

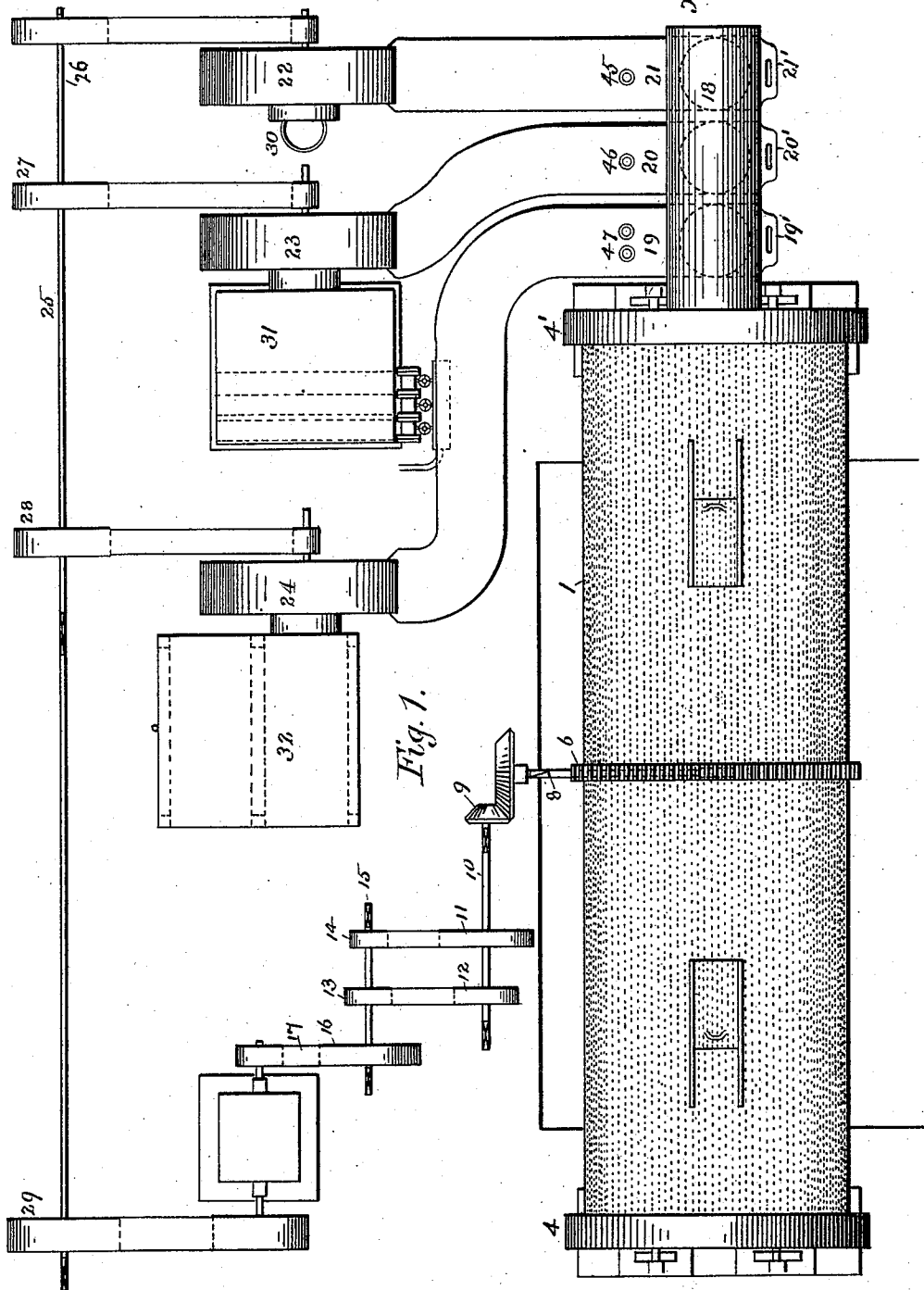
(No Model.)

