

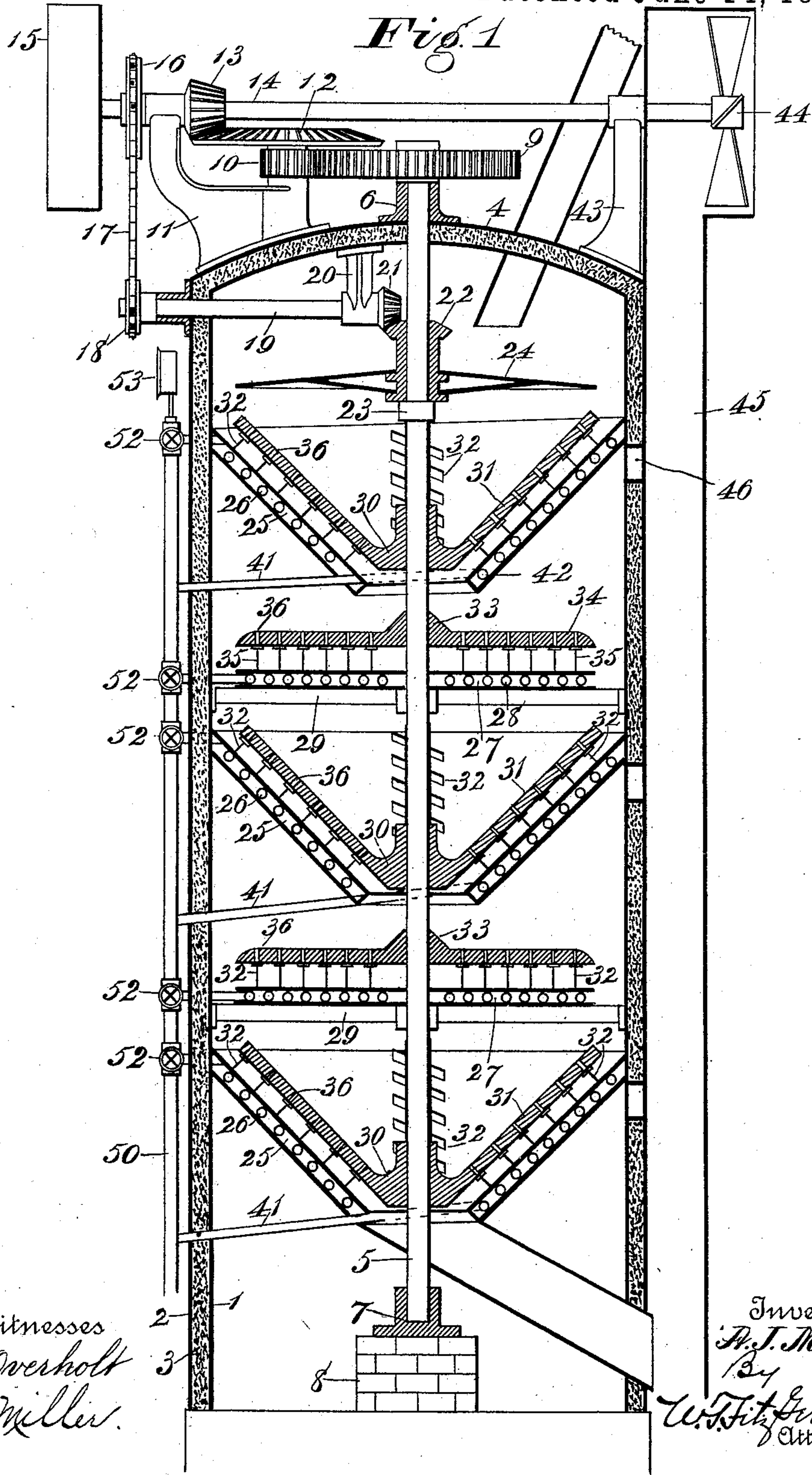
(No Model.)

3 Sheets—Sheet 1.

A. J. MILLER.
DRYING APPARATUS.

No. 605,736.

Patented June 14, 1898.



Witnesses
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(No Model.)

