

PATENT SPECIFICATION (11)

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- (21) Application No. 319/73 (22) Filed 3 Jan 1973
 (31) Convention Application No. 7201637 (32) Filed 11 Jan 1972 in
 (33) France (FR)
 (44) Complete Specification published 21 Jan 1976
 (51) INT CL² C12B 1/12
 (52) Index at acceptance
 C6E 3
 F4S1 16B



(54) "IMPROVEMENTS IN OR RELATING TO TANKS"

(71) We, BRASSERIES KRONEN-BOURG, a Societe anonyme organised under the laws of France, of 68 route d'Oberhaus-
 5 BOURG (B. Rhin), France, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to jacketed tanks which can be used for the fermentation of for example beer.

Beer is produced by fermenting the wort of sprouted barley malt and maize, flavoured
 15 with hops. The fermentation takes place in several stages, the most important and most delicate of which is the main fermentation of the wort.

When the main fermentation is completed,
 20 the beer must first stand whilst its temperature decreases slowly from 14.5 degrees Celsius to 6 degrees Celsius, then it must stand whilst being maintained at a low and constant temperature of minus 1 degree
 25 Celsius. The first stand takes place in the "warm keep" and the second, by analogy with the temperature, in the "cold keep".

Until now three series of separate vats have been used, one for the fermentation proper,
 30 one for the "warm keep" and finally one for the "cold keep".

This process uses a very complex installation both as regards the circuits for decanting from one vat to another and as regards the
 35 indispensable and enormous cleaning system. All this equipment, of stainless material, requires a very high investment. In addition, the complexity of the connections existing between them requires the presence of
 40 adequate supervisory staff present at the various important points in order to be able to act quickly in case anything abnormal happens during one of the stages of an operation.

45 According to the present invention there is

provided a jacketed tank comprising a cylindrical main body closed at the top by a dome and at the bottom by an inverted cone, the lateral surfaces of the cylindrical main body and the inverted cone supporting a
 50 plurality of vertically spaced heating or cooling stages which together constitute the jacket of the tank and each of which comprises a plurality of pockets, the pockets of each stage being connected so that heating or
 55 cooling fluid can be passed through at least two of the pockets thereof in series.

The tank of the invention makes it possible to achieve characteristic and constant temperatures in given regions of its inner
 60 volume. Since its structure enables it to carry out the "warm keep" and the "cold keep" in its single inner volume, it enables the simplification of the decanting apparatus as well as the cleaning system. It will be simple
 65 to understand that a notable reduction in cost price per production unit follows from this.

In addition, it is possible to save time in the production cycle of the beer and above all, to
 70 obtain a large quantity of beer of constant taste and appearance.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in
 75 which:—

Figure 1 is an elevational view of a tank provided with pockets and associated conduits which may be connected to external
 supplies of heating or cooling liquid;

Figure 2 is a partial cross-sectional view, to
 80 a larger scale, of a pocket;

Figure 2a is a partial elevational view with parts cut away of a pocket;

Figure 3 is a longitudinal sectional view of the jacket tank showing the inlets and outlets
 85 as well as the various tapping points;

Figures 4a, 4b, 4c, 4d, 4e, 4f, 4g are sectional views of the central tube at different levels, showing the successive additions of the
 90 sampling tubes to this same central tube;

Figure 5 is a profile view of the inlet pipe of the tank;

Figure 6 is a plan view of the inlet pipe of the tank;

5 Figure 7 is a sectional view of the tank according to the invention, at the level of line VII-VII of Figure 3, showing the drawing-off device;

10 Figure 8 is a sectional view of the tank showing its complete cleaning apparatus;

Figure 9 is a plan view of the upper arrangement of the cleaning apparatus; and,

Figure 10 is a plan view of the axial arrangement of the cleaning apparatus.

15 With reference firstly to Figure 1, a jacketed tank according to the invention is shown which comprises a main cylindrical body part 1, an upper part 2 hereinafter referred to as the dome, and a lower part 3 in the shape of an inverted cone. An outlet aperture 4 for liquid contained in the bottom of the cone is provided in the cone apex.

20 The lateral surface of the main body part 1 supports a plurality of cooling or heating pockets 5 which are all identical in shape, for example rectangular in vertical section and arcuate in horizontal section. These pockets 5 are arranged in a plurality of vertically spaced heating or cooling stages which each extend around the main body part 1 and together constitute the jackets of the tank. Adjacent pairs of the pockets 5 in each stage are interconnected via apertures 6 and 7 linked by a conduit 8 which is inclined to the vertical so as to form a series arrangement which may be connected to external supplies of heating or cooling fluid. The apertures 6 and 7 are connected to conduits 9 and 10 respectively so that a plurality of separate circuits is formed each of which includes two pockets 5 connected in series.

