May 13, 1969 I. EDDLESTON 3,443,372

PRODUCTION OF YARN AND APPARATUS FOR USE THEREIN

Filed April 18, 1967 Sheet 1 of 3

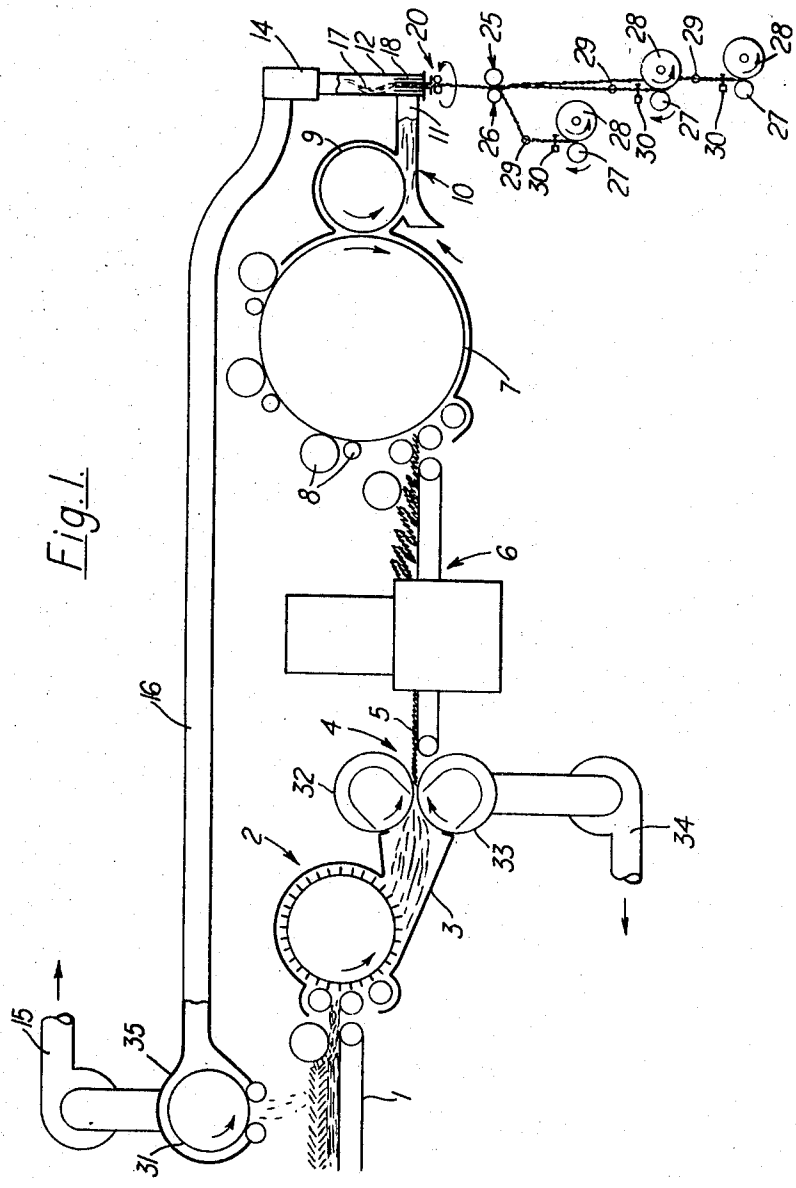


Fig. 1.

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Fig. 2.

