(No Model.) 4 Sheets—Sheet 1.

C. G. BOSCH.

MALTING MACHINE.

No. 546,994. Patented Oct. 1, 1895.

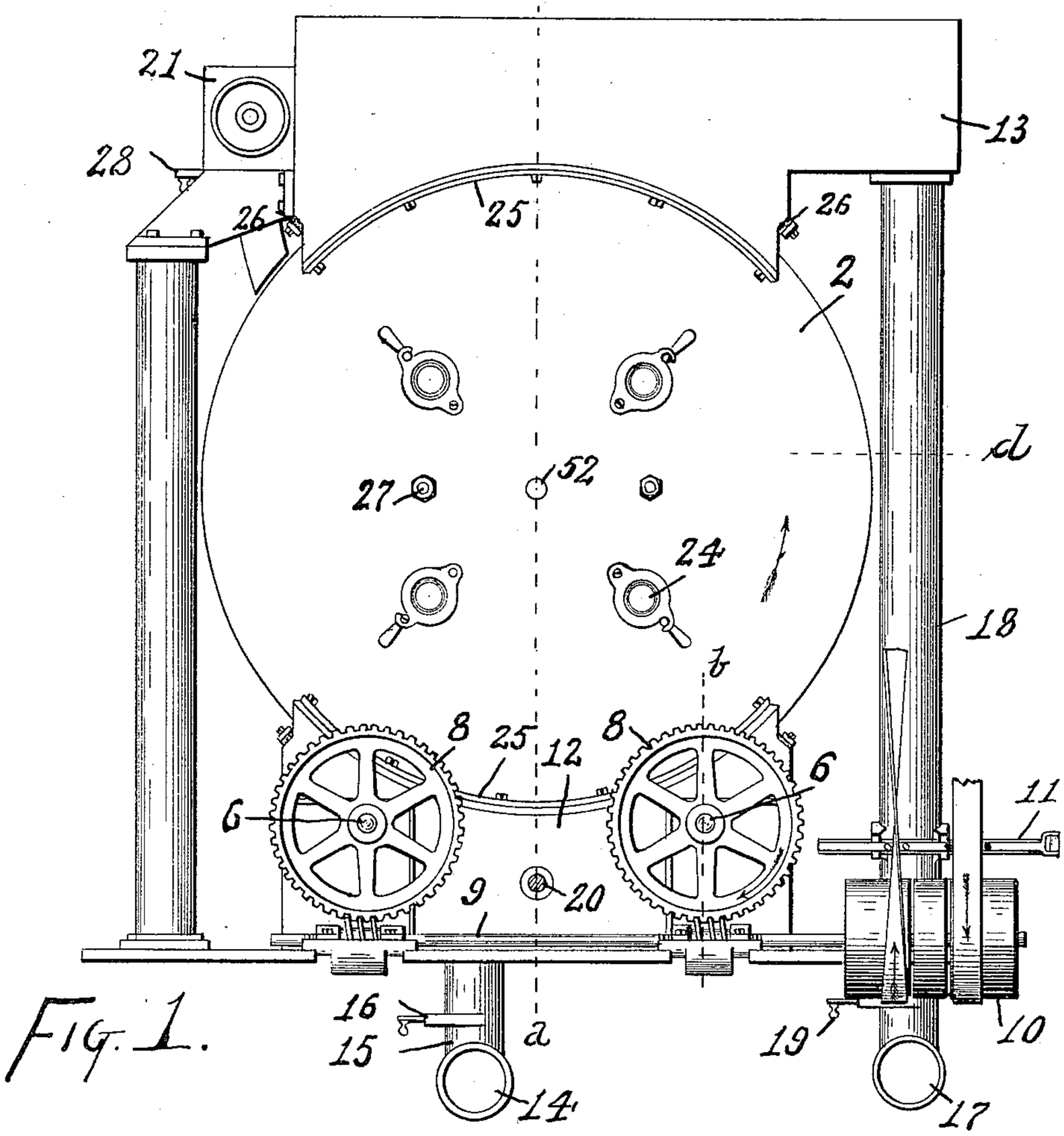

FIG. 1.

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C. M. Shipley.

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(No Model.) 4 Sheets—Sheet 2.

C. G. BOSCH.

MALTING MACHINE.

