(No Model.) 2 Sheets—Sheet 1.

H. STIER.

MALTING APPARATUS.

No. 572,665. Patented Dec. 8, 1896.

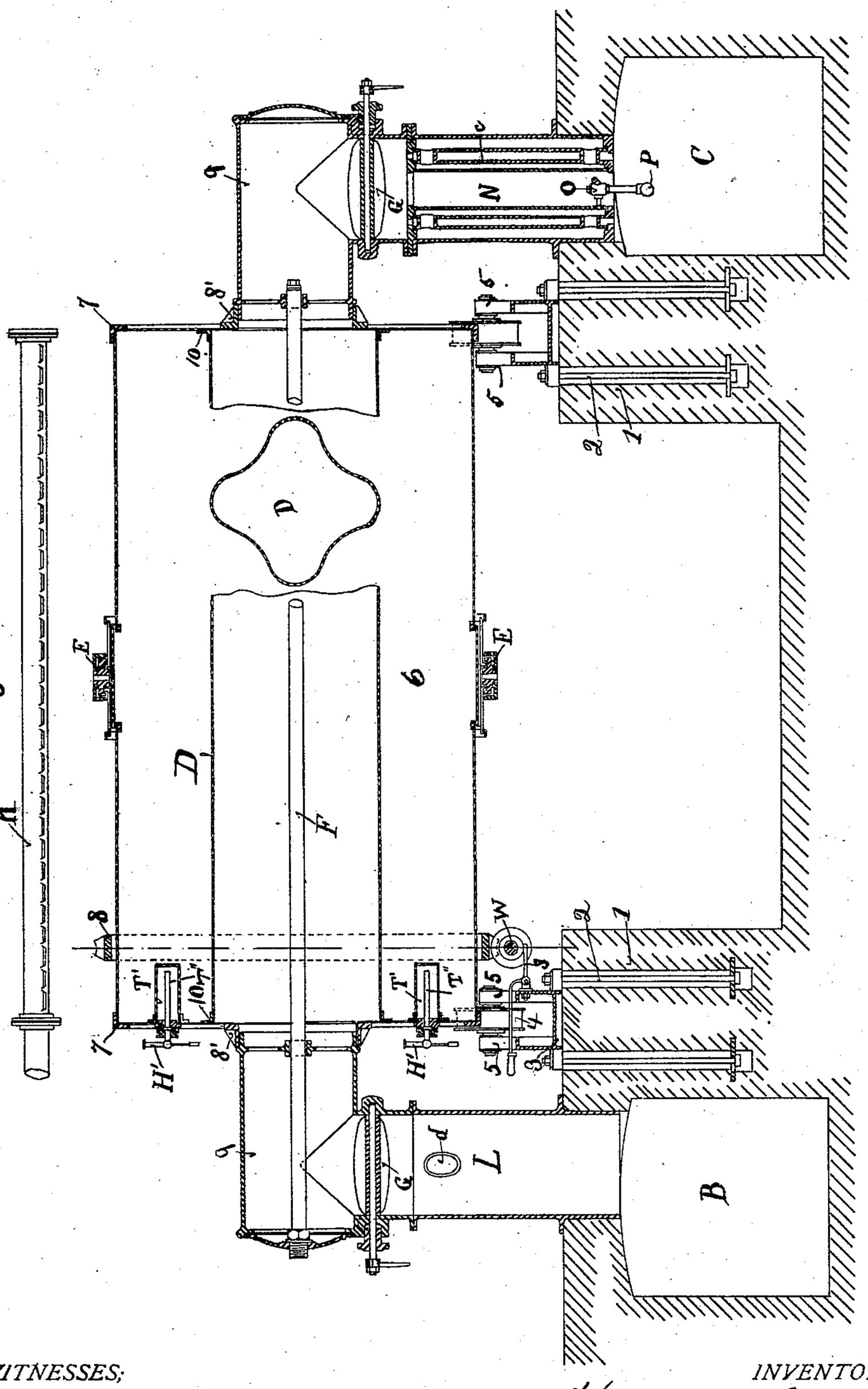

Fig. 1.

WITNESSES;
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T. Simmons.

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(No Model.) 2 Sheets—Sheet 2.

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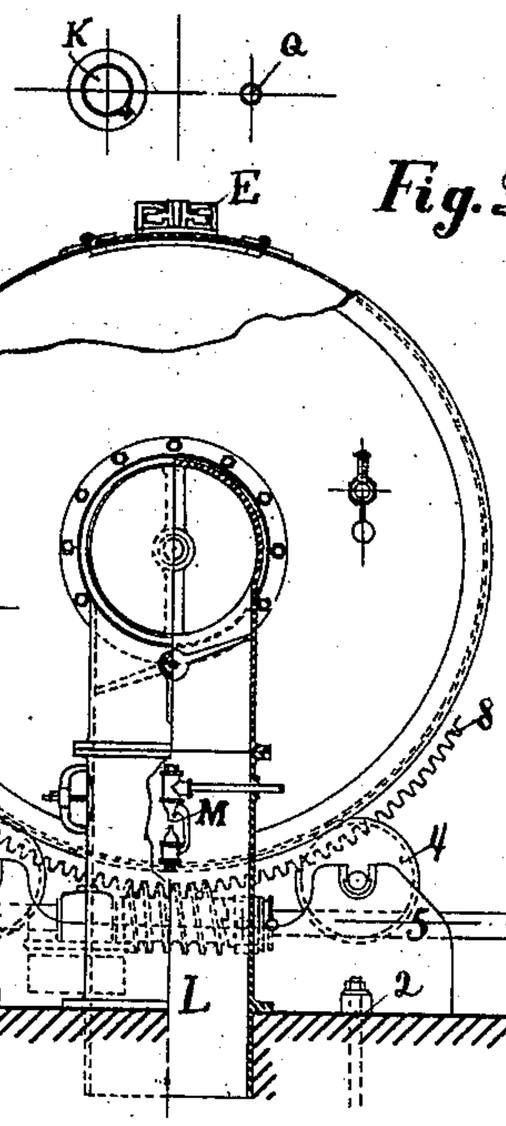

Fig. 2.

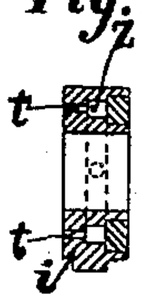

Fig. 5.

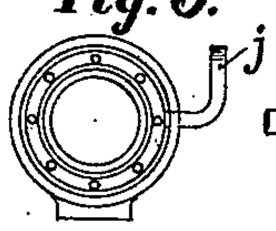

Fig. 6.

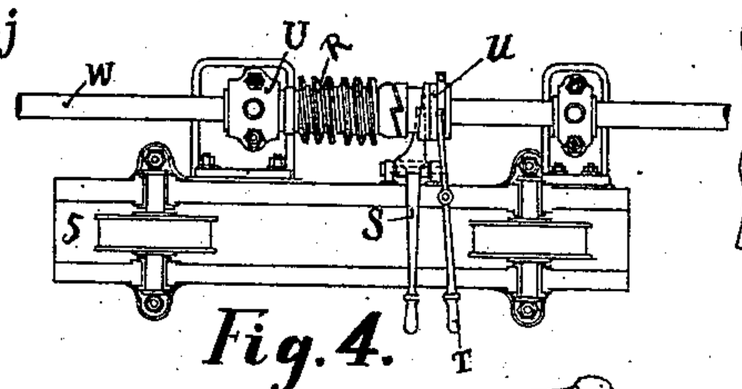

Fig. 4.

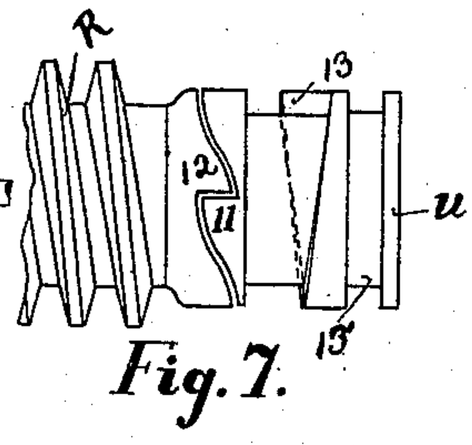

Fig. 7.

