Nov. 17, 1942. B. H. CARD 2,302,526

APPARATUS FOR TREATMENT OF FEED AND OTHER MATERIAL WITH MOLASSES

Filed Nov. 22, 1937

Fig. 1.

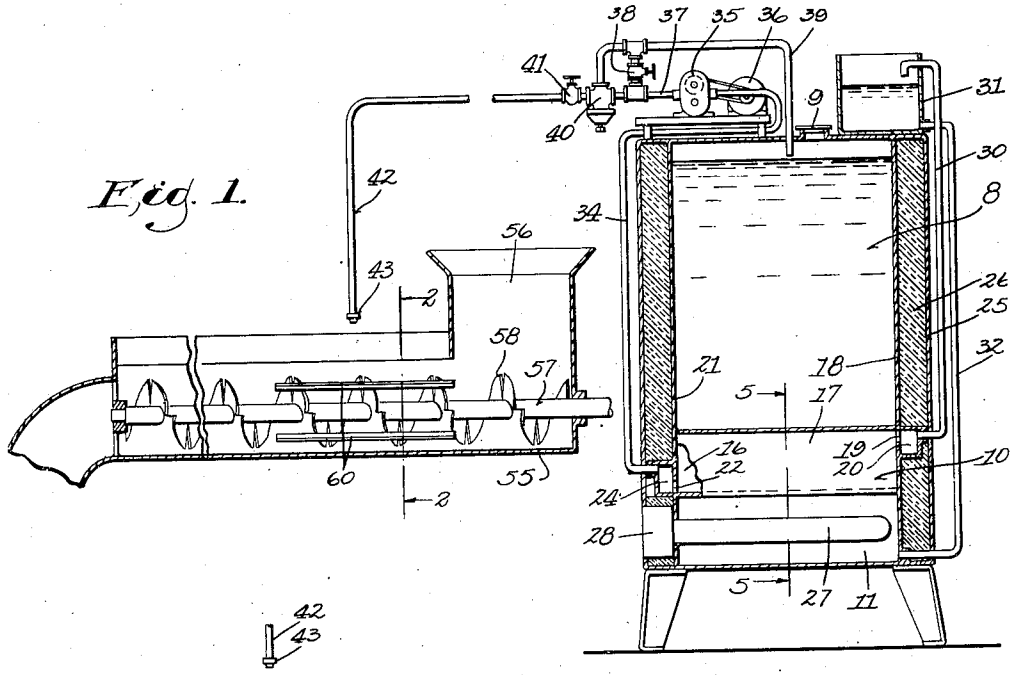


Fig. 2.

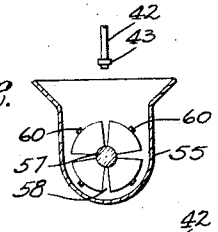


Fig. 5.

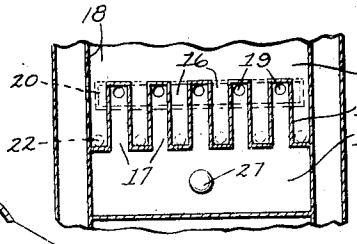


Fig. 3.

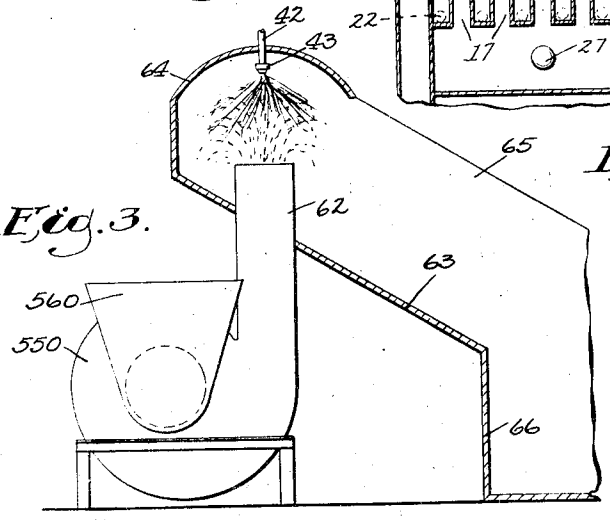


Fig. 4.

