

(No Model.)

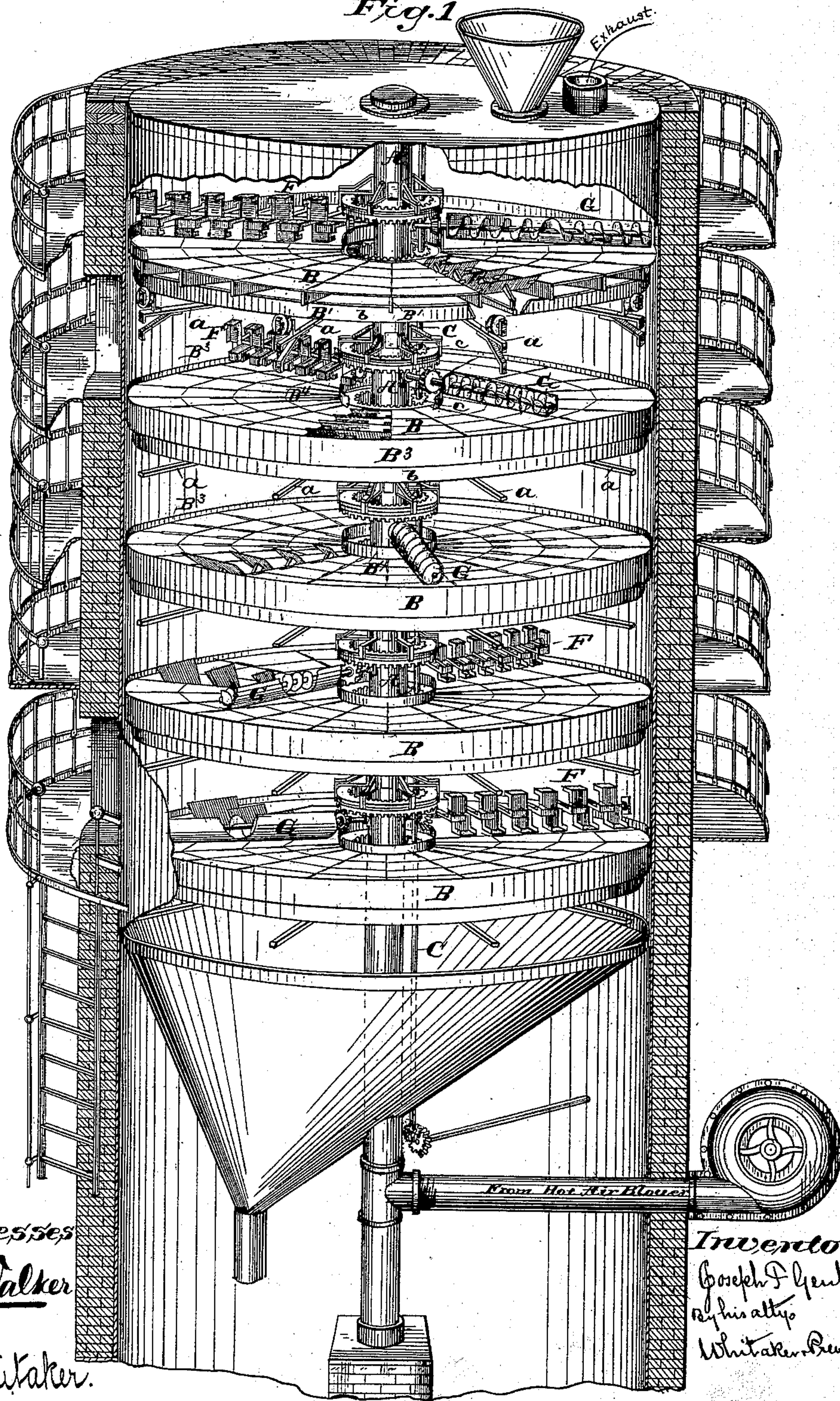
6 Sheets—Sheet 1.

J. F. GENT.
DRYING APPARATUS.

No. 410,085.

Patented Aug. 27 1889.

Fig. 1



Witnesses
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(No Model.)

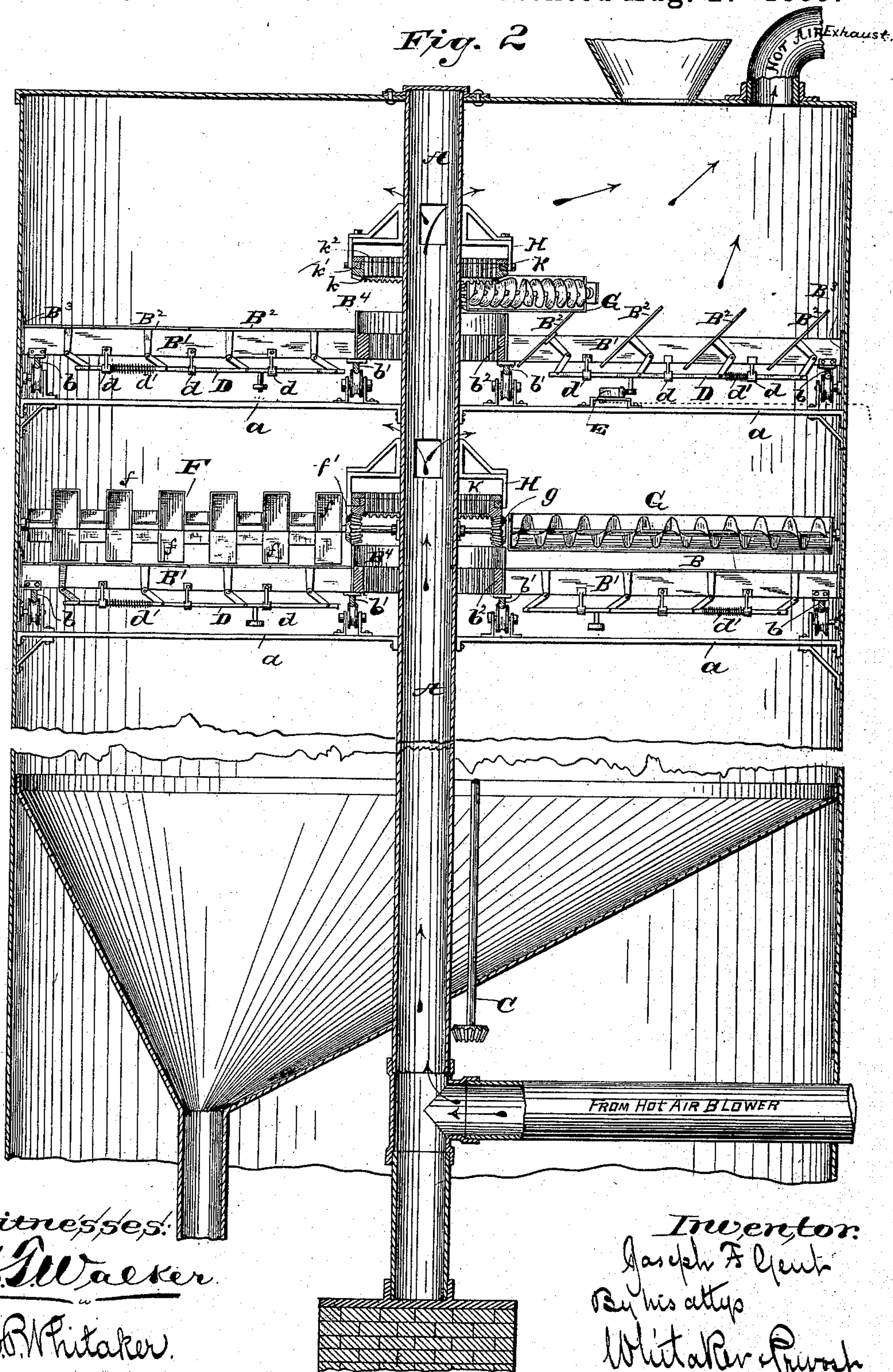
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Fig. 2



