Jan. 14, 1958 W. W. AVERA 2,819,579

APPARATUS FOR CATCHING BROKEN ENDS ON TEXTILE MACHINES

Filed Feb. 11, 1955 3 Sheets-Sheet 1

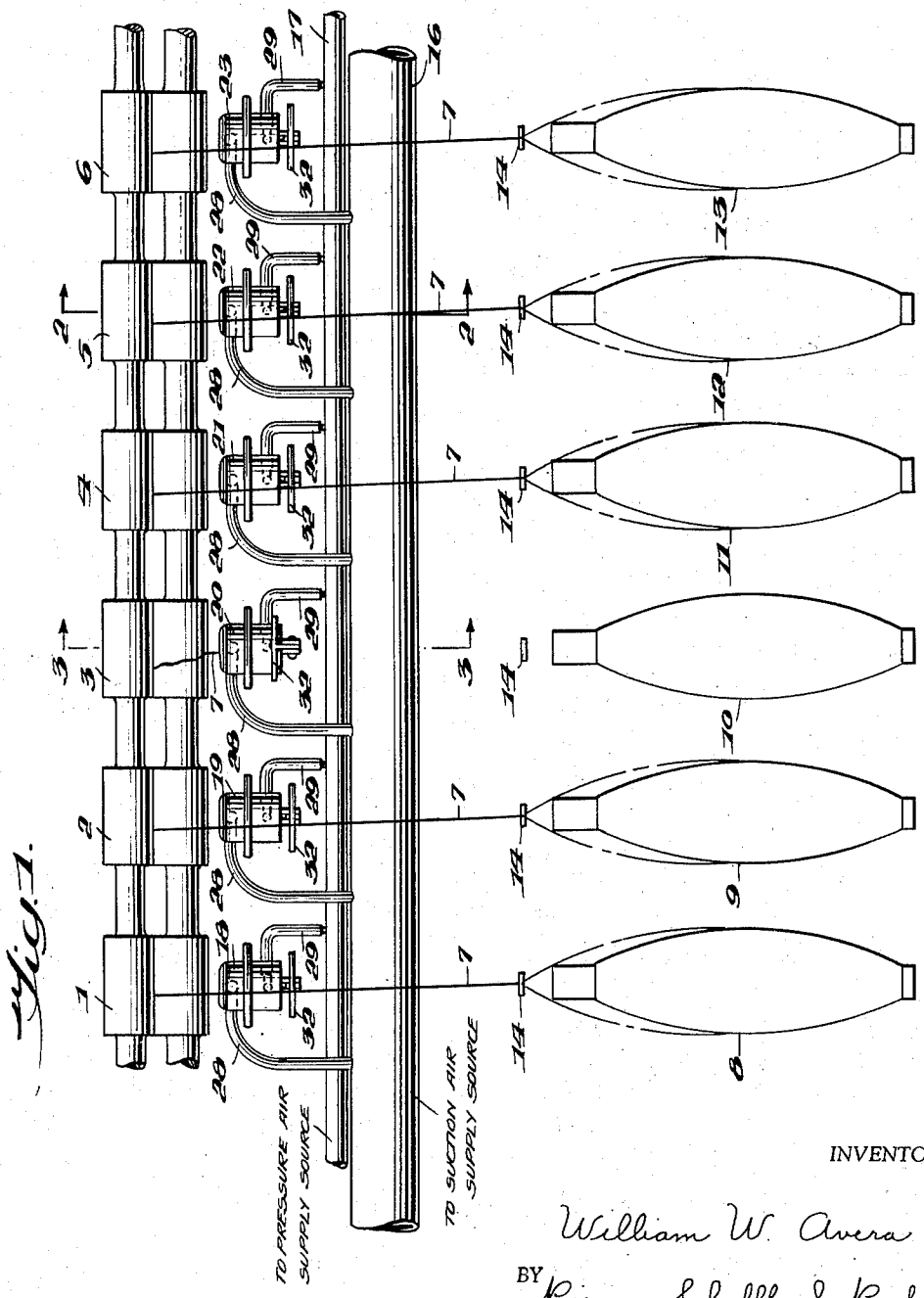


Fig. 1.

