May 9, 1933. P. D. CANNON 1,908,472

ART OF AND APPARATUS FOR MAKING TEXTILE YARNS

Filed Jan. 6, 1931 2 Sheets-Sheet 1

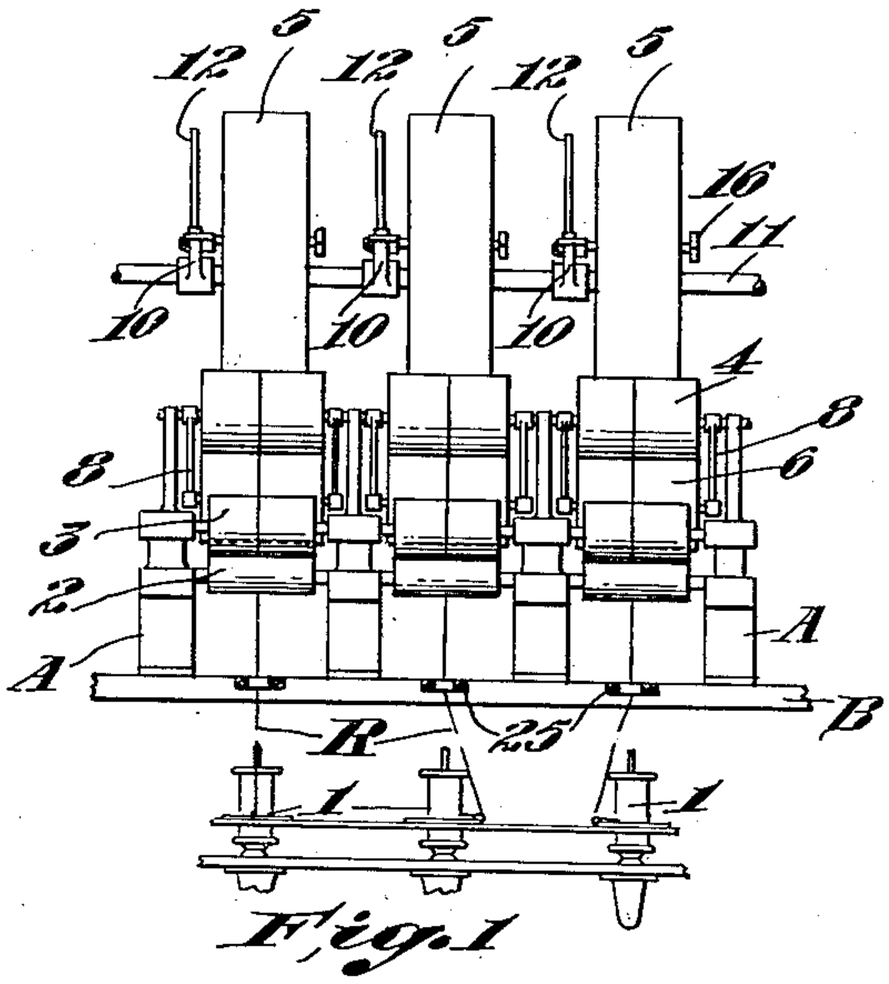

Fig. 1

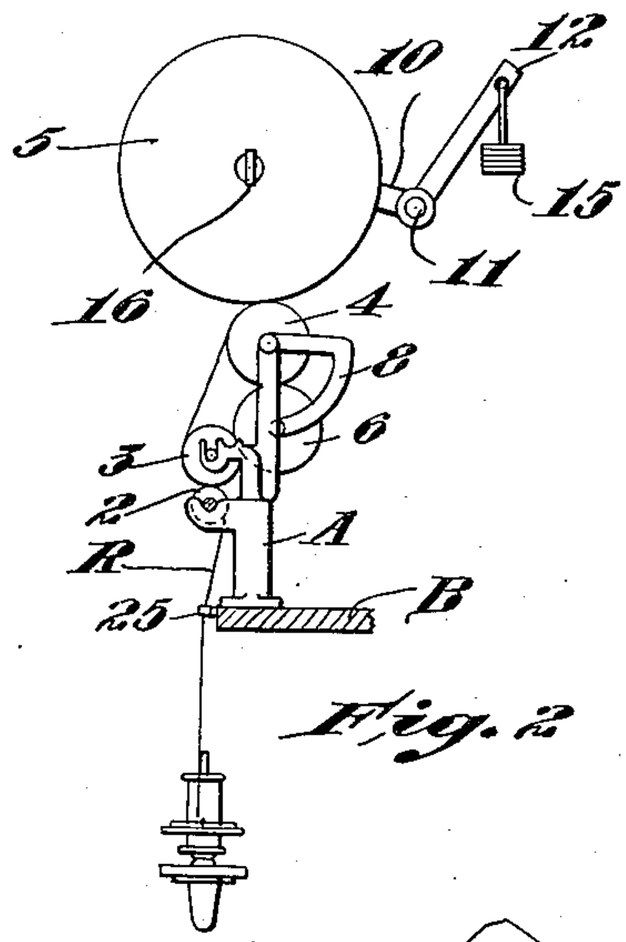

Fig. 2

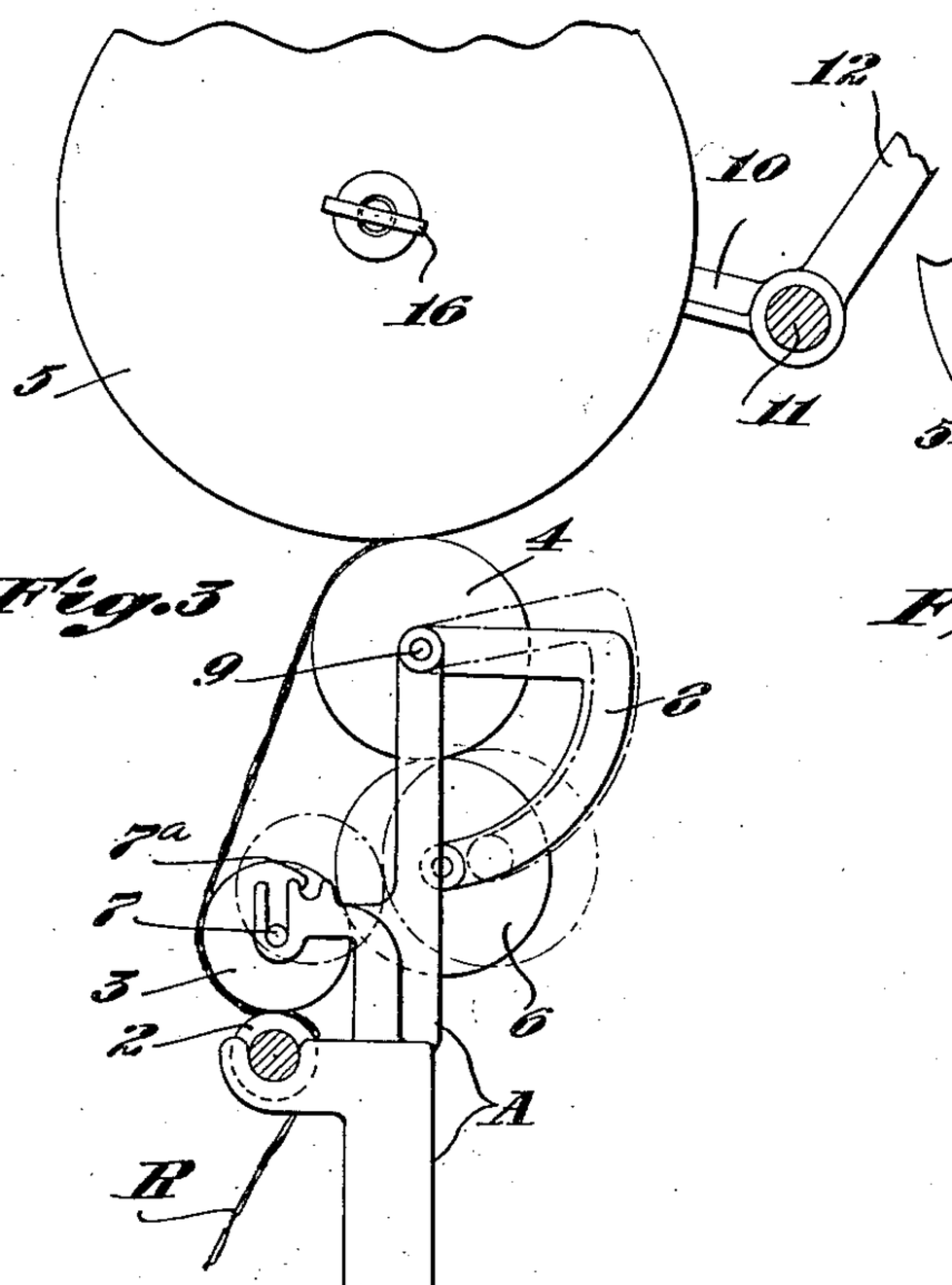