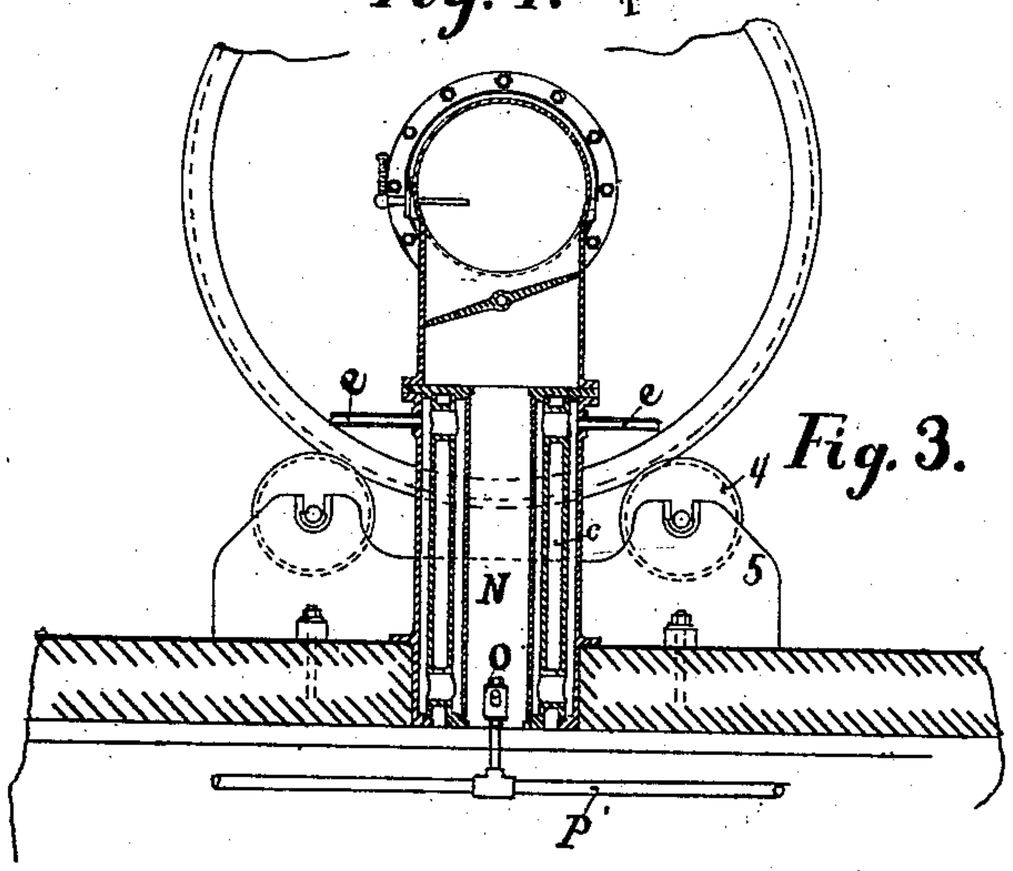

Fig. 3.

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UNITED STATES PATENT OFFICE.

HERMANN STIER, OF CINCINNATI, OHIO, ASSIGNOR OF ONE-HALF TO ALBERT SCHWILL & CO., OF SAME PLACE.

MALTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 572,665, dated December 8, 1896.

Application filed October 12, 1893. Serial No. 487,979. (No model.)

To all whom it may concern:

Be it known that I, HERMANN STIER, a subject of the Emperor of Germany, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Malting Apparatus, of which the following is a specification.

The object of my invention is to provide a malting apparatus with devices for controlling its operation and for the application of air, heat, and moisture, so as to uniformly control the process of malting, whereby a uniform and homogeneous malt is obtained.

Another object of my invention is to make each apparatus self-contained, so that each apparatus is independent of all others, avoiding the use of canals hitherto employed in mechanical devices.

