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[54] **CLOSED LOOP CARDING MACHINE CONTROL**

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[52] **U.S. Cl.** **19/240**

[51] **Int. Cl.** **D01h 5/38**

[58] **Field of Search** 19/239, 240, 241

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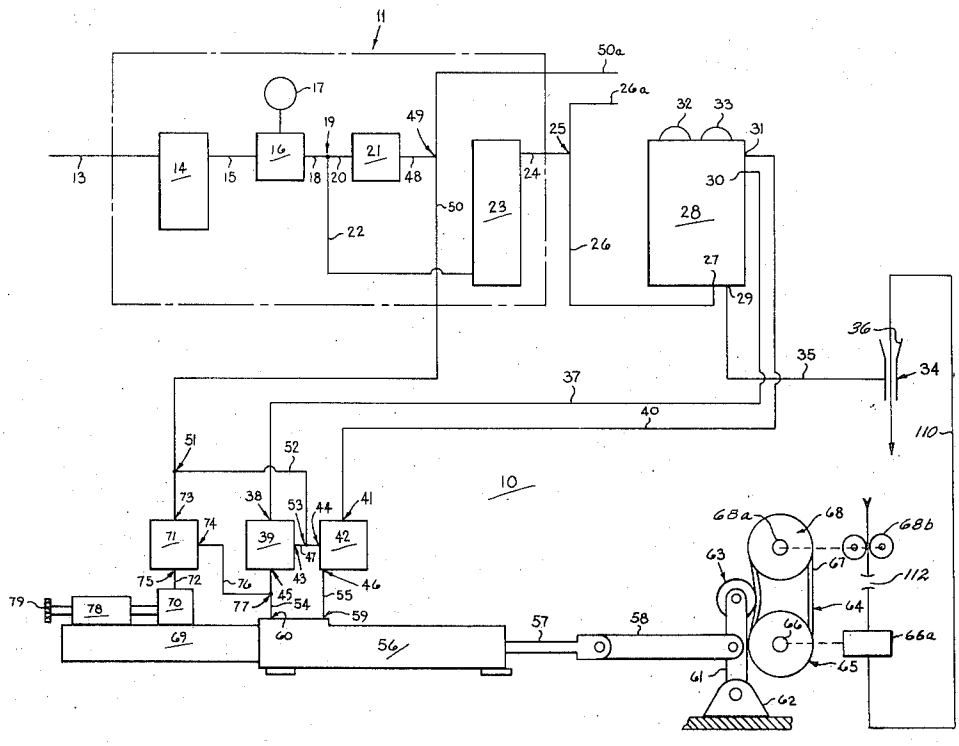
Primary Examiner—Dorsey Newton