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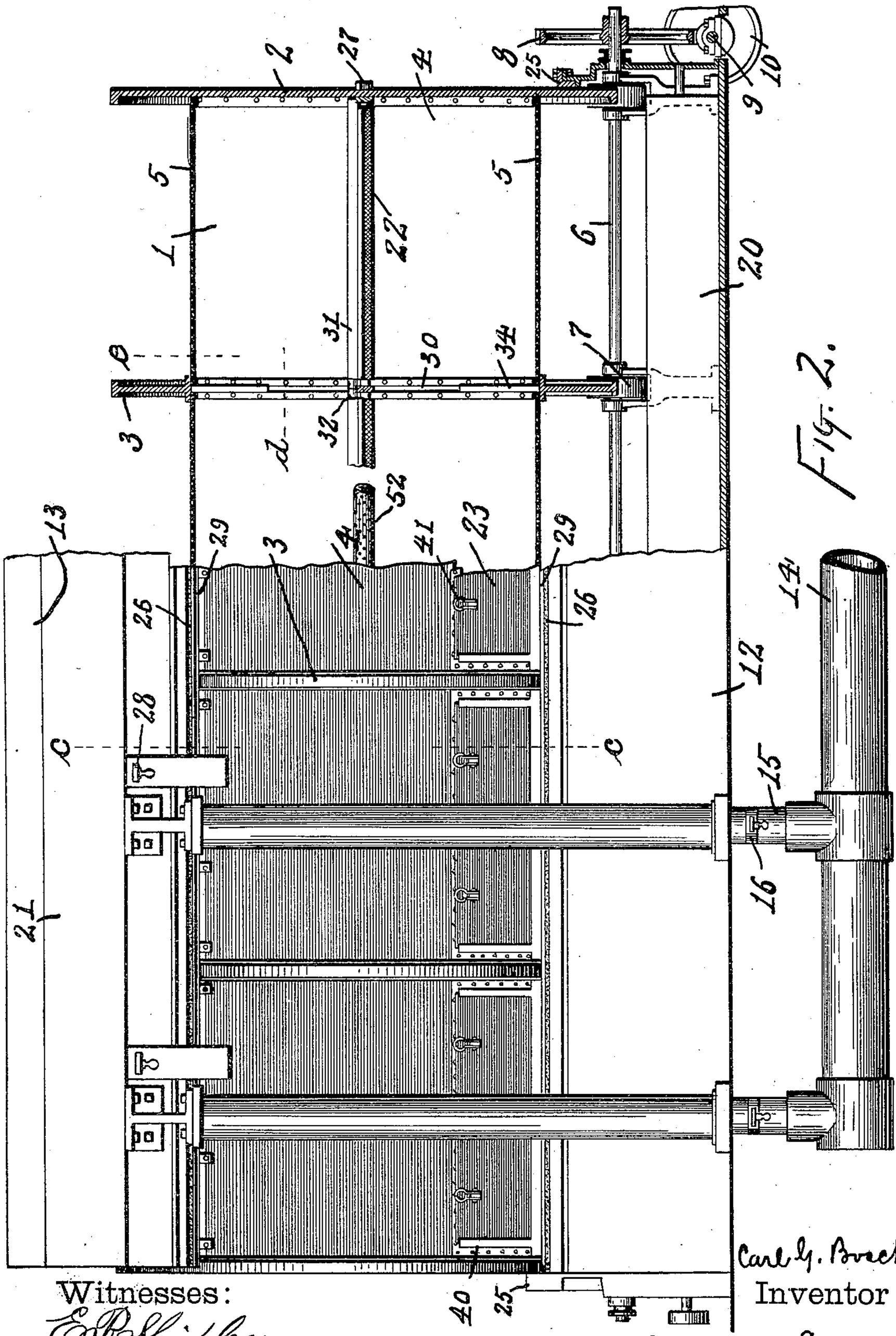

Fig. 2.

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4 Sheets—Sheet 3.

C. G. BOSCH.

MALTING MACHINE.

No. 546,994. Patented Oct. 1, 1895.

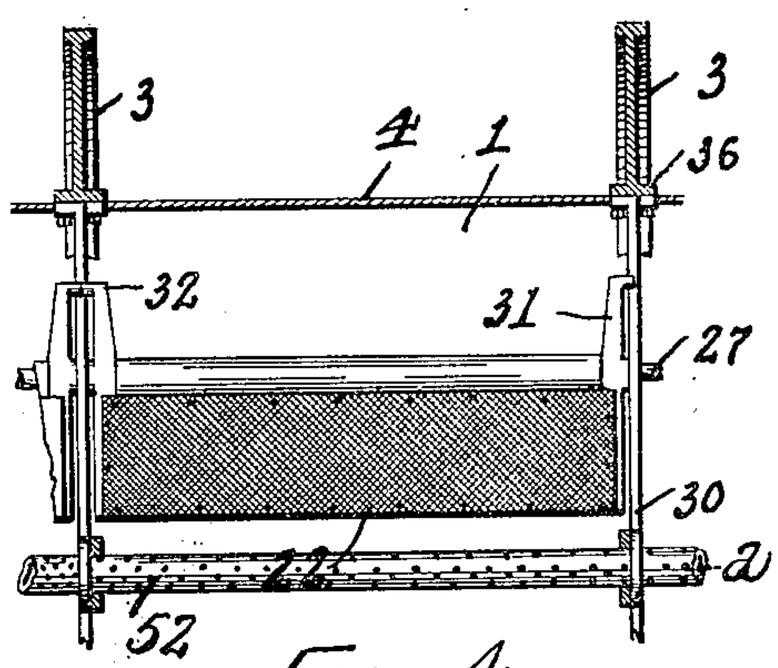

Fig. 4.