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Fig 2

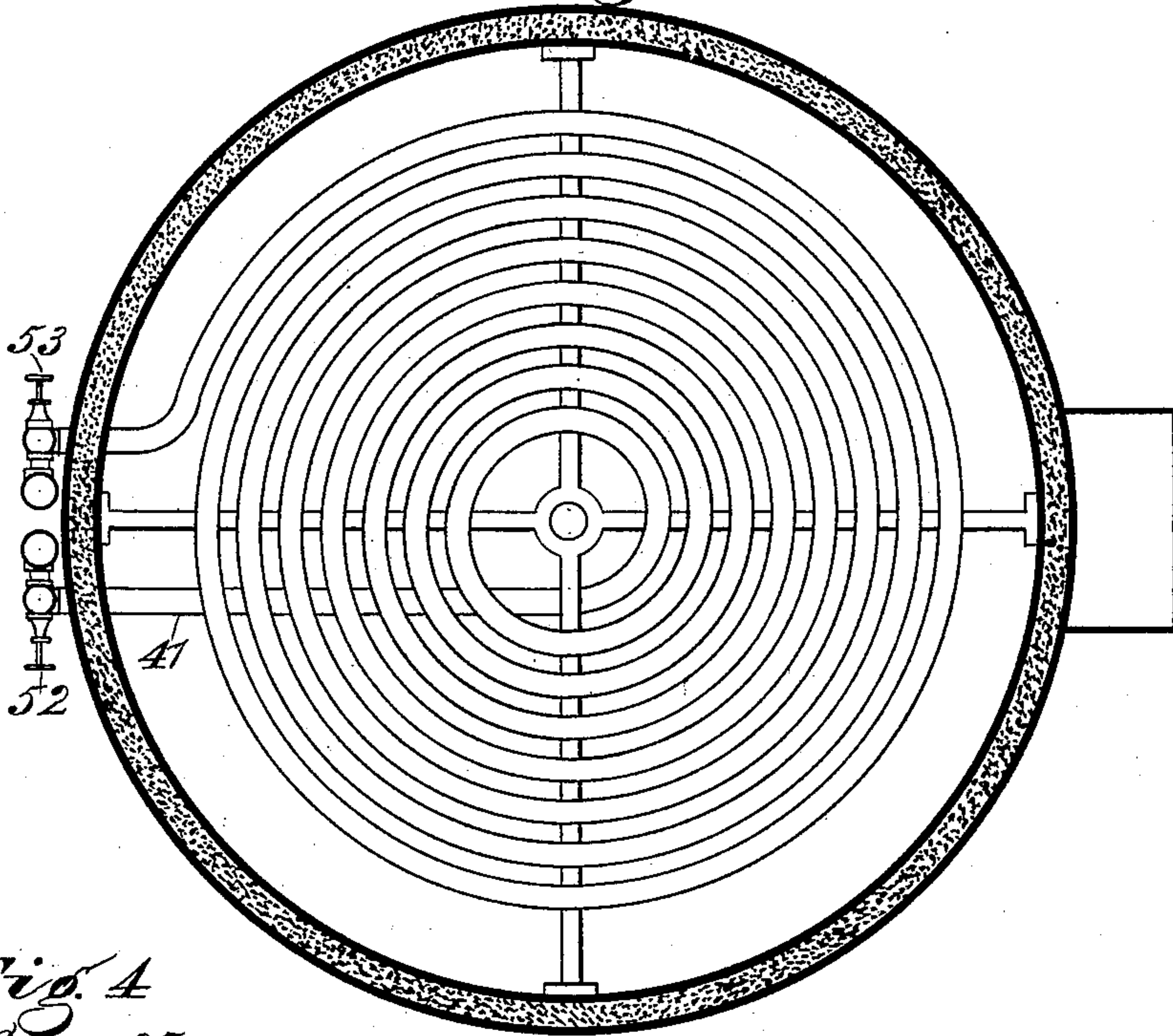