Fig. 3

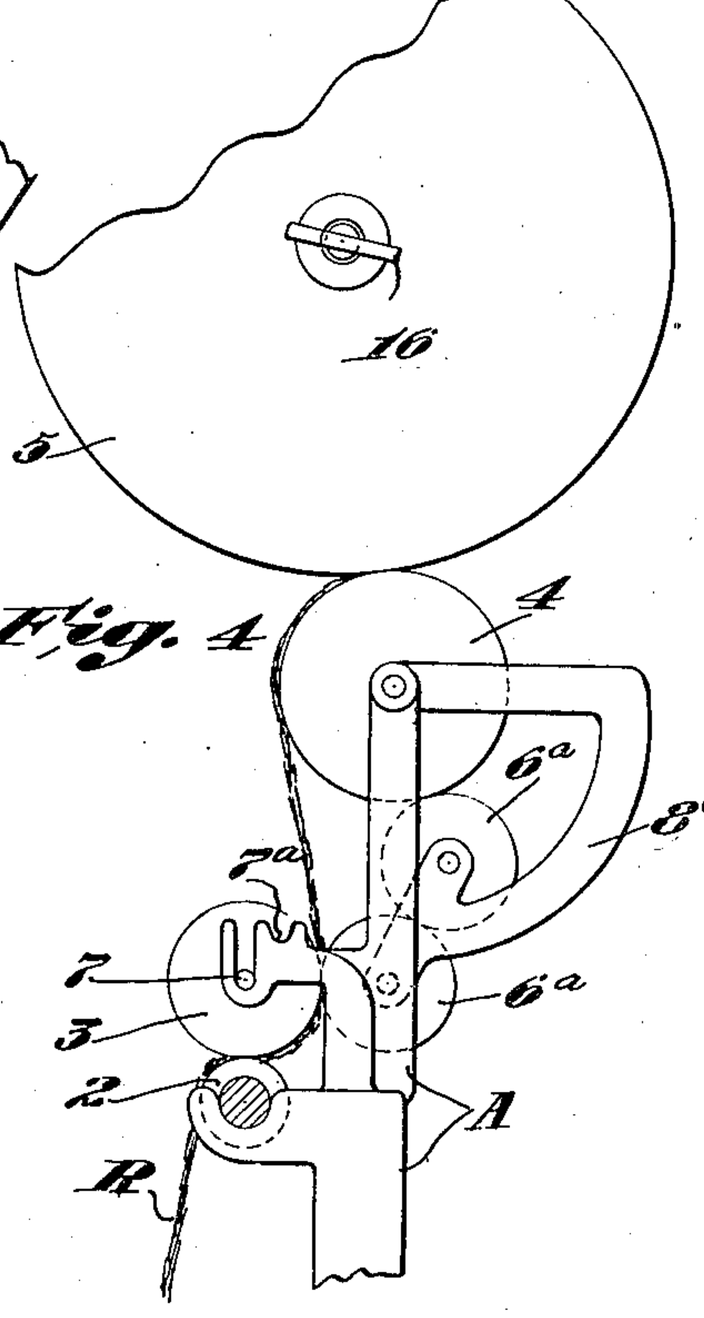

Fig. 4

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ART OF AND APPARATUS FOR MAKING TEXTILE YARNS

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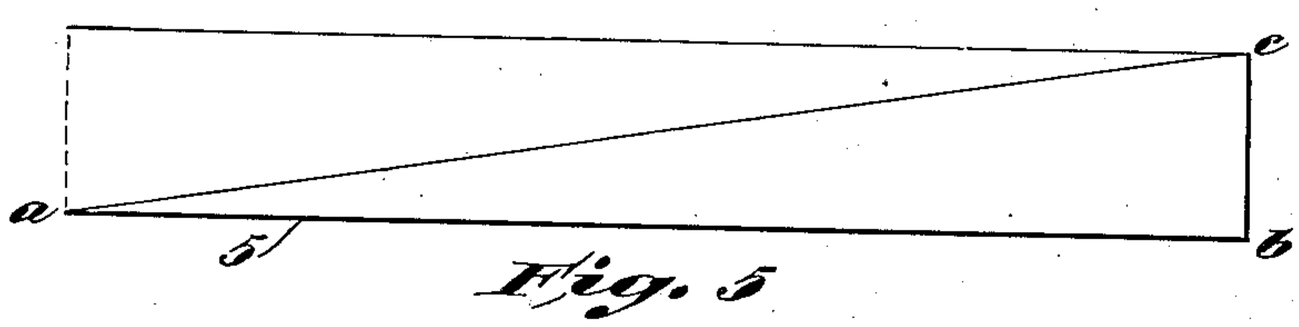