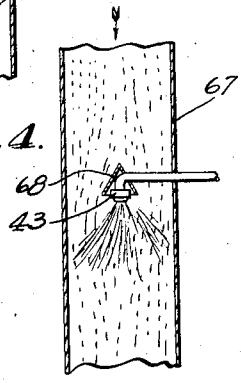


Fig. 6.

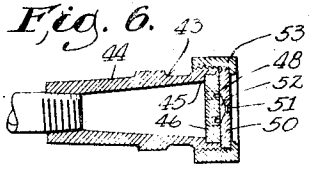
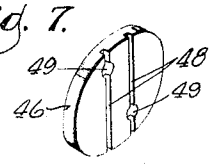


Fig. 7.



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APPARATUS FOR TREATMENT OF FEED AND OTHER MATERIAL WITH MOLASSES

Benjamin H. Card, Fairwater, Wis.

Application November 22, 1937, Serial No. 175,765

20 Claims. (Cl. 99—235)

This invention relates to improvements in apparatus for the treatment of feed and other material with molasses. The present apparatus is useful, among other purposes, for the practice of the process of molasses treatment which is disclosed in a companion application of T. W. Black entitled "Art of mixing feeds with molasses."

It is the primary object of the invention to provide novel, simple and inexpensively constructed apparatus in which molasses can be quickly and uniformly heated and maintained at a desired temperature without burning or caramelization thereof, and can be sprayed in a relatively non-viscous state to produce a finely atomized spray for the treatment of free air of previously divided particles of the material to be treated.

Other objects will appear in more detail from the following disclosure.

In the drawing:

Figure 1 is a view in section of a preferred form of feed treating apparatus embodying this invention.

Figure 2 is a detail view in cross section through the feed trough on the section indicated at 2—2 in Fig. 1.

Figure 3 shows a modified arrangement of the feed handling apparatus partially in side elevation and partially in section.

Figure 4 shows a further modified embodiment of the feed handling apparatus.

Figure 5 is a detail view taken in cross section on the line 5—5 of Fig. 1.

Figure 6 and Figure 7 are detail views on an enlarged scale showing a preferred type of spray nozzle which I have successfully employed for this and other apparatus.

Like parts are identified by the same reference characters throughout the several views.

The apparatus may conveniently be considered in two separate parts, the first of which handles the molasses and the second of which handles the feed or other material requiring treatment. The molasses handling portion of the apparatus includes a tank or reservoir 8 which may conveniently be formed of sheet metal and provided with a filler cap at 9, the reservoir being otherwise closed. The bottom of the reservoir 8 comprises a convoluted web 10 serving as a partition between the reservoir 8 and a water chamber 11. The convoluted bottom 10 provides a series of upwardly opening pockets 16 communicating with the molasses reservoir and an alternate series of downwardly opening pockets 17 communicating with the water chamber 11.

In the side wall 18 which is common to the molasses reservoir 8 and the water chamber 9, I provide a series of ports at 19 which afford communication between the pockets 17 and a sheet metal manifold 20. In the opposite wall 21 which is common to the molasses reservoir 8 and the water chamber 11, I provide at a lower level a like series of ports 22 which afford communication between the bottoms of the pockets 16 and an exterior sheet metal manifold at 24. Both the molasses reservoir and the water chamber are enclosed in the jacket 25, the intervening space being preferably filled with thermal insulation at 26.

Projecting into the water chamber 11 is an immersion type electric heating element 27 which is preferably provided at its head end 28 with any conventional thermostatic control (not shown).

The several ports 19 serve to keep the pockets 17 free of vapor and full of water. A pipe 30 leads from manifold 20 to the top of a water supply tank 31 which is mounted on the top of the apparatus. The lower portion of the supply tank communicates through pipe 32 with the bottom of the water chamber. This arrangement ensures that the water chamber will always be kept filled with the water under slight head.

The convolutions of the water chamber provide not only for an increased surface area for heat transfer between the water chamber and the molasses, but they also provide means for subdividing the mass of molasses in reservoir 8 for quick heating of that portion thereof which is in pockets 16. While convection currents in the molasses will tend, in time, to heat all of the molasses, I withdraw the molasses from the bottom of the molasses chamber through the several pockets 16, thereby ensuring the intimate contact of the withdrawn molasses with the water heated convoluted partition walls 16 so that the molasses withdrawn is virtually at the temperature fixed by the heating element 27.

