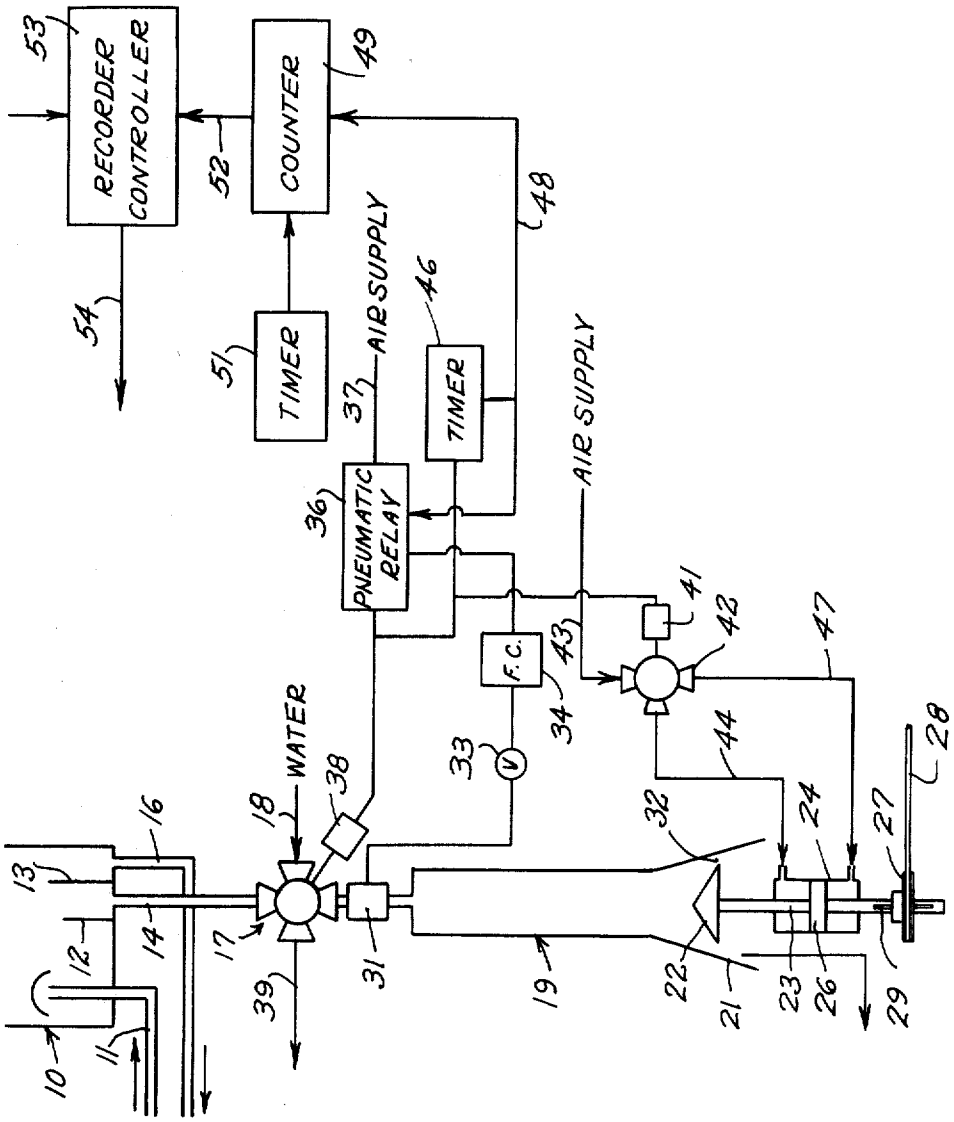
May 31, 1966 M. A. KEYES 3,253,740

APPARATUS FOR CONTINUOUS MEASUREMENT AND CONTROL OF SHIVE CONTENT

Filed Dec. 10, 1964



INVENTOR.