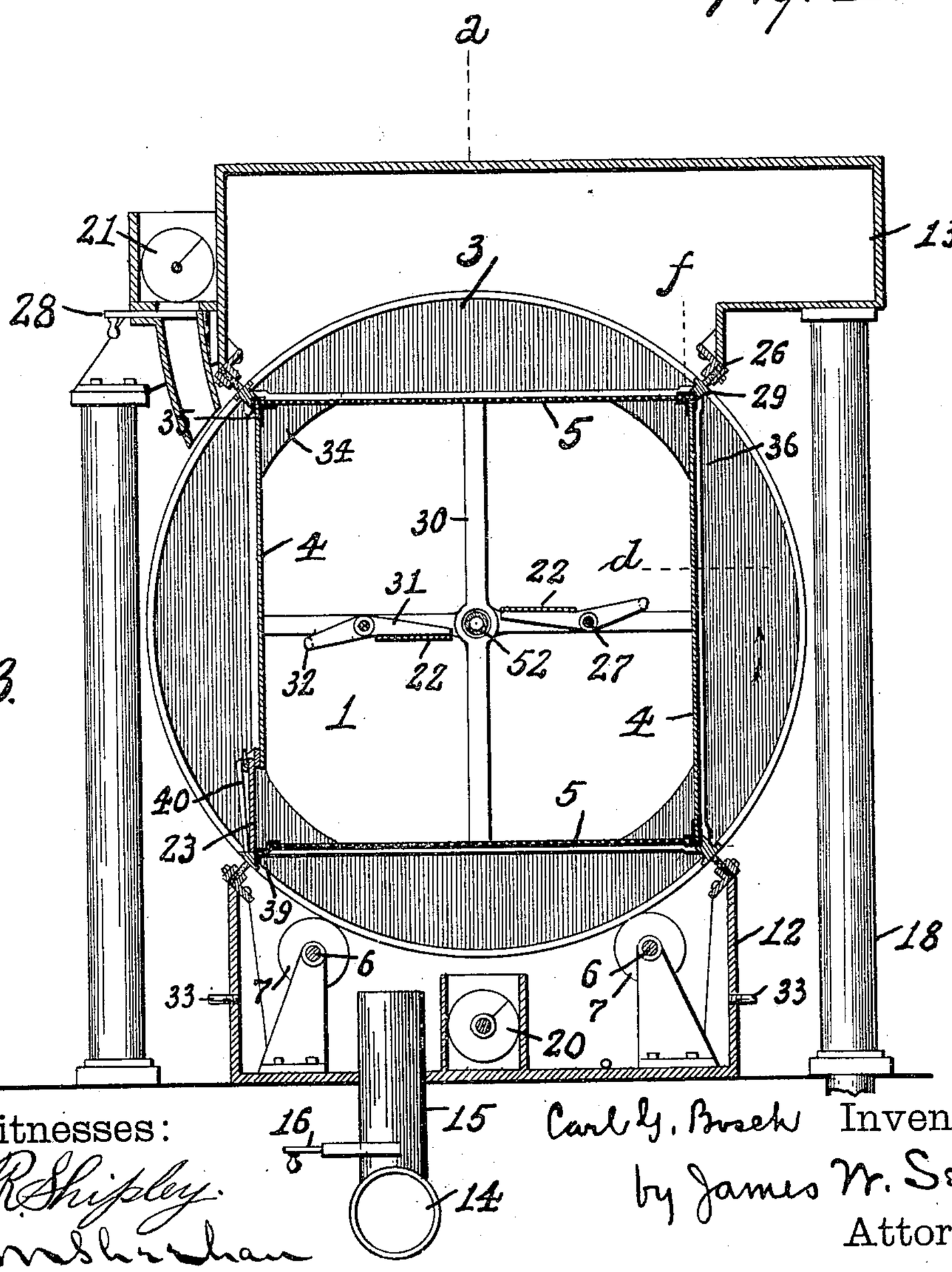

Fig. 3.

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(No Model.) 4 Sheets—Sheet 4.

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MALTING MACHINE.

No. 546,994. Patented Oct. 1, 1895.

FIG. 6.

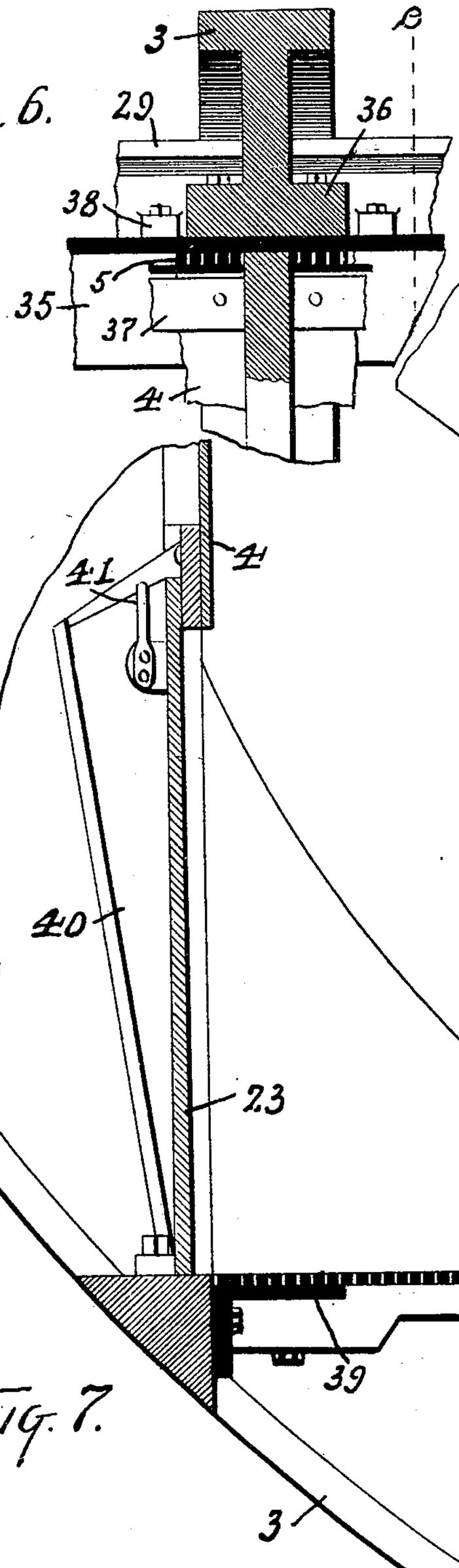

FIG. 7.

