

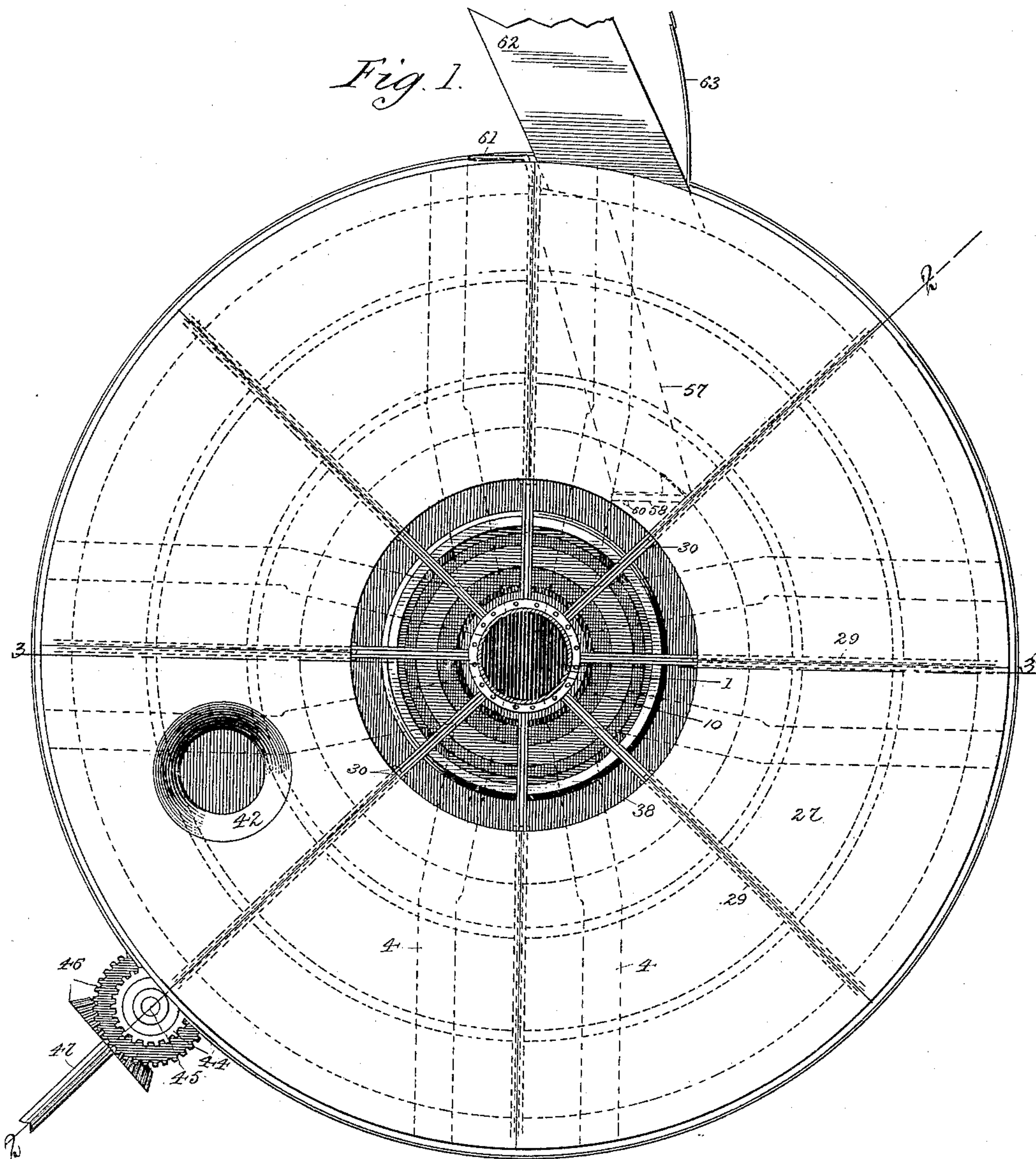
(No Model.)

4 Sheets—Sheet 1.

J. B. SEAMAN.  
DRYING OR EVAPORATING APPARATUS.

No. 411,397.

Patented Sept. 17, 1889.



Witnesses,

L. J. Mann  
Frederick Goodwin

Inventor,

Joseph Borrell Seaman

By, Offield Torrie & Phelps

Attys.

