J. F. DORNFELD.

MALTING APPARATUS.

APPLICATION FILED FEB. 1, 1906.

944,127.

Patented Dec. 21, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

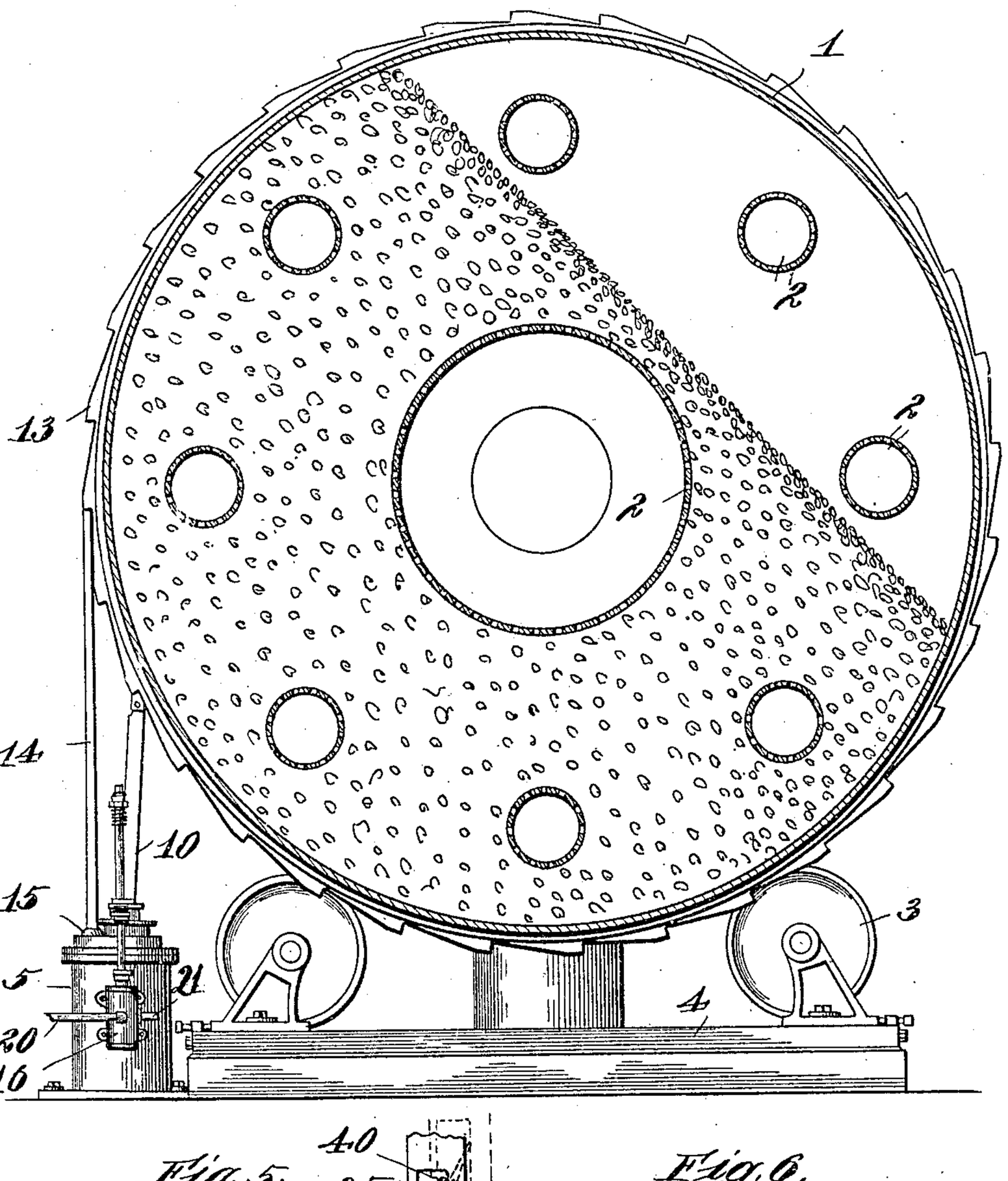


Fig. 5.

