Aug. 3, 1948. W. B. KLEIN 2,446,373

SLURRY FEEDING APPARATUS

Filed Sept. 1, 1944

Fig. 1.

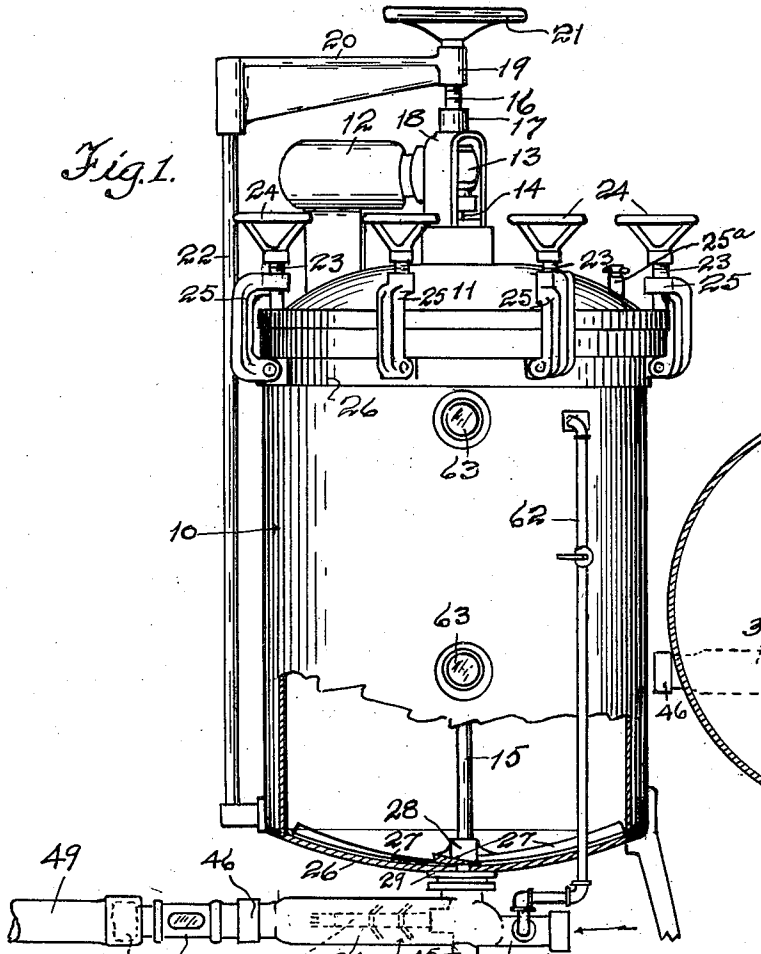


Fig. 2.

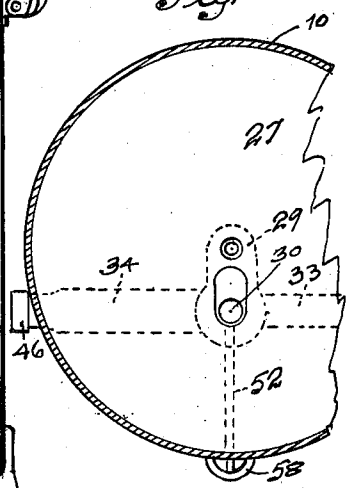


Fig. 4.

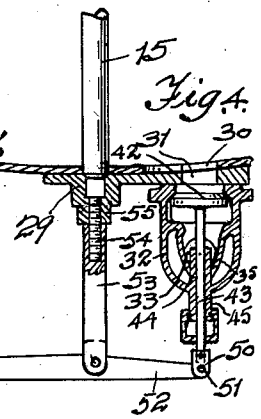
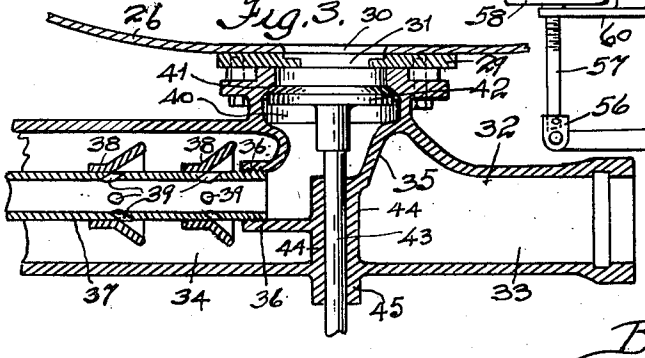


Fig. 3.



