

RESERVE COPY. PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: PERCY HENRY WATTS, MICHAEL EDWARD ASH and GEORGE
CORDERY PHILLPOTTS

943.812

Date of filing Complete Specification April 4, 1962.

Application Date April 14, 1961.

No. 12065/44.

(Divided out of No. 943,811).

Complete Specification Published Dec. 4, 1963.

© Crown Copyright 1963.



943.812

Index at acceptance:—Class C6 E(11B1, 11B2)

International Classification:—C 12 c

COMPLETE SPECIFICATION

An improved Method and Apparatus for Preparing Brewers Wort

5 We, ARTHUR GUINNESS SON AND COMPANY (PARK ROYAL) LIMITED, of Park Royal Brewery, Park Royal, London, N.W.10, a British Company, 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 This invention relates to a process and apparatus for the preparation of brewers wort and is concerned with mashing of ground malted grain (commonly called "grist" in the Brewing Industry) with hot water, conversion and subsequent filtration and extraction of
15 wort.

20 The traditional infusion process normally termed "a mashing process" broadly involves mixing grist with hot water to produce a porridge-like mixture or mash which is passed into large vessels called mash tuns. These are operated intermittently, that is to say a batch of mash is fed to a mash tun and, after a suitable period of conversion during which the mash is maintained at one or more appropriate temperatures to convert the starches in
25 the mash into sugars, the resultant sweet liquid or wort is drained off from the bottom of the mash tun. When draining commences, the grains are in suspension in the mash, but the action of draining through the perforate floor of the mash tun settles the grains on this floor so that they finally form a filter bed which may be as much as six feet in depth in the normal mash tun and through which the
35 remaining liquid passes. As the initial runnings are inevitably cloudy, these may be re-circulated so that they pass again through the filter bed. A deep filter bed of this kind renders filtration a slow process and moreover after the wort has been drawn off, it is

necessary to sparge the bed of spent grains in the mash tun with water, in some cases for a period of several hours, to secure high extractive efficiency. The cleaning of these large mash tuns, which has to take place between every batch, is a difficult and laborious process which adds to the length of time between the processing of successive batches.

45 A continuous mashing process has also been proposed in which the mash is passed at a controlled rate through a tower, being allowed to remain in this tower for a suitable conversion period and being maintained at an appropriate temperature or range of temperatures during the process. Separation occurs as the spent grains emerge from the top or bottom of the tower. The rates of feed of water and malted grain and rates of take-off, may be controlled separately or together. It has been found that a continuous process of
50 this kind tends to result in cloudy wort, because the grains are kept in suspension throughout the process and are inevitably subject to movement and agitation which results in fine particles passing out in suspension in the wort and making it cloudy. Thus a further filtration step is required, which tends to make the process more expensive.

55 A further mashing process has been suggested in United Kingdom Patent 852,561 in which the preparation of wort comprises feeding mash in separate quantities into separate compartments defined in a circular vessel by a plurality of angularly spaced members rotating about the axis of said vessel, successively holding the mash over an imperforate section during the period necessary for conditioning the mash (i.e. conversion) and for settlement of the spent grains to form a filter bed, carrying the mash over a perforate section of the
60 65 70 75 80

[Price 4s. 6d.]

vessel floor for a sufficient time to permit adequate separation of the wort from the grains, collecting the separated wort and carrying the spent grains over a discharge section of the vessel floor to remove the grains from the vessel. This process also may involve re-circulation of the wort when it is drawn off from the various compartments.

The term "re-circulation of wort" is intended in this Specification to denote the sparging over some part of the bed, of wort drawn from beneath the same part or from beneath some other part of the bed.

We have found that the gradual movement of the mash laterally over the floor of the vessel, tends to disturb the filter bed after it has settled, and thus to impair the clarity of the filtered wort. In addition, whilst it is possible to discharge a substantial part of the spent grains through an aperture in the floor of the vessel, relatively complex sealing arrangements are required to prevent loss of wort through this discharge opening.

In the actual conversion step of the mashing process, it can be beneficial to agitate the mash, but in most prior mashing processes in which conversion and filtration take place in the same vessel, such agitation is not beneficial. It will be noted that in the traditional batch process, and in the processes above described, there is a tendency to produce a cloudy wort, at least initially. For many beers this is not desirable.

Our co-pending Application No. 13499/61 (serial no. 943,811) from which this Application is divided describes a continuous mashing process in which the filtration step is separable from the conversion step, and may, in itself, be a completely separate step.

This invention is concerned with a conversion step in a continuous mashing process, intended to be used in conjunction with a filtration step which follows separately. Thus, agitation of the mash during conversion has no adverse effect upon the clarity of the resulting wort.

It is an object of our invention to provide an improved method of and means for continuously carrying out conversion of mash at a controlled rate and under variable temperature conditions so that conversion appropriate to the differing requirements of the Brewer of stout, porter or ale and of the Brewer of lager for example, may be carried out using the same equipment without substantial changes.

The improved conversion method and apparatus of this invention may with advantage be used in conjunction with the filtration step of our co-pending Application No. 13499/61 (serial no. 943811).

This conversion process may comprise passing the mash in a controlled flow and through at least one heated conversion zone defined by the interior walls of a rotating hollow

cylinder having vanes and baffles attached inside it, the axis of the cylinder being substantially horizontal or inclined slightly, the inlet level to this zone being higher than the outlet level therefrom; the rotation of the cylinder continuously acting to agitate the mash mechanically within the conversion zone whereby the components of the mash are prevented from separating, and finally passing the mash, without extracting wort therefrom, away from the conversion zone and towards a filtration zone.

The term "cylinder" used herein may mean a right regular cylinder or a tapered cylinder.

More particularly the rotating cylinder carries vanes and baffles fixed to its walls and extending inwardly therefrom through and between which the mash is permitted to flow.

For decoction mashing, such as is commonly employed by Lager Brewers, the above mentioned apparatus may be modified in various ways. For example, two or more rotating cylinder converters may be employed in series, and some of the mash emerging from the first cylinder can be taken off separately, "heat-treated" and then returned to the main flow.

Where the expressions "heat-treated", "heat-treating" and "heat-treatment" are used in this specification in relation to that fraction of the mash which is separated from the main flow for the purposes of decoction mashing, we mean heating the separated fraction of the mash so that required enzymic reactions, e.g. saccharification, takes place and, where required, finally boiling such mash. It may either be returned to the conversion zone from which it was separated or to a subsequent conversion zone. Alternatively, where a single rotating cylinder converter is used, an outlet may be arranged part way along its length and a proportion of the mash may be drawn off at this point for heat-treatment and return to the cylinder.

It is a principal object of our method and apparatus to achieve a high holding efficiency in the conversion zone, notwithstanding the fact that throughflow of mash is continuous. We aim to ensure that every particle of mash remains in the conversion zone for substantially the same length of time.

In our method and apparatus the preferred layout is such that the mash is arranged to pass through the conversion zone under the influence of gravity alone and is not mechanically impelled. Moreover, all agitation which takes place in the mash within the conversion zone, is substantially in planes normal to the axis of the cylinder.

If a conventional type of stirring were to be carried out in which agitation of the mash induced it to move in random directions throughout the cylinder, or with a substantial component of movement along the axis of the cylinder, there would be a tendency for some

70

75

80

85

90

95

100

105

110

115

120

125

130

particles of mash to pass through the conversion zone much more rapidly than others.

In order to feed the ingredients for the mash continuously and cleanly to the, or to the
 5 conversion zone under controllable conditions, we prefer to operate as follows. Malted grain, with any desired additions, is fed continuously or intermittently to a supply zone constituted by a hopper which is maintained at or about a constant level and from
 10 which the grain is continuously and mechanically transferred, through an enclosed passage, at a predetermined rate, by a variable feed mechanism, to a conventional type of grinding mill. From this the grist is fed by a screw
 15 or other means working continuously at a predetermined and controllable rate, somewhat greater than the rate of feed of the feed mechanism which supplies the grist to the mill, through an enclosed passage into a mixing zone, where water is added to it in a pre-determined and variable quantity, and mechanical agitation takes place to produce a
 20 lightly mixed mash.

25 Preferably the grist is fed into the mixing zone below the level of the mash therein, while the water, heated to an appropriate temperature as desired, may be fed into the mixing zone above or below the surface of the mash.
 30 A variable and controllable feed, such as a weir arrangement is employed to pass the lightly mixed mash from the mixing zone into the conversion zone. In some cases it may be desirable to dispense with the mixing step altogether and to feed grist and water
 35 directly into the conversion zone.

40 If it is desired to mill the grain wet, then the grain may first be steeped in water which is thereafter drained off, and the wet grain then passed to the grinding mill.

The enclosing of the feed passages to and from the mill and the submerged feed to the mixing zone, where employed, all contribute to the cleanliness of the process and avoid
 45 loose dust and particles of grist being scattered, as often occurs with traditional opening feeding methods. The provision of a mechanism removing grist from the mill which is capable of operating faster than the mechanism feeding grist into the mill, enables any
 50 tendency to clogging in the mill to be avoided.

A continuous mashing process, utilising the conversion step of this invention, coupled with a suitable filtration step—for example that
 55 described in our co-pending Application No. 13499/61, (serial no. 943811) has several advantages over the traditional method of mashing. It is a continuous rather than a batch process and control over the rates of feed, temperatures and other variable factors can
 60 be exercised more closely. Any changes in the wort being produced can be corrected rapidly by controlling these variables severally or independently; moreover, by the use of an
 65 automatic wort sampler and tester, such

changes may to a large extent, be carried out automatically by linking the sampling and testing mechanism to the mechanisms which operate controls for the variables. Moreover, the linear separation of the conversion step from the filtration step in our process, enables conversion conditions, such as agitation of the mash, and conversion times and temperatures, to be varied according to the type of wort required, without affecting the remainder of the process. 70 75

One embodiment of our invention will now be described in relation to the Figures 1 and 2 of the diagrammatic drawings, which accompany the Provisional Specification which two
 80 Figures illustrate the conversion step, and in which:—

Fig. 1 is a diagrammatic general arrangement of the mashing equipment to show the relationship of the various components. 85

Fig. 2 is a part sectional perspective view of the converting and mixing cylinder of Fig. 1.

Referring to Fig. 1, grist is fed to a hopper 1. The grist is then fed by a conveyor 2 to a hopper 3 and thence to a grinding mill 6. The ground grist is extruded from the chamber 9 by a conveyor 10. The conveyor 10 is arranged so as to be able to operate faster than the conveyor 2. This avoids any clogging, prevents dust from building up and also avoids any tendency for moisture to seep back from the mixing pot 12. 90 95

The ground grist passes to a mash pot 12 where it is mixed with hot mashing liquor from a pipe 13, the mixture is mashed by a blade 14 and the rate of feed of water and ground grist is such that the mash gradually overflows down a tube 16 to a rotating drum 17. The drum is carried on rollers 18 and churns up the mash inside it. The mash eventually overflows from the drum through a tube 19 and is passed to any suitable continuous filtration apparatus. 100 105

In the conversion operation, which is described in more detail as follows, grist from a hopper 1 is fed by an enclosed screw-conveyor 2 to an enclosed hopper 3. The conveyor is driven by a motor 4, and is connected to the motor by a variator 5. Thus the rate of feed of grist to the hopper 3 can be regulated. 110 115

The grist passes from the hopper 3 to a grinding mill 6, which is driven by a motor 7 through a speed reducer 8. The grist when ground, passes to a further enclosed screw-conveyor 10, driven by a motor 11. 120

The ground grist is conveyed to a mash pot 12, in which it is mixed with hot water fed by a pipe 13. The mixture is stirred gently by the paddle 14 of the mixer 15 and a mash is thus formed. 125

As the mash overflows from the mash pot it flows along a tube 16 into a rotating drum 17. Inside the drum the mash is churned as 130

the drum is rotated on the rollers 18, which are driven by known means.

Fig. 2 shows the interior of the rotating drum, generally shown in Fig. 1 by the reference numeral 17. The rotating drum contains a series of baffles 33 and guides 34 by which the mash is thoroughly mixed as it passes through the drum.

There is a slight fall between the inlet and outlet levels of the drum which ensures a steady flow by gravity through the convertor.

To carry out conversion, heat must be applied to the mash. This is done by any suitable conventional heating arrangement applied to the drum, and illustrated diagrammatically by a heating jacket 21 in Fig. 1.

The mash eventually emerges from the drum through the outlet 19. The rotatable drum contains a plurality of substantially radially directed longitudinally extending vanes 34, attached to the inside of the drum wall and spaced circumferentially from each other. The vanes 34 extend inwardly towards the axis of the drum for a distance which is preferably about a quarter to one third the radius of the drum. The purpose of the vanes 34 is to hold some of the mash while the drum is rotating, and prevent the mash from lying in a pool in the bottom half of the drum. The vanes pick up the mash and carry it for part of a revolution until such time as the upper surface of the vane slopes downwardly when the mash will run off into the base of the drum.

In order to restrain the mash from running straight through the drum from one end to the other, a series of transverse baffles 33 are provided each baffle being cut away as at 33a to provide a segmental aperture to permit restricted longitudinal flow of mash through the drum when the aperture is in the lower part of the drum during rotation. These apertures are each staggered radially with respect to the adjacent apertures in preceding and succeeding baffles, so that the mash cannot directly flow through the drum even in the case when the drum is stationary or traveling slowly. When the drum is rotating at normal speed, the baffles act to partially restrain the through-flow of mash and the combined action of the vanes and baffles is to thoroughly mix the mash during its passage through the drum.

WHAT WE CLAIM IS:—

1. In a continuous mashing process for the production of brewers wort, a conversion step which includes continuously making a mash by mixing grist and water, continuously passing the mash in a controlled flow into and through at least one heated conversion zone, defined by the interior walls of a hollow drum or cylinder of which the axis is substantially horizontal, the inlet level to this zone being higher than the outlet level therefrom; continuously agitating the mash mech-

anically within the or each conversion zone, whereby the solid and liquid components are maintained intimately mixed during the production of wort, and continuously passing the mash, without extracting wort therefrom, away from the conversion zone and towards a filtration zone.

2. In a continuous decoction mashing process, a conversion step as claimed in Claim 1, in which the mash is caused to flow sequentially through a series of heated conversion zones, and some of the mash emerging from one conversion zone is separated from the main flow, heat-treated and returned to the main flow.

3. In a continuous decoction mashing process, a conversion step as claimed in Claim 2, in which that fraction of the mash which has been separated from the main flow and heat-treated is returned to the conversion zone from which it was separated.

4. In a continuous decoction mashing process, a conversion step as claimed in Claim 2, in which that fraction of the mash which has been separated from the main flow and heat-treated is returned to a conversion zone further downstream in the series than the zone from which it was separated.

5. In a continuous decoction mashing process, a conversion step as claimed in Claim 1, in which the mash is caused to flow through a single heated conversion zone, and some of the mash is withdrawn from this zone and is separated from the main flow of mash, is separately heat-treated and is returned to the main flow.

6. In a continuous decoction mashing process, a conversion step as claimed in Claim 1, in which the mash is caused to flow through a single heated conversion zone, and some of the mash is withdrawn from this zone and is separated from the main flow of mash, is separately heat-treated and is then returned to the main flow and is re-cycled through the conversion zone.

7. In a continuous mashing process as claimed in any one of the preceding Claims, a conversion step which comprises passing malted grain with any desired additives, continuously or intermittently to a grain supply zone maintained at or about a constant level; continuously and mechanically transferring the grain through an enclosed passage, at a variable but predetermined rate, from the supply zone to a grinding mill; grinding the grain to form grist, and continuously and mechanically transferring the grist, together with a variable but predetermined quantity of water, through an enclosed passage to the, or to the first, conversion zone.

8. In a continuous mashing process as claimed in Claim 7, a conversion step which includes adding water to the grist in a variable but predetermined quantity in a mixing zone; gently agitating the water and grist to produce a lightly mixed mash, and trans-

the drum is rotated on the rollers 18, which are driven by known means.

Fig. 2 shows the interior of the rotating drum, generally shown in Fig. 1 by the reference numeral 17. The rotating drum contains a series of baffles 33 and guides 34 by which the mash is thoroughly mixed as it passes through the drum.

There is a slight fall between the inlet and outlet levels of the drum which ensures a steady flow by gravity through the convertor.

To carry out conversion, heat must be applied to the mash. This is done by any suitable conventional heating arrangement applied to the drum, and illustrated diagrammatically by a heating jacket 21 in Fig. 1.

The mash eventually emerges from the drum through the outlet 19. The rotatable drum contains a plurality of substantially radially directed longitudinally extending vanes 34, attached to the inside of the drum wall and spaced circumferentially from each other. The vanes 34 extend inwardly towards the axis of the drum for a distance which is preferably about a quarter to one third the radius of the drum. The purpose of the vanes 34 is to hold some of the mash while the drum is rotating, and prevent the mash from lying in a pool in the bottom half of the drum. The vanes pick up the mash and carry it for part of a revolution until such time as the upper surface of the vane slopes downwardly when the mash will run off into the base of the drum.

In order to restrain the mash from running straight through the drum from one end to the other, a series of transverse baffles 33 are provided each baffle being cut away as at 33a to provide a segmental aperture to permit restricted longitudinal flow of mash through the drum when the aperture is in the lower part of the drum during rotation. These apertures are each staggered radially with respect to the adjacent apertures in preceding and succeeding baffles, so that the mash cannot directly flow through the drum even in the case when the drum is stationary or travelling slowly. When the drum is rotating at normal speed, the baffles act to partially restrain the through-flow of mash and the combined action of the vanes and baffles is to thoroughly mix the mash during its passage through the drum.

WHAT WE CLAIM IS:—

1. In a continuous mashing process for the production of brewers wort, a conversion step which includes continuously making a mash by mixing grist and water, continuously passing the mash in a controlled flow into and through at least one heated conversion zone, defined by the interior walls of a hollow drum or cylinder of which the axis is substantially horizontal, the inlet level to this zone being higher than the outlet level therefrom; continuously agitating the mash mech-

anically within the or each conversion zone, whereby the solid and liquid components are maintained intimately mixed during the production of wort, and continuously passing the mash, without extracting wort therefrom, away from the conversion zone and towards a filtration zone.

2. In a continuous decoction mashing process, a conversion step as claimed in Claim 1, in which the mash is caused to flow sequentially through a series of heated conversion zones, and some of the mash emerging from one conversion zone is separated from the main flow, heat-treated and returned to the main flow.

3. In a continuous decoction mashing process, a conversion step as claimed in Claim 2, in which that fraction of the mash which has been separated from the main flow and heat-treated is returned to the conversion zone from which it was separated.

4. In a continuous decoction mashing process, a conversion step as claimed in Claim 2, in which that fraction of the mash which has been separated from the main flow and heat-treated is returned to a conversion zone further downstream in the series than the zone from which it was separated.

5. In a continuous decoction mashing process, a conversion step as claimed in Claim 1, in which the mash is caused to flow through a single heated conversion zone, and some of the mash is withdrawn from this zone and is separated from the main flow of mash, is separately heat-treated and is returned to the main flow.

6. In a continuous decoction mashing process, a conversion step as claimed in Claim 1, in which the mash is caused to flow through a single heated conversion zone, and some of the mash is withdrawn from this zone and is separated from the main flow of mash, is separately heat-treated and is then returned to the main flow and is re-cycled through the conversion zone.

7. In a continuous mashing process as claimed in any one of the preceding Claims, a conversion step which comprises passing malted grain with any desired additives, continuously or intermittently to a grain supply zone maintained at or about a constant level; continuously and mechanically transferring the grain through an enclosed passage, at a variable but predetermined rate, from the supply zone to a grinding mill; grinding the grain to form grist, and continuously and mechanically transferring the grist, together with a variable but predetermined quantity of water, through an enclosed passage to the, or to the first, conversion zone.

8. In a continuous mashing process as claimed in Claim 7, a conversion step which includes adding water to the grist in a variable but predetermined quantity in a mixing zone; gently agitating the water and grist to produce a lightly mixed mash, and trans-





5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130

fering this mash to the or to the first conversion zone.

9. In a continuous mashing process as claimed in Claim 7 or 8, a conversion step in which the water which is added to the grist is heated before being so added.

10. In a continuous mashing process as claimed in any one of the preceding Claims 7 to 9, a conversion step in which the grist is introduced into the pre-mixing zone below the surface of the mash which is formed therein.

11. In a continuous mashing process as claimed in any one of the preceding Claims 7 to 10, a conversion step in which the grain is first steeped in water to dampen it, the water is then drained off and the damp grain is passed to the grinding mill.

12. A continuous mashing process which includes converting the mash by means of a conversion step as claimed in any of the preceding Claims 1 to 11, and passing the converted mash to a continuously operating filtration system to extract the wort from the solids of the mash.

13. In a continuous mashing process, a conversion step substantially as hereinbefore described.

14. In a continuous mashing process, the conversion step herein described with reference to Figs. 1 and 2 of the drawings accompanying the Provisional Specification.

15. Apparatus for carrying out the conversion step in a continuous mashing process, including at least one rotatable hollow drum or cylinder of which the axis is substantially horizontal; means for rotating the cylinder continuously; means for agitating the mash mechanically within the or each cylinder; means for heating the or each cylinder to a variable but predetermined temperature; means for feeding the mash continuously to the or each cylinder, and means for feeding the mash from the or each cylinder at a lower level from the level at which the mash is introduced into that cylinder.

16. Apparatus as claimed in Claim 15 in which the or each cylinder includes radially directed longitudinally extending vanes fixed to and extending inwardly from the walls of the cylinder.

17. Apparatus as claimed in Claim 15 or 16, in which the or each cylinder includes transverse baffles extending partially across the cylinder to interrupt the direct flow of mash through the cylinder.

18. Apparatus as claimed in Claims 15, 16 and 17 inclusive, in which the or each cylinder includes baffles and vanes.

19. Apparatus as claimed in any of the preceding Claims 15 to 18 in which the rotary cylinder includes a plurality of substantially radially directed longitudinally extending vanes attached to the inside of the wall of the cylinder and spaced circumferentially from

each other, these vanes extending inwardly towards the axis of the cylinder for part of the radius thereof whereby the mash is partially restrained, during rotation of the cylinder, from flowing directly down the inside of the cylinder wall towards the bottom of the cylinder, and a plurality of transverse baffles located in a diametral plane across the cylinder and spaced from each other, each baffle being cut away to provide a segmental aperture between its border and the wall of the cylinder to permit restricted longitudinal flow of mash through the cylinder and each aperture being staggered in the radial plane with respect to adjacent apertures in the immediately preceding and succeeding baffle, whereby direct longitudinal through-flow of the mash is restrained, the arrangement being such that the vanes and baffles act in combination with the rotary motion of the cylinder, to permit thorough mixing of the mash during its passage through the cylinder.

20. Apparatus as claimed in any of the preceding claims 15 to 19 including a series of cylinders, each lower in level than the preceding cylinder, through which the mash flows during conversion.

21. Apparatus for continuous decoction mashing as claimed in any one of the preceding Claims 15 to 19, including a single cylinder having inlet and outlet orifices at opposite ends; means for separating a fraction of the mash from the main flow; means for heat-treating the fraction of mash so separated, and means for returning the heat-treated mash to the main flow.

22. Apparatus for continuous decoction mashing as claimed in Claim 20, including means for separating a fraction of the mash emerging from the first cylinder in the series; means for heat-treating the fraction of the mash so separated, and means for returning the heat-treated mash to the main flow.

23. Apparatus as claimed in any one of the preceding Claims 15 to 22 for carrying out the conversion step in a continuous mashing process, including a grain hopper; means for supplying grain continuously or intermittently to the hopper; means for maintaining the grain at a substantially constant level in the hopper; a continuously operable grinding mill; means for transferring the grain continuously and mechanically from the hopper to the grinding mill, and means for continuously and mechanically transferring grist from the mill towards the or the first conversion cylinder.

24. Apparatus as claimed in Claim 23, in which the means for transferring grist from the mill is capable of operating at a faster feed rate than the means for passing grain to the mill, in order to prevent clogging in the mill.

25. Apparatus as claimed in Claims 23 or 24



24 in which the feed passages to and from the mill are enclosed to avoid scattering of dust and particles of grist.

5 26. Apparatus as claimed in any one of the Claims 23 to 25, including means for feeding grist and water to the or to the first conversion cylinder.

10 *the* 27. Apparatus as claimed in any one of Claims 23 to 31, including a pre-mixing vessel; means for feeding grist and water to the vessel; means for gently agitating the grist and water to mix them lightly into a mash in the vessel, and means for feeding the mash to the or to the first conversion 15 cylinder.

28. Apparatus as claimed in Claim 26 or 27, including means for heating the water to a variable but predetermined temperature.

20 29. Apparatus as claimed in Claim 27 including means for introducing the grist into the pre-mixing vessel below the level of the mash.

30. Apparatus as claimed in any one of the preceding Claims 23 to 29, including means

for steeping the grain in water to dampen it; means for draining the water from the grain, and means for passing the wet grain to the grinding mill. 25

31. Apparatus for continuous mashing which includes conversion apparatus as claimed in any of the preceding Claims 15 to 30, in conjunction with apparatus for continuously filtering the wort from the converted mash. 30

32. Apparatus for continuous mashing including conversion apparatus substantially as herein described. 35

33. Apparatus for continuous mashing including the conversion apparatus substantially as herein described with reference to Figures 1 and 2 of the drawings accompanying the Provisional Specification. 40

URQUHART-DYKES & LORD,
Chartered Patent Agents,
Maxwell House, 11, Arundel Street,
Strand, London, W.C.2.
and
12, South Parade, Leeds 1, Yorks. *RM*

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1963.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

ERRATA

SPECIFICATION No. 943,812

Page 1, heading, for "No. 12066/64" read
"No. 12066/62"

Page 1, heading, delete "Class"

Page 2, line 63, after "flow" insert "into"

Page 6, line 8, after "of" insert "the"

THE PATENT OFFICE

17th February 1964