

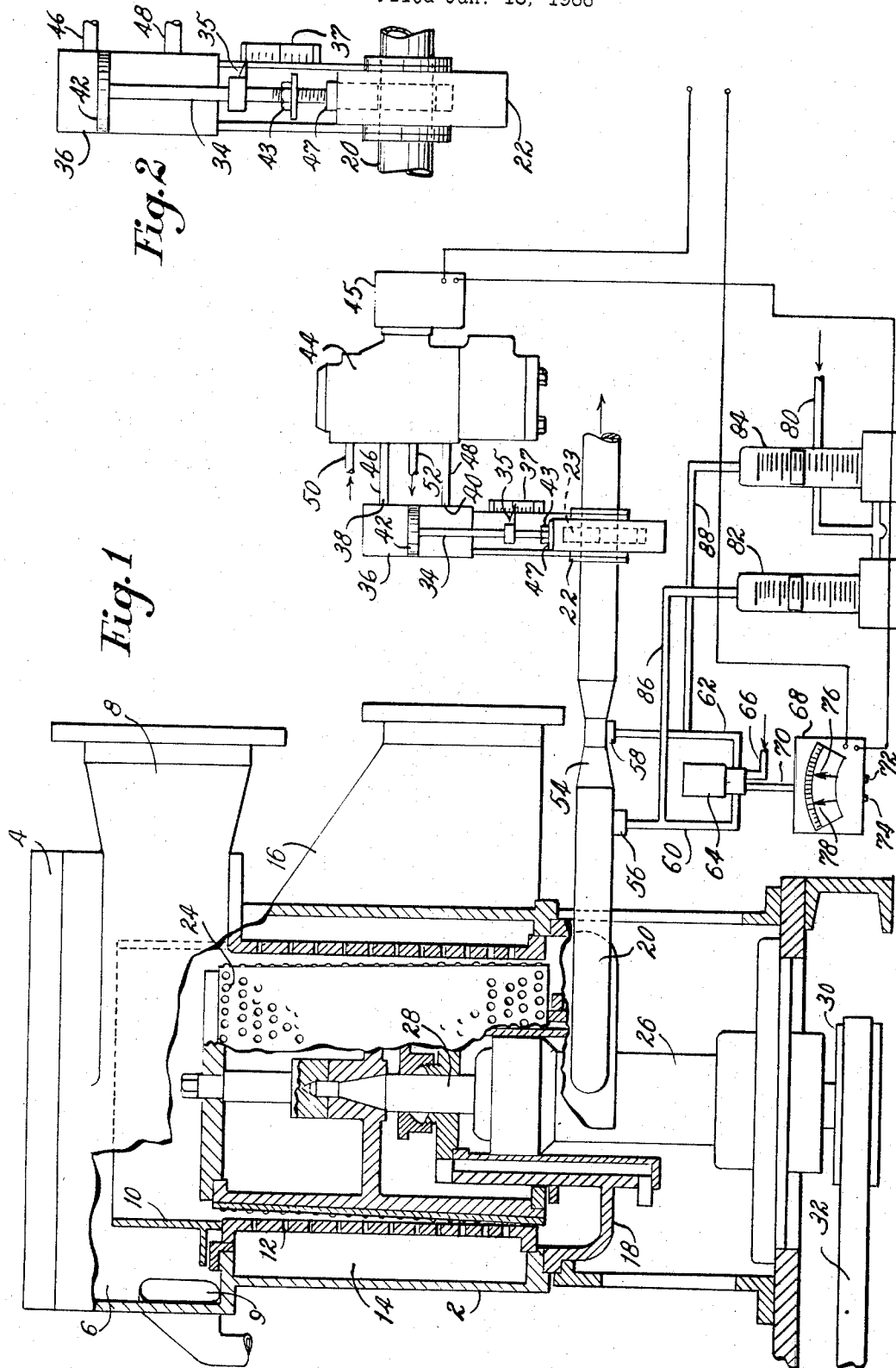
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SCREENING APPARATUS CONTROL

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SCREENING APPARATUS CONTROL

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ABSTRACT OF THE DISCLOSURE

A screening apparatus with a throttle valve in the rejects line capable of being set to an optimum throttle setting and an actuator which opens the valve from the throttle position when a predetermined minimum flow is sensed. The system restores the valve to its former throttle setting after solids are removed, by sensing increase in the flow. The optimum continuous flow setting is thereby resumed. Also disclosed for the system are a venturi tube differential pressure sensor, fiber-free flow sensing lines and a V-ported control valve.