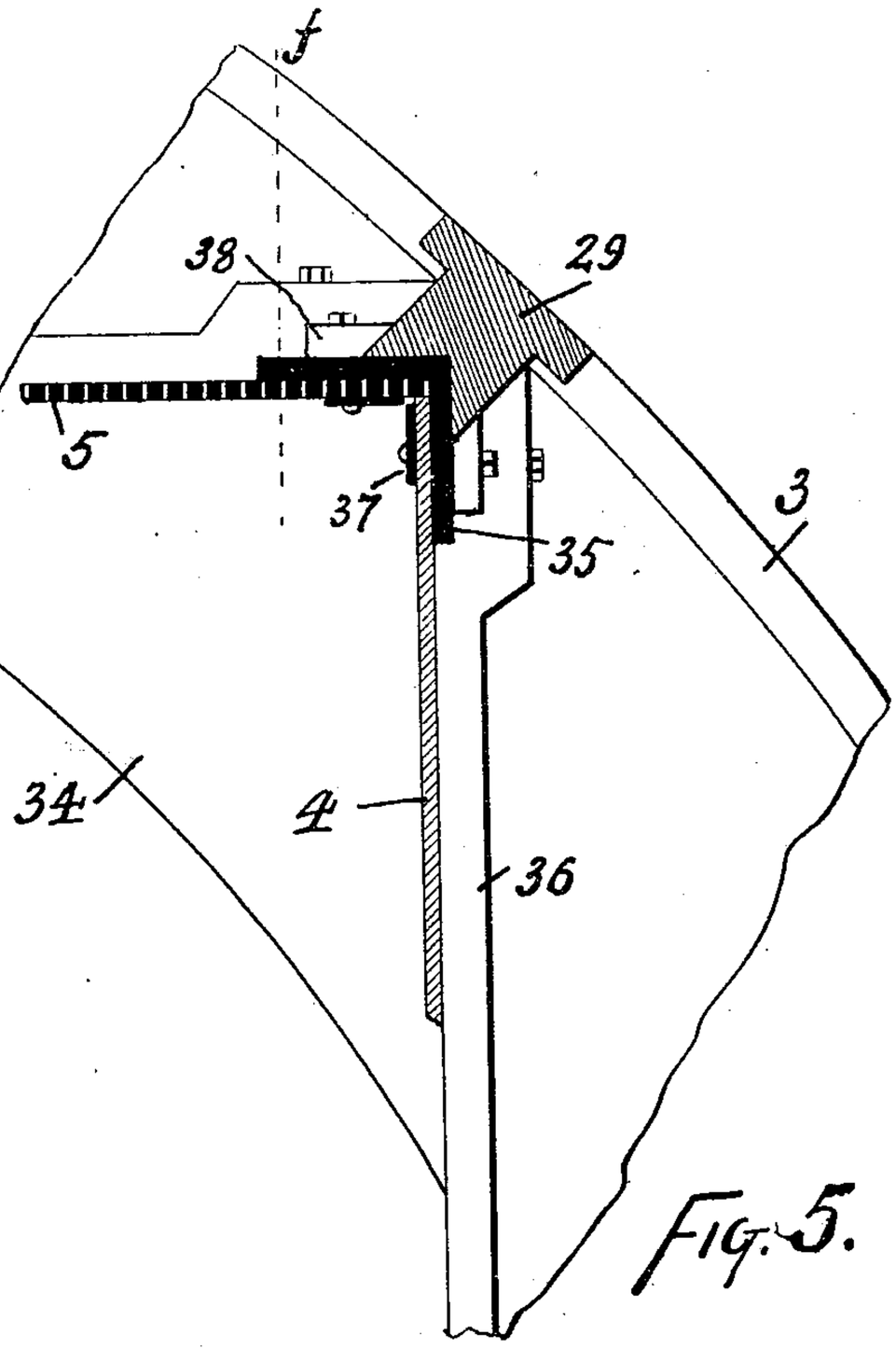

FIG. 5.

Witnesses
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by James W. See
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UNITED STATES PATENT OFFICE.

CARL G. BOSCH, OF DAVENPORT, IOWA.

MALTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 546,994, dated October 1, 1895.

Application filed August 27, 1894. Serial No. 521,397. (No model.)

To all whom it may concern:

Be it known that I, CARL G. BOSCH, of Davenport, Scott county, Iowa, have invented certain new and useful Improvements in Malting-Machines, of which the following is a specification.

My invention pertains to that class of machines employed in the operation of washing, steeping, germinating, and drying grain to be malted.

Reference is hereby made to United States Letters Patent No. 277,107, granted to me May 8, 1883, for apparatus for malting. In that apparatus the grain is contained in a rotatable horizontally-disposed perforated cylinder located in a casing and provided with means for producing currents of air through the body of grain contained in the cylinder. A general understanding of the apparatus described in that patent will be found advantageous to a ready understanding of the general type of machine to which my present improvements relate.

I have ascertained by practical experience that one of the main troubles in dealing with grain in the process of malting, regardless of the system employed, is due to the difficulty of getting air-currents to act uniformly upon the grain. When a current of air is caused to pass through a body of grain it seeks the path of least resistance, and if the body of grain be not uniform in depth the current favors shallower portions, thus preventing the proper action of the air upon the grain at the deeper portions of the body of the grain, and where some portions of the body of grain are exceedingly shallow the resistance to the passage of air may be so slight as to practically form a short-cut for the current of air, which under such circumstances will fail in useful effect on other portions of the grain. In malting-machines heretofore tried it has been found impossible to secure a body of grain of uniform depth throughout for subjection to the air-currents. For instance, assume a horizontally-disposed perforated cylinder half filled with grain. The grain is of great depth along under the axis of the cylinder; but at the sides of the cylinder the depth tapers to almost nothing. A current of air seeking to go through such a body of grain would seek the sides of the body where the grain is thin, and possibly no air whatever would go through the center and deeper portions of the mass. Again, in malting-machines there has heretofore been a failure to have the proper control of the air-currents and also a failure to secure proper condition of the air, and the apparatus has been far from convenient in its working. The grain-turning devices have generally been not only inefficient but injurious to the grain. The old hand-shoveling methods on floors are more or less injurious to grain by the action of the tools and the feet of the workman.

By means of my present improvements I secure a good condition of air and a good control of the distribution of currents, and I secure a uniform subjection of the grain to the currents of air and an apparatus very convenient for operation and not injurious to the grain, which is turned by its own gravity.

My improvements will be readily understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is an end elevation of a malting-machine exemplifying my present improvements; Fig. 2, a side elevation of the same, (left-hand side of Fig. 1,) parts appearing in vertical longitudinal section in the planes of lines *a* and *b*, (seen in Fig. 1 and other figures of the drawings;) Fig. 3, a vertical transverse section of the apparatus (from the right of Fig. 2) in the plane of line *c* of Fig. 2; Fig. 4, a plan of one of the grain-turners 22, tank portions appearing in horizontal section in the plane of line *d* of Fig. 3; Fig. 5, an enlarged vertical transverse section of tank portions in the plane of line *e* of Figs. 2 and 6; Fig. 6, an enlarged vertical longitudinal section of tank portions in the plane of line *f* of Figs. 3 and 5; Fig. 7, an enlarged vertical transverse section of tank portions similar to Fig. 5, but relating to that corner of the tank which is provided with doors, being the lower left-hand corner of the tank as it appears in Fig. 3.

Corresponding numerals of reference are employed in all of the figures of the drawings, and where attention is herein called to a particular figure of the drawings it is for the

reason that the part in question will be more clearly understood from the given figure of the drawings.