Another object of my invention is to provide a strong and durable apparatus which is not liable to get out of order, and one that is easily controlled. Various other details of my invention are fully set forth in the description of the accompanying drawings.

Another object of my invention is to provide a process of malting and cooling which shall at all times be under the control of the operator, making not only a more uniform but a better quality of malt.

The various features of my invention are fully set forth in the description of the accompanying drawings, making a part of this specification, in which—

Figure 1 is a longitudinal section of my apparatus. Fig. 2 is an end elevation, partly in section, of the moistening end of the apparatus. Fig. 3 is a sectional elevation of the opposite end. Fig. 4 is a top plan view of the clutch and drum-driving mechanism. Figs. 5 and 6 are detail views of the lubricating-box. Fig. 7 is a detail view of the worm-clutch.

1 1 represent abutments; 2, anchoring-rods on which the bed-plate 3 is mounted.

4 represents rollers which journal in the flanges 5 of the bed-plate, upon which the revolving drum 6 journals. There are four of these journal-rollers. The drum 6 is provided with angle-iron hoops 7 at the corners which rest upon the journal-rollers.

8 represents an annular gear secured externally upon the drum 6, the teeth of which engage with the worm R, loosely journaled on the shaft *w*. The ends of the drum 6 are provided with annular angle-flanges 8′, which journal upon the drums 9. Within the drum 6 is provided a drum D, having concave sides, which is secured to the heads of the larger drum 6 by angle-plates 10. Said drum D revolves with the drum 6. Shaft *w* is driven by any desired power.

It is desirable to stop and start the drum readily, and for this purpose I have provided the following mechanism: *u* represents a clutch provided with teeth 11, engaging with teeth 12 of the worm-gear R. 13 represents a left-hand screw. T represents a lever swiveled in the groove 13′, by means of which lever the clutch is thrown into gear; but as the power employed to turn a large drum filled with a charge of malt is very great and it is difficult to uncouple by the lever T, I provide a lever S, the inner end of which is provided with a half-nut, which when the lever S is turned down in the position shown in Fig. 1 engages with the left-hand thread 13 and the clutch-coupling *u* is moved automatically, disengaging the clutch. When the drum is to be thrown into gear, the lever S is raised and disconnected with the thread 13, and then the clutch may be readily thrown to make the coupling by means of the lever T.

In order to control the temperature and moisture, and hence rapidity and exactness of malting, I have provided the following instrumentalities: The outer drum 6 is pierced with small orifices. The inner drum D is likewise pierced with similar orifices, through which the air escapes in the cooling and drying process. In order to note the temperature, which must be kept very regular, I provide a series of angle-thermometers H′. Each of said thermometers consists of a glass tube bent to form a right angle, the inner end of which is journaled on a tube T″, which is closed at its other end and projects into the drum 6, forming one end of the thermometer. Said tube is incased by a reticulated metallic casing T′, secured to the interior of the head

of the drum, which prevents the malt from coming in contact with the tube and at the same time allows a circulation of air and gas through the casing, keeping the tube at the same temperature as the interior of the drum. The bent tube and the tube T'' composing the thermometer pass through a stuffing-box secured in the head of the drum, and a weight depends from the bent tube, whereby the tube is always maintained in an upright position.

In order to provide the proper amount of moisture during the malting process, I provide a sprayer M in the mouth of the pipe L, just below the drum 9.

B represents an air-supply chamber, into which air is forced by any ordinary air-pump or fan, by means of which pipe L is supplied.

G represents a damper for opening and closing pipe L, as the case may require.

The moistened air is driven by the fan from pipe L through the drum 9 into the interior drum D, and is forced through the small orifice in the periphery thereof, through the malt, and escapes through the orifices of the exterior drum 6.

d represents a manhole in pipe L.