Fig 4

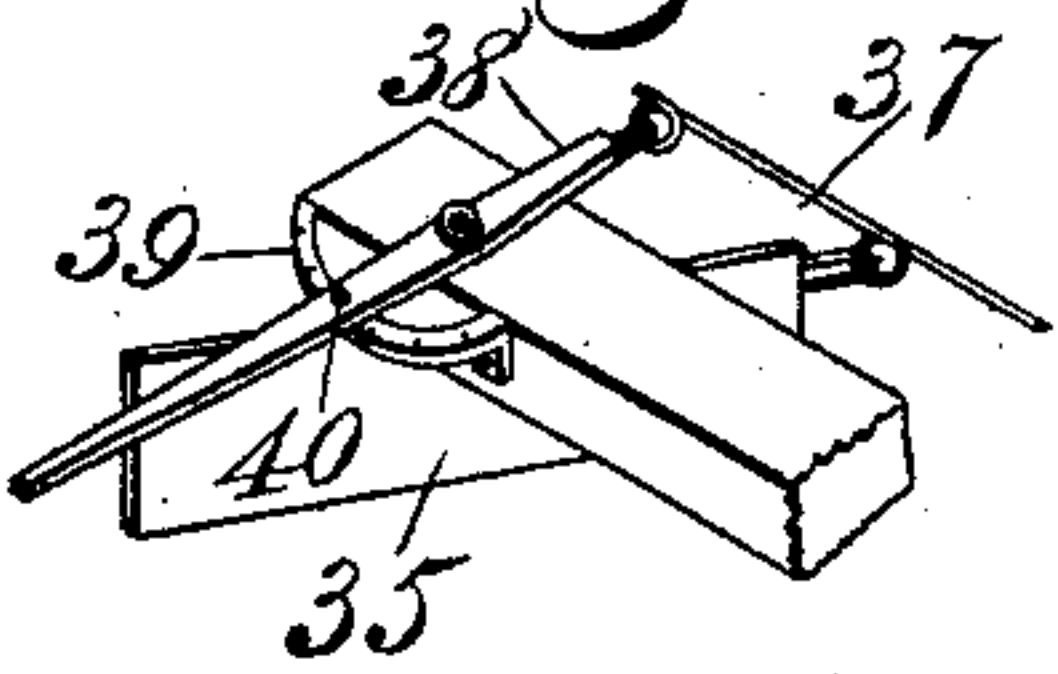
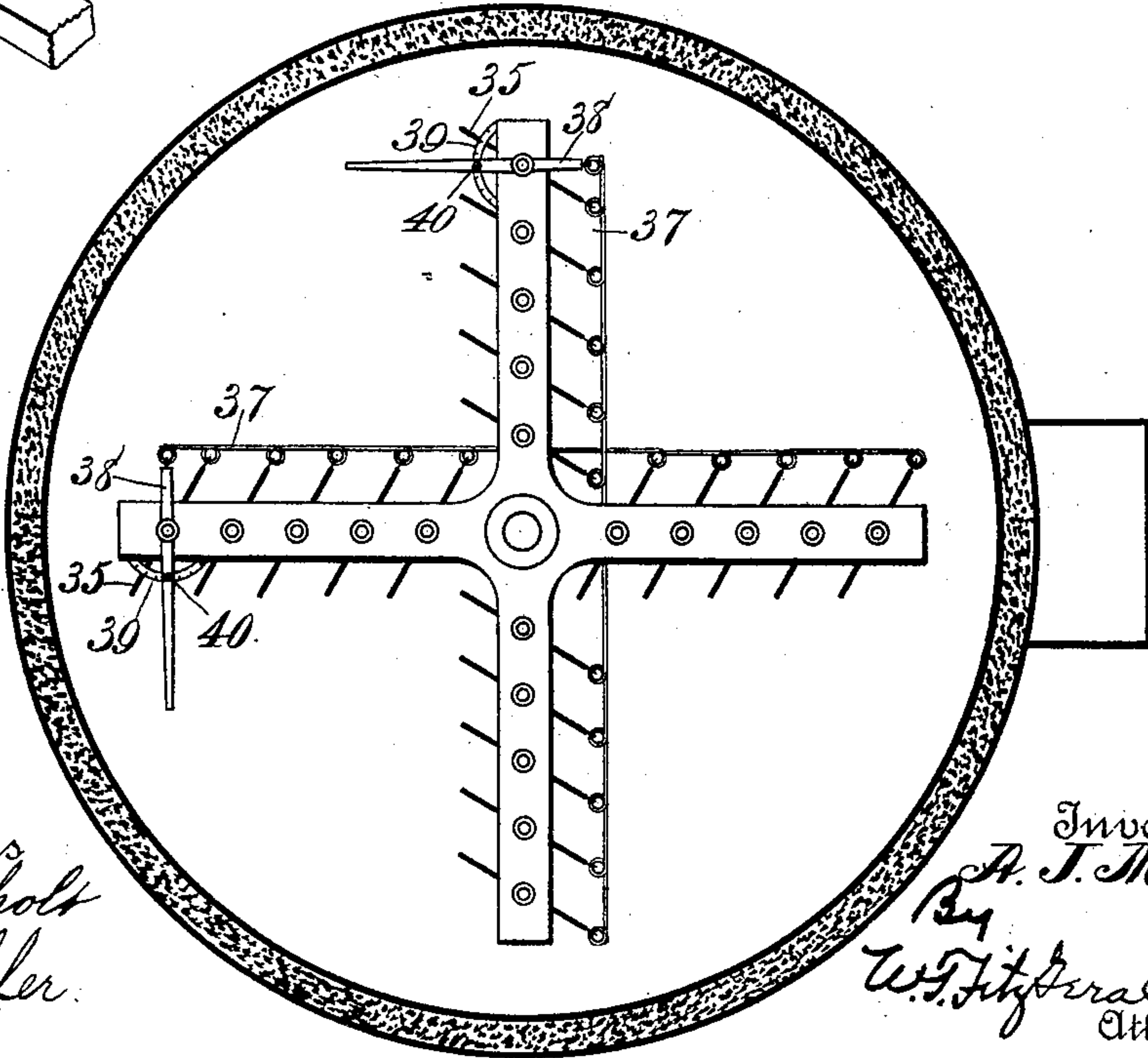