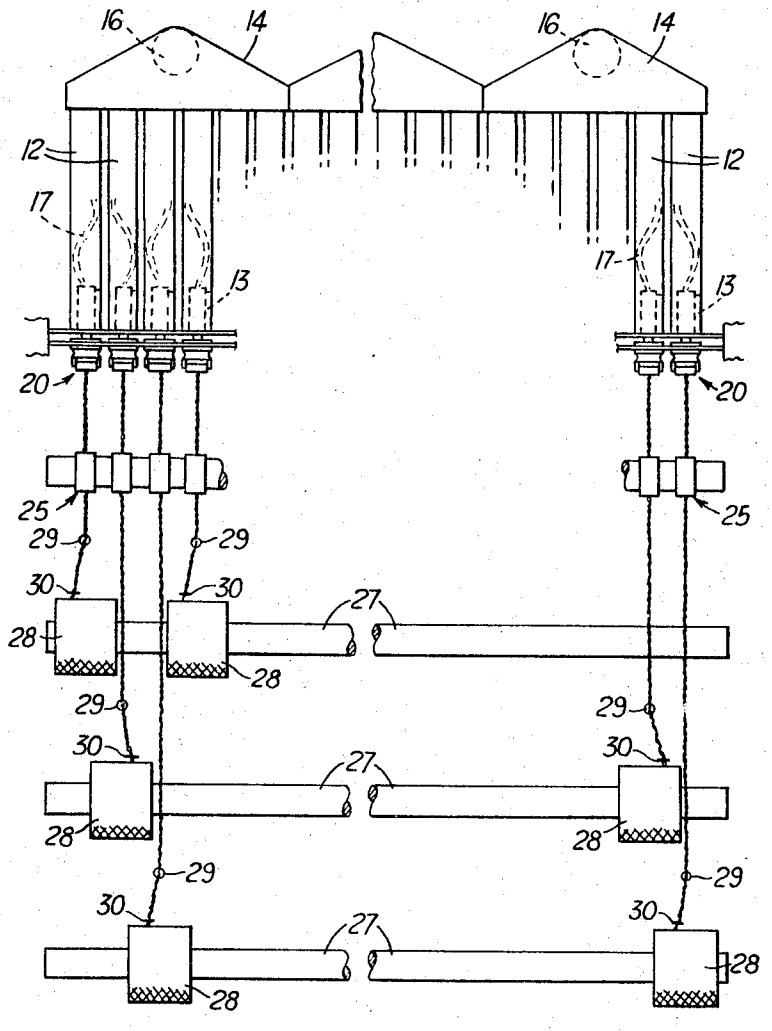

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Fig.3.

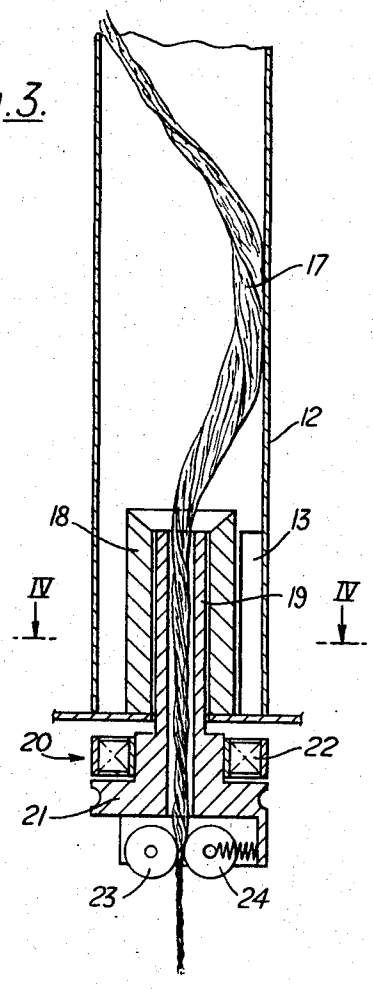
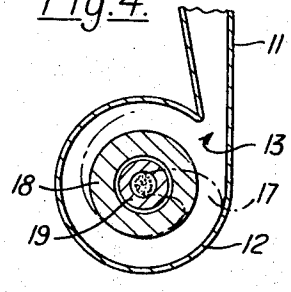


Fig.4.



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PRODUCTION OF YARN AND APPARATUS FOR USE THEREIN

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U.S. Cl. 57—58.89 10 Claims

ABSTRACT OF THE DISCLOSURE

In break spinning yarn the tail of the yarn is formed in a vortex of air from fibers introduced with the air at the yarn-outlet end of the vortex chamber and the yarn is mechanically twisted on leaving the vortex. Unused fibers carried away in the air stream are returned to fibre-preparing apparatus to be reused.

This invention relates to the break spinning of yarn and to apparatus for use therein.

Break spinning is a method of yarn production in which a stream of fibres, which may be individual or in bundles, is fed to a rotating end of yarn. The end of the yarn, that is to say its tail, rotates in a space into which the fibres are introduced, and sweeps up the fibres in that space and thereby grows as more fibres are added to it. The fibres forming the tail are randomly interlaced and lightly twisted together, the twist varying randomly from fibre to fibre. The tail requires more twisting subsequently to form a yarn.

The fibres may either be fed mechanically or carried in an air stream to the space in which the tail rotates. The use of air greatly simplies the apparatus, and it is known to form a vortex of air in an essentially tubular chamber by the introduction of air under pressure tangentially into the yarn-outlet end of the chamber, and to introduce an air stream carrying the fibres close to the tip of the tail. In this apparatus the tail travels to the outlet through the vortex, rotating as it does so, and twist is inserted by the compressed air introduced to form the vortex.

According to the present invention yarn formed in a vortex of air created by an air stream introduced into a vortex chamber is mechanically twisted on leaving the chamber. The formation of the yarn by causing the rotating tail to collect fibers in a vortex is simple and reliable, but if the air introduced to form the vortex is used to impart the twist the regularity of that twist is unreliable. The fibres are merely mutually entangled each with a small twist of random value, and the overall twist is limited by the way in which the tail tends to roll round inside vortex chamber, thereby untwisting itself. In the invention the pneumatic vortex merely causes the tail to rotate and collect fibres flowing past it, and a controlled amount of ordered twist is inserted mechanically into the formed yarn.

