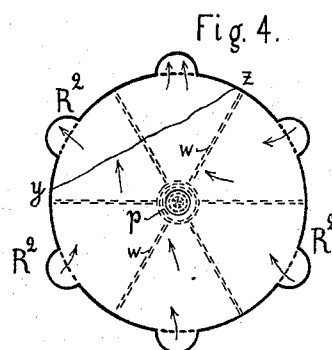
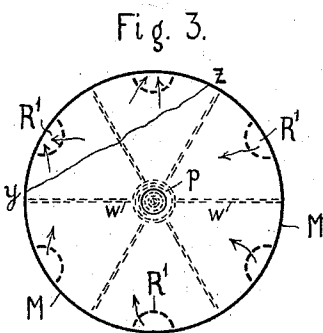
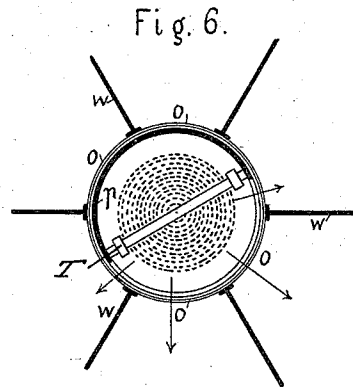
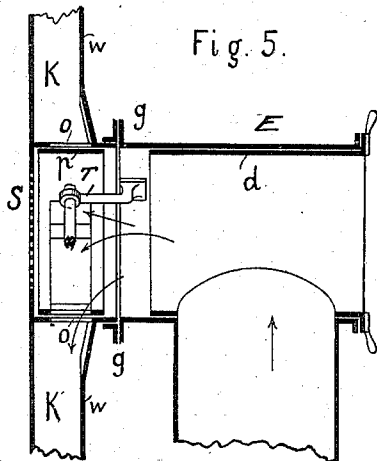
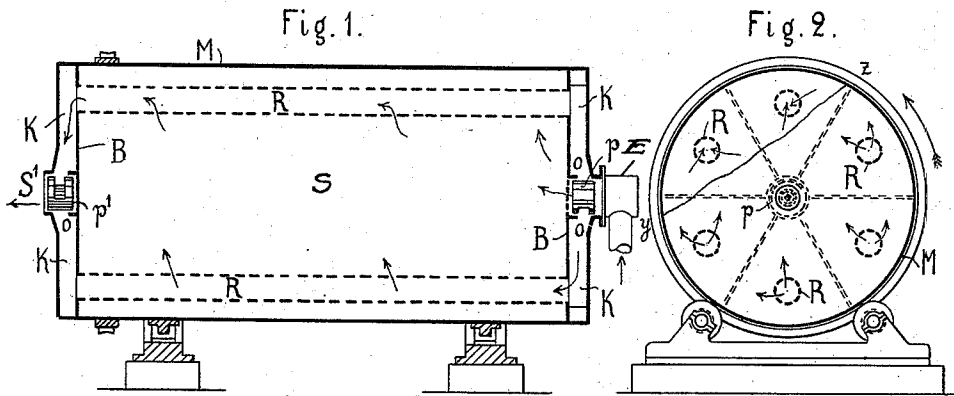


(No Model.)

F. KNÜTTEL.  
PNEUMATIC MALTING APPARATUS.

No. 470,580.

Patented Mar. 8, 1892.



Witnesses:  
*Ewell A. Erick*  
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Inventor  
*Friedrich Knüttel*  
by *Mercellus Daily*  
his attorney.

# UNITED STATES PATENT OFFICE.

FRIEDRICH KNÜTTEL, OF CHARLOTTENBURG, GERMANY.

## PNEUMATIC MALTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 470,580, dated March 8, 1892.

Application filed August 18, 1891. Serial No. 403,026. (No model.)

*To all whom it may concern:*

Be it known that I, FRIEDRICH KNÜTTEL, a subject of the King of Prussia, residing at Charlottenburg, near Berlin, Kingdom of Prussia, German Empire, have invented new and useful Improvements in Pneumatic Malting Apparatus, of which the following is a specification.

This invention relates to pneumatic malting apparatus or drums in which grain is caused to germinate, with a view to its conversion into malt, by exposure to the action of moist and moderately-warm air which is caused to pass through the mass of grain and in which the malt is subsequently withered and dried by means of dry air of appropriate temperature, the mass of grain being at the same time continually turned over or stirred by imparting to the drum a slow continuous or intermittent rotary motion.

By means of the improvements hereinafter described a uniform distribution of the air throughout the contents of the drum is obtained in the germinating as well as in the withering and drying processes by providing the drum with a combination of passages and means for controlling the supply and escape of air to and from the grain or malt in such a manner as to cause the air to pass through the materials in every direction and in a uniform manner, as hereinafter explained.

In order that the said invention may be fully understood, I will now proceed more particularly to describe the same, and for that purpose shall refer to the several figures on the annexed sheet of drawings, the same letters of reference indicating corresponding parts in all the figures.

Figures 1 and 2 of the accompanying drawings represent a rotary malting-drum arranged according to this invention in longitudinal and transverse sections, respectively, and Figs. 5 and 6 represent details of construction drawn to a larger scale. Figs. 3 and 4 illustrate a modified form of the ventilating-passages hereinafter described.