The molasses withdrawn from pocket 16 passes into manifold 24 through ports 22 and is thence conveyed through the suction pipe 34 to pressure pump 35 which is preferably adapted to develop a pressure of approximately 150 pounds on the molasses. The pump is driven by a motor 36 or any other convenient prime mover. Its delivery pipe 37 has a manually controlled bypass valve 38 which may be opened to relieve the

pressure of the pump and return the molasses through pipe 39 back to the top of reservoir 8. There is also a relief valve 40, which may be set to function at a predetermined pressure in line 37 for the automatic return of excess molasses through the pipe 39 to reservoir 8, even though the valve 38 be closed.

Beyond the relief valve 40 is a manually operable valve 41 which controls delivery of the molasses through pipe 42 to the spray nozzle 43 which is shown in detail in Figs. 6 and 7.

The spray nozzle 43 comprises a barrel 44 gradually expanding in cross section and shouldered at 45 to receive the disk 46 which has in its outer face slots 48 which may be parallel and are provided with openings at 49 near their opposite ends for admitting to the slots the material to be sprayed.

The orifice disk 50 covers the slotted face of disk 45 and is provided with an orifice 51 having a conical counterbore at 52 with respect to which the slots 48 are tangential. The molasses travels in opposite directions from the openings 49 through the slots to the counterbore, thus establishing a high velocity whirl in the counterbore chamber 52. The exterior of the orifice 51 may likewise be counterbored if desired and the molasses or other material will issue from plate 50 in an extremely fine mist. The nozzle can readily be cleaned by removing the retaining ring 53, which is all that holds the plates 46 and 50.

The spray nozzle 43 is shown in Fig. 1 to be positioned over the feed trough 55 into which previously comminuted or ground feed or other material in finely divided form is delivered through hopper 56 to be advanced through the trough by feed screw 57. The feed screw preferably has a mutilated thread 58 to break up any lumps in the feed so as to assure that its component particles will be free for molasses treatment. At an intermediate portion of the trough the feed screw is peripherally provided with axially extending blades at 60. As the feed screw is rotated, these blades engage the finely divided feed and toss it into the air immediately beneath the spray nozzle 43 so that when the feed is encountered by the finely atomized molasses its particles will be unsupported and will tend to be moving in opposition to the path of the atomized molasses.

As explained in the aforesaid application of T. W. Black, the viscosity of the molasses is altered by heat and also its water content is given off in the spray sufficiently so that the finely atomized molasses will deposit in virtually dry form upon the finely divided feed. The ensuing product may be made to contain a very high percentage of molasses without being sticky to any degree whatever.

In the construction shown in Fig. 3 the previously finely divided feed is introduced through hopper 560 into the eye of a centrifugal blower fan 550 from which it is discharged through the spout 62 in an upward direction in opposition to the finely atomized spray of molasses delivered from the nozzle 43. The treatment occurs in the upper end of a feed chute 63 which is closed at its top by dome 64 by is open at 65 for ventilation so that the water vapor released from the molasses spray can readily escape. The treated material falls through the feed chute 63 into a storage bin 66.

In the construction shown in Fig. 4, the finely divided material to be treated is falling freely through a conduit 67 in which the spray nozzle 43 is disposed, protected from direct contact with the feed by means of a baffle 68. In this arrangement the spray issuing from nozzle 43 will move in the same direction as the feed, whereas in the constructions shown in Figs. 1, 2 and 3 the movement will be opposite. The molasses spray has been shown in the drawing only for purposes of illustration. In actual practice, in the use of the disclosed nozzle and the disclosed heater and pressure delivery, the spray will be substantially invisible.

I have found it practicable to heat the molasses to temperatures between 100 degrees and 150 degrees F. The preferred temperature is approximately 140 degrees F., which is very close to the point at which the molasses will caramelize. The water vapor does not escape from the molasses until the molasses is sprayed from the nozzle. At this point a certain amount of vapor is driven off, and it is my belief that the molasses is at least partially caramelized or is otherwise caused to change its form by reason of the release of moisture. In any event, it is not sticky when deposited on the previously sub-divided feed even though quantities thereof may be incorporated in the feed to a degree never heretofore reached in practice.

