

(No Model.)

5 Sheets—Sheet 1.

F. A. HETHERINGTON.  
SAND DRIER.

No. 582,353.

Patented May 11, 1897.

Fig. 1.

WITNESSES:

J. D. Deal  
H. C. Newman

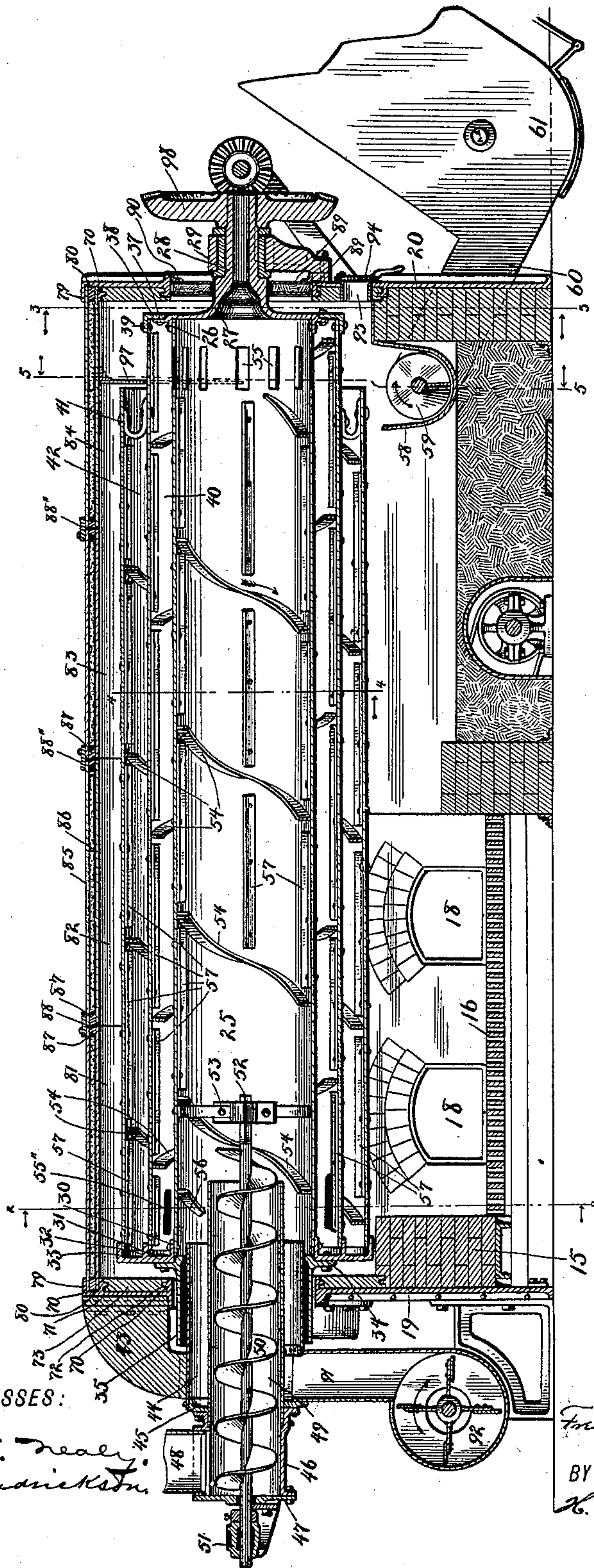
INVENTOR

Fredrick A. Hetherington

BY

H. P. Lord & Son

ATTORNEYS.





(No Model.)