This invention relates to screening apparatus.

It is a primary object of the invention to provide a rejects control which offers improvement in the operation of the screen in permitting a setting of the rejects opening considered to be optimum for controlling the particular screening operation while protecting the screen plate, rejects line and entire system from the effect of an increase in solid material in the rejects that sometimes occurs even under such optimum operating conditions. Other objects are to provide a means for controlling passage of material through a screen to limit the amount of good fiber being removed with the rejected matter and at the same time provide protection against plugging and fouling of the screen plate, and to provide all of the above in a simple, inexpensive and easily maintained construction.

The invention features a screening apparatus including a valve in the rejects line from the screening chamber having a control member adapted to be set at the predetermined optimum throttled position, an actuator for opening said valve substantially beyond said throttled position without disturbing the setting on said control member, and a sensor responsive to a predetermined minimum flow value in said rejects line to cause said actuator to open said valve substantially beyond said optimum position, said sensor being constructed and arranged not to change the opening of said valve from said optimum position in response to variations in flow through said rejects line insufficient to reduce the flow to said minimum value, said sensor further responsive to return said valve to said optimum position upon the restoration of flow to a value appreciably above said minimum value.

Other objects, features, and advantages will appear from the following description of a preferred embodiment of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is a partially diagrammatic view of screening apparatus of the invention with the rejects valve in its preset throttled position; and

FIG. 2 is an enlarged view of a portion of FIG. 1 with the rejects valve in a wide open position.

Referring to the drawings the screening apparatus shown, particularly adapted for screening fibrous suspensions such as paper pulp, includes a vertically arranged pressure casing 2 with a removable pressure dome 4. An annular inlet gutter 6 is defined in the upper region of the casing 2 and an inlet conduit 8 is arranged to introduce pulp to be screened into the inlet gutter 6. A gutter trap 9 communicates with the inlet gutter 6 for removing

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heavy debris thrown to the periphery by centrifugal force.

The inlet gutter 6 communicates radially over a baffle 10 with the central part of the screening apparatus. Below the baffle 10 is located a circumferentially apertured screen member 12 whose walls are spaced inwardly relative to the casing 2, so as to define a volute shaped accepts chamber 14 outside of the screen member 12. A tangential accepts conduit 16 adapted to remove fluid under substantial pressure is connected to the accepts chamber 14, having its initial portion extending the full height of the screen member 12.

Below the screen member 12 is arranged an annular rejects gutter 18 in communication with the inside of the cylindrical screen member 12. A rejects conduit 20 communicates with this rejects gutter 18, this conduit being capable of removing fluid under substantial pressure and being provided with a valve 22 which serves to regulate the flow therethrough.

An irregular surfaced rotary drum 24 of circular cross section is mounted inside and concentric with the screen member 12, and has a height equal to that of screen member 12. The drum 24 is mounted upon a rotary shaft 28 which extends through pedestal 26 and carries a pulley 30 driven by belt 32 and electric motor (not shown) to develop a surface speed of at least 3,000 f.p.m. when the casing is full of suspension.

The stationary screen member 12 may be of the usual form for pulp screening, e.g., for fine screening it can have 23 percent open area provided by circular holes of $\frac{1}{16}$ inch diameter spaced in a staggered pattern on $\frac{1}{8}$ inch centers.

Valve 22 is preferably a V-ported valve as shown which is capable of opening to full or nearly full pipe cross section (e.g., a standard Fabri Vee Port Valve) and its setting affects the flow of rejects through conduit 20 and hence the operation of the entire apparatus. Too great a rejects flow can result in a high loss of good fibers, while plugging of the rejects line, usually caused by the throttled rejects valve, will in turn cause a clogging up of the screen and ineffective operation of the entire apparatus. To control the opening of valve 22 a rod 34 is connected to slidable gate 23 of the valve and extends into a power cylinder 36 having a pair of air input ports 38, 40 above and below piston 42. A nut 43 is threaded on rod 34 to prevent valve 22 from closing beyond a desired minimum point, the nut contacting the stop surface 47 on the valve housing. Pointer 35 on rod 34 is arranged against calibrated scale 37 to indicate the extent of opening of the valve. Ports 38, 40 communicate with a solenoid operated four way air valve 44 (e.g., Automatic Switch Co. Part No. 83440) through conduits 46, 48 for alternate connection to pressurized air supply conduit 50 and exhaust conduit 52.