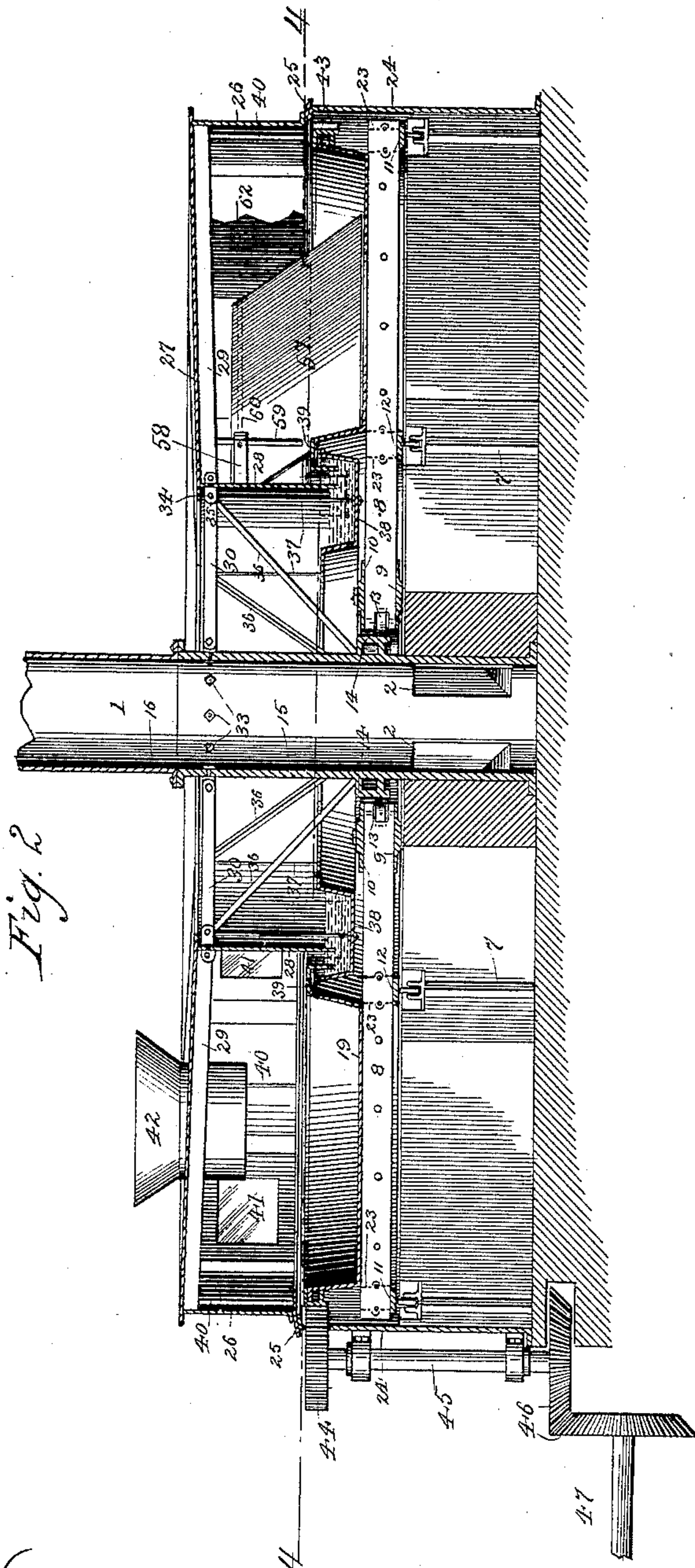
(No Model.)

4 Sheets—Sheet 2.

J. B. SEAMAN.  
DRYING OR EVAPORATING APPARATUS.

No. 411,397.

Patented Sept. 17, 1889.



Witnesses,

*L. J. Munn.*

*Frederick Goodwin*

*Inventor*

*Joseph Bonwell Seaman*  
*By* *Offield Torle & Phelps*

*Attys.*



(No Model.)

4 Sheets—Sheet 3.

J. B. SEAMAN.  
DRYING OR EVAPORATING APPARATUS.

No. 411,397.

Patented Sept. 17, 1889.

Fig. 5.

