No. 885,291. PATENTED APR. 21, 1908.

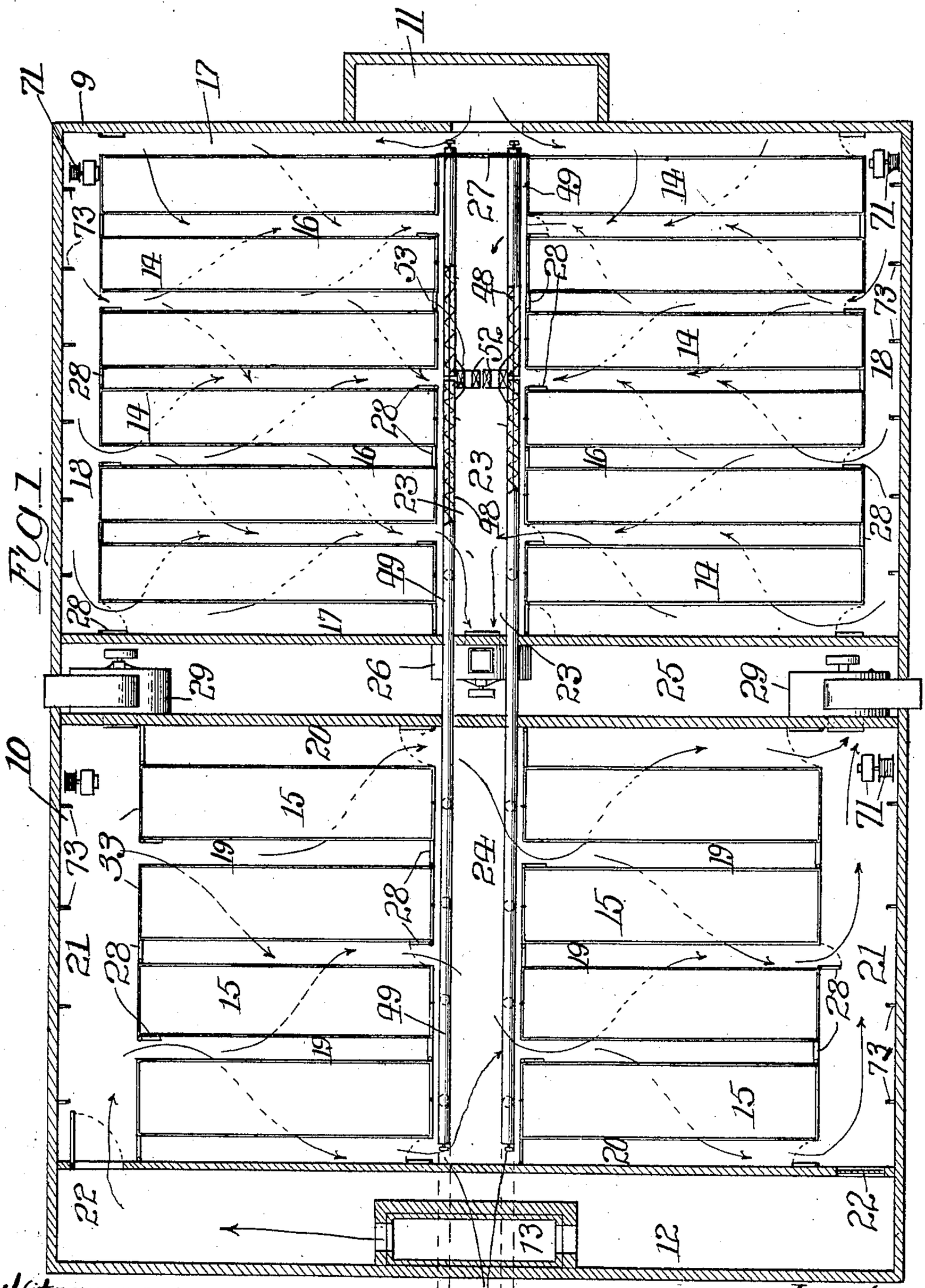
W. P. RICE.

MALTING APPARATUS.

APPLICATION FILED JULY 7, 1906.

5 SHEETS—SHEET 1.

FIG. 1.



