Aug. 9, 1932. W. F. RICHARDS 1,870,423

MILK EVAPORATING MEANS

Filed Aug. 15, 1929 2 Sheets-Sheet 1

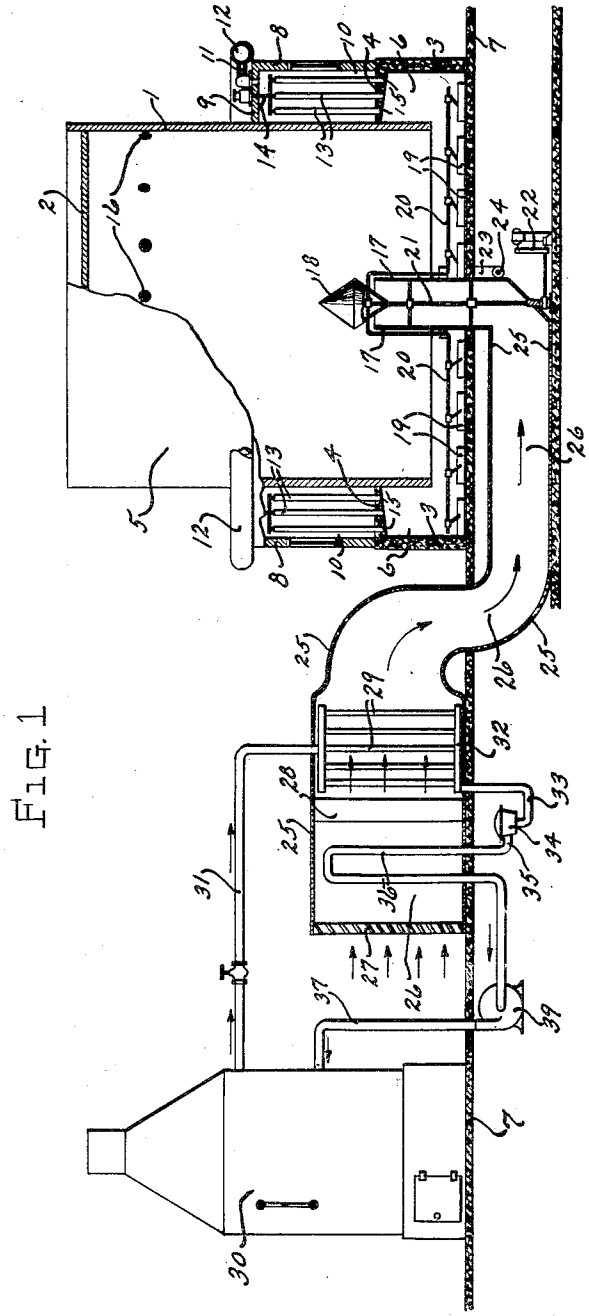


Fig. 1

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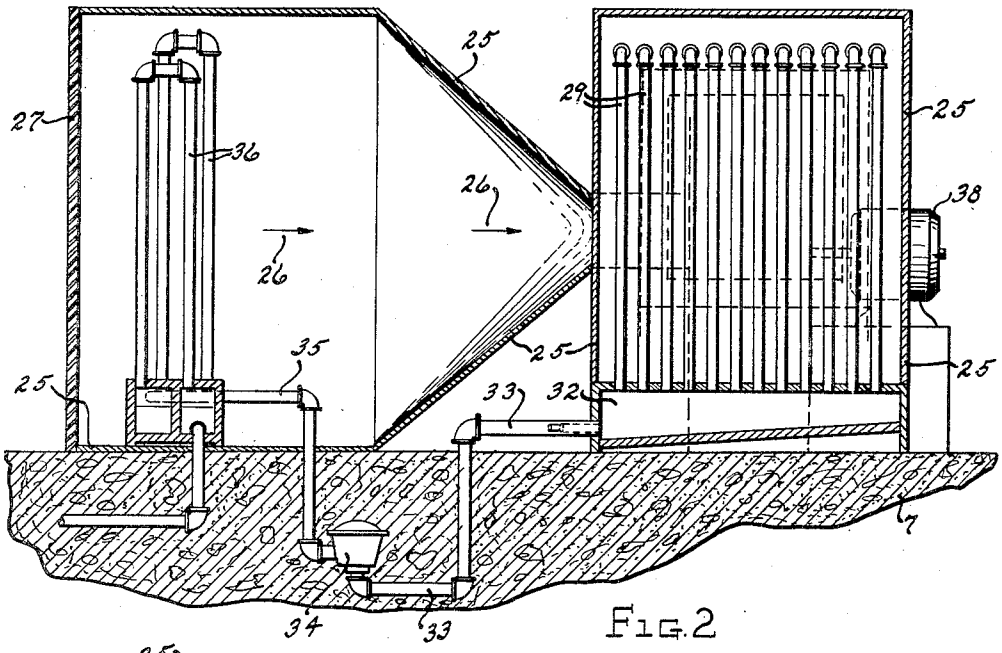


