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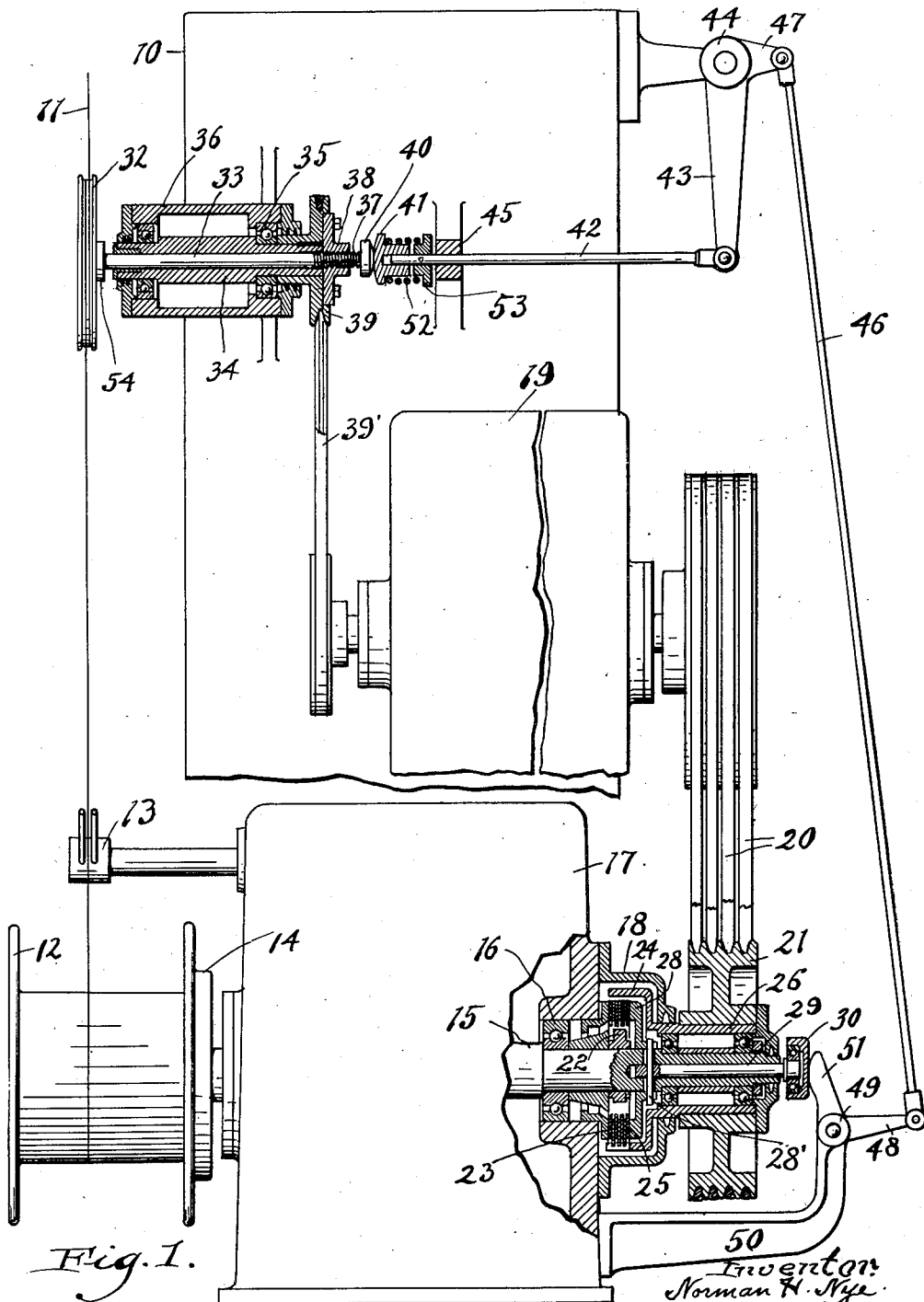
N. H. NYE

2,016,509

WINDING DEVICE

Filed April 30, 1931

2 Sheets-Sheet 1



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WINDING DEVICE

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Fig. 3.