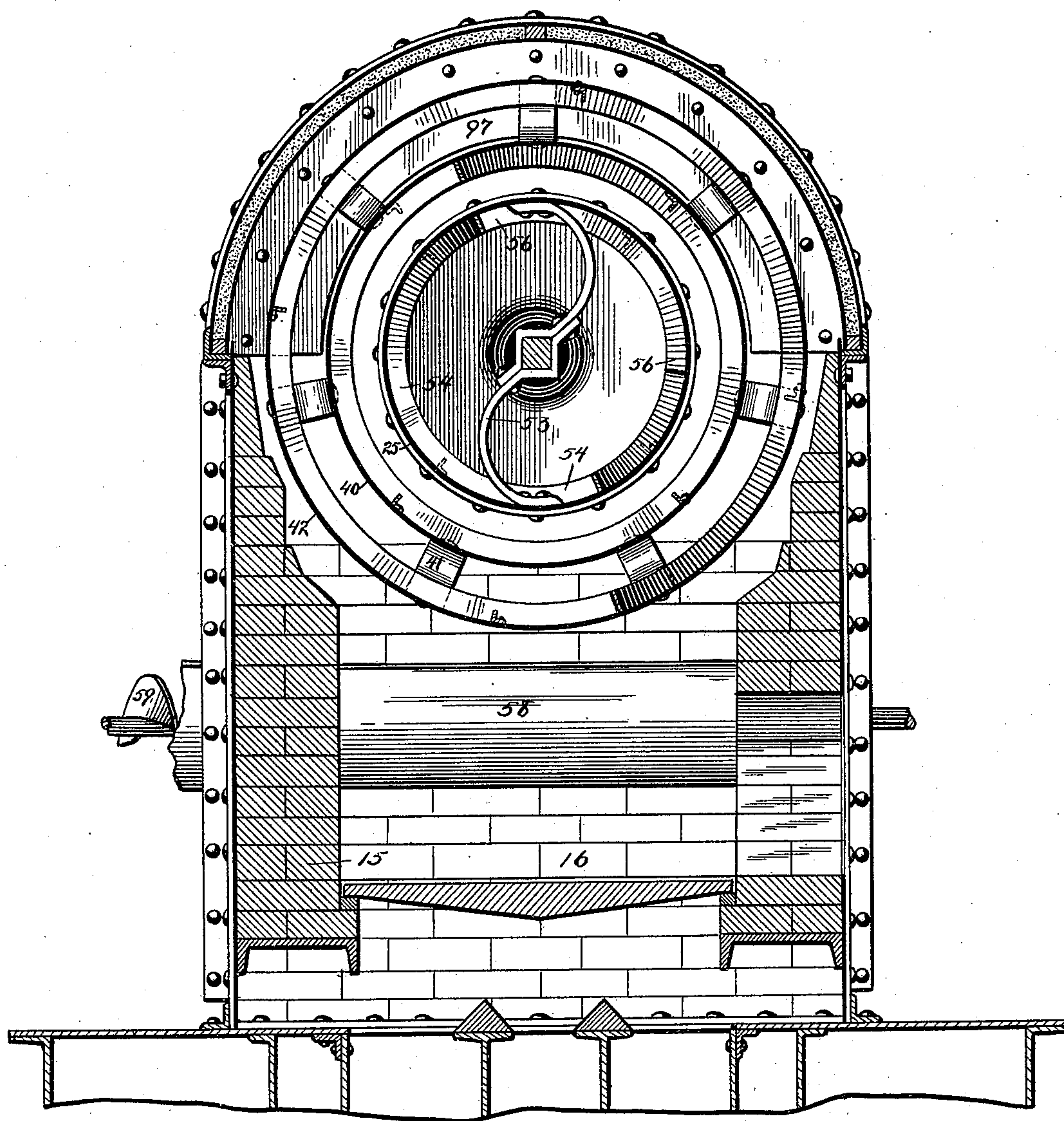
5 Sheets—Sheet 2.

F. A. HETHERINGTON.  
SAND DRIER.

No. 582,353.

Patented May 11, 1897.

*Fig. 2.*



WITNESSES:

*H. D. Neely.*  
*H. C. Hendrickson.*

INVENTOR

*Frederick A. Hetherington*

BY

*H. P. Goodwin*

ATTORNEYS





5 Sheets—Sheet 3.

F. A. HETHERINGTON.

## SAND DRIER.

No. 582,353.

Patented May 11, 1897.



**WITNESSES:**

34. 10. Nealy.  
H. C. Hendrickson.

INVENTOR  
Frederick A. Bethcrounpton

BY  
H. T. Hood & Son

**ATTORNEYS**



(No Model.)

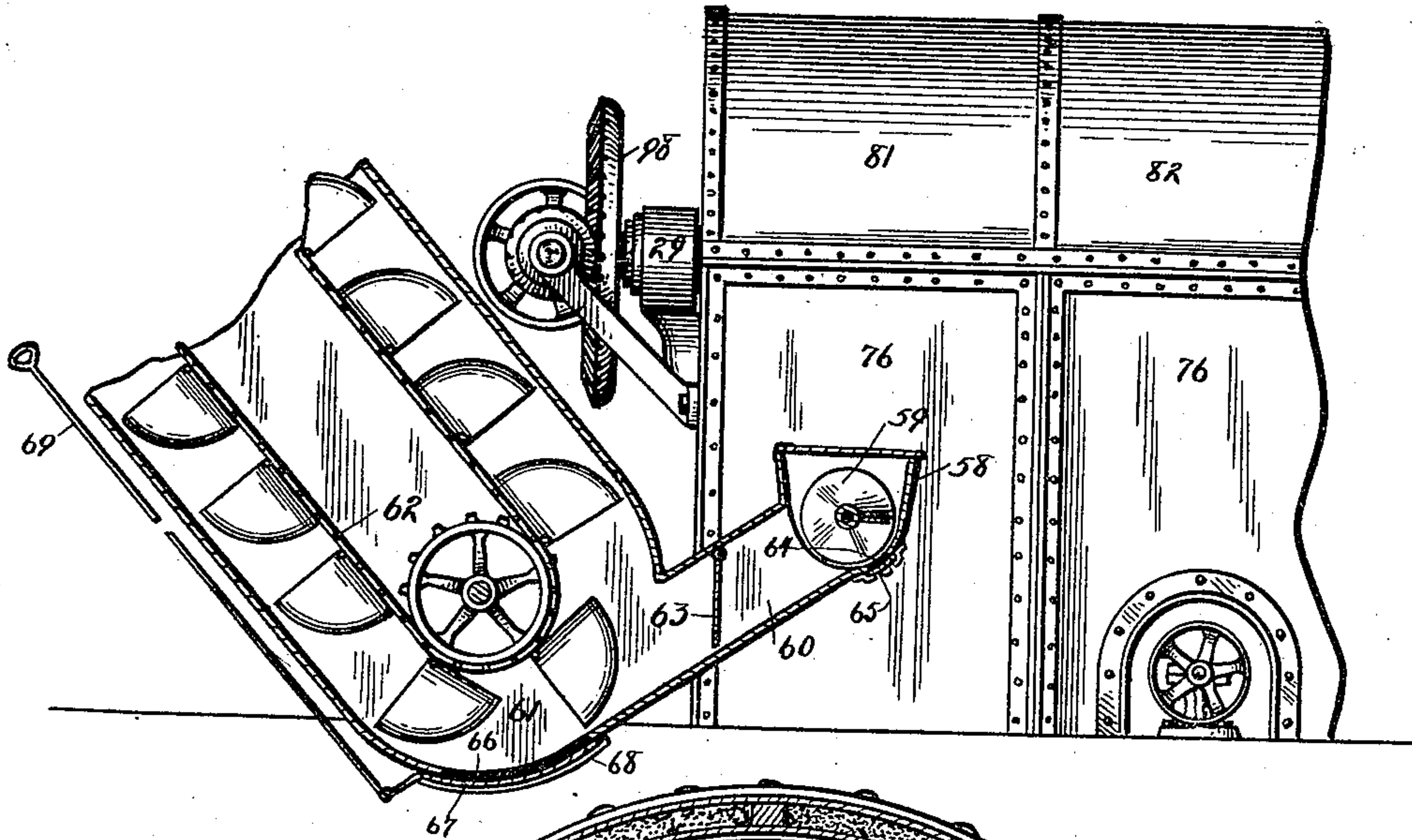
F. A. HETHERINGTON.  
SAND DRIER.