Fig. 5

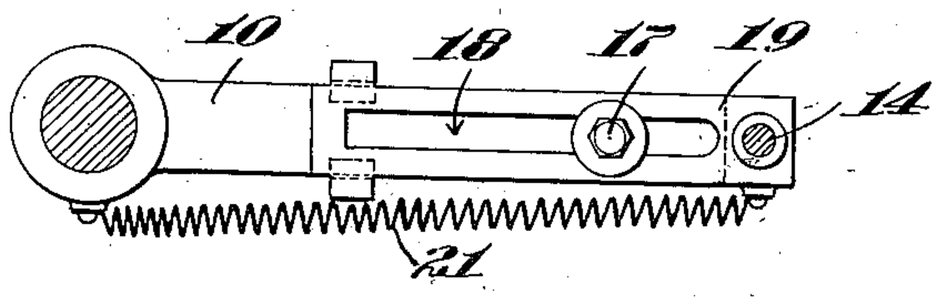

Fig. 8

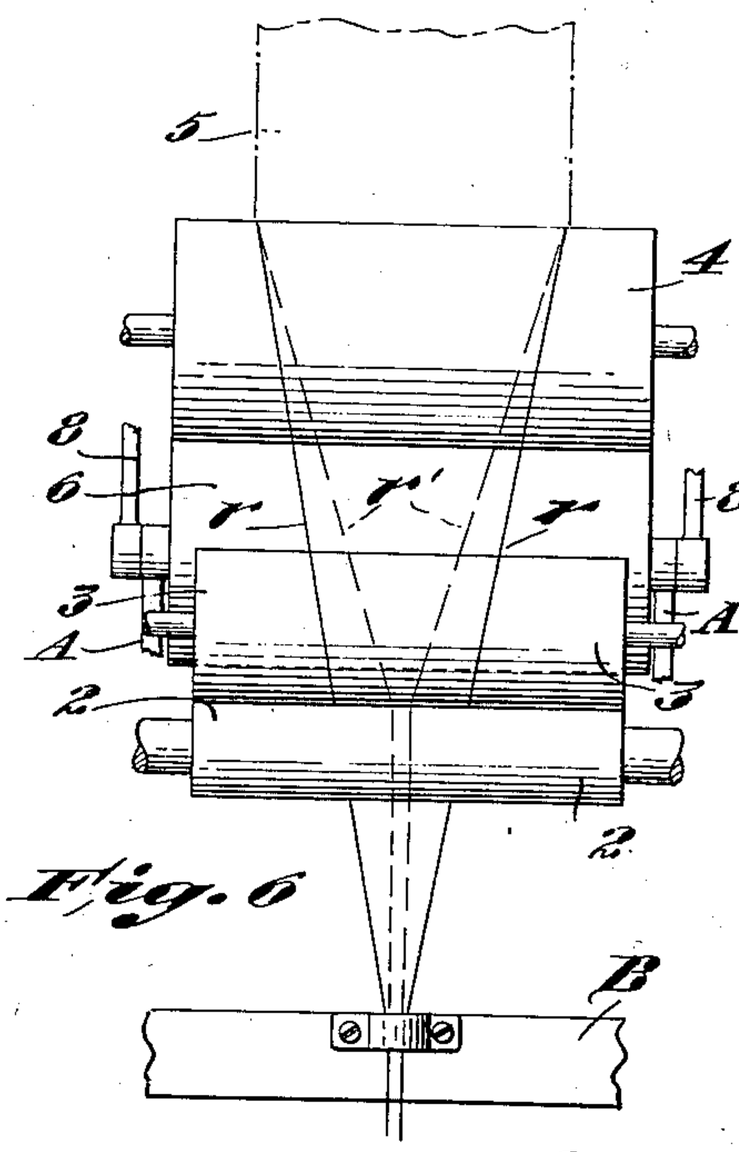

Fig. 6

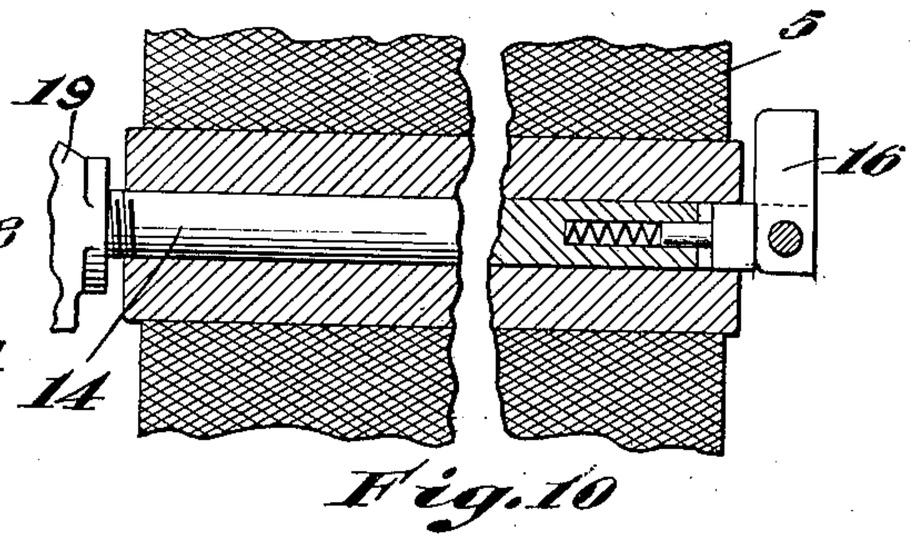

Fig. 10

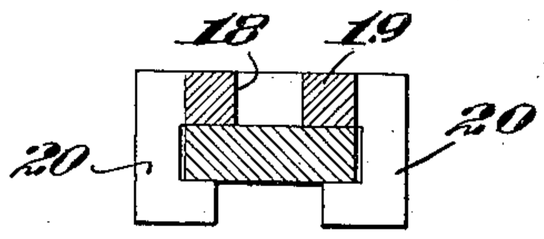

Fig. 9

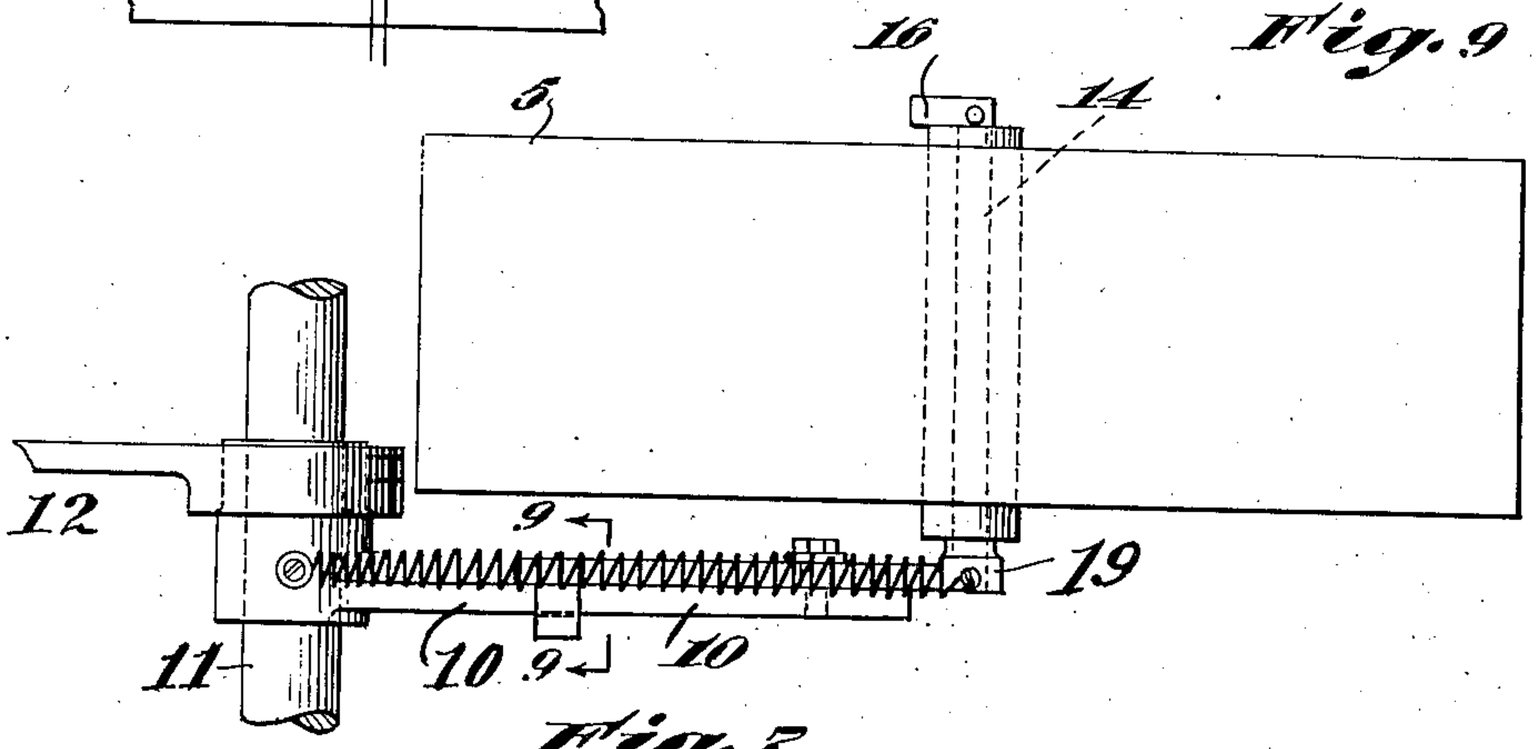

Fig. 7

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Patented May 9, 1933 1,908,472

UNITED STATES PATENT OFFICE

PHILLIP DAVID CANNON, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO JOHNS-MANVILLE CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

ART OF AND APPARATUS FOR MAKING TEXTILE YARNS

Application filed January 6, 1931. Serial No. 506,841.

My invention herein described relates to an art of spinning or twisting filamentous material applicable to material to be spun or twisted from a single strand or a plurality of strands, and is concerned especially with the spinning of loosely coherent and fragile filaments or strands; for example, strands consisting in whole or in large part of very short fibres, or fibres having an inferior capacity for mutual adherence to form a strand.

One object of this invention is to avoid certain stages of preparation of rovings into spun yarn or plies of twisted strands prior to the assumption of the final spun or twisted state, which stages of preparation have heretofore been resorted to because believed to be essential to practical results in the manufacture of yarn from such materials. Another object is to enable the use of more tenuous and less coherent material for spun yarns of asbestos or other non-coherent fibrous materials than have been regarded as possible materials for the manufacture of yarn by spinning directly from slubbings or rovings in any previous practice of which I am aware. Another object of the invention is to provide an art or method of spinning weak rovings of feebly-cohering fibres adapted to reach a spun, or spun and ply-twisted, stage without preliminary operations on the sliver, slubbing or rovings; and to provide apparatus ancillary to practice of the method.

A specific example of a material to the manipulation of which my invention is specially adapted is furnished by asbestos of short-fibre quality, which is first formed into condensed slivers or condenser rovings, often or usually with admixture of cotton fibre, the roving comprising a condensed ribbon or ribbons of a light fleece of such fibres formed by a carding machine. I may first form the usual traverse-wound self-supporting cheeses or balls of such roving, laid either in a single strand or in a plurality of parallel strands, traversed back and forth from one side to the other on the cylindrical face of the wound package, cheese or ball, in a manner well known. These packages may be the usual product of a finisher condenser carding machine. Each ball or cheese may be built on or subsequently be applied to a tubular quill or core.

According to this invention, it is recommended that the roving strands, single or plural, be delivered continuously from this cheese or ball in a relaxed state, without tensile elongation, to a point at and beyond which the strand or strands are subjected to a spinning twist. Conveyance of the strand or strands may be, for example by carriage by a conveyor system or train of rolls, frictionally driven by a driving roll at a speed related to the rate of spinning or twisting, the cheese or ball itself being frictionally driven by a primary member of this system or train; the roving material, having been laid in reversed helices during winding, is unwound and delivered, as the cheese or ball is driven to unwind, preferably by frictional surface contact, at a linear velocity at least equal to or greater than the surface speed of the cheese or ball, so that no substantial draft or tension is imposed on the roving during unwinding from the cheese or ball. The roving is therefore in relaxed condition until subjected to a spinning twist, the degree or rate of which is adjusted conformably to the character of this roving material, for forming a yarn by spinning and/or twisting it in the usual manner. The spinning or twisting instrument proper may be any usual or known device capable of spinning or twisting a relatively weak roving.

The invention includes the mode of dealing with the material in a slack state resulting from substantially positive and regular delivery of a tender roving at a rate preventing any substantial tensile stress on it, and in the same condition in which the roving is delivered from the condenser carding machine directly to the spinning instrument.

The procedure dispenses with heretofore intervening stages of preliminary spinning, doubling, and spooling, and also makes it possible to produce yarn from asbestos and other feebly coherent fibres of shorter staple than heretofore, in any practice of which I am aware. The invention includes the art or method and the apparatus for practicing it hereinafter explained.

The invention will be explained with the aid of the drawings of specific instances of apparatus hereto annexed, in which:

Fig. 1 shows a portion of a spinning or twisting frame, in front elevation;

Fig. 2 is a side elevation partly in section of devices shown in Fig. 1;

Fig. 3 is an end elevation of the roving-delivery train of rolls;

Fig. 4 is an end elevation of a modified form of said train;

Fig. 5 is a diagram development of the surface of an unwinding supply package illustrating the difference between the rate of delivery of a roving and peripheral rate of travel of the unwinding cheese of roving;

Fig. 6 is a front elevation of the roving delivery train of rolls shown in Fig. 3;

Fig. 7 is a plan of the cheese holding frame;

Fig. 8 is a side view of the extensible cheese supporting arm;

Fig. 9 is a section on line 9—9 of Fig. 7; and

Fig. 10 a section through a cheese and the unwinding support, showing a core or quill retaining lug.

The invention may be carried out on any usual spinning or twisting frame, which as shown, for example, in Figs. 1, 2, 3, 4 and 6, may provide for spinning or twisting and winding on bobbins, for example by the devices of any usual ring frame, by which the rovings R are spun, or twisted together, or both, as they come from a delivery roll 2 rotating in bearings on standards A, conveniently mounted, as shown on the finger-board B. The rovings from cheeses 5 are carried to the delivery roll 2 over a top roll 3 and by a tractor drum or roll 4 which acts to support and drive the cheese 5. Means, shown as a friction gearing comprising a roll 6 may be provided for driving roll 4 from roll 3. Roll 6, while preferably a cylinder as long as roll 3, need be only a short roll and engage only a small portion of the length of roll 3, if desired (not shown). In some cases gearing or a belt might be resorted to instead.

The usual supporting means for top roll 3 permits it to be disengaged from the delivery roll 2 to interrupt operation of the devices for feeding the roving whenever it is found desirable. This may comprise end bearings for the top roll spindle in standards A having vertical slots 7 in which the roll spindle is journaled to turn during normal operation. The roll may be lifted by hand from the slots 7 into slots 7^a of much less depth in the bearing standard adapted to support the roll spindle when normally lifted out of engagement with delivery roll 2. The top roll 3 might be lifted mechanically upon occasion, as by the lever device illustrated for lifting a similar roll 13^a in my Letters Patent No. 1,732,592 dated October 22, 1929, for example.

To permit the top roll 3 to be lifted and held out of engagement with the delivery roll 2 as just described it is desirable to move the friction roll 6 out of the way, for which I may provide a hinged support on standards A for the roll 6. As shown the support comprises frame members 8 pivoted on the transverse spindle 9 of the roll 4, said spindle being journalled at each end in holes in the standards A and frame 8.

The tenuous and delicate nature of the rovings to be spun makes it desirable to avoid crushing stresses beyond a permissible maximum, and this invention provides means avoiding compressive stress on the cheeses 5, which may comprise means for holding balls, cheeses, or other unwinding packages against an unwinding tractor surface, such as the roll 4, with a pressure less than that implied by the weight of the unwinding package. One device for this may comprise counterbalancing mechanism, operating independently for each unwinding cheese.

In one form, the arm 10 of a bell crank lever 10, 12 is pivoted on a longitudinal strut or shaft 11 above and to the rear of each roll 4 and carries a spindle 14 (Figs. 7, 8 and 10) for the unwinding cheese. Another upwardly extending counterweight arm 12 of the bell crank lever 10, 12 may carry in a bore at its end a link supporting a counterweight 15 so as to provide for motion of the bore about shaft 11 in an arcuate path including or approaching the vertical plane of shaft 11. The effect of the counterweight is thus variable directly with the virtual length of the counterweight arm, which varies with the position of spindle 14, which measures the radius of the unwinding package. Arm 10 may comprise a telescoping construction, shown in detail in Figs. 7, 8 and 9, to enable the spindle 14 to be moved forward out of line with the other cheeses to doff a core or replenish with a new cheese. The arm 10, in the preferred construction, is bored and threaded for a hold-down screw 17 (Fig. 8) taking into a longitudinal slot 18 of the adjustable arm member 19, which is provided with hook lugs 20, 20 taking over the main member of the arm 10, on which the member 19 can slide to the limits of slot 18. Member 19 is bored to receive spindle 14. A spring 21, connected to the remote ends of arm member 10 and 19, normally retains slide member 19 at its inner limit.

Spindle 14 may be provided with any usual spring-held dog 16 at the outer end to lock on the cheese or core.

The arrangements for feeding the roving may be varied within the invention. Fig. 4, for example, illustrates a modification in which the roving or rovings pass between the top roll 3 and a friction roll 6^a of a train

bearing a member 6^b in driving contact with tractor roll 4. Rolls 6^a, 6^b and 4 may have spindles bearing in holes of a frame 8^a like frame 8. The roving in this case is fed forwardly over delivery roll 2 after passing between rolls 3 and 6^a. In the form of Fig. 4 the arc of contact of the roving with the delivery roll 2 is shorter than in the device of Fig. 3. The arrangement of Fig. 3 is more especially adapted for delivering a multi-ply roving. A single or multiple roving may be delivered through pot-eyes 25 at or near the axes of the spindles.

Fig. 5 is a development of the circumferential surface of a cheese 5 of a length a—b. The distance a—c indicates the length of a roving laid in a helix by traverse winding in which a stroke of the traverse occurs in the length a—b of the winding surface. It will be apparent that the distance a—c is greater than a—b. If therefore the surface of cheese 5 is driven at a constant rate to unwind, this results in the roving unwinding from the cheese at a rate greater than the surface speed of the cheese, in the proportion represented by the excess of the distance a—c over the corresponding peripheral distance a—b. Since the peripheral speed is like for the cheeses 5 and the roll surfaces 4 and 3, tension on the unwinding roving is precluded and the roving unwinds from surface contacts on the roll 4 traversing from side to side, to limits indicated by the lines r, r′, respectively, according to passage in front of or behind top roll 3, and the traverse of the winding on the cheese, without putting any undue tension on the roving, and providing sufficient slack in the roving to prevent breakage. According to the usual mode of winding the cheeses of roving, the pitch of the spiral laid by the traversing winding guide is related to the peripheral speed of the winding package, so that the slack resulting from the peripheral unwinding of the traverse-wound winding remains constant. Delivery roll 2 therefore delivers a slack roving or rovings to the traveler or flier of the spinning or twisting devices 1.

In operation, the delivery roll 2, positively driven by the usual means at any desired rate related to the rate of rotation of the spindles and bobbins 1, drives the front roll 3, which in turn drives the idler roll 6, Fig. 3, or the rolls 6^a, Fig. 4, which constitute a friction transmission train driving the tractor roll 4. The cheese, traverse wound either of a single strand or a plurality of strands, from which the final yarn is to be made, rests upon roll 4 and is driven at substantially the peripheral speed of roll 4. The roving is thus carried in a relaxed state to the nip between rolls 2 and 3 whence it may pass to the traveler, flier or other rotary guide of the spinning or twisting frame 1. For a single strand of roving particularly, the construction of Fig. 4 in which the rovings are fed back of roll 3 and between rolls 2 and 3 to the front of roll 2, may be relied upon to reduce even the slight stress, usually permissible, from gravity and air-resistance to the ballooning strand incident to the use of the devices of Fig. 3. The arc of contact on delivery roll 2 is shorter in the form of Fig. 4 than in the form of Fig. 3, and the delivery point of the roving is more nearly concentric with the spindle and axis of rotation of the traveler; or flier, if used. The twist will extend up to the point where the strand leaves the roll 2. The strand passes between the rolls 2 and 3 ensuring a linear rate of feed related to the rotation of the spindle, and the more nearly the twist reaches the point of delivery of the strand, the more nearly regular will be the product.

