Jan. 8, 1957 F. A. CRAIG 2,776,755

APPARATUS FOR STRAINING LIQUIDS

Filed Feb. 14, 1951 4 Sheets-Sheet 1

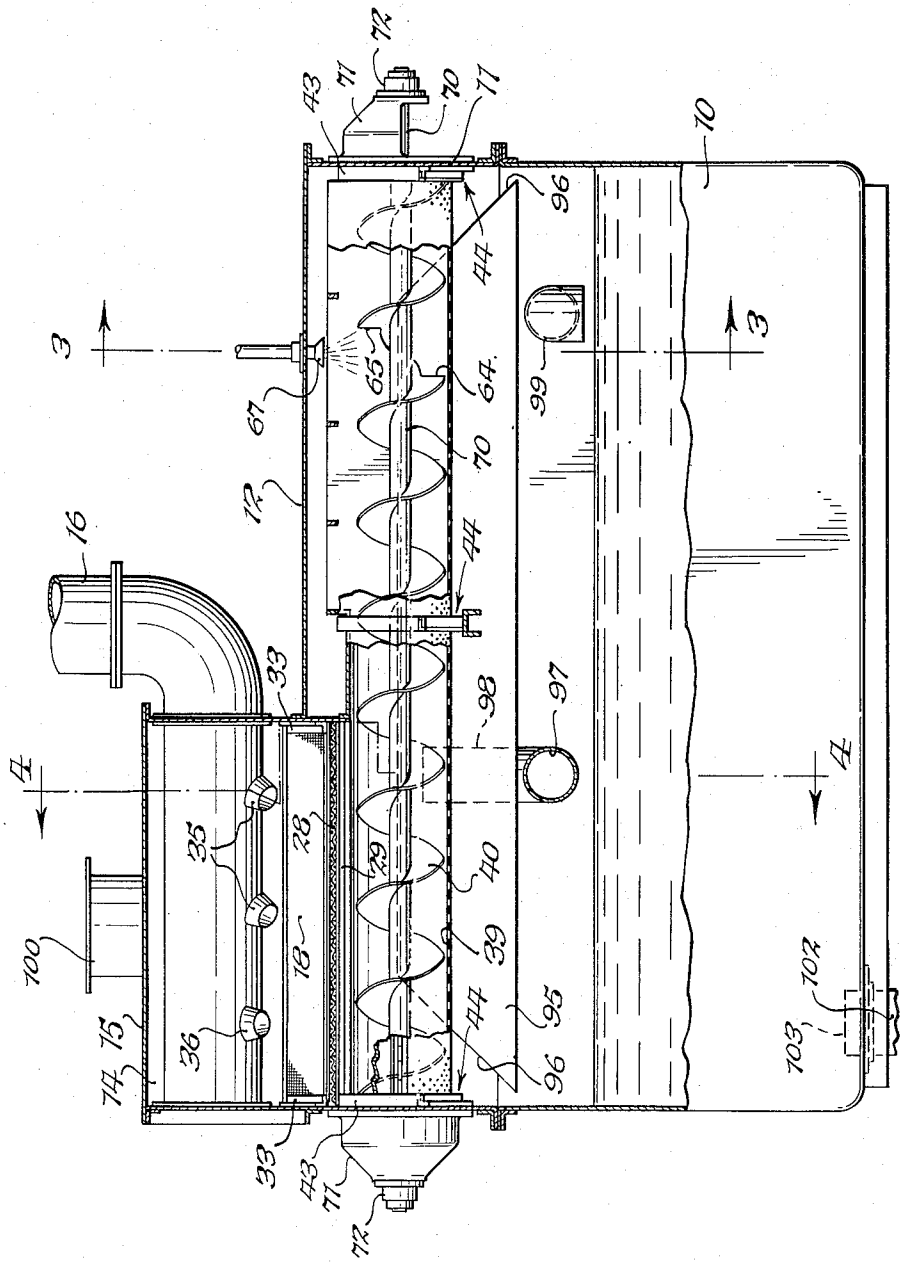


Fig. 1.

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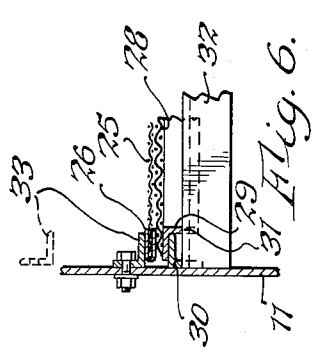


Fig. 6.

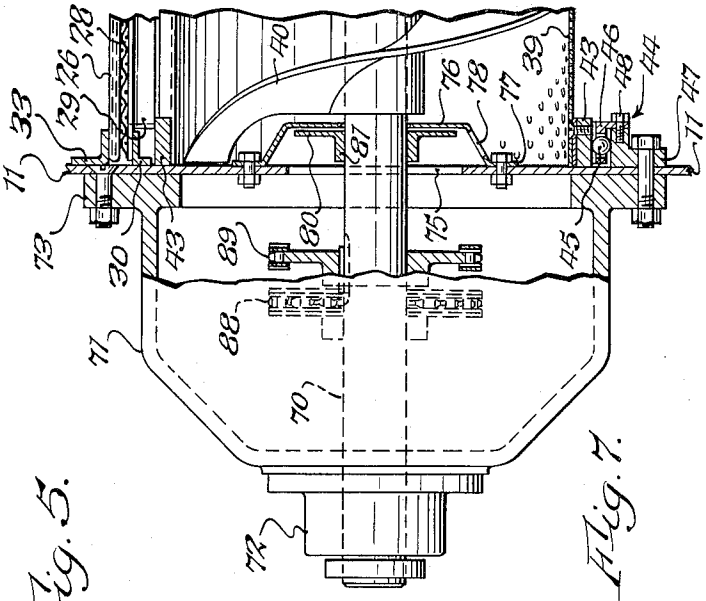


Fig. 7.

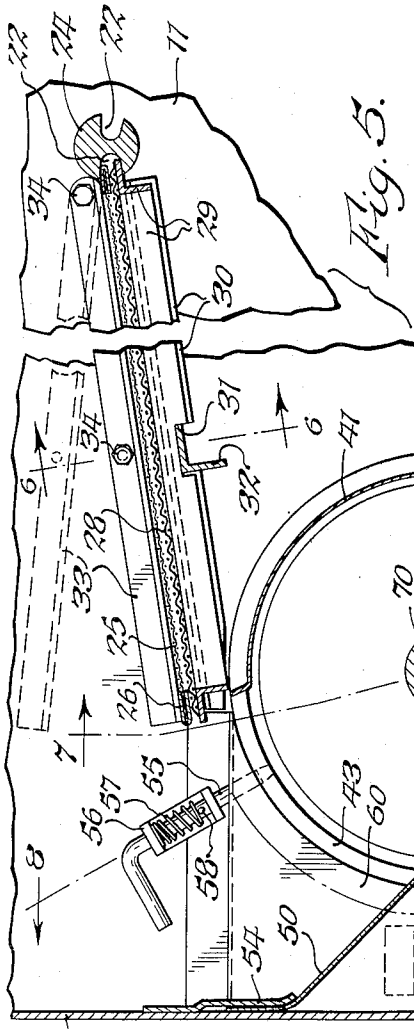


Fig. 5.

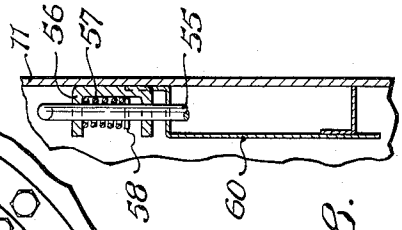


Fig. 8.

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APPARATUS FOR STRAINING LIQUIDS

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Fig. 3.

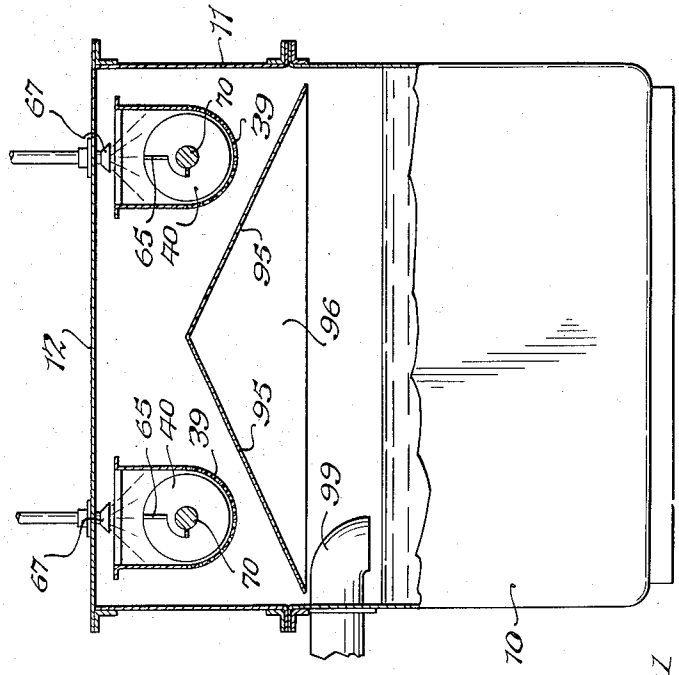
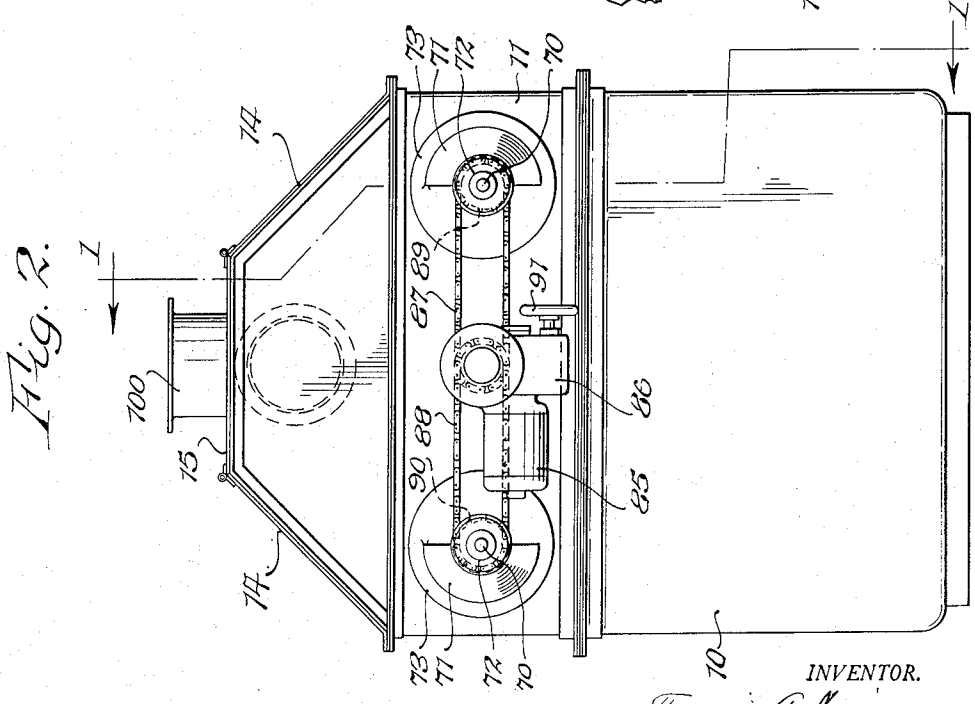


Fig. 2.



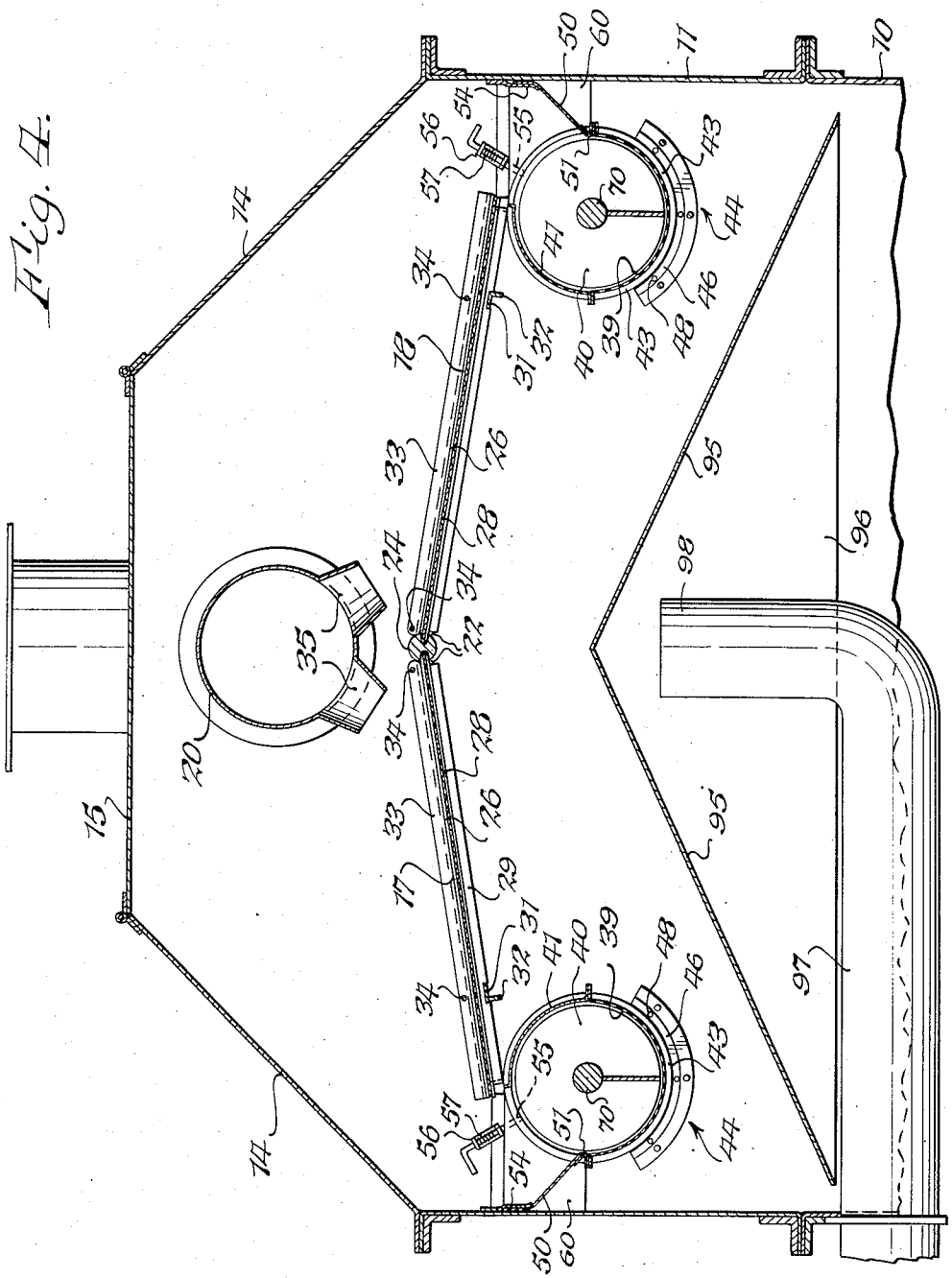
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APPARATUS FOR STRAINING LIQUIDS

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Fig. 4.



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2,776,755

APPARATUS FOR STRAINING LIQUIDS

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Application February 14, 1951, Serial No. 210,866

9 Claims. (Cl. 210—150.8)

This invention relates to improvements in apparatus for straining liquids, such for example as brewer's wort which is strained to remove hop leaves and other solid or semi-solid materials therefrom.

One of the objects of this invention is to provide straining apparatus of this type of improved construction by means of which an increased recovery of liquid from the separated material is obtained.

Another object is to provide an apparatus of this type with means of improved construction for keeping the screens or strainer elements of the apparatus clear of the material which is being strained from the liquid. Another object is to provide an improved method and means of sparging or washing the material separated from the liquid to efficiently recover liquid adhering to such material. A further object is to provide screening means of improved construction for use with apparatus of this type. It is also an object of this invention to provide apparatus of this type with an improved bearing structure for preventing the liquid which is being operated on from entering the bearing and to prevent the entrance of lubricant from the bearing into the apparatus. A further object is to provide means for varying the speed of the movable parts of the apparatus to adapt the same to operate efficiently on liquids containing varying quantities of material to be separated therefrom. Another object is to provide means within the apparatus for cooling the liquid which is being operated on.

Other objects and advantages will be apparent from the following description of one embodiment of the invention and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a longitudinal, sectional elevation of a liquid straining apparatus embodying this invention, the section being taken on line 1—1, Fig. 2.

Fig. 2 is an end view thereof taken at the left side of Fig. 1.

Fig. 3 is a transverse sectional elevation thereof, on line 3—3, Fig. 1.

Fig. 4 is a fragmentary transverse sectional elevation thereof, on an enlarged scale, on line 4—4, Fig. 1.

Fig. 5 is a fragmentary transverse sectional view thereof showing the end portion of one of the troughs and the mounting of a strainer element in relation to the same.

Fig. 6 is a fragmentary sectional view thereof, on line 6—6, Fig. 5.

Fig. 7 is a fragmentary longitudinal sectional elevation thereof, on line 7—7, Fig. 5.

Fig. 8 is a fragmentary section thereof, on line 8—8, Fig. 5.

I have illustrated in this application one embodiment of my invention which is particularly adapted for use in connection with the straining of hop leaves from hot brewer's wort as the same comes from the brewing kettle. It will be understood, however, that it is not intended to limit this invention to the particular construction illustrated nor to the use for which the particular apparatus

shown is intended, since it will be obvious that my invention may be applied to the straining of other liquids to remove solid or semi-solid materials therefrom.

In the particular construction shown by way of example, the straining apparatus is enclosed in a housing which may be of any suitable or desired form, that shown being of substantially rectangular side and bottom walls and includes a tank 10 in the lower portion thereof in which the strained liquid is collected, and an upper portion 11 above the tank and suitably mounted thereon. The top of the housing is closed at the discharge end thereof by means of a substantially flat top plate 12 and the remaining portion of the housing has a cover including upwardly inclined side walls 14 and a fixed top 15. Preferably the inclined side walls 14 are hinged on the top so that they may be swung upwardly to obtain access to the interior of the housing.

The liquid to be strained may be conducted into the upper portion of the housing in any suitable manner, for example, by means of a pipe 16 which may, for example, lead downwardly from a brew kettle located above the strainer.

Within the housing are arranged one or more inclined strainer elements or devices 17 and 18 and the liquid to be strained is supplied to the upper surfaces of these strainer plates by a conduit 20 connected with the inlet pipe 16. The strainer elements are preferably removably mounted so that they can be readily removed from the apparatus for cleaning or replacement and, in the construction shown, the upper edges of the two strainer elements are formed to enter into recesses 22 of a fixed holding member or bar 24 suitably secured at its ends to the housing of the apparatus.

The strainer elements may be of any suitable or desired construction and I have found that in the apparatus shown, the best results are obtained if the straining is effected through a relatively fine mesh woven screen 25. In order to support this screening material or cloth in correct relation to other parts of the apparatus, so that the screening material will lie approximately in a plane without sagging, the edges of the woven screening cloth are secured to a frame 26 of any suitable construction, which is of rectangular shape provided with frame members on the four sides thereof. Preferably these frame members are of U-shape in cross section and the edges of the screening material 25 enter into these U-shaped frame members and are suitably secured thereto, see Figs. 5 and 6.

To prevent sagging of the screening material, in the construction shown for this purpose, coarse wire screening material 28 is employed upon which the fine screening 25 may rest. This coarse wire screening is welded or otherwise secured to a rectangular frame formed of bars 29 of angle shape or other cross section. The frame members 26 of the fine mesh screen may be suitably secured or may lay on the screen 28. The coarse screen frame 29 lies at its ends upon a pair of supports or angle bars 30 secured to the housing 11, Figs. 5 to 7.

The screening elements may be mounted in their operative positions in any suitable or desired manner, and in the construction shown, a portion of the lower face of the frame 29 of the screening element may be provided at opposite sides thereof with notches 31, Fig. 5, and a screen supporting member 32 is secured to the housing of the apparatus in such relation that after the upper edge of a screen element has been seated in a recess 22 of the supporting member 24, the screening element is swung downwardly about the recess so that the supporting member 32 enters the notches 31 of the frame 29, whereupon the screening element is held against endwise movement from its operative position. Clamping means in the form of hinged angle bars indicated at 33 may be used to

securely clamp the opposite ends of each screen element in place. These clamping bars may be secured in clamping position by bolts **34**, Fig. 5, the upper bolts **34** serving as hinge points about which the clamping bars **33** may be swung into the broken line positions shown in Figs. 5 and 6 when the lower bolts **34** are removed. Thus either or both screens **25** and **28** may be easily removed for cleaning. Other means for mounting the screening elements on the apparatus may be employed, if desired.

The screen **25** may, of course, be of any mesh suitable for cooperating with the liquid which is being strained and the material contained therein. When the apparatus is used in connection with the straining of wort, screening cloth of 20 x 20 mesh has been found satisfactory, although screening cloths of coarse or finer mesh may be used, if desired. The wire screening cloth may be made of any suitable material which will not react in any manner with the liquid which is being strained. The supporting screen **28** may be of relatively coarse mesh and is employed only for supporting the wire cloth screening material **25** to prevent sagging of the same, and is not depended upon to remove any solid or semi-solid material from the liquid. Other means for supporting the screening cloth **25** may be provided.