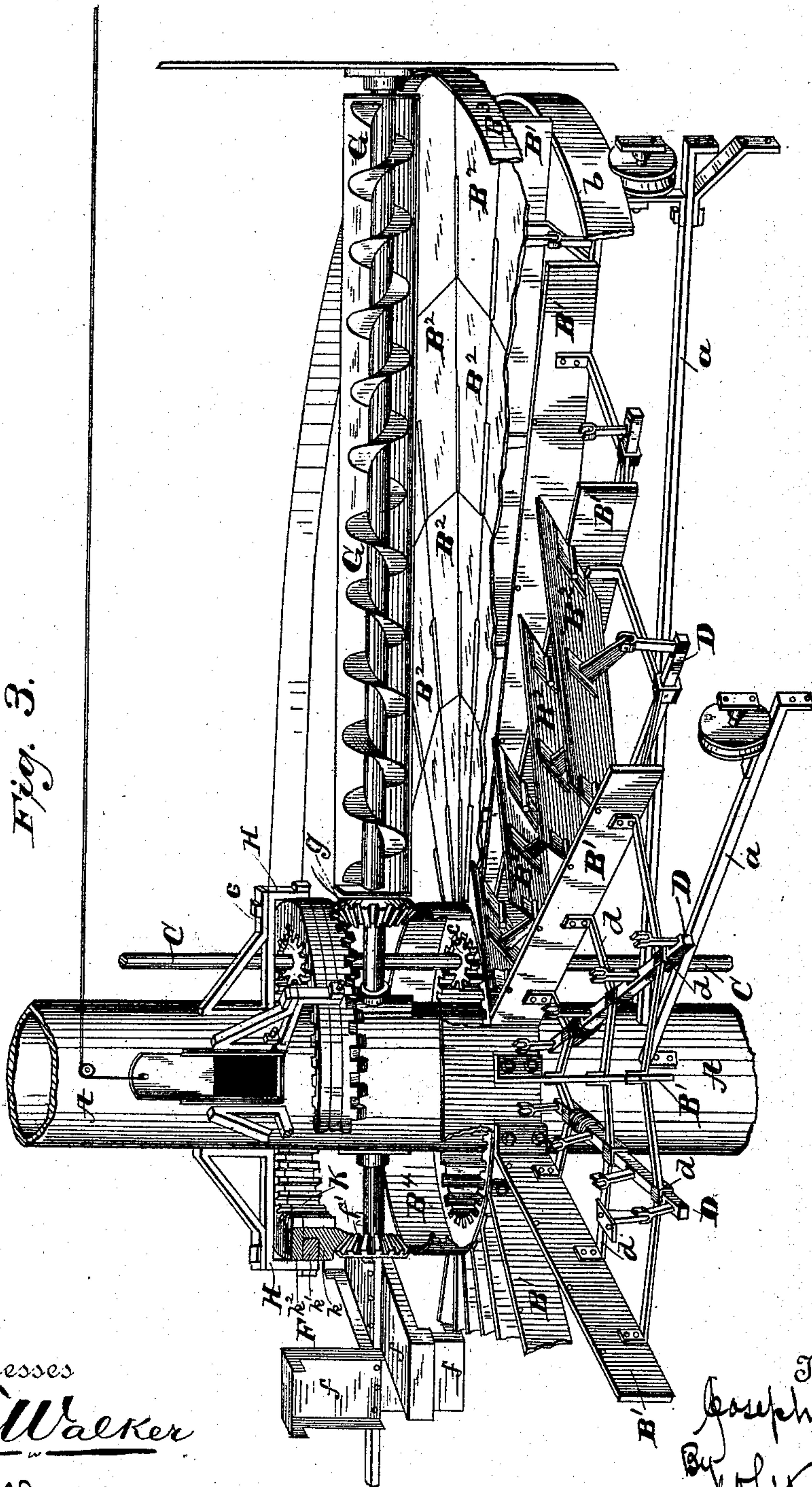
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6 Sheets—Sheet 4.

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Fig. 4.