In order further to secure regularity of delivery and to avoid the effect of decreasing weight of the unwinding cheese, and to prevent the effect of this weight to crush the rovings, or to press the surface too lightly against the roll 4 to secure a proper frictional drive, the operation of the counterbalance lever 10, 12 and variable counterweight 15 may be relied upon. The arcuate motion of the point of application of the weight as the size of the cheese diminishes reduces the effect of the counterweight substantially in accordance with the decrease of weight of the unwinding cheese and the unbalanced weight of its spindle and its supporting means. Accordingly the pressure exerted by the cheese upon drum 4 remains substantially constant at a predetermined value throughout the unwinding of the cheese.

Since it is contemplated to set up a plurality of these roving delivery trains side by side as shown in Fig. 1, operated from rolls driven in unison by the usual delivery roll driving devices of the spinning or twisting frame, and to have the delivery units as close together as possible, the distance between the operating units does not permit the removal of a cheese or its core from its spindle when it is in its normal position.

When it becomes necessary to replace an exhausted cheese by a full cheese, the member 19 which supports the cheese is pulled outwardly from the frame, the telescoping arms 10 and 19 sliding to permit outward movement of the spindle 14 with the arm 19; the empty core is then doffed by unlocking latch 16, and a full cheese is inserted on the shaft in its place. The spring 21 then acts to draw the telescoping arms back into normal position.

By the operations above described a condensed ribbon of carded sliver, hereinabove referred to as a roving, is conveyed continuously, preferably vertically, in a relaxed state, without any substantial tensile stress to disarrange the fibres laid together by the

condensing operation, through a point on the axis of the twisting run between the delivery roll 2 and the spinning or twisting device. The twisting device, shown as a free-running traveler of the usual ring spinning unit, might be anything capable of twisting the strand. The travellers are recommended to be of light weight and well-finished for a minimum frictional stress on the spinning run of the forming yarn.

The effect of these operations is to confine any tensile stresses on the roving to that part of the roving which is in the act of being twisted, and this conduces to a twisted lie of the fibres in the spun strand in an optimum state of mutual frictional contact contributing to a high tensile strength in relation to the nature of the material. Such tensile stress is not of sufficient magnitude to cause any substantial elongation by slippage of the fibres lengthwise, and does not contribute to thin places or irregularity of twist.

In this specification and the appended claims the words "spinning" and "twisting" are mutually interchangeable expressions of the same rotary operation upon a strand or strands for the purpose of giving an axial twist to the elongated mass of fibres comprising it or them. In the case of plural strands, the effect is mutually to twist together individual strands at the same time subjected to twisting on their own axes. The devices of this application may be applied without change to make the article and practice the art or method of my Patent No. 1,732,593 dated October 22, 1929, or to feed the strands of roving in the machine of my Patent No. 1,732,592 dated October 22, 1929.

I claim:

1. Art of making a yarn from textile material of inferior spinning capacity comprising preparing a condensed unspun carded strand, winding said strand in reversed helical coils to form a package, and subsequently unwinding the package so as to deliver the strand vertically in a slack state, without substantial tensile stress tending to elongation of the strand, through a twisting run induced by a spinning device.

2. Art of making a yarn from textile material of inferior spinning capacity comprising preparing a condensed unspun carded textile strand, winding said strand in reverse helical runs to form a self-sustaining package, unwinding the said package at a certain surface speed, and conveying the unwinding strand at a greater velocity than said surface speed through a twisting run in the roving induced by a spinning device.

3. Art of making yarn from textile fibres of inferior cohesive capacity comprising building a self-supporting cross wound package comprising an unspun strand of said material laid in reversed helices, rotating said package to unwind at a substantially constant predetermined surface speed definitely related to the speed of a spinning device operating on said strand, and delivering the strand to the twisting run caused by the spinning device at a linear rate greater than said surface speed.

4. Machine for making yarns from unspun rovings of textile fibrous material comprising a spinning device adapted to be rotated at a certain speed, a delivery roll means for driving the delivery roll at a predetermined substantially constant speed definitely related to the rate of rotation of said spinning device, in combination with means for delivering unspun roving in slack untensioned condition to the delivery roll, said means comprising a support for a cross wound package of roving, and means for rotating the package to unwind at a surface speed substantially equal to that of said delivery roll.

5. Machine for making yarns from unspun rovings of textile fibrous material comprising a spinning device adapted to be rotated at a certain speed, and a delivery roll for roving rotated at a substantially constant surface speed definitely related to the rate of rotation of said spinning device, in combination with means for delivering unspun textile strand at a linear speed greater than that of the delivery roll, and comprising conveyor devices for presenting the strand in a relaxed state to said delivery roll.

6. Machine for making yarns from unspun rovings of textile fibrous material comprising a spinning device adapted to be rotated at a certain speed, and a delivery roll, means for driving the roll at a substantially constant predetermined surface speed definitely related to the rate of rotation of said spinning device, in combination with means for supporting a self-sustaining cross-wound package comprising reversed helices of a textile strand, and means for rotating said package at such a surface speed as compared with that of the delivery roll that the strand is delivered to the roll in a slack condition.

7. Machine for making yarns from unspun rovings of textile fibrous material comprising a plurality of spinning devices each adapted to be rotated at a certain speed, series of delivery rolls, means for driving said delivery rolls at a surface speed definitely related to the rate of rotation of said spinning devices, in combination with a series of supports, each adapted to hold a cross-wound self-sustaining package of unspun textile strand, said supports being independently movable from winding to inoperative position, conveyor devices for roving in a relaxed state between each package and the corresponding delivery roll, and friction-driven means for rotating the package to unwind and driving the conveyor devices at a linear speed substantially equal to that of the surface speed of said delivery roll.