In the drawings, giving attention preferably to Figs. 2 and 3 for the present, 1 indicates a horizontally-disposed metallic rotary grain-tank of square cross-section; 2, the head-plates thereof, their peripheries forming circles circumscribing the square of the tank; 3, intermediate circular tires upon the tank between the head-plates, these tires having webs by which they are connected to the tank; 4, two opposite side walls of the tank formed of plain metal, these side walls being hereinafter referred to as the "sides" and so appearing in Fig. 3; 5, the top and bottom walls of the tank when the tank is in the position seen in Fig. 3, these walls being formed of perforated metal or wire cloth, preferably wire-cloth No. 14 gage, one-sixth-inch mesh, galvanized, the side walls 4 being preferably formed of No. 14 galvanized sheet-iron; 6, a pair of parallel shafts disposed longitudinally under the tank; 7, friction-wheels fast on those shafts and engaging the peripheries of tires 3 and head-plates 2; 8, worm-wheels on one of the outer ends of both said shafts; 9, Fig. 1, a worm-shaft driving both these worm-wheels; 10, Fig. 1, tight and loose pulleys on shaft 9 for open and cross belts, so that the shaft may be turned by power in either direction, as desired; 11, Fig. 1, a belt-shifter for controlling the belts and determining whether the tank shall turn in one or the other direction or remain at rest; 12, an air-trunk disposed longitudinally under the tank, all of the upper edges of the trunk making substantially air-tight contact with the outside of the tank when the tank is in the position indicated in Fig. 3 or the reverse of that position; 13, a similar air-trunk disposed over the grain-tank; 14, an air-main disposed along parallel with the lower air-trunk and adapted to convey to the trunk a current of air in proper condition, as by means of a fan; 15, branches by which the air goes from main 14 to the lower trunk, these branches being distributed along the length of the trunk; 16, valves in those branches for regulating the flow of air through them; 17, a second air-main connected with the upper air-trunk and adapted to receive air from or supply air to that upper trunk; 18, branches connecting main 17 with the upper air-trunk and distributed along the length of that trunk; 19, valves in those branches for controlling the flow of air through them; 20, a discharging-conveyer in the air-trunk along under the grain-tank; 21, a supply-conveyer along over the grain-tank; 22, pivoted grain-turners arranged within the tank, consisting of normally radial shelves near the center of the tank and carried on pivot-shafts therein and formed, preferably, of wire-cloth; 23, slide doors at the foot of one of the walls 4; 24, Fig. 1, small inspection-doors, preferably glazed, in the head-plates of the tank; 25, Figs. 1, and 2, packing-plates secured to the edges of the end walls of the air-trunks and bearing inwardly against the head-plates of the tank and adjustably secured, so as to secure a practically air-tight joint between the tank and air-trunks at the ends; 26, packing-strips, as of rubber, secured at the edges of the side walls of the air-trunks where they approach the tank; 27, rods or shafts extending longitudinally through the tank and serving as pivots for the grain-turners 22; 28, outlet-valves distributed along the length of the supply-conveyer 21; 29, packing-ribs secured at the external corners of the tank, the whole length of the tank, and flush exteriorly with the tires and head-plates and adapted to have their outside surfaces engaged by the packing-strips 26 when the tank is set with any wall-level; 30, Fig. 3, cross-frames secured within the tank and giving intermediate support to the rods 27, the grain-turners 22 being in longitudinal sections swinging between these cross-frames, these frames also supporting the perforated axially-disposed water-pipe 52; 31, the frames of the grain-turners 22, to which the wire-cloth of the turners is attached, these frames consisting of an arm at each end of a grain-turner, a tube upon the pivot-shaft extending from arm to arm; 32, stop-lugs on the frames of the grain-turners adapted to engage a part of cross-frames 31 and arrest the rotation of the grain-turners, as hereinafter explained, and 33 water-pipes connected with the lower air-trunk 12, by means of which a quantity of water can be kept in the bottom of that air-trunk to further moisten the air going to the tank from the air-trunk.

Giving present attention to Fig. 3, we find the apparatus empty. Doors 23 may be removed and the tank may be turned till the door-openings come under the supply-conveyer 21, the open and cross belts furnishing means by which the tank may be turned accurately to place. Valves 28 are now to be opened and the supply-conveyer permitted to charge the tank with grain, the valves being properly manipulated to secure a fair distribution of the grain along in the tank. When the tank is properly filled with grain—say, two-thirds full—the supply is to be stopped and the doors are to be closed. The tank is then started into rotation (see arrow in Fig. 1) and water forced into the central pipe 52, washing the grain after the manner indicated in my earlier patent previously referred to, the water flowing from the tank into the lower trunk, whence it may be disposed of in any appropriate manner. This results in washing and wetting the grain. While this takes place, the grain becomes well tumbled and uniformly acted upon. The tank is then stopped for a period, allowing the grain time to swell. Water is added from time to time in order to thoroughly and evenly soak the