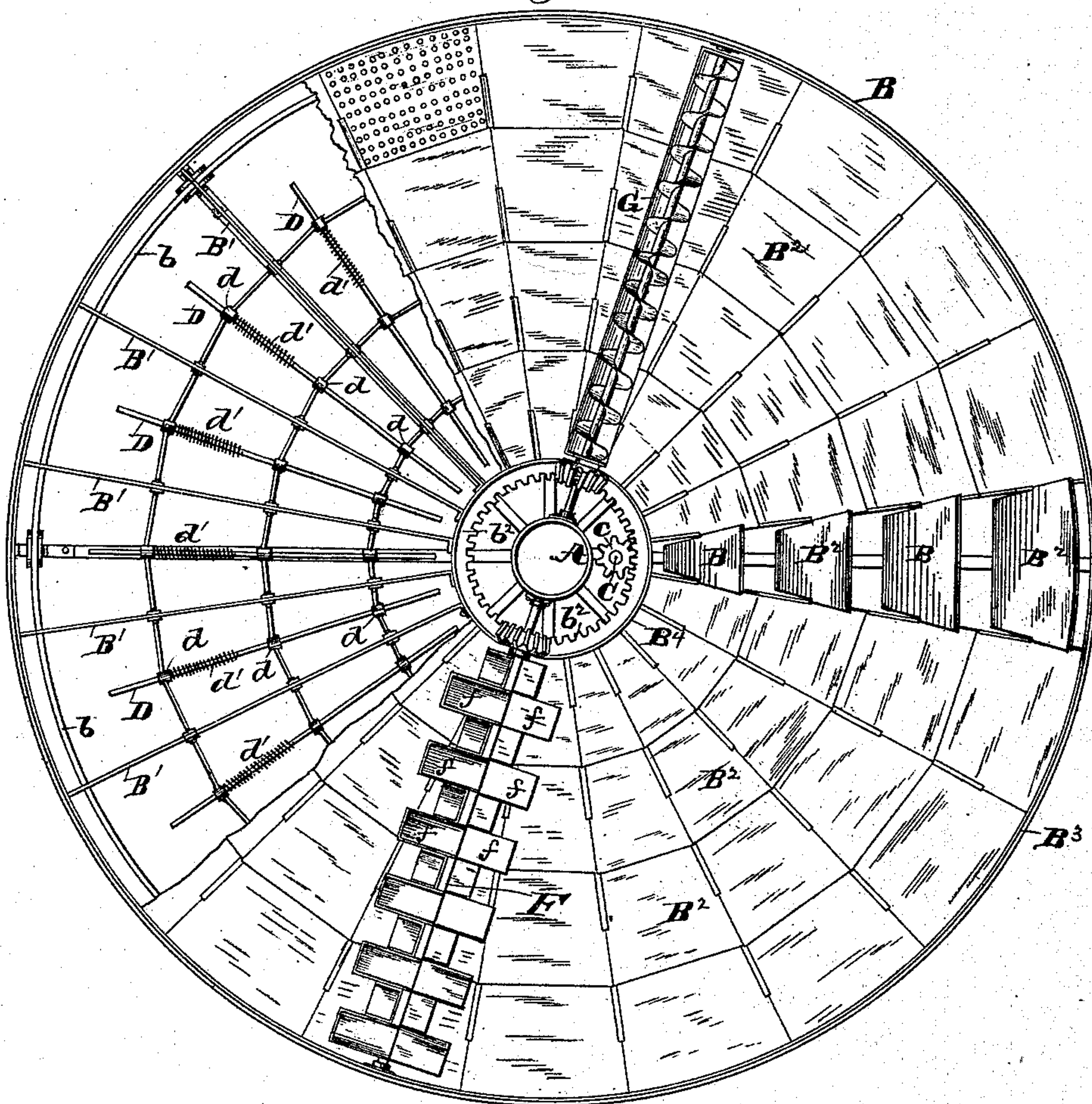
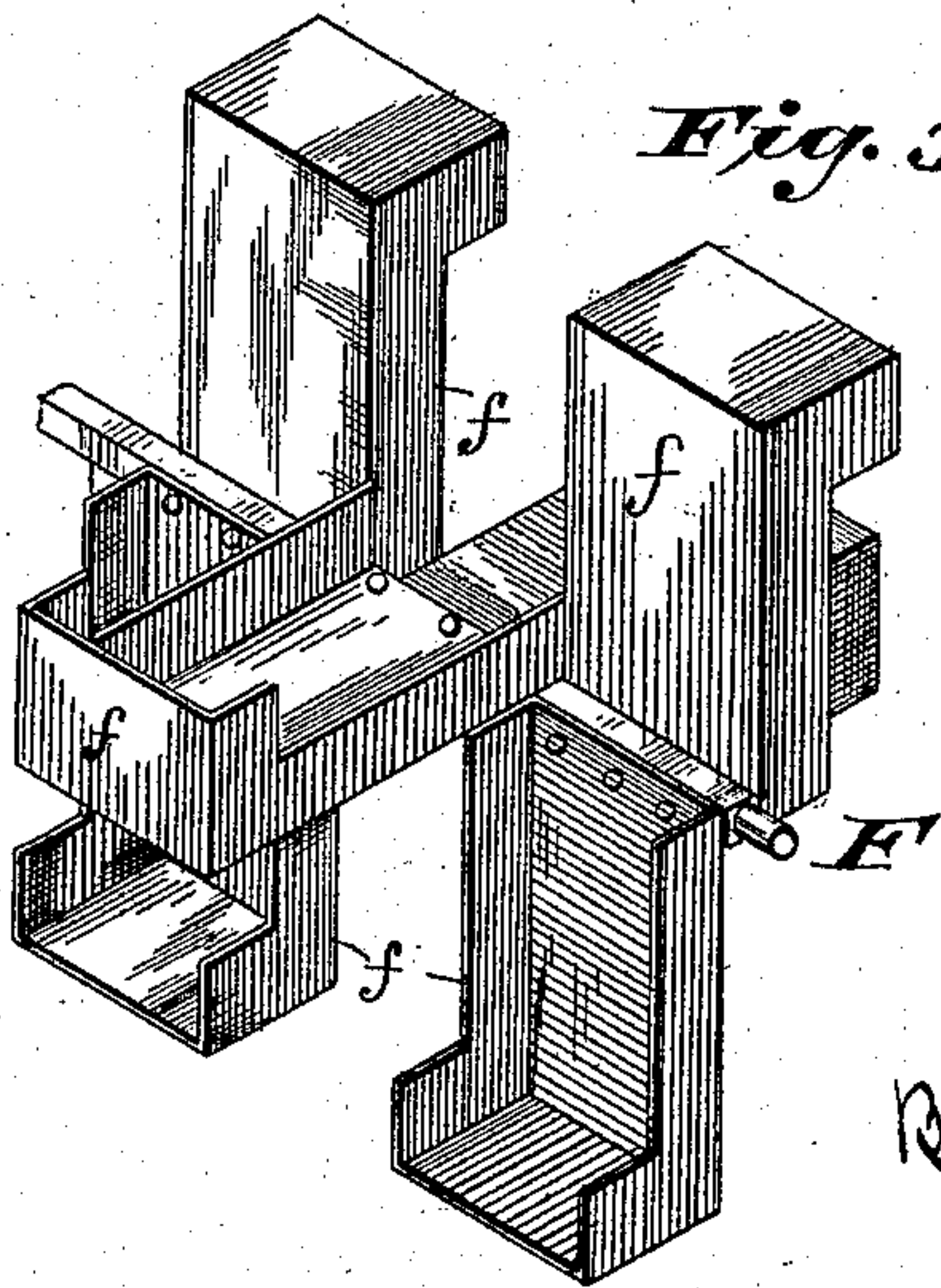


Fig. 5.