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SLURRY FEEDING APPARATUS

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10 Claims. (Cl. 259—43)

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The present invention is directed to an apparatus for feeding a slurry of finely powdered material such as diatomaceous earth to a filter having foraminous plate surfaces upon which the material is initially deposited in the form of a coating which thereafter serves as a filtering medium for beer or other liquids. In an apparatus of this character it is important to introduce the material into the stream of beer or the like in a finely comminuted evenly disposed condition, and the present mechanism is designed to attain this result.

Filtering material which may be properly referred to as "filter-aid" is first introduced into the slurry tank to which a volume of liquid is admitted to moisten the filter-aid or material which, being heavier than the liquid, will settle to the bottom in the form of a somewhat stiff paste in which condition it will be fed downwardly and first commingle with additional liquid diverted from the main stream running toward the filter, after which the comminuted and additionally liquified mixture will be introduced into the main stream so that when it reaches the filter, it will be thoroughly distributed throughout the volume of liquid and thereby deposited evenly on the filter plates to provide a constantly renewing filter surface until the deposit accumulates to an excessive thickness after which the filter plates are washed in preparation for another cycle of the operations above described.

The present invention is not concerned with the filter itself, but only with those features which serve to additionally liquify and introduce the thinned out slurry into the stream of liquid flowing to the filter.

Further objects and details will appear from the description of the invention in conjunction with the accompanying drawings; wherein

Figure 1 is a side elevation of the slurry tank of the present invention partially broken away to reveal the base of the tank;

Fig. 2 is a cross-sectional view of the base of the tank showing in dotted lines the arrangement of the passages;

Fig. 3 is an enlarged sectional elevation of the passages through which the slurry is directed; and

Fig. 4 is a view of the passages taken at right angles to the section of Fig. 3 together with the means for adjusting the discharge valve from the tank.

The present invention is applied to the base of the tank 10 having a cover 11 which mounts a motor 12 adapted through a suitable gear reduction train 13 to impart slow rotation through a

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vertical stub shaft 14, which when the cover is lowered in position will engage through a suitable chuck connection with a vertical scraper shaft 15. The cover together with the motor and associated parts is adapted to be raised by the rotation of an adjusting screw 16 rotatably engaging with a head 17 on the frame 18 which is carried by the cover. The adjusting screw is threaded through a sleeve 19 at the inner end of a swinging arm 20 and the upper end of the screw carries a handwheel 21. The arm 20 is swivelled upon and over a post 22 which permits the cover, when lifted, to be swung away from the head of the tank. When the cover is registered with the tank and lowered, it will be sealed in position by clamping screws 23, mounting handwheels 24 and carried by pivoted brackets 25 secured to a collar 26, which surrounds the upper end of the tank. The above features are standard in the art and need not be described in further detail. A capped charging tube 25a permits charging without lifting the cover.

The base 26 of the tank is of dished formation, and the filter-aid material deposited thereon is slightly lifted by the rotation of scraper blades 27 which radiate from a collar 28 keyed to the shaft 15. The scraper blades, of which one is shown in section in Fig. 1, are wedge-shaped in cross-section with the leading edge thin and sharp and in close proximity to the dished surface of the tank while the trailing edge is thicker so that the acting upper faces of the blades will present a slight obliquity to the base of the tank with the result that the slurry, in the form of a relatively stiff paste, will be elevated slightly as the blades pass under the mass thereby serving, in a slight degree, to constantly soften the mass so that it will not condense into a solid cake or become harder than is required to permit its discharge by gravity from the base of the tank.

The base of the tank has secured thereto a base plate 29 which affords a central bearing for the scraper shaft 15 and is extended laterally therefrom to afford communication with a discharge aperture 30 which registers with a passage 31 in the plate (see Fig. 4). The base plate serves as a connection for the feeder valve casing 32 which is suspended below the tank at one side of the center thereof.

The feeder valve casing is cored to provide a liquid inflow passage 33 of relatively smaller diameter than a liquid outflow passage 34 and which communicates at the center of the casing with the liquid outflow passage 34 of relatively greater diameter than the inflow passage

33. The center of the casing is formed to provide an internal neck 35 which on the outflow side is extended to provide a threaded nipple 36 into which is screwed the inner end of a centrally disposed mixing tube 37 having mounted thereon a plurality of spaced skirts 38, the head ends of which closely fit around and are rigidly secured to the mixing tube while the flaring rear ends extend out into the liquid channel within the outflow passage and serve to divert liquid inwardly therefrom through obliquely extending apertures 39 drilled through the walls of the mixing tube at the converging forward end of the respective skirts.

