the hollow shaft of the spinning chamber.

In the apparatus performing the method according to the present invention the underpressure source for withdrawing the resulting air flow from the spinning chamber is located in a collecting space into which merges the outlet slot, or which is connected to said collecting space.

It is advantageous from the viewpoint of economy to form the underpressure source by the outer surface of the rotary spinning chamber, or a part of the chamber. This construction is particularly advantageous for high speed rotary spinning chambers.

A further improvement in separating fibers from air is achieved by arranging a baffle, preferably in the form of a disc, between the feeding channel, on one side, and the opening of the hollow pin and the clearance opening between the hollow pin and the hollow shaft, on the other side.

In relation to the devices mentioned before, a better balancing of the oppositely directed flows is attained, as the weak flow through the yarn withdrawing channel in the hollow pin is supplemented by a similarly weak flow passing through the clearance at the end of the hollow pin and the hollow shaft of the spinning chamber. Thus a substantial reduction of fiber losses through the circumferential outlet slot between the lid of the spinning chamber and its front margin is secured.

In the accompanying drawings, an embodiment of the device for performing the method according to the present invention is shown by way of example.

In the drawings:

FIG. 1 is a fragmentary view in axial section through a part of a spinning unit in accordance with the invention; and

FIG. 2 is a view on an enlarged scale in axial section through a part of a spinning chamber with a baffle in the form of a disc.

The spinning unit fragmentarily shown in FIG. 1 includes a known fiber opening mechanism with e.g. a fiber opening roller (not shown) mounted inside body 1, and a twisting mechanism with a spinning chamber 5. A fibrous silver (not shown) is presented to the fiber opening mechanism, is opened there, and the separated fibers 3 are fed through a feeding channel 4 by an air flow into the spinning chamber 5 which is closed at its front margin 52 by a lid 11 which, in the construction shown, is formed by a part of body 1. Inside the spinning chamber 5 yarn 6 is formed in a known manner, the yarn being withdrawn via the skewed end 7 of a hollow pin 9 through the channel 8 formed therein. Yarn 6 is withdrawn by withdrawing mechanism 10 and is further wound in a known manner on to a bobbin (not shown).

The spinning chamber 5 is mounted on a hollow pin 9 by a hollow shaft 12 in such manner that a predetermined clearance 91 exists between the hollow pin 9 and the hollow shaft 12. Pressure air is fed through a pressure line 13 from a source (not shown) into said clearance. Thereupon an air lubricating cushion is formed in clearance 91, and the hollow shaft 12 of the spinning chamber 5 is journalled in such air cushion. In this case the spinning chamber 5 is driven by a separate electric motor 14 mounted in body 2. Rotor 140 is fixed directly on the hollow shaft 12.

The inner space 15 of spinning chamber 5 is connected by an outlet slot 16 between lid 11 and front margin 52 of spinning chamber 5 to the outer collecting space 17 through which the air from spinning chamber 5 is passed into an outlet conduit 18. The outer surface 19 of spinning chamber 5 or a part of the chamber may be made in the form of a fan, i.e. an underpressure source, or creates a sufficient underpressure by its own ventilation losses. However, it is also possible to use another underpressure source, (not shown) connected to the outlet conduit 18 of collecting space 17. Air flow Q_1 passes into spinning chamber 5 from the side of lid 11 through the feeding channel 4 and, on the opposite side of spinning chamber 5. Air flow Q2 is fed thereto through hollow pin 9, i.e. through the channel 8 for withdrawing yarn 6. Air flow Q_3 flows from clearance 91.

It is advantageous as shown in FIG. 2 to separate the air flows Q_2 and Q_3 in the inner space 15 of spinning chamber 5 from the inlet flow Q_1 by a baffle 20, advantageously in the form of a disc. The air leaves the spinning chamber 5 through outlet slot 16 and thus forms an outlet air flow Q_V.

The apparatus described above is an air lubricated mounting of spinning chamber 5. Without that, a considerable difference exists between the contribution of air flow Q_1 and air flow Q_2 to the outlet flow from spinning chamber 5. By using an air bearing with a hollow pin 9, it is possible to use the supplied pressure air in a suitable manner for lubricating, and to direct the air in the form of flow Q_3 into spinning chamber 5 in such manner as favorably to influence therein the shape of the flow. As shown in FIG. 1, it is obvious that the air flows Q_2 and Q_3 flow mutually parallely against flow Q_1, thus contributing to its bending from the original direction thereof given by feeding channel 4 into the path depicted by the dash line. In such manner, said air flows participate in a very favorable directing of the fed fibers 3 towards the sliding wall 51 of the spinning chamber 5.

The more perfect the distribution of fibers 3 on sliding wall 51 of spinning chamber 5, the smaller are the fiber losses from the spinning chamber 5 through outlet slot 16 at the lid 11 of spinning chamber 5. At the same time, the losses of fibers 3 are diminished, and their undesired wrapping on the yarn being formed in the section between collecting surface 53 and the skewed end 7 of hollow pin 9 is reduced. This method is further improved by inserting a baffle 20 (FIG. 2) advantageously in the form of a disc, into the inner space 15 of spinning chamber 5 between feeding channel 4 on the one side and the opening of hollow pin 9 and the opening of clearance 91 between hollow pin 9 and hollow shaft 12 on the other side.