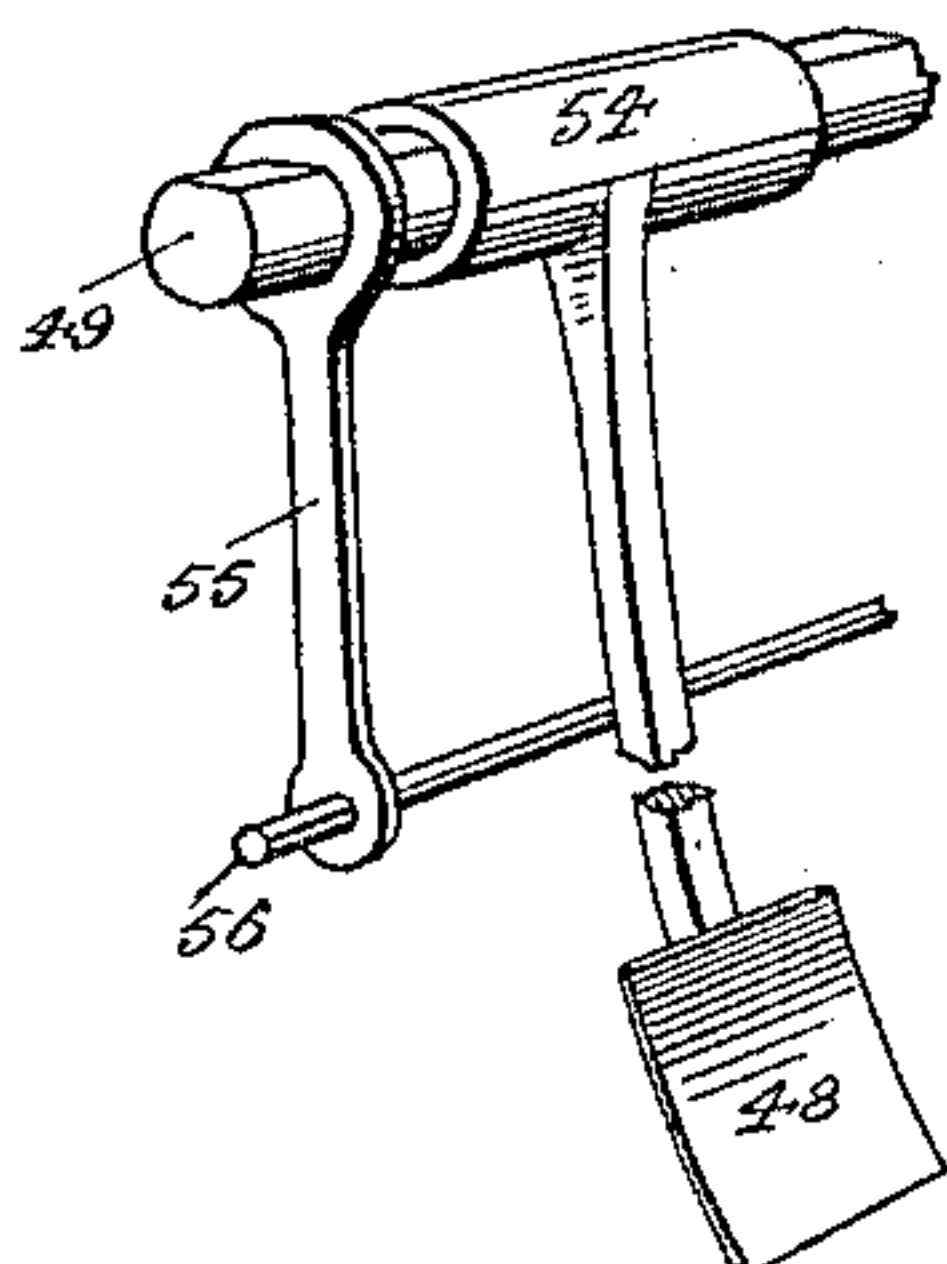


Fig. 6.

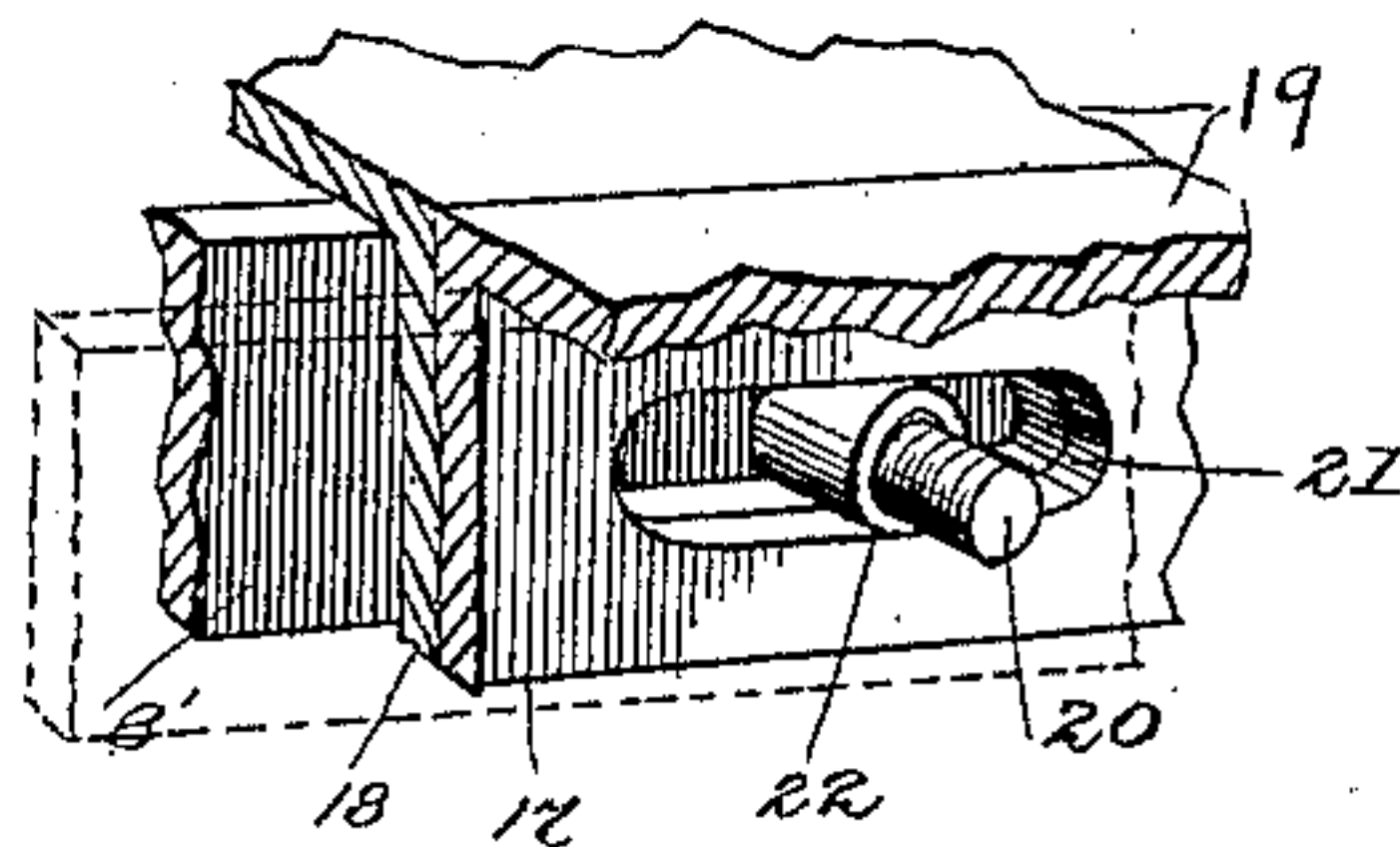


Fig. 3.