4 Sheets—Sheet 1.

J. A. TILDEN.
MALTING MACHINE.

No. 576,631.

Patented Feb. 9, 1897.



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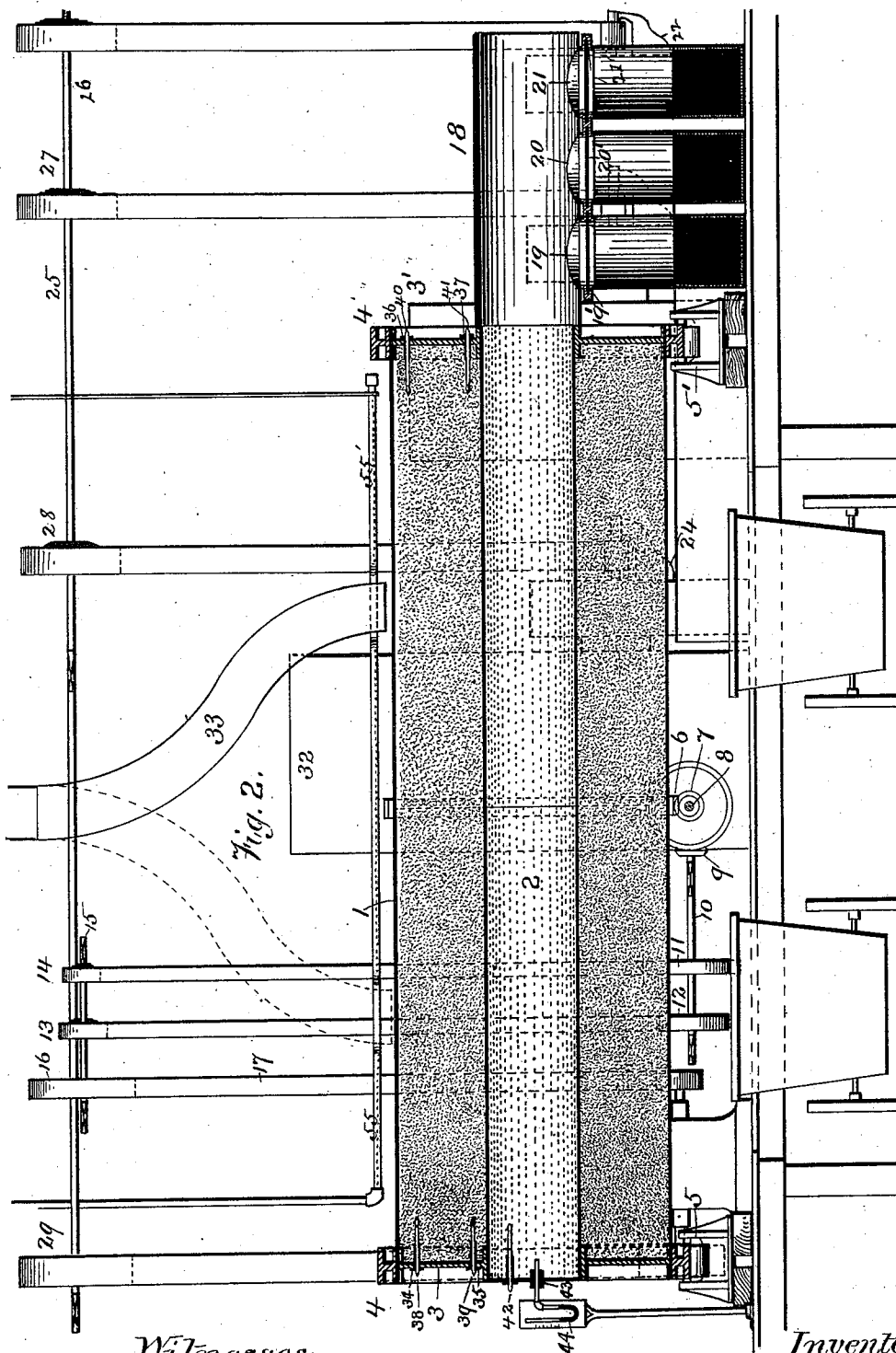
(No Model.)

4 Sheets—Sheet 2.

J. A. TILDEN.
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No. 576,631.

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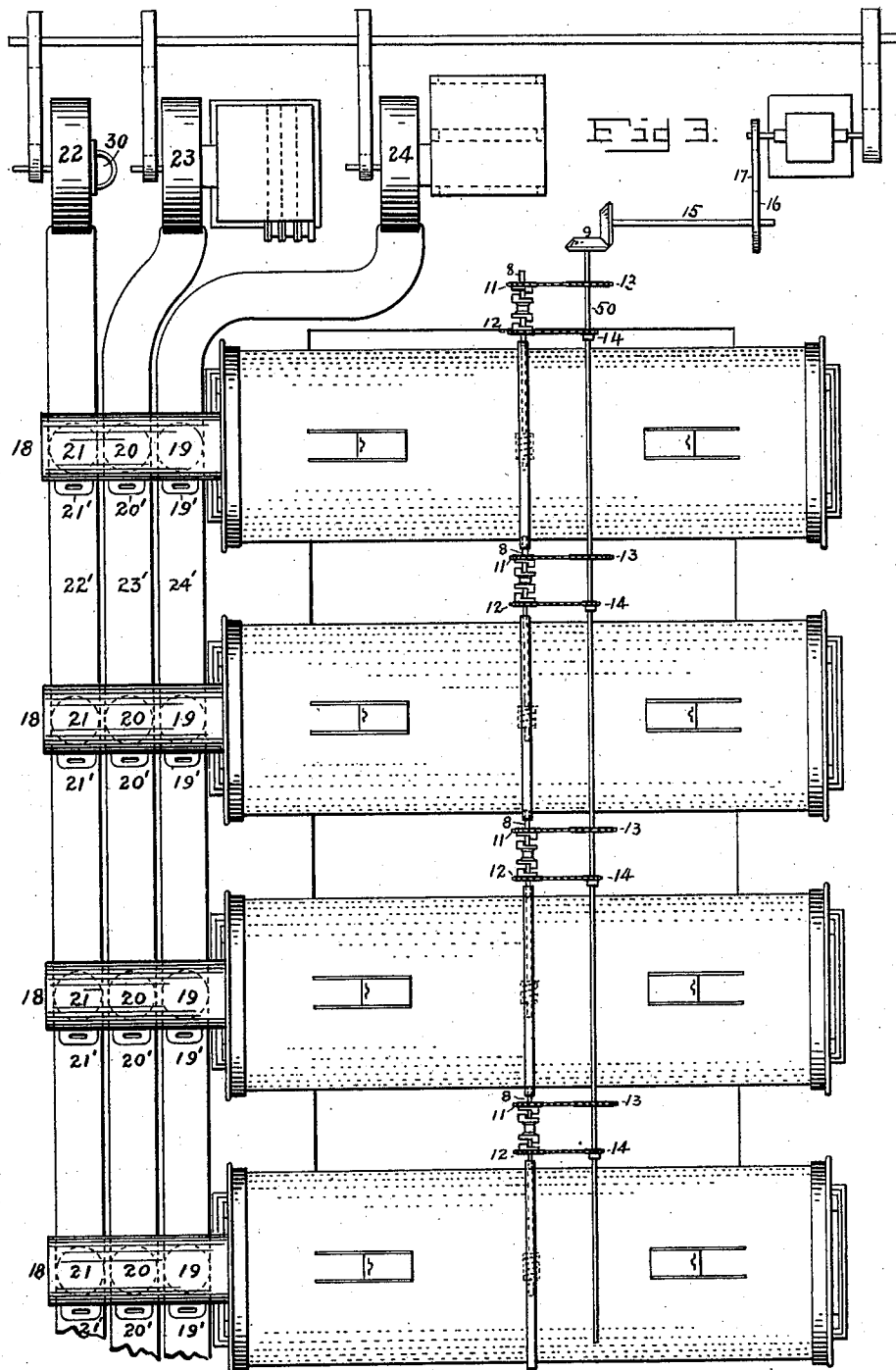
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4 Sheets—Sheet 3.

J. A. TILDEN.
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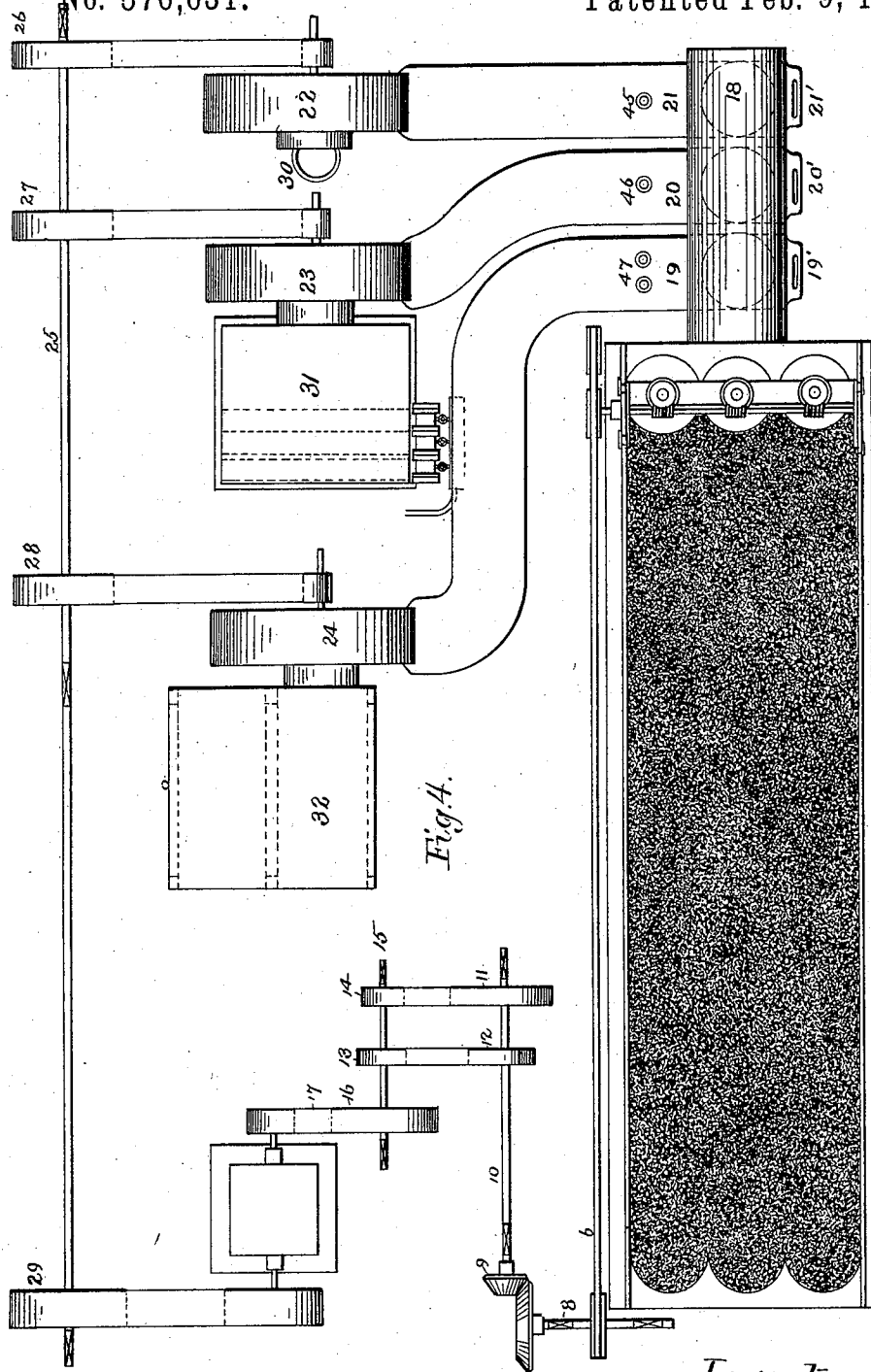
(No Model.)

4 Sheets—Sheet 4.

J. A. TILDEN.
MALTING MACHINE.

No. 576,631.

Patented Feb. 9, 1897.



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UNITED STATES PATENT OFFICE.

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MALTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 576,631, dated February 9, 1897.

Application filed July 3, 1893. Serial No. 479,546. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. TILDEN, a citizen of the United States, and a resident of Hyde Park, in the county of Norfolk and Commonwealth of Massachusetts, have invented a new and useful Improvement in Pneumatic Malting Machinery, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

My invention relates to malting-machines, and more especially to such machines adapted to operate under what is generally known as the "pneumatic" system; and it has for its object to improve the construction and arrangement of such machinery, whereby such system may be more easily, readily, and thoroughly carried out; and to these ends my invention consists in the various features of construction and arrangement of parts substantially as hereinafter more particularly set forth.

Referring to the drawings, Figure 1 represents a general view in plan of one of a series of pneumatic malting-receptacles and its appurtenances. Fig. 2 is a sectional view of the same, taken on the line *x x*. Fig. 3 represents a general view in plan of a series of pneumatic malting-receptacles and their appurtenances. Fig. 4 represents a general plan view of one of a series of pneumatic malting-receptacles of a form modified from that shown in Fig. 3.

Similar numerals refer to similar parts in the several drawings.

Referring to Fig. 1, 1 is a pneumatic malting-receptacle of the drum variety. It is made of perforated metal, preferably from five to seven feet in diameter and about twenty feet in length. This drum has arranged centrally within it a cylinder 2, Fig. 2, of about one-third the diameter of the outer drum, made of a similar perforated metal. They are secured one to the other by means of spiders 3 3' at opposite ends, a perforated plate being secured to said spiders, so that the internal space between the outer drum and inner cylinder forms a complete chamber surrounded by foraminous walls. Rings 4 4' are secured on the outside drum at the extreme

ends, and the whole is mounted on carriages 5 5', provided with wheels, by means of which the whole apparatus can be rotated with as little friction as possible.

A gear-ring 6 is secured to the outside of the drum and a worm 7 is located to engage with the gear, said worm being governed by means of an agitating counter-shaft 8, upon which is mounted a bevel-gear, which in turn meshes with a bevel-gear 9 on a shaft 10. This shaft 10 is provided with two pulleys 11 12 of different diameters, each connected by means of belts with corresponding pulleys of different diameters 13 14 upon a shaft 15, each of which is a clutch-pulley arranged so that either one or the other may be made to engage with the shaft 15 to be driven by it. These are clutch-pulleys of any pattern which may be found upon the market. This shaft 15 has also a pulley 16, which is connected by means of a belt 17 to a corresponding pulley mounted upon an engine or other main motor, (better shown in Fig. 1,) so that when the engine is moving at a regular speed the drum can be rotated at different speeds by throwing one or the other of the clutch-pulleys into engagement.