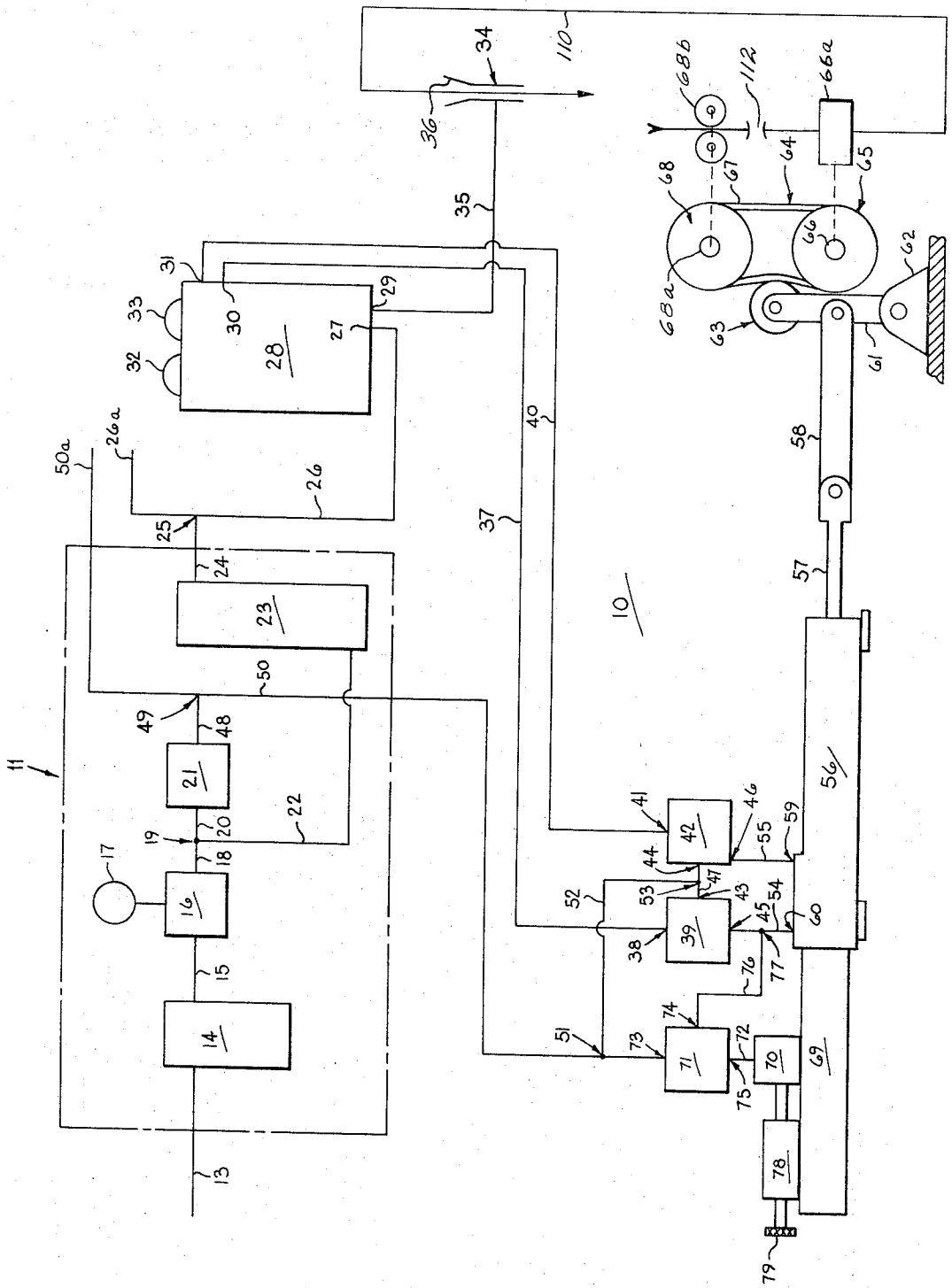
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[57] **ABSTRACT**

A closed loop fluidic control system for carding machines including a sliver sensor means for monitoring a parameter of the sliver passing therethrough, fluidic signal means connected to the sliver sensor means for producing pneumatic output signals indicating variations in the parameter of the sliver being monitored, control means connected to the fluidic signal means for receiving therefrom the pneumatic output signals produced thereby, actuator means operated by the control means in accord with the pneumatic output signals received by the latter, and means interconnecting the actuator means to the speed transmission drive of the carding machine whereby when the parameter of the sliver being monitored is of a first magnitude the actuator means effectuates a first change in the speed transmission drive means thereby reducing the speed of the carding machine and when the parameter of the sliver being monitored is of a second magnitude the actuator means effectuates a second change in the speed transmission drive means thereby increasing the speed of the carding machine.

8 Claims, 1 Drawing Figure




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CLOSED LOOP CARDING MACHINE CONTROL

BACKGROUND OF THE INVENTION

1. Field of the Invention

My invention relates to closed loop control systems preferably for use with textile machinery, and more particularly to a fluidic closed loop control system for controlling the production from a carding machine of sliver having uniform weight.

2. Description of the Prior Art

Closed loop control systems have been employed heretofore by the prior art in a variety of different applications. Generally though such control systems have been in the nature of mechanical, electromechanical, or electrical systems. Each of these different types of prior art systems however have proven to be inherently possessed of certain disadvantages. For example, in the case of mechanical systems, one disadvantage thereof is that the uninterrupted operating life of the system is generally limited. This stems primarily from the fact that the mechanical components which are employed in the system characteristically have a tendency to become inoperative over a period of time due to the wear and tear to which these components are subjected through constant operation. In addition, mechanical systems often are incapable of providing the degree of sensitivity of measurement as well as the speed of response desired in the case of many control applications for closed loop systems.

Insofar as there are mechanical components operating in the aforereferenced prior art electromechanical systems, these latter systems have a tendency to be subject to the same disadvantages noted hereinabove as being found in mechanical systems. On the other hand electromechanical systems normally possess some advantages over mechanical systems particularly with regard to reliability in operation and speed of response. That is the electrical components employed in these systems generally permit a faster speed of response such that control functions can be initiated much more rapidly than is possible with pure mechanical systems. In addition, barring electrical power failures attributable to non-system causes, the uninterrupted operating life of electrical systems is generally better than with mechanical systems.