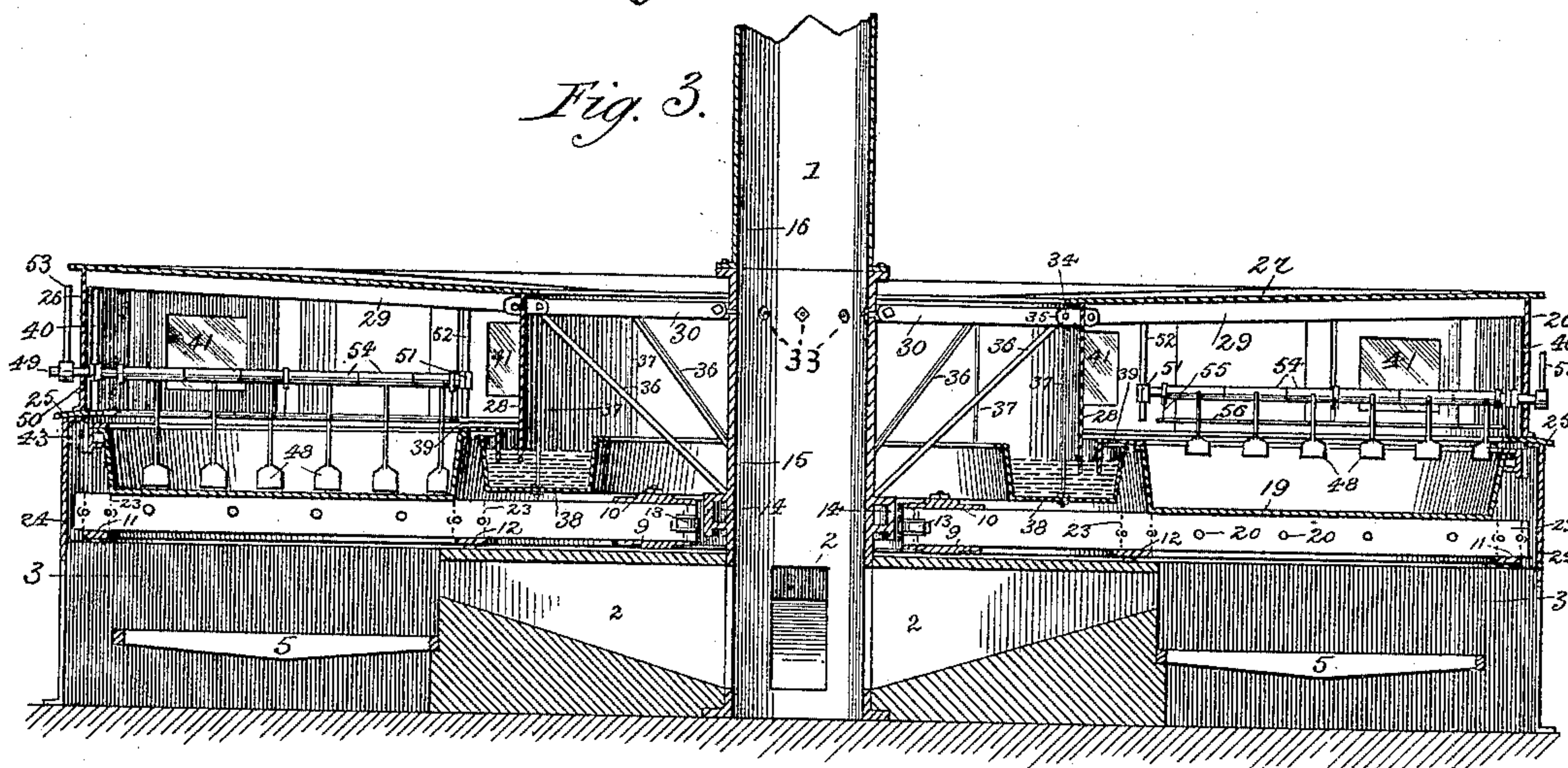
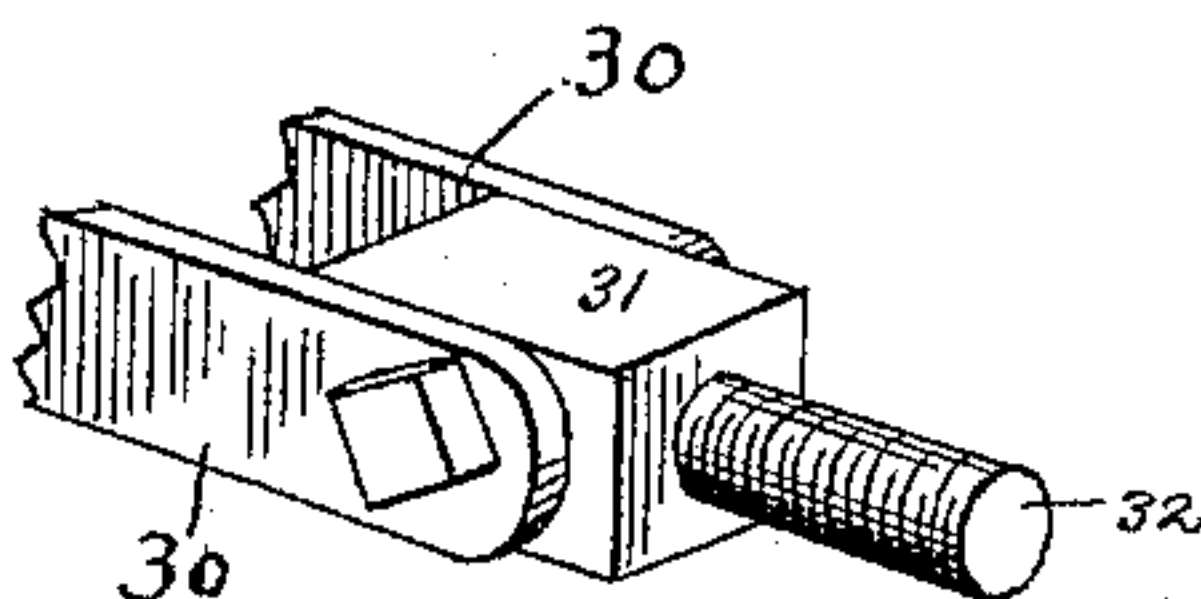
