This invention relates to means for feeding reagents to concentrating or metallurgical mills, in accurate proportion to the ore or in accurate amounts per unit of time.

It is aimed to provide a novel structure or means utilizing the principle of the amount of liquid which will flow through a calibrated orifice from a constant head source for an adjustable predetermined period of time.

It is aimed further to provide such a structure wherein the orifice which controls the stream volume is completely open during the open time period and is closed completely during the closed time period, being distinctly advantageous over reagent feeder systems where the amount of flow is continuous and the volume fed is regulated by opening or closing a conventional valve, since a round orifice fully opened is much less apt to become clogged with foreign particles as compared to a narrow circular or semi-circular opening formed by a gate or globe valve when slightly opened.

It is further aimed to provide a means which will operate easily and expeditiously with accuracy, which avoids measuring tanks or float valves and which employs a recording means.

The more specific objects and advantages will become apparent from a consideration of the description following taken in connection with the accompanying drawings illustrating an operative embodiment and wherein the Fig. 1 is in diagram and Fig. 2 is a detail perspective view of a conventional weighing means which may be used.

Referring specifically to the drawings, I designates a storage tank adapted to contain the reagent. An outlet pipe or conduit 2 leads therefrom, preferably adjacent the base thereof, and includes a conventional strainer at 3. Pipe 2 leads to a circulating pump 4 and a pipe or conduit 5 from the pump 4 leads to and discharges into a constant head tank at 6, located within the tank 1 and having an overflow pipe at 7, leading from adjacent the top of the tank 6 and disposed to empty into the tank 1. A feed line or conduit 8 leads from adjacent the base of the constant head tank 6 to the concentrating or metallurgical mill (not shown).

Operatively mounted in the feeder pipe 8 is a valve 9 of such construction as to be operable by a solenoid at 10. Such valve has a variable or calibrated port and the same is round, as well as the chamber therein and the bore of the feeder pipe 8. The electric current to operate the solenoid 10 is taken from any suitable source of supply as by means of conductors 11 which are operatively connected to a definite time limit relay shown generally at 12 and from which wires or conductors 13 and 14 lead to the solenoid 10. The valve 9 and time relay are of constructions well known in the art and for instance as disclosed in Patents 1,699,126 and 1,493,433. The said time limit relay controls the length of time which the solenoid valve 9 is energized and therefore open.

Said relay 12 includes a clock motor at 15. The solenoid valve 9, for example, may be the Automatic Switch Co.'s type PXIX Cat. No. 8263 with calibrated port and the definite time relay 12 may be the General Electric Co.'s type MC 10 Cat. No. 3120002G1.

Each time a predetermined quantity of ore, say 400 pounds, passes over the weightometer W, the weightometer totalizer 20 by means of cam 22 rotates 90 degrees and causes momentary contact of switch contacts 23 to energize solenoid valve 9 and electromagnetic 11'. Contacts 23 remain closed continuing to energize solenoid valve 9 and the electromagnet 18 until operation of relay unit 12 causes contacts 15' to open the electrical circuit to both the electromagnet 10 and solenoid valve 9. This circuit remains electrically open until totalizer cam 22 again closes contacts 23.

In connection with the feed of the ore, a weighing means is employed such as a weightometer generally shown at W. Such weightometer or weighing means has associated with it a totalizer of conventional form shown at 20 and on a rotatable shaft 22a of such totalizer, a cam 22 is fastened which at times is adapted to cause the engagement of spring mounted contacts 23, having a conductor 24 connected to one of the conductors 11 and a conductor 25 connected within the relay 12 and then connected to the conductor 14. Said weightometer W is of the type manufactured by Merrick Scale Mfg. Co., Passaic, New Jersey, patented February 20, 1912, No. 1,018,068. Essentially such weightometer is an ordinary platform scale over which a conveyor belt B runs. A combination of the motion of the conveyor belt and the variation of the scale beam passes through an integrator to which the totalizer 20 is attached.