The drum consists of a cylindrical casing M, provided at each extremity with an internal division-plate B. The chambers or spaces K, formed between these plates and the ends of the casing, are connected near the circumference by a number of ventilating tubes or

passages R of suitable shape and form in section, being cylindrical, for example, in the arrangement illustrated in Fig. 2. These ventilating-tubes are constructed of finely-perforated sheet metal, or they may be composed of finely-woven wire fabric, such as is employed in the manufacture of sieves. The spaces or chambers K at the ends of the drum communicate with central cylindrical tubular connections S and S', Fig. 1, and are divided by radial partitions *w* into as many compartments as there are connecting-tubes R. These compartments of the chambers K communicate with the connections S S' through openings *o* and constitute connections between the tubes R and the said tubular unions. The arrangement of the openings corresponding with the tubes R and communicating with the tubular union or connection S, for example, is represented drawn to a larger scale in vertical longitudinal section in Fig. 5 and in transverse section in Fig. 6. These tubular connections, which rotate with the drum, are connected by means of suitable glands or stuffing-boxes with elbow-pipes, (the elbow-pipe corresponding to the connection S being represented at E in Fig. 5,) through which air in the condition suitable for the treatment of the contents of the drum, as hereinbefore specified, is passed into the apparatus or allowed to escape therefrom, the said elbow-pipes being provided for this purpose with rotary slides or valves *d*, working in the horizontal part, or with other suitable regulating or controlling devices enabling the amount of air passing through the apparatus to be regulated or shut off, if required.

The air inlet and outlet connections S S' are provided internally with closely-fitting cylinders *p p'*, likewise provided with openings, but so arranged as to close or cover a certain number of the openings *o* and leave the others uncovered or open. These cylinders *p* and *p'* act as distribution-valves and are retained in the required positions by any suitable means—such as attachment to the stationary elbow-pipe E, Fig. 5, by means of support T—so that when the drum is rotated (being supported upon rollers or suitable trunnions and receiving motion from any suitable mechanical arrangement) the openings in the side of the tubular connection S, as well as

those in the connection  $S'$ , are successively caused to coincide alternately with the closed and with the open part of the stationary cylinders or distributors  $p p'$ , and thus alternately open and close the communications with the compartments or passages in the chambers K.

Now when the surface of the grain or malt contained in the cylinder is tilted up in the direction of the line  $y z$ , Fig. 2, by the rotary motion of the drum the uppermost of the ventilating-tubes R are entirely uncovered, being situated in the upper or empty space in the drum, while others of the said tubes are completely buried underneath the grain. The supply-distributor  $p$  is so arranged relatively to the air-passages that it closes those of the openings  $o$  which communicate with the tubes in the upper or empty part of the drum, but allows air to pass through those of the openings  $o$  that communicate with the tubes that are buried under the grain or malt. The openings  $o$  which correspond with the tubes R that are below the surface of the malt are partly or wholly uncovered by the valves, which regulate the areas of the openings in accordance with the position of the corresponding ventilating-tubes. The distributor or slide  $p'$  at the opposite end of the drum is inversely arranged, so that at this end the orifices  $o$  corresponding with the ends of the tubes R that are covered by the malt are closed and the orifices communicating with the tubes above the malt are fully open to the tubular union  $S'$ . Under these conditions when air is supplied to the drum by being exhausted from the tube  $S'$  or forced into the tube S, for example, this air is compelled, owing to the arrangement and action of the distributing-slides  $p$  and  $p'$ , hereinbefore described, to pass through the drum and through the malt in the direction indicated by the arrows in the drawings. By these means it is evident that the current of air is caused to flow in all possible directions through the body of grain. The action is similar when the general direction of the current is reversed by admitting or forcing in the air at  $S'$  and discharging or exhausting it at S.

In the arrangement illustrated in the drawings the orifices  $o$  in the connection S which for the time are connected with the tubes R occupying the lowest positions underneath

the malt are completely open, and therefore allow the greatest amount of air to pass to these undermost ventilating-tubes in accordance with the thickness of the superincumbent layer of malt through which the air is required to pass. On the other hand, the ventilating-tubes that for the time are situated at intermediate levels between the upper and lower parts of the drum and are covered by a thinner layer of malt are supplied through the partly-closed orifices  $o$  with a correspondingly-diminished volume of air, this being a condition of the utmost importance for obtaining a product of uniform quality in all the germinating, withering, and drying processes which are performed in the drum.

The ventilating-tubes, which are represented in Fig. 2 as being of circular form in transverse section, may evidently be of any other suitable shape, if desired—such, for example, as the semicircular or trough-shaped passages represented in Figs. 3 and 4. In place of the chamber K, with compartments connecting tubes or passages of any other convenient form may be employed to connect the ventilating tubes or passages R (or  $R'$  or  $R^2$ , Figs. 3 and 4,) with the openings  $o$  in the supply-passages S and  $S'$  without affecting the action of the apparatus.

What I claim, and desire to secure by Letters Patent of the United States, is—

A rotating malt-drum having at each end a series of compartments K, each of which at one end is connected to its corresponding compartment at the other end by a perforated tube or channel R, in combination with air-distributing devices  $p p'$ , inversely arranged with regard to each other in the ends at the inlet and outlet and establishing communication between these and one or more of the compartments of their respective ends consecutively, and means for producing a current of air, in the manner and for the purpose substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FRIEDRICH KNÜTTEL.

Witnesses:

RUDOLF REUTER,  
EMIL GERHARDT.