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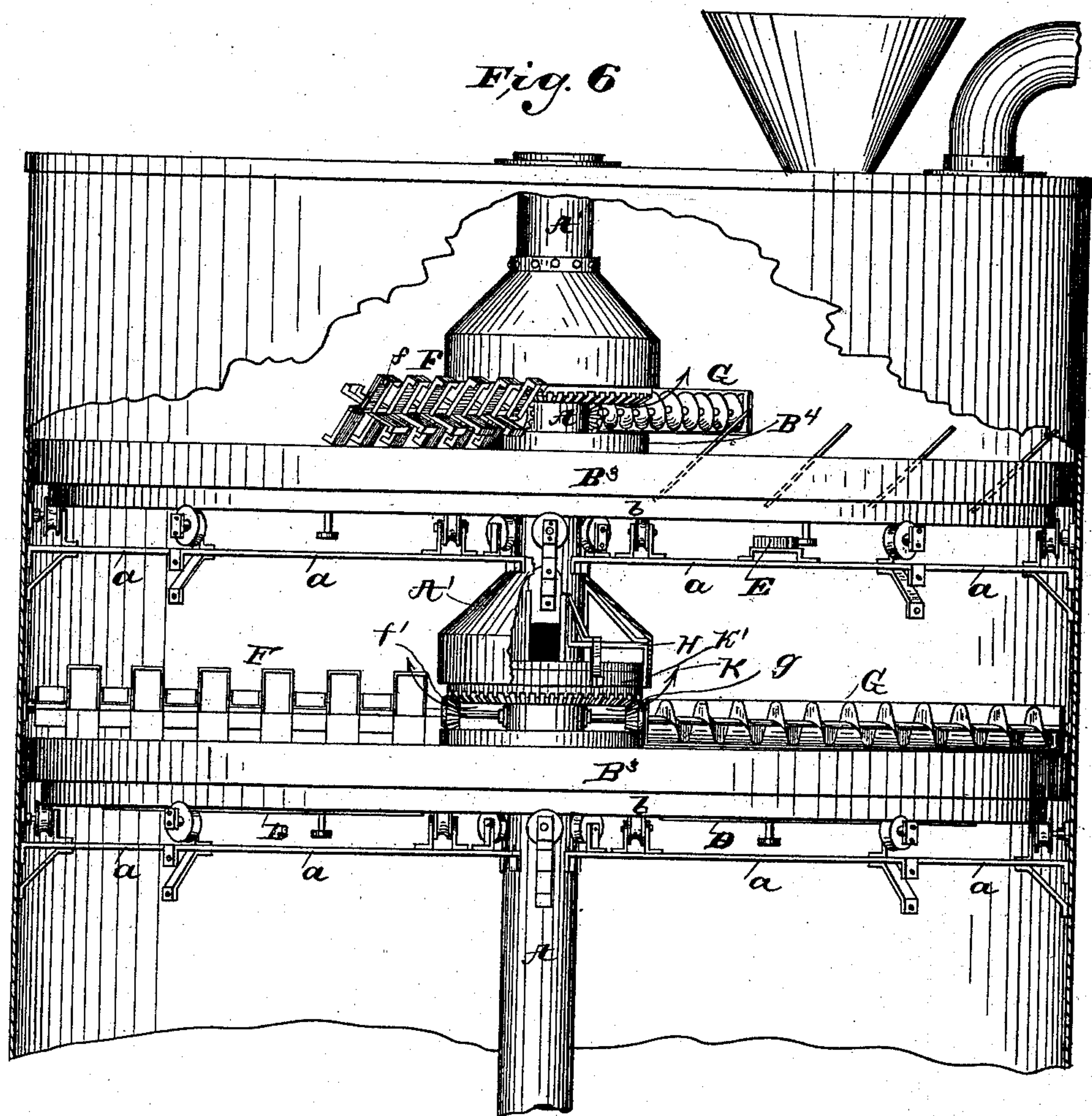
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Fig. 7.

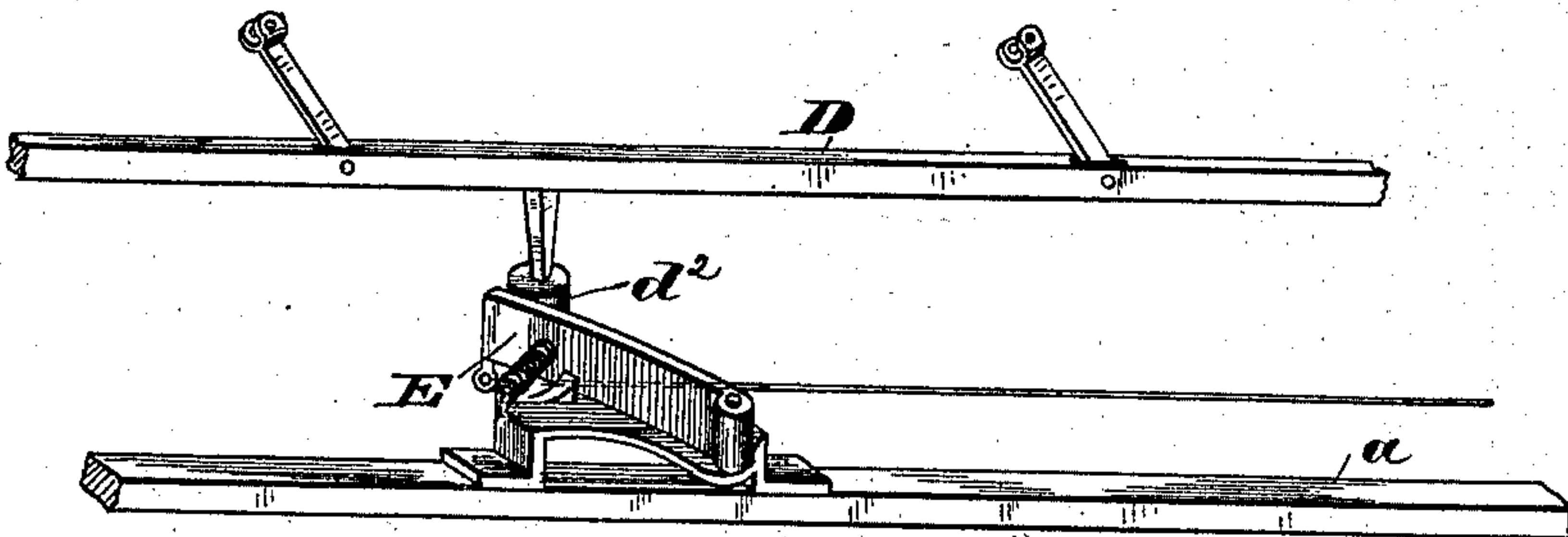


Fig. 8.

