May 22, 1951 F. J. FETTE 2,553,567

FILTER

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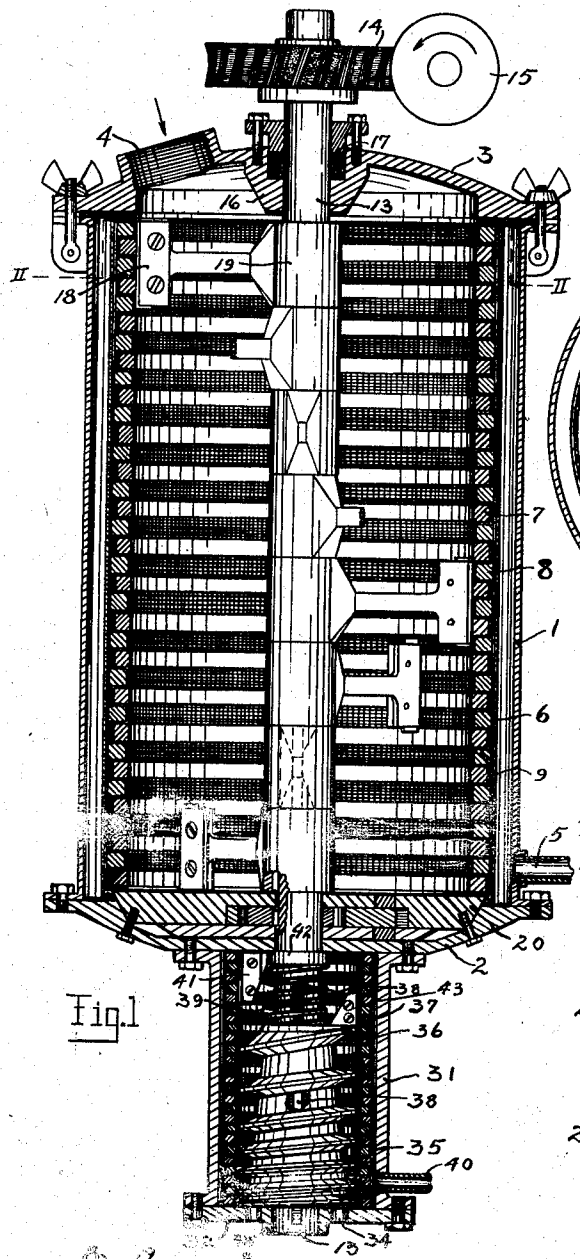

Fig.1

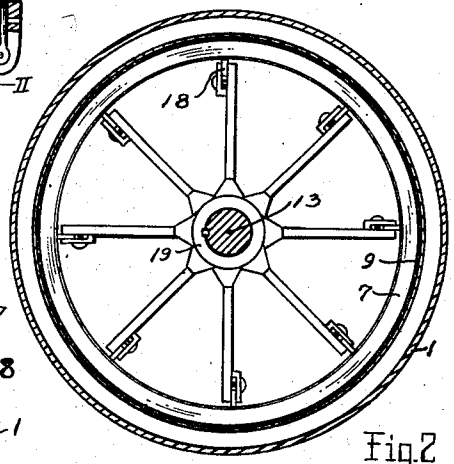

Fig.2

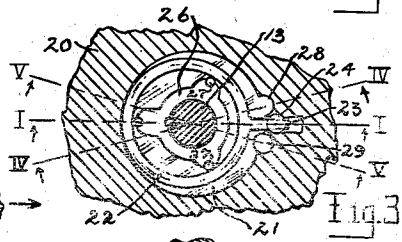

Fig.3

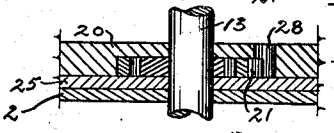

Fig.4

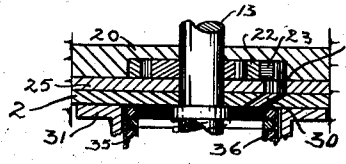

Fig.5

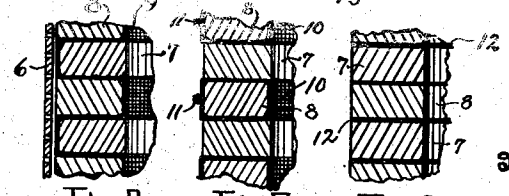

Fig.6 Fig.7 Fig.8

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FILTER

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1 Claim. (Cl. 210—167)

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This invention relates to that type of filters in which solids in suspension are continuously removed from the liquid and expelled from the apparatus.