25 Each of the vertically spaced stages covering the lateral surface of the cylindrical main body part 1 is provided with a supply system as described above.

30 The lateral surface of the conical part 3 also supports a plurality of pockets arranged in series of vertically spaced stages, the number of and shape of the pockets varying from one stage to the next. In the illustrated embodiment the pockets of the separate stages are indicated by numerals 11, 12, 13 and 14. Again adjacent pairs of the pockets of the separate stages have apertures 6 and 7 interconnected by a conduit 8. A network of circuits formed by conduits 15 and 16 supply the series connected pairs of pockets.

35 The described arrangement of circuits enables a large number of local temperature variations to be achieved.

40 Figures 2 and 2a illustrate the internal structure of a pocket.

45 Metal arches 18, spot welded at 17, are secured on the lateral wall of the cylindrical main body part 1, thus providing parallel

staggered circulation chambers 19 for a cooling or heating liquid.

These are arranged transverse to the general direction of flow of fluid through the pockets such that fluid passing through the pockets is caused to alternately fall and rise through at least two successive chambers.

70 Reference is now made to Figure 3, which shows the upper part of the dome 2 and an arrangement of pipes 20 having three branches for supplying or drawing off wort which will be described in more detail hereafter.

75 Provided in the upper side of the dome 2 are four observation ports 21, one of which is shown on the left-hand side in Figure 3, an illuminating port 22, a man-hole (not shown) and a carbon dioxide inlet 23.

80 Replacement intakes 24 are provided at the connection between the dome 2 and the cylindrical part 1 and at the base of the cone 3, the intakes 24 being shown on the right-hand side in Figure 3.

85 An annular horizontal support 24a supports the cylindrical lateral wall 1 and is itself supported by the upper edge of a circular wall 24b on which it rests.

90 Positioned and fixed at the centre of the dome 2 is the upper end 25 of a central tube 26 comprising a rectilinear and vertical main part 27 extending along the axis of the cylinder 1 and of the cone 3.

95 This tube is bent at a point approximately half way along the height of the cone 3 in order that its lower oblique part 28 passes perpendicularly through the lateral wall of said cone. Its end 29 has an oblique outlet 30 for recovering detergent.

100 This central tube 26 contains a plurality of pipes (indicated schematically by arrows 31) which respectively communicate with a series of short pipes 32 leading from "short" sampling points and a series of long pipes 33 leading from "long" sampling points, the pipes 33 being supported by oblique arms 34. The short and long pipes 32 and 33 alternate vertically along the tube 26 and are staggered angularly around the axis of this tube. Figures 4a, 4b, 4c, 4d, 4e, 4f, 4g show the various successive additions to the central tube of the various individual tapping circuits aforementioned from top to bottom.

105 By keeping watch on these various circuits it is possible successively to check the homogeneity of the beer close to the centre and in a central region for heights increasing along the vertical part 27 of the tube 26 and along a length corresponding to the useful height of the tank.

110 The length of the tapping points for sampling is determined in order to give a good representation of the homogeneity of the beer in the useful part of the tank, taking into account the circulation of the liquid by means of convection currents existing in the

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fermentation method employed.

Disposed in the lateral wall of the cylindrical part 1 (shown on the right-hand side in Figure 3) are various tapping pipes 35.

5 A plurality of the pipes 35 is arranged in each of a series of vertical planes, the pipes of each of the series of planes being staggered angularly for example at 20° intervals from each other around the wall of the part 1.

10 These tapping pipes 35 are connected to a recovery circuit (not shown) and facilitate sampling at various levels and in various directions.

15 Disposed at the left-hand side of Figure 3 at different levels are a first series of tubes 36 called "glove fingers". The tubes 36 are closed at their inner ends which bear against the central tube 26 and their outer ends which bear against the central tube 26 and their outer ends adjoin the walls of the cylinder 1 or cone 3. Two "glove finger" tubes 37 and 38 which are shorter than tubes 36 are located in the left-hand inner lower part of the cone 3. The latter are spaced apart and interconnected by a branch 39.

25 The various tubes 36, 37 and 38 are connected to a circuit, not shown, adjoining temperature indicators and recording means, which make it possible to obtain a sufficiently true picture of the temperature distribution in the useful region inside the tank.

The various positions for discharging and drawing off the wort will now be described with reference to Figure 5, 6 and 7.

35 The device 20 for discharging the wort comprises an arrangement of pipes formed by three branches 40 slightly inclined with respect to the horizontal. These branches rest on vertical supports 41 fixed to the upper structure of the dome 2 and they are held on these supports by means of clips 42.