A metering venturi tube 54 is inserted in the rejects line before valve 22, and upstream tap 56 and venturi throat tap 58 are respectively connected by conduits 60, 62 to the high and low pressure sides of a differential pressure cell 64 (e.g., Foxboro Co. Pneumatic Differential Pressure Cell Transmitter D117EZ). Cell 64 serves to transduce the pressure differential between taps 56, 58 into an output air pressure value between 3 and 15 p.s.i. (for this particular cell), input air being introduced into the cell at 66. The output of cell 64 is fed to a pressure switch 68 (e.g., Mercoid Co. Switch DA31-2) through conduit 70. Switch 68 is adjustable at controls 72, 74 to respond to selected high and low pressure limits indicated by needles 76, 78. Switch 68 is in turn connected electrically to operate solenoid 45 of valve 44.

Clear water at a regulated pressure is continuously introduced through conduit 80, through purge rotometers 82, 84 (Foxboro Co. Part No. D-105-NX), and conduits 86, 88 into conduits 60, 62. Needle valves in said rotom-

eters aid in equalizing the flows in conduits 86, 88 so that the pressure differential between taps 56, 58 will be accurately transmitted to cell 64 while keeping the cell, taps and conduits free of the material from the rejects line.

In operation, with solenoid 45 de-energized air will be admitted through port 38 above piston 42 to partially close the gate or closure member 23 of valve 22 to a throttled position in which nut 43 is forced against stop surface 47 (FIG. 1). Nut 43 is adjusted until an optimum valve position is reached in which, by observation or analysis of the accepts and rejects outputs, the screening apparatus is operating as desired. Control 74 on switch 68 is set at a pressure value between 3 and 15 p.s.i. reflecting a pressure differential between taps 56, 58 and, in turn, a rejects flow rate generally corresponding to unplugged flow through the rejects line. Similarly, control 72 is set at a pressure value between 3 and 15 p.s.i. but lower than the setting of control 74 to reflect a pressure from cell 64 corresponding to flow rate through the rejects line so low as to indicate actual or imminent plugging of the line and fouling of the screen. So long as the rejects flow rate remains above the minimum value set on control 72 the switch 68 will not respond to flow variations in the rejects line and member 23 of valve 22 will remain in its optimum position, thus avoiding any undesirable disturbance of the operating conditions at the screen.

However, should the rejects flow rate drop below the preset minimum, switch 68 will energize solenoid 45, reversing the air connections to cylinder 36 so that air is applied through port 40 to raise rod 34 and member 23 to open valve 22 wide (FIG. 2), which action will reduce temporarily the amount of material passing through the screen plate, speed up the rejects flow, and eventually clear the line. The setting of control nut 43 remains unchanged. When the rejects line is sufficiently clear to raise the rejects flow rate to the value set on control 74, switch 68 will again de-energize solenoid 45, thus reversing the air connection to cylinder 36, returning member 23 of valve 22 to its optimum position and restoring the desired conditions at the screen.

Other embodiments (e.g., elimination of the purge system by use of diaphragm type pressure transducers located in the wall of the rejects conduit, replacement of the differential pressure cell and pressure switch with a straight pressure differential switch, use of a magnetic flowmeter instead of a venturi system to measure the rejects flow, etc.) will occur to those skilled in the art and are within the scope of the invention.

What is claimed is:

1. A screening apparatus for a liquid containing a fibrous material comprising
 - an inlet chamber,
 - means for supplying said liquid to said inlet chamber,
 - an apertured screen member exposed to said inlet chamber,
 - an accepts passage for receiving the portion of liquid and fibre which passes through said screen member,
 - a rejects line connected to said inlet chamber for removing rejected matter that does not pass through said screen member,
 - a throttle valve in said rejects line for regulating the passage of all material entering said rejects line from said screen, said valve having a control member for setting said valve at a first preset open position to establish a regulated flow,
 - an actuator connected to said valve for opening said valve to a second preset position with a substantially larger opening than said first position without disturbing the setting on said control, and
 - a sensor responsive to a predetermined minimum flow value in said rejects line having means to cause said actuator to open said valve to said second open position to purge said valve, said sensor further responsive to return said valve to said first open position upon the restoration of flow to a value appreciably above said minimum value.
2. The device of claim 1 wherein said sensor includes a venturi tube in said rejects line and a pressure differential responsive device having spaced inputs communicating with liquid in said rejects line and outputs communicating with said actuator, one of said inputs communicating with liquid in said tube.
3. The device of claim 2 wherein said inputs are liquid conducting lines and means are provided for maintaining said lines filled with fibre-free liquid.

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