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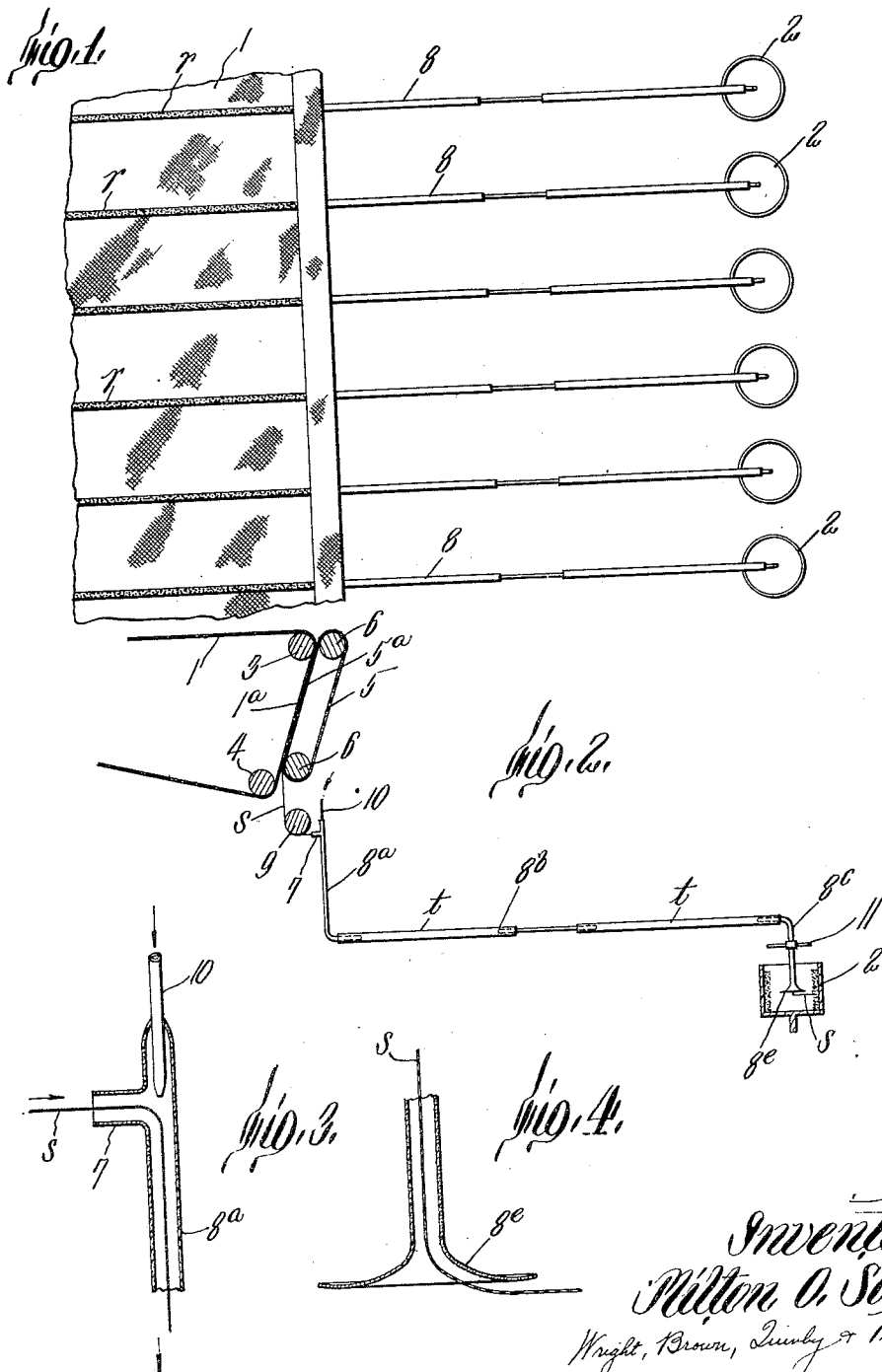
M. O. SCHUR

1,915,451

METHOD OF AND MEANS FOR DIRECTING AND ACCUMULATING STRAND MATERIAL

Filed Dec. 22, 1930

2 Sheets-Sheet 1



Inventor
Milton O. Schur
Wright, Brown, Limby & May
Attys

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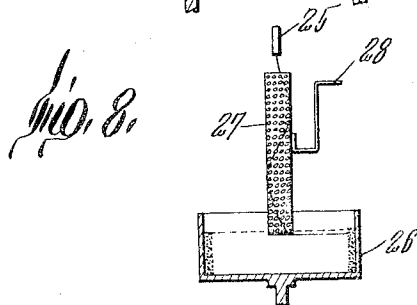
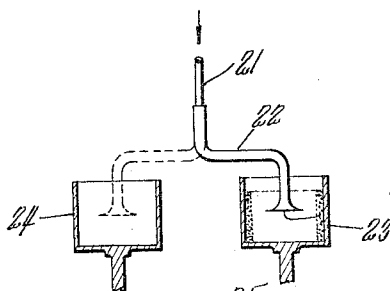
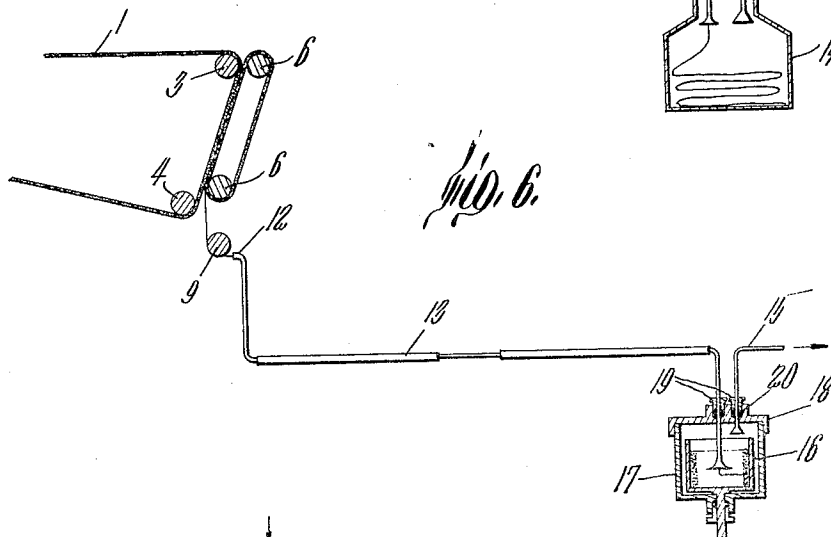
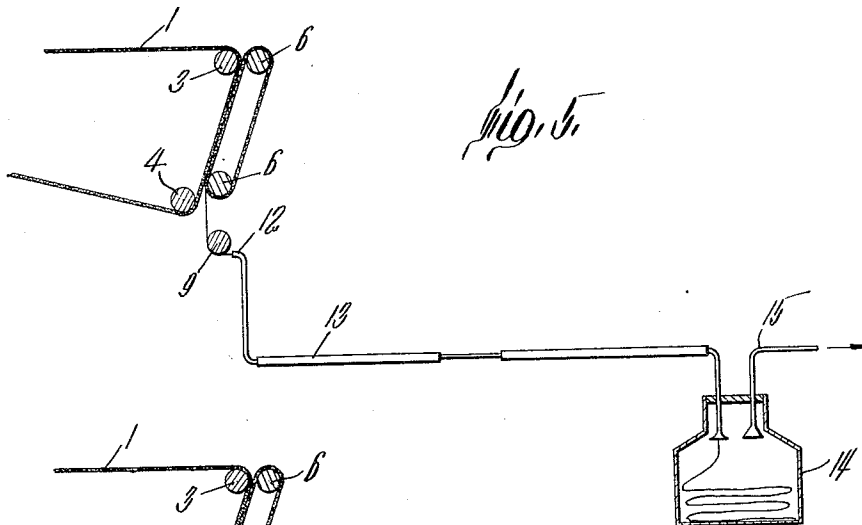
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Inventor
Milton O. Schur
Wright, Brown, Limby & May.
Attys

UNITED STATES PATENT OFFICE

MILTON O. SCHUE, OF BERLIN, NEW HAMPSHIRE, ASSIGNOR TO BROWN COMPANY,
OF BERLIN, NEW HAMPSHIRE, A CORPORATION OF MAINE

METHOD OF AND MEANS FOR DIRECTING AND ACCUMULATING STRAND MATERIAL

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This invention relates to a method of and means for directing and accumulating strand material, especially in those instances where such strand material is being fabricated continuously at a high rate of speed and where such strand material is so light that when allowed to proceed unsupported through the atmosphere from the fabricating means to an accumulator, air currents tend to misdirect it from the desired course.

In accordance with the present invention, continuous strand material of the character described is directed from the fabricating means through an atmospheric gap to an accumulator in a confined stream of gaseous medium flowing to the accumulator. While not restricted thereto, the principles of my invention are especially applicable to fine strands of fibrous material, for instance, strands of waterlaid, interfelted fiber designed for intertwisting into yarns or twines. Such strands may be made by rolling narrow ribbons of wet pulp formed on machinery of the papermaking type into round bodies or rovings. In actual practice, a large number of ribbons are deposited from an aqueous suspension of pulp in closely spaced relationship on a wire cloth, and the wet ribbons are rolled to round form, preferably while they are supported on the cloth. A serious problem heretofore encountered in this field of manufacture was the accumulation of a large number of tender strands without breaking them and without entangling them with one another as they proceeded at high speed from the fabricating mechanism through an air gap to suitable accumulators. The solution of this problem was especially perplexing because of the high speed at which it is desired to produce the strands, their tendency to cling to solid objects, such as guide rolls, with which they contact, and their uncertainty of direction when disturbed by air currents. The problem is rendered further troublesome when, as is the case in practical operation, the space which separates the ribbons of pulp on the fabricating mechanism is much less than the space occupied by the accumulator necessary for each strand. In fact, it is the cus-

tom to arrange the accumulators in staggered relation in order to avoid an impractical tandem arrangement of the accumulators in a line many times the width of the fabricating mechanism. Such staggering of the accumulators, however, means that the strands must be led in different directions to the accumulators, and further that these directions of travel must be controlled in order to avoid snarls between the strands or catching on the accumulators. By applying my invention, it becomes possible to control the direction of the strands as desired, as each strand is surrounded by a confined stream of gaseous medium directing it positively to the accumulator to which it is intended to proceed. I prefer to produce a confined stream of gaseous medium flowing to the accumulator in a tube or duct of small diameter having a strand-inlet end adjacent to the locality at which the strand leaves the strand-forming mechanism and having a strand-outlet end adjacent to the accumulator. The strand-inlet end is preferably under suction, so that the strand is sucked into the stream of gaseous medium immediately upon leaving the strand-forming mechanism, and is continuously carried to the accumulator as it is being produced. The strand is preferably accumulated or collected in a centrifugal can or so-called spinning pot similar to that used in the accumulation of rayon yarn as it comes from spinning machines. A spinning pot is advantageous, in that the tender strand is automatically deposited on the wall of the pot at the same rate as it is being fed thereinto, with little if any danger of breakage, and is wound into an annular mass, from which it may later be progressively unwound for twisting and plying with similar strand material. When a spinning pot is used, the desired suction at the strand inlet end of the strand-directing tube may be conveniently generated as by an air jet arranged to blow past the strand-inlet end. The stream of air and the strand material carried thereby may be led immediately adjacent to or into the spinning pot.

With these and other features and objects in view, I shall now describe my invention

in conjunction with the accompanying drawings, wherein

Figure 1 shows diagrammatically and conventionally a fragmentary plan view of a strand-forming mechanism used in making strands of waterlaid, interfelted fiber and the strand-directing and strand-accumulating units.

Figure 2 represents a side view of the strand-forming mechanism and a preferred type of strand-directing and strand-accumulating unit.

Figure 3 is a vertical section through the suction or intake end of a strand-directing tube.

Figure 4 is a similar section through the discharge end of a strand-directing tube.

Figures 5 and 6 are views similar to Figure 2, but showing different types of strand-accumulators.

Figure 7 shows a modified discharge-end construction of strand-directing tube.

Figure 8 shows still another discharge-end construction of strand-directing tube.

In Figure 1, I have, for convenience of illustration, shown the ribbons of pulp r being carried by an endless, wire gauze 1, at rather widely spaced intervals, so that after they have been rolled into strands, they may be directed in parallelism to a series of spinning pots 2 arranged in tandem. In actual practice, however, where the ribbons of pulp are separated only, say, $\frac{1}{2}$ to $\frac{3}{4}$ of an inch to lend capacity to the machine, and where the pots are many times this distance in diameter, it is necessary to stagger the pots in order to avoid a line of pots of inordinate length. It should therefore be understood that my drawings are not intended for working purposes in the sense that they give proper relative sizes or distances, but are good pictorial representations of my invention. The ribbons of pulp carried by the wire gauze are wet, as they have been deposited and interfelted thereon from a dilute aqueous suspension. Before being delivered to the pots, they are rolled while wet into fine strands or rovings by suitable means. As shown, the gauze passes over the guide roll 3 downwardly almost in a vertical direction to a guide roll 4, from which it proceeds to the same source whence it came. While the pulp ribbons are on the stretch of gauze 1a between the rolls 3 and 4, they are rolled out and removed from the gauze, so that the gauze may return to the pulp-depositing station (not shown), where pulp fibers are continuously being laid down thereon from aqueous suspension. The rolling or roving means shown is an endless belt 5 supported on a pair of spaced rolls 6 and whose outer face 5a makes contact with the stretch of gauze 1a. The rolls 6 are arranged at an angle to the horizontal, whereas the rolls 3 and 4 are horizontally disposed, so that the belt travels at an

angle relative to the direction of travel of the gauze. The relative angular motion between the contacting surfaces causes a rolling out of the pulp ribbons on the gauze into fine, round bodies or strands of pulp, which are quite weak as they emerge, still moist, from between the moving surfaces. Each round body or strand s is sucked immediately after release into a horizontal intake end 7 of a relatively long, strand-directing tube 8 leading to a spinning pot 2. Preferably, as shown in Figure 2, a rotating guide roll 9 is arranged directly under the lower roll 6 to receive the strand immediately after its release, and to carry its end near the suction created at the intake end 7. This causes the strand immediately to be drawn into the directing-tube 8, the stream of air flowing in the tube serving to convey the strand to its desired destiny. The strand is conducted from the horizontal intake end 7 of the strand-directing tube, downwardly through a vertical section 8a, thence horizontally through a horizontal section 8b, and finally downwardly, through a vertical discharge section 8c into the spinning pot 2. The tube 8 might obviously be fashioned to direct the strand by any other suitable course to the accumulating pot. The vertical section 8a is, as best shown in Figure 3, preferably extended beyond the horizontal intake end 7 and contracted against a nozzle 10 which projects into the vertical section and delivers a jet of air under suitable super-atmospheric pressure past the intake end, so as to create the desired suction thereat and thus to cause a stream of air to flow through the tube 8. The vertical discharge section 8c is preferably flared at its delivery end 8e, so as to inhibit any tendency of the strand winding about this end and so as to guide the strand more closely to the inner wall of the spinning pot against which it is thrown by centrifugal action as the pot spins at high speed. If desired, the section 8c may be oscillated to cause the delivery end to traverse the height of the pot and thus to form an annular mass of strand material in the pot. To this end, I have shown a horizontal bar 11 affixed to the section 8c and which may be oscillated by suitable means (not shown). One or more pieces of flexible rubber tubing t may be used in the tube 8, which may otherwise conveniently be made of glass, to permit oscillation. If desired, the pot 2, rather than the section 8c, may be oscillated vertically to effect the winding of the strand as an annular mass therein. An important advantage possessed by the embodiment of my invention thus far described is that the collection of the strands may be carried out with the common type of spinning pot under atmospheric pressure.

In Figure 5 I have shown a modification in which, rather than using an air jet for creating a suction at the intake end 12 of 1.

the strand-directing tube 13, I obtain the desired effect by conducting the strand through the tube 13 into a stationary container 14, which is constantly being evacuated by a tube 15 leading therefrom to a vacuum pump or vacuum chamber (not shown). The container 14 being closed, other than communicating with the evacuating means by the tube 15 and with the atmosphere by the tube 13, produces a suction at the intake end 12, wherefore a stream of air is caused to flow through the tube to serve as a positive carrying vehicle for the strand.

The modification shown in Figure 6 is similar to that shown in Figure 5, except that the accumulator is a spinning pot 16 rotating within a closed housing 17 having a removable cover 18 suitably clamped thereto. The cover is shown provided with glands 19 and suitable packing material 20 through which the strand-directing tube 13 and the air evacuator tube 15 pass into the housing 17. The housing may be made of sufficient height to permit the vertical oscillation by suitable means (not shown) of the pot requisite for forming therein an annular mass of strand material.

For convenience in changing pots without much interruption in the accumulation of the strand material, as shown in Figure 7, the discharge end 21 of the strand-directing tube may be received in a suitable elbow 22, which, after one pot 23 has collected a proper quantity of material, may be quickly turned or switched to feed into another pot 24.