grain, and while this is being done the tank should be slowly revolved. When the grain is sufficiently steeped, then the tank is stopped and germination begins. The tank is to be stopped in the position shown in Fig. 3, with the grain level therein, so as to present a uniform depth of grain over the lower perforated wall of the tank. This cannot be accomplished by merely stopping the tank with its bottom level, for that would leave the grain with a certain side slope at its top. The grain is leveled by stopping the tank after it has turned a short distance beyond the position indicated in Fig. 3 and then turning it back to the correct position, the reversing of the motion neutralizing the slope before referred to. The proper manipulation of the belts to secure uniformity in the body of the grain is quickly acquired by practice. The air-moving machinery, whatever it may be, is now put into motion and valves 16 and 19 adjusted to secure a flow of air from one air-trunk to the other through the grain uniformly throughout the length of the tank. The air is to be properly purified and moistened to act in the desired manner upon the grain. The grain may thus be moistened and ventilated, as desired, and allowed to stand to permit proper action of the grain to take place. The grain may be thoroughly turned, when desired, by starting the tank into motion, which reverses the grain, the action of the grain-turners aiding in the operation. It will be noticed in Fig. 3 that the left-hand grain-turner can descend no farther. Consequently the grain upon that side of the tank cannot descend by gravity faster than permitted by the rotation of the tank; but when the tank has turned a certain distance the weight of the grain will be upon what is now the lower side of that grain-turner and then the slip will take place, the grain-turner turning partly over and later becoming replaced by the flow of the slipping grain. A more complete reversal is thus effected than if the slip of the grain was depended upon and not checked.

The grain may be subjected to the action of heated air or cooled air or dry air or moist air, according to the step of the malting process to be executed, the subjection of the grain to the air being uniform and the grain being turned as frequently as desired. The air may be first moved upwardly and then downwardly by proper control of the ducts which bring the air to the machine. Water may be held in the lower trunk to further moisten the air by evaporation. Should experience show that superior drying of grain at one portion of the length of the tank indicates that the air is inclined to favor any special portion in the length of the tank, the flow at that point may be lessened by a proper adjustment of the damper in the appropriate branch-pipe. When the malt is to be dried, then heated air is put through the grain, the tank being properly turned from time to time to reverse and mix the grain. During the drying processes the water is, of course, to be drained from the lower trunk, leaving it dry.

All of the various steps upon the grain may be conducted upon the charge within the tank, or, if preferred, a number of the machines may be employed, each executing its own step of the process, the grain going successively from one machine to the other. Thus one machine may wash and steep, the next machine germinate, and the next machine dry the grain. When the work upon the grain is done, then the tank is turned till the doors are over discharging-conveyer 20, whereupon the doors are to be properly opened to cause the grain to flow to the conveyer and be carried out, as desired. When the tank is in this discharging position, its form is that of a self-clearing hopper, and no shoveling or raking is required, as the tank will discharge clean. The upper air-trunk and its air connections may in cases be dispensed with, the air blowing upward through the grain and out into the atmosphere from the top of the tank or air being sucked downwardly; but by having a pair of opposite air-trunks it becomes possible to either blow or suck the air through the grain in either direction and the surrounding atmosphere will be clearer.

Details of construction will now be more fully explained.

Referring further to the drawings, 34, Fig. 3, indicates gusset-like projections of the webs of the tires 3 into the corners of the tank, whereby strength is given to the tires and general tank structure at the corners of the tank; 35, Fig. 5, angle-bars at the corners of the tank, extending from head-plate to head-plate through appropriately-shaped mortises in the tires and bolted to the head-plates and tires, the longitudinal edges of the walls of the tank being secured against the inner faces of these angle-bars and the packing-ribs 29 being secured to their outer faces; 36, flanges projecting from the webs of the tires around the tank-walls and having the ends of the sections of the tank-walls seating against their inner surfaces, the tank-walls being formed of sections extending from tire to tire and from head-plate to nearest tires; 37, clip-strips inside the tank-walls and clamping the edges of the tank-walls to the angle-bars, rivets or bolts being employed; 38, flanges or jaws upon the packing-strips 29, by means of which those packing-strips are bolted to the angle-bars; 39, that one of the angle-bars which is at the door corners of the tank, this bar being reversed, so as to present one of its angles outwardly, thus not interfering with the free flow of grain out through the doorway, the angle-bars forming the longitudinal ribs of the tank structure, while the tires form the circumferential ribs; 40, the door-frames secured to the proper side wall of the tank and to the proper packing-strip and having tapered guideways at the ends, so that the doors, when home, are

forced snugly up to their seats, the doors being secured in the example by bolts at their bases engaging the packing-rib at the foot of the door, and 41 handles or clevises by means of which the doors may be handled.

I claim as my invention—

1. In a malting machine, the combination, substantially as set forth, of a horizontal tank having a perforated flat bottom and mounted for rotation on a horizontal axis, an air-trunk with its wall-edges joining the margins of said perforated bottom, and an air-conduit communicating with said air trunk.

