Oct. 25, 1927. 1,646,582

E. P. HALLIBURTON

MIXER AND PROPORTIONER

Filed Aug. 9, 1926

Fig. 1

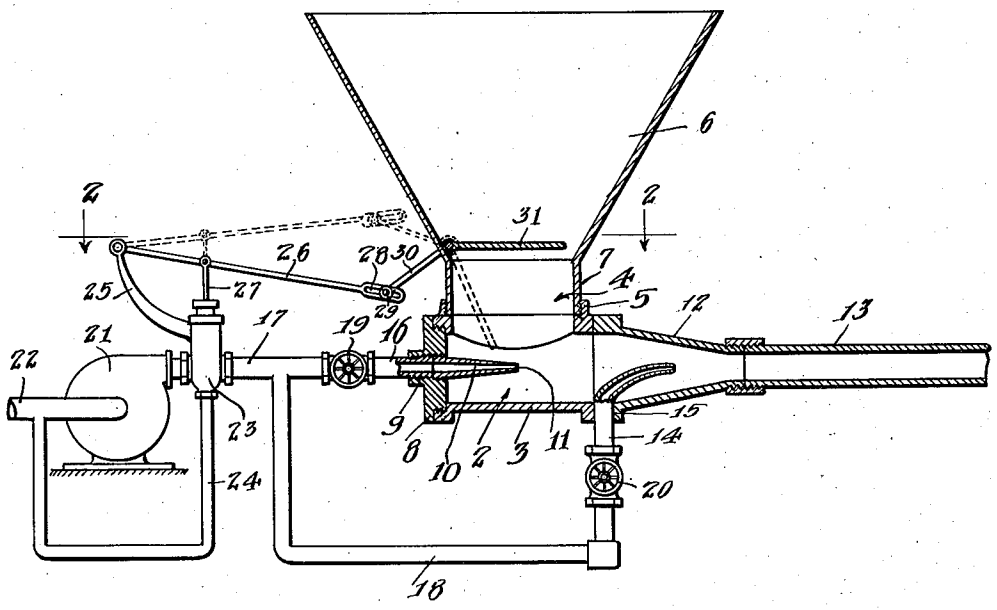
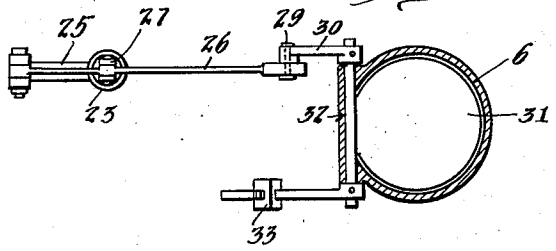


Fig. 2



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MIXER AND PROPORTIONER.

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This invention relates to a device for mixing and proportioning solid materials with liquids, and refers particularly to a device for mixing liquids and hydraulic cement in order to form a fluid cement grout.

The principal object of the present invention is to provide a mixing apparatus of the type in which the liquid is placed under high velocity in order that the high velocity stream of the liquid can draw in the solid material, mix the solid material with the liquid material, and eject the same from the mixing zone, which is characterized by the fact that the supply of the solid material in the mixer is made to automatically control the supply of the liquid material thereto. With the mixer of the present invention, the placing of solid material in the apparatus automatically operates to turn on the supply of liquid material for performing the mixing operations, and moreover when at any time the supply of the solid material is exhausted, in consequence thereof operates to automatically cut off the supply of liquid material. Thereby, the device of the present invention prevents the device from delivering anything but a supply of mixed material.

Further objects of the present invention are to provide a device of this class with means for recirculating the liquid material around the pumping element of the apparatus when the passage of the liquid material to the mixing device is automatically shut off; to provide a means for supplying the liquid material in the mixing zone through a plurality of jets, one constituting a main mixing and proportioning jet, and the other constituting a supplemental jet by means of which the consistency of the mixed material may be readily varied at will without changing the rate of supply of the liquid; all of these objects being carried out in a mixer in which there is an automatic control through a single valve of the liquid supply actuated by the supply of the solid material.

Various further objects of the present invention will be apparent from a description of the preferred form of the mixer embodying the invention. For this purpose, reference is made to the accompanying drawings in which I have illustrated one example of a mixer embodying the present invention.

In the drawings:

Figure 1 is an elevation of the mixing apparatus partially in vertical section; and

Figure 2 is a transverse section on the line 2—2 of Fig. 1, certain parts being omitted to clarify the view.

Referring to the drawings, the mixing device per se is illustrated as provided with a mixing or reduced pressure chamber 2, provided within a T pipe section 3 which is provided with an opening 4 at its upper side, which opening is bordered by an upturned internally threaded annular flange 5. A frusto-conical hopper 6 is provided, said hopper having an externally threaded flange 7 which is threaded within the flange 5 of the T pipe section 6.

The T section 3 is provided with a circular bushing 8 at its rear end. Said bushing 8 has an axially threaded opening 9 through which extends a nozzle or jet pipe 10, the discharge end 11 of said nozzle being approximately in alignment with the axis of the feed hopper 6 so as to form a jet which passes by the discharge outlet from said hopper. It is understood that the specific arrangement of the jet pipe 10 is not essential to the invention, but in place the jet pipe 10 may be placed in various positions, such, for example, as extending axially down through the feed hopper 6, it being necessary only that the stream of fluid issuing from the end 11 of the jet pipe should be in position to create a region of reduced pressure or suction on the materials within the feed hopper 6.

The forward or discharge end of the mixing or proportioning chamber 2 communicates with a tapering pipe section 12 with a discharge line 13, through which the materials from the mixer may be passed to the point of use.

The jet pipe 10 constitutes the main mixing and proportioning means of the device, and may be solely employed for this purpose. However, I prefer to employ an additional or supplemental jet pipe 14 positioned preferably near the outlet from the mixing and proportioning chamber 2 and directed towards the outlet. Said jet pipe 14 is indicated as passing into the mixing chamber through a threaded opening 15 near the forward bottom side of said mixing chamber, and as curving therefrom toward the axis of the mixing chamber in order to provide a minimum obstruction to the materials being forced from the mixing chamber 2 under the action of the main mixing jet 10. The mixing jets 10 and 14 may, if desired, be con-

nected to separate supplies of fluid of the same or different kinds, but I prefer to connect both jets to the same source of supply. For this purpose, the jet 10 is connected with a line 16 leading to a line 17, and the jet 14 is connected to a line 18 leading to the same main supply line 17. The lines 16 and 18 are provided with the valves 19 and 20, respectively, which provide means by which the relative proportions of the fluid from the line 17 which is passed through the jets 10 and 14 may be controlled.

The line 17 receives its supply of fluid from a pump 21 which is connected to an inlet line 22, which it is understood leads to a source of fluid (not shown). The line 17 is provided with a two-way valve 23 which may be of any desired construction adapted to connect the pump in one position with the line 17, and in another position with a recirculating line 24 which is illustrated as connected from the valve around to the inlet line 22 of the pump.

The two-way valve 23 is indicated as of an automatic type, preferably having an arm 25 providing a pivot support for a connecting lever 26, which in turn is attached to the valve rod 27 of the two-way valve 23. The lever arm 26 has a slot 28 in which a pin 29 provided on the end of an arm 30 operates. The arm 30 is rigidly attached to a pressure plate 31 disposed within the feed hopper 6 near the lower end of the same and indicated as pivoted at 32 so that it may move from a horizontal position in which it would receive the weight of the material within the hopper 6, to a downwardly inclined position indicated by the dotted lines in Fig. 1, wherein the pressure plate would not substantially interfere with the discharge materials from the hopper 6.

The pressure plate 31 is indicated as attached to a weight 33 or other suitable means for yieldingly maintaining the pressure plate 31 in the horizontal position or the position in which it can receive the weight of materials within the hopper.

In the operation of the apparatus thus described, the pump 21 is first started in operation to provide the desired pressure upon the fluid, such as water, which is to be admixed with a solid material such as cement. Until a supply of the solid material is placed in the hopper 6, the weight 33 holds the pressure plate 31 in a horizontal position, and the lever arm 26 is so connected with the pressure plate 31 and the valve rod 27 that in this position the two-way valve 23 is in the position in which the fluid is cut off from the line 17 and is re-circulated through the line 24. Comminuted solid material, such as cement, is then placed in the feed hopper, preferably sufficient to substantially fill the hopper. The weight of such material on the pressure plate 31 operates to push the pressure plate to the down position, which in turn actuates the two-way valve 23 through the arm 30 and lever arm 26 to shut off the fluid from re-circulating through the line 24 and pass the fluid through the line 17 to the jet pipes 10 and 14. The fluid passing through these jet pipes issues in a high velocity stream which creates a region of reduced pressure or suction, which operates on the material within the hopper 6 to assist in drawing the material into the mixing chamber 2 wherein it is admixed with the fluid and ejected through the outlet of the mixing chamber 2 and through the line 13 to the place of use; the feeding of the solid material to the mixing chamber, the mixing of the solid material with the fluid, and the ejection of the mixed material from the mixing chamber all being accomplished preferably solely by the action of the high velocity streams of water, and substantially solely by the high velocity stream of water leaving the jet pipe 10.

The jet pipe 14 constitutes mainly a means for thinning the admixture formed and delivered by the jet pipe 10; by regulation of the valves 19 and 20, any desired consistency of mixed material may be supplied from the apparatus without regulation of the pump 21 or varying the size or position of the discharge opening 11 of the jet pipe 10.

When at any time the supply of solid material, such as cement, within the feed hopper 6, becomes exhausted, there is insufficient pressure to maintain the pressure plate 31 in the down position. Accordingly, the pressure plate 31 will swing outward under the action of the weight 33, switching the two-way valve 23 from the line 17 to the recirculating line 24, thus automatically stopping the mixing action. This automatic action not only cuts off the fluid from the main mixing jet 10 but also from the thinning jet 14. It will be seen that the apparatus thus is so constructed that it will not deliver anything but a mixture of materials through the delivery line 13, irrespective of whether the supply of the cement or other sold material is maintained.

While the form of the mixing apparatus herein described is well adapted to carry out the objects of the present invention, it is understood that various modifications and changes may be made without departing from the spirit of the invention as included within the appended claims.

I claim:

1. A mixer comprising a container for dry material, means for forming a high velocity stream of liquid for drawing in, mixing, and delivering an admixture of said dry material and liquid, and means operated by the weight of the dry material within the chamber for establishing said high velocity jet of liquid, and operative, in the absence of said

weight, to shut off said high velocity stream of liquid.

2. A mixer for producing fluid cement grout, including a feed hopper, a jet pipe having its outlet positioned near the outlet of said hopper and arranged to form a high velocity stream of liquid operative to draw in material from said feed hopper, mix the same with the liquid, and discharge the same from the mixing zone, a supplemental jet pipe for thinning the admixture, a line connecting the jet pipes with a common source of liquid, a valve for said line, and a pressure plate within the hopper connected to said valve and adapted to open the valve through the pressure of the material within the hopper, and to close the valve in the absence of material within the hopper.

3. A mixer for producing fluid cement grout, comprising a feed hopper, a mixing chamber in which said hopper is adapted to discharge, means for forming a high velocity stream of liquid in position to exert a reduced pressure at the outlet of said hopper, operative to draw the cement therefrom into said mixing chamber, and to discharge the mixed material therefrom, supplemental means for forming a separate high velocity stream of liquid in said mixing chamber, and means for regulating the supply of liquid to said second jet to proportion the consistency of the admixture.

4. A mixer for producing a fluid cement grout, comprising a feed hopper, a jet pipe positioned to form a high velocity jet of liquid by the outlet of said feed hopper, means for supplying liquid under pressure to said jet pipe, re-circulating means for said last metioned means, and means operative to normally close the supply of liquid to said jet pipe and direct the same through said re-circulating means, said means being operative by weight of the material in said hopper to close off said re-circulating means and open the supply of liquid to said jet pipe.

5. A mixer of the class described, comprising a hopper, a jet pipe positioned to discharge by the outlet of said hopper, a pump for supplying liquid under pressure to said jet pipe, a re-circulating line around said pump, a two-way valve for controlling the passage of liquid to said jet pipe and re-circulating line, a gate for said hopper, and means interconnecting the gate to the two-way valve.

Signed at Los Angeles, California, this 2nd day of August, 1926.

ERLE PALMER HALLIBURTON.