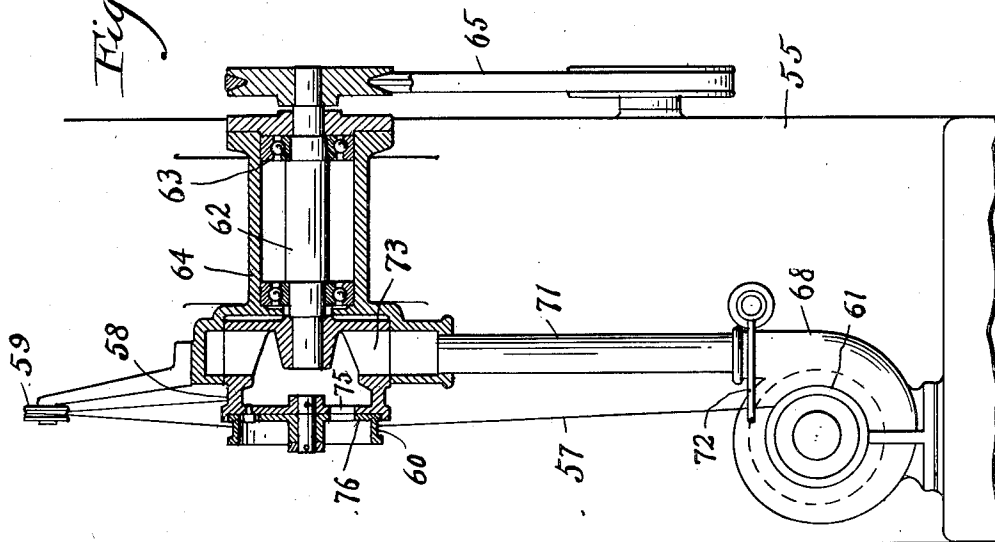
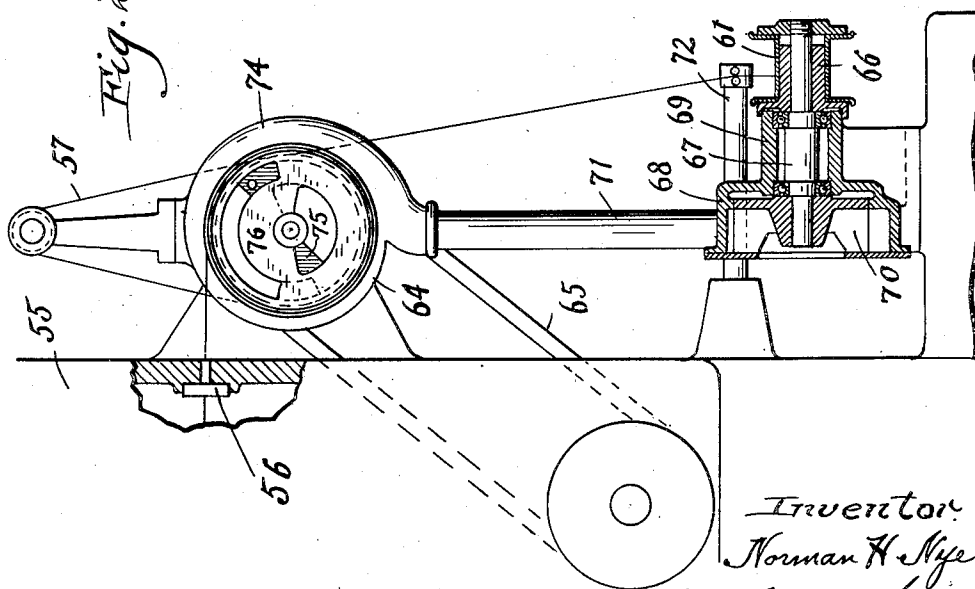


Fig. 2.



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UNITED STATES PATENT OFFICE

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WINDING DEVICE

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5 Claims. (Cl. 242—25)

This invention relates to winding devices and more particularly to the provision of improved devices of this kind, wherein the strand or strip of material being wound will have either a constant lineal speed or a controlled variable speed.

Winding devices have been constructed heretofore embodying many different forms of governing mechanisms, whereby the speed of the winding means is regulated in response to the tension or slackness of the material being wound. In the main, these devices have been impractical or unsatisfactory because the governing mechanism requires very careful adjustment to suit the strength of the material, and if the governing mechanism is not correctly adjusted the tension to which the material is subjected will be excessive, or the speed of the winding means will not be correctly regulated. In my winding device, I propose to govern the winding means in such a way that the speed of the latter will be correctly regulated, regardless of variations occurring in the tension of the material being wound.

Accordingly, it may be stated that as an object of my invention I aim to provide a novel form of winding device, in which the speed of rotation of the spool, or like winding means, will be automatically regulated in response to the lineal speed of the material.

Another object of my invention is to provide a device of the kind mentioned, in which the speed of rotation of the winding means is regulated by means actuated in response to a speed differential between a member driven by the material and a member driven from the source of power which actuates the winding means.

Another object of my invention is to provide a device of the kind mentioned, in which the speed of rotation of the winding means, is governed by controlling the delivery of power thereto by control means which is responsive to changes in the lineal speed of the material.

A further object of this invention is to provide a device of the kind mentioned, in which the winding means is driven by fluid pressure creating means associated with a member about which the material to be wound is wrapped.

Another object of this invention is to provide a device of this kind in which the winding means is driven by fluid pressure creating means associated with a member about which the material to be wound is wrapped, and in which the speed of rotation of the winding means is regulated in response to the lineal speed of the material.

Still another object of the invention is to provide a device of the kind mentioned, in which

the speed of rotation of the winding means is regulated by a fluid-flow control device actuated in response to changes in the lineal speed of the material.

Other objects and advantages of this invention will be apparent from the following description when taken in conjunction with the accompanying sheets of drawings, in which:

Figure 1 is an elevational view, partly in section, of a winding device embodying my invention;

Fig. 2 is an elevational view, partly in section, of another winding device embodying my invention; and

Fig. 3 is another elevational view of the winding device of Fig. 2.

In the drawings, to which detailed reference will presently be made, I have shown winding devices in which the speed of rotation of the winding means is regulated by means responsive to the lineal speed of the material, and although in illustrating my invention I have shown only two such devices, it will be understood, of course, that the principle of my invention may be embodied in various winding mechanisms including those used in conjunction with machines for drawing wire, or with machine for performing annealing, tinning, enameling or other operations.

In Fig. 1 I have represented generally a machine, such as a wire drawing machine, from which the strand is being delivered for winding on suitable rotatable winding means, here shown in the form of a spool. As the strand is wound upon the spool, it may be laid or distributed thereon by means of the distributing device. No detailed description of this device is believed to be necessary, since any one of the many available devices of this kind may be used.

The spool is removably mounted upon a suitable arbor or carrier which is secured to the drive shaft. This drive shaft is supported in suitable bearings mounted in the casing, and is adapted to be driven through the clutch mechanism from any suitable source of power, such as the electric motor. The clutch is of the type known as a slip clutch, and although any suitable slip clutch construction may be used, the device should be such that the power transmitted to the spool through the belt and the pulley may be readily controlled so as to regulate the speed at which the spool is rotated. The clutch construction herein illustrated includes a clutch element secured to the shaft and having a plurality of spaced friction discs

23, and a second clutch element 24 also having a plurality of friction discs 25 arranged between, and in alternate relation with, the friction discs 23. The clutch element 24 is constructed with a sleeve portion 26 which is journaled upon the shaft 15 and to which the pulley 21 is keyed or otherwise secured. The power transmitted through the clutch is regulated by varying the friction between the sets of friction discs, and for this purpose I provide a disc compressing member 28, supported upon the shaft 15 so as to have limited axial movement thereof. An actuating rod 29 is slidably mounted in the shaft 15, having its inner end operably connected with the compressing member 28 by means of the pin 28', and at its outer end being provided with a rotatable contact button 30.

It will be seen from the arrangement of clutch structure just described that when a force is applied to the button 30 to press the same inwardly toward the spool 12, the friction between the clutch discs is increased, causing a decrease in the amount of slippage therebetween and correspondingly increasing the speed of rotation of the spool. When pressure upon the button 30 is reduced or released, the friction between the clutch discs is also reduced, with the result that the amount of slippage between these discs is increased and the speed of rotation of the spool is correspondingly decreased.

It should be stated that as the driving motor 19 I prefer to employ an electric motor having a substantially constant speed characteristic, and vary the speed of rotation of the spool 12 by varying the transmission of power thereto, that is to say, I permit the motor 19 to be operated at substantially constant speed and vary the speed of the spool 12 by regulating the amount of power transmitted thereto from the motor. Instead of providing a separate motor for driving the spool as shown in Fig. 1, the spool may be driven in the same way from the driving means of the machine 10, which operates at substantially constant speed.

Accordingly, to regulate the speed at which the spool 12 is driven by varying the amount of power transmitted through the clutch, as just explained, I provide means for actuating the clutch in response to the lineal speed of the material being wound. To this end I employ a sheave or drum 32, which is secured to a shaft or spindle 33 and around which the strand 11 is wrapped. This shaft is rotatably mounted in, and extends through, a second shaft 34 which is rotatably supported in bearings 35 mounted in suitable supporting means, such as the bearing bracket 36 secured to the casing of the machine 10. At the end of the spindle 33 opposite that to which the drum 32 is secured, I provide a helically threaded screw portion 37 which cooperates with a similarly threaded nut 38. This nut is secured to a pulley 39, which in turn is secured to the shaft 34 and is adapted to be driven by any suitable means, preferably by some means operating at substantially constant speed, which might be an individual motor or a part of the machine 10. In this instance the pulley 39 is shown as being driven from the motor 19 by the belt 39'.

It will be seen from this arrangement that, as the strand 11 is taken up by the spool 12, the drum 32 and the spindle 33 to which it is secured will be rotated at a speed corresponding with the rate at which the strand is being wound. At the same time, the pulley 39 and the nut 38

secured thereto will be rotated in the same direction by the belt 39'. If the speed of rotation of the spindle 33 and that of the nut 38 are exactly equal, there will be no relative movement therebetween. In other words, if the speeds of these two members are equal, there will be no tendency for the screw portion 37 to travel through the nut in either direction, but if the spool 12 tends to take up the strand at a rate which will give the spindle 33 a faster speed of rotation than the nut 38, the spindle will travel through the nut in a lefthand direction, as seen in Fig. 1. If the spool 12 tends to run too slowly, the spindle 33 will travel through the nut 38 in the opposite direction to press the contact button 40 against the contact member 41.

To transmit motion from the speed responsive device just described to the clutch 18 so as to regulate the speed of the spool accordingly, I provide a rod 42 on one end of which the contact member 41 is slidably and rotatably mounted and at its opposite end is pivotally connected to the arm 43 of the bell crank lever 44. Suitable guiding means may be provided for the rod 42, such as the guide bracket 45, which is carried by the casing of the machine 10. A rod 46 connects the arm 47 of the bell crank lever 44 with the arm 48 of a clutch actuating lever 49. The lever 49 is pivotally supported adjacent the clutch 18 by means of the bracket 50, 30 and is provided with an actuating arm or finger 51 which engages the rotatable button 30. It will be seen from the arrangement of linkage just described that when the rod 42 is moved toward the right, as seen in Fig. 1, the clutch pin 29 will be moved inwardly to increase the friction between the clutch discs and thereby increase the speed of rotation of the spool.

Since the transmission of power by the clutch 18 depends upon the pressure applied to the clutch discs rather than the extent of movement of these members, I provide a yielding connection between the member 41 and the rod 42, so that changes transmitted through the linkage to the clutch will be in the nature of slowly acting pressure changes rather than as direct or sudden movements, such as would be transmitted through rigidly connected linkage, and would result in sudden changes in the speed of the spool and probably in breakage of the material being wound. This yielding connection comprises a coil spring 52 having one end in engagement with, and centered upon, the contact member 41 and its other end in engagement with and centered upon, a collar 53. The spring 52 is normally under slight compression so as to always hold the member 41 against the button 40. The collar 53 is pinned or otherwise secured to the rod 42, so that upon movement of the contact member 41, changes occurring in the compression of the spring 52 will be transmitted to this rod and through the linkage to the clutch. Movement of the spindle 33 toward the left, as seen in Fig. 1, or in other words, in a clutch releasing direction, will be limited by the engagement of the button 40 with the nut 38, and movement of the spindle in the opposite, or clutch actuating direction, is limited by the hub 54 of the drum 32 engaging the cover of the bearing bracket 36.