5 Sheets—Sheet 4.

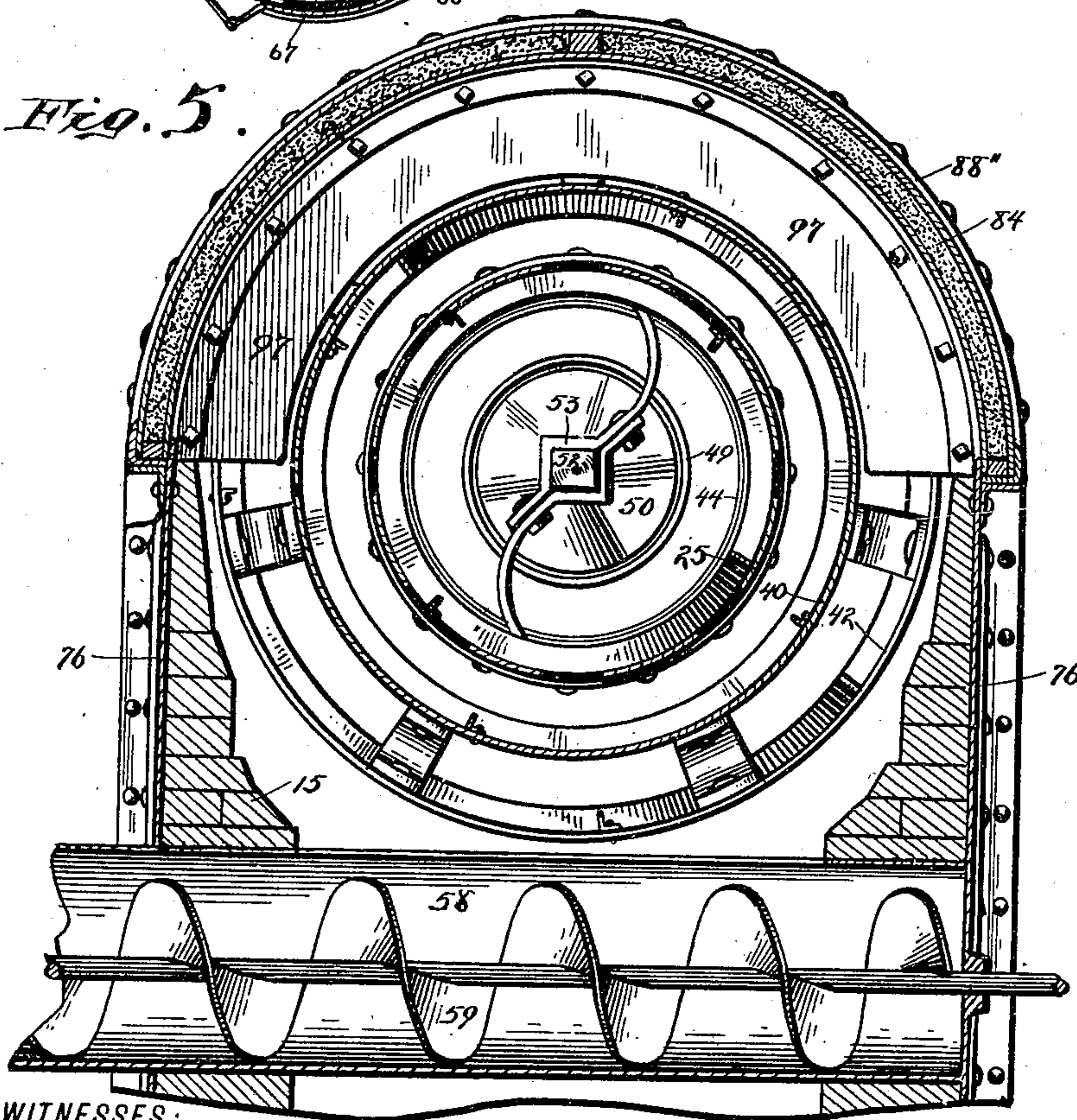
No. 582,353.

Patented May 11, 1897.

*Fig. 11.*



*Fig. 5.*



WITNESSES:

H. S. Neely  
H. C. Hendrickson

INVENTOR

Frederick A. Hetherington

BY

H. T. Hood & Son

ATTORNEYS



(No Model.)