Finally, with regard to electrical systems, these systems have proven for many applications of closed loop control systems to be satisfactory from the standpoint of speed of response and reliability of operation. However when employed particularly in conjunction with textile machines, electrical closed loop control systems have often proven to be susceptible to certain disadvantages. For example, the reliability of operation of the electrical components in the system is often greatly affected by the environmental conditions prevalent at the point of application. These conditions can detrimentally influence the accuracy of the measurements obtained as well as the overall efficiency of the system.

Recently fluidic sensors have become known in the prior art which by virtue of the fact that they include no moving parts are characterized by extremely long life. Further the degree of accuracy in measurement sensitivity obtainable from such fluidic sensors has proven to be satisfactory from the standpoint of the requirements of for example the textile industry. Moreover, such fluidic sensors are normally unaffected by environmental conditions which have proven capable

of adversely affecting the operation of the components employed in electrical closed loop control systems. Generally speaking however such fluidic sensors have heretofore been employed in open loop systems wherein the fluidic sensors function merely to produce a signal evidencing unacceptable variations in the parameter of the article being monitored.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide a novel and improved closed loop fluidic control system for controlling the operation of a machine to produce therefrom strand-like material uniformly having the desired parameter.

It is another object of the present invention to provide such a closed loop fluidic control system wherein changes in the operating conditions of the machine are effectuated in response to the sensing of variations in the parameter of the strand-like material being monitored.

A further object of the present invention is to provide such a closed loop fluidic control system for controlling a carding machine to produce slivers of uniform weight.

A still further object of the present invention is to provide such a closed loop fluidic control system for controlling a carding machine wherein at least a 2 to 1 reduction in sliver weight variations is obtainable over that heretofore possible from prior art systems.

Yet another object of the present invention is to provide such a closed loop fluidic control system which is characterized by reliability of operation, speed of response, and relatively long life.

SUMMARY OF THE INVENTION

In accordance with a preferred form of the invention there is provided a closed loop fluidic control system preferably for use with machines of the texile industry such as carding machines. The closed loop fluidic control system includes a sliver sensor means for monitoring a parameter of the sliver passing therethrough. Fluidic signal means are provided connected to the sliver sensor means for producing pneumatic output signals indicating variations in the parameter of the sliver being monitored. Pneumatic control means are connected to the fluid signal means for receiving therefrom the pneumatic output signals produced by the fluidic signal means. Pneumatic actuator means are operated by the pneumatic control means in accord with the pneumatic output signals received by the latter from the fluidic signal means. Means are provided interconnecting the pneumatic actuator means to the speed transmission drive means of the carding machine whereby when the parameter of the sliver being monitored is of a first magnitude the pneumatic actuator means effectuates a first change in the speed transmission drive means thereby reducing the speed of the carding machine and when the parameter of the sliver being monitored is of a second magnitude the pneumatic actuator means effectuates a second change in the speed transmission drive means thereby increasing the speed of the carding machine.

The invention will be more fully understood from the following detailed description and its scope will be pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE is a schematic representation of a closed loop fluidic control system constructed in accordance with the present invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing there is diagrammatically illustrated therein a closed loop fluidic control system, generally designated by reference numeral **10**, constructed in accord with the present invention. The control system **10** shown is capable of controlling the operation of a textile machine (elements of which are shown in the drawing) to ensure the production therefrom of strand-like material **110** uniformly having a desired parameter.

As depicted in the drawing the closed loop fluidic control system **10** preferably includes a fluid supply filter-regulator portion **11**. The fluid supply filter-regulator portion **11** receives a fluid such as air under suitable pressure through pipe means **13** from a suitable fluid power supply (not shown). When the closed loop fluidic control system **10** is being used in industrial applications and when air is employed as the operating medium therefor, the air may be supplied from a suitable "shop air" system commonly available in most industrial plants. On the other hand where "shop air" is not available or it is not otherwise feasible to use it, the fluid power supply for the closed loop fluidic control system may be supplied from any other source such as a self-contained bottled supply of air, etc.

Referring further to the drawing, the fluid power supply is fed to a first filter means **14** which includes a coarse filter which functions to remove large size, normally solid impurities which may be present in the fluid flow from the power supply. Thereafter the fluid flows through pipe means **15** to a pressure regulator **16** preferably suitably equipped with an exposed pressure gage **17**. Commonly, the fluid being supplied from the power supply source is at a pressure in the order of 100 psi. Thus, the pressure regulator **16** functions to reduce the pressure of the fluid flow to a predetermined operating pressure of approximately 60 psi. Further the pressure regulator **16** serves to dampen any wide variations in supply pressure which might otherwise occur. That is, the pressure regulator **16** is capable of maintaining the fluid flow therefrom at substantially a uniform pressure.