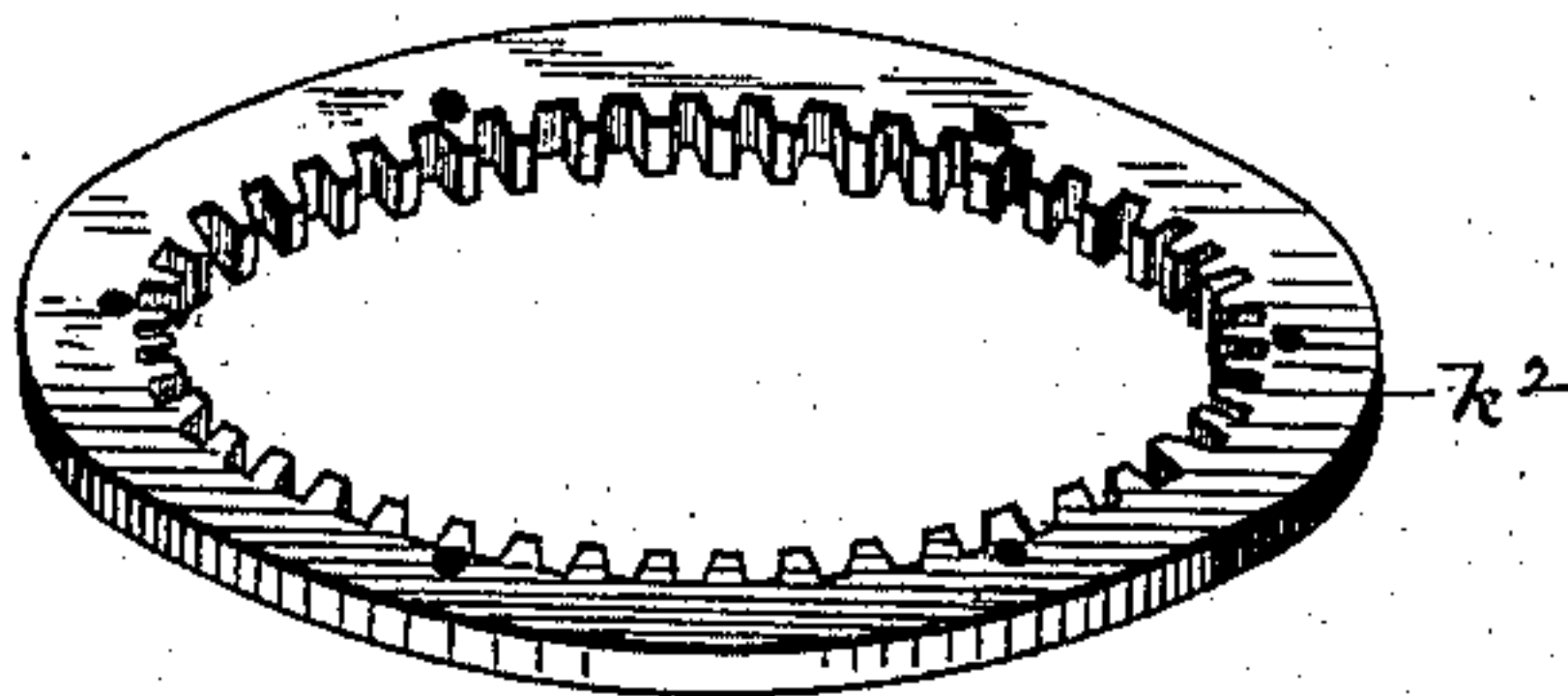


Fig. 9.