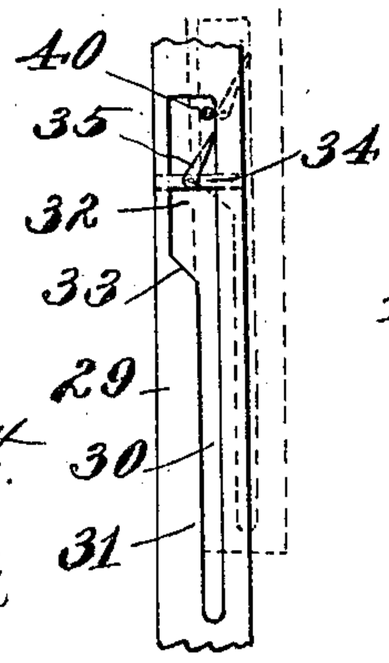
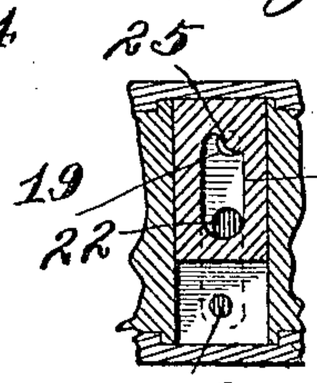


Fig. 6.



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2 SHEETS—SHEET 2.

Fig. 2.

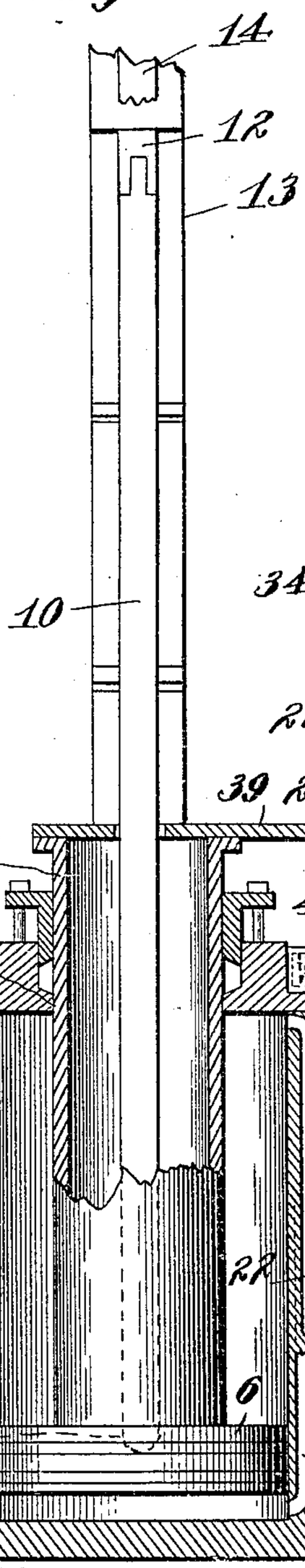


Fig. 3.