Fig 3



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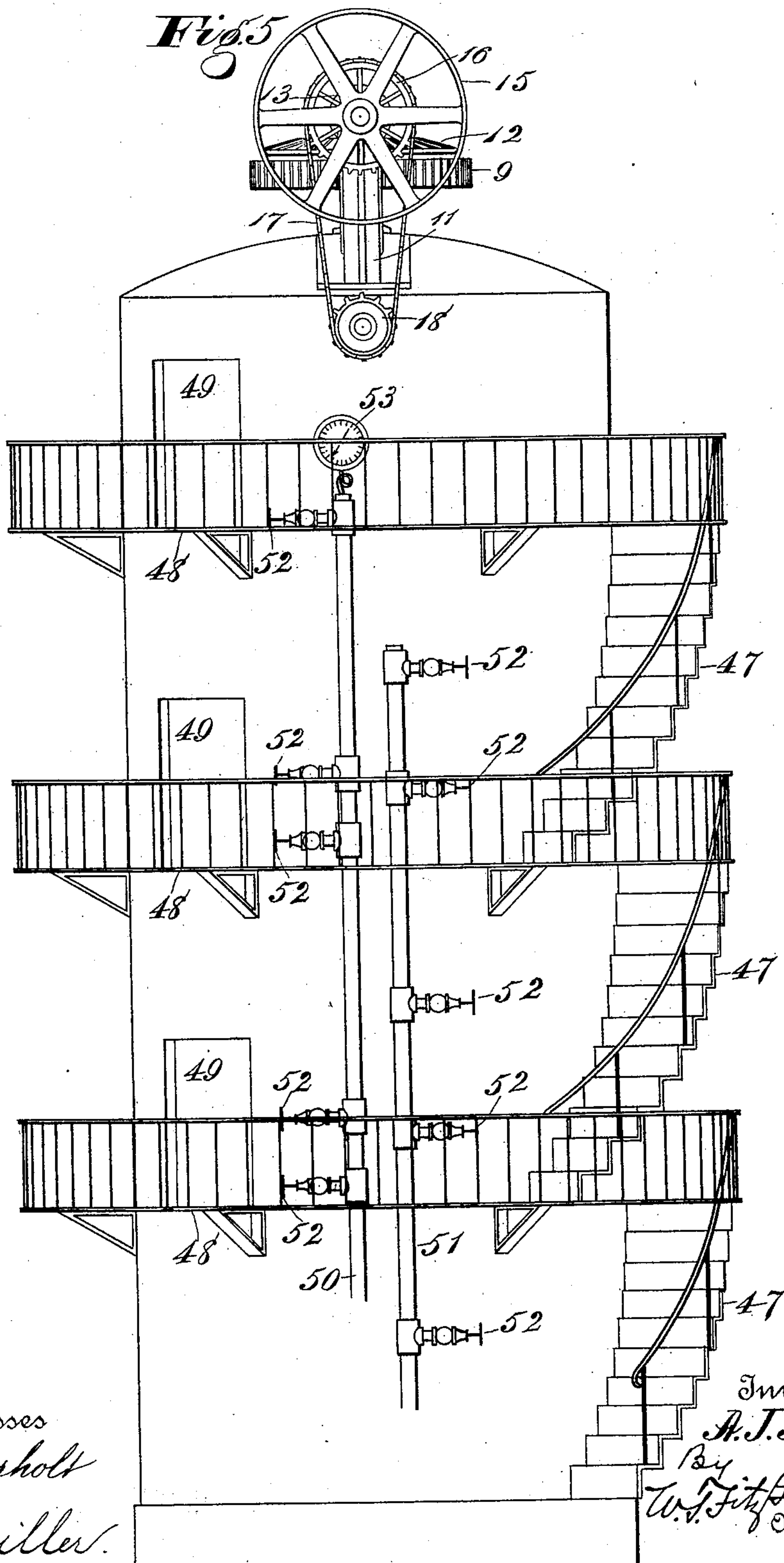
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UNITED STATES PATENT OFFICE.