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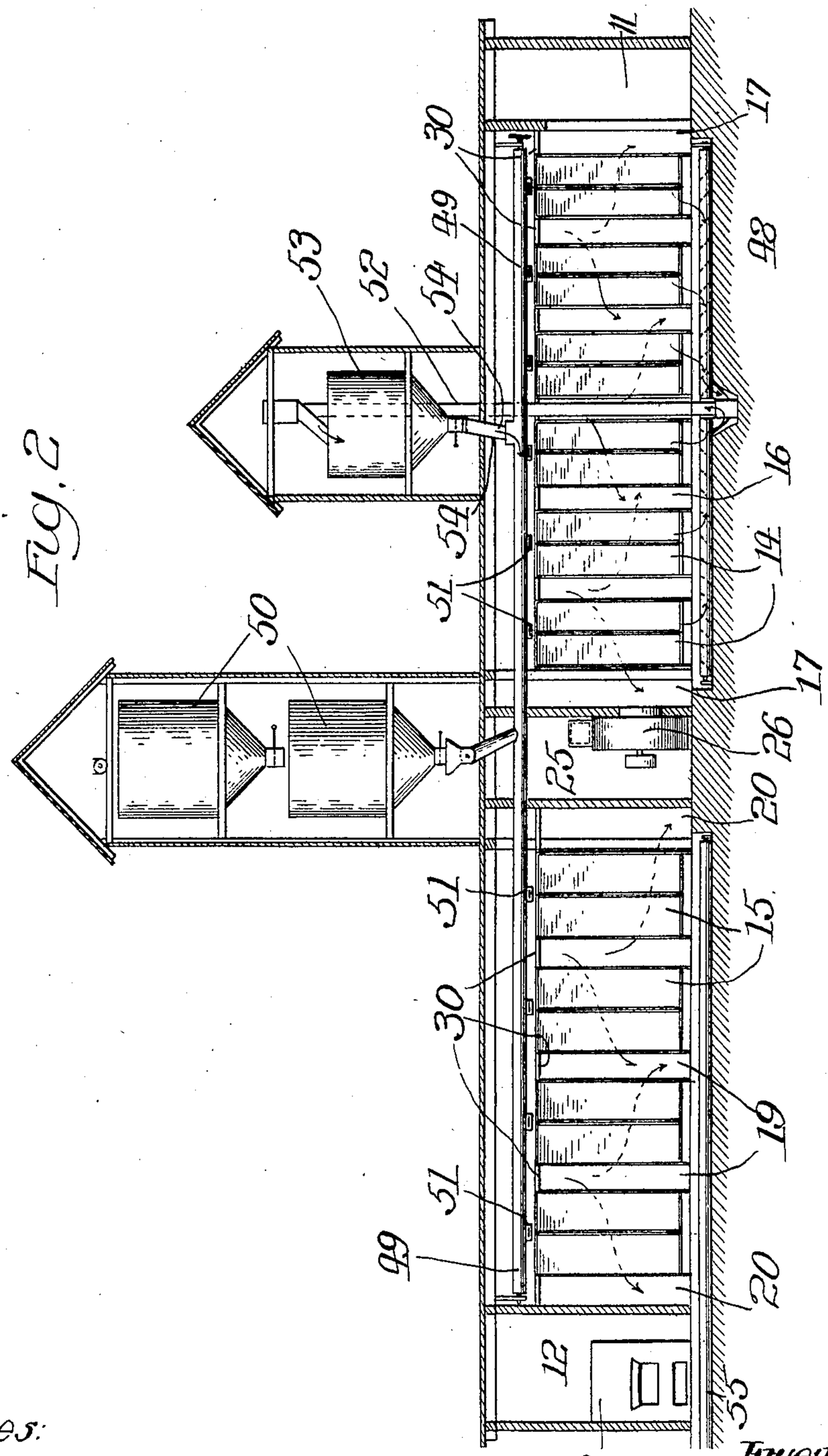
5 SHEETS—SHEET 2.

Fig. 2



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5 SHEETS—SHEET 3.

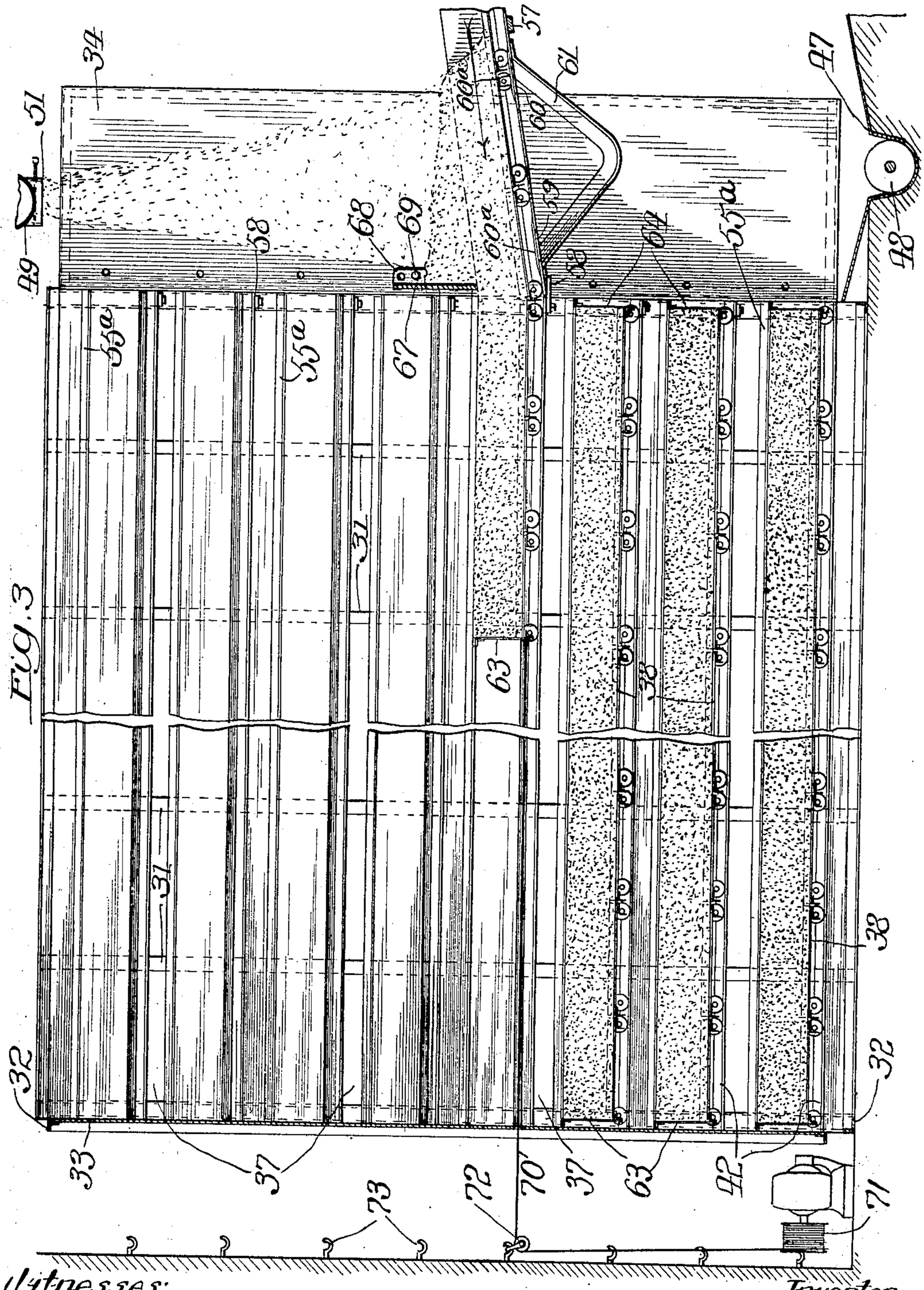

Fig. 3.

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5 SHEETS—SHEET 4.