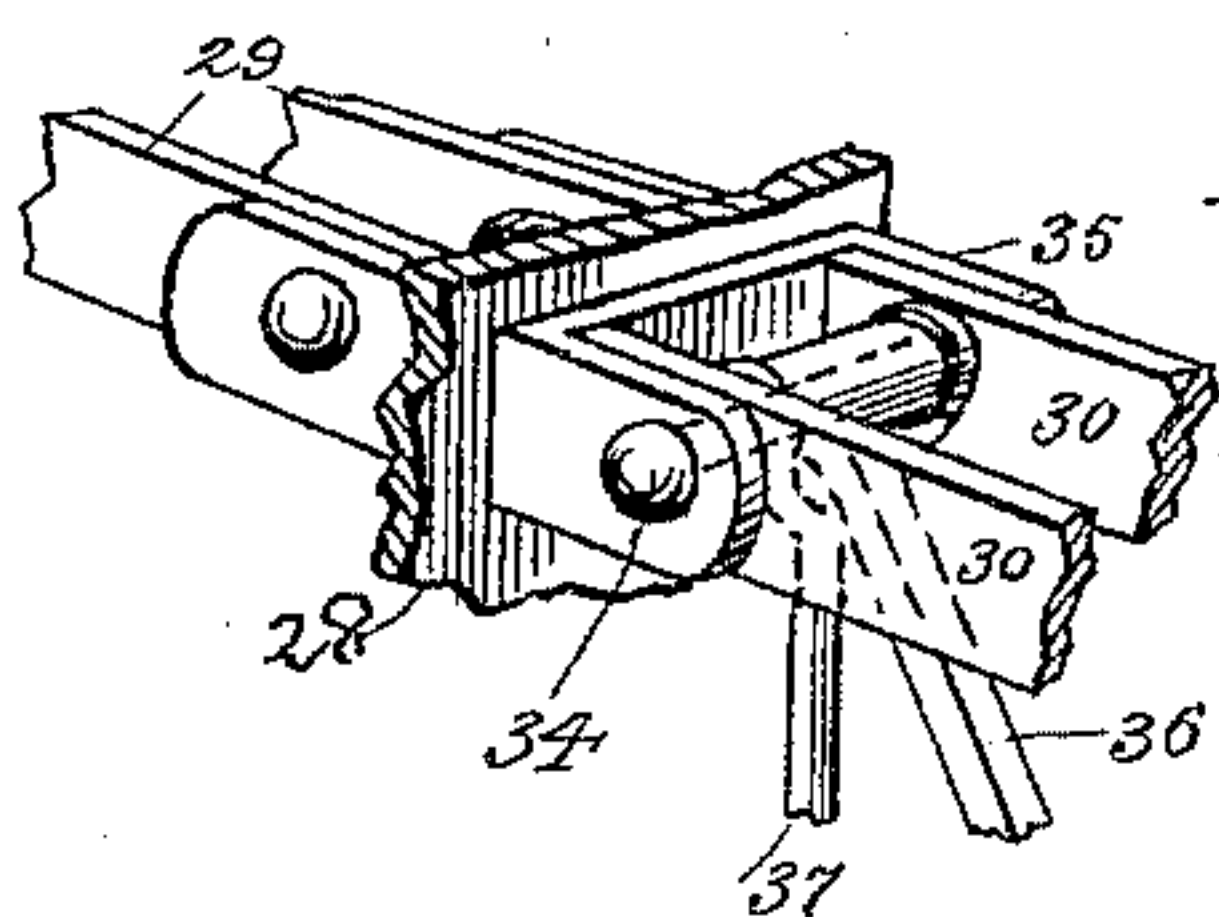