I claim:

1. In a device for spraying a non-adhesive molasses coating, the combination with an atomizing nozzle and a reservoir for molasses, of means for the pressure delivery of molasses from the reservoir to the nozzle, said means including a pump and passages comprising a heat delivery wall, means for retaining a heating liquid in contact with said wall, and means for maintaining such liquid at a predetermined temperature close to the temperature of molasses caramelization for the heating of the molasses prior to its delivery to the nozzle.

2. Apparatus of the character described comprising the combination with a molasses chamber, a pump and a nozzle, of conduit means connecting said chamber with said pump and nozzle and comprising a jacketed surface, a heating liquid disposed within the jacket in contact with said surface, and means for heating said liquid to a predetermined temperature close to the temperature of caramelization.

3. Apparatus of the character described comprising the combination with a molasses reservoir and a nozzle, of a pump having an inlet pipe connecting with said reservoir and an outlet pump connecting with said nozzle, and means for heating the molasses almost to the point of caramelization prior to its delivery to the pump, a valve controlling the delivery of the molasses from the pump to the nozzle, and by-pass means for return of the molasses to the reservoir from a point between the pump and valve.

4. Apparatus of the character described comprising the combination with a molasses tank, a pump and a nozzle, of a molasses conduit including a molasses heating means and a thermally insulated casing in which said tank and heating means are both enclosed.

5. In a device of the character described, the combination with a molasses reservoir, of a water chamber, a common casing enclosing said reservoir and chamber, and means for heating the water in said chamber, said chamber being provided with heat exchange means for delivering heat to the molasses and means for maintaining

water in said chamber in contact with said heat exchange means.

6. In a device of the character described, the combination with a casing subdivided intermediate its top and bottom by a partition defining a molasses reservoir and a chamber for heating liquid, said partition being convoluted to provide alternate pockets communicating respectively with the reservoir and said chamber, a heating element in said chamber, a manifold opening to the bottoms of pockets communicating with said reservoir, and a manifold open to the tops of pockets communicating with said chamber.

7. In a device of the character described, the combination with a casing subdivided intermediate its top and bottom by a partition defining a molasses reservoir and a chamber for heating liquid, said partition being convoluted to provide alternate pockets communicating respectively with the reservoir and said chamber, a heating element in said chamber, a manifold opening to the bottoms of pockets communicating with said reservoir, and a manifold open to the tops of pockets communicating with said chamber, said last mentioned manifold being vented.

8. In a device of the character described, the combination with a casing subdivided intermediate its top and bottom by a partition defining a molasses reservoir and a chamber for heating liquid, said partition being convoluted to provide alternate pockets communicating respectively with the reservoir and said chamber, a heating element in said chamber, a manifold opening to the bottoms of pockets communicating with said reservoir, and a manifold open to the tops of pockets communicating with said chamber, together with a pump and spray nozzle operatively connected with said first mentioned manifold.

9. In a device of the character described, the combination with a pump and nozzle, of a molasses reservoir, conduit connections from said reservoir to said pump and said nozzle, and means for heating the molasses, said heating means comprising a chamber beneath said reservoir and having a wall in common therewith, said wall being convoluted to provide pockets communicating respectively with the chamber and the reservoir, a heating element in said chamber, and a manifold with which one of said conduits communicates, said manifold having means affording communication with the several pockets opening into said reservoir.

10. In a device of the character described, the combination with a spray nozzle, a pump, and molasses conduit connections therefor, of a single casing having a partition subdividing said casing intermediate its top and bottom to provide a molasses reservoir with which said connections communicate, a heating chamber, heat transfer means extending from said heating chamber into said molasses reservoir, and a heating element in the heating chamber.

11. In a device of the character described, the combination with a spray nozzle, a pump, and molasses conduit connections therefor, of a single casing having a partition subdividing said casing intermediate its top and bottom to provide a molasses reservoir with which said connections communicate, a heating chamber, heat transfer means extending from said heating chamber into said molasses reservoir, and a heating element in the heating chamber, an insulating jacket enclosing said casing, and a supply tank mounted on said casing and provided with a connection to said chamber for maintaining said chamber filled with liquid.