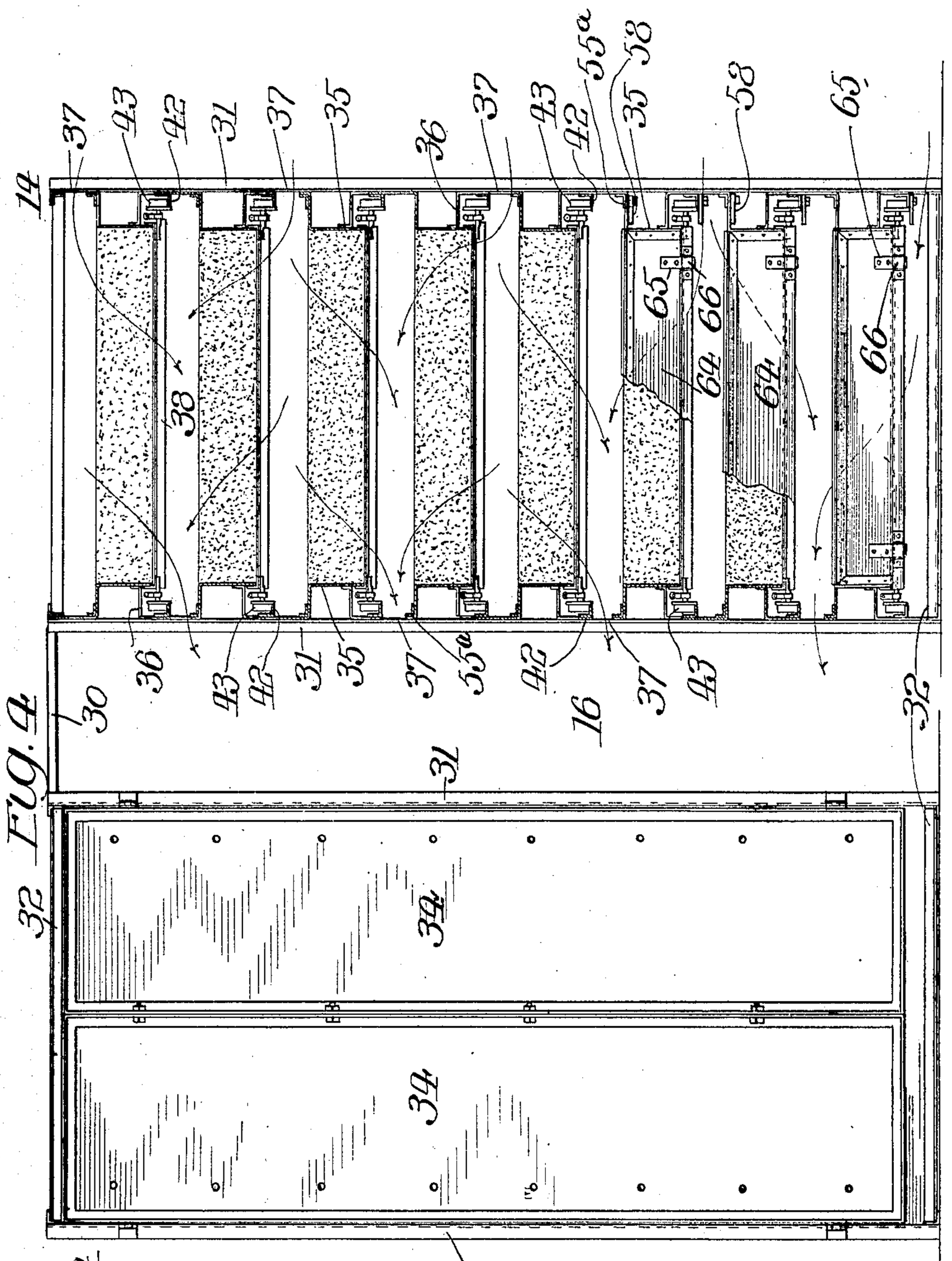

FIG. 4

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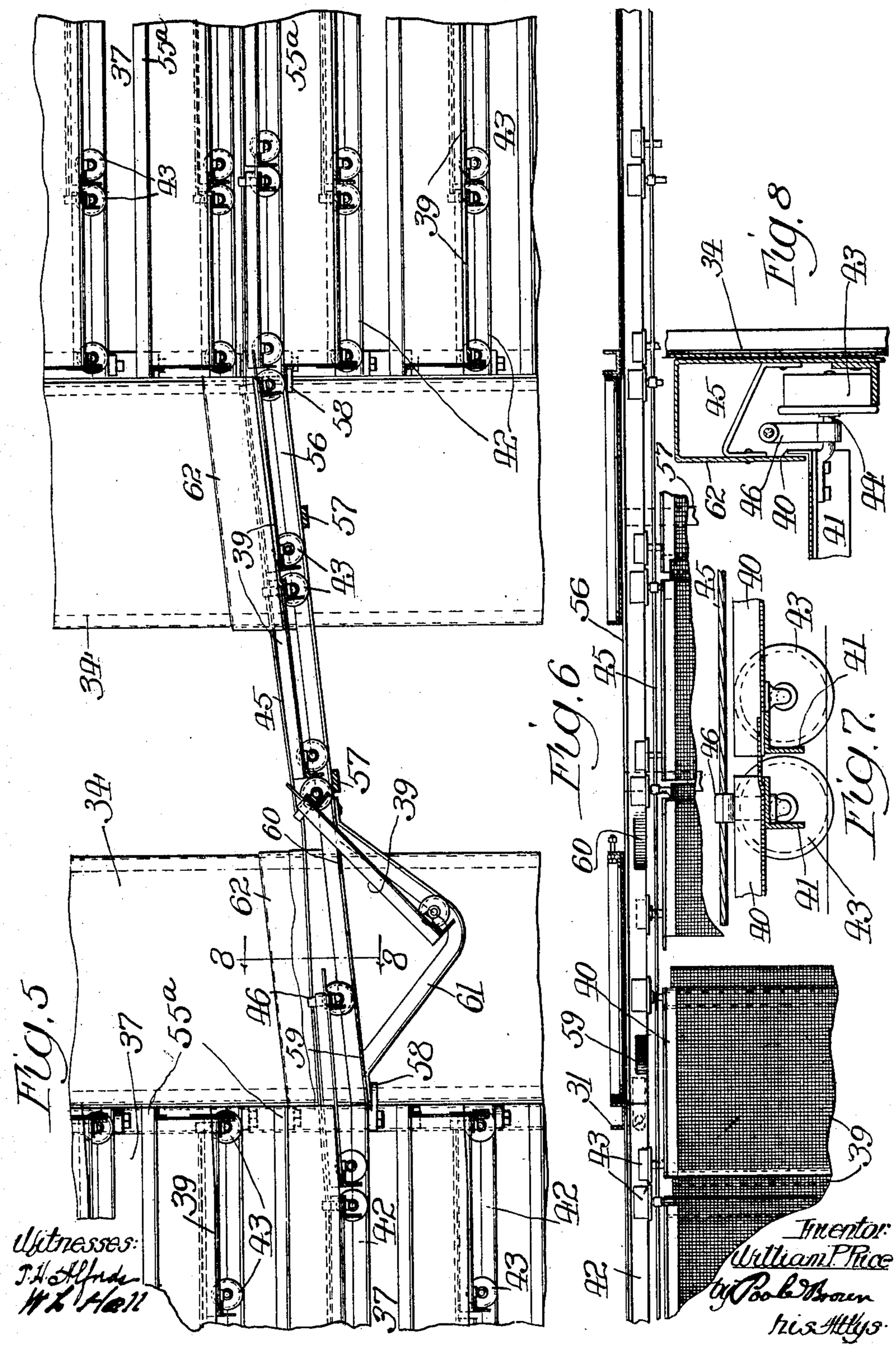
5 SHEETS—SHEET 5.



UNITED STATES PATENT OFFICE.

WILLIAM PAUL RICE, OF CHICAGO, ILLINOIS.

MALTING APPARATUS.

No. 885,291. Specification of Letters Patent. Patented April 21, 1908.

Application filed July 7, 1906. Serial No. 325,083.

To all whom it may concern:

Be it known that I, WILLIAM P. RICE, a citizen of the United States, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Malting Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in the art of producing malt, and refers more specifically to the construction of the malt house and the apparatus in which and by which the grain, from which the malt is produced, is handled from the time it leaves the steeping tub until it is dried and ready for storage or shipment.

The present improvements relate generally to the type of malt house and apparatus shown in my prior United States Letters Patent No. 794,313, granted July 11th, 1905.

Among the objects of my present invention is to improve the construction and operation of the shelves whereby the work of handling the malt while on the shelves and for dumping the malt from the shelves and loading it thereon is facilitated and the cost of such work reduced, and a further object of the invention is to simplify and lessen the cost of the apparatus as a whole.