Upon one end of the drum is a head 18, which is made to fit over the end of the central cylinder, so that a good joint is formed in such a manner that the drum may be turned while the pipe is stationary. Into this head are led ducts 19 20 21, which lead, respectively, to fans 22 23 24 through main conduits 22' 23' 24', all of which are connected by driving belts and pulleys 26 27 28 upon the shaft 25, the various pulleys being of the clutch pattern, so that the fans can be brought into operation as desired. Another pulley 29 is connected by means of a belt with a corresponding driving-pulley upon the engine or other main motor. The ducts 19 20 21 are provided with dampers 19' 20' 21', located at their juncture with the head 18, so that either one or all of them may be closed or opened, as desired. One of the fans 22 is arranged to take the ordinary atmosphere from the room and is provided with a furnace 30 near the suction-pipe, in which sulfuric-acid gas or other bleaching agent may be produced. The second fan 23 is connected with a steam-

heater 31, consisting of a nest of pipes inclosed on all but one side, so that the air may be drawn through the pipes and directed into the machine at a high temperature. This heater is of the ordinary commercial pattern and needs no further description. The third fan 24 is connected with a moistening device 32, which will be more fully described later. This is arranged to deliver to the machine air saturated with moisture.

The drum 1 is provided with apertures having covers arranged so that they can be readily opened. A chute 34 is suspended above the machine, so arranged that the grain can be directed through the apertures to the interior of the machine.

On both ends of the machine I arrange tubes 34, 35, 36, and 37, into which I insert thermometers 38, 39, 40, and 41, so that their ends will be submerged in the grain, and by which the temperature of the grain may be determined at each end of the machine and also near the outside and inside of the drum. I also arrange in a similar manner a thermometer 42 in the end of the internal cylinder to determine the temperature of the air which is about to pass through the grain. At the end of the internal cylinder at 43 I arrange a pressure-indicator 44, by means of which I may determine the pressure of air in the interior of the cylinder. I also arrange at each of the conduits 22' 23' 24' thermometers, as indicated at 45, 46, and 47, that at 47 to be a wet-and-dry bulb arranged to show the temperature and humidity of the atmosphere which is passing through it.

Referring now to Fig. 3 to illustrate more clearly what is meant by a series of pneumatic malting-receptacles, I have shown four such receptacles, each of which is connected with the same main motor, the same moist-air conduit, the same hot-air conduit, and the same atmospheric-air conduit. I have shown the said conduits and the main shaft as being broken off to indicate that this arrangement can be continued indefinitely within reasonably practicable limits. In this arrangement, as in Fig. 1, the main motor communicates, by means of the belt 17 and pulley 16, its motion to the shaft 15. The motion of this shaft is communicated to a main shaft 50, which runs transversely to the malting-receptacles, by means of bevel-gearing 9, and the motion of this main shaft is communicated to the agitating counter-shafts 8 by means of the pulleys 11 and 12, driven by pulleys 13 and 14 on the main shaft 50. In this way the rate of agitation of the grain in each malting-receptacle may be varied in relation to the main motor as required, the variation of speed being due to the fact that pulleys 13 and 14 are of different diameter. This figure also shows how the malting-receptacles are individually connected with the main atmospheric-air conduit 22', the main hot-air conduit 23', and the main moist-air conduit 24' by means of the ducts 21, 20, and 19, respectively, (indicated

by the circular dotted lines under the heads 18.) It also shows the atmospheric-air fan 22, the hot-air fan 23, the moist-air fan 24, connecting with their respective conduits, and the dampers 21', 20', and 19', which control the communication between the heads 18 and their respective main conduits. By means of the fan 22 and the furnace 30 a bleaching agent is supplied to each malting-receptacle in the series, as required by the condition of the grain. Thus, although the malting-receptacles are arranged in a series, each individual receptacle may be started or stopped or rotated at a fast or a slow speed entirely independent of the other receptacles, and likewise hot air, moist air, atmospheric air, or a bleaching-gas may be supplied to each individual receptacle regardless of what is supplied to the other receptacles in the series.