ANDREW J. MILLER, OF METAMORA, INDIANA.

DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 605,736, dated June 14, 1898.

Application filed June 14, 1897. Serial No. 640,744. (No model.)

To all whom it may concern:

Be it known that I, ANDREW J. MILLER, a citizen of the United States, residing at Metamora, in the county of Franklin and State of Indiana, have invented certain new and useful Improvements in Drying Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention, which will be clearly set forth in the following specification, pointed out in the claims, and illustrated in the accompanying drawings, comprehends a method for drying all kinds of grain, malt, and other substances from which it is desired to extract the moisture preparatory to storage or use; and it consists of certain details of construction and combination of parts necessary to not only thoroughly disintegrate the mass of grain, malt, or other subject-matter treated, but also thoroughly eliminate all moisture therefrom, leaving it in a dry and desirable condition, the object being to produce such results at a minimum cost.

In the accompanying drawings, Figure 1 is a vertical central section of my drying apparatus complete. Fig. 2 is a horizontal section thereof on a line immediately above one of the heating-coils. Fig. 3 is a horizontal section of Fig. 1 on a line immediately above one of the rotary agitators. Fig. 4 is a perspective detail of one of the agitating-blades and means for adjusting the same. Fig. 5 is a side elevation showing the exterior appearance of my complete drying apparatus.

In the following specification I will refer to the preferred accessories and construction thereof deemed necessary to carry out my invention; but it will be understood that any substantial equivalent thereof is comprehended by me in this application, and I do not therefore wish to be confined strictly to the exact showing I have made.

Briefly stated, my invention consists in a suitable housing within which is mounted in series certain agitating and heat-imparting devices designed to separate any compacted mass of the grain or malt or other subject-matter treated and bring each particle thereof into coöperation with the heat-imparting devices, and, further, in means for supplying

the heat either directly by a blast of heated air delivered into the lower part of the housing or by a series of steam-coils suitably mounted into coöperation with the agitating devices, and also additional means for withdrawing from the housing the moisture given off by the subject-matter treated.

Referring in detail to the several parts of my invention, I provide a tower-like housing consisting, preferably, of an inner casing 1, an outer casing 2, and an intermediate wall 3, formed between said casings and consisting of any suitable non-conducting material, and while I prefer to so form the housing that it will be cylindrical in cross-section yet it will be understood that any preferred outline may be adopted. The walls thus provided are suitably inclosed at the top, as by the arch-cap 4, and disposed centrally within the housing thus provided I mount the shaft 5, by means of which power is communicated to the interior devices. Said shaft is provided, respectively, at its upper and lower ends with suitable bearings 6 and 7, the latter being reliably held in position preferably by a support 8, formed of masonry.

To the upper end of the shaft 5 I secure the gear 9, designed to mesh with the gear 10, mounted upon the bracket 11, which in turn is secured to the upper part of the housing in any preferred way.