In the process it is necessary to introduce dry air, but of a certain temperature, as in summer air colder than the normal temperature is required, and in winter air warmer than the normal temperature is required. In order to regulate the temperature, therefore, I provide the following instrumentalities:

C represents a chamber into which air is forced; *c*, a series of annular drums set in the pipe N, through the annular spaces of which hot or cold water or steam is introduced, as occasion may require. Air forced up through the annular space between the water-annulus becomes heated or cooled, as the case may be, and enters through stationary drum 9 into the interior revolving drum D, escaping through the orifices in its periphery into the space of the exterior drum, and finally passing out through the orifices in the periphery of the same.

e e represent induction-pipes for supplying the annular drums in the pipe N, and P represents a discharge-pipe for carrying off the water and steam. In order that the several apparatus may be connected in one supply-pipe system, I provide a valve O in the branch leading to pipe P.

G represents a damper for opening and closing the connection of pipe N with the drum 9.

In the process of cooling the use of air alone is not at all times desirable, as the supply of oxygen may be too great, carrying off valuable substances from the grain by a too rapid growth. To obviate this difficulty, I provide cooling-pipes K Q. Q is an ordinary punctured pipe with a series of orifices through which the water passes on to the outside of the drum in drops or small streams; but this can only be used when air is being forced in through the pipe N or L with an internal pressure into drum 6 to prevent the water which drops on the outside from passing in through the small orifices. Pipe K is provided, therefore, which is stretched along from the drum 6 and is provided with a series of oblong fine slits the lips of which are slightly asunder, causing the water to be converted into fine spray, and hence is sprayed upon the drum 6 as it revolves, the heat of which evaporates the water rapidly and prevents any great amount from entering the drum. In this way the drum can be revolved and cooled without the use of cold air being forced through the mass of the malt from the inside.

F represents a water-supply pipe spanning the interior of the drum D. It is furnished with orifices along its periphery, through which water is forced into the interior of drum D for cleansing it. The orifices of the exterior drum 6 may be used for cleansing-water applied through them after the malt is removed.

Mode of operation: The steeped grain is taken from the steeping-tubs and introduced into the larger drum through the manhole-drums E. After the drum is filled and the doors are closed the drum is started to revolve. The grain by this means is distributed equally through the apparatus and thoroughly mixed. As the drum revolves the grain as it falls from the sides of the drum drops onto the inner drum D, and the star or irregular shape of the drum turns the grain over and more thoroughly mixes and distributes it. Besides, this shape of drum furnishes more surface than a cylindrical drum. It is necessary to keep up the moisture during the malting process, and this is supplied by a draft of air from the chamber B, moistened in the pipe L by the spraying apparatus M. It is forced into drum D and passed out through the apertures in the periphery into the drum 6. The germination of the grain generates a large amount of heat, and the deleterious gases escape through the orifices of the drum 6. If the heat be too great, the water cooling, as hereinbefore explained, may be applied by means of the pipes K or Q. Thus the undue heating of the malt and a thorough ventilation of the same are effected without unduly drying the grain, maintaining the proper heat and dampness for forming the diastase.

In order to prevent undue heating of the driving-shaft beams due to the side thrust of the worm-gear, I provide the following mechanism: U represents an oil-box which is composed of ring *i*, having an annular recess *z* in the periphery thereof. *t* represents oil-holes bored from the side of the rings into the recess *z*. *j* represents a pipe tapping into the annular recess for supplying oil. The orifices *t* about the worm-gear oil the sides of the same and thence pass on to the shaft and

keep the same lubricated. The form and construction of these parts are shown in Figs. 5 and 6.

I have shown the heating and cooling coil placed in a separate pipe from the moistening apparatus, but I do not wish to limit myself to this construction, as in many cases the air-spraying device is only used at a time when the air heating and cooling coil is idle, and in such cases air-spraying devices may be placed in the same pipe as the air heating and cooling drums. Neither do I wish to limit myself to the specific kind of apparatus for heating and cooling the air in the supply-pipe, as the result does not depend upon the kind of apparatus, but upon the proper regulation of the supply of air and heat and cold.

In the malting part of the process it is preferred to keep about one hundred per cent. of moisture in the air, and for this purpose I prefer to moisten the air as it enters the chamber B with the spraying apparatus operating similar to that shown in the pipe L, thereby securing the proper amount of moisture in the air. If the air which is forced in is not properly moistened passing through the grain, a drying of the malt will occur, or, in other words, the sprouting of the grain will be hindered and the formation of the diastase will be imperfect.