When the strand-directing tube discharges into a pot under atmospheric pressure, as is the case with the apparatus shown in Figures 2 and 7, the delivery end of the tube may be porous or perforated to reduce turbulence or eddying of air in the pot and also to reduce the resistance or back-pressure. Excellent results are obtained if, as shown in Figure 8, the strand is blown from the strand-directing tube 25 into the centrifuge pot 26, through a perforated tube or can 27 of much smaller diameter than the pot and which is oscillated by an arm 28 up and down in line with the axis of the pot. In such case, the strand rotates within the oscillating tube, and hence a certain degree of further rolling or roving may be effected within the can. In actual practice, the strand-directing tube may be, say $\frac{3}{8}$ inch in diameter, and the oscillating can, say, $\frac{1}{2}$ inch in diameter and 10 inches long. The centrifuge pot may be, say, 10 inches in diameter by 4 inches deep, and make 3000 R. P. M., with the strand material being delivered thereinto at the rate of, say, 400 feet per minute. These figures are given only by way of example and may be varied from widely.

In the foregoing description, I have used the expression "strand material" as connoting a pulp ribbon in rolled-out condition, but

it is obvious that my method is applicable to strips or ribbons which in being directed to an accumulator present difficulties similar to those encountered with strand material. In making strands intended for interplying into yarns or string, it is generally preferable to roll out the moist pulp ribbons before they are accumulated, but one may also adopt my method when delivering the ribbons, as such, into centrifugal pots being rotated at sufficiently high rates of speed to effect appreciable twisting and rounding of the ribbons. Hence, the expression "strand material" as used in the appended claims is not to be interpreted in a limiting sense, unless the claims so require, but is intended to include ribbons or strips. I have heretofore spoken about directing the strand material through the atmosphere by a confined stream of gaseous medium flowing to the accumulator. I am not using the word "confined" in the sense that the stream is in absolute confinement, as in some of the embodiments of my invention described, the stream is open to the atmosphere at both ends. I am using the word "confined" in the sense that the stream of gaseous medium is in a tubing or duct which shields it and the strand of material transported thereby from atmospheric disturbances. Gaseous media other than air, e. g., steam or mixtures of steam and air, may be used. If desired, heated air may be used, or the directing-tube may be jacketed with a heating medium which effects a partial or complete drying of the moist strand material as it proceeds to the accumulator.

It is thus seen that my invention solves the problem of directing light, continuous strand material from a locus of support or fixation, from which it proceeds unsupported through the atmosphere, to another locus, and more especially to an accumulator, separated by a substantial atmospheric gap from the locus of support. In the particular example given in the specification and dealing with fine, moist strands of waterlaid, interfelted fibers, the locus of support is the wire gauze, this support being furnished for the pulp ribbons until after they have been transformed into the fine strands. As already indicated, however, my invention comprehends the removal of the pulp ribbons as such from the wire gauze support, and their conduction directly to an accumulator by the method hereinbefore described.

I claim:

1. Apparatus of the class described, comprising an endless, wire gauze for carrying a continuous ribbon of wet pulp, means for rolling said ribbon into a strand while on said gauze, a centrifugal pot into which said strand is directed unsupported through the atmosphere from said gauze, an open-ended duct through which said strand is conducted

in its course from said gauze to said pot, and means for creating a flow of gaseous medium through said duct in the direction in which said strand travels therethrough.

5 2. The combination, with a centrifugal pot in which a continuous strand is accumulated, of a tube having strand-inlet and strand-outlet ends for directing said strand into said pot, means for creating a flow of gaseous medium through said tube in the direction of travel of said strand, and openings through the wall of said tube at its discharge end to permit the escape of gaseous medium.

15 3. The combination, with a centrifugal pot in which a continuous strand is accumulated, of an oscillating tube discharging into said pot, a stationary tube having strand-inlet and strand-outlet ends for directing said strand into said oscillating tube, and means for creating a flow of gaseous medium through said stationary tube.

25 4. The combination, with a centrifugal pot in which a continuous strand is accumulated, of a perforated oscillating tube discharging into said pot, a tube having strand-inlet and strand-outlet ends for directing said strand into said oscillating tube, and means for creating a flow of gaseous medium through said directing tube.

30 5. Apparatus of the class described, comprising an endless, wire gauze for carrying a continuous ribbon of wet pulp, means for rolling said ribbon into a strand while on said gauze, an accumulator to which said strand is directed through the atmosphere from said gauze, an open-ended duct through which said strand is conducted in its course from said gauze to said accumulator, and means for creating a flow of gaseous medium through said duct in the direction in which said strand travels therethrough.

40 In testimony whereof I have affixed my signature.

MILTON O. SCHUR.

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