Fig. 1.



Witnesses,

L. J. Mann,  
Frederick Goodman

Inventor,

Joseph Bonwell Seaman  
By, Offield Torke + Phelps  
Attys.



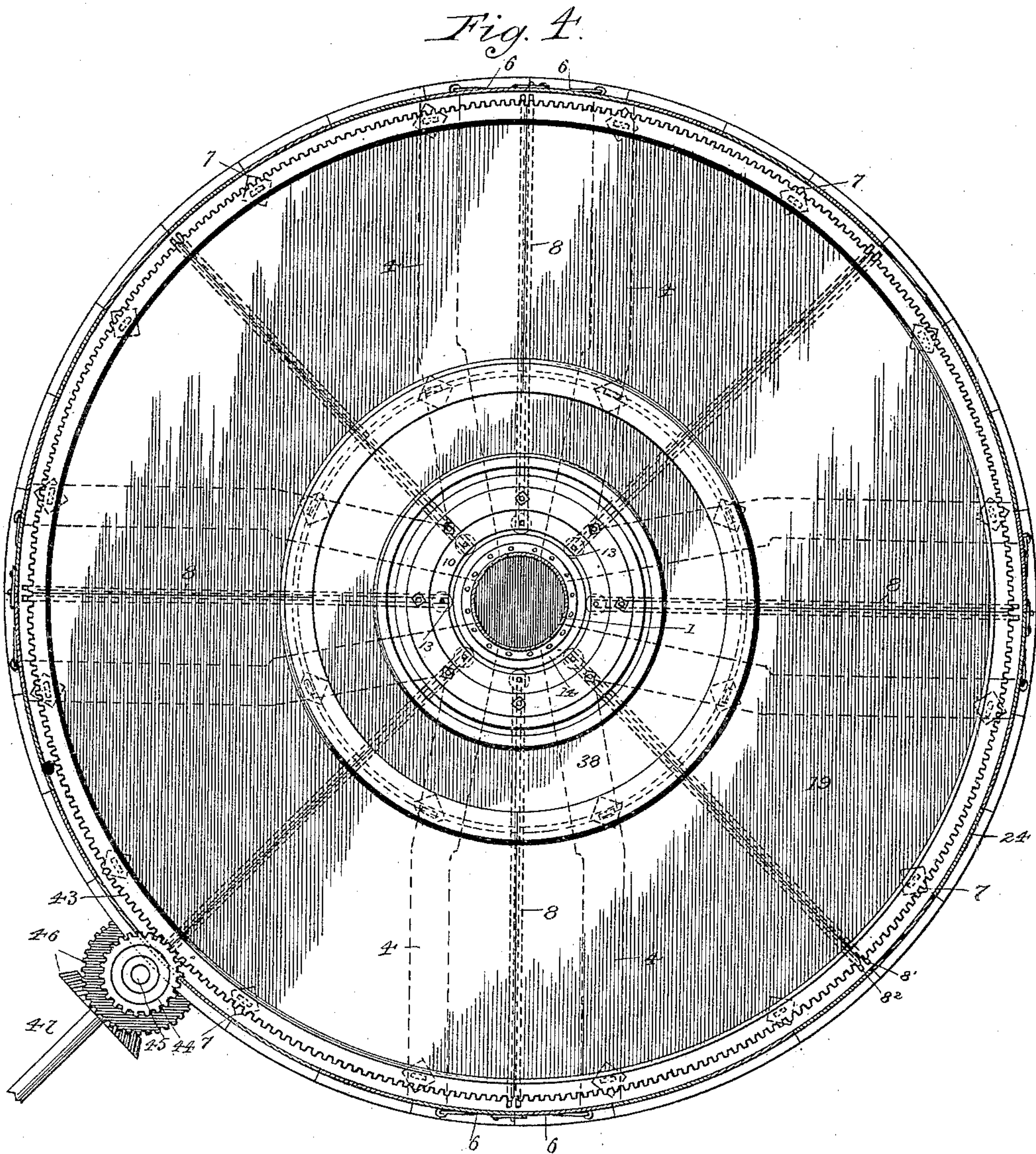
(No Model.)

4 Sheets—Sheet 4.

J. B. SEAMAN.  
DRYING OR EVAPORATING APPARATUS.

No. 411,397.

Patented Sept. 17, 1889.



Witnesses,

L. F. Mann.

Frederick Goodwin

Inventor

Joseph Bonwell Seaman

By, Offield Torle + Phelps

Attys.



# UNITED STATES PATENT OFFICE.

JOSEPH BORWELL SEAMAN, OF SOUTH LYNNE, ILLINOIS.

## DRYING OR EVAPORATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 411,397, dated September 17, 1889.

Application filed November 29, 1886. Serial No. 220,169. (No model.)

### *To all whom it may concern:*

Be it known that I, JOSEPH BORWELL SEAMAN, a citizen of the United States, residing at South Lynne, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Drying or Evaporating Apparatus, (which I desire to protect by Letters Patent of the United States,) of which the following is a specification.

My invention consists, essentially, in the arrangement and construction of my furnaces and drying-pans, and in certain details of the various parts, all of which are hereinafter described in connection with the drawings, and pointed out in the claims.

In the drawings annexed to this specification, and forming a part thereof, Figure 1 is a top plan view; Figs. 2 and 3, vertical sections on the lines 2 2 3 3, respectively, of Fig. 1; and Fig. 4, a horizontal section on the line 4 4 of Fig. 2. Figs. 5, 6, and 7 are detailed views of several parts on a larger scale.

The furnaces which furnish the heat to the drying-pans are arranged radially about the central flue 1, with which they connect through passages 2, the furnaces 3 being shown in vertical section in Fig. 3 and in plan view in Fig. 1, wherein the walls thereof 4 are indicated by broken lines. The grate-bars 5 of the furnaces are shown in Fig. 3. The furnace-doors 6 6, Fig. 4, are placed at the end of the furnace opposite to the flue. The passage-way between each furnace and the flue has an equal cross-section at each end, but is extended horizontally at the end next to the furnace, in order to force the flames and products of combustion to pass in close proximity to the bottom of the evaporating-pan, and is extended vertically at the flue, as is shown in Fig. 3, in order to economize space at that point and enable a flue of moderate size to be used with a number of furnaces.

At regular intervals about the circumferences of the circles formed by the outer and inner end walls of the furnaces are placed standards 7, of which any suitable number may be used, sixteen being shown in Fig. 4 on the outer circumference and eight on the inner, provided in their tops with friction-rollers journaled so as to be adapted to revolve, which rollers form the support for the structure which carries the evaporating-pan,

and which will now be described. This structure consists, primarily, of a series of radially-arranged arms 8, (shown in elevation in Fig. 2 and by broken lines in Figs. 1 and 4,) eight of these arms being employed, their inner ends set in two annular plates 9 and 10 immediately surrounding the flue, and their outer ends being connected by annular plate 11 beneath them, so placed as to be immediately above the rollers of the outer standards 7. Between the extremities of the arms, and so placed as to be immediately over the inner circle of supporting-rollers, is another annular plate 12, attached to the under sides of the arms and resting upon the inner circle of rollers. The arms 8 carry on their inner ends rollers 13, which rest against the flange 14, formed on the flue, this flange constituting a bearing for these rollers as the structure revolves. The flue, as shown, is made in two parts, the part 15, on which the flange 14 is formed, being set into the masonry at its base and having attached to its top by flanges above an extension of lighter material 16. Each arm, which as a whole is designated 8, is made double, and between the two parts thereof 8' 8'' are held downwardly-projecting flanges 17 18, connected with the bottom of the annular pan 19. This pan is made in segments, each segment corresponding to the space between two successive arms 8, and the ends of each segment of the pan-bottom are bent downward, so as to form the flanges 17 18, which are pressed between the parts 8' 8'' of the corresponding arm 8. It is necessary that the joints between the adjoining segments of the pan shall be perfectly tight, and to secure this the beams 8' 8'' are pressed together by the bolts 20. In order to permit lateral contraction and expansion of the metal of the pans under the heat of the furnaces without distortion, the holes 21, through which these bolts 20 pass, are elongated, as shown particularly in Fig. 6, and to facilitate movement of the several parts the bolt may be inclosed in a section of gas-pipe 22. Blocks 23 (shown in broken lines in Figs. 2 and 3) are placed between the beams 8' 8'' at each side of the pan beyond the ends of the downwardly-extending flanges 17 and 18.