Presuming operation, the valve 9 is initially in closed position. The weightometer totalizer 20 will be operated by the ore fed to the mill or concentrator and when a predetermined quantity of the ore is fed, the cam 22 will close the contacts 23. For example, such cam will close the contacts 23 every time four hundred pounds of ore is...
fed to the mill. The pointer 16 is adjustable and for instance is set to ten seconds, the period which the valve 9 is to remain open, for discharge of the reagent from tank 8, under constant pressure head. Thus when the contacts 23 are closed, the relay 12 is operated and valve 9, through its solenoid 18 is opened. It will remain open for the period that the contacts 23 are engaged, and for which the pointer 16 is set, for instance ten seconds, after which the valve promptly closes and remains closed until the succeeding operation or passage of four hundred pounds of ore to the mill, and movement of the cam 22 to close contacts 23 and open the valve 9.

Variation of the time which electromagnet 11' and solenoid valve 9 are energized is controlled by lever 17' as described in the patents previously mentioned. Attached to said lever 17' is a rheostat 17 having a control brush device 16. When the time element is varied, the rheostat resistance is varied also, as both are controlled by the same knob. By varying the resistance in the rheostat, electromagnets 19' are thrown out of magnetic balance so that armature 20' rotates toward the stronger electromagnet, causing pen 21 to make a graphic chart which indicates the position of lever 17'. Lever 17' governs the length of time solenoid valve 9 was open. The electric clock motor 22' drives chart 18.

In some instances, the weightometer totalizer 28 is not used. Under such circumstances, the cam 22 is operated by the clock motor 18, to which it is attached and with which contacts 23 will be associated as in the form described. Under such conditions, for instance, the solenoid valve 9 is operating with a ten foot head and the port is bored to give two gallons of reagent per minute at such pressure. The pointer 16 is set to ten seconds for the valve 9 to open per minute. The result is that \( \frac{\frac{2}{2}}{\frac{100}{12}} \) gal. = \( \frac{1}{2} \) gal. of reagents are fed to the mill per minute. In milling practice, reagents are measured in pounds, therefore the above would naturally be converted to pounds per ton or minute.

Incidental to the operation of the device, the quantity of reagent fed would be graphically depicted by the pen 21 on the rotatable chart 18. In the first instance given, the charts would be printed to read in pounds of reagents fed per ton of ore milled and in the second instance given would be printed in pounds of reagents fed per hour. Attention is called to the fact that the system or mechanism shown is but one of many methods of applying a graphic chart to the device. For instance, a conventional orifice meter could be inserted in the discharge line.

I should like to mention that the constant head for the reagents could be attained by many other methods than that shown on the drawings. A conventional pressure regulating valve could be used in the event that the reagent storage tanks were sufficiently above the solenoid valve to give the desired pressure or an agent 14' could be used instead of the pump 4 to circulate the reagents. Various changes may be resorted to provided they fall within the spirit and scope of the invention.

I claim as my invention:

1. In a metallurgical mill, weighing mechanism to feed reagent to ore, means to supply reagent under constant head, a normally closed valve in said means for measuring volume, means operable periodically in accordance with the weight of ore, to open and close valve through operation of the last means a period of time proportioned to the said weight of ore.

2. Means for feeding a reagent to ore, comprising means to supply the reagent under constant head, a normally closed valve, means operable in accordance with the weight of ore being supplied to close an electric circuit, and solenoid means in said circuit to open said valve for a predetermined length of time proportioned to the said weight of ore.

3. Means for feeding a reagent to ore, comprising means to supply the reagent under constant head, a normally closed valve, means operable in accordance with the weight of ore being supplied to close an electric circuit, and solenoid means in said circuit to open said valve for a predetermined length of time proportioned to the said weight of ore.

4. In a metallurgical mill, apparatus for supplying reagent to ore, a tank, a constant pressure tank within the first mentioned tank having an overflow member communicating with the first mentioned tank, a conduit leading from the first mentioned tank to the second mentioned tank including a pump, feeder means feeding reagent from the second mentioned tank including a valve to measure volume, said valve being normally closed, and means to periodically open the valve according to the weight of fed ore.

5. In apparatus for supplying reagent to ore, a tank, a constant pressure tank within the first mentioned tank having an overflow member communicating with the first mentioned tank, a conduit leading from the first mentioned tank to the second mentioned tank including a pump, feeder means for reagent feeding a definite predetermined amount of reagents per period of time.

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