In Figs. 2 and 3 of the drawings, I have shown my invention embodied in another winding device which may be associated with various machines which perform operations upon strand or strip material. In this instance, I have represented such a machine 55 as being a wire draw-

ing machine having a die 56 through which the strand of wire 57 is adapted to be drawn by the wire drawing drum 58. From the drawing drum 58, the strand passes over an idler sheave 59 and is wrapped around a rotatable governing drum 60 from whence the strand passes to the spool 61 upon which it is to be wound.

The drawing drum 58 is secured to a drive shaft 62 which is supported in suitable bearings 63 mounted in the bracket 64. This bracket may be secured to any available support, such as the casing of the machine 55. The shaft 62 may be driven by the belt 65 from any suitable source of power, such as the driving means of the machine 55.

The spool 61 upon which the strand is to be wound is removably mounted upon a head or arbor 66 which is secured to a drive shaft 67. For supplying power to the drive shaft to rotate the spool, I provide a fluid motor or turbine 68 having a volute casing formed with a laterally extending, hollow sleeve portion 69 which supports the drive shaft. A rotor 70 is secured to the end of the drive shaft opposite that upon which the spool is mounted, and is adapted to be driven by motive fluid supplied to the casing of the motor through the passage 71. If desired, a strand laying mechanism 72 may be employed for laying or distributing the strand upon the spool, and for this purpose any of the available and well known mechanisms of this kind may be employed.

For supplying motive fluid to the motor 68 for the purpose of driving the spool, I construct the drawing drum 58 so as to embody an impeller 73 which is rotatable in the volute casing 74. It will be seen from the arrangement described that upon rotation of the drawing drum to withdraw the strand from the machine 55 and advance the same toward the winding means, the impeller 73 will be rotated for the purpose of supplying motive fluid to the spool driving motor 68 through the passage 71. Thus the motor 68 and the fluid pressure creating means associated with the drum 58 together constitute a fluid transmission whereby power is transmitted to the spool to drive the latter.

To regulate the speed at which the spool is driven, I provide fluid-flow controlling means for controlling the power to be transmitted through the fluid transmission. I prefer to have the fluid-flow device control the intake passage for the casing 74, but, if desired, this device could be arranged to control the discharge passage. In this instance, the fluid-flow controlling means comprises a valve element 75 formed integral with the drawing drum 58 and a cooperating valve element 76 formed integral with the governing drum 60. These valve elements are so constructed and arranged that one of the elements forms a movable shutter for a fluid passage through the other element, whereby the area of the intake passage of the casing 74 can be varied, and consequently the delivery of motive fluid to the motor 68 controlled.

During operation of my winding device, the rotation of the impeller 73 draws air through the opening of the valve elements and supplies this air under pressure as motive fluid to the motor 68. When the governing drum 60 and the drawing drum 58 are rotated at the same speed, there is no relative movement between the valve elements, and consequently for a given speed of rotation of the impeller 73, there is no change in the volume of air which can be drawn in and supplied to the fluid motor 68. Consequently, so long as the gov-

erning drum and the drawing drum rotate at the same speed, the speed of rotation of the spool will be kept substantially constant. If the spool tends to run too fast, the governing drum will be rotated faster than the drawing drum and will cause the valve element 76 to move relative to the valve element 70 to decrease the area of the air inlet passage. This reduction in the area of the inlet passage reduces the amount of motive fluid which can be delivered to the motor 68 and correspondingly reduces the speed of the spool 61. If the spool tends to run too slowly, the governing drum will lag behind the drawing drum and the area of the air inlet opening will be increased. This increase in the area of the inlet opening allows more air to be drawn in by the impeller and delivered to the motor, with the result that the speed of the spool is correspondingly increased.

