Feb. 26, 1952 W. E. McFADDEN 2,587,188

APPARATUS FOR REGULATING THE FLOW OF THIXOTROPIC COLLOIDS AND THE LIKE

Filed Oct. 18, 1945 2 SHEETS—SHEET 1

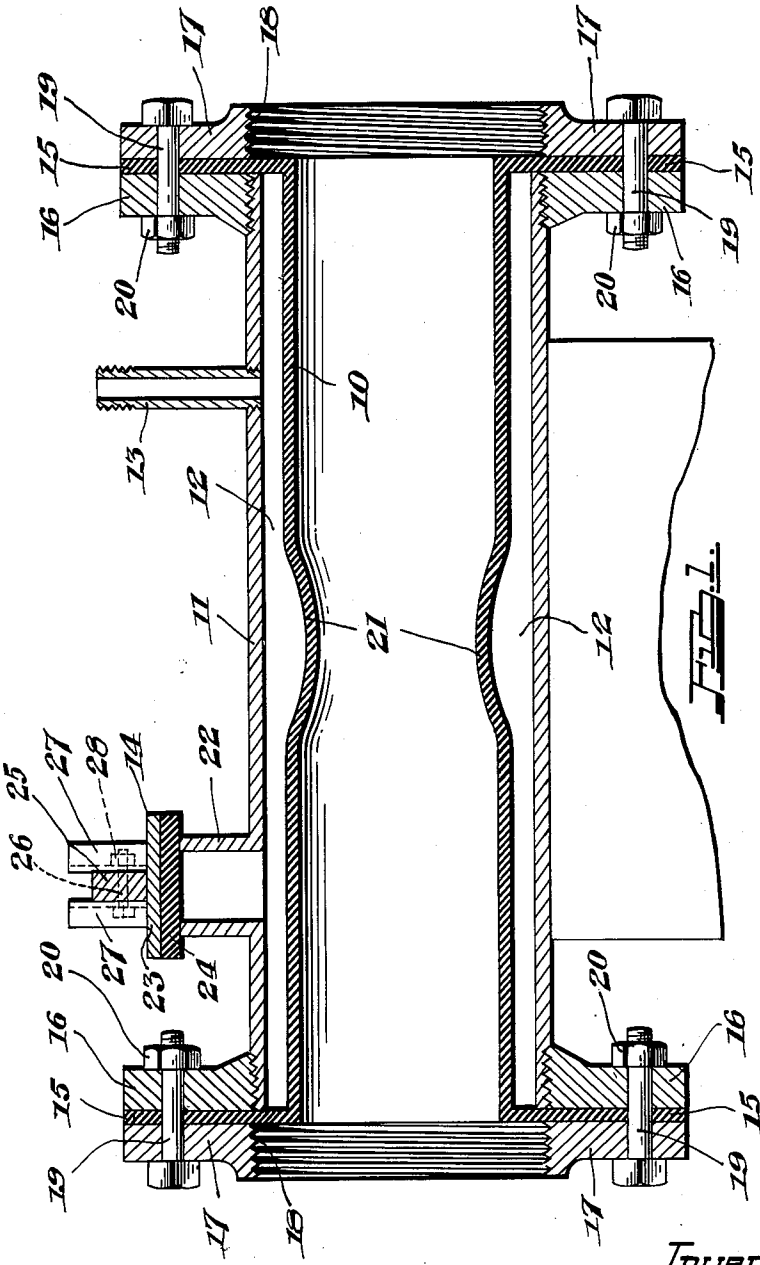


FIG. 1.

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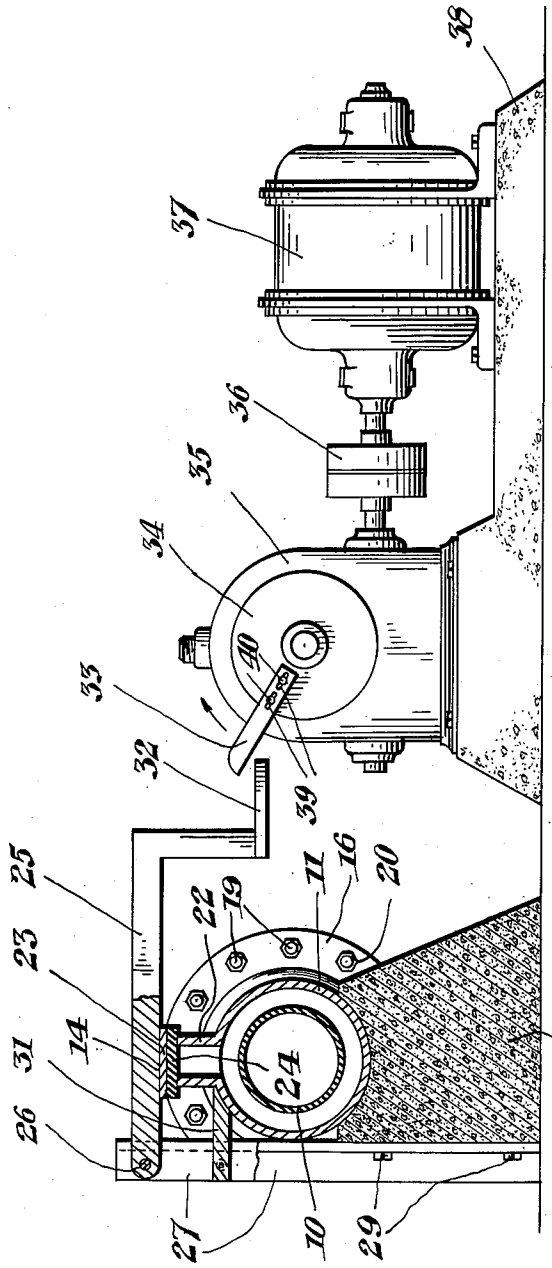