The neck 35 is flared at its upper end and merges into a valve chamber 40 provided with a beveled seat 41 which coacts with a valve 42 carried by a stem 43 extending through a central vertical sleeve 44 and boss extension 45 to the exterior of the feeder valve casing.

It will be noted that the passageway through the neck 35 is walled off from direct communication with the inflow and outflow passages which, however, communicate around the sides of the neck, so that the current flow of the liquid is maintained at sufficient velocity to divert the required amount of liquid into the mixing tube through the skirted apertures 39 thereby creating a suction which draws down the required amount of filter-aid material admitted past valve 42, which material is first commingled with the flowing liquid within the tube to provide a thinned out slurry before its final admission into the main stream. The outflow passage terminates in a coupling head 46 to which is secured a sight glass 47 having a coupling 48 to which is secured a flexible hose 49 leading to the filter tank, not shown. If desired the mixing tube 37 may be extended into the sight glass to make visible the amount of thin slurry being discharged while if the tube 37 terminates, as shown, the final condition of the main stream will be indicated.

The lower end of the valve stem 43 is pivoted within a bifurcated head 50 which is pivoted by a pin 51 to the outer end of a lever 52, pivoted at an intermediate point upon a hanger 53 which is suspended from a screw stud 54 threaded into a boss 55 depending from the base plate 29 in axial alignment with the mounting for the shaft 15. The outer end of the lever 52 has pivoted thereon a socket 56 which receives and pivots the lower end of an adjusting screw 57 which is threaded through the hub of a handwheel 58 journalled between the upper and lower arms 59 and 60 of a bracket 61 hanging from the base of the tank, the arrangement being such that the rotation of the handwheel will vertically adjust the screw 57 to raise or lower the lever 52, and thus adjust the valve stem 43 to regulate the rate of discharge of the slurry from the tank.

In order to provide for the equalizing of pressures within the tank and within the inflow passage, a pressure equalizing valved pipe 62 is provided which leads from the upper portion of the tank downwardly and makes connection with the inflow passage. In order to make inspection of conditions within the tank, a plurality of sight glasses 63 are provided but such features are common in the art and need not be described in detail.

Operation

The operation may be briefly summarized as follows: With the top cover swung back, the required amount of filter-aid material is introduced into the tank, and with the valve 42 closed, liquid of the character to be filtered—beer for instance—is admitted to the tank through the pipe 62, and pressure is equalized within the tank and the feed valve casing. The filter-aid material will deposit like a sediment in the base of the tank to the required depth and in a relatively stiff pasty condition sufficiently moist, however, to readily flow out in the required amount when the discharge valve is opened. The motor will be operated to slightly lift the body of filter-aid material as the scraper blades revolve and a proper current flow will be established through the feed valve casing and to the filter.

In these conditions, the thick pasty slurry will be drawn down in proper amount from the base of the tank and into the neck 35 and out through the mixing tube 37 where it will encounter additional liquid diverted from the main stream to the interior of the tube. The thick slurry will thus be transformed into a thin slurry and discharged from the end of the mixing tube which extends to a point near the coupling head 46. Thus, by the time the slurry reaches the main stream of liquid, it will be in a thinned out condition so that it will readily mingle and diffuse through the main stream and thus become thoroughly comminuted by the time it reaches the surfaces of the filter plates. It is to be understood that the scraper blades do not act, in any appreciable degree, as a mixer since they simply elevate the mass of thick slurry slightly with each passage, so that the compacting of the mass will be prevented in any degree which would impair its pasty condition or interfere with its discharge. It will also be understood that the scraper blades do not act as feeders since the inclination of the blades is such as to produce a lifting of the mass rather than a forcing down thereof into a discharge aperture. Although the invention has been described in full detail, it will be understood that variations in the form and arrangement of the passage and the nature of the feeds may be made without departing from the spirit of the invention.

I claim:

1. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom, a feeder valve casing communicating with the aperture in the tank bottom and a valve for regulating the discharge of slurry through said aperture, the valve casing being provided with communicating inflow and outflow channels and an inner passageway adapted to receive slurry admitted by the valve, an inner mixing tube within the outflow channel apertured at the inner end portion and communicating with said inner passageway and adapted to receive liquid diverted from the outflow channel to the interior of the tube to mix with and increase the liquification of the slurry within the mixing tube prior to its discharge into the stream flowing through the outflow channel.

2. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom, a feeder valve casing communicating with the aperture in the tank bottom and a valve for regulating the discharge of slurry through said aperture, the valve casing being provided with

communicating inflow and outflow channels and an inner passageway adapted to receive slurry admitted by the valve, an inner mixing tube within the outflow channel apertured at its inner end portion and adapted to receive liquid diverted to the interior of the mixing tube to mix with and increase the liquification of the slurry within the mixing tube prior to the discharge of such slurry into the stream flowing through the outflow channel, and an outwardly projecting member adjacent the apertured portion of the mixing tube arranged to direct liquid from the stream to the interior of the mixing tube to mix with and thin the slurry in the mixing tube prior to the discharge of such slurry into the stream through the outflow channel.

3. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom and having a rotatable scraper tapered in thickness from its leading edge and adapted, when rotated, to elevate said deposit to replenish the desired moisture content thereof, a feeder valve casing communicating with the aperture in the tank bottom and a valve for regulating the discharge of slurry through said aperture, the valve casing being provided with communicating inflow and outflow channels and an inner passageway adapted to receive slurry admitted by the valve, an inner mixing tube within the outflow channel communicating with said inner passageway to receive slurry therefrom and apertured at its inner end portion and adapted to receive liquid diverted from the outflow channel to mix with the slurry within the mixing tube to increase the liquification of the slurry within the mixing tube prior to the discharge of such slurry into the stream flowing through the outflow channel, and an outwardly projecting skirt located in the outflow channel adjacent the apertured portion of the mixing tube and arranged to divert liquid from said outflow channel to the interior of the mixing tube to mix with and thin the slurry therein prior to the discharge of such slurry from the mixing tube into the stream flowing through the outflow channel.

4. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom, a feeder valve casing communicating with the aperture in the tank bottom and a valve for regulating the discharge of slurry through said aperture, the valve casing being provided with communicating inflow and outflow channels and an inner passageway of elbow shape having its intake end directed upwardly below the valve and its outlet end directed horizontally within the outflow channel, said inner passageway being adapted to receive slurry admitted by the valve, an inner mixing tube within the outflow channel communicating with the horizontal outlet end of the inner passageway and receiving slurry therefrom, said inner mixing tube being apertured at its inner end portion and adapted to receive liquid diverted from the outflow channel to mix with the slurry in the mixing tube to increase the liquification of such slurry prior to the discharge of slurry from the mixing tube into the stream flowing through the outflow channel, and an outwardly projecting member located adjacent the apertured end portion of the tube and arranged to divert liquid from the stream to the interior of the mixing tube.

5. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom and having a rotatable scraper tapered in thickness from its leading edge and adapted when rotated to elevate said deposit to replenish the desired moisture content thereof, a feeder valve casing communicating with the aperture in the tank bottom and a valve for regulating the discharge of slurry through said aperture, the valve casing being provided with communicating inflow and outflow channels and an inner passageway of elbow shape having its intake end directed upwardly below the valve and its outlet end directed horizontally within the outflow channel, said inner passageway being adapted to receive slurry admitted by the valve, an inner mixing tube within the outflow channel communicating with the horizontal outlet end of the inner passageway and having an apertured inner end portion adapted to receive liquid diverted from the outflow channel to the interior of the mixing tube to mix with slurry therein to increase the liquification of the slurry within said mixing tube prior to the discharge of slurry from the mixing tube into the stream flowing through the outflow channel, and an outwardly projecting skirt located in the outflow channel adjacent the apertured inner end portion of the mixing tube and arranged to direct liquid to the interior of the mixing tube from the stream flowing through the outflow channel.

6. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom, a feeder valve casing secured to the bottom of the tank and having an inner passageway of elbow shape with its intake end directed upwardly below the aperture in the tank bottom and its discharge end directed horizontally, the casing further having inflow and outflow channels communicating with one another around the lower end of the inner passageway, a vertical valve stem adjustably entered through the base of the inner passageway and carrying a valve at its upper end adapted to seat in position to control the down feeding of slurry through the tank aperture and into the upturned end of the inner passageway, an inner mixing tube within the outflow channel connected with the horizontal discharge end of the inner passageway and receiving slurry therefrom and having its inner end portion apertured to receive liquid diverted from the outflow channel to the interior of the mixing tube to mix with slurry therein and increase the liquification of such slurry prior to the discharge of slurry from the mixing tube into the stream flowing through the outflow channel, and means for diverting liquid from the outflow channel through the apertured portion of the inner mixing tube into the latter.

7. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom, a feeder valve casing secured to the bottom of the tank and having an inner passageway of elbow shape with its intake end directed upward-

ly below the aperture in the tank bottom, and its discharge end directed horizontally, the casing further having inflow and outflow channels communicating with one another around the lower end of the inner passageway, a vertical valve stem adjustably entered through the base of the inner passageway and carrying a valve at its upper end adapted to seat in position to control the down feeding of slurry through the tank aperture and into the upturned end of the inner passageway, an inner mixing tube within the outflow channel communicating with the horizontally directed discharge end of the inner passageway to receive slurry therefrom and having its inner end portion apertured and adapted to receive liquid diverted from the outflow channel to the interior of the mixing tube to mix with slurry therein and increase the liquification of the same prior to the discharge of slurry from the mixing tube into the stream flowing through the outflow channel, and an outwardly projecting skirt located in the outflow channel adjacent the apertured end portion of the mixing tube and arranged to direct into the mixing tube liquid from the stream flowing through the outflow channel.

8. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom, a feeder valve casing communicating with the aperture in the tank bottom and a valve for regulating the discharge of slurry through said aperture, the valve casing being provided with communicating inflow and outflow channels and an inner passageway adapted to receive slurry admitted by the valve, an inner mixing tube within the outflow channel communicating with said inner passageway and receiving slurry therefrom, and having an inner apertured end portion adapted to receive liquid diverted from the outflow channel to the interior of the mixing tube to mix with the slurry therein and increase the liquification of the slurry within the mixing tube prior to the discharge of slurry from the mixing tube into the stream flowing through the outflow channel, means for diverting liquid from the outflow channel through the apertured portion of the inner mixing tube into the latter, the outflow channel being provided with a sight glass to permit observation of the main stream of slurry within the discharge from the inner mixing tube intermixing therewith.

9. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom and having a scraper rotatable on a vertical axis and provided with blades of wedge shape cross section tapered in thickness from their leading edges and adapted when rotated with the thin edges in the leading position to elevate said deposit to replenish its moisture content, a feeder valve casing secured to the bottom of the tank and having an inner passageway of elbow shape with its intake end directed upwardly below the aperture in the tank bottom and its discharge end directed horizontally, the casing further having inflow and outflow channels communicating with one another around the lower end of the inner passageway, a vertical valve stem adjustably entered through the base of the inner passageway and carrying a valve at its upper end and adapted to seat in position to control the down feeding of slurry through the tank aperture and into the upturned end of the inner passageway, an inner mixing tube within the outflow channel communicating with the horizontally directed discharge end of the inner passageway and receiving slurry therefrom, said mixing tube having an apertured inner end portion adapted to receive liquid diverted from the stream flowing through the outflow channel to the interior of the mixing tube to mix with slurry therein and increase the liquification of the slurry within the mixing tube prior to the discharge of slurry from the mixing tube into the stream flowing through the outflow channel, and an outwardly projecting skirt located in the outflow channel adjacent the apertured portion of the mixing tube and arranged to direct liquid from the stream in the outflow channel to the interior of the mixing tube.

10. In slurry feeding apparatus, the combination of a tank adapted to hold a deposit of filtering material in the form of a relatively thick slurry with a superposed volume of liquid, the tank being provided with an aperture in its bottom, a feeder valve casing communicating with the aperture in the tank bottom and a valve for regulating the discharge of slurry through said aperture, the valve casing being provided with communicating inflow and outflow channels and provided with an inner passageway of elbow shape having its intake end directed upwardly below the valve and its outlet end directed horizontally within the outflow channel, said inner passageway being adapted to receive slurry admitted by the valve, an inner mixing tube arranged within the outflow channel and spaced throughout its entire length from the walls of said outflow channel and connected with and adapted to receive slurry from the outlet of said inner passageway, said mixing tube being apertured beyond the valve casing and adapted to receive liquid through the apertures diverted from the outflow channel to the interior of the mixing tube to increase liquification of the slurry within the mixing tube prior to the discharge of such slurry into the stream flowing through the outflow channel.

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