In the drawings:—Figure 1 is a diagrammatic horizontal section of a malt house and apparatus made in accordance with my improved system. Fig. 2 is a diagrammatic horizontal section thereof. Fig. 3 is an enlarged longitudinal, vertical section, broken away, of one of the units, showing the manner of loading the shelves of the units. Fig. 4 is an end view and a partial vertical, transverse section of two adjacent units. Fig. 5 is a longitudinal vertical section of the two adjoining ends of two adjacent units, showing the means for dumping the contents of the shelves for the purpose of turning the same. Fig. 6 is a fragmentary plan view of the adjoining ends of the parts shown in Fig. 5. Fig. 7 illustrates the manner of connecting the sections or trays constituting the shelves. Fig. 8 is a fragmentary sectional view, taken on line 8—8 of Fig. 5.

The malt house consists, for the most part, of a single story structure. The general division of the floor plan shown in Fig. 1, embraces a germinating room 9, a drying room 10, an attemperating room 11 and a furnace room 12, in which latter is located a furnace 13.

14, 14 designate, as a whole, the malting units located side by side in the germinating room 9, and 15, 15 the drying units located side by side in the drying room. The malting and drying units are made substantially alike, as is also the mechanism for directing the air therethrough, and the description which follows of the germinating units and the manner of operating the same, answers for the description of the construction and operation of the drying units, except so far as the operation of the latter is modified, as hereinafter indicated.

The germinating units are separated from each other by aisles 16, 16 and from the side walls of the room by other aisles 17 which latter are connected at their ends by transverse aisles 18 located at the opposite ends of the units. The attemperating room communicates with one of the side aisles 17 and from thence to the end aisles 18. Likewise the drying units are separated from each other by aisles 19 and from the side walls of the drying room by other aisles 20 which latter communicate at their ends with end aisles 21. The furnace room communicates at each end with the drying room through openings closed by doors 22 whereby heated air may be directed to either end of the drying room. The said malting and drying units are arranged in two sets or groups, each located at the sides of central aisles 23, 24.

25 designates a passage located between the germinating and drying rooms and separated by partitions therefrom. 26 designates an exhaust fan located in said passage 25 and communicating with the central aisle 23 of the germinating room and adapted to discharge outside of the house. Air is drawn by said fan from the attemperating room through the aisles 17 and 18 to certain of the aisles 16 and from thence pass through the units in contact with the malt and discharged to other adjacent aisles 16, from whence it is directed through the central aisle 23 to the fan. The end of the aisle 23 adjacent to the attemperating room is closed by partitions 27. The aisles 16 and 17 are provided at their ends with doors 28 and during the germinating period the door at one end of each aisle is closed while the door at the other end thereof is open, and of the corresponding doors of adjacent aisles one is open and the

other is closed. The type of units shown in Figs. 1 to 5, inclusive, is of a construction to admit air to the malt on the shelves laterally through openings in the side walls of the units, the air passing from a high pressure aisle through said openings to the spaces above and below the perforated shelves and through said shelves and the malt thereon and thence through openings in the opposite side walls of the units to the low pressure aisle. The aisles 19 and 20 are provided at their ends with like doors 28 and the passage of the air through the units 15 and the malt therein is similar to the malting units, except that two exhaust fans 29 are provided for the drying room, each receiving air from one of the end aisles 21. One door 22 is open at a time while the other is closed and the exhaust fan remote from the open door 22 is operated, thereby drawing the air through both sets of groups of drying units, as indicated by the arrows in Fig. 1. By reversing the relation of the operating fan 29 and open door 28 the direction of the movement of air through the malt in said units may be reversed. Usually the malt is spread in thin layers on the drying unit shelves and such reversal of the drying air usually renders the turning of the malt during the drying period unnecessary. The aisles between the several units and between the units and walls are closed from communication with the space surrounding the units by horizontal partitions 30 (Figs. 2 and 4).

The supporting structure of the units consists of side vertical standards 31 connected by upper and lower cross-beams 32. The rear ends of the units are closed by permanent end walls 33 and are closed at their front ends by doors 34. The side walls of the units consist of elongated plates 35 which are attached to the standards at their upper sides and may also be supported at their lower sides by brackets 36 attached to said plates or standards. Said plates are separated by spaces constituting air admission openings 37, before referred to.

38, 38 designate the superposed shelves of the units on which the layers of malt are supported. Said shelves consist of a series of trays 39 (Fig. 6) flexibly joined together by means permitting the shelves to be separately dumped to discharge their contents in a manner hereinafter described. The shelf sections or trays consist of angle bar side and end frame members 40 and 41 and a perforated bottom or supporting surface. Said connected trays are supported and travel on horizontal tracks 42, fixed to the upright standards of the unit, through the medium of wheels 43. Each shelf section or tray is provided with four wheels mounted on stub-axles 44 extending laterally from the trays. The side plates 35 of the unit are turned inwardly and downwardly to afford spaces for the supporting wheels 43 and the lower margins of said side plates fit inside the vertical flanges of the end member of the shelf section or trays, thereby providing grain tight joints between the shelves and said side plates. The said trays or shelf sections are connected by cables or ropes 45 which are attached to arms 46 rising from the front axles 44 of each tray, the cables being unattached to the rear ends of the trays.