2. In a malting machine, the combination, substantially as set forth, of a horizontal tank rectangular in vertical cross-section and having two opposite perforated walls and mounted for rotation on a horizontal axis, a fixed air-trunk with its wall-edges arranged for juncture with the margins of either of said perforated tank-walls, and an air-conduit communicating with said air-trunk.

3. In a malting machine, the combination, substantially as set forth, of a horizontal tank rectangular in vertical cross-section and having two opposite perforated walls and mounted for rotation on a horizontal axis, a pair of fixed air-trunks with their wall-edges arranged for juncture with the margins of said perforated tank-walls, and air-conduits communicating with said air-trunks.

4. In a malting machine, the combination, substantially as set forth, of a horizontal tank rectangular in vertical cross-section and having two opposite perforated walls and mounted for rotation on a horizontal axis, a fixed air-trunk with its wall-edges arranged for juncture with the margins of either of said perforated tank-walls, an air-conduit communicating with said air-trunk, and mechanism for turning said tank in one direction or the other.

5. In a malting machine, the combination, substantially as set forth, of a tank rectangular in cross-section, and tires encircling said tank and having webs extending inwardly to the exterior of the tank and having gussets projecting inwardly at the corners of the tank into the interior of the tank.

6. In a malting machine, the combination, substantially as set forth, of a tank mounted for rotation on a horizontal axis, grain-turning shelves or plates pivotally mounted in the tank on axes parallel with that of the tank, and stops carried by the tank and limiting the pivotal motion of the grain-turners.

7. In a malting machine, the combination, substantially as set forth, of a rotary tank with perforated opposite walls, an air trunk below said tank with its wall-edges arranged for juncture with the margins of one of said perforated walls, a second air-trunk rigidly supported over the tank with its wall-edges in juncture with the margins of the other perforated tank-wall, and air-conduits communicating with said air-trunks.

8. In a malting machine, the combination, substantially as set forth, of a rotary horizontal tank with perforated walls, columns at the sides thereof, an air-trunk supported by said columns over and in communication with the tank, and an air-trunk between the columns under and in communication with the tank.

9. In a malting machine, the combination, substantially as set forth, of a horizontal rotary tank rectangular in cross-section and having perforated and unperforated walls, a conveyer under said tank, and doors along one of the corners of the tank in an unperforated wall thereof.

10. In a malting machine, the combination, substantially as set forth, of a horizontal rotary tank rectangular in cross-section and having perforated and unperforated walls, doors in one unperforated wall of the tank along a corner of the tank, a conveyer under the tank, and a conveyer extending along above one side of the tank.

11. In a malting machine, the combination, substantially as set forth, of a horizontal rotary tank rectangular in cross-section, packing-ribs upon the corners of the tank, a fixed air-trunk parallel with the tank, and packing-strips at the edges of the air-trunk and adapted to make contact with said packing-ribs.

12. In a malting machine, the combination, substantially as set forth, of circular head-plates, intermediate webbed circular tires, angle-bars extending between the head-plates and through mortises in the webs of the tires, and tank-walls secured to said angle-bars.

13. In a malting machine, the combination, substantially as set forth, of circular head-plates, intermediate webbed circular tires having chordal flanges on their web-faces, angle-bars extending between the head-plates and through mortises in the webs of the tires, and tank-wall sections secured to said flanges and angle-bars.

14. In a malting machine, the combination, substantially as set forth, of circular head-plates, intermediate webbed circular tires, angle-bars extending between the head-plates and through the tire-webs, tank-walls secured to the angle-bars, and packing ribs secured to the angle-bars and having their exteriors flush with the peripheries of the tires.

15. In a malting machine, the combination, substantially as set forth, of circular head-plates, intermediate webbed circular tires, three angle-bars extending between the head-plates and through the tire-webs and presenting their inner surfaces toward the axis of the tires, a fourth angle-bar similarly extending but presenting its inner surfaces outwardly, tank-walls secured to said angle-bars, and doorways in a tank-wall and along said fourth angle-bar.

16. In a malting machine, the combination, substantially as set forth, of circular head-plates, intermediate webbed circular tires, longitudinal ribs at the four corners of a square inscribed in said intermediate circular

tires, four tank-walls secured to said ribs, and doorways in one edge of one of said walls and extending from tire to tire.

17. In a malting machine, the combination, substantially as set forth, of a horizontal rectangular rotary tank with plain and perforated walls, a fixed air trunk connected substantially air tight with a perforated tank-wall, a shaft for rotating the tank with reference to the air trunk, tight and loose pulleys on said shaft, and reversing belts engaging said pulleys.

18. In a malting machine, the combination, substantially as set forth, of a horizontal rotary tank with perforated walls, an air-trunk under said tank and communicating therewith, an air-conduit communicating with said air-trunk, and a water pipe communicating with said air-trunk.

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