The pipe or conduit **20** which conveys the liquid to the inclined screening elements may be provided with discharge openings of any suitable or desired type to discharge the required amount of liquid on the screening elements. The liquid must be discharged from the pipe or conduit **20** in such a manner that the force of the liquid tends to wash the material to be screened across the surface of the strainer elements to the lower edges thereof, since it is desirable to use only the force of the liquid to keep the screening elements clear, mechanical means for scraping the screened out material from the upper surfaces of the screening elements not being desirable.

I have found that the best results for constantly removing solid or semi-solid material from the upper surfaces of the strainer elements **17** and **18** is obtained by providing two or more streams of liquid which are directed in such a manner so that one of the streams supplements the other stream in distributing the solid or semi-solid material over the surface of the strainers thereby preventing channeling or piling of the material at the bottom of the strainer element. In the construction shown, see particularly Figures 1 and 4, the tube or conduit **20** is provided at each side thereof with one or more discharge nozzles or spouts **35** which are so positioned on the tube **20** as to direct currents of liquid to be strained downwardly across the screening elements **17** and **18** in an angular relation to the length of the same, and another nozzle or spout **36** spaced from the nozzles or spouts **35** and so positioned as to direct a stream of liquid substantially straight down the strainer elements **17** and **18** from the upper to the lower edge thereof. It is important that the nozzle **36**, which directs the stream of liquid straight down the strainer elements **17** and **18**, be the last nozzle in the series of nozzles and that the remaining spout or nozzle or spouts or nozzles **35** be angularly positioned on the tube **20** so that the orifices of the nozzles or spouts **35** will be directed in the direction of the spout or nozzle **36**. It is to be noted in Figs. 1 and 5 for example that the spouts or nozzles **35** and **36** have extremely large orifices so as to handle large quantities of liquid to be strained. The hop leaves in the wort would tend to clog a small or constricted orifice. It is to be further noted that the nozzles are arranged close to the top of the straining element to provide most efficient use of the straining elements **17** and **18**.

Nozzle **36** at the end of the series of nozzles or spouts, must be directed straight downwardly to prevent splashing of the liquid against the side wall of the housing. The nozzles **35** are directed at an angle to nozzle **36** in order to cause the liquid flowing from the spouts **35** to move

in a direction of the liquid flowing from spout **36** thereby permitting an even distribution of the hop leaves at the end of the strainer element **18**. If all of the nozzles were arranged in the manner of nozzle **36**, then channeling, or boring, or piling of the hop leaves into individual piles would result at the end of the screening elements **17** and **18** preventing efficient straining of the hop leaves. If the nozzles were all angled as nozzles or spouts **35**, then the liquid would flow against the end wall of the housing and would produce a boring, or piling, or channeling effect at this wall. This would also be undesirable. The present arrangement of the nozzles is extremely important to the operation of this particular system.

The liquid which has not passed through the openings in the strainer elements, together with the material to be separated from the liquid passes over the lower ends of these strainer elements into troughs **39**, in which final separation of the material from the liquid takes place. Preferably these troughs are substantially semi-cylindrical in form and are preferably made of perforate metal. The material in these troughs is fed lengthwise of the same by any suitable means, such for example as a spiral conveyor **40** which moves the material dropped into the same from the strainer elements lengthwise of the trough toward the discharge end of the machine. During this movement additional liquid can drain from the material and pass downwardly into the tank **10**. The upper portions of each of these conveyor troughs are partly closed by means of an imperforate wall or cover **41** which is arranged below a strainer element and prevents strained liquid from passing into the trough **39**. These troughs at opposite sides of the machine may be in the form of one continuous trough extending from end to end of the machine, or a plurality of connected troughs. The troughs may also be mounted on the machine in any suitable or desired manner, but preferably they are arranged to swing about the axis of the conveyor screw through approximately 180 degrees so as to facilitate washing and cleaning of the same. In the construction shown, the troughs are provided at the ends thereof and at points intermediate of their length with annular bearing members **43** suitably secured thereto, see Figs. 5 and 7. These bearing members are supported by suitable bearing members **44** mounted in fixed relation to the housing of the apparatus. These latter bearing members may be of any suitable or desired construction. Preferably a plurality of bearing balls **45**, Figs. 5 and 7, are provided for supporting the bearing rings **43**. These balls are arranged in cages or ball retainers **46** mounted in fixed relation to a housing wall **11**. In the construction shown for this purpose, an arc-shaped bearing support **47** is mounted on an end wall of the frame or housing member **11**, and the ball retainer cages are provided with downwardly extending flanges provided with apertures through which bolts **48** may pass for bolting the cages to the bearing supporting members **47**. Since the cages **46** are fixed, the bearing balls will, of course, rotate only through a limited extent and will, therefore, not act as true ball bearings. They serve more in the nature of point supports for the movable bearing rings **43** mounted on the troughs. Apparatus of this type when used in connection with the removal of hop leaves from wort is subjected to radical changes in temperature, ranging from room temperature to the temperature of the incoming wort, which is practically at the boiling point of water, and these changes in temperature produce expansion and warping of parts of the apparatus. With bearings as heretofore used, in which surface contacts were employed, it was found that due to warpage, it frequently became difficult or impossible to turn the troughs so that they could be cleaned. With point contacts, such as shown in Figs. 5 and 7, the changes in the material due to changes in temperature do not tend to prevent turning of the troughs. Any other bearing mounting for the troughs may be provided, if desired.