By reference to Fig. 4 it will be observed that the air openings 37 in the side walls of the unit are located between the several shelves 38 and each open into a space above the layer of malt supported on a subjacent shelf. Each shelf and side and end walls may conveniently be designated a compartment, the shelf constituting the bottom of the compartment. The air inlet and outlet openings 37 therefore open into such compartments above the malt space thereof. It will be observed, by reference to Fig. 4, that each compartment is open at one side and closed at its other side, and that the openings of adjacent compartments are located on opposite sides of the units. Therefore, air entering a compartment from a high pressure aisle passes through a layer or layers of malt into another compartment or compartments from whence it is directed to a low pressure aisle. As herein shown, the air inlet and outlet openings 37 are appropriated one to each shelf, but in some instances the air may pass through more than one shelf after it has entered the unit and before it is discharged therefrom.

The malt is dumped from the shelves, either for the purpose of turning the malt or for directing it away from the units, by moving said shelves outwardly through the open ends of the units, or those closed by the doors 34, the malt falling into an open topped conveyer trough 47 at the inner ends of the units and being carried through said trough by a screw-conveyer 48 as hereinafter described; and the shelves are loaded, at the time they are directed back into their compartments of the units from an overhead conveyer 49 to which latter the malt or steeped grain is delivered. The steeped grain is delivered directly into the conveyer 49 from the steep tubs 50, and said conveyer is provided with a plurality of valved discharge openings 51 through which the malt is discharged from said conveyer to the shelves of the several units. The malt is directed from the conveyer trough 47 to the conveyer 49 as follows: The screw-conveyer 48 is formed with right and left hand ends which direct the malt from the ends of the trough to a vertical elevator 52 communicating with said trough at its longitudinal center. Said elevator discharges at its upper end into a hopper 53, the valved discharge spout 54 of which directs the malt to conveyer 49, through which it is directed to the shelves of the several

units as described. The conveyer 49 is continued over the drying units so as to carry the malt, when sufficiently germinated, from the hopper 53 to the drying units; and it is delivered to the shelves of the drying units in the same manner as it is delivered to the shelves of the germinating units. The dried malt is discharged from the shelves thereof as they are drawn outwardly through the open ends thereof into suitable conveyers 55 which convey the malt outside the house, as to a storage house. As herein shown, a conveyer 48 and elevator 52 is provided for each oppositely disposed group of units, the conveyer being located closely adjacent to the units, as shown in Fig. 3.

Various means may be employed to dump the malt into the lower conveyer or conveyers as the shelves move outwardly through the open ends of the units. When the units are disposed in opposite sets, as herein shown, the dumping operation is conveniently effected by directing each shelf from its compartment over a suitable bridge track extending between the units and into the corresponding compartment of the opposite unit above the malt space therein. When thus arranged and operated the several compartments of the units are provided above the malt space therein with track rails 55[a] upon which shelves of the opposite units travel when moving outwardly into their dumping positions (Fig. 5).

The bridge track over which the shelves travel from one unit to an opposing unit comprise two rails 56 of angle iron form, connected by cross-bars 57, as herein shown, and rest at their ends on brackets or supports 58 connected with the under sides of and extending outwardly from the track rails 42 and 55[a]. Said supports are hinged to said rails in order that the same may be swung horizontally inwardly transversely to the tracks (Fig. 4) when not in use so as not to obstruct the closing of the doors 34.

The manner of dumping the several trays of the shelves is effected as follows: The horizontal webs of the rails of the bridge track are provided with openings 59 and 60 and the rear wheels of the trays of the belts are made so narrow as to pass through said openings 59 as the trays move outwardly over the bridge track whereby the rear ends of the trays drop downwardly in a position to dump the contents thereof, as shown in Fig. 5. The front wheels of the tray are made of such width as to pass over the openings 59 and 60 without dropping therethrough. The rear wheels of said shelves, while in their dumping positions, travel on downwardly curved guide rails 61 attached to the track rails and depending therefrom, and in the forward progress of the trays the upwardly inclined parts of said guide rails gradually brings the trays into the line of the shelf; the rear wheels of the trays passing through the forward openings 60 to the bridge track rails. During the time a shelf is thus passing from its compartment to the compartment of an opposite unit the trays are thus dumped one at a time and afterwards brought into the line of the moving shelf. After a shelf has been drawn completely out of one unit, and its contents dumped in the manner described, it is drawn backwardly into its own compartment, and during the time it is passing into its compartment it is again reloaded from the conveyer 49. While said shelf is passing backwardly across the bridge track to its own compartment, the openings 59 and 60 of the bridge track rails are closed by suitable plates 60[a].

In order to prevent the malt from falling from the sides of the shelves as the same is being delivered thereto in the manner stated, side guards 62 are provided (Figs. 5 and 8). Said guards are made of inverted U-shape in cross-section and the outer arms thereof are attached to the vertical flanges of the rails of the bridge track while the inner arms thereof extend over the trays of the shelves in overlapping relation with respect to the vertical flanges of the side bars 40 thereof. The end trays of each shelf are provided with vertical plates 63 and 64 which constitute the end walls of the compartments of which the shelves constitute the bottoms. The inner or forward end plates 64 are detachably fitted to their trays in order that the same may be moved preparatory to the dumping operation. For this purpose said latter end plates are provided with lugs 65 which enter loops 66 on the end trays, as shown in Fig. 4.