40 These branches terminate in elbows 43 connected to vertical discharge pipes 44 by means of a bolted connection 45. The branches 40 disposed at an angle of 120° with respect to each other converge on and are supplied through a central bent conduit 46 connected to an external circuit (not shown).

50 The arrangement 20 is staggered with respect to the centre of the dome 2 and may also serve for sampling beer in a stage of the method of using the tank.

55 Drawing-off pipes 47 (Figure 7) are composed of several circuits making it possible to direct the drawn off product either to the outside (ejection of the sediment) or to a recovery circuit (for example for the yeast or fermented product) or finally for a re-circulation of the fermented product.

60 Thus a central conduit 48 is connected to the aperture 4 through a valve 49. This conduit divides into two secondary branches 50 and 51. The first secondary branch 50 serves for recovering the beer, and is connected

halfway along its length to a branch 52 comprising branches 53, 54 and 55 providing connection to external arrangements (not shown).

70 The second secondary branch 51 is divided into three secondary branches 56, 57, 58 provided for drawing off the material to be treated or the re-circulation of the beer, each secondary branch comprising a valve 56a, 57a and 58a respectively. The branches 56 and 58 are interconnected by a conduit by way of a valve 59a.

The cleaning device will now be described with reference to Figures 8, 9 and 10.

80 This device is composed of an arrangement 60 arranged on the dome 2 and an arrangement 61 extending axially of the tank, the central tube 26 being used as a conduit for supplying detergent, as well as for its recovery. The arrangement 61 is indicated schematically by an arrow.

85 Attention will firstly be paid to the arrangement 60, referring to Figures 8 and 9 and subsequently to the various supply conduits. The arrangement 60 is for cleaning upper portions of the tank.

A conduit 62 (see Figure 9) arranged above the dome 2 supplies the two arrangements.

90 It is connected to the axial arrangement 61 through a valve 63 and to the arrangement 60 through a valve 64 and a conduit 65.

95 The conduit 65 supplies a pipe 66 (bent in the form of an open circle) which is concentric with the dome 2 and has branches 67 extending outwards at regular intervals therefrom. The pipe 66 also has four inner branches 68. All these branches have an elbow, pass through the dome 2 and terminate in spray heads 69 which are identical for the two types of branch.

100 Supports 70 and 71 integral with the upper side of the dome 2 keep the lower parts of these branches parallel with the axis of the tank.

105 The arrangement 61 will now be described with reference to Figures 8 and 10, the arrangement 61 being for cleaning the central portions of the tank.

110 The arrangement 61 comprises horizontally and radially extending branches. The various branches will be numbered from the top in Figure 8. They will thus be localised in space. Referring simultaneously to Figures 8 and 10, the twelve branches are numbered from 72 to 83.

115 They all comprise spray heads like the aforementioned spray heads 69, the longest branches having oblique arms 84 and 85 for supporting them from the central tube.

120 The cleaning circuit is terminated at the lower end of the central tube 26 by the oblique outlet 30 described with reference to Figure 3 for recovering detergent.

WHAT WE CLAIM IS:—

1. A jacketed tank comprising a cylindri-

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fermentation method employed.

Disposed in the lateral wall of the cylindrical part 1 (shown on the right-hand side in Figure 3) are various tapping pipes 35. A plurality of the pipes 35 is arranged in each of a series of vertical planes, the pipes of each of the series of planes being staggered angularly for example at 20° intervals from each other around the wall of the part 1.

These tapping pipes 35 are connected to a recovery circuit (not shown) and facilitate sampling at various levels and in various directions.

Disposed at the left-hand side of Figure 3 at different levels are a first series of tubes 36 called "glove fingers". The tubes 36 are closed at their inner ends which bear against the central tube 26 and their outer ends which bear against the central tube 26 and their outer ends adjoin the walls of the cylinder 1 or cone 3. Two "glove finger" tubes 37 and 38 which are shorter than tubes 36 are located in the left-hand inner lower part of the cone 3. The latter are spaced apart and interconnected by a branch 39.

The various tubes 36, 37 and 38 are connected to a circuit, not shown, adjoining temperature indicators and recording means, which make it possible to obtain a sufficiently true picture of the temperature distribution in the useful region inside the tank.

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These branches terminate in elbows 43 connected to vertical discharge pipes 44 by means of a bolted connection 45. The branches 40 disposed at an angle of 120° with respect to each other converge on and are supplied through a central bent conduit 46 connected to an external circuit (not shown).

The arrangement 20 is staggered with respect to the centre of the dome 2 and may also serve for sampling beer in a stage of the method of using the tank.

Drawing-off pipes 47 (Figure 7) are composed of several circuits making it possible to direct the drawn off product either to the outside (ejection of the sediment) or to a recovery circuit (for example for the yeast or fermented product) or finally for a re-circulation of the fermented product.