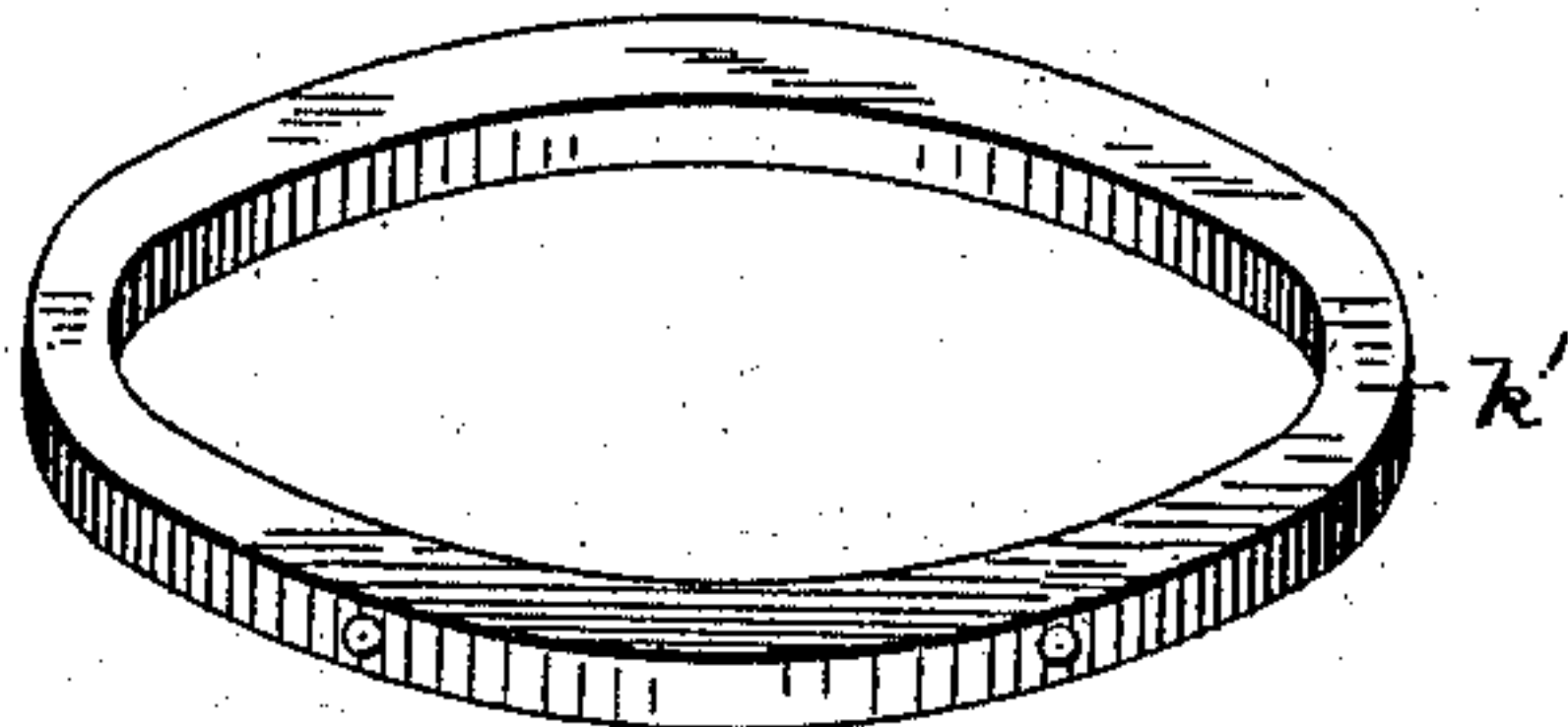
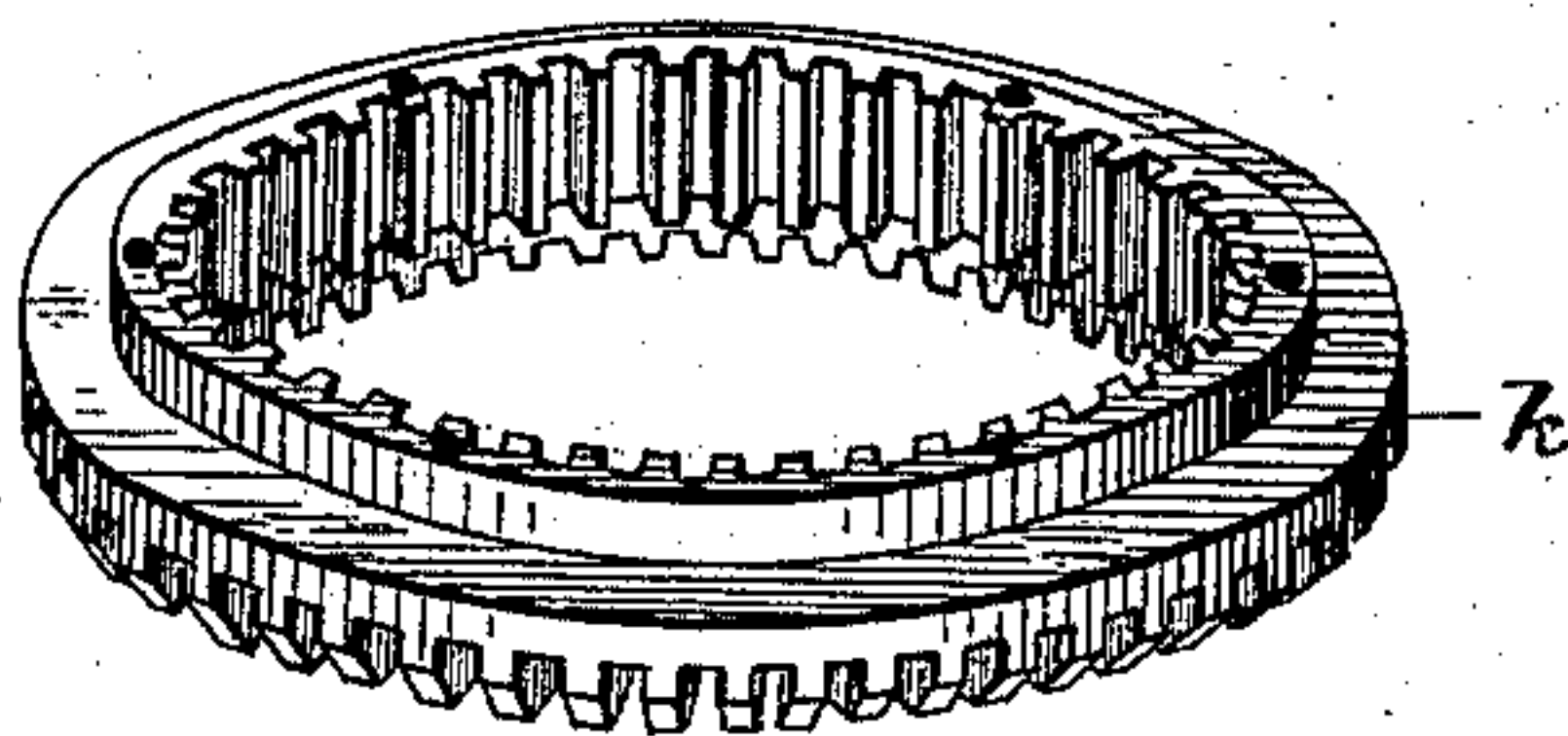


Fig. 10.



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UNITED STATES PATENT OFFICE.

JOSEPH F. GENT, OF COLUMBUS, INDIANA.

DRYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 410,085, dated August 27, 1889.

Application filed June 22, 1888. Serial No. 277,905. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH F. GENT, a citizen of the United States, residing at Columbus, in the county of Bartholomew 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.

My invention relates to drying apparatus adapted especially for drying finely-divided substances of granular or other form; and it consists in certain peculiar features of construction and combination, which will be hereinafter more fully described.

In the drawings I have illustrated one form in which I have contemplated embodying my invention, and said invention is fully disclosed in the following specification and claims.

In the drawings which form a part of this specification, Figure 1 is a perspective view of the interior of a drying apparatus or kiln constructed according to my invention, showing the wall or casing in section. Fig. 2 is a vertical section of the same. Fig. 3 is a perspective view of a portion of one floor of the apparatus. Fig. 4 is a plan view of one of said floors with a portion of the flooring broken away. Fig. 5 is a perspective view of a portion of one of the stirring devices employed by me. Fig. 6 is a partial section of the apparatus, showing a slightly-modified construction. Figs. 7, 8, 9, and 10 are detail views of parts of the mechanism.

The apparatus illustrated in the drawings is inclosed in a suitable building or tower, preferably of circular form in cross-section, which may contain as many floors, arranged one above the other, as is found convenient or desirable. In constructing this circular building I may form the walls and roof of metal or of masonry, or both, as preferred, and the building is preferably provided with suitable means for affording access to each and any of the floors of the drier. In the center of this circular building, rigidly supported in any convenient manner, is a shaft A, which is preferably hollow, and may be

formed of sections of pipe of the desired diameter, suitably connected.

Each of the circular floors B of the kiln is provided with a central aperture, somewhat larger than the shaft A, to admit of the passage of the same, and said floors are supported upon a series of radial arms *a*, suitably secured to the central shaft and to the wall of the kiln. The floors B are provided at their peripheries with a depending track *b*, and a similar track *b'* surrounds the central openings of the floors on the under side of the same. These circular tracks engage rollers mounted upon the radial arms *a* and support the floors in position to rotate about the shaft A as an axis. I may, however, support the rollers upon brackets suitably attached to the shaft A and to the wall of the kiln, if desired. In the apertures surrounding the central shaft are rigidly mounted internal gears *b*² or gear-rings, and motion is imparted to the same and to the circular floors by means of gears *c* on the driving-shaft C, which extends vertically through the central apertures of the floors.

Each of the floors consists of a framing of radial joists B', in which are pivotally mounted the flooring-sections B². The exterior periphery of the floor is provided with a rim B³, which extends a short distance above the flooring, and a similar rim or flange B⁴ surrounds the central apertures of the floors. Beneath the sections B² and supported by braces from the joists B' are guides *d*, in which are mounted the sliding rods D. The sections B² are connected to the sliding rods D by any preferred means, so that a longitudinal movement of the rods will cause each section of the flooring above the same to tilt on its pivotal axis, as best seen in Fig. 3. The connection between rods D and the sections B² may consist of a projection attached to each of the sections and connected to the rod by means of a link—a simple link or any other preferred means. The object of these rods and connections is to enable all the sections embraced between the center and circumference of the floor and pivoted between two joists to be simultaneously tilted by the longitudinal movement of one rod D, thereby discharging or dump-

ing all material upon such series of sections. A spring, weight, or other preferred means is interposed between the rod D and one of the guides d and holds the said rod normally in such a position that the sections B^2 of the flooring lie horizontally in their places, and said spring or other device will return the rod D and sections B^2 to their normal positions after the sections have been tilted to dump the material, as before described. I prefer to provide a construction for dumping these series of sections automatically and successively; and to this end I mount upon some convenient part of the stationary frame— as upon one of the radial arms a —a cam E, adapted to be engaged by a roller d^2 , mounted upon an arm projecting downwardly from each of the rods D. This cam is so constructed as to provide an inclined surface to engage the roller d^2 , and force the rod D to move longitudinally, of itself, thereby dumping the series of sections B^2 with which it is connected. As the floor B rotates on its axis, the rollers d^2 of rods D will successively engage the cam E and dump the series of sections connected thereto; hence it will be seen that the entire floor will be cleared by one rotation of the same. I prefer to place the cams E in such relation that each floor below the top will dump at a point in advance of the one above it, thereby providing a cleared space for each floor to dump upon. I also prefer to pivot the cam E in such a manner that it may be retracted and drawn out of the path of rollers d^2 by means of a connection extending to any convenient point, so that the rollers d^2 may pass the cam without engaging it, if desired.

Upon each floor of the apparatus I provide one or more stirrers F and levelers G. I prefer to employ one each of these devices for every floor and to locate them on each floor a little in advance of their positions on the preceding one. I may, however employ one or more of either form of device, if found desirable. These devices are mounted upon shafts which rotate in bearings attached to the wall of the kiln and to the central shaft A, and are provided near their inner ends with gears f and g , respectively. Upon the central shaft A, at a suitable distance above each of the floors B, are attached brackets H, which support an internal gear K. This gear K is composed of three parts, one of which is a base portion k , having gear-teeth upon its lower face in addition to its internal gear-teeth, and provided on the inner edge of its upper face with a projecting flange or ring. Upon this base portion, and surrounding the projecting flange, is a smooth ring k' , which is equal in thickness to the said flange, and upon these is placed the top ring k^2 , which is bolted or otherwise secured to the lower or base portion, preferably by means of bolts passing through the flange of the said base portion, thus leaving the central ring k' free to turn upon the flange. The central ring k'

is rigidly attached to the brackets H, before mentioned, and this construction supports the internal gear in such a manner as to permit it to rotate upon the central ring k' . The brackets H are placed at such a height above the floor that the bevel gear-teeth on the lower edge of the internal gear engage the gears f and g upon the shafts which support the stirring and leveling devices. I may, however, construct the said internal gear with gear-teeth upon its upper face and support it below the gears f and g and engaging the same. These devices, whatever their form, I term "gear-ring supports." The teeth of the internal gear are engaged by a gear on the power-shaft C, and the rotation of said shaft will cause the internal gear to revolve, thereby rotating the stirrer F and leveler G.

The stirring device F is constructed preferably as shown in Fig. 5, and consists of two series of angular scoops, each series being composed of scoops extending in opposite directions from the shaft. These are provided with side portions to better hold the material, and when viewed from the end of the shaft the scoops on opposite sides of the shaft face in opposite directions. The scoops of one series are also interposed between the scoops of the other series and extend at right angles thereto, so that the action of the stirrer may be more nearly continuous. The main body of the scoop is attached to the side of the shaft and extends outwardly therefrom. The scoop at its outer end is provided with a lip f' , placed at an angle to the main body. The scoop has no rear wall, so that as the shaft is rotated the outer ends of the scoops will descend into the material and raise a portion of it, which upon a further rotation of the stirrer will be caught by the main body of the scoop, and as this is raised above the level or horizontal plane of the shaft will be discharged upon the opposite side thereof. The scoop having no rear wall permits the free discharge of the material therefrom as soon as the main body is given an upward inclination sufficient for this purpose, effectively stirring the material and exposing it to the heated air.

The shell or casing of my improved leveling device or leveler extends, preferably, the entire distance between the rims B^3 and B^4 , and consists of two faces extending longitudinally of the device and meeting at right angles, the lower face being substantially parallel with the floor and a short distance above the same. I may, if preferred, construct the shell or casing in the form of half of a cylinder and mount it as before described. This shell or casing is provided with end pieces through which the shaft of a right and left spiral conveyer passes, and the shell is suitably attached to some fixed portion of the frame, so that it does not rotate with the conveyer. The right and left conveyers are joined at or near the center of the shaft, and will feed the material in the shell from the

center of the same toward the ends. As the floor and its contents pass beneath the leveling device the material will be leveled, all the excess entering the shell and being conveyed to another portion of the shell before being forced out by fresh material. By means of these devices F and G the grain will be thoroughly stirred and exposed to the air, and will not be allowed to collect in heaps, but will be spread evenly over the floor.

If found desirable, I may employ a spiral conveyer, feeding in one direction only. For instance, if it is found that the sections B² tend to dump the material toward the center of the drier, the spiral conveyers on each floor below the top may be made to feed outwardly to correct this tendency and secure an even spreading of the grain, as shown in Fig. 6.

At some convenient point near or at the top of the drier or kiln is a hopper through which the material may be introduced into the machine, and below the lowest floor I provide a hopper having its largest diameter equal to or exceeding the diameter of the floor above to receive the grain, whence it may be delivered to any convenient point.

As before stated, the shaft A is preferably hollow and serves as a means for supplying heated air to the different floors. For this purpose apertures are formed in the shaft at different points—preferably one or more for each floor—and I may provide means for governing said apertures from some convenient point, as indicated in Fig. 3. I also provide an opening at or near the top of the kiln for the exit of the heated air, which will have absorbed a certain amount of moisture from the material, and this aperture I may connect with an exhaust mechanism if found desirable. The air may be heated and introduced into shaft A in any preferred manner, and will dry the material rapidly and effectually.