The primary object of the invention is to provide a filter to remove from the wort of beer all solids including molds, before the wort enters the cooker.

Another object of the invention is to provide a filter in which the filter elements are easily removable for cleaning or replacement.

A further object of the invention is the provision of a fabric filter element having metallic reinforcements to resist outward pressure.

In the preferred embodiment of the invention selected for the purpose of illustration, Figure 1 is a central, vertical section through the filter with parts in elevation and parts broken away; Fig. 2 is a horizontal, transverse section on the line II—II of Fig. 1; Fig. 3 is a plan view of the pump with the surrounding plate in section; Fig. 4 is a fragmentary vertical section on the plane indicated by the line IV—IV of Fig. 3; Fig. 5 is a similar section on the plane indicated by the line V—V of Fig. 3; Fig. 6 is a fragmentary section on a larger scale than that of Figs. 1 to 5 of a group of rings in the filter assembly; Fig. 7 is a modification and Fig. 8 a still further modification of the structure shown in Fig. 6.

A cylindrical chamber 1 has a base 2 and a top 3. In the top, is an inlet opening 4 opening into the central portion of the chamber. An outlet opening 5 is at the lower portion of the wall of the chamber 1. Spaced inwardly from the chamber wall is a cylindrical, perforated, metal shell 6 within which is an assembly of metal rings 7 and 8. In the preferred form shown in Figs. 1 and 6, a fabric 9 is formed as a tube or open-ended bag of an internal diameter to receive the rings 7. After a ring 7 has been set inside of the tube, a ring 8 is slipped over the outside of the tube into a position closely adjacent to the first ring, and a second ring 7 is then slipped inside close to the ring 8 and so on, with the rings alternating inside and outside of the fabric, with layers of fabric between the adjacent rings.

Preferably, the rings 7 have an inside radius smaller than that of the rings 8 by an amount equal to the thickness of the fabric, so that when the assembly is completed, the exposed inner surfaces of the fabric 9 are in the same cylindrical surface with the inner surfaces of the rings 7.

The outside of the assembly may similarly be

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made even at all points by making the outside radius of the rings 8 greater than that of the rings 7 by a thickness of the fabric, as shown in Fig. 6.

As a modification, each of the rings 8 may have a complete, annular, fabric covering 10 held by an outside seam 11, as seen in Fig. 7, the intermediate rings 7 being left uncovered.

In the further modification illustrated in Fig. 8, a gasket 12 of fabric of any desired thickness may be inserted between rings 7 and 8, preferably all rings being of equal inner diameters, that is all of the size of 7 or all of size 8, none of the rings being covered. Obviously all the rings could be of the covered type as 8 in Fig. 7, if desired. In any or all of the arrangements illustrated or suggested, the metal rings will provide a strong reinforcement against any possible pressure that the liquid could exert on the fabric held between them. It will be noted that more than half of the cylindrical surface of the ring and fabric assembly exposed to liquid under pressure is of fabric.

Liquid entering at the inlet 4 will pass into the fabric wherever a surface or edge is exposed on the interior of the cylindrical assembly and will flow through and between the fibers and outwardly between the metal rings into the space between the shell 6 and the wall of the chamber 1, finally reaching the outlet at 5.

In any of the forms shown, the ring and fabric assembly may be slid down into the perforated shell 6 and the shell with the element inside may then be set into the cylinder 1 concentrically with the cylinder and with a shaft 13 which is mounted coaxially of the cylinder for rotation by gears 14 and 15. The top 3 has a suitable bearing 16 and a stuffing box 17 for the upper end of the shaft.

A plurality of scrapers 18, each attached to a sleeve 19 keyed upon the shaft, have their outer ends in contact with the cylindrical inner surface of the ring and fabric filter assembly. As shown in Figs. 1 and 2, these scrapers are set progressively around the shaft and with a slight overlap longitudinally, so that as the shaft turns counterclockwise, looking downward from the top, the scrapers act to scrape the entire inner surface of the assembly. The sludge will drop to the bottom of the interior of the assembly, which rests upon a plate 20 supported in the base 2, and having a central opening for the shaft 13.