Having thus described the apparatus and its arrangement, the operation to carry out the process of malting as set forth in my previous patent is followed out in this manner: I introduce the grain into the annular space between the interior and exterior cylinders by means of the chute, not wholly filling the space, but so that the upper surface of the grain will stand on an incline, so that as the drum revolves the grains will successively fall and turn over and change their relative position as they arrive at the highest position in the drum, and in the continuous rotation of the drum the grain will be intermittently agitated once during each revolution of the drum. Having loaded the machine as described, I allow a shower of water to fall upon the drum, which will percolate through the perforations of the cylinder and saturate the grain. In order that the water may thoroughly permeate all portions of the mass of grain, I rotate the cylinder occasionally during this stage of the process. The water admitted to the grain at this stage should be of a temperature of from 50° to 60° Fahrenheit. The grain should be kept under this treatment for a period of two or three days, or until it has absorbed sufficient moisture to produce germination. At the end of this time the water is shut off from the pipe and the mass of grain is allowed to drain thoroughly. This stage corresponds to what is known as "steeping." The apparatus is then allowed to stand still and the mass of grain will in a very short time begin to heat spontaneously. This should continue for about a half-day or a day, until the temperature has reached 62° Fahrenheit, which can easily be determined by the thermometers 38, 39, 40, and 41. At this time the machine should be rotated by throwing in the clutch-pulley 13, which will cause it to rotate about once in thirty minutes. At the same time the damper 19' should be opened, the other two being closed. This allows the moist air to be drawn from the moistener and directed by means of the fan 24 to the machine, the air being delivered into the machine at practically full

saturation and at a temperature of about 62° Fahrenheit, which is determined by referring to the wet-and-dry thermometer 47 for the humidity and the temperature, Fig. 7. This should be continued for from three to five days, or until the rootlets have attained their proper growth, which is easily determined by examination of the grain to determine the growth of the acrospire. At this point the moist-air damper is closed and the damper 21' opened, thereby shutting away from the machine the moist air and admitting in its place air through the fan 22, which is non-saturated air taken directly from the room at ordinary atmospheric temperature, causing the rootlets to shrivel up and become detached. During this process or before the moisture is wholly expelled the grain is bleached by placing in the furnace 30 a sufficient amount of sulfur and salt or other bleaching agent to produce fumes, which are drawn with the air into the fan and forced through the mass of grain.

To accomplish the final stage in the process, the grain is agitated more rapidly than in the previous stages by disengaging the clutch-pulley 13 and throwing into action the pulley 14, which will cause the drum to rotate more rapidly—about once in ten minutes. To supply the heat at variable temperatures, as required in this stage of the process, I arrange a heater in sections, as shown at 31', Fig. 7, that is, there are several sets of pipes arranged so that steam can be admitted to one, two, three, or more of the sections, as required, thereby gradually increasing the temperature of the air from the non-saturated air at ordinary atmospheric temperatures to dry hot air at a temperature of 220° Fahrenheit. In case, however, that a bank of machines are being used and that it is desired to supply a gradually-increasing hot air to one or more of the machines at a time, I can obtain the variable temperature in the following manner: Instead of providing the sectional heater the pipes may be arranged in one group of sufficient heating area to supply the requisite amount of heated air at 220°, and I may vary the temperature by opening the damper which admits the hot air to the machine gradually, and at the same time closing the damper which supplies the non-saturated air at ordinary atmospheric conditions gradually. In this way the air at ordinary atmospheric conditions as it enters the machine is gradually increased in temperature by means of the incoming hot air until such time as the damper admitting the air at ordinary conditions is closed off and there is a continuous supply of hot air.

I am aware that perforated drums of substantially the construction described have been used for malting grain, also that moistening and heating devices have been combined therewith to obtain atmospheric conditions for malting grains, and I do not claim such; but the organization of apparatus as

set forth, by which the varying speeds of the drum may be attained and the various atmospheric conditions effected in an integral machine, by which a complete process or certain stages of a process can be completed by varying the conditions step by step without removal of the grain from the machine, forms the novel feature of my invention.