The operation of the kiln in drying granular or finely-divided material is as follows: Power is applied to the shaft C in any suitable manner and the floors and the stirring and leveling devices are put in motion. The material is introduced into the apparatus through the hopper and allowed to fall upon the upper floor, preferably a short distance in front of the leveling device G. The material will then be taken up by the leveling device or leveler and distributed evenly over the floor by the right and left spiral conveyer. As the floor rotates farther, it will be stirred and turned over by the stirring device or stirrer F, and upon still further rotation the cam E is allowed to engage one of the rollers d² and dump the first series of sections a short distance from the point where the material is introduced. Each series of sections is then dumped in succession until the floor is cleared, when it is refilled, as before described. This operation is continued until all the floors are filled, when the contents of the lowest floor is dumped into the hopper

beneath the same, and if sufficiently dry is conducted away, or, if not, it may be elevated and introduced into the kiln as before by any desired means. The heated air supplied to all the floors will dry the material rapidly, so that ordinarily when it has descended from the highest floor to the lowest it will be thoroughly dried. If found desirable, the cams E of all the floors or any of them may be retracted out of the path of rollers d² and the material allowed to remain upon the floors a longer time before being dumped. In order to insure a more rapid drying of the material, I may provide the sections B² of the flooring with fine perforations, as shown in one portion of Fig. 4, which will allow the heated air to pass up through the material and assist in drying the same. It will be seen that the central apertures of the floor surrounding the shaft A form means whereby the heated air may rise from one floor to another and permit the moist heated air from all the floors to rise and escape through the aperture provided in the upper part of the kiln.

I may prefer to provide a hood or apron A', to serve as a covering for the central aperture of each floor, as shown in Fig. 6. This apron will protect the mechanism surrounding said apertures, will provide an inclined surface to guide all material falling thereon to the floor, and will direct the current of heated air downward upon the contents of the floors.

I do not desire to be limited to my exact constructions described and shown, as it is obvious that similar forms of construction might be employed without departing from the spirit of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. In a drying apparatus, the combination, with revolving floors having central apertures, of a central tubular air-shaft and a driving-shaft for said floors extending through said central apertures, substantially as described.

2. In a drying apparatus, the combination, with the revolving floors having central apertures surrounding a central air-shaft, said apertures being provided with internal gears supported from said shaft above said floors and provided with gear-teeth on one of their horizontal faces, of a stirrer and a leveler for each floor, having their shafts provided with gears engaging the teeth on the horizontal faces of said internal gears, and a driving-shaft extending through said central apertures and provided with pinions engaging said internal gears, substantially as described.

3. In a drying apparatus, the combination, with the revolving floors surrounding a stationary central air-shaft, of an internal gear provided with gear-teeth on one of its horizontal faces, and with a peripheral groove, a ring in said groove connected to said central shaft, a driving-shaft engaging said internal gear, and a stirrer and a leveler for each floor,

having gears engaging the gear-teeth on the horizontal face of said internal gear, substantially as described.

4. In a drying apparatus, the combination, 5 with a stationary central air-shaft, of a revolving floor surrounding the same, a gear-ring surrounding said shaft, the gear-ring support, a driving-shaft engaging said gear-ring, and a stirrer having a gear engaging the 10 gear-ring, substantially as described.

5. In a drying apparatus, the combination of revolving floors one above the other, having central apertures surrounding a central air-shaft, the said apertures being provided with gear-rings, gear-rings supported 15 from said central shaft above said floors, a stirrer for each floor, having their shafts provided with gears engaging the gear-rings above the floors, and a driving-shaft extending 20 through the central apertures of the floors, and provided with pinions engaging all of said gear-rings, substantially as described.

6. In a drying apparatus, the combination, 25 with a series of revolving drying-floors located one above the other and provided with central apertures, and a stirrer and a leveler for each floor, of a central air-shaft extending upward through the apertures of said floors, and a driving-shaft for said stirring and said 30 leveling device extending through the apertures of the floors between the air-shaft and the inner edges of said floors, substantially as described.

7. A drying apparatus consisting of a number of revolving floors located one above the 35 other, each floor being composed of radial series of dumping-sections pivoted at right angles to the radius of the floor, each series of sections of one floor being adapted to dump 40 at a point in advance of the dumping-point of the floor below, substantially as described.

8. In a drying apparatus, the combination, with a number of rotating floors arranged one 45 above the other and composed of radial series of dumping-sections pivoted at right angles to the radius of the floor, of a leveler for each floor, substantially as described.

9. In a drying apparatus, the combination, 50 with a number of rotating floors arranged one above the other and composed of several radial series of dumping-sections dumping toward the centers of said floors, of a leveler for each floor, the dumping-point of each floor being between the dumping-point and the 55 leveler of the floor below, substantially as described.

10. A leveler consisting of a shaft provided with a spiral conveyer and a partial casing 60 for said conveyer, one edge of said casing being located substantially in line with the center of said shaft and conveyer and beneath the same, substantially as described.

11. A leveler consisting of a shaft provided with a right and left spiral conveyer joined

near the center of the shaft, and a partial 65 casing for said conveyer, substantially as described.

12. A stirrer consisting of a shaft provided with scoops, each scoop having an approximately straight main body extending outwardly from the shaft at a tangent thereto 70 and having an angular lip at its outer end, the shaft and said lip being on opposite sides of the main body, whereby a free rearward discharge is given each scoop on the opposite 75 side of the shaft, substantially as described.

13. A stirrer consisting of a shaft provided with scoops arranged in pairs extending tangentially from the shaft in opposite directions in a plane transversely of the shaft and 80 attached on opposite sides of the same, each scoop having an approximately straight main body provided at its outer end with an angular lip, the shaft and said lip being on opposite 85 sides of the main body, whereby a free rearward discharge is given each scoop on the opposite side of the shaft, substantially as described.

14. A stirrer consisting of a shaft provided 90 with scoops, each of said scoops having a main body attached to said shaft tangentially, extending outwardly and provided at its outer end with an angular lip, and having a free discharge on the opposite side of the 95 shaft, the said scoops being arranged in series, each series consisting of two sets of scoops extending tangentially from the shaft in opposite directions, the sets of one series 100 being located between the sets of the other series and at right angles thereto, substantially as described.

15. A drying apparatus consisting of rotating floors located one above the other, each floor being composed of radial joists and sections of flooring pivoted between said radial 105 joists, of radial rods having a longitudinal movement located beneath said pivoted sections and connected with said sections for dumping the same, substantially as described. 110

16. In a drying apparatus, the combination, with rotating floors located one above the other, each floor being composed of radial joists and sections of flooring pivoted between said radial joists, of radial rods having 115 a longitudinal movement located beneath said pivoted sections and connected with the same, arms depending from said rods, and a cam mounted on a stationary part of the frame beneath each floor in the path of said 120 depending arms, substantially as described.

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

JOSEPH F. GENT.

Witnesses:

E. T. WALKER,
L. P. WHITAKER.