From the pressure regulator **16** the fluid flows through pipe means **18** to one side of a valve means **19** which divides the fluid flow such that a portion of the fluid flows through pipe means **20** to an oiler **21** while the other portion of the fluid flows through pipe means **22** to a second filter means **23**. The portion of the fluid which flows to the oiler **21** has entrained therein small amounts of oil as it flows through the oiler **21**. The addition of small amounts of oil to this portion of the fluid enhances the lubricating qualities thereof and thereby helps to lubricate the valves through which this portion of the fluid flows in the course of its passage through the closed loop fluidic control system **10** as will be more fully described hereinafter.

The other portion of the fluid which flows through pipe means **22** to second filter means **23** is further filtered by means of a fine filter included in second filter means **23**. Thereafter this portion of the fluid flows through pipe means **24** to a junction **25** with pipe means **26**. One end of pipe means **26** is suitably connected to an inlet means **27** of fluidic signal means **28**. As illustrated in the drawing, fluidic signal means **28** further includes an output means **29**, a first signal output means **30**, a second signal output means **31**, and preferably a pair of indicating lights **32** and **33**, respectively. Housed within the enclosure for fluidic signal means **28** are the components (not shown) of a fluid signal generating and amplifying circuits of the type which is described and illustrated in copending patent application, Ser. No. 130,635, filed Apr. 2, 1971 in the name of H. Stern, entitled "Fluid Gaging Device," and which is assigned to the same assignee as the present invention. Inasmuch as an explanation of the details of construction of the aforesaid fluid signal generating and amplifying circuit and the manner of operation thereof are not deemed necessary for purposes of an understanding of the present invention, further description thereof is not included in the present application except for that which follows hereinafter. A detailed description thereof however may be had by reference to the aforementioned copending patent application.

The portion of the fluid which is supplied to fluidic signal means **28** through inlet means **27** exits therefrom through output means **29**. This fluid is then supplied to a suitable inlet (not shown) of sensor means **34** by means of pipe means **35**. As depicted in the drawing, sensor means **34** preferably comprises what is commonly referred to in the art as a "trumpet sensor." That is, sensor means **34** takes the form of a cylindrically shaped, hollow member capable of receiving strand-like material **110** such as a sliver produced by a carding machine. Further as illustrated in the drawing the sensor means **34** may be provided at one end thereof with a funnel-shaped guide **36** to assist in inserting and guiding the strand-like material as it passes through the hollow interior of the sensor means **34**.

In accord with the preferred embodiment of the invention, the mode of operation of the sensor means **34** is as set forth in the following description thereof. One end of a continuous length of strand-like material **110** is inserted into the funnel-shaped end **36** of sensor head **34**. As this continuous length of strand-like material passes through the hollow interior of sensor means **34**, fluid supplied through pipe means **35** is blown thereagainst. When air is the fluid being supplied to sensor means **34**, the air is permitted to exit to the atmosphere from either end of the sensor means **34**. The pressure of the fluid in the pipe means **35** varies in accordance with the resistance that the fluid encounters in its passage through the sensor means **34**. Moreover, the amount of resistance which the fluid encounters is directly related to the dimensional parameters of the strand-like material passing through sensor means **34**. Thus it is possible by measuring the back pressure in the pipe means **35** to detect variations in the dimensional parameters of the strand-like material. More particularly, in accord with the present invention, it is possible to measure variations in the density of a sliver as it passes through sensor means **34**. These variations are sensed in terms of the back pressure in pipe means **35** and generate corresponding signals in fluidic signal means **28**. Normally it is found desirable to also amplify these signals before they leave the fluidic signal means **28**. As noted hereinabove the fluid signal generating and amplifying circuitry described in the aforerefer-

enced copending patent application may be employed to accomplish the above-described functions.