Having described my invention, what I claim is—

1. A malting apparatus consisting of the outer perforated drum 6 and the inner perforated drum D provided with concave sides, said drums revolving together, fixed, imperforate drums 9 journaled in the ends of the drum D and connected with air-supply pipes, means for revolving the perforated drums, and means for forcing the air into the inner drum and thence outwardly through the periphery of the outer drum, substantially as described.

2. A malting apparatus consisting of the outer perforated drum 6, and the inner perforated drum D provided with concave sides, said drums revolving together, fixed, imperforate drums 9 journaled in the ends of the drum D, air-supply pipes connected with the drums 9, spraying, heating and cooling devices arranged in said pipes, means for revolving the perforated drums, and means for forcing the air into the inner drum and thence outwardly through the periphery of the outer drum, substantially as described.

3. In a malting apparatus, the combination with the perforated revolving drum 6, of an interior perforated drum D secured to the heads of drum 6 and revolving therewith and provided with concave sides, substantially as shown and described.

4. A malting apparatus, consisting of the outer perforated drum 6, the inner perforated drum D of irregular shape in cross-section, said drums being fixed to revolve together upon suitable rollers, upon which the periphery of the outer drum rests, means for forcing air into the interior of the inner drum, thence outwardly through the periphery of the outer drum, and means for applying a spray of water to the periphery of the outer drum simultaneously with the forcing of the air outward therethrough, whereby the charge is kept at the appropriate moisture and temperature, substantially as described.

5. In a malting apparatus the combination with the perforated revolving drum 6 and the interior drum D secured thereto, of one or more pendulous thermometers H′ each consisting of a tube bent at a right angle and journaled in a stuffing-box secured in the head of the drum 6 and provided with a pendulous weight for maintaining the thermometer-tube in an upright position, and a reticulated casing secured within the drum and incasing the inner end of the thermometer, substantially as shown and described.

6. A malting apparatus comprising an outer perforated drum, an inner perforated drum of irregular shape in cross-section, the two drums being adapted to revolve together; means for forcing air into the interior of the inner drum, thence outwardly through the periphery of the outer drum, and means for applying a spray of water to the periphery of the outer drum simultaneously with the forcing of the air outward therethrough, substantially as described.

7. A malting apparatus comprising an outer perforated drum and an inner perforated drum of irregular shape in cross-section, adapting it to turn over and more thoroughly mix and distribute the grain falling thereon, fixed imperforate drums journaled in the ends of said inner drum, air-supply pipes connected with said imperforate drums, spraying, heating and cooling devices combined with said pipes, means for revolving the two perforated drums, and means for forcing air into the inner drum and thence outwardly through the periphery of the outer drum, substantially as described.

8. In a malting apparatus, the combination with an outer perforated drum and an inner perforated drum, the two adapted to revolve together, of a pendulous thermometer consisting of a tube bent at an angle and journaled in suitable bearings provided therefor in the head of the outer drum, a pendulous weight for maintaining the thermometer in an upright position, and a reticulated casing arranged in the space between the two drums and incasing the inner end of the thermometer, substantially as described.

9. In a malting apparatus, the combination of an outer perforated drum, and an inner perforated drum adapted to revolve together, said inner drum having an irregular or star-shaped cross-section, whereby it is adapted to turn over the grain falling thereon and more thoroughly mix and distribute the same as the two drums revolve, substantially as described.

10. In a malting apparatus, the combination

with an outer revolving drum, of a peripherally-perforated drum arranged within said outer drum and having an irregular external surface providing a series of concavities which are adapted to be brought successively into position to receive the grain falling thereon from the sides of the outer drum as the latter revolves, whereby the grain is turned over and thoroughly mixed and distributed, substantially as described.

In testimony whereof I have hereunto set my hand.

HERMANN STIER.

Witnesses:
T. SIMMONS,
WILL WOOD.