Preferably the fibres from which the yarn is formed are carried into the vortex in the air stream that creates the vortex. This air stream enters at the yarn-outlet end of the vortex chamber, with the result that he fibres are carried along the vortex over the whole length of the rotating tail, instead of being introduced only towards the tip of the tail as hitherto. Thus only a single air stream is introduced into the chamber.

The invention includes apparatus for carrying out the process and comprising a vorter chamber having a yarn outlet, means for introducing air and fibre into the chamber and a twisting device mounted to twist the yarn as it

leaves the outlet. Preferably the chamber is tubular with a narrow elongated inlet close to the yarn outlet and parallel to the axis, and the means for introducing air and fibre into the chamber include a conduit arranged so that the fibre-laden air passes through the inlet tangentially into the chamber.

It is desirable to produce a number of yarns simultaneously, and to enable this to be done the complete plant includes a number of vortex chambers parallel to one another, each with its own twisting device.

A further feature of the invention is concerned with the recovery of unused fibers, that is to say fibres not caught by the tail and introduced into the yarn. It is of course necessary to prepare the fibres in order to introduce them into the air stream by which they are carried to the yarn-forming chamber, and the apparatus for this purpose may take various forms. The essence of this feature of the invention is that the unused fibres in the air stream leaving the vortex chamber travel in a circuit to be reintroduced into the same or another vortex chamber, being separated from the air stream at a point in the circuit.

Thus the preferred form of complete plant for preparing the fibre and forming yarn includes fibre-preparing apparatus, which is arranged to feed all the vortex chambers, means for combining the air streams from all the chambers, and means for separating unused fibres from this combined stream and returning them to the fibre-preparing apparatus.

The preferred plant according to the invention will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:

FIGURE 1 is a side view of the plant;

FIGURE 2 is an end view looking from the right-hand side of FIGURE 1 and is on a larger scale;

FIGURE 3 is an enlarged view of part of a vortex chamber and the associated twisting device; and

FIGURE 4 is a section on the line IV—IV in FIGURE 3.

The plant shown is designed for the break spinning of asbestos yarn from asbestos fibres blended together for the purpose. The constituent fibres of various types are conveyed from hoppers by a conveyor **1** to a blender **2** which opens and blends the fibres, discharging them as a stream of fibre in air through a casing **3** to a web-forming apparatus **4**; these pieces of apparatus may be of any convenient kind. The web **5** thus formed passes to a mechanism **6** for folding it and delivering it to a toothed cylinder **7** which breaks up the web **5** into small fibre bundles and individual fibres, and carries the fibres forward. While on this cylinder, the fibres are engaged by pairs of rollers **8** which work and level them, so that the feed of fibre to a final toothed cylinder **9** is substantially uniform. The fibres are doffed from the cylinder **9** by air into an air conduit **10**, the inlet of which is open to the atmosphere.

The conduit **10** is divided into a number of parallel branches **11**, each leading to a vortex chamber **12**. FIGURE 2 shows how the vortex chambers are arranged side by side. Simply by way of example there may be twenty-four vortex chambers so that twenty-four yarns are produced simultaneously.

Each vortex chamber **12** is a vertical tube, which may, for example, be 24 inches long and 2 inches in diameter. At its base there is an air inlet **13** through which fibre-laden air enters from the branch **11**. The chambers **12** discharge air into four manifolds **14** on the suction side of a fan **15**, which sets up suction in parallel conduits **16** connected to the manifolds **14**.

The branch **11** and inlet **13** are arranged so that the air stream enters the chamber **12** tangentially and sets up

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a vortex. A yarn tail **17** is formed, and is continuously withdrawn through an outlet formed at the lower end of the chamber **12** within a reentrant tube **18** which is on the same level as the inlet **13**, so that the incoming air stream first enters the annular space around this tube **18** and is immediately set into rotation. This ensures that streamline vortex air flow begins at once. The tail continuously collects fibre from the air and so remains substantially constant in length.

Each branch conduit **11** forms a V-shaped passage, the apex of the V being on the wall of the vortex chamber **12** at the inlet **13**. This ensures that as the fibres enter the chamber **12** the velocity of the air stream is increasing, with the result that the fibres tend to be aligned in the direction of the air stream. Thus when they are collected by the tail they are aligned substantially in the same direction as it is, and the result is increased alignment of fibre in the yarn.

The reentrant tube **18** receives a hollow spindle **19** of a twisting device **20**, so that the yarn on leaving the vortex chamber and passing into the tube **18** continues through the spindle **19**. The twisting device **20** comprises a freely rotatable circular base plate **21**, which is carried in a bearing **22** and driven by a belt not shown. In the centre of the base plate there is a hole which forms a continuation of the hollow interior of the spindle **19** and through which the yarn passes. The base plate **21** carries two freely rotatable mutually parallel rollers **23** and **24** so mounted that the axis of rotation of the base plate passes through and is perpendicular to their line of nip. The roller **23** is fixed in position whilst the roller **24** is spring-loaded to accommodate yarns of different thickness passing through them.