Referring further to the drawing, as was described previously fluidic signal means 28 is provided with a first signal output means 30 and a second signal output means 31. Thus when the density of the sliver passing through sensor means 34 is sensed to be of a first magnitude, a corresponding signal reflecting the existence of this condition is generated and amplified by fluidic signal means 28. This signal is then sent from first signal output means 30 through pipe means 37 to the input port 38 of a first three-way valve 39. At the same time, one of the lights 32 and 33 is illuminated to provide a visual indication that the density of the sliver has varied in a first direction from the predetermined desired magnitude. Similarly, when the density of the sliver passing through sensor means 34 is sensed to be of a second magnitude, a corresponding signal reflecting the existence of this condition is generated and amplified by fluidic signal means 28. This signal is then sent from second signal output means 31 through pipe means 40 to the input port 41 of a second three-way valve 42. Substantially simultaneously, the other of the lights 32 and 33 is illuminated to provide a visual indication that the density of the sliver has varied in a second direction from the predetermined desired magnitude. Most commonly, the circuitry of fluidic signal means 28 is conditioned such that a signal will be generated when the density of the sliver is sensed to be less than a predetermined desired magnitude and such that another signal will be generated when the density of the sliver is sensed to be more than the predetermined desired magnitude. Further, when the density of the sliver is of the predetermined desired magnitude no signal is generated by the fluidic signal means 28 and therefore no signal is transmitted to either three-way valve 39 or three-way valve 42. It should also be noted that only one of the aforesaid three conditions will exist at any given time. That is, either a signal will be transmitted through first signal output means 30, or a signal will be transmitted through second signal output means 31, or no signal will be transmitted from fluidic signal means 28.

In accord with the preferred embodiment of the invention, the three-way valves 39 and 42 employed in the closed loop fluidic control system 10 are each valves of the type which are capable of accepting a low pressure fluid signal. Such valves are well-known in the art and accordingly it is not deemed necessary for an understanding of the present invention that the construction of these valves be further described herein or illustrated in the drawing for this application. In addition to the aforementioned inlet ports 38 and 41, respectively, each of the three-way valves 39 and 42 further includes a supply port 43 and 44, respectively, and an output port 45 and 46, respectively. As illustrated in the drawing, the supply ports 43 and 44 are interconnected by means of pipe means 47. The supply flow for the three-way valves 39 and 42 is provided from the power supply source (not shown) as is employed to supply fluid to the fluidic signal means 28. However as described previously hereinabove the fluid which leaves pressure regulator 16 flows through pipe means 18 to junction 19 whereat a portion of the fluid flows through pipe means 22 to second filter means 23 and therefrom through pipe means 24, junction 25 and pipe means 26 to inlet means 27 of fluidic signal means 28. The other portion of the fluid flows from junction 19 through pipe means 20 to oiler 21. It is this latter portion of the fluid which is supplied to the supply ports of the three-way valves 39 and 42. More specifically, this latter portion of the fluid which has oil entrained therein as it flows through the oiler 21 flows through pipe means 48 to junction 49 whereat pipe means 48 is joined to pipe means 50, through pipe means 50 to junction 51 and therefrom through pipe means 52 to junction 53 whereat pipe means 52 is joined to pipe means 47. From pipe means 47 the fluid flows through supply ports 43 and 44 into three-way valves 39 and 42, respectively.

Referring now further to the drawing, it will be seen with reference thereto that outlet ports 45 and 46 of three-way valves 39 and 42, respectively, are each connected by means of pipe means 54 and 55, respectively, to an actuator means 56. The latter actuator means 56 in accordance with the preferred embodiment of the invention comprises a pneumatic actuator, i.e., an air cylinder housing a piston-like member 57 having one end thereof suitably affixed to a lever 58 such as to permit some degree of movement relative thereto. The piston-like member 57 is suitably mounted in the pneumatic actuator means 56 such that when fluid flows from outlet port 46 of three-way valve 42 through pipe means 55 to the actuator means 56, the fluid causes the piston-like member 57 to move inwardly into the actuator means 56. That is, when fluid is admitted through inlet 59 of actuator means 56, the piston-like member 57 is caused to move to the left as viewed with reference to the drawing. Conversely, when fluid flows from outlet port 45 of three-way valve 39 through pipe means 54 to the actuator means 56, the fluid causes the piston-like member 57 to move outwardly of the actuator means 56. That is, when fluid is admitted through inlet 60 of actuator means 56, the piston-like member 57 moves to the right as viewed with reference to the drawing.