FIG. 2

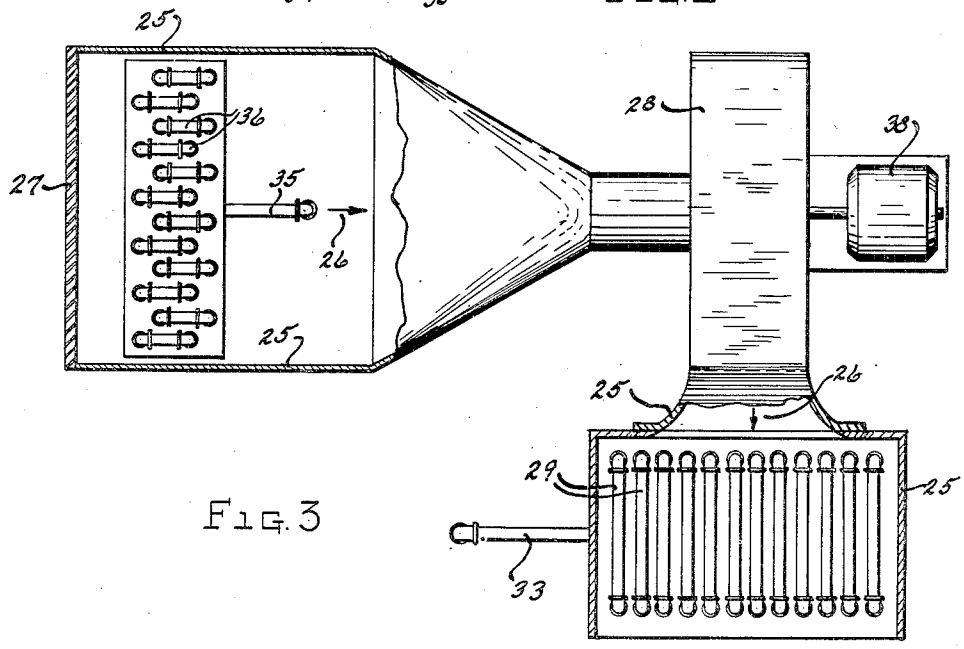


FIG. 3

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UNITED STATES PATENT OFFICE

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MILK EVAPORATING MEANS

Application filed August 15, 1929. Serial No. 386,058.

This invention relates to apparatus for desiccating milk and like products, and more particularly the invention pertains to means for improving the thermal efficiency of such apparatus.

Milk drying apparatus of the type to which reference is had includes a large casing forming a drying chamber into which milk to be dried is sprayed. For the purpose of drying this milk heated air is introduced into the casing, and it will be apparent that a large volume of air having a high heat content is necessary for the purpose. In practice enough heat is introduced by the air as a medium that the milk is desiccated before it falls to the bottom of the chamber, where it is collected and removed by means to be described.

Heating the necessary great quantity of air to the required temperature is one of the most expensive factors in the operation of such a plant, and it is especially to the air heating means that my invention is directed. The usual air heating means is steam, supplied from a boiler or boilers and arranged to pass through heat-transfer means such as pipe coils located in the air passage through which the air moves to the drying chamber.

For purposes of economy the condensate from these coils is returned to the boiler and such would be an economic arrangement were not such a quantity of air at such a high temperature required. According to my invention, however, I provide for more efficient heat transfer to the air, by arranging a second heat-transfer means such as a second pipe coil in the air passage, and passing therethrough the condensate from the first described heating coil before its return to the boiler, employing simply the usual steam trap between the two heating coils to insure steam in the first coil and water in the second coil. Preferably the second or low temperature coil is arranged in the air passage ahead of the first or high temperature steam coil so that the air is preheated by the condensate before being subjected to the temperature of the steam coil. Obviously the result is a lower temperature of boiler return water so that as where the boiler is considerably removed from the heating coils, less heat is left to be lost in the return connection.