FIG. 2.

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Patented Feb. 26, 1952

2,587,188

UNITED STATES PATENT OFFICE

2,587,188

APPARATUS FOR REGULATING THE FLOW OF THIXOTROPIC COLLOIDS AND THE LIKE

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Application October 18, 1945, Serial No. 622,995

4 Claims. (Cl. 138—45)

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This invention relates to a method and apparatus for regulating the flow of certain types of fluid such as thixotropic colloids which must be kept in a state of agitation.

Suspensions which fairly readily deposit their solid particles if allowed to remain motionless, and heavy slurries and pastes which stick to and clog valve parts and in some cases jell or stiffen when allowed to remain motionless, are very difficult to handle. They are commonly conveyed in tubing (which term is used herein to include a series of connected pipes) and a great need has been felt for apparatus suitable for regulating the flow of such fluids in the tubing. Thus the apparatus according to the present invention, which regulates the flow of such fluids while maintaining the same in a state of agitation, has a wide application in, for example, the fields of ore dressing, refractory slips, Portland cement, sea-water treatment for the recovery of values, and food processing.

The flow regulating apparatus according to the present invention has been designed for and has particular application to the regulation of the flow of those materials known as thixotropic colloids. It is typical of these thixotropic colloids that, on standing for a short time, they act like a solid, exhibiting little or no tendency to flow, and if cut with a knife maintain their shape. On being vigorously stirred, however, they become quite fluid, and behave like a viscous liquid, but on cessation of agitation they soon stiffen, and act like a solid. An example of such a material is the residue left after the treament of zinc ores by standard hydrometallurgical treatment. This material is essentially zinc ferrite with more or less ferric hydroxide, zinc sulphate, zinc sulphide and small quantities of other constituents formed into a pulp with water, the latter comprising 30% to 40% of the weight.

In many methods of treating such materials it is necessary that they be fed to various operations in a uniform manner. One method of doing this is to place the material in a tank, agitate it by mechanical stirrers until it is fluid and then let it flow to the next stage of the process through pipes or tubing provided with one or more valves whose openings may be regulated. Ordinary valves are quite unsatisfactory for this process because when they are partly shut off, the material is not sufficiently agitated in the valves or in the pipe leading to the valves so that the material reverts to the solid form and clogs the valve and the pipes.

The object of the present invention is to provide a method and apparatus for controlling the

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flow in tubing conveying fluids of the kind described while maintaining the same in a state of agitation.

More specifically an object of the invention is to provide a method for conveying such fluids in which the same are passed through tubing including a flexible tube, and the cross section of the flexible tube is altered cyclically by cyclically increasing and decreasing external pressure on the tube.

A further specific object of the invention is to provide apparatus for connection in tubing for conveying fluids of the kind described, comprising a flexible tube and means for cyclically decreasing the cross section of the flexible tube and allowing it to expand.

A further specific object of the invention is to provide in combination with such apparatus adjustable means for varying the proportions of the cycle of increase and release of pressure to adjust the rate of flow through the tubing.

Other objects and features of the invention will appear from the following description with reference to the drawings in which—

Figure 1 is a section in elevation of the apparatus according to the invention, and

Figure 2 is an end view of the apparatus taken on a section through the relief valve, and showing the mechanism for cyclically actuating the relief valve.