The other end of lever 58 is suitably connected to lever 61 which has one end pivotably mounted to a fixed support 62 and has an idler pulley 63 movably supported at its other end. The idler pulley 63 coacts with the variable speed drive transmission 64 of a textile machine (elements of which are shown in the drawing) in a manner to be described with more particularity hereinafter. The speed drive transmission 64 consists of a fixed V-belt pulley 65 driven from the doffer shaft 66, and which in turn through V-belt 67 drives a variable pitch pulley 68 which has its shaft 68*a* connected to variable speed means 68*b* through suitable gearing (not shown). Doffer shaft 66 is connected to constant speed delivery means 66*a* through suitable gearing (not shown). Variable speed feed means 68*b*, constant speed delivery means 66*a* and other means inserted therebetween at the breakaway 112 in material 110 are provided by any well known standard machine such as a carding machine of a type shown in U.S. Pat. No. 3,644,964 or any other suitable type of machine. As depicted in the drawing, the idler pulley 63 is mounted on the end of lever 61 so as to extend between the drive V-belt pulley 65 and the variable pitch V-belt pulley 68. Further the idler pulley 63 is actuated by pneumatic actuator means 56 such as to engage and press against the V-belt 67 forcing the latter to change path configuration changing the variable pitch V-belt pulley contact with the V-belt to a varying radius

thereby increasing or decreasing the speed ratio between the variable pitch pulley 68 and the fixed pitch pulley 65 and thus respectively between feed rollers 68*b* and constant speed rollers 66*a* thereby causing a corresponding change in a characteristic of strand like material 110 passing therethrough which characteristic is monitored by sensor means 34.

A hydraulic snubber 69 is suitably attached in a manner wellknown in the art to the pneumatic actuator means 56. The snubber 69 comprises an air actuated locking piston (not shown) which functions to limit the extent of movement of the piston-like member 57. The snubber 69 has associated therewith a stop check valve 70 which in turn is controlled by a three-way valve 71 to which it is connected by pipe means 72. The three-way valve 71 is preferably of the type capable of accepting a high pressure fluid signal. Inasmuch as the construction of such valves is conventional and is well-known to those skilled in the art, it is not deemed necessary to include herein any detailed description thereof or illustration thereof apart from the description which follows immediately hereinafter. The three-way valve 71 includes a supply port 73, a signal input port 74 and an output port 75. Referring to the drawing, it can be seen therefrom that fluid is supplied to supply port 73 of three-way valve 71 from oiler 21 through pipe means 48, junction 49, pipe means 50 and junction 51. Further it can be seen that the signal input port 73 of three-way valve 71 is connected through pipe means 76 and junction 77 to pipe means 54 and thereby to the output port 45 of three-way valve 39, and that pipe means 72 connects output port 75 of three-way valve 71 to the inlet of stop check valve 70. At this point it should be noted that the small amount of oil which is added to the portion of the fluid which flows to three-way valves 39, 42 and 71, stock check valve 70, hydraulic snubber 69 and pneumatic actuator means 56 by the oiler 21 as the fluid flows therethrough is designed to satisfy at least in part the lubrication requirements of the various operating components of the aforementioned valves, snubber and actuator means. However it is of course also to be understood that where sufficient lubrication is otherwise provided the oiler 21 and its attendant function of entraining oil in the fluid passing therethrough may be omitted if so desired.

To control the rate at which fluid is admitted to the hydraulic snubber 69 and thereby the rate at which the piston-like member 57 of pneumatic actuator means 56 is permitted to move, an adjustment means 78 is preferably provided. The adjustment means 78 comprises a needle valve (not shown) by means of which the desired rate at which piston-like member 57 moves may be preset. Further by rotation of the knurled knob 79 this velocity of movement rate control may be periodically adjusted as needed.