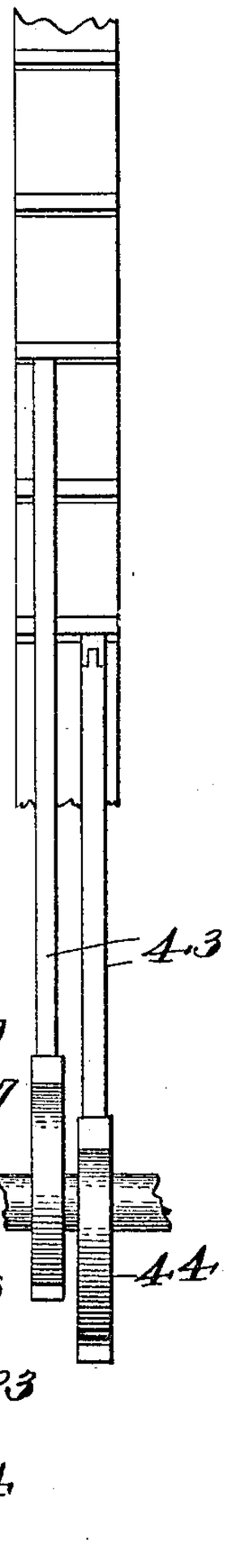
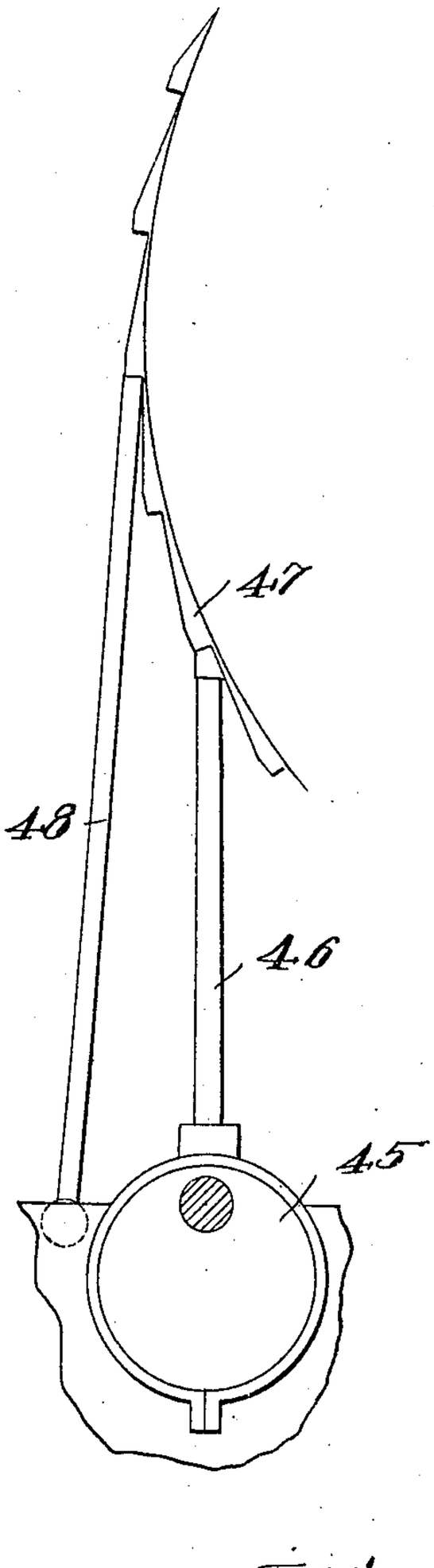


Fig. 4.



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MALTING APPARATUS.

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To all whom it may concern:

Be it known that I, JOHN F. DORNFELD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Malting Apparatus, of which the following is a specification.

This invention relates to the art of malting, and it refers particularly to that system of malting in which the grain is germinated or dried, or both, in rotatory drums. In this method of malting, the malt to be grown or dried is placed within a drum, filling the latter about three-fourths full, and the drum rotated to stir and turn the malt. When the drum is rotated the upper surface of the body of malt changes to a slope corresponding approximately to the natural angle of repose of the material, and during the course of a revolution all of the grain will be brought to the surface of said slope. If the drum be rotated continuously, the slope will become steeper and comparatively large masses of the grain will periodically break away at the upper end of the slope and roll to the lower end thereof. In such a movement of a large mass of grain the mass will not be thoroughly broken up, and the ventilation, moistening or drying, as the case may be, consequently will be more or less imperfect.

One of the objects of this invention is the production of means for stirring and turning a body of malt thoroughly throughout its mass. This object I accomplish, in the embodiment herein shown of my invention, by intermittently rotating the malting drum, permitting the drum to be at rest during a certain predetermined interval and under a comparatively rapid movement during the succeeding interval, whereby a small quantity of grain is loosened from the body of grain at the upper end of the slope at each movement of the drum, such loosened grain sliding or rolling down the slope in a comparatively thin sheet or layer.

Another object of the invention is the production of means for intermittently rotating a malting drum, adapted to permit of a perfect and convenient regulation of the speed of rotation. I have found that a hydraulic motor the piston rod of which is arranged to engage an annular rack upon the periphery of the drum, is particularly well adapted to attain this object.

Further objects of the invention will appear in the following description of the embodiment herein shown of said invention.

In the accompanying drawings, Figure 1 is a transverse vertical sectional view of a malting drum provided with a driving means embodying the features of my invention. Fig. 2 is a vertical central section through the hydraulic motor comprised in said driving means. Figs. 3 and 4 are views of two substitute forms of driving means. Figs. 5 and 6 are detail views of mechanisms comprised in the hydraulic motor above referred to.

The embodiment herein shown of my invention comprises a malting drum 1 containing a suitable arrangement of perforated tubes 2 through which tubes currents of air may be maintained for ventilating or drying the malt. Means may also be provided in said drum for spraying water upon the grain during the process of germination, but as such spraying means do not relate to the present invention, I have thought it unnecessary to illustrate them in the drawings. The drum 1 is rotatably supported in any suitable way, as upon rollers 3 mounted upon a base 4 and rolling in contact with annular rails (not shown) upon the periphery of the drum.

Various means may be used for intermittently rotating the drum 1. The rotating means shown in Figs. 1 and 2 comprises a cylinder 5 mounted in a vertical position beside the drum. The piston 6 for said cylinder has a tubular guide member 7 fixed rigidly to said piston and extending through an opening 8 in the upper head 9 of the cylinder. A piston rod 10 is pivotally attached to the piston 6 in any suitable way, as by means of a ball and socket joint 11, and said piston rod extends upwardly through the tubular guide member 7. At its upper end the piston rod 10 is provided with a pivoted bearing shoe 12 adapted to engage the teeth of an annular rack 13 secured upon the periphery of the drum 1. At each upward stroke of the piston the drum 1 is rotated through a distance equal to the length of one or more of said rack teeth, depending upon the relation between the size of said teeth and the stroke of said piston. As the bulk of the grain is in the ascending side of the drum, means must be provided for supporting the unbalanced weight of the load during the intervals between upward strokes of the piston. The

means herein shown for this purpose consists of a supporting arm 14 having a ball-and-socket connection 15 with the cylinder 5 at its lower end and extending upwardly into position to engage a tooth of the rack 13 upon the completion of an upward movement of the piston 6. In order that the arm 14 shall certainly engage a tooth at the proper time, it is desirable to rotate the drum a little past the point where said arm can drop beneath the proper tooth, but it will be obvious that the rearward rotation or settling of the drum must be slow and gentle on account of the great weight on one side of its center in order to avoid injurious shock to the mechanism. To this end I have so arranged the valve mechanism that the exhaust passage shall be somewhat constricted during the commencement of the downward movement of the piston, thus causing the piston to move slowly when beginning its downward stroke. This valve mechanism will be next described.

Upon one side of the cylinder 5 is mounted a valve chest 16, the cylindrical valve chamber 17 of which communicates with the upper end of the cylinder by means of the port 18, with the lower end of the cylinder through the port 19, with a suitable source of liquid under pressure through the inlet pipe 20, and with the exhaust pipe 21 through the central exhaust port 22. Preferably the pressure fluid used is a suitable non-freezing oil which is returned to the pressure pump through the exhaust pipe 21. Within the cylindrical chamber 17 of the valve chest 16 is slidably mounted a rotatable valve member 23 provided in one side with a recess 24 adapted to connect either of the cylinder ports 18 and 19 with the exhaust port 22. At its upper end the recess 24 is narrower than in the remainder of its length, providing a portion 25 for a purpose to appear hereinafter. To the valve member 23 is fixed an upwardly extending valve rod 26 carrying a bracket 27 adjustably movable longitudinally of said valve rod and secured in adjusted position by means of nuts 28. In the vertically extending portion 29 of said bracket is formed a cam slot 30 comprising a narrow and straight portion 31 and an enlarged upper portion 32, an inclined shoulder 33 being formed at the lower end of said enlarged portion. Upon an arm 34, fixed to the upper part of the bracket 27, is pivoted a switch tongue 35 which lies within the enlarged portion 32 of the cam slot 30, and the free end of which normally rests against one of the side walls of said slot. Two coiled springs 36 and 37 are adjustably fixed to and surround the valve rod 26, one at the upper end of said rod and the other at a distance below the first, the free ends of said springs extending toward each other. The springs 36 and 37 are fixed with relation to nuts 38 screw-threaded upon the valve rod 26, whereby an adjustment of their positions is made possible. A shifting arm 39 is fixed with relation to the piston 6, in this instance being attached to the guide member 7 of said piston, which shifting arm 39 has a forked outer end adapted to embrace the valve rod 26. Upon the shifting arm 39 is fixed a pin 40 lying within the cam slot 30. A detent means is provided for releasably holding the valve member 23 in its upper and lower positions, said detent means comprising a spring-pressed locking plunger 41 suitably supported upon the cylinder 5, the point of which plunger is adapted to enter either of two locking notches 42 in the valve rod 26.

Assuming the parts to be in the positions shown in Fig. 2, the operation of the drum-rotating means just described is as follows: Pressure fluid passes from the chamber 17 of the valve chest 16 through the port 19 into the lower end of the cylinder 5, and the pressure fluid theretofore admitted to the opposite end of the cylinder is free to exhaust through the port 18, the exhaust port 22 and the exhaust pipe 21. The upper end of the piston rod 10 lying against the annular rack 13 upon the drum 1, the drum is rotated upon the upward movement of the piston 6, which movement is continued a little beyond what is needed to permit the upper end of the supporting arm 14 to drop beneath a tooth of said rack. During the latter end of the upward movement of the piston the shifting arm 29 engages the spring 36 and compresses said spring until the force stored in the spring is sufficient to overcome that exerted by the detent plunger 41, when the spring 36 throws the valve member 23 to its upper position, in which position said valve member is locked by the detent plunger 41. Just before the spring 36 thus moved the valve member 23, the pin 40 moving with the shifting arm 39 entered the enlarged portion 32 of the cam slot 30 and passed above the switch tongue 35. The upward movement of the bracket 27 with the valve rod 26 and valve member 23 therefore brought said switch tongue into engagement with the pin 40, said switch tongue acting as a cam to impart a partial rotation to the valve member 23. The partial rotation thus given the valve member is sufficient to cause the portion 25 of said valve member to partially close the end of the port 19 through which an exhaust movement of the pressure liquid is beginning. Owing to the back pressure thus created, the downward stroke of the piston 6 will be slower than its up stroke until such time as the pin 40 strikes the inclined shoulder 33 and returns the valve member to its normal position, wherein the passage 19 is fully open. Thereafter the remainder of

the downward stroke of the piston is made at full speed. The mechanism is so adjusted that the drum shall settle into engagement with the upper end of the supporting arm 14 before or at the completion of the slow part of the downward stroke of the piston, thus preventing injurious shock or jar to the apparatus. The bracket 27 and springs 36 and 37 may be adjusted in position longitudinally of the valve rod 26 so as to vary the length of the stroke of the piston 6 and consequently the distance through which the drum 1 is rotated at each upward stroke.

In Fig. 3 is shown an arrangement of two driving rods 43 each actuated by a constantly rotated eccentric 44. The eccentrics 44 are set 180° apart, so that one of said driving rods shall be rotating the drum while the other driving rod is retreating.

Like the form of drive shown in Fig. 2, that represented in Fig. 4 is adapted to rotate the drum intermittently. Said last mentioned driving means comprises an eccentric 45 for reciprocating a pusher rod 46 arranged to engage the teeth of an annular rack 47 upon the drum. As in the first drive, the drum is rotated slightly more than is necessary to enable the supporting arm 48 to drop underneath a tooth. Being reciprocated by an eccentric, the pusher rod 46 moves more slowly at the extremities of its travel than at intermediate points, consequently the drum settles back slowly and without injurious shock into engagement with the supporting arm 48.

In operation, the free surface of the grain in the drum 1 assumes an inclined position, as shown in Fig. 1. In the rotation of the drum the body of grain will be rotated with the drum, and upon reaching the upper end of the inclined surface of the mass, the "crest" of the advancing body of grain periodically breaks away and falls to the lower end of the sloping surface of grain, said movement of the grain being assisted by each forward impulse imparted to the cylinder by the upward movement of the piston 6. The drum being intermittently rotated, a small quantity of the grain is thus spilled over at each partial rotation of the drum, and slides down to the foot of the slope in a layer, whereby more thorough stirring and mixing up of the kernels is obtained than when large masses or lumps of matted grain are spilled over at longer intervals.

The intermittent rotation of the drum, unless excessively slow, necessarily results in some shock to the mass of grain in said drum, either at the beginning or the end of each partial rotation. Such shocks tend to cause a more frequent movement of the grain upon the free surface of the mass than would otherwise occur.

I claim as my invention:

1. In a malting apparatus, in combination, a rotatory drum; means for intermittently rotating said drum through a partial revolution, adapted to permit of a slow partial return movement of the drum; and means for supporting the unbalanced weight of the drum and its load during the intervals between rotations.

2. In a malting apparatus, in combination, a rotatory drum; an annular rack on said drum; a motor having a piston rod adapted to engage the teeth of said rack for rotating said drum; and a supporting member adapted to limit the back motion of said drum.

3. The combination with a malting receptacle, of means for imparting a progressive movement to said receptacle and to permit a slight return movement thereof, one of said movements being relatively slow at the beginning and speedier toward the end of the movement.

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