12. A device of the character described comprising the combination of a casing provided between its top and bottom with a sheet metal partition convoluted to provide alternate upwardly and downwardly opening pockets, said casing having apertures in its walls communicating with the respective pockets, and sheet metal manifolds into which the several apertures open.

13. Means for applying to particles of comminuted feed a superficial non-adhesive coating of molasses, said means comprising the combination with a feed conduit, of a nozzle directed to feed in said conduit and comprising means for atomizing hot molasses under pressure to an almost invisible fineness of spray, means for delivering molasses under pressure to the nozzle, and means for supplying hot molasses to said delivering means including a storage chamber and a controlled heating means for maintaining the delivered molasses at a temperature only slightly below the point of caramelization, whereby the molasses delivered from said nozzle will reach the particles of feed in such a condition as to be substantially non-adhesive after coating such particles.

14. Means for applying to particles of comminuted feed a substantially completely non-adhesive coating of molasses, said means comprising the combination with a feed conveyor comprising means in which the feed particles are delivered unsupported in free space, of a nozzle directed to a portion of said conveyor in which the unsupported particles of feed are exposed to the nozzle, said nozzle comprising means for spraying hot molasses in the form of an extremely fine and substantially invisible mist, a storage chamber for the molasses, means for expelling molasses from the storage chamber through the nozzle under substantial pressure, and means for heating the molasses to a temperature approximating 140° F. sufficiently close to the caramelization point thereof so that upon the atomization of the molasses in its delivery from the nozzle the molasses will give off water vapor and reach the particles of feed to comprise a non-adhesive coating thereon.

15. Apparatus of the character described, comprising the combination with a molasses chamber and a nozzle, of means for delivering molasses from the chamber to the nozzle, means for heating the delivered molasses almost to the point of caramelization, said nozzle comprising means for spraying the heated molasses under pressure in a form so finely atomized as to be substantially invisible, whereby the particles of mist comprising the molasses give off water vapor upon delivery from the nozzle, together with means for producing relative movement between said nozzle and comminuted particles of feed to be coated by the molasses sprayed therefrom.

16. Apparatus for heating molasses and the like including a receptacle, a heat conducting wall disposed therein and dividing said receptacle into upper and lower compartments, the upper compartment being adapted to receive molasses to be heated and the lower compartment being substantially filled with a heating fluid having means disposed therein for heating the fluid, said compartments having overlapping portions separated by said heat transfer wall whereby temperature of the molasses within the overlapping portion of the upper compartment can be quickly raised

to the temperature of the heating fluid by heat conduction through said wall without heating that portion of the molasses above the overlapping portion to a like temperature.

17. In a device for heating molasses and the like preparatory to spraying, a receptacle provided interiorly with a convoluted heat conducting member to divide the receptacle into an upper molasses compartment and a lower heating compartment, said member being in fluid sealing relation with the interior walls of the receptacle to prevent fluid communication between the compartments while allowing heat transfer therebetween, a heating element disposed within the lower compartment, and means for maintaining said lower compartment substantially filled with liquid while allowing gases to escape therefrom, the lower portion of the upper compartment having an outlet to provide for the withdrawal of heated molasses.

18. A device as set forth in claim 17 wherein said means for maintaining the heating compartment substantially filled with liquid while allowing gases to escape includes an auxiliary liquid tank disposed above the level of the heating tank, conduit means intermediate the bottom portion of the auxiliary tank and the bottom portion of the heating compartment to provide gravity feed therebetween, and conduit means between the top portion of the heating compartment at a point within the auxiliary tank above the liquid level therein to allow gases to escape from the heating tank.

19. A device for heating viscous material including a tank for the material to be heated, said tank having a bottom portion provided with depending spaced well-like portions with heat conducting walls, means for evenly applying a predetermined amount of heat to the exterior of the heat conducting walls for rapid transfer of heat therethrough to the material on the bottom portion of the tank, and means for drawing off heated material from the well-like portions.

20. The apparatus set forth in claim 15 wherein the means for producing relative movement comprises mechanism for delivering unsupported through free space before said nozzle the comminuted particles of feed to be coated by the molasses sprayed from the nozzle.

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