Nov. 17, 1942. L. D. JONES 2,302,553

LIQUID FEEDING SYSTEM

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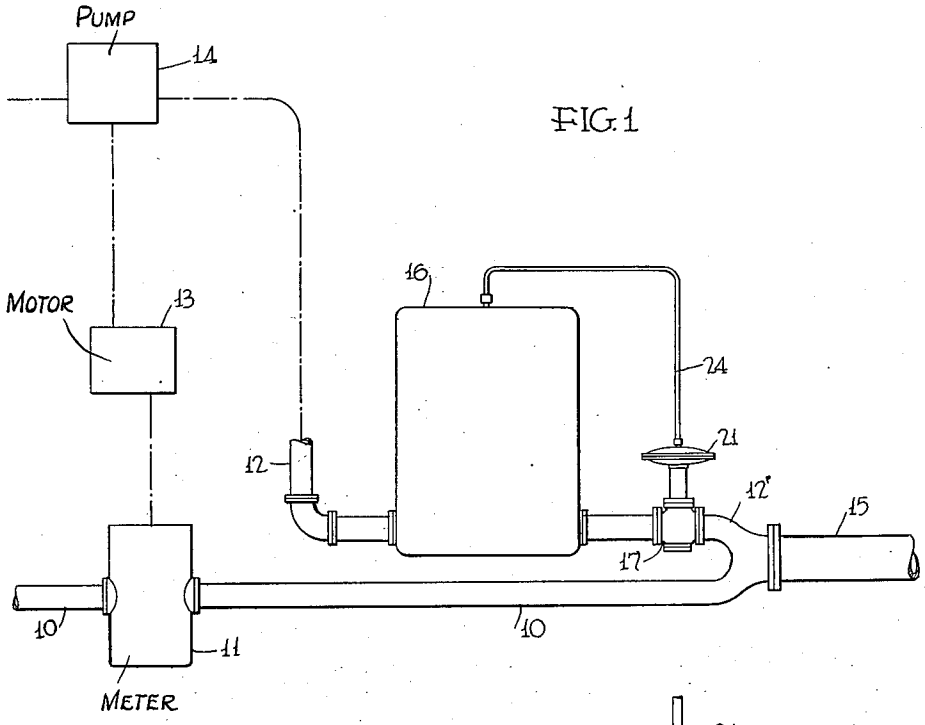


FIG. 1

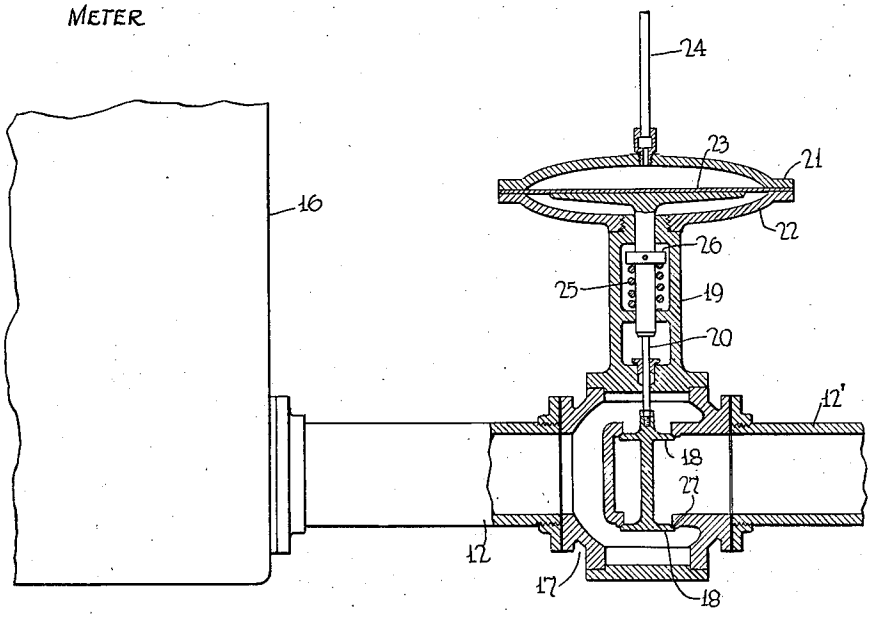


FIG. 2.

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LIQUID FEEDING SYSTEM

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5 Claims. (Cl. 137—78)

The present invention pertains to a liquid feeding system. It was developed as a solution of certain problems encountered in the use of proportioning apparatus of the type illustrated in the applicant's prior Patents 2,009,890 and 2,058,889, and it will accordingly be described with reference to those patents and those problems.

One of the principal uses of the apparatus of Patents 2,009,890 and 2,058,889 has been that of effecting proportionate feed between an oil and a reagent. In this and analogous uses, the liquid to be treated is fed in a steady stream through a reciprocated fluid actuated meter, and the treating liquid is fed in intermittent impulses controlled by flow of the liquid to be treated through the meter. While such a system is satisfactory in cases in which both liquids are fed to a relatively large mixing chamber, it results in irregular treatment in cases in which attempts are made to effect such treatment in mixing apparatus of relatively small cross section. A feature of the present invention consists in the fact that it provides an arrangement by which a liquid, fed in intermittent impulses as in the systems of the above-mentioned patents, may have these intermittent impulses smoothed out and converted into continuous flow. While the present invention is useful, regardless of whether the use occurs in a proportioning apparatus or some other connection in which it is desirable to convert intermittent flow to continuous flow, the above explanation is made for the purpose of indicating one important field of use in which it may be applied.

Figure 1 is a partly diagrammatic side elevation illustrating the preferred arrangement of the present invention, and

Figure 2 is a detailed cross sectional view of parts of the apparatus.

For the sake of convenience of description, it will be assumed that the invention is applied to the proportionate feed of oil and liquid reagent. The oil is fed continuously through conduit 10 by a pump or other suitable source of energy, and passes through a metering device 11, which controls the intermittent feed of reagent through conduit 12. The intermittent feed of reagent may be controlled by a valve, which is in turn controlled by the meter 11, as taught in my prior Patent 2,058,889, but this control is preferably effected by a reciprocating fluid pressure motor 13 which drives a reciprocating pump 14, which in turn impels reagent intermittently through the conduit 12, as taught in my prior Patent 2,009,890. In any case, the reagent in the conduit 12 is fed in a series of intermittent impulses, and the frequency of such impulses is determined by the rate of reciprocation of the pistons in the meter 11, as taught in my two prior patents discussed above.

The effect of the features of the present invention described above is to cause continuous feed of oil through the conduit 10 toward the mixing zone 15 and intermittent feed of alkali through the conduit 12 toward this same mixing zone. If the intermittent feed of the reagent were allowed to proceed through the conduit 12 to the zone 15, the effect would be to cause over-dosage of oil during intervals at which the pump 14 is acting to impel reagent through the conduit 12 and under-dosage at other times in the cycle of operation of the pump 14. The present invention provides apparatus for smoothing out the intermittent impulses of the pump 14 and thereby causing smooth flow of reagent through the conduit 12 to the mixing zone 15, and this smooth flow is accurately proportioned to the quantity of oil passing through the conduit 10.

The desired result of smoothing out the flow of reagent is accomplished by interposing in the line of flow of liquid through the conduit 12 a closed reservoir 16 of fairly large capacity as compared to the size of the conduit 12, and this reservoir is many times the volume of liquid discharged by a single impulse of the pump 14. Thus, the body of liquid maintained between the control point of the pump 14 and valve 17 is many times the volume fed in a single impulse of said pump. Liquid flowing through the conduit 12 passes into the reservoir 16 and tends to fill this reservoir gradually. This tendency to fill the reservoir is the result of provision of a normally closed valve 17 between the reservoir 16 and the mixing zone 15. The valve 17 may comprise a pair of valve plugs 18 which coact with valve seats 27 in the conduit 12, forming a valve assembly of the "balanced" type. The valve assembly includes a housing 19 connected to the conduit 12, and the valve stem 20, which is connected to the plugs 18 and reciprocates within the housing. The upper end of the valve stem 20 is secured to the moving member of a fluid pressure motor 21, which may comprise a housing 22 having a flexible diaphragm 23 secured at its outer edges to the housing. A conduit 24 is secured to the upper end of the housing 21, and this conduit is secured at its opposite end to the upper end of the reservoir 16. A spring 25 is interposed between a part of the housing 19 and a collar 26 on the valve stem 20, and this spring normally urges the valve plugs 18 into seating engagement with the valve seats

27, maintaining the section 12' of the conduit 12 sealed against admission of liquid into that section from the main part of the conduit 12.

In the operation of the apparatus, oil is passed through conduit 10, including the metering device 11. The flow of oil through this meter automatically causes reagent to be passed through conduit 12 in successive impulses proportioned to the flow of oil. After the reagent has filled the portion of the conduit 12 between the pump 14 and the valve 17, this reagent will rise in the reservoir 16, since the valve 17 prevents passage of reagent into the section 12' of the conduit 12 at this stage of the operation. As the level of the reagent in the reservoir 16 rises, the air in the upper part of this reservoir and in the conduit 24 will be compressed, thereby imposing substantial pressure upon the top of the disc or membrane 23. When the liquid rises in the reservoir to a sufficient extent to overcome the pressure of the spring 25 tending to hold the valve plugs 18 in closed position, the membrane 23 and valve stem 20 will descend under the influence of the pressure from conduit 24 and cause the valve plugs 18 to move to open position, thereby permitting the liquid to flow from reservoir 16 into the section 12' of the conduit 12 and into the mixing zone 15. After this stage of the operation is reached, there will be a tendency of the valve 17 to close as the liquid descends in reservoir 16 and to open as this liquid ascends in the reservoir 16. Since a substantial pressure is attained in the reservoir 16 before the valve 17 is operated to open position, however, the fluctuation in the position of the valve plugs 18 due to introduction of successive increments of liquid into the pipe 12 from the pump 14 will be relatively slight, and the intermittent flow of liquid from pump 14 into conduit 12 will be converted into a steady stream leaving the reservoir 16.

After equilibrium has been fairly established as discussed above, any substantial decrease in the rate of flow of liquid from the pump 14 will be compensated by a corresponding diminution in the degree of opening of the valve 17, and any substantial increase in such rate of flow will be compensated by a corresponding increase in the opening of said valve. Thus, after equilibrium is established, if the rate of flow from the pump 14 to the reservoir 16 is decreased, the first tendency will be for liquid in the reservoir 16 to pass through the valve 17 at a greater rate than the rate of passage from the pump 14 to the reservoir 16. This results in a lowering of the level of liquid in the reservoir 16, with corresponding decrease of pressure in the top of that reservoir and in the conduit 24. This decrease in pressure permits the spring 25 to actuate the valve plug 18 toward closed position, the extent of such actuation depending upon the level to which the liquid in reservoir 16 has fallen. If the diminished rate of flow is maintained substantially constant, the valve plug 18 will ultimately reach an adjusted position adapted to maintain a fairly steady flow of liquid into the mixing zone 15 at this diminished rate. Conversely, if the rate of flow of liquid from the pump 14 is increased, the valve plug 18 will be moved away from its seat, due to increase of pressure in the top of the reservoir 16 and in the conduit 24, as will be readily understandable from the above discussion.

While the invention has been described specifically in its relationship to proportioning apparatus of the type illustrated in my prior Patents 2,009,890 and 2,058,889, it will be understood that the invention is applicable in the solution of various proportioning problems involving conversion of intermittent feed into continuous feed, and even of problems other than proportioning problems involving the necessity for a similar operation.

Various modifications will be obvious to those skilled in the art, and I do not therefore wish to be limited except by the scope of the following claims.

I claim:

1. In a liquid feeding system, the combination comprising, a conduit, means for feeding a liquid in intermittent impulses through said conduit, a reservoir interconnected with said conduit and adapted to receive liquid fed intermittently therethrough, a valve in said conduit on the downstream side of said reservoir, means for holding said valve normally in closed position to prevent flow of liquid through said conduit past said valve, and means associated with said valve and said reservoir for actuating said valve to open position to a degree depending upon the quantity of liquid in said reservoir upon accumulation of a predetermined quantity of liquid in said reservoir.

2. In a liquid feeding system, the combination comprising, a conduit, means for feeding a liquid in intermittent impulses through said conduit, a reservoir interconnected with said conduit and adapted to receive liquid fed intermittently through said conduit, a valve on the downstream side of said reservoir, means for holding said valve normally in closed position to prevent flow of liquid through said conduit past said valve, a fluid pressure motor associated with said valve for actuating said valve to open position to a degree depending upon the quantity of liquid in said reservoir, and means for operating said fluid pressure motor to actuate said valve to open position upon accumulation of a predetermined quantity of liquid in said reservoir.

3. In a liquid feeding system, the combination comprising, a conduit, means for feeding a liquid in intermittent impulses through said conduit, a reservoir interconnected with said conduit and having a substantially closed upper end extending upwardly from said conduit, said reservoir being adapted to receive liquid fed intermittently through said conduit, a valve in said conduit on the downstream side of said reservoir, means for holding said valve normally in closed position to prevent flow of liquid through said conduit past said valve and means responsive to development of a predetermined pressure by compression of the gas in the upper end of said reservoir for actuating said valve to open position to a degree depending upon said pressure.

4. In a liquid feeding system, the combination comprising, a conduit, means for feeding a liquid in intermittent impulses through said conduit, a reservoir interconnected with said conduit and adapted to receive liquid fed intermittently through said conduit, said reservoir having a substantially closed upper end adapted to constitute an air space at the upper end of said reservoir, a valve in said conduit on the downstream side of said reservoir, means for holding said valve normally in closed position to prevent flow of liquid through said conduit past said valve, a fluid pressure motor operative to oppose said last-mentioned means and actuate said valve to open position, and a conduit interconnecting the upper end of said reservoir and said fluid pressure mo-

tor for actuating said fluid pressure motor to valve opening position to a degree depending upon the pressure upon development of predetermined pressure in the upper end of said reservoir.

5. In a liquid feeding system, the combination comprising, a conduit, means for feeding a liquid in intermittent impulses through said conduit, a reservoir interconnected with said conduit and adapted to receive liquid fed intermittently therethrough, a valve in said conduit on the downstream side of said reservoir, means for controlling the degree of opening of said valve to control the flow of liquid through said conduit past said valve, and means responsive to accumulation of liquid beyond a predetermined amount in said reservoir for actuating said last-mentioned means.

LEO D. JONES.

CERTIFICATE OF CORRECTION.

Patent No. 2,302,553. November 17, 1942.

LEO D. JONES.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, lines 38 to 40, claim 2, strike out the words "to a degree depending upon the quantity of liquid in said reservoir" and insert the same after "position" in line 42; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of March, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.