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Filed Feb. 11, 1955 3 Sheets-Sheet 2

Fig. 3.

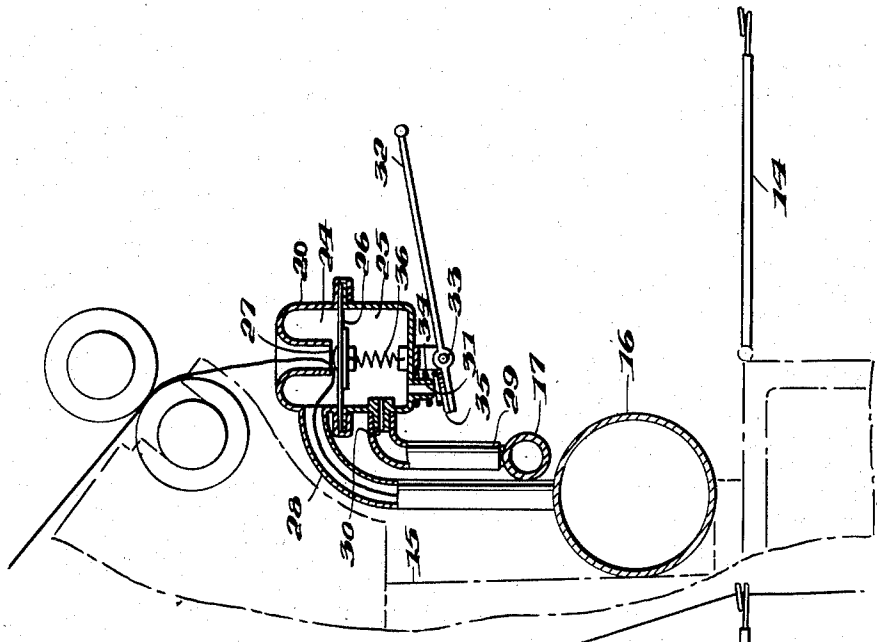
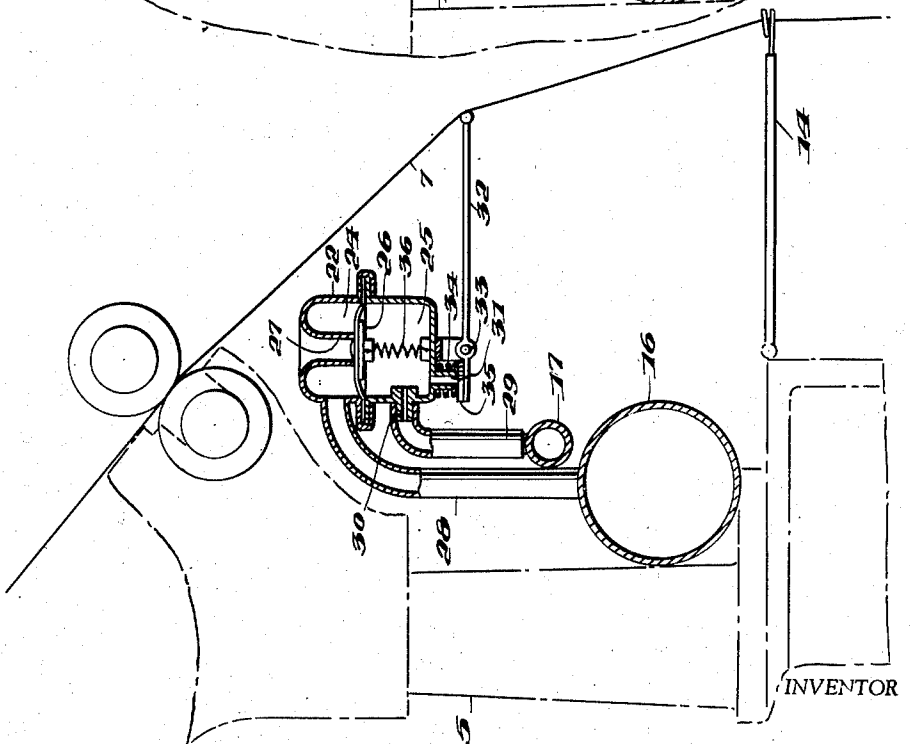


Fig. 2.



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Filed Feb. 11, 1955 3 Sheets-Sheet 3

Fig. 4.

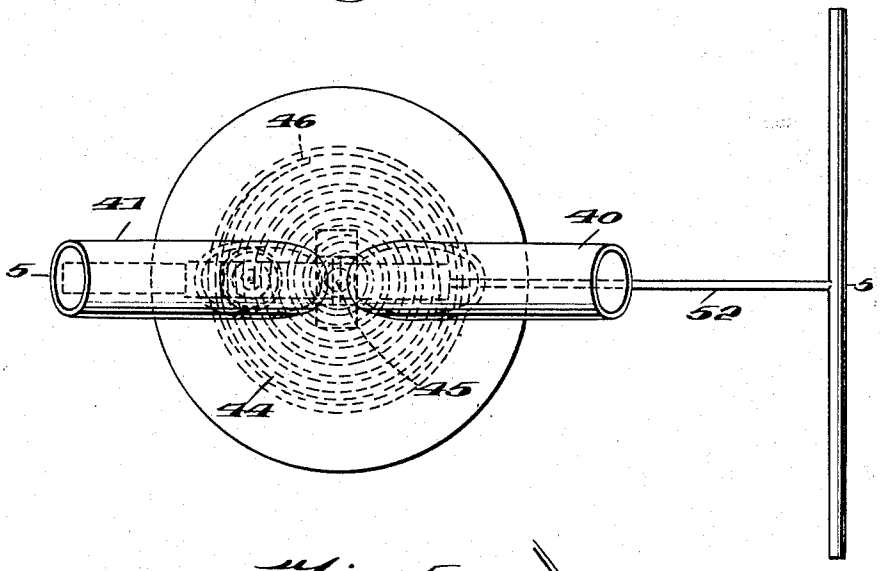
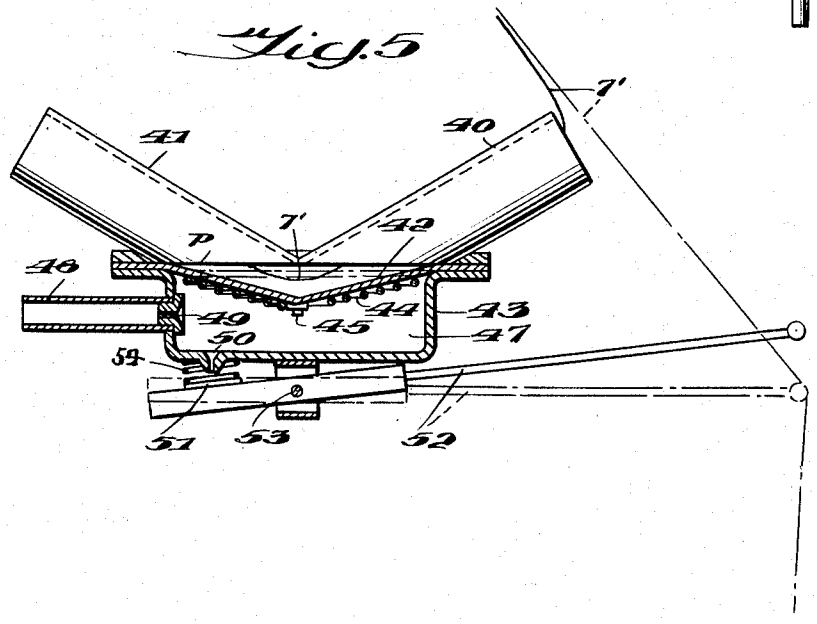


Fig. 5



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APPARATUS FOR CATCHING BROKEN ENDS ON TEXTILE MACHINES

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8 Claims. (Cl. 57—34.5)

The present invention relates to devices for clearing textile machines of the general type wherein continuous lengths formed from textile fibers, such as slivers, rovings and the like are drawn, straightened or twisted preparatory to weaving or knitting into cloth, or sale as yarn or thread. Examples of such machines are slubbers, drawing frames, roving frames and spinning frames. More particularly, the present invention pertains to an improved vacuum or suction device for catching and removing the ends of any normally continuous fibrous length which happens to break while being processed on the machine.

A primary object of the invention is to provide a suction device for catching the ends of any broken fibrous lengths which requires a very low horsepower to operate. Not only does this effect a savings in cost of operating the end catching device but it also results in a corresponding reduction in the heat load of the room. The latter is most important, particularly in hot weather, since the rooms in which the machinery is located must be maintained at optimum temperature and humidity conditions which require the use of air conditioning equipment in the summer to cool the air. Consequently any reduction in heat generated in the room is reflected by a corresponding reduction in load on the air conditioning equipment.

The present inventive concept is in contrast to prior developed suction type end collection devices wherein air is continuously sucked in through the tube openings associated respectively with the fibrous lengths regardless of whether or not there are any breaks in the fibrous lengths. Such systems require greater horsepower to establish sufficient suction simultaneously through all of the tube openings in order to suck in an end when a break occurs and hence are more costly to operate and add to the heat load of the room.

The primary objective of this invention is reached by an arrangement, defined more particularly in the appended claims, wherein actual suction through tubes which suck in the broken ends occurs only when there is a break in the length of fiber, and even then the suction developed is limited to the collection tube associated with the particular length of fiber on the machine which becomes broken.

A more particular object of the invention is to provide a collection device for broken ends of a plurality of normally continuous lengths of fibers being worked simultaneously on a textile machine comprising a suction tube, having an entrance opening therein, for and positioned adjacent each of the fibrous lengths, all of the tube openings being normally closed when all of the plurality of fibrous lengths remain unbroken, means associated with each of the fibrous lengths for detecting a break therein, and means responsive to the detecting means for uncovering only the opening in the tube associated with the broken length thereby sucking in the end of the same. The broken end then continues to feed into the tube

until the operator, noting the break, repairs the same by tying the ends together and processing of that particular length is resumed.

A still more specific object is to provide a collection device for broken ends of normally continuous lengths of fiber being processed comprising a tube for each length, each said tube being under constant suction and including an entrance opening, normally closed except when a break in the fibrous length occurs, located adjacent the fibrous length, a differential pressure actuated valve for closing and opening the entrance to the tube, and a detector device in the form of a feeler which rides in contact with the fibrous length, the detector being coupled to the valve and controlling operation of the latter such that upon a break in the fibrous length, the valve opens to uncover or otherwise open the entrance opening to the tube causing the end of the broken length to be sucked into the tube.

The foregoing as well as other objects and advantages inherent in the invention will become more apparent from the following detailed description of preferred embodiments thereof and the accompanying drawings, as applied to a spinning frame. However, it is to be understood that application of the invention to a spinning frame is exemplary rather than limitative, it being possible to apply the same principles of end collection to other types of textile machines such as, for example, drawing frames roving frames, slubbers, et cetera without departing from the spirit and scope of the invention as defined in the appended claims.

With reference now to the drawings:

Fig. 1 is a view longitudinally of a portion of a spinning frame, showing a plurality of spindles, the front rolls associated with the spindles, and the end collection device associated with each strand being spun into thread.

Fig. 2 is a transverse section at an enlarged scale on line 2—2 of Fig. 1 showing the end collection device in relation to a strand (unbroken) in the process of being spun;

Fig. 3 is also a transverse section at an enlarged scale similar to Fig. 2 and taken on line 3—3 of Fig. 2 to show how the end collection device operates to suck in an end when the strand breaks;

Fig. 4 is a top plan view of a somewhat different construction for the differential pressure valve component of the end collection device which controls opening and closing of each suction tube and;

Fig. 5 is a central vertical section taken on line 5—5 of Fig. 4 with certain parts shown in elevation.

With reference now to the drawings, and Figs. 1–3 in particular, the structural details of the spinning frame have for the most part been omitted in order to simplify the drawings and also because they do not constitute any essentials of the inventive concept defined in the appended claims. Consequently the only spinning frame structures illustrated in solid lines are several pairs of front rolls 1—6 through which the strands 7 are drawn, the associated vertical spindles 8—13 which are rotated about their vertical axes to spin and wind the thread, and the thread guides 14 interposed between the rolls and spindles. Supporting structure 15 of the spinning frame for the rolls, thread guides and the end collection device has been outlined by broken lines.

The device according to the invention for catching broken ends is comprised of a header pipe 16 extending horizontally for the length of the spinning frame and located beneath the front rolls 1—6. Air suction, i. e. negative pressure, is maintained in this pipe by any suitable means such as for example a suction fan, not shown, that can

be driven by an electric motor or by a power take-off from the motor which drives the spindles 8—13.

A second header pipe 17 extends parallel with the header pipe 16 and a positive air pressure is maintained in pipe 17 by any suitable means such as a blower fan which also can be driven independently by a motor or by a power take-off from the spindle drive.

For each thread being spun, an end collection device in the form of a suction inlet controlled by a valve is provided. These valves, numbered 18—23, are located respectively below the roll pairs 1—6, and the arrangement is such that upon a break in any strand, the valve and suction inlet associated with that particular strand opens and sucks in the loose end of the broken strand as it continues to feed through the front rolls. All other valves and suction inlets remain closed.

Each of the control valves 18—23, as shown clearly in Figs. 2–3, is seen to be comprised of an upper chamber 24 and a lower chamber 25. These two chambers have one wall in common constituted by a flexible diaphragm 26 therebetween which also serves to open and close a central air inlet 27 to the upper chamber 24. Upper chamber 24 is connected to the air suction header pipe 16 by conduit 28, and the lower chamber 25 is connected to the pressure air conduit 17 by means of conduit 29 and a small bore orifice 30.

The lower chamber 25 is provided with a leak port 31 adapted to be closed and opened by means of a feeler arm 32 which rides in contact with the strand 7 and serves to detect whenever a break in the strand occurs. In Fig. 2, the strand 7 is being spun, i. e. it is unbroken, and it will be seen that the front end of feeler arm 32, mounted pivotally intermediate its ends at 33 on the lower end of the valve 22, is held in a substantially horizontal position by the tension in the strand against an opposing force applied to the rear end of arm 32 by a coil spring 34 which surrounds the leak port 31. The rear end of arm 32 is provided with a plate 35 which, in the feeler arm position shown in Fig. 2, closes off the air exit end of the leak port 31. In the position shown in Fig. 3, the strand 7 is broken, which releases the hold-down force on the front end of feeler arm 32, whereupon the arm is rotated counter-clockwise by the restoring force in compressed spring 34, and plate 35 moves away from and opens leak port 31.

A tension spring 36 has its lower end anchored to the bottom wall of the lower chamber 25 and its upper end connected to the center of diaphragm 26. The spring tension in 36 acts in opposition to the positive air pressure which exists in the lower chamber 25 and acts upwardly against diaphragm 26. With the parts in the position shown in Fig. 2, i. e. with leak port 31 closed, the positive air pressure, i. e. air pressure above that of the surrounding atmosphere in conjunction with the suction pressure, i. e. below atmospheric, existing in the upper chamber 24 establishes an upward force against the under face of diaphragm 26 sufficient to overcome the downward pull on the diaphragm by spring 36 with the result that the diaphragm 26 maintains the air inlet 27 to the upper chamber 22 closed.

In the event of a strand break, the parts move to the position shown in Fig. 3, thus opening leak port 31. Leak port 31 has an area larger than that of the constriction orifice 30 with the result that air pressure in the lower chamber 25 reduces to zero enabling the tension spring 36 to pull down diaphragm 26 and thus open inlet 27 to the interior of upper chamber 24 whereupon air in the vicinity of the broken strand end will be drawn into inlet 27, flowing through chamber 24 and pipe 28 to the suction header 16. This flow of air picks up the broken strand end sucking it into inlet 27, and through chamber 24 into pipe 28. The strand end will continue to be drawn into pipe 28 and suction header 16 until noticed by an operator whereupon the broken end of the strand feeding through the rolls is tied to the thread end on the spindle and spinning of that particular strand is resumed.