Marion A. Keyes

BY Mill, Sherman, Meroni, Gross & Simpson ATTORNEYS

United States Patent Office 3,253,740 Patented May 31, 1966

3,253,740

APPARATUS FOR CONTINUOUS MEASUREMENT AND CONTROL OF SHIVE CONTENT

Marion A. Keyes, South Beloit, Ill., assignor to Beloit Corporation, Beloit, Wis., a corporation of Wisconsin

Filed Dec. 10, 1964, Ser. No. 417,376
9 Claims. (Cl. 222—52)

The present invention relates to a continuous device for controlling the quantity of uncooked chunks or shives in a papermaking process.

The problem of shive control is particularly troublesome in semichemical pulping processes where it is important to achieve the correct degree of refining of the pulp before it is formed into the web. In such systems, it is necessary to operate between the extremes of too little refining, in which case there is a loss of stock forming material, and too much refining prior to washing, which adversely affects the drainage properties of the stock.

The system of the present invention provides a continuously operable sensing and recording mechanism for monitoring the shive concentration in the stock feed. In accordance with the invention, the stock from a headbox is supplied under a constant hydrostatic head to a metering tube in which there is an adjustably positionable constriction means in the form of a plug. The constriction means and the internal wall of the metering tube cooperate to define an orifice of size such that the fibrous portion of the stock can pass freely therebetween, but the shives are trapped and eventually build up a deposit in the orifice. Fluid flow sensing means are provided to sense the flow rate of material passing through the metering tube, and when an accumulation of the shives causes a diminution of the flow rate of stock through the tube, the flow sensing means operates other devices to first withdraw the plug and thereby enlarge the orifice in the tube, second, to flush the tube with water while diverting the stock flow therefrom, and third, to send a signal to a counting device. A timer is provided to control the introduction of flushing water to a predetermined time interval. At the conclusion of the interval, the apparatus is reset, the plug moved back into constricting relation within the tube, and the flow of stock through the metering tube is resumed. The counter, actuated by the impulses from the relay or other device which actuates the various mechanisms associated with the metering tube, is cycled by means of another timer device so that it counts the number of actuations of the relay for a predetermined time interval dependent upon the setting of the timer. This intelligence is then transferred to a recorder-controller which, in a preferred form of the invention, compares this intelligence with a control. When the number of actuations of the relay per interval of time exceeds that which has been programmed into the recorder-controller, the recorder-controller issues a control signal which can then be used to modify a process variable in the direction of reducing the amount of shives retained in the stock.

An object of the present invention is to provide a continuously operable shive monitoring and measuring device for papermaking operations.

Another object of the invention is to provide a continuous system for monitoring shive contents to produce a control signal which can be used to adjust the shive concentration to desired limits.

Still another object of the invention is to provide a device for the continuous monitoring of stock which is completely automatic in operation.

Other objects and features of the present invention will become apparent to those skilled in the art from the following detailed description of the attached sheet of

drawings which illustrates a preferred embodiment of the invention.

In the single figure of the drawings, reference numeral **10** indicates generally a headbox for supplying papermaking stock at a constant hydrostatic pressure. Stock is introduced into the headbox **10** through an inlet line **11**, and a pair of weirs **12** and **13** are positioned in spaced relation within the headbox **10**. Stock is continuously removed from the headbox **10** in the region between the weirs **12** and **13** by means of an outlet line **14** while the overflow beyond the weir **13** is returned to the process stream by means of a line **16**.

The stock in the line **14** is directed to a four-way valve **17** which selectively introduces the stock or water from a water line **18** into a metering tube generally indicated at reference numeral **19** in the drawings. The metering tube **19** is generally cylindrical in configuration, and contains an outwardly flared bell portion **21** at the discharge end thereof. Located in the bell-shaped discharge portion **21** is a conical plug **22** which is adjustably positionable within the discharge outlet **21**. The plug **22** is mounted on a stem **23** which is received within a cylinder **24**. A piston **26** is carried by the stem **23** and is operable in response to air pressure injected therein to move the plug **22** up and down, and thereby provide a greater or a lesser constriction to the flow of material through the metering tube **19**. Improved results are obtained if the plug **22** is also rotated, and to this end, there is provided a pulley **27** driven by a belt **28**, and having a key therein engaging an elongated slot **29** formed in the stem **23**. The belt **28** thus provides a driving connection to the stem **23**, while permitting vertical movement of the stem **23** when required.