It will be readily seen by the foregoing that I am enabled by this apparatus to take the grain into the machine and subject it to all the variable conditions by which the several stages are perfected from beginning to end, or I may take the grain in certain advanced stages and complete the process in my apparatus without removal of the grain from the machine after it has once been started. For instance, I may take the grain after it has been steeped and carry out the remaining stages of the process to completion, or I may take the grain after it has been steeped and couched and finish the more important steps, producing a finished malt ready for the market.

So far as the pneumatic malting-receptacle is concerned, the rotary or drum form herein described and shown is my preferable construction. The same arrangement and organization, however, can be attained in connection with other forms of receptacles, as is shown in Fig. 7, the receptacle in this instance being a vat provided with a perforated bottom and a chamber into which the variable temperatures and atmospheres are conducted, so that they may be distributed to the grain, said receptacle being provided with a series of traveling agitators for intermittently agitating the grain. The same effect is produced, so far as the agitation of the grain is concerned, the variable speeds at which it can be agitated, and the introduction of the variable atmospheres in this vat, as in a rotary receptacle, as previously described. I do not therefore confine myself to any particular form of receptacle for the grain, as I may apply all the apparatus described in connection with various forms of receptacles, so that my process can be carried out successfully.

It is obvious that the air may be drawn through a receptacle by placing the latter between an exhaust-fan and the ducts, which are provided with dampers. In this event it is necessary to provide a jacket or covering to the machine, a method already known in the state of the art. It is therefore the spirit of my invention to include such a receptacle as may be placed between the exhaust-fan and the various air-supplying ducts by which the requisite kinds of atmospheres may be led into the receptacle and perform their work upon the contents, the regulation being controlled by means of the dampers. In other words, my invention is not confined in any sense to the particular form of pneumatic malting-receptacle. My only requirements are that it shall be one adapted to receive divers kinds of air, as above described, and one

in which the grain can be agitated at various speeds, as required.

Having thus fully set forth the nature of my apparatus, what I desire to claim and secure by Letters Patent is—

1. The combination with a series of pneumatic malting-receptacles of means whereby the rate of agitation of the grain in each receptacle may be varied in relation to the main motor, as required in the different stages of the process of malting.

2. The combination with a series of pneumatic malting-receptacles of a main motor, an agitating counter-shaft for each receptacle, and graduated pulleys communicating a relative change of speed between the main motor and each counter-shaft.

3. The combination with a series of pneumatic malting-receptacles of a main moist-air conduit, a main hot-air conduit, a main atmospheric-air conduit, and ducts connecting said main moist, hot, and atmospheric air conduits with each receptacle.

4. The combination with a series of pneumatic malting-receptacles of a main moist-air conduit, a main hot-air conduit, a main atmospheric-air conduit, a fan adapted to force air into each of said conduits, and ducts connecting said main moist, hot, and atmospheric air conduits with each receptacle.

5. The combination with a series of pneumatic malting-receptacles of a main moist-air

conduit, a main hot-air conduit, a main atmospheric-air conduit, and ducts provided with dampers connecting said main moist, hot, and atmospheric air conduits with each receptacle, whereby the proper atmospheric conditions may be supplied to the grain in each receptacle, as required in the various stages in the process of malting.

6. The combination with a series of pneumatic malting-receptacles of means whereby the rate of agitation of the grain may be varied in each receptacle in relation to the main motor, a main moist-air conduit, a main hot-air conduit, a main atmospheric-air conduit, and ducts connecting said main moist, hot, and atmospheric air conduits with each receptacle, whereby the proper atmospheric conditions may be supplied and the rate of agitation of the grain be varied in each receptacle, as required in the process of malting.

7. The combination with a series of pneumatic malting-receptacles of a fan, a conduit connecting said fan with each receptacle, and a furnace for producing a bleaching agent, said malting-receptacles, conduits, fan and furnace being so combined that the bleaching agent shall be caused to pass through the grain in each receptacle as required.

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