8. Machine for making yarns from cross-wound packages of weak unspun strands of textile fibrous material laid in reversed spiral windings comprising a spinning device adapted to be rotated at a certain speed, and a delivery roll rotated at a predetermined substantially constant surface speed definitely related to the rate of rotation of said spinning device, in combination with a support for a package to be unwound, a tractor roll in contact with the surface of the unwinding package, and means for driving the tractor roll at a substantially constant surface speed substantially equal to the surface speed of said delivery roll, whereby to deliver a roving in a slack state to be twisted between said delivery roll and said spinning device.

9. Machine for making yarns from unspun rovings of textile fibrous material comprising a spinning device adapted to be rotated at a certain speed, and a delivery roll for roving rotated at a surface speed related to the rate of rotation of said spinning device, in combination with means for supporting a wound package of roving for substantially free rotation, an unwinding tractor roll in surface contact with said package of roving, and drive means normally operative to transmit motion of rotation to said tractor roll from said delivery roll in a direction to unwind said package, said drive means comprising a pair of normally engaging elements, and means supporting one of said elements for movement out of operative engagement with the other.

10. Machine for making yarns from unspun rovings of textile fibrous material comprising a spinning device adapted to be rotated at a certain speed, and a delivery roll for roving rotated at a surface speed related to the rate of rotation of said spinning device, in combination with tractor means for driving a wound package of roving by surface contact, movable means for supporting said package for substantially free rotation, and means cooperating with the package supporting means operative to maintain a substantially uniform contact pressure between the package and tractor means irrespective of the diameter of the package.

11. Machine for making yarns from unspun rovings of textile fibrous material comprising a spinning device adapted to be rotated at a certain speed, and a delivery roll for roving rotated at a surface speed related to the rate of rotation of said spinning device, in combination with tractor means for driving a wound package of roving by surface contact, and a support permitting rotation of said wound package having freedom of motion in response to gravity of said support and package whereby to hold said package in contact with said tractor means, and counterbalance means reacting on said support to reduce the pressure between said package and said tractor means.

12. Machine for making yarns from unspun rovings of textile fibrous material comprising a spinning device adapted to be rotated at a certain speed, and a delivery roll for roving rotated at a surface speed related to the rate of rotation of said spinning device, in combination with tractor means for driving a wound package of roving by surface contact, and a support permitting rotation of said wound package having freedom of motion in response to gravity of said support and package whereby to hold said package in contact with said tractor means, and counterbalance means reacting automatically on said support variably according to the radius of the wound package to reduce the pressure between said package and tractor means.

13. In a textile machine, the combination with a part having an endless tractor surface, and means for driving said part to move said surface, of a support for a wound package of material to be rotated by said surface comprising a lever pivoted on a part of the machine having an arm provided with a spindle for said package to hold said package against said tractor surface, and another arm disposed for motion in an arc above said pivot and carrying a counterweight opposing the weight of said package, whereby decrease of diameter of said package lessens the effect of said counterweight to lift the package from contact with the tractor surface.

14. In a textile machine having a driven delivery roll and a package engaging part having a traction surface adapted to support and frictionally drive for unwinding a wound package of roving, a top roll driven by said delivery roll, driving means for driving said package engaging part having a traction surface engaging said top roll, and journal means normally supporting the top roll for rotation, said journal means being so constructed and arranged that the top roll may be moved out of engagement with the delivery roll to stop the winding operation.

15. In a textile machine, a driven delivery roll, a top roll driven by said delivery roll, a tractor roll for driving a wound package of roving, means to drive said tractor roll from said top roll, and manually operable means to interrupt the rotation of said tractor roll, comprising means permitting displacement of the top roll in relation to said delivery roll.

16. In a textile machine a series of tractor driving devices for wound packages, a corresponding series of supports for wound packages, each support comprising an arm having a package spindle normally disposed at an angle to the arm, the several spindles normally being substantially in alignment, each spindle being bodily movable lengthwise of

its arm from normal position through a distance greater than the radius of a full wound package to permit replenishment of the exhausted package, and means tending to restore each spindle to normal position.

17. In a textile machine, a tractor roll and driving means therefor, and a support for an unwinding package of textile material comprising a two-armed lever pivoted on the machine having a laterally projecting spindle on one arm for supporting a package in contact with said tractor roll, said arm having parts held together by a telescoping joint adapted to be extended to position the spindle for doffing and replenishment of the supply.

18. In a textile machine, a series of aligned tractor rolls and driving means therefor, and a series of supports for a series of unwinding packages of textile material, comprising a two-armed lever for each package pivoted on the machine having a laterally projecting spindle on one arm for supporting a package in contact with said tractor roll, said arm having parts held together by a telescoping joint adapted to be extended to position the spindle for doffing and replenishment of the supply.

19. In a textile machine, a tractor roll and driving means therefor, and a support for an unwinding package of textile material, comprising a two-armed lever pivoted on the machine having a laterally projecting spindle on one arm for supporting a package in contact with said tractor roll, said arm having parts held together by a telescoping joint adapted to be extended to position the spindle for doffing and replenishment of the supply, said lever having an arm and counterbalance extending upwardly in relation to its pivotal center.

20. In a textile machine, a series of aligned tractor rolls and driving means therefor, and a series of supports for a series of unwinding packages of textile material, comprising a two-armed lever for each package pivoted on the machine having a laterally projecting spindle on one arm for supporting a package in contact with said tractor roll, said arm having parts held together by a telescoping joint adapted to be extended to position the spindle for doffing and replenishment of the supply, said levers each having an arm and counterbalance extending upwardly in relation to its pivotal center, and divergently in relation to the spindle-carrying arm.

Signed by me at Manville, New Jersey, this twenty-sixth day of December, 1930.

PHILLIP DAVID CANNON.