It should be noted that the drawing drum 58 is somewhat larger in diameter than the control drum 60 which results in some slippage between the material and the drawing drum. This slippage is desirable because it permits the control drum to move relative to the drawing drum as the former responds to changes in the rate at which the material is being taken up by the spool, and this relative movement between the drums, as explained above, regulates the transmission of power for driving the spool, and consequently the speed of rotation of the latter.

In the operation of my novel winding devices the speed of rotation of the spool will be regulated by varying the rate at which power is delivered to the spool through the relatively movable cooperating members of the power transmitting means, and this power transmitting rate is, in turn, dependent upon the slippage occurring between the relatively movable members as permitted by the control means. In the winding device of Fig. 1 the relatively movable members of the power transmitting means are the clutch discs 23 and 25, and in the device of Fig. 2 the relatively movable members of the power transmitting means are the rotors 70 and 73. The control of the slippage between the relatively movable members of the power transmitting means is dependent upon the speed at which the control drum is driven by the strand being wound. In the operation of these winding devices the speed of this drum fluctuates between speed limits which necessarily are relatively close together, because the strand being wound is delivered, or, in other words, made available for winding, at a substantially uniform rate by the wire drawing machine.

It will now be readily seen from the winding devices disclosed, that by my invention I have provided novel mechanism of this kind in which the speed of the spool, or similar winding means, is regulated in response to a speed differential between cooperating members of a control device. Since one of these cooperating members is driven by the material being wound, it will be seen that the speed of rotation of the spool will be correctly regulated in response to the lineal speed of the material and wholly independently of variations occurring in the tension thereof.

While I have illustrated and described the device of my invention in a detailed manner, it should be understood, however, that I do not intend to limit myself to the precise details and arrangements of structure illustrated and described, but regard my invention as including such changes and modifications as do not involve

a departure from the spirit of the invention and the scope of the appended claims.

Having thus described my invention, I claim:

1. In a device of the character described, the combination of rotatable means upon which material may be wound, a source of power, means comprising a fluid transmission for transmitting power from said source to said rotatable means to drive the latter, and fluid-flow controlling means for regulating the speed of said rotatable means, said flow controlling means comprising relatively movable cooperating valve elements one being actuated from said source of power and the other being actuated by said material.
2. In a device of the character described, the combination of rotatable means upon which a strand is adapted to be wound, a source of power, means comprising a fluid transmission for transmitting power from said source to said rotatable means to drive the latter, and fluid-flow controlling means for regulating the speed of said rotatable means, said flow controlling means comprising relatively rotatable coaxial members around which the strand is wrapped, and cooperating valve elements actuated by the relative movement of said members.
3. In a device of the character described, the combination of rotatable means upon which a strand may be wound, a fluid motor for driving said rotatable means, a power source, fluid pressure creating means driven at substantially constant speed from said power source for supplying motive fluid to said motor, and governing means for controlling the supply of motive fluid to said motor to regulate the speed of said rotatable means, said governing means comprising a strand contacting element connected with said pressure creating means for advancing the strand

toward the winding means at a substantially constant rate, a second strand contacting element driven by the strand and movable relative to the first mentioned element, and cooperating valve elements actuated by the relative movement of said strand contacting elements.

4. In winding apparatus the combination of rotatable means upon which a strand may be wound, an air turbine for driving said rotatable means, a blower for supplying air to said turbine, means for driving said blower, a rotary member actuated by the blower driving means for advancing the strand toward the rotatable means, a second rotary member arranged coaxially with the first mentioned rotary member and engaging the strand between said first mentioned rotary member and said rotatable means, said rotary members being arranged for limited relative rotary movement therebetween, and valve means responsive to the relative movement between said rotary members for controlling the air supply to the turbine.

5. In winding apparatus the combination of rotatable means upon which a strand may be wound, an air turbine for driving said rotatable means, a blower for supplying air to said turbine, means for driving said blower, a drum rotated by said driving means for advancing the strand toward the rotatable means, an air intake for said blower, a rotatable member arranged coaxially with said drum and engaging the strand intermediate said drum and said rotatable means, and cooperating valve elements actuated by relative rotary movement between said drum and said rotatable member for controlling said air intake.

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