Thus a central conduit 48 is connected to the aperture 4 through a valve 49. This conduit divides into two secondary branches 50 and 51. The first secondary branch 50 serves for recovering the beer, and is connected

halfway along its length to a branch 52 comprising branches 53, 54 and 55 providing connection to external arrangements (not shown).

The second secondary branch 51 is divided into three secondary branches 56, 57, 58 provided for drawing off the material to be treated or the re-circulation of the beer, each secondary branch comprising a valve 56a, 57a and 58a respectively. The branches 56 and 58 are interconnected by a conduit by way of a valve 59a.

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This device is composed of an arrangement 60 arranged on the dome 2 and an arrangement 61 extending axially of the tank, the central tube 26 being used as a conduit for supplying detergent, as well as for its recovery. The arrangement 61 is indicated schematically by an arrow.

Attention will firstly be paid to the arrangement 60, referring to Figures 8 and 9 and subsequently to the various supply conduits. The arrangement 60 is for cleaning upper portions of the tank.

A conduit 62 (see Figure 9) arranged above the dome 2 supplies the two arrangements.

It is connected to the axial arrangement 61 through a valve 63 and to the arrangement 60 through a valve 64 and a conduit 65.

The conduit 65 supplies a pipe 66 (bent in the form of an open circle) which is concentric with the dome 2 and has branches 67 extending outwards at regular intervals therefrom. The pipe 66 also has four inner branches 68. All these branches have an elbow, pass through the dome 2 and terminate in spray heads 69 which are identical for the two types of branch.

Supports 70 and 71 integral with the upper side of the dome 2 keep the lower parts of these branches parallel with the axis of the tank.

The arrangement 61 will now be described with reference to Figures 8 and 10, the arrangement 61 being for cleaning the central portions of the tank.

The arrangement 61 comprises horizontally and radially extending branches. The various branches will be numbered from the top in Figure 8. They will thus be localised in space. Referring simultaneously to Figures 8 and 10, the twelve branches are numbered from 72 to 83.

They all comprise spray heads like the aforementioned spray heads 69, the longest branches having oblique arms 84 and 85 for supporting them from the central tube.

The cleaning circuit is terminated at the lower end of the central tube 26 by the oblique outlet 30 described with reference to Figure 3 for recovering detergent.

WHAT WE CLAIM IS:—

1. A jacketed tank comprising a cylindri-



cal main body closed at the top by a dome and at the bottom by an inverted cone, the lateral surfaces of the cylindrical main body and the inverted cone supporting a plurality of vertically spaced heating or cooling stages which together constitute the jacket of the tank and each of which comprises a plurality of pockets, the pockets of each stage being connected so that heating or cooling fluid can be passed through at least two of the pockets thereof in series.

2. A jacketed tank according to claim 1, comprising a central tube extending along the major axis of the cylindrical main body, the central tube containing a plurality of pipes which respectively communicate with pipes for taking samples from the tank, and the central tube forming a supply means for conveying cleaning fluid to an arrangement for cleaning central portions of the tank.

3. A jacketed tank according to claim 1 or 2, wherein the dome is provided with an arrangement of pipes for supplying or drawing off wort projecting vertically down from said dome, while further in the upper part of the tank there are provided pipes for the supply of gas as well as pipes for supplying fluid for cleaning upper portions of the tank.

4. A jacketed tank according to any one of the preceding claims, wherein the pockets each comprise an upper aperture and a lower aperture, adjacent pairs of pockets being connected by a conduit extending from an upper to a lower aperture so as to form a series arrangement which may be connected to external supplies of heating or cooling fluid.

5. A jacketed tank according to claim 2,

wherein the pipes contained within the central tube are connected to short and long tapping points by respective pipes arranged perpendicular to the central tube.

6. A jacketed tank according to claim 3, wherein the arrangement for cleaning upper portions of the tank comprises a supply pipe formed into a circle and located above the dome, the supply pipe having a plurality of radially outwardly extending branches and radially inwardly extending branches which are bent and passed through the dome parallel to the axis of the main body, the ends of the branches being provided with spray heads.

7. A jacketed tank according to claim 2, wherein the arrangement for cleaning central portions of the tank comprises a plurality of branches which extend from the central tube at various levels and are provided at their ends with spray heads, the lower branches being longer than the upper branches and being supported by oblique arms.

8. A jacketed tank according to any one of the preceding claims, comprising a drawing-off pipe communicating with first and second secondary branches, the first branch being connected to a plurality of further branches, the second branch splitting into three sub-branches each provided with a respective valve, two of the three sub-branches being interconnected by a conduit and a valve.

9. A jacketed tank substantially as herein described with reference to the accompanying drawings.

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