In order that the malt may be loaded upon the shelves at a uniform thickness, a leveling plate 67 is provided which is attached to the structure in any suitable manner adjacent to the open end of the compartment into which the shelf is being drawn during the loading operation, and the position of the lower margin of said plate determinates the thickness of the layer delivered to the shelf. Said plate is herein shown as provided at its margins with flanges 68 having a plurality of openings, and the plate is held in place by means ofpins 69 extending through said openings and corresponding openings in the doors 34. The plurality of vertically separated openings of the flanges 68 permits the leveling plate to be raised or lowered as desired to vary thicknesses of the layer of malt loaded on the shelf. Such adjustability of the leveling plates is desirable for the reason that when the steeped grain is first delivered to the shelves, it constitutes a thinner layer than when subsequently loaded thereon inasmuch as the germinating process increases the bulk of the malt. The steeped grain may, in practice,

be spread upon the shelves in a layer of about eight inches in depth, and this depth gradually increases until the final depth of the layer, after full germination thus takes place, is in the neighborhood of twelve inches.

The capacity of the drying units is regulated to accord with the capacity of the malting units and to the mode of procedure followed in producing the malt. In the present instance, six malting units are located on each side of the central aisle 23 and four drying units are located on the opposite sides of the aisle 24. This scheme is followed when 6 days are required for growing the malt and two days for drying. The six malting units on each side of the house are so loaded that the contents of one unit will be ready for unloading each day, and each day's batch or piece is transferred into two of the drying units and remains in said units two days during the drying process. It will thus be seen that one pair of drying units on each side of the house will be unloaded each day to afford space to receive the contents of one of the germinating units on the corresponding side of the house. If the period of malting and drying be varied the proportions of the apparatus will, of course, be correspondingly varied. The capacity of the drying units relatively to the malting apparatus is such that the layers of malt on the shelves of the drying apparatus is considerably thinner than the layers on the shelves of the malting units. By reason of the fact that provision is made for reversing the current of drying air in the drying units, it will ordinarily be unnecessary to turn the malt in said units. If found desirable, however, to turn the drying malt, the same apparatus may be employed in connection with the drying units as is shown in connection with the germinating units. It will, of course, be understood that the dried malt is loaded upon and discharged from the shelves in the same manner and by the use of the same apparatus as hereinbefore described in connection with the malting units. But a single bridge track is required for each opposing set of malting units and drying units inasmuch as but one shelf is loaded or unloaded at one time. Suitable lifting devices will be provided, in practice, to shift the bridge track from one level to another.

Any suitable means may be employed for moving the several shelves from their compartments into the corresponding compartments of opposite units and the reverse. A convenient means for effecting this result is to attach cables 70 to the ends of said shelves, as indicated in Fig. 3, and to pass them rearwardly through openings in the outer or permanent end walls of the unit. Said cables are trained about drums 71, 71, one at each end of each series of units and operated by any suitable power, as an electric motor. In order to bring the cable in line with the several shelves, said cables are trained through swiveled pulleys 72, adapted to be attached to hooks 73 located vertically and laterally in line with the several shelves, as indicated in Figs. 1 and 3. Conveniently, the several operating parts of the system will be driven through the medium of suitably arranged electric motors, and controllers therefor may be arranged in the aisles 23 and 24 between the oppositely located sets of units.

It will be understood that the structural details herein shown may be widely varied within the limits of my invention and I do not wish to be limited to such details except as hereinafter made the subject of specific claims.

I claim as my invention:—

1. In a malting apparatus, two malting units arranged end to end with a space between them, malt shelves supported in said units, means whereby said shelves may be moved each out of its unit across said space into the adjacent unit and means for dumping the contents thereof between said units.

2. In a malting apparatus, two malting units arranged end to end with a space between them, malt shelves supported in said units, means for moving each shelf out of its unit across said space into the adjacent unit, means for dumping the contents thereof between said units, and conveying apparatus constructed and arranged to receive the malt dumped from the shelves and to redeposit the same thereon.

3. In a malting apparatus, two malting units arranged end to end with a space between them, malt shelves supported in said units, means for moving each shelf out of its unit across said space into the adjacent unit, means for dumping the contents thereof between said units, and means for loading malt on said shelves as they are moved backwardly into their units.

4. In a malting apparatus, two malting units arranged end to end with a space between them, malt shelves supported in said units, means arranged to move each shelf out of its unit across said space into the adjacent unit, means for dumping the contents thereof between said units, means for loading malt on said shelves as they are moved backwardly into their units, and a leveling board located at the entrance of the unit for leveling the malt on the shelf as it is moved into its unit.

5. In a malting apparatus, two malting units arranged end to end with a space between them, rails arranged to bridge said space, malt shelves supported in said units, each adapted to be moved out of its unit, over the bridge rails and into the adjacent unit, said shelves each embracing a plurality of flexibly joined sections, and said bridge rails being arranged to permit said shelf sections to tilt to dumping positions.

6. In a malting apparatus, two malting units arranged end to end with a space between them, rails arranged to bridge said space and malt shelves supported in said units, each adapted to be moved out of its unit, over the bridge rails and into the adjacent unit, said shelves each embracing a plurality of flexibly joined sections supported on rollers, track rails in the units on which the rollers rest and roll, and means whereby the shelf sections are tilted as the shelf passes over the bridge rails and thereby dump the contents thereof into the space between said units.

7. In a malting apparatus, two malting units arranged end to end with a space between them, rails arranged to bridge said space, malt shelves supported in said units, each adapted to be moved out of its unit over the bridge rails into the adjacent unit, said shelves embracing a plurality of flexibly joined sections supported on rollers, track rails in the units on which said rollers rest and roll, the sections of each shelf being arranged to tilt downwardly at the rear ends thereof and the rails being provided with openings through which the rear rollers of the shelf sections drop and inclined guide rails acting to guide said rear rollers to said bridge track rails.