The lower surface of the plate 20 is formed with a recess 21 serving as a pump chamber to receive an oscillatory, ring-shaped pump member

22 provided with a radially projecting arm 23 which is slidable within a slot in a guide pin 24, the ends of which are pivoted in the plate 26 and in the plate 25 which lies beneath the plate 20 to form a lower wall for the recess 21. The member 22 has flat upper and lower surfaces sliding in close contact with the smooth surfaces of the plates 20 and 25 and it is oscillated within the recess 21 by a cam 26 keyed to the shaft 13 and in three-point contact with the interior of the ring portion of the member 22 through antifriction rollers 27.

An intake opening 28 seen in Figs. 3 and 4 but not in Fig. 1, is formed in the plate 20 as a passage from the bottom of the chamber within the filter assembly to the pump chamber 21. An outlet passage 29 formed in the plate 25, seen in Figs. 3 and 5 but not in Fig. 1, connects with a passage 30 in the base 2 and leads into the top of a press chamber 31.

With the parts in the position shown in Fig. 3, the cam 26 has drawn the ring member 22 away from the inlet 28 to the opposite side of the recess 21 creating a suction, which, aided by the pressure in the chamber 1, has caused sludge to move from the inlet into the space opened between the ring and the inlet. This is half of the total space between the ring and the wall of the recess, the other half being filled with fluid sludge which will leave at the outlets 29 and 30 as the rotation of the cam continues to draw in sludge at 28 until the ring covers both the inlet and outlet ports at 180° of movement from the position of Fig. 3. The ring will continue its swinging and sliding movement around the inner wall of the recess, again opening both ports. The arm 23 separates the two passages so that the liquid sludge cannot pass the barrier formed by the arm.

The cylindrical press chamber 31 is secured at its upper end to the lower surface of the base 2. A bottom member 32 secured upon the lower end of the chamber 31 has a central bearing 33 for the lower end of the shaft 13 surrounded by discharge openings 34. Within the chamber 31 is a perforated cylinder 35 containing a ring and fabric filter assembly 36 similar to that used in chamber 1 except for size. The arrangement of ring and fabric is shown as in Fig. 6 but that of Fig. 7 or 8 may be used instead.

A screw 37 with a spiral flange is slidably mounted on the shaft 13, a spline 38 permitting upward movement of the screw on the shaft when the pressure upon the solids in the lower turns of the screw becomes greater than the resistance offered by the spring 39. This upward movement of the screw on the shaft acts to uncover the discharge openings 34 to permit the escape of solids from which a high percentage of water has been removed and since the resistance to pressure is a function of the quantity of water present in the solids, the discharge will normally occur when the desired dryness has been effected. The strength of the spring 39 will be chosen according to the material being pressed out.

The pressure exerted by the pump member 22 will force much of the liquid out at the upper portion of the filter assembly 36 and the pressure of the screw will drive the rest out through the portion of the filter assembly opposite the screw. The liquid leaves the screw press chamber 31 through an outlet tube 40.

A scraper 41 on a sleeve 42 secured to the shaft 13 will engage the inner surface of the uppermost rings in the assembly and a scraper arm 43 on the upper end of the screw 37 will engage the intermediate portion of the filter surface not reached by the scraper 41 or the spiral flange, and since these two scrapers are keyed to the same shaft on opposite sides, they can never interfere with each other no matter how far upward movement of the screw may compress the spring 39.

This invention is primarily designed for use in filtering liquid produced in the preliminary treatment of malt in the saccharifier to produce sugar and dextrine. All solids that have not been converted into soluble substances, including any molds present in the malt, will be removed so that the liquid entering the cooker will be clear and free from anything that might be detrimental to the flavor or aroma of the beer.

It will be understood that the invention is not limited to the details of construction and arrangement herein shown and described, but many changes in form, proportions, and location of parts may be made by those skilled in the art without departing from the invention as claimed.

I claim:

Filtering apparatus having a chamber, a filter assembly within the chamber adapted to receive liquid under pressure, the assembly comprising a plurality of metallic rings and a tubular fabric permeable to liquid, the rings being set alternately inside and outside of the fabric whereby to impose portions of the fabric between adjacent rings, the rings differing in interior radii by an amount substantially equal to the thickness of the fabric and with the rings of greater interior radius on the outside, whereby the inner surface of the assembly is substantially cylindrical with annular portions of the fabric exposed on the inside, and scraping means movable in contact with the cylindrical inner surface to remove solids therefrom.

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