The entire structure is inclosed in a metal casing, the lower part of which 24 is cylin-



drical and rises to the level of the top of the pan, where it is attached to a rim 25, projecting horizontally within the casing and carrying a second metal cylinder 26, upon the top of which rests the outer edge of the annular top 27, the inner edge of which is supported by an inner vertical cylinder 28 of a diameter slightly less than the diameter of the circle formed by the inner edge of the evaporating-pan. This top is of thin metal, and is supported by double stringers 29, passing from the outer wall of cylinder 26 to the inner cylinder 28, and attached to the latter, as shown in Fig. 7. The cylinder 28 is in turn supported by a triangular structure consisting of tie-rods 30, attached at one end to the lower section of the flue 15 by means of block 31, to which they are bolted, this block having a shank 32, which screws into the flue, and is secured by a nut 33 on the inside. The other end of this tie-rod, which is made double, hangs upon a bolt 34, passing through double bracket 35, attached to the cylinder 28. Upon this bolt 34 is also pivoted a diagonal brace 36, which passes diagonally toward the flue, its inner end resting upon the top of flange 14. The rod 30 and the brace 36 thus give support to the cylinder 28 and the inside edge of the top of the casing. Depending from this bolt 34 is a rod 37, the lower end of which passes through the bottom of a second annular pan 38, to which it is secured by nuts above and below the bottom of the pan. This pan, as is shown, is of comparatively small size, and is so placed with reference to the cylinder 28 that the lower edge of the latter passes down to a point considerably below its top.

To the inner edge of the principal evaporating-pan 19 is attached flange 39, which projects horizontally and then downwardly into the pan 38. In order that the cylinder 26 may be made of thin metal, posts 40 are placed at intervals just within the cylinder 26, their lower ends resting upon the inner part of rim 25 and their upper ends in contact with a stringer 29, or the top 27, so as to afford support for the latter. The cylinder 26 is provided at intervals with windows 41, filled with some transparent substance—such as glass or mica—sixteen of which are shown. At one point in the roof a hopper 42 is provided, through which the material to be acted upon is introduced. To the outer edge of the pan 19 is affixed a cog-gearing 43, with which meshes a pinion 44 on a vertical shaft 45, driven through beveled gearing 46 from main shaft 47, and by this means a rotary motion is given the pan over the furnaces. This is necessary in order to evenly distribute the heat to the contents of the pan and prevent the rapid destruction of the bottom of the pan, which would occur if the latter were stationary with reference to the furnaces.

The provision for stirring and mixing the contents of the pan consists of a set of paddles or shovels 48, hung upon a horizontal

shaft 49, journaled in a box 50, attached to one of the uprights 40, and another box 51, suspended from the top of the casing by rod 52, the shaft 49 having on its outer end, outside of the casing, a crank-arm 53, by which its position is governed. Instead of rigidly attaching the shovels 48 to the shaft 49, I find it better to give them a pivotal attachment, and this I accomplish by fastening the upper ends of their shanks to sections of gas-pipe 54, strung on the shaft 49. To this shaft is rigidly attached, by means of arms 55, somewhat shorter than the shanks of the shovels, a rod 56, passing behind all the shovel-shanks, so that when the shaft 49 is revolved this rod will come in contact with the shanks and raise the shovels, and their position with reference to the bottom of the pan can be thus determined from without. I arrange these sets of shovels at intervals around the pan, using as many sets as is found necessary to thoroughly mix and stir the contents of the pan, and setting the shovels of each set with reference to the shovels of the other sets, so that as the pan revolves no part of its bottom will be left untouched by them.

I do not confine myself to any particular direction of inclination of the stirrers. They may be perpendicular or inclined in either direction with reference to the movement of the pan.

The several joints of the casing are made air and vapor tight, and the pan 38 is filled with water or other liquid, so as to immerse the lower edges of cylinder 28 and flange 39, thus acting as a water seal between the cylinder 28 and the revolving pan. Provision for emptying the pan of its contents when the treatment has been completed is made by means of a plate 57, attached to a rod 60, the inner end of which is pivoted in an arm 58, extending from the hanger 59, depending from the roof, provided for the purpose, and the outer end of which projects through the casing, and is provided without the casing with a crank-arm 61, by which its position may be changed. The direction of this plate is placed at an angle to the radial lines of the pan, as shown in broken lines in Fig. 1, and is of such a size as to pass in its inclined direction from the inner to the outer sides of the pan. It is also of such a length that when its lower edge rests upon the bottom of the pan it is inclined at an acute angle toward the direction from which the pan is moving. The casing 26 is provided with a number of doors about its periphery, all or a number of which may be thrown open when it is desirable to rapidly cool the interior of the casing. The windows 41 may be mounted in these doors or in other parts of the cylinder. When it is desired to empty the pan, one of these doors 63, appropriately placed with reference to the plate 57, as shown in Fig. 1, is thrown open and a trough or chute 62 inserted, so as to receive the material as it is pushed up and out by the revolving motion of the pan upon