Proceeding now to a description of the mode of operation of the closed loop fluidic control system 10 in accordance with the present invention, strand-like material from an industrial machine such as a sliver from a textile machine is made to pass through sensor means 34 wherein one of the dimensional parameters of the material such as for example the density thereof is continuously monitored as it passes through the sensor means 34. This is accomplished by the fluidic signal means 28 which senses the back pressure in pipe means 35 of the fluid being supplied to sensor means 34. The pressure of the fluid in the pipe means 35 varies in accordance with the resistance that the fluid encounters in its passage through the sensor means 34. Since the amount of resistance which the fluid encounters is directly related to the dimensional parameters of the strand-like material passing through sensor means 34, it is possible by measuring the back pressure in the pipe means 35 to detect variations in the dimensional parameters such as the density of the strand-like material. When the density of the strand-like material passing through sensor means 34 is sensed to be of a first magnitude, a corresponding signal reflecting the existence of this condition is generated and amplified by fluidic signal means 28. This signal is then sent from first signal output means 30 to the pneumatic control means including three-way valve 39. Similarly when the density of the strand-like material passing through sensor means 34 is sensed to be of a second magnitude, a corresponding signal reflecting the existence of this condition is generated and amplified by fluidic signal means 28. This signal is then sent from second signal output means 31 to the pneumatic control means including three-way valve 42. Further, when the density of the strand-like material is of the predetermined desired magnitude no signal is generated by the fluidic signal means 28 and therefore no signal is transmitted to the pneumatic control means. In addition to providing the aforedescribed digital pneumatic output, the fluid signal means 28 also provides a visual electrical output by means of lights 32 and 33. The operation of lights 32 and 33 is such that one of these lights is illuminated when an output is provided at first signal output means 30 while the other light is illuminated when an output is provided at second signal output means 31. The aforesaid digital pneumatic output signals sent from fluidic signal means 28 are utilized to drive the pneumatic actuator means 56 through the pneumatic control means including the low to high pressure three-way pneumatic valves 39 and 42. The actuator means 56 is connected to the variable speed transmission in such a manner that when the density of the strand-like material is sensed to be above a desired magnitude a first signal is sent to the pneumatic control means which actuates the actuator means 56 to cause the latter to effect a change in the speed transmission to produce a reduction in the speed of variable speed feed means 68b and when the density of the strand-like material is sensed to be below the desired magnitude a second signal is sent to the pneumatic control means which actuates the actuator means 56 to cause the latter to effect a change in the speed transmission to produce an increase in the speed of variable speed feed means 68b. A hydraulic snubber 69 with settable velocity rate control is attached to the actuator means 56 to allow adjustment of system response to achieve a stable system. In addition a "stop check" valve is preferably used in association with the hydraulic snubber 69 to prevent any motion of the pneumatic actuator means 56 when no signal is present from the fluidic signal means 28.

Referring again to the drawing, it will be noted therein that each of pipe means 26 and pipe means 50 has an unconnected end 26*a* and 50*a*, respectively. It is contemplated within the scope of the present invention that the end 26*a* of pipe means 26 as well as the end 50*a* of pipe means 50 may be employed to connect the power supply source (not shown) to other installa-

tions of sensor means, fluidic signal means, pneumatic control means and pneumatic actuator means.

Thus, in accordance with the present invention there has been provided a novel and improved closed loop fluidic control system for controlling the operation of a machine to produce therefrom strand-like material uniformly having the desired parameter. Further, the mode of operation of the closed loop fluidic control system of the instant invention is such that changes in the operating conditions of the machine are effectuated in response to the sensing of variations in the parameter of the strand-like material being monitored. In addition, the closed loop fluidic control system is capable of controlling a carding machine to produce slivers of uniform weight. Moreover with the closed loop fluidic control system of the present invention at least a 2 to 1 reduction in sliver weight variations is obtainable over that heretofore possible from prior art systems. Finally, in accord with the present invention there has been provided a closed loop fluidic control system which is characterized by reliablity of operation, speed of response, and relatively long life.

While only one embodiment of my invention has been specifically illustrated in the drawing of the instant application, a number of modifications thereof have been referred to hereinabove. For example, in those applications wherein the fluid supply is sufficiently free from contamination so as to obviate any necessity for filtering the fluid supply and/or in those applications wherein the valves are sufficiently lubricated by other means the use of filter means and/or an oiler may if so desired be omitted. For other installations wherein the pressure of the fluid supply does not vary significantly and wherein the pressure is of the magnitude desired to be supplied to the various valves and fluid signal means, the regulator 16 may also if so desired be omitted. Finally, although specific examples of pneumatic control means and pneumatic actuator means have been described hereinabove and illustrated in the drawing, it is also contemplated within the scope of the present invention that other control means and actuator means may be substituted therefor. In this connection, these other control means and actuator means may take the form of mechanical and/or electrical devices or combinations thereof. Thus, it will be appreciated that many other modifications of my invention may readily be made by those skilled in the art. I therefore intend by the appended claims to cover the above modifications as well as all other modifications which fall within the true spirit and scope of my invention.

I claim:

1. A closed loop fluidic control system having constant speed delivery means for controlling the operation of variable speed feed means to produce therefrom strand-like material having a desired uniform character comprising:

a. at least one pneumatic sensor means for monitoring a parameter of strand-like material passing therethrough;

b. at least one fluidic signal means having a first and a second output port, said fluidic signal means being connected to said sensor means for producing a first pneumatic output signal from said first output port indicating a variation beyond a first predetermined value in a first direction in said parameter of said strand-like material, a second output signal from said second output port indicating a variation beyond a second predetermined value in a second direction in said parameter of said strand-like material, and no output signal from either of said first and second output ports for variations between said first and second predetermined values in said parameter of strand-like material;

c. pneumatic control means including first and second low to high pressure three way valves each of said valves having an input port and an output port, the first input port of said first valve being connected to said first output port said fluidic signal means for receiving therefrom said first output signal produced by said fluidic signal means, the first input port of said second valve being connected to said second output port of said fluidic signal means for receiving therefrom said second output signal produced by said fluidic signal means;

d. at least one pneumatic actuator means connected to the respective output ports of said first and second valves of said control means and operated by said control means in accord with the receipt by said control means of said first and second output signals from said fluidic signal means; and

e. means interconnecting said actuator means to said variable speed feed means whereby when said strand-like material is sensed to have varied beyond said first predetermined value in said first direction said first output signal is produced by said fluidic signal means and transmitted to said control means to operate said actuator means to reduce the speed of said variable speed feed means to restore said strand-like material to said desired uniform character, and when said strand-like material is sensed to have varied beyond said second predetermined value in said second direction said second output signal is produced by said fluidic signal means and transmitted to said control means to operate said actuator means to increase the speed of said variable speed feed means to restore said strand-like material to said desired uniform character.

2. A closed loop fluidic control system as set forth in claim 1 further comprising:

a. filter supply and regulator means for filtering and regulating the pressure of the fluid supplied to said sensor means, said fluid signal means, said control means, and said actuator means; and

b. hydraulic snubber means connected to said actuator means, said hydraulic snubber means including settable velocity rate control means for allowing adjustment in system response to achieve a stable system.

3. A closed loop fluidic control system as set forth in claim 1 wherein:

a. said fluidic signal means includes a first visual indicating means which is illuminated when said first pneumatic output signal is produced;

b. said fluidic signal means includes a second visual indicating means which is illuminated when said second pneumatic output signal is produced.

4. A closed loop fluidic control system as set forth in claim 1 wherein said actuator means includes a cylinder and a member having one end thereof within said cylinder and another end thereof extending outwardly from said cylinder.

5. A closed loop fluidic control system as set forth in claim 4, wherein said interconnecting means includes a first lever having one of two ends connected to said other end of said member, a second lever connected to the second end of said first lever and having first and second ends, means for fixing the first end of said second lever, and an idler pulley connected to the second end of said second lever for coacting with and changing the speed of said variable speed feed means to restore said strand-like material to said desired uniform character.

6. A closed loop fluidic control system having constant speed delivery means for controlling the operation of variable speed feed means to produce therefrom a strand-like material having a uniform character comprising:

a. at least one sensor means for monitoring a parameter of the material passing therethrough;

b. at least one fluidic signal means connected to said sensor means for producing at least one pneumatic output signal indicating a variation in said parameter of the material;

c. at least one pneumatic control means connected to said fluidic signal means for receiving therefrom said pneumatic output signal produced by said fluidic signal means;

d. at least one pneumatic actuator means connected to said pneumatic control means and operated by said pneumatic control means in accord with the receipt by said pneumatic control means of said pneumatic output signal from said fluidic signal means, said actuator means including an enclosure and a member having one end thereof within said enclosure and another end thereof extending outwardly from said enclosure; and

e. means interconnecting said pneumatic actuator means to said variable speed feed means, said interconnecting means including a first lever having one of two ends connected to said other end of said member, a second lever connected to the second end of said first lever and having first and second ends, means for fixing the first end of said second lever, and an idler pulley connected to the second end of said second lever for coacting with said variable speed feed means whereby when the material is sensed to have varied from said parameter and pneumatic output signal is produced by said fluidic signal means and transmitted to said pneumatic control means to operate said member of said pneumatic actuator means to cause said idler pulley to effectuate a change in the speed of said variable speed feed means to restore the material to said uniform character.

7. A closed loop fluidic control system as set forth in claim 6 wherein:

a. said pneumatic output signal produced by said fluidic signal means is a digital signal;

b. said pneumatic control means includes a first low to high pressure three-way valve and a second low to high pressure three-way valve, each of said first and second low to high pressure three-way valves having an output port connected to said pneumatic actuator means; and

c. said pneumatic actuator means includes an air cylinder.

8. A closed loop fluidic control system as set forth in claim 7, further comprising:

a. filter supply and regulator means for filtering and regulating the pressure of the fluid supplied to said sensor means, said fluid signal means, said pneumatic control means and said pneumatic actuator means; and

b. hydraulic snubber means connected to said pneumatic actuator means, said hydraulic snubber means including settable velocity rate control means for allowing adjustment in system response to achieve a stable system.

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