The shaft upon which the gear 10 is mounted carries on its upper end the beveled gear 12, arranged to mesh with the bevel-gear 13, keyed to the shaft 14, said shaft being driven by any suitable power through the mediation of the band wheel or pulley 15, secured to the outer end thereof. Upon the shaft 14 I secure near the driving-pulley 15 the sprocket 16, designed to coöperate by means of the chain 17 with the sprocket 18, which is keyed to the shaft 19, the latter being supported at its inner end by the bracket 20 and at this point carries the beveled gear 21, arranged to coöperate with a similar gear 22, loosely mounted upon the shaft 5 and held in rotatable position by the collar 23. By this arrangement of the parts it will be observed that the gear 22 will rotate independently of the movement of the shaft 5, the object being to impart a rapid rotation to the spreader 24, rigidly secured to the gear 22, the purpose of

which will be hereinafter more specifically pointed out.

In order that the grain or other matter treated (which is delivered into the upper part of the housing by any suitable means) may be separated, I provide, in addition to the spreader 24, a series of agitating devices designed to successively coöperate with each other as the grain is directed by gravity to the lower part of the housing, said devices now being specifically referred to.

Immediately under the spreader 24 I locate the inwardly-inclined hollow or open floor 25, consisting of any suitable material, such as heavy sheet metal, and between the upper and lower surfaces I dispose a concentrically-formed though conically-disposed heating-coil 26, preferably extending from the upper to the lower edge of the floor thus provided.

The object in providing an inwardly and downwardly directed floor at this point the upper edge of which is securely connected to the wall forming the housing is to receive the grain from the spreader and direct it to the central part of the housing, where it is received by the table 27, also preferably formed with a hollow or open floor and consisting of heavy sheet metal, between the upper and lower walls of which I dispose a series of concentrically-formed heating-coils 27. The table 27 may be held in position free from rotation with the shaft 5 by the angle-irons or supports 29, the ends of which are secured to the walls forming the housing.

In order to thoroughly separate any mass of grain or other matter treated caused by mold or dampness or other causes, I provide a series of rotary agitators consisting, as in the case of a conical floor, of the hub 30, securely keyed to the shaft 5 and designed to rotate therewith. Integrally formed with said hub or otherwise attached thereto are the radial arms 31, disposed at such an angle as will leave them in a plane which is parallel with the plane occupied by the conical floor or hopper 25, though a sufficient distance therefrom to permit the mounting and adjustment of a series of blades 32, secured thereto.

Designed to coöperate with the floor 27 is the agitating device, consisting of the hub 33, having integrally formed or otherwise secured thereto the radial arms 34, which in like manner with the arms 31 are provided with a series of adjustable blades 35. As will be shown in Fig. 4, each of the blades 32 and 35 is oblong in outline, and being mounted edgewise upon the rotary axle or shaft 36 the plane occupied by them may be simultaneously varied at will, as each of them is pivotally connected to the controlling-rod 37, in turn pivotally connected to the operating-lever 38, adjustably held in position by the quadrant 39 and set-screw 40.

While the construction just described provides a simple means for simultaneously moving and adjusting all of the blades, it will of course be apparent that other equally effi-

cient means may be adopted for such purpose, and I therefore claim any substantial equivalent thereof. By arranging the conically-disposed floor or hopper 26 and the horizontally-disposed table 27 in series I make it possible to cause the grain or other matter treated to travel over greater area of drying-surface than would be possible without such disposition of said parts, as it will be clear that the subject-matter treated will first be received by the spreader 24, which, revolving at a very rapid rate, will direct the matter against the walls of the housing and thence into the hopper 26, where it will be acted upon by the series of blades 32, and finally delivered by gravity upon the table 27, immediately around the shaft 7, from whence it will be forced by the blades 35 upon the arms 34 toward the outer edge of the table, from whence it will fall into the succeeding hopper and thus again centered around the shaft upon the succeeding table, when the operation is repeated again and again in proportion to the number of agitators and floors thus provided, it being understood that any preferred number of the devices may be thus provided in series.

Circulation through the coils 26 is provided by means of the pipe 41, connecting with the lower end 42 of the conically-disposed coil, said pipe 41 being connected with pipe 51, preferably disposed upon the outer side of the housing.