The exact nature of my invention together with further objects and advantages thereof will be apparent from the following description taken in connection with the accompanying drawings in which Fig. 1 is a generally diagrammatic showing of the principal parts of a milk desiccating system in which my invention is incorporated; and Figs. 2 and 3 are detail views in vertical and horizontal planes respectively, of the air heating means, parts being broken away to show details of construction.

With reference now to Fig. 1 of the drawings, 1 represents a circular side wall of the drying chamber, closed at its top by a ceiling 2 and surrounded at its lower portion with a base wall 3 joining the wall 1 by an annular base portion 4; so that a generally cylindrical drying chamber 5 is formed, with a circular bay 6 about its lower extremity, The whole is supported on a superstructure 7 so that parts to be described may be located therebelow.

Above the base wall 3 is a wall 8 with a ceiling 9, together forming an annular space 10 having connection as by a number of spaced elbows 11 with an exhaust header 12 extending about the chamber 5. Within the space 10 are a number of bags 13 supported at their upper ends by suitable agitating means 14 conventionally indicated in the drawing, and having their lower open mouths secured in openings 15 in the base portion 4. Thus exit from the drying chamber 5 is had on all sides beneath the edge of the casing wall 1, up into the bags 13, out through the bags, and up into the header 12.

The milk or other liquid to be desiccated is introduced into the chamber 5 through a number of openings 16 spaced about the upper extremity of the casing 1; suitable spray nozzles being located in the openings 16 and the fluid being supplied thereto under pressure in any convenient manner.

A pipe 17 extends through the superstructure 7 into the chamber 5, having an open mouth with a cone shaped baffle 18 positioned thereabove to prevent entrance into

the pipe by falling particles. The lower end of the pipe 17 has hot air supply connection with means to be described.

The floor beneath the chamber 5 extends uninterruptedly under the bays 6. A number of scrapers 19 rest upon this floor and are arranged to be rotated by a rig 20 which supports them and is driven through a shaft 21, which shaft extends through the pipe 17 for the purpose and has driven connection with a motor 22.

A trough 23 extends along the floor generally radially of the casing and has at its lower extremity a screw conveyor indicated at 24.

For the purpose of furnishing air to the pipe 17 a duct 25 is provided forming a passage 26. The duct is provided at its mouth, which may be open to atmosphere, with a scrubber 27 for cleaning the air admitted. A blower indicated at 28 produces flow of air through the passage 26 as indicated by the arrows.

In the passage is heat-transfer means as the steam piping 29. Condensate from the piping 29 is collected in a header 32 and led by connection as at 33 to the inlet of a steam trap 34. This trap may be of usual construction adapted to prevent passage of steam but effect passage of water under the pressure of its steam side. The outlet connection 35 of the trap leads to a coil 36 in the passage 26 which in turn may have return connection as at 37 with the boiler 30 and including the pump 39. Thus the boiler supplies steam by way of the connection 31 so that the piping 29 is subjected to steam temperatures. As the blower 28 is operated by its motor 38, air is drawn into the passage 26 through the scrubber 27 and forced past the piping 29 cooling the same sufficiently to condense the steam therein. The condensate passes through the trap 34 which forces the same under the boiler steam pressure through the coil 36. Thus by the coil 36 the air is heated to a considerable temperature, so that its temperature may be more easily still further raised by the piping 29. The outlet from the coil 36 may be as illustrated back to the boiler or it may empty directly into a sump.

As the heated air enters the chamber 5 through the pipe 17 it is deflected by the baffle 18. The liquid spray entering by way of the opening 16 comes in contact with this air and gives up its moisture. The air has exit past the lower edges of the casing 1 and to the exhaust casing 12 as described. The temperature and quantity of air supplied is sufficient that the milk drops to the floor as a dry powder; thence it is moved by the scrapers 19 into the trough 23 and collected by the conveyor 24. Any of this powder carried up into the bags 13 is prevented further passage with the air, and is shaken from the bags downwardly onto the floor of the bay 6 so that it also ultimately reaches the conveyor 24.

What I claim is:

Air heating means for driers of the kind described, comprising an air supply conduit for conducting heated air to the drier, means for causing air flow through said conduit, a steam heating coil in said conduit, a source of heating steam for said coil, a steam trap for collecting hot condensate from said steam coil, a preheating coil in said conduit in advance of said steam coil and connected to said trap for receiving hot condensate therefrom, thereby to preheat the air before it reaches the steam coil and conserving heat, and means for returning the cooled condensate to said steam source.

In testimony whereof I hereby affix my signature.

WILLIAM F. RICHARDS.