The troughs are provided with guards or liquid deflectors which prevent splashing of the liquid discharged from the strainer elements beyond the edges of the troughs and into the tank 10. For this purpose, each trough is provided at the outer edge thereof with a splash guard or deflector 50 which extends from the outer edge of the trough to the adjacent side wall. In the construction shown, the splash guard is pivoted or hinged at 51 to the outer edge of the trough. The troughs are provided intermediate of the bearing rings 43 with longitudinally extending plates or bars 52 which reinforce the relatively thin, perforate metal of the troughs, and the hinges 51 for the plates 50 may be secured to these bars 52 in such manner that the outwardly bent edges of the troughs are clamped between the bars 52 and a leaf of a hinge 51. The outer ends of these splash guards 50, when in their operative positions, extend into recesses formed between a side wall of the housing 11 and an offset plate 54, the upper edge of which may be welded or otherwise secured to the wall of the housing 11. Consequently, any liquid splashing against the housing wall will be deflected downwardly by the offset plate 54 to the splash plate 50 which, in turn, conducts such liquid into the trough.

Any suitable means may be provided for releasably holding the troughs in their operative positions, and in the construction shown for this purpose, the bearing ring 43 secured to the trough may be provided with an aperture into which a locking pin or bolt 55 may extend. This bolt, in the particular construction shown, is mounted in a bracket 56 of approximately U-shape welded or otherwise mounted on a wall of the housing, see Fig. 8, and a spring 57 acts on a pin 58 extending through the locking bolt and against one flange of the U-shaped member 56 to yieldingly urge the locking bolt into its locking position.

When the locking bolt 55 is pulled against the action of the spring 57 out of locking engagement with the ring 43 of the trough, the trough may be turned in a counterclockwise direction, Fig. 5. This turning will draw the upper end of the splash guard 50 out of the slot between the housing wall and the offset plate 54, and the trough may then be turned into substantially inverted position, carrying the splash plate with it. When the trough is turned back into its operative position, the splash plate 50 is inserted into the gap between the housing wall and the offset plate 54 and the trough may then again be locked in place by the bolt 55. Any other means for locking the trough in its operative position may be provided, if desired.

60 represents an offset plate or spacer secured to the housing wall and extending over a portion of the bearing ring 43 of the conveyor trough. The spacer projects outwardly from an end wall of the housing 11 and the splash plate 50 extends up to this spacer. By means of this construction, the splash plate 50 can be made narrow enough to pass beyond the stationary bearing 44 when the conveyor trough is swung into an inverted position.

The screw conveyors 40 carry the material discharged into the troughs lengthwise of the housing, and during this travel of the material the liquid is drained from the same through the perforations in the trough 39. The troughs and the conveyors extend beyond the inclined strainer elements into the portion of the housing below the flat cover 12, where no more liquid from the strainer elements can enter the same. Further draining of liquid from the material takes place in this part of each trough. This, of course, is desirable to remove from the material as much of the liquid as possible, and consequently, in strainers of this type as heretofore constructed, a sparge pipe with outlets at intervals lengthwise thereof for supplying washing water to the material in the conveyor was arranged over the portion of the trough beyond the strainer elements. I have found that better washing or sparging may be

obtained if the material during its passage through the trough is collected into a pile or accumulation and sparge water is then sprayed on such pile or accumulation. With prior constructions the lower portions of the conveyor flights or convolutions each pushed ahead of it along the bottom of the trough a smaller quantity of material, and the remainder of the part of the trough between each flight or convolution and the next one ahead of it would contain no material. In other words, a small amount of material was accumulated in front of the lower part of each screw flight of the conveyor and the remaining perforate portion of the trough between adjacent conveyor flights would be free from any of this matter. Consequently, a considerable proportion of the sparge water sprayed into the conveyor would be directed on these empty portions of the conveyor trough and passed through these perforations without effecting any washing of the material.

In order to overcome this difficulty of prior constructions, I have provided the conveyor screw with one or more portions in which the screw flights are interrupted. For example in Fig. 1, it will be noted that the convolutions of the conveyor screw are interrupted from a part 64 of the conveyor to a part 65 thereof. Consequently, material discharged from the part 64 of the conveyor screw will be accumulated in a pile, which pile is advanced by small increments of movement until sufficient material was accumulated, so that it would be picked up a little at a time by the edge 65 of the conveyor screw. This permits an accumulation of a mass of material between the edges 64 and 65 of the conveyor and this material will, of course, move quite slowly. I have, consequently, provided a spray nozzle 67 over the interrupted portion of the conveyor screw which directs a sparge water or washing liquid on the accumulated pile of material between the edges 64 and 65 of the conveyor. By means of this construction, it is consequently, possible to thoroughly wash remaining liquid extract, wort or other liquid from the material accumulated in this part of the trough without wasting water or unnecessarily diluting the liquid which has been strained. It has been found that washing the material removed from the liquid while the same is accumulated in a pile in the trough results in a much more efficient removal of liquid from the material. While I have shown only one interruption in the screw conveyor, two or more interruptions may be provided, if desired, thus producing two or more accumulations of material to each which a stream of sparge liquid may be directed.

It is very desirable to provide means for preventing the liquid which is being treated from coming into contact with the bearings of the shafts of the spiral conveyors for the purpose of avoiding deterioration of the bearings, and it is also very necessary to prevent any lubricant in the bearings from contaminating the liquid being strained. For this purpose, the conveyor shaft 70 extends outwardly beyond the end walls of the housing and suitable bearing brackets 71 are provided having bearings 72 mounted thereon. The bearing brackets 71 are preferably of approximately semi-cylindrical or semi-conical shape and are provided with flanges 73 which may be secured to the outer surface of a wall of the housing 11. The bearings 72 would, consequently, be spaced at a considerable distance from the housing wall.