The stock after passing through the valve **17** actuates a fluid flow sensor **31**, such as a flow meter. The stock in normal operation then passes into the metering tube **19** and flows between the inner wall of the tube **19** and the plug **22**, the two defining a restricted orifice **32** which is of sufficient size to permit free passage of the fiber containing stock through the bell-shaped discharge outlet **21**, while retaining larger shives therein.

The flow meter **31** is in a line containing a valve **33** and a flow controller **34** which is connected to a pneumatically operated relay **36**. An air line **37** supplies compressed air for operation of the relay. Closing of the relay **36** operates to energize a solenoid **38** which changes the position of the four way valve **17** from one in which stock is introduced into the metering tube **19** to one in which water from the line **18** is introduced into the metering tube **19** to flush the accumulated residue from within the column. During flushing, the stock is diverted to the process stream by means of a line **39**.

Closing of the relay **36** also operates to energize a solenoid **41** which actuates a three way valve **42**. Compressed air is introduced through the valve **42** from an air line **43**. Upon actuation of the solenoid **41**, the air in the line **43** is injected into a line **44** which supplies the air under pressure to the cylinder **24** at a point above the piston **26**, and causes the piston to move downwardly, and carry with it the plug **22**. The removal of the constriction from the throat of the metering tube thereby provides for more complete flushing of the accumulated materials from within the metering tube during the flushing cycle.

The duration of the flushing cycle is determined by the setting of a timer **46** associated with the relay **36**. The timer **46** provides for opening of the four way valve **17** for a predetermined interval of time, so that each flushing cycle is of exactly the same duration. After the interval prescribed by the timer **46** has expired, the pneumatic relay **36** is deenergized, thereby deenergizing the solenoid **38** and the solenoid **41**. When this occurs, the flow

of stock into the metering tube **19** is resumed through the four-way valve **17** and the flow meter **31**. The constriction provided by the plug **22** is again re-introduced into the discharge end of the metering tube **19** by providing air pressure on the opposite side of the piston **26**, by means of a line **47** connected to the three-way valve **42**. A normal operation is then resumed, until such time as the flow meter **31** again senses a reduction in the flow through the metering tube **19** caused by the accumulation of shives in the orifice **32**.

The number of operations of the pneumatic relay **36** per specified interval of time is used as a measure of the shive concentration in the stock. Each time the pneumatic relay **36** operates to commence flushing of the metering tube **19**, a signal pulse is supplied by means of a line **48** from the relay **36** to a counter **49**. The counter **49** is cycled by a timer **51** to operate over a predetermined time interval. At the conclusion of such time interval, the counter **49** is reset by operation of the timer **51**, and the accumulated counts which have been fed to the counter **49** are transmitted by means of a line **52** to a recorder-controller **53**. In the latter, the intelligence inherent in the transmission of the data from the counter **52** is compared with a predetermined program, to thereby sense automatically whether the amount of shives in the stock has become excessive. To take a specific example, if the timer **51** is set for a 15-minute interval, and it has been predetermined that the number of flushings for a 15-minute period which would be characteristic of a properly refined stock is three, and the counter **49** provides four impulses during its cycling time, the recorder-controller **53** immediately puts out a control signal through a line **54** which modifies a process variable in the direction of reducing the amount of shives in the stock. This can be accomplished by using the control signal to set the plug position on a prebreaker refiner, or the reject rate on the stock screen.