8. In a malting apparatus two malting units arranged end to end with a space between them, rails arranged to bridge said space, malt shelves, each comprising a plurality of sections mounted on rollers which rest and roll on track rails in said units, draw devices to which the forward end of each section of each shelf is connected, said bridge rails being constructed to permit the rear ends of the shelf sections to tilt downwardly, and means for guiding said rear rollers of the sections to the level of the bridge rails.

9. In a malting apparatus two malting units arranged end to end with a space between them, rails arranged to bridge said space, malt shelves, each comprising a plurality of sections mounted on rollers which rest and roll on track rails in said units, draw devices to which the forward end of each section of each shelf is connected, said bridge rails being provided with openings through which the rear rollers of the sections pass to permit said sections to tilt downwardly and means for guiding said rear rollers of the sections to the level of the bridge rails.

10. In a malting apparatus two malting units arranged end to end with a space between them, rails arranged to bridge said space, malt shelves, each comprising a plurality of sections mounted on rollers which rest and roll on track rails in said units, draw devices to which the forward end of each section of each shelf is connected, said bridge rails being provided with openings through which the rear rollers of the sections pass to permit said sections to tilt downwardly, and guides beneath said bridge rails upon which said rollers drop and by which they are guided to the track rails.

11. In a malting apparatus, two malting units arranged end to end with a space between them, each unit comprising a plurality of vertically separated, closely spaced shelves, composed of flexibly joined sections, track rails on which said shelves are supported, and bridge rails extending between said units and movable to the level of either of said shelves, said bridge rails being arranged to permit the shelves to pass from one unit to the other and the sections of the shelves to tilt while passing thereover to dump their contents between said units.

12. In a malting apparatus, two malting units arranged end to end with a space between them, each unit comprising a plurality of vertically separated, closely spaced shelves, composed of flexibly joined sections, track rails on which said shelves are supported, and bridge rails extending between said units and movable to the level of either of said shelves, said bridge rails being arranged to permit the shelves to pass from one unit to the other and the sections of the shelves to tilt while passing thereover to dump their contents between said units, and means for loading said shelves as they are moved backwardly into the units.

13. In a malting apparatus, two malting units arranged end to end with a space between them, each unit comprising a plurality of vertically separated, closely spaced shelves, composed of flexibly joined sections, track rails on which said shelves are supported, bridge rails extending between said units and movable to the level of either of said shelves, said bridge rails being arranged to permit the shelves to pass from one unit to the other and the sections of the shelves to tilt while passing thereover to dump their contents between said units, a conveyer located to receive the malt dumped from said shelves, and a conveyer above said space receiving malt from the lower conveyer and adapted to discharge malt on said shelves as the latter are moved backwardly into said units.

14. In a malting apparatus, two malting units arranged end to end with a space between them, malt shelves supported in said units, means arranged to move each shelf out of its unit across said space into the adjacent unit, means for dumping the contents thereof between said units, and doors for closing the ends of said units adjacent to said space and arranged to be opened to permit the shelves to pass out of said units.

15. In a malting apparatus, two malting units arranged end to end with a space be-

tween them, malt shelves supported in said units, means arranged to move each shelf out of its unit across said space into the adjacent unit, means for dumping the contents thereof between said units, doors for closing the ends of said units adjacent to said space and arranged to be opened to permit the shelves to pass out of said units, side-boards arranged at the sides of said shelves when passing from one unit to the other and means for loading the shelves as they are moved rearwardly into said units.

16. A malting unit comprising a plurality of closely spaced, vertically separated shelves, track rails on which said shelves are supported, said shelves each comprising a plurality of flexibly joined sections, means arranged to withdraw each shelf from one end of the unit, means for dumping the contents of the shelves when withdrawn, and rails extending from said unit and adapted to be moved to the level of either of the shelves to support the latter in their withdrawn positions.

17. A malting unit comprising a plurality of closely spaced, vertically separated shelves, track rails on which said shelves are supported, said shelves each comprising a plurality of flexibly joined sections, means arranged to withdraw said shelves from one end of the unit, means for dumping the contents of the shelves when withdrawn, rails extending from said unit to support the shelves in their withdrawn positions, and means for loading said shelves as they are moved backwardly into the unit.

18. A malting unit comprising a plurality of closely spaced, vertically separated shelves, track rails on which said shelves are supported, said shelves each comprising a plurality of flexibly joined sections, means arranged to withdraw said shelves from one end of the unit, means for dumping the contents of the shelves when withdrawn, rails extending from said unit to support the shelves in their withdrawn positions, and conveying mechanism constructed and arranged to receive the malt dumped from said shelves and redeposit the same on the shelves as they are being moved backwardly into the unit.

19. A malting unit comprising a plurality of closely spaced, vertically separated shelves, track rails on which said shelves are supported, said shelves each comprising a plurality of flexibly joined sections, means arranged to withdraw each shelf from one end of the unit, means for dumping the contents of the shelves when withdrawn, and stationary rails on which said shelves are supported when withdrawn from the units.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 3rd day of July A. D. 1906.

WILLIAM PAUL RICE.

Witnesses:
WILLIAM L. HALL,
GEORGE R. WILKINS.