The opposite end of the shaft 14 from that occupied by the pulley 15 is supported by bracket 43, properly mounted in position upon the housing, and attached to this end of the shaft is the exhaust-fan 44, properly housed in the upper end of the air-shaft 45, which communicates at intervals with the interior of the housing, as by openings 46, formed in the wall, the object of this construction being to enable the moisture-laden air to be withdrawn from the housing by said fan, the purpose being to facilitate the process of drying.

It would obviously fall within the scope of my invention to construct the floors of heavy sheet metal and admit hot air from the bottom of the housing, whereby it would come in direct contact with the material under treatment. In this event the series of heat-coils might not be deemed necessary.

If the steam-coils are omitted, any suitable furnace may be used in connection with the housing thus or otherwise provided. For cheap and ready construction the housing thus specially constructed and provided may be dispensed with, in which case the agitating devices, formed substantially as shown, may be mounted in a building of suitable character and reliance had upon a furnace or the series of coils of pipes, as may be deemed most expedient.

If the construction illustrated in Fig. 1 is adopted for the housing, it will be found desirable to provide accessibility to the various

parts, which may be done by erecting a series of stairs 47 and platforms 48, cooperating therewith at suitable intervals. This arrangement will render any of the interior parts readily accessible by means of suitably-provided doors 49 and will be found very desirable in all constructions of a permanent character.

The series of heating-coils may be supplied with steam by means of the delivery-pipe 50, the exhaust being provided for by the return-pipe 51, each having check-valves 52 of the usual construction, while a pressure gage or indicator 53 may be employed to readily enable the temperature to be reliably controlled.

Believing that the construction, operation, and advantages of my improved drying apparatus will be fully apparent from the foregoing specification and the accompanying drawings, I will dispense with further reference thereto.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a drier, the combination with a suitable housing of a rotatable shaft mounted therein, a spreader and radial vertically-inclined arms keyed on said shaft, said arms carrying blades or agitators, an inwardly-inclined hollow floor having heating-coils therein, said floor being open at its center, and means for operating the foregoing devices, as set forth.

2. In a drier, the combination with a suitable housing of a rotatable shaft vertically mounted in the housing, a spreader and radial arms vertically inclined carrying blades or agitators keyed to said shaft, an inwardly-inclined hollow floor having heating-coils therein, said floor being open at its center, horizontal arms carrying spreaders or agitators, a horizontal floor having heating-coils therein, and means to operate the foregoing devices, all arranged as set forth.

3. In a drier, the combination with a suitable housing of a rotatable shaft therein, a hopper for the admission of the grain, a horizontal spreader and arms radially and vertically disposed, said arms carrying agitators and keyed to said shaft, floors cooperating

with said agitators and separate and independent means to rotate respectively the spreader and the radial arms, all arranged as set forth.

4. In a drier, the combination with a suitable housing of a rotatable shaft vertically mounted therein, a hopper for the grain, radial arms vertically disposed carrying agitators and keyed to said shaft, floors cooperating with said agitators, and means to actuate the foregoing devices consisting of a crank-shaft carrying beveled gearing operating said rotatable shaft and a sprocket and chain acting on bevel-gearing operating the spreader, all arranged as set forth.

5. In a drier, the combination with a suitable housing of a rotatable shaft vertically mounted therein, a series of inclined and horizontally-disposed floors, a series of rotating arms keyed to said shaft and carrying agitators designed to cooperate with said floors, an air-shaft cooperating with said housing and an exhaust-fan mounted in said shaft and adapted to withdraw the moisture-laden atmosphere from said housing, all operatively arranged as set forth.

6. In a drier, the combination with a suitable housing of a rotatable shaft journaled therein, a horizontal spreader loosely mounted on said shaft, and means to lock the spreader in operative condition, radial arms keyed to said shaft carrying agitators, floors designed to cooperate with said agitators, and means to operate the foregoing devices, all arranged as set forth.

7. In a drier, the combination with a suitable housing of a horizontal spreader-disk, a series of radial arms carrying agitators, means to simultaneously adjust and secure in position all of said blades at any desired angle, and means for imparting greater speed to the disk than that imparted to the agitators, all arranged as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ANDREW J. MILLER.

Witnesses:

W. G. BLACKLEDGE,
FRANCIS R. HARDER.