Some distance below the twisting device the yarn is engaged by delivery rollers **25** and **26**. There is a single roller **26** that extends across the end of the plant and is positively driven by means not shown at the desired yarn take-off speed. There is one roller **25** for each yarn, each roller **25** being spring-loaded and driven by nipping the yarn against the roller **26**. The yarn leaving the rollers **25** and **26** is wound into packages **28** in conventional manner, each package being rotated by contact with a roller **27**. Since a finished package may be about 8 inches in diameter, it is necessary to stagger the packages in both the longitudinal and transverse directions in order to accommodate them below the row of vortex chambers, as shown in FIGURES 1 and 2. Yarn guides **29** and **30** are provided to lead the yarns to the packages.

All the rollers **23**, **24**, **25** and **26** and **27** may advantageously be covered with a resilient material such as rubber.

The unused fibres are returned to the blender **1**. To enable this to be done a rotary gauze cylinder **31** is provided in a manifold **25** to which the conduits **16** lead and its hollow interior is connected to the fan **15**. The unused fibres are caught by the cylinder **31**, while the air passes through this. The fibres fall off the cylinder onto the fibres already present on the conveyor **1**, and thus are blended with them by the cylinder **2**.

The return of the unused fibres in the blender in this manner eliminates build-up of fibres on fan blades or the like to form accumulations which would detach themselves and form slubs in the yarn or might even be large enough to destroy the tail, if passed through the vortex chamber.

It is important to prevent the emission of harmful dust into the atmosphere. From the conduit **11** to the cylinder **31** the air pressure is below atmospheric. The fan **15** discharges to atmosphere through a filter not shown. The web-forming apparatus **4** includes two hollow gauze-covered cylinders **32** and **33**, the interiors of which are connected to a fan **34**, which discharges through another filter not shown. Thus the risk of the escape of dust is very low.

The invention is applicable to the production of yarn from short textile fibres such as cotton, reclaimed waste cotton, reclaimed waste wool, reclaimed man-made fibre and other fibres, as well as asbestos.

I claim:

1. A method of break spinning yarn comprising forming a vortex of air by tangentially directing a stream of air into a substantially cylindrical chamber adjacent one end thereof, feeding fibers into said vortex by the same stream of air which creates and maintains the vortex through a common opening, assembling the fibers into a yarn tail in said vortex and continuously withdrawing said yarn tail from said vortex as said fibers are assembled thereon.

2. A method of break spinning yarn as set forth in claim **1** further comprising mechanically twisting the assembled fibers as said yarn tail is withdrawn from said vortex.

3. A method of break spinning yarn as set forth in claim **1** further comprising removing unused fibers from said air stream subsequent to leaving said vortex and automatically reintroducing said unused fibers into a vortex forming air stream.

4. A method of break spinning yarn as set forth in claim **1** further comprising accelerating the fibers in said vortex forming air stream immediately prior to entering said vortex.

5. An apparatus for break spinning yarn comprising a vortex chamber having a yarn outlet and a single inlet passage means for introducing air and fibers into said chamber to form a vortex of air for assembling said fibers into a yarn tail.

6. An apparatus according to claim **5** wherein said chamber is a hollow elongated cylindrical chamber with a narrow elongated inlet close to said yarn outlet and parallel to the axis of said chamber, said single inlet passage means for introducing air and fibers into said chamber includes a conduit connected to said inlet and tangentially disposed relative to said cylindrical chamber so that the fiber-laden air passes through said inlet tangentially into said chamber and further comprising a twisting device mounted adjacent said yarn outlet to twist the yarn as it leaves the outlet.

7. An apparatus according to claim **6** wherein said yarn outlet from said chamber is in an imperforate reentrant tube which extends into said chamber and is substantially coextensive in length with said elongated inlet.

8. An apparatus according to claim **5** wherein said twisting device is comprised of a twister head having a freely rotatable circular base plate with a hole therethrough for receiving said yarn tail as it leaves said chamber and two freely rotatable mutually parallel rollers mounted on said base plate so that the axis of rotation of said base plate is disposed to pass through and perpendicular to the line of nip therebetween.

9. An apparatus as set forth in claim **8** wherein a plurality of said vortex chambers are provided parallel to one another with a twisting device disposed adjacent the yarn tail outlet of each of said chambers.

10. An apparatus according to claim **9** further comprising a fiber preparing apparatus arranged to feed all of said vortex chambers, means for combining the air streams from all of said chambers and means for separating unused fibers from the combined stream and returning said fibers to said fiber preparing apparatus.

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