In order to prevent liquid from passing out of the housing 11 along the conveyor shaft 70, I provide relatively large openings 75 in the wall of the housing through which the shafts 70 extend and I also provide a retainer or closure cap 76 at each opening which extends about the shaft and across the opening 75 and which is provided with a central aperture through which the shaft 70 may freely extend. The retainer cap is of dished form with a peripheral flange 77 which is se-

cured in any suitable manner to the inner surface of the wall of the housing. The retainer cap is provided in the lower portion thereof with an aperture **78** through which liquid entering the retainer cap may flow down into the conveyor trough.

I also provide within the retainer cap a disk **80** which has a hub **81** suitably secured to the conveyor shaft **70** and arranged in closely spaced relationship to the retainer cap **76**. Consequently, any liquid which passes along the shaft **70** through the opening in the retainer cap will be deflected by the disk **80** so that it will flow downwardly into the lower portion of the retainer cap, where it may pass through the opening **78** into the trough. By means of this construction, the flow of liquid along the shaft to the bearing **72** will be prevented, and by arranging the bearing **72** in spaced relation to the wall of the housing **11**, lubricant will not pass from the bearing into the liquid which is under treatment. By making the bearing bracket **71** of hollow form which is half open, suitable drive means for the conveyor shaft may be located within the bracket **71**. This type of bearing construction also enables the bearing brackets to be used at both ends of the conveyor shafts, the brackets being arranged with their open faces facing each other, Fig. 2, at the drive end of the conveyor shaft, and the brackets at the discharge end of each conveyor are turned with their open faces extending downwardly, as shown in Fig. 1, to permit discharge of the material from the straining apparatus at the end of each conveyor trough through the open face of the bearing bracket.

The drive means for the conveyor shaft is shown in Fig. 2 and includes an electric motor **85** which drives a variable speed reducing gear **86** which in turn drives a pair of sprocket gears connected by means of chains **87** and **88** with sprocket wheels **89** and **90** which are secured to the conveyor shafts **70**. The variable speed gear reduction mechanism may be of any suitable or well known construction, mechanisms of this type being readily available on the market, and the mechanism shown is provided with a speed adjusting mechanism or part **91** by means of which the speed of rotation of the conveyor may be controlled. This variable speed control is desirable in order to enable the operator to adjust the speed of the screw conveyors so that the maximum amount of liquid may be strained and washed from the material which has been separated from the liquid. Generally speaking, when a liquid contains a larger quantity of material to be separated therefrom, more sparging or washing is necessary and, consequently, the conveyors should be operated at lower speeds to effect a thorough sparging of the material.

When the apparatus is used for straining hops from wort, the wort is cooled immediately after leaving the strainer. The cooling of the wort generally takes place in two stages, the first being a preliminary cooling by means of which the temperature of the wort is lowered to the extent of approximately 30 or 40 degrees below the boiling point, and the second being a final cooling, during which the wort is cooled approximately to room temperature for admission into the fermentation vats. The reason for the preliminary cooling is that the wort contains certain protein substances known as "trube," which are soluble in the wort when the same is near the boiling point and which precipitate out of the wort when the temperature of the same is dropped about 30 or 40 degrees. This trube is then removed from the hot wort before the same goes to the final coolers, for the reason that the precipitated particles of trube are apt to clog the distributor which supplies the wort to the final cooler.

I have found that the apparatus disclosed can very conveniently and without material added expense be used to effect cooling of the hot wort immediately after it has been strained. For this purpose, I have provided under the straining elements and the troughs a sheet metal structure of approximately the shape of a roof on which the strained liquid or wort drops, and I have also provided conduits for conducting air to the underside of this roof-shaped structure to cool the same. In the construction illustrated by way of example, the cooling member comprises a pair of inclined plates **95** secured together at their upper edges, and end plates **96** which are secured to the inclined plates **95**. This roof-shaped structure is arranged with the edges thereof spaced from the walls of the housing **11** so that liquid dropping on the the cooling element can be readily discharged from the same into the tank **10**. The cooling element is required mainly under the portion of the apparatus in which the strainer elements are located, but if desired, this structure may extend throughout the length of the apparatus, as shown in Fig. 1.

In order to effect cooling of liquid dropping on the upper surface of the roof-shaped cooling element, I provide an inlet pipe **97** for filtered air which has a branch **98** which extends upwardly into the roof-shaped structure. The air supplied to the cooling element need only be at approximately room temperature, since the wort entering the straining apparatus is near the boiling point of water. **99** represents a vent pipe through which air passing into the apparatus through the air inlet pipe **97** may escape from the apparatus. As usual, however, the apparatus is also provided at the upper portion thereof, above the strainer elements, with a vent **100**, and consequently, some of the air admitted by the inlet pipe **97** may pass upwardly through the vent **100**.

After the liquid wort has been cooled sufficiently to cause precipitation of the trube, it is permitted to stand for a short period of time to allow the trube to precipitate in the bottom of a container or vessel. This container may be separate from the straining apparatus, in which case the liquid from the tank **10** may be pumped to such precipitating vessel, or if desired, the tank **10** of the strainer may be of a size large enough to contain an entire brew, in which case the brew may be left standing in the bottom of the tank for a period of approximately fifteen minutes, whereupon it is drawn through an outlet pipe **102**, Fig. 1, having a portion **103** thereof extending above the bottom of the tank **10**. Consequently, when liquid is drawn through the pipe **102**, the trube, together with some of the liquid will be left in the bottom of the tank, and subjected to straining or filtering to separate the trube from the liquid.