the plate 57, this plate being lowered until its lower edge rests upon the bottom of the pan. The contents are thus forced up the plate 57, over the side of the pan, and out through the spout. I do not confine myself to this means for emptying the pan, nor to the particular form of means shown. Thus it will probably be found convenient to reduce the length of the plate 57 so that it will operate only upon a part of the contents of the pan at one time, the weight of material carried by it and the consequent strain upon the parts being thus reduced. Thus the plate if made considerably shorter than that shown could be made to operate first upon that part of the material lying along the outer side of the pan, and then pushed in toward the inner side of the pan, taking successive bands or strips of the material, the spout being pushed in to accommodate the successive positions of the plate.

The operation of my machine is as follows: Fires having been built in the furnaces, the material to be operated upon is introduced through the hopper into the pan 19, and the latter given a continuous rotary motion, the shovels being so placed meanwhile as to thoroughly stir and mix its contents until the material is thoroughly dried, when the plate 57 is lowered, the exit-spout introduced, and the whole mass discharged into proper receptacles outside of the casing. The revolution of the pan over the furnaces thoroughly distributes the heat to all parts thereof and to all parts of the contents, and the shovels thoroughly mix the contents. The windows about the casing permit the progress of the operation to be thoroughly inspected at all times, so that any failure to thoroughly mix the mass may be at once known, and the attendant can tell when the time for removing it has arrived. These two features are of great importance in my invention, since the degree of heat which must be used in order to evaporate tank-waste is such that exposure to it would speedily destroy a fixed pan, a liability which is obviated by the motion of the pan, and, further, the stability of the product depends upon the material being heated throughout to the same extent—that is, to a regular distribution of the heat accompanying a complete agitation of the material, since otherwise some parts would be less affected by the heat than others, and would be taken out in a partially raw, and therefore unstable, condition, and the deterioration of these parts would affect and finally be destructive of the whole mass. The proper mixing can only be insured by constant observation and inspection during the progress of the evaporation, and the windows provided in my apparatus permit the operation to be constantly inspected by the attendant. I am thus enabled to overcome the great difficulties which have heretofore been experienced in thoroughly drying tank-waste and to obtain a homogene-

ous product, which will not absorb moisture and can be transported and stored for an indefinite time for use as a fertilizer.

The various joints of the casings are made as tight as practicable, in order to prevent dissipation of ammonia and other gases, and consequent weakening of the product, an appropriate door for closing the hopper being provided. The liquid in the smaller pan then serves both as a water seal and condenser, such steam as escapes being forced through the liquid and leaving its ammonia therein.

The mounting of the revolving structure upon rollers or casters journaled in fixed supports, instead of attaching the rollers directly to the revolving structure or to standards depending from it, is an advantageous construction, for the reason that the passage of the rollers or standards through the flame as the structure revolves is avoided.

A feature of the apparatus of great importance, though not essential to some of my combinations, is the radial arrangement of the furnaces, which both gives a very compact machine relative to capacity and is one in which all parts of the pan can be conveniently inspected.

It should be observed that the adjustability of the shovels or stirrers enables me to fix the several sets at varying distances from the bottom of the pan, insuring the mixing of all parts of the mass as the pan revolves.

The construction of the several parts of my machine may be modified, and many parts thereof might be omitted without doing away entirely with the serviceable character of many of the combinations. Thus the feature of making all the joints of the casing steam-tight, while desirable, is not absolutely essential to the usefulness of the apparatus. So, too, the condenser adds to its efficiency, but may be dispensed with, and it would be possible to obtain some results with stationary pans. I wish it understood, therefore, that I do not confine myself strictly to the details of construction which are shown and described herein.

I claim—

1. The combination of a close annular casing, an annular evaporating-pan placed within the same and provided with a depending flange, and a second annular pan containing liquid in which said flange and the inner casing are immersed, whereby said liquid acts both as condenser and a water seal.

2. In an evaporating apparatus, the combination, with a horizontal rock-shaft having one of its ends projected outside the casing and bearing on said end a crank-arm whereby to rock it, of a set of stirrers comprising arms bearing shovels at one end and sleeves at the other, through which sleeves the rock-shaft passes, and a rod supported on arms rigidly attached to and depending from said rock-shaft and parallel thereto, and against



which the stirrer-arms have a bearing, and by means of which their position is fixed, substantially as described.

3. The combination of an annular evaporating-pan provided on its inner periphery with a depending flange 39, with a casing about said pan, a cylinder 28, and a second pan containing liquid in which said flange and the lower edge of said cylinder are immersed, whereby a water seal is provided, and gearing, substantially as described, for rotating said evaporating-pan.

4. The combination of the flue 1, a furnace 3, and passage-way 2, said passage-way being horizontally elongated where it connects with the furnace and vertically elongated where it connects with the flue, substantially as set forth.

5. The combination, with the flue 1, of the set of radially-arranged furnaces 3 and passages 2, said passages being of the same capacity throughout, but horizontally elongated where they connect with the furnaces and vertically elongated where they connect with the flue, substantially as and for the purpose set forth.

6. In combination with a furnace and central flue, an annular revolving evaporating-pan incased, an inner annular liquid-bearing condensing-chamber, and the partially-submerged flange and cylinder, substantially as described and shown.

JOSEPH BORWELL SEAMAN.

Witnesses:

FREDERICK C. GOODWIN,  
E. L. HUBER.