From the foregoing, it will be understood that the device of the present invention provides a completley automatic system for monitoring and controlling the amount of shives in a papermaking stock. The system lends itself to complete automation since no operator is required once the timers and the recorder-controller have been preset.

It should be understood that various modifications can be made to the described embodiments without departing from the scope of the present invention.

I claim as my invention:

1. A continuous shive control device comprising a metering means, means for supplying stock to said metering means under a constant hydrostatic head, a constriction means in said metering means providing an orifice for the flow of stock therethrough, sensing means operable to determine a predetermined diminution of flow about said constriction means, and means operable in response to operation of said sensing means to count the number of operations of said sensing means per predetermined time interval.

2. A continuous shive control device comprising a metering tube, means for supplying stock to said metering tube under a constant hydrostatic head, a constriction means adjustably positionable in said tube to provide therein a passage of reduced cross-sectional dimensions, flow metering means sensing the flow through said metering tube, valve means operable to terminate flow of stock into said metering tube and to introduce water therein for flushing accumulated material from said passage in response to sensing of a predetermined reduction in flow by said flow metering means, and means for counting the number of operations of said valve means per predetermined time interval.

3. A continuous shive control device comprising a metering tube, means for supplying stock to said metering tube under a constant hydrostatic head, a constriction means adjustably positionable in said tube to provide therein a passage of reduced cross-sectional dimensions, flow metering means sensing the flow through said metering tube, valve means operable to terminate the flow of stock into said metering tube and to introduce water therein for flushing accumulated material from said passage in response to the sensing of a predetermined reduction in flow by said flow metering means, timer means controlling the introduction of water to a predetermined time interval, and means for counting the number of operations of said valve means per predetermined time interval.

4. A continuous shive control device comprising a metering tube, means for supplying stock to said metering tube under a constant hydrostatic head, valve means arranged to selectively introduce said stock to said metering tube and flushing water into said metering tube, in adjustably positionable plug in said tube providing a constriction for the flow of stock therethrough, flow sensing means positioned to sense the flow of stock into said tube, relay means operable by said sensing means to operate said valve means to terminate introduction of stock and inject flushing water into said metering tube, means operable by said relay means to simultaneously move said plug into a position where said plug provides a lesser constriction to the passage of flushing water than it does to stock passage, a timer means controlling introduction of flushing water to said tube to a predetermined time interval, and counting means for counting the number of operations of said relay means in a predetermined time interval.

5. The device of claim **4** which also includes means for rotating said plug within said metering tube.

6. A continuous shive control device comprising a metering tube, means for supplying stock to said metering tube under a constant hydrostatic head, valve means arranged to selectively introduce said stock to said metering tube and flushing water into said metering tube, an adjustably positionable plug in said tube providing a constriction for the flow of stock therethrough, flow sensing means positioned to sense the flow of stock into said tube, relay means operable by said sensing means to operate said valve means to terminate introduction of stock and inject flushing water into said metering tube, means operable by said relay means to simultaneously move said plug into a position where said plug provides a lesser constriction to the passage of flushing water than it does to stock passage, a first timer means controlling introduction of flushing water to said tube to a predetermined time interval, a counter, means connecting said counter to said relay means, said counter being arranged to count the number of times said relay means is rendered operable to introduce flushing water into said tube, a second timer cycling the operation of said counter to a predetermined time interval, and a recorder-controller receiving the output of said counter for recording the number of counts on said counter during each cycle of operation of said second timer.

7. The device of claim **6** in which said recorder-controller compares the output of said counter with a predetermined value and provides an energizing signal when said output exceeds said predetermined value.

8. The device of claim **6** which also includes means for rotating said plug within said metering tube.

9. The device of claim **6** in which said metering tube has a bell shaped outlet end and said plug is a conically shaped element extending into said bell shaped outlet end.

References Cited by the Examiner

UNITED STATES PATENTS

2,391,393 4/1960 Jones ..... 222—148 X

RAPHAEL M. LUPO, *Primary Examiner.*