Even if the tank **10** is not of sufficient size to contain a complete brew, the cooling of the wort during the straining operation is very desirable for the reason that cooling equipment can be installed in the hop strainer at a relatively low cost and the cooling effected in the hop strainer results in reducing the required refrigeration load on the hot wort cooler. The amount of cooling within the hop strainer can readily bring the wort down to the breaking point at which precipitation of the protein matter or trube takes place. If the strained wort is pumped from the tank **10**, the reduction in temperature by means of the construction described will prevent cavitation from occurring when the wort is pumped from the tank **10**. Removal of trube expedites fermentation of the wort.

It will be understood that various changes in the details, materials and arrangements of parts which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

I claim as my invention:

1. An apparatus for straining a material from a liquid, including a housing, an inclined strainer element over which said liquid flows, a trough at the lower end of said strainer element into which liquid is discharged from said strainer element, a screw conveyor in said

trough, a shaft on which said screw conveyor is mounted and which has an end extending through an opening in a wall of said housing, a bearing on the exterior of said housing for said shaft, a retainer cap mounted on the inner surface of said housing, said cap being of dished form and extending inwardly into said housing and having an opening therein through which said shaft extends and a discharge opening in the lower portion thereof through which liquid entering said cap can be discharged into said trough, and an imperforate disk secured to said shaft and arranged in close proximity to the inner surface of said dished retainer cap and which serves as a stop for liquid passing through said opening in said retainer cap through which said shaft extends, said disk deflecting liquid passing through said opening downwardly to the lower end of said retainer cap for discharge through said discharge opening.

2. In an apparatus for straining material from a liquid, the combination of a housing, an inclined strainer element arranged in said housing, a conduit for supplying liquid containing said material to the upper portion of said strainer element, an imperforate structure of thin metal sheets arranged at an inclination below said strainer element and upon which liquid passing through the perforations of said strainer element drops and from which said liquid flows into the lower part of said housing, a conduit for conducting cooling air into said housing below said imperforate structure, and an exit for air from said housing, whereby the liquid which has been strained is cooled.

3. In an apparatus for straining a material from a liquid, the combination of a housing enclosing said apparatus, a pair of inclined strainer elements having their upper edge portions adjacent to each other, a conduit for supplying liquid to be strained to the upper portions of said strainer elements, troughs at the opposite ends of said strainer elements into which liquid is discharged from the lower ends of said strainer elements, an inclined roof-shaped structure of imperforate material arranged below said strainer elements and said troughs and having the edge portions thereof spaced from said housing and upon which liquid discharged from said strainer elements and said troughs drops and flows along said structure into the lower portion of said housing, a conduit for admitting cooling air into said apparatus underneath said roof-shaped structure for cooling the liquid which drops thereon, and a discharge pipe for air arranged in the side of said housing below said roof-shaped structure and through which air is discharged from said housing.

4. In an apparatus for straining hops from wort, the combination of a housing, an inclined strainer element arranged in said housing, means for supplying wort containing hops to the upper portion of said strainer element, an imperforate structure of thin, heat-conducting material arranged below said strainer element at an inclination to the horizontal and upon which wort passing through the strainer element drops and flows down said structure into the lower portion of said housing, a conduit for conducting cooling air into said housing below said imperforate structure for cooling liquid flowing upon said structure, an exit through which air from said housing is discharged, a tank into which the cooled strained wort is conducted and in which trube thrown out of solution in the wort, because of the cooling of the same is precipitated at the bottom thereof, and means for withdrawing wort free from trube from said tank above the bottom thereof.

5. Apparatus according to claim 4 characterized in that said tank in which precipitation of trube takes place is located in the lower portion of said apparatus.

6. In an apparatus for straining a material from a liquid the combination of an inclined perforate substantially flat straining element, a conduit for discharging the liquid to be strained to the upper portion of said straining element, a series of discharge spouts in said conduit, each of said spouts having a large orifice to permit discharge of a solid stream of liquid on to said straining element, the last one of said spouts in said series being mounted to discharge a stream of liquid down said straining element in a direction substantially straight from the upper portion of said straining element to the lower portion thereof, and all of the other spouts in said series being mounted to discharge a stream of liquid angularly down said strainer element and in the direction of the flow of liquid coming from the said last one of said spouts in said series, so that the material to be strained is evenly distributed at the bottom edge portion of said straining element and channeling and piling of a material is prevented.

7. An apparatus for straining material from a liquid as in claim 6 in which the material is hops and the liquid is wort and in which the straining element comprises a substantially 20 mesh screen supported by a coarse mesh screen.

8. In an apparatus for straining a material from a liquid, the combination of an inclined perforate substantially flat straining element, a conduit for discharging the liquid to be strained to the upper portion of said straining element, at least three discharge spouts arranged in a row mounted in said conduit, each of said spouts having a large orifice to permit discharge of a solid stream of liquid on to said straining element, only one of the end spouts of said row of spouts being mounted to discharge a stream of liquid down said straining element in a direction substantially straight from the upper portion of said straining element to the lower portion thereof, and all of the other spouts being mounted to discharge a stream of liquid angularly down said strainer element and in the direction of the flow of liquid coming from the said only one of said end spouts, so that the material to be strained is evenly distributed at the bottom edge portion of said straining element and channeling and piling of the material is prevented.

9. An apparatus for straining a material from a liquid as in claim 8 in which the liquid is wort and the material is hops, and in which the straining element comprises a substantially 20 mesh screen supported by a coarse mesh screen.

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