It has been proved that particularly favorable results are obtained by performing the method so that the flow rates of the separate air flows have a mutual relation given by the range

$$Q_V : Q_1 : Q_2 : Q_3 = 100\ (70+90) : (2+20) : (1+20),$$

of which Q_V is the rate of air flow passing through the outlet slot, Q_1 is the rate of air flow in the feeding channel, Q_2 is the rate of air flow in the hollow pin i.e. the yarn withdrawing channel and $Q3$ is the rate of air flow passing through the clearance between the hollow pin and the hollow shaft of the spinning chamber.

Although the invention is illustrated and described with reference to a plurality of preferred embodiments thereof, it is to be expressly understood that it is in no way limited to the disclosure of such a plurality of preferred embodiments, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. In a method of open end spinning yarn from staple fibers in a spinning apparatus having a rotary underpressure spinning chamber mounted in an air lubricated bearing, a feeding channel for feeding fibers from a fiber opening mechanism merging into said spinning chamber through a stationary lid, and a yarn withdrawing element, in the form of a hollow pin passing through the hollow shaft of the spinning chamber with a predetermined clearance, opposite the lid of the spinning chamber and engaging its front opening and lubricating air being blown into said clearance, the improvement wherein within the inner space of the rotary underpressure spinning chamber there are joined three air flows, of which a first one is an air flow passing together with the fibers through the feeding channel, a second air flow being fed from the ambient atmosphere through the hollow pin for withdrawing the yarn and a third air flow is fed through the clearance between the hollow pin and the hollow shaft of the spinning chamber, said air flow forming a resulting air flow inside the spinning chamber preventing fiber losses and the wrapping of fibers about the yarn being formed therein, said resulting air flow escaping through an outlet slot between the stationary lid and the front margin of the spinning chamber into a collecting space.

2. A method as claimed in claim 1, wherein the rate of air flow of the separate air flows has a mutual relation given by the range:

$$Q_V : Q_1 : Q_2 : Q_3 = 100 : (70+90) : (2+20) : (1+20)$$

in which

Q_V denotes the rate of air flow escaping through the outlet slot;

Q_1 denotes the rate of air flow in the feeding channel;

Q_2 denotes the rate of air flow in the passage in the hollow pin forming the yarn withdrawing channel; and

Q_3 denotes the rate of air flow passing through the clearance between the hollow pin and the hollow shaft of the spinning chamber.

3. In an apparatus for the open end spinning of yarn from staple fibers in a rotary underpressure spinning chamber mounted in an air lubricated bearing, said apparatus having a feeding channel for feeding fibers from a fiber opening mechanism merging into said spinning chamber through a stationary lid, and a yarn withdrawing element, in the form of a hollow pin passing through the hollow shaft of the spinning chamber with a predetermined clearance disposed opposite the lid of the spinning chamber engaging its front opening, and means for blowing lubricating air into said clearance, the improvement which comprises means joining with the inner space of the rotary underpressure spinning chamber three air flows, of which a first one is an air flow passing together with the fibers through the feeding channel, a second air flow is fed from the ambient atmosphere through the hollow pin for withdrawing yarn and the third air flow is fed through the clearance between the hollow pin and the hollow shaft of the spinning chamber, said air flows forming a resulting air flow inside the spinning chamber preventing fiber losses and the wrapping of fibers about the yarn being formed therein and an outlet slot for said resulting air from said resulting air flow, said outlet slot being disposed between the stationary lid and the front margin of the spinning chamber and collecting space.

4. Apparatus as claimed in claim **3** comprising an underpressure source for withdrawing the resulting air flow from the spinning chamber, said underpressure source being connected to said collecting space.

5. Apparatus as claimed in claim **4,** wherein the underpressure source for withdrawing the resulting air flow from the spinning chamber is located in the collecting space into which the outlet slot opens.

6. Apparatus as claimed in claim **4** wherein the underpressure source is formed by a part of the rotary spinning chamber.

7. Apparatus as claimed in claim **4** wherein the underpressure source is formed by the outer surface of the rotary spinning chamber.

8. Apparatus as claimed in claim **4,** comprising a baffle inserted between the feeding channel on one side, and the opening through the hollow pin and the clearance opening between the hollow pin and the hollow shaft on the other side.

9. Apparatus as claimed in claim **8,** wherein the baffle is disc-shaped.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,924,398
DATED : December 9, 1975
INVENTOR(S) : Esser et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 29, change "(70+90):(2+20):(1+20)" to
--(70 to 90):(2 to 20):(1 to 20)--.

Col.4, line 22, change "(70+90):(2+20):(1+20)" to
--(70 to 90):(2 to 20):(1 to 20)--.

Col. 4, line 64, change "(70+90):(2+20):(1+20)" to
--(70 to 90):(2 to 20):(1 to 20)--.

Signed and Sealed this

twenty-ninth Day of *June 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks