March 11, 1952 E. H. THOMPSON 2,588,591

MIXING DEVICE

Filed Feb. 2, 1946 2 SHEETS—SHEET 1

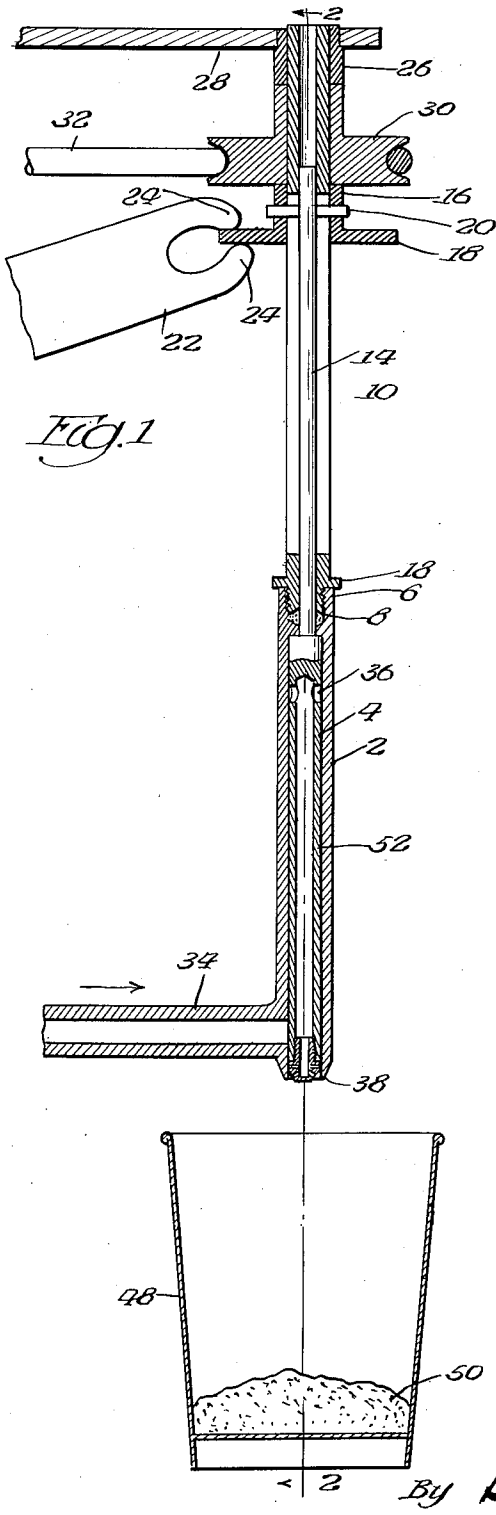


FIG. 1

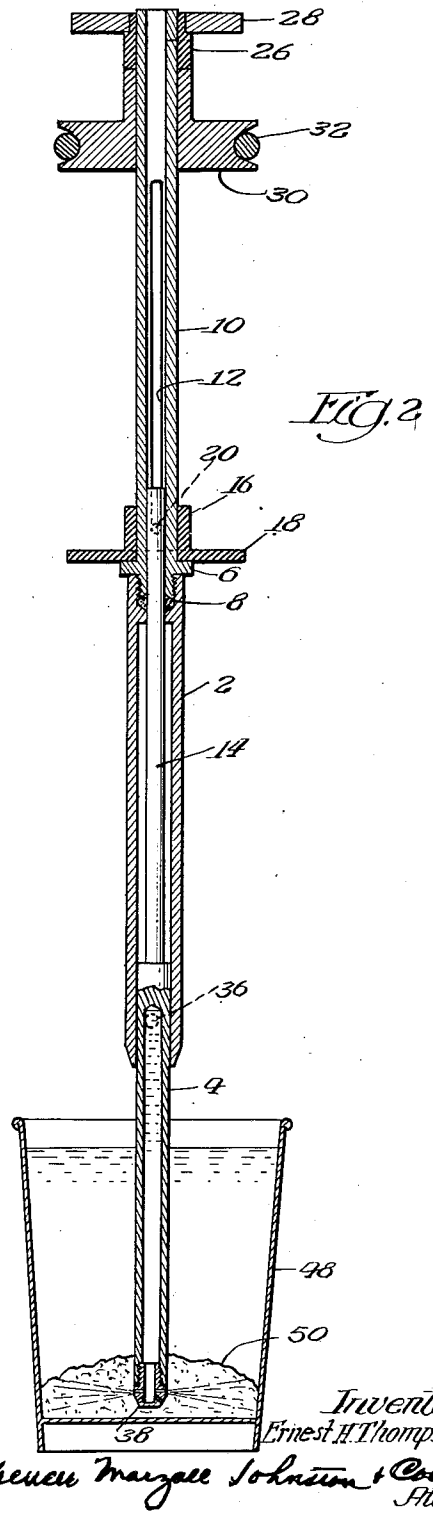


FIG. 2

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March 11, 1952 E. H. THOMPSON 2,588,591

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Filed Feb. 2, 1946 2 SHEETS--SHEET 2

Fig. 3

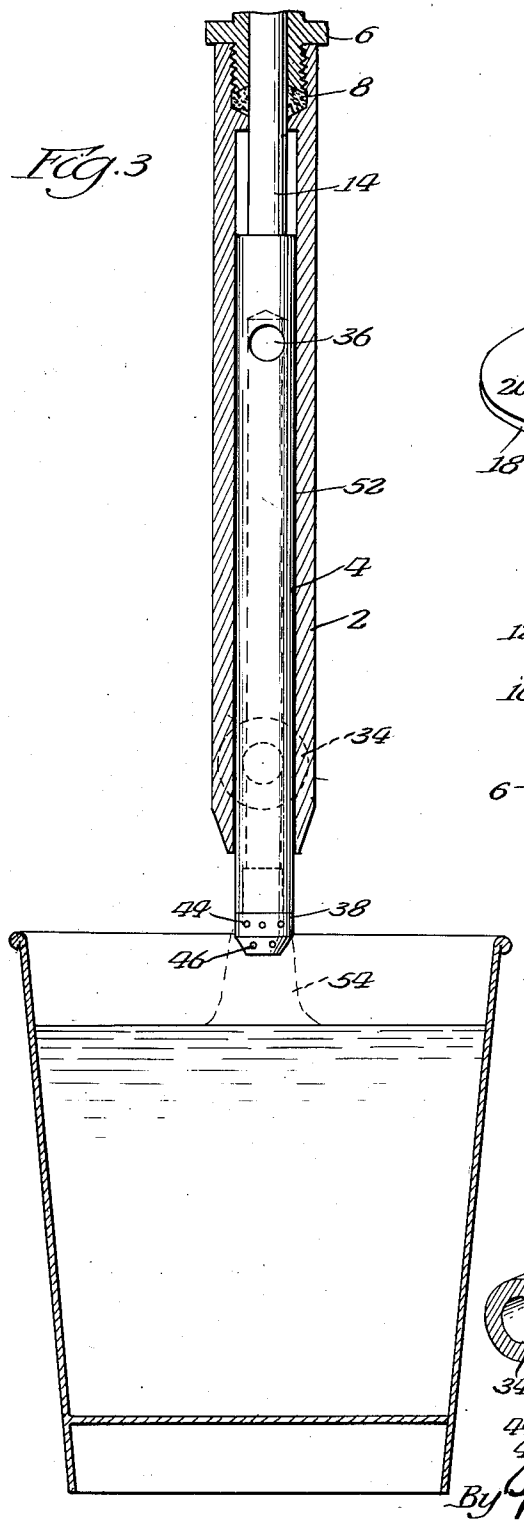


Fig. 4

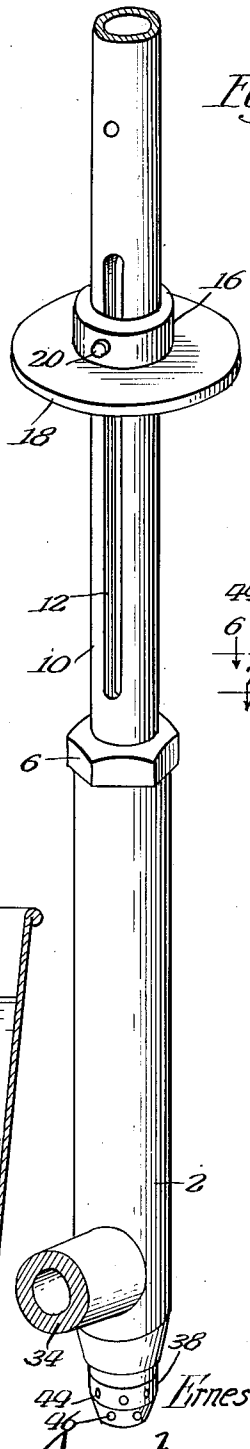


Fig. 5

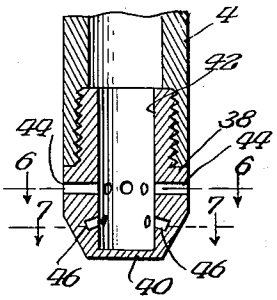


Fig. 6

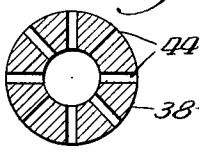
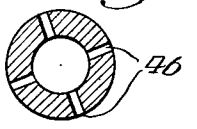


Fig. 7



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2,588,591

UNITED STATES PATENT OFFICE

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MIXING DEVICE

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8 Claims. (Cl. 259—23)

1

This invention relates in general to a mixing device for mixing solids and fluids, and more particularly to a device where a finely divided, or comminuted solid material located in a receptacle will be mixed with a liquid which is dispersed therethrough.

While the various adaptations of my apparatus may include the admixture with fluids of such solids as cement, sand, gravel and the like, they also embrace, and the invention is more particularly directed to, the making of beverages, either hot or cold, such as coffee, postum, cocoa, malted milk, and others.

In general, the device embodying my invention comprises an elongated cylindrical member having a plurality of passages, or orifices, in one end thereof to permit a fluid to pass therethrough. A receptacle is provided with a quantity of the comminuted solid material and the receptacle and cylindrical member are then placed so that the end of the cylindrical member is located within the receptacle. While the preferred way of doing this is to reciprocate the cylindrical member, it is within the purview of the invention to also reciprocate the receptacle, or to permit any other relative movement which will position the cylindrical member within the receptacle during the mixing operation and outside thereof during inoperative periods. Relative rotation between the member and receptacle is then effected and as the fluid is passed through the cylinder it is sprayed or forced outwardly in streams through the orifices. If desired, the fluid may also be forcefully sprayed by means of a pump. This spray of liquid agitates and mixes with the solid material, and as the receptacle is filled the mixing process becomes complete and the spray means may be removed.

In accordance with the foregoing, then it is an object of the present invention to provide a device for quickly and easily mixing fluids and solids.

Another object of the invention is to provide a rotatable conduit for the passage of fluid, having a spray nozzle at one end thereof of a novel type, to disperse the fluid throughout the solid and mix therewith.

A further object of the invention is to provide means for permitting fluid to pass through the conduit and nozzle while it is within the receptacle but to stop the flow of such fluid by the mere removal of the conduit from the receptacle.

Still another object is to provide novel spray means wherein two or more rows or series of orifices are located adjacent each other, one of

2

which rows is substantially normal to the axis of rotation, and the other of which is directed angularly toward the bottom of the receptacle, so that the powder or finely divided solid material will be driven by the angular spray into the path of the normal spray, thus decreasing considerably the time necessary for admixture.

A still further object, with respect to the device as used for making beverages, is to provide a means for a continuous slow dripping or oozing of the fluid through and around the tip or nozzle for the purpose of maintaining the nozzle clean and free from sediment.

Other objects and advantages of the invention will become apparent upon a reading of the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a vertical section through the device in its inoperative position;

Fig. 2 is a vertical section through the device in its operative position, taken substantially along the plane of line 2—2 of Fig. 1;

Fig. 3 is an enlarged vertical section along the same plane as Fig. 2, but showing the conduit or cylindrical member in a partially receded position and the fluid dripping therefrom;

Fig. 4 is a perspective view of the apparatus;

Fig. 5 is an enlarged vertical section through the nozzle showing the relative position of the orifices;

Fig. 6 is a horizontal section taken substantially along the plane of line 6—6 of Fig. 5; and

Fig. 7 is a horizontal section taken substantially along the plane of line 7—7 of Fig. 5.

It will be noted that the preferred embodiment of my invention is shown as adapted for use in mixing beverages, and for purposes of ease in understanding, it will be so referred to; however this is not intended in any way as limiting, since the device may be used for mixing other solids and fluids without in any way departing from the spirit of the invention.

In its broader conception, of course, it is necessary that there be a relative rotation between the receptacle and the spray, but for practical purposes it would appear that a better admixture results when the spray is rotated, and for that reason the invention is shown and described in this preferred form.

Referring now more particularly to the drawings, and more especially to Figs. 1, 2, and 4, I provide an external tube or cylinder 2 within which an elongated internal plunger or cylindrical member is mounted for rotation and vertical reciprocation. The upper end of the ex-

ternal tube 2 is provided with screw threads to receive a removable cap 6, below which packing 8 is located.

A sleeve 10 extends upwardly from the cap 6 and has an elongated slot 12 therein which extends therethrough and throughout a considerable portion of the length thereof. The plunger 4 has secured thereto at one end a rod 14 which passes upwardly through packing 8 and cap 6, and is mounted for rotation and vertical reciprocation within the sleeve 10.

A collar 16 surrounds the sleeve 10 and is adapted to slide longitudinally thereof. This collar is provided with a flanged portion 18, and a pin 20 extends through the collar 16, slot 12 in the sleeve 10, and the rod 14, so that reciprocation of the flanged collar will also cause reciprocation of the rod 14 and plunger 4 attached thereto. It will be clear that when this operation takes place, the pin 20 will ride substantially the length of the slot 12.

The means by which this reciprocating movement takes place may be varied to suit conditions, and any suitable expedient, even manual means, may be used. For purposes of illustration I have shown an arm 22 having a pincers-like end consisting of similar inturned portions 24, spaced apart a sufficient distance to receive at least the outer edge of the flange 18. In this instance any desired means, mechanical or otherwise, may be used to actuate the arm 22, but it will be evident that when the arm is moved either upwardly or downwardly it will carry with it, as explained above, the plunger 4 to place it in either of the positions shown in Fig. 1 or 2.

In the illustrated embodiment of the invention the sleeve 10 extends upwardly through a bearing 26 suitably mounted in a support 28. Adjacent the bearing I provide a pulley 30 which may be rotated in the usual manner by means of a belt 32 running from a suitable motor (not shown).

It will be evident, from the foregoing, that a rotation of the pulley 30 will likewise cause rotation of the sleve 10, the pulley being keyed thereto. Since the pin 20 passes through the slot 12 of the sleeve, every part connected thereto, including the flanged collar 16, 18, rod 14, and plunger 4, will also be rotated. If desired, an annular groove may be provided on each face of the flange 18 in which the rounded ends of the members 24 may ride during rotation of these various parts.

Thus far, the explanation has been confined to the manner in which the rotation and reciprocation of the plunger 4 is accomplished. The means by which the mixing of the fluid and solid takes place will now be described.

A conduit 34 is provided for the passage of fluid therethrough and is connected to the outer cylindrical member 2 within which the plunger 4 moves. Near the upper end of the plunger 4 cross-feed holes 36 are located so that, when the plunger is in its lowermost position, the holes 36 will be in communication with the conduit 34. Fluid under pressure passing through the conduit will also be fed through the holes 36 and to the interior of the plunger, where it passes downwardly and is sprayed outwardly through the nozzle or spray-tip connected to the lower end thereof.

The details of my novel spray tip may be more readily understood by reference to Figs. 5, 6 and 7. The lower end of the plunger is screw-threaded to receive the removable tip 38 which preferably has a closed lower end 40, but which also has a vertical passage 42 therein communicating with the interior of the plunger 4. At one level I provide a series of radially extending passages or orifices 44 in a plane normal to the axis of rotation of the plunger. At another level, below the first series, is a second series of orifices 46 also extending radially outwardly, but directed angularly toward the end of the removable tip. While the actual number of these orifices in each series may be varied to suit conditions or the size of the apparatus, for convenience I have shown eight in the first series and four in the second. I have found it highly desirable, however, to locate those of the second series between those of the first instead of in vertical alignment therewith as more clearly shown in Figs. 3 and 4. It may also be desirable under certain circumstances to increase the number of the series of orifices, that is, to provide three or four instead of the two series shown, and this may be done without departing in any way from the spirit of the invention.

Since the fluid passes from the conduit 34 through the holes 36, into the interior of the plunger and downwardly to the removable tip, the rotation of the plunger and tip will induce a rotary spray of fluid outwardly through all of the orifices. One spray will be downwardly and the other outwardly substantially as shown in Fig. 2.

As mentioned previously, my invention is subject to use in mixing many different types of fluids and solids, but as described herein it is particularly adapted for the making of beverages, and when so used a receptacle, such as indicated at 48, may be placed beneath the plunger and contain a quantity of the powder or comminuted solid material as shown at 50.

In the operation of the device as shown, the arm 22 is actuated to lower the plunger 4 into the receptacle 48 so that it will occupy the position shown in Fig. 2. At this point rotation of the plunger will take place and the holes 36 therein will be in alignment with the conduit 34, whereby fluid will pass therethrough and out of the orifices 44 and 46. This fluid, either hot or cold, will then be dispersed throughout and mix with the solid material. The orifices 46, being directed angularly toward the bottom of the receptacle, will direct the fluid downwardly to mix with some of the material, but will also force some of the material upwardly into the path of the fluid being sprayed from the upper series of orifices 44. This action will assure complete admixture in the shortest possible time.

When the receptacle is filled with the mixture, the arm 22 will be actuated to elevate the plunger, which action will automatically stop the flow of fluid through the removable tip by removing the holes 36 from the path of the flow of fluid through the conduit 34.

To insure against any of the solid material remaining around the tip or the lower part of the plunger, and to thus make the device more sanitary, I do not permit a tight fit between the plunger 4 and the cylinder 2 within which it reciprocates, but rather I provide a small annular space between the two members as more clearly shown at 52 in Fig. 3. At the end of the mixing operation and after the plunger has receded into its cylinder, this space will permit a small amount of fluid to continue to flow into the cylinder 2 and around the plunger 4, which fluid will then flow down the outside of the plunger and drip therefrom in a manner substantially like that shown at 54 in Fig. 3. If the pressure of the fluid is sufficient it will also creep upwardly to the

holes 36 and down the inside of the plunger. Thus any remaining solid material thereon will be washed off. The additional advantages arising out of this arrangement coupled with the removability of the tip or nozzle 38 will be readily appreciated, in that it may be desirable to mix the same fluid with different solids in succeeding operations, which may necessitate the use of a tip with different sized orifices. The automatic cleaning operation will insure that no part of one solid will remain to be mixed with a different solid.

As stated previously, even though the preferred form of the invention calls for rotation of the spray, the important consideration is the relative rotation between the spray and receptacle. It will be clear that the invention also contemplates rotation of the receptacle while the spray means remains stationary; rotation of both the spray and receptacle in opposite directions, or rotation of both in the same direction at different rates of speed.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A mixing device comprising, in combination, a receptacle adapted to contain a quantity of a comminuted solid material, a plunger mounted for reciprocation into and out of said receptacle, means for forcing a liquid through said plunger, means in said plunger for spraying a plurality of streams of said liquid at different levels into said solid material for admixture therewith, and means for rotating said plunger during the spraying of said liquid.

2. A mixing device comprising, in combination, a receptacle adapted to contain a quantity of a comminuted solid material, a plunger mounted for reciprocation into and out of said receptacle, means for forcing a liquid through said plunger when it is within the receptacle, means in said plunger for spraying a plurality of streams of said liquid into said solid material for admixture therewith, and shut-off means for stopping the flow of said liquid by removing said plunger from the receptacle.

3. A mixing device comprising, in combination, a receptacle adapted to contain a quantity of a comminuted solid material, a plunger mounted for reciprocation into and out of said receptacle, means for forcing a liquid through said plunger and into said solid material for admixture therewith when said plunger is within the receptacle, and shut-off means for stopping the flow of said liquid by removing said plunger from the receptacle.

4. A mixing device comprising, in combination, a receptacle adapted to contain a quantity of a comminuted solid material, a plunger mounted for reciprocation into and out of said receptacle, a removable tip in one end of said plunger having a plurality of orifices therein, some of said orifices being directed angularly toward the bottom of said receptacle, and means for forcing a liquid through said plunger and orifices, to thereby mix said liquid and solid material.

5. A mixing device comprising, in combination, a receptacle adapted to contain a quantity of a comminuted solid material, a plunger, means to reciprocate said plunger into and out of said receptacle, a removable tip on one end of said plunger containing a plurality of orifices therein communicating with the interior of said plunger, means for forcing a liquid through said plunger and orifices after the plunger has been moved into said receptacle, and means for rotating said plunger, whereby the liquid passing therethrough will be directed outwardly in a plurality of streams into said solid material and mix therewith.

6. In a drink mixing device of the character described, an outer cylinder, a plunger mounted for reciprocation within said cylinder to operative and inoperative positions, means for forcing a liquid through said plunger and out of one end thereof when the plunger is in operative position, and means for continuing to force a small amount of said liquid around the outer surface of said plunger when it is in inoperative position, to thereby maintain said plunger clean.

7. In a drink mixing device of the character described, an outer cylinder, a plunger mounted for reciprocation within said cylinder to operative and inoperative positions, means for forcing a liquid through said plunger and out of one end thereof when the plunger is in operative position and an annular space between said plunger and said outer cylinder, whereby the liquid forcing means will continue to force liquid into said space when said plunger is in inoperative position and thereby maintain said plunger clean.

8. The method of making a beverage which comprises the steps of placing a powdered beverage ingredient into a receptacle, spraying a plurality of streams of liquid angularly into said powdered beverage ingredient, simultaneously spraying a plurality of streams of liquid radially outwardly in a substantially horizontal plane above said angular streams, and then causing a relative rotation between the liquid and powder, whereby the angular streams will move the powder into the path of the substantially horizontal streams to effect a thorough admixture of the powder and liquid.

ERNEST H. THOMPSON.

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