In suction type end collection devices developed prior to this improvement, the equivalent of applicant's air inlet 27 remains open continuously, with the result that the suction fan must be large enough to develop sufficient suction to draw in air continuously through all of the collection inlets associated with the suction header. As distinguished therefrom, the air inlets 27 of all the control valves remain closed except in the case of a strand break whereupon only the air inlet associated with that particular strand opens to place the same in communication with the suction fan. Since the probability is that not more than a few strands on an entire spinning frame will be broken at any one time, it is obvious that the load on the suction fan will be far less than that which obtains with the arrangements of the prior art. Consequently the suction fan can be much smaller, i. e., it can have a much lower horsepower rating which not only is more economical to operate but also results in less heat to be removed from the room when air cooling becomes necessary to maintain a desired temperature condition.

The embodiment shown in Figs. 4 and 5 is basically similar to that shown in Figs. 1–3 except for the arrangement of the differential pressure operated valve which controls flow of suction air to draw in the broken end. For the Figs. 4, 5 construction the suction air header pipe and the pressure air header pipe corresponding to header pipes 16, 17, respectively have been omitted for the sake of simplification.

With reference now to Figs. 4 and 5 it will be seen that the functional equivalent of the upper chamber 24 in each of the valves 18—23 is now constituted by two tubes 40, 41 which meet at an oblique angle, the two tubes being cut obliquely to their longitudinal axes at their junction along a horizontal plane P which passes through the apex of the tube junction. A flexible diaphragm 42 is mounted on the valve casing 43 such that it is movable from the position shown in Fig. 5, wherein the two tubes 40, 41 are in communication at their junction, to a position shown in broken lines wherein the diaphragm is located in the plane P thus closing off communication between tubes 40, 41. The position shown in full lines in Fig. 5 is the position taken when there is a strand break and there is communication between the two tubes 40, 41, thus causing the strand end 7' to be sucked into and through tubes 40, 41 into the suction header 16 that is connected to the outlet end of tube 41.

As in the first embodiment described the position of diaphragm 42 is determined in part by a spring, this time a flat spiral spring 44 having the center end 45 secured to the center of the diaphragm and the outer end 46 secured to the outer edge of the diaphragm. The stressing of the spring is such that it tends to pull the center of the diaphragm down to the position shown in Fig. 5. Opposing the spring action is a positive air pressure normally maintained in chamber 47 against the underside of diaphragm 42, this pressure being produced by a small blower which delivers the air through a header corresponding to header 17 of the embodiment of Figs. 1–3, and a branch pipe 48 and restriction orifice 49, corresponding to the pressure air supply pipe 29 and orifice 30 of that embodiment. Also, as in the previously described embodiment, chamber 47 includes a leak port 50, the outlet end of which is adapted to be closed by a plate 51 on a detector arm 52 pivotally mounted at 53 on the bottom of valve casing 43, and which is adapted to contact the strand as it passes from the front rolls down to the spindles. As long as the strand remains unbroken, detector arm 52 occupies the position shown in broken lines wherein plate 51 closes off the mouth of leak port 50. Air pressure built up within chamber 47 from the conduit 48 and orifice 49 is then sufficient to overcome the counter action exerted by spring 44 causing the diaphragm to be moved to plane P, the position indicated

in broken lines, thus closing off communication between tubes 40, 41.

In the event of a strand break, the loading spring 54 associated with leak port 50 causes arm 52 to rotate counter-clockwise to the position shown in full lines. With leak port 50 now open, the air pressure in chamber 47 drops, with the result that the restoring force in spring 44 is now sufficient to move the center of diaphragm 42 to the position shown in full lines thus establishing communication between tubes 40, 41 and effecting a flow of air inwardly through these tubes to the suction header which draws in with it the broken strand end.

In conclusion it will be seen that each of the embodiments illustrated and described operates in essentially the same manner. As long as any strand remains unbroken, there is no flow of suction air into the inlet of the suction tube associated with that particular strand. In the event that a strand breaks, the device which detects the break then functions to place the suction tube inlet associated with the broken strand in communication with the source of suction pressure whereupon air is drawn into the suction tube and with it the broken strand end.