The apparatus consists basically of the flexible tube 10 and tubular housing 11 defining between them the air chamber 12, and of the inlet tube 13 and relief valve 14. The flexible tube which is preferably made of rubber is provided with a radial flange 15 at each end. The housing 11 is similarly provided with a radial flange 16 at each end which as shown may conveniently be threaded onto the housing 11. Corresponding flange members 17, threaded at 18 for attachment to pipes leading respectively to an agitator tank and to the next stage of the treatment process, cooperate with the flanges 16 to firmly engage the flanges 15 and effect a tight seal between the flanges 15 and 16, thereby preventing the escape of air from the chamber 12. The flanges 16 and 17 are tightened down onto the flanges 15 by means of the bolts 19 and nuts 20, the former being passed through suitable aligned holes formed in the flanges 15, 16 and 17. When a fluid under pressure, for example air, is admitted through the inlet pipe 13, the rubber tube 10 is constricted as indicated at 21, the extent of constriction depending on the pressure applied and the duration of application.

The relief valve 14 consists of a seat 22 in the

form of a tube which may be welded or otherwise secured to the housing 11 in line with a hole formed therein, a valve member 23, and a washer 24 carried by the valve 23 and arranged to effect a tight seal with the seat 22. Because the diameter of the seat 22 is relatively large the pressure in the chamber 12 may be immediately dropped by lifting the member 23 and its washer 24, thereby allowing the tube 10 to be expanded by the fluid passing through it. By opening and closing the valve 14 in a suitable cyclic manner, the rate of passage of fluid through the tube 10 may be accurately controlled, and moreover the fluid in the tube 10 and in the pipes preceding and following it may be kept in a state of agitation so that, in the case of a thixotropic colloid, it remains fluid.

A convenient arrangement for cyclically and automatically actuating the relief valve 14 is shown in Fig. 2. The member 23 carrying the gasket 24 is connected to an arm 25 which is of sufficient weight to normally hold the relief valve closed. This arm 25 is hinged at one end to pivot between two angle members 27 on a pin 26 supported at its ends by the angle members 27 and secured by a nut 28. The angle members 27 are conveniently connected by bolts 29 to the base 30 which supports the housing 11. The angle members 27 are further supported by a brace 31 extending between each angle member 27 and the housing 11.

When the free end of the arm 25 is lifted to cause it to pivot on the pin 26 the member 23 and gasket 24 are lifted from the seat 22. To the free end of the arm 25 there is connected an extension 32 which extends into the path travelled, in the direction indicated by the arrow, by a cam member 33 carried by a wheel 34 rotated through speed reducer 35 and a suitable coupling 36 by a motor 37, the speed reducer 35 and motor 37 being mounted on a base 38. As the wheel 34 revolves it brings the arm 33 into contact with the underside of the extension 32 thereby pivoting the arm 25 and lifting the member 23 and its gasket 24 from the seating 22.

It will be observed that the length of time during which the relief valve is opened is dependent on the length of time during which the extension 32 is engaged by the member 33 and that this may be regulated by shortening and lengthening the distance which the member 33 projects from the wheel 34. Accordingly the member 33 is provided with suitable slots 39 through which pass bolts 40 for securing the member 33 to the wheel 34. Thus when it is desired to increase the rate of flow through the tube 10, and for this purpose to decrease the duration of the increase of pressure on the tube 10, the distance which the arm 33 extends from the wheel 34 is increased. The result is to produce a cyclic contraction and

expansion of the tube which prevents the fluid therein from coming to rest.

What I claim is:

1. Apparatus for controlling the flow in tubing conveying fluids requiring to be maintained in a state of agitation, comprising a flexible tube adapted for connection in said tubing, a housing enclosing at least a portion of the flexible tube and defining therewith a sealed chamber surrounding the same, means for admitting a separate fluid under pressure to such chamber, and means for causing the pressure exerted by such separate fluid on the flexible tube to increase and decrease cyclically to decrease the cross-section of the flexible tube, and therefore allow it to increase cyclically.

2. Apparatus as defined in claim 1 in which said means for causing the pressure exerted by the fluid to increase and decrease comprises a relief valve operable to relieve pressure in said chamber and means for intermittently opening and closing the same.

3. Apparatus as defined in claim 2 in which said means for intermittently opening and closing the relief valve comprises a hinged arm normally bearing on the relief valve to hold said valve closed, a cam member, and means for causing said cam member cyclically to engage the hinged arm and move said arm to open the relief valve.

4. A device as defined in claim 2 in which said means for intermittently opening and closing the relief valve comprises a hinged arm normally bearing on the relief valve to hold said valve closed, a cam wheel, means for driving the cam wheel and a cam lever projecting from the wheel to travel a circular path into which the free end of the hinged arm projects, whereby said cam lever cyclically engages the free end of said hinged arm to move the same to open the relief valve.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
493,733	McGahan	Mar. 21, 1893
821,184	Oakes	May 22, 1906
1,427,455	Gates	Aug. 29, 1922
2,348,402	Miller	May 9, 1944
2,380,969	King	Aug. 7, 1945

FOREIGN PATENTS

Number	Country	Date
540,685	Great Britain	of 1941
371,681	Italy	of 1939