It is to be further understood that other embodiments falling within the scope of this inventive concept are possible. Thus, for example, the air pressure control valve which opens and closes the suction inlet for the strand end can be replaced with its mechanical or electrical equivalent and these are intended to be covered by the scope of the appended claims. Moreover, as indicated in the introduction, the basic principles of the invention are applicable as well to other types of textile machinery for processing normally continuous fibrous lengths into slubs, rovings, strands, threads and the like.

I claim:

1. The combination with a textile machine frame which includes pairs of drawing rolls through which fibrous lengths are drawn and rotary devices associated with the lengths for twisting the same, of a device for catching the ends of any of said fibrous lengths as may become broken, said end catching device comprising an air pressure controlled valve means individual to each fibrous length being twisted, each said valve means comprising a first negative pressure air chamber and a second positive pressure air chamber and a flexible diaphragm defining a common wall between and separating said chambers, an inlet to said first chamber disposed adjacent the corresponding fibrous length between the rolls and rotary twisting device for sucking in the end of the fibrous length feeding from the rolls in the event of a break therein, said diaphragm also serving to control flow of suction air between said inlet and first chamber, spring means tending to bias said diaphragm to a position wherein communication is established between said inlet and first chamber, a source of negative pressure air including tube means connected with said first chamber for carrying off the broken end sucked into said first chamber, a source of positive pressure air connected with said second chamber, said second chamber including a leak port for venting air therefrom, the air pressure in said second chamber being sufficient when said leak port is closed to move said diaphragm against the force exerted by said spring means to a position wherein it closes off communication between said inlet and first chamber, and a member adapted to ride in contact with each fibrous length being twisted for detecting a break therein, said detecting member controlling said leak port and being operative to open said leak port in the event of a break in the length and vent air from said second chamber thus lowering the pressure in said second chamber and permitting said spring means to move said diaphragm to the position wherein communication is established between said inlet and first chamber.

2. The invention as defined in claim 1 wherein said spring means is a tension spring, one end of said spring being connected to said diaphragm and the other end of said spring being anchored to a fixed point.

3. The invention as defined in claim 1 wherein said spring means is a flat spiral spring, the inner end of said spring being secured to a central portion of said diaphragm and the outer end of said spring being anchored to the outer portion of said diaphragm.

4. The invention as defined in claim 1 wherein said source of negative pressure air includes a negative pressure air header extends for the length of said machine frame and wherein the tube means extending from said header to the first chambers of said valve means.

5. The invention as defined in claim 1 wherein said source of positive pressure air includes a positive pressure air header extending for the length of said machine frame and tube means extending from said header to the second chambers of said valve means.

6. The invention as defined in claim 1 wherein said member for detecting a break in the fibrous length is comprised of a feeler member mounted pivotally intermediate the ends thereof, one end of said feeler member being adapted to contact the fibrous length being twisted and the other end of said feeler member including means adapted to open and close said leak port from said second chamber.

7. The combination with a textile machine which includes a frame, pairs of drawing rolls spaced along the frame and through which continuous lengths of fibers are drawn, and a twisting device individual to each said fibrous length for twisting the same subsequent to leaving said drawing rolls, of a device for catching the ends of any of said fibrous lengths as may become broken between the rolls and twisting device during the twisting action, said end catching device comprising a suction tube individual to each fibrous length being twisted, one end of each said tube being connected to a source of air suction and the other end of each tube terminating adjacent the fibrous length asociated therewith and between the corresponding rolls and twisting device, each said tube being comprised of two tubular sections meeting at an oblique angle and cut off obliquely to their axes along a common plane which includes the apex of the junction between said tubular sections, a flexible diaphragm adapted to be moved between a first position wherein said diaphragm occupies said common plane and cuts off communication between said tubular sections and a second position wherein communication is established between said tubular sections, means associated with each fibrous length between the rolls and twisting device for detecting a break in the length, and means controlled by said break detecting means for actuating said diaphragm from the first to the second position thereof.

8. The invention as defined in claim 7 and which includes a chamber wherein positive pressure air can be applied to one side of said diaphragm for maintaining said diaphragm in its first position, a source of positive pressure air connected to said chamber, and a leak port for venting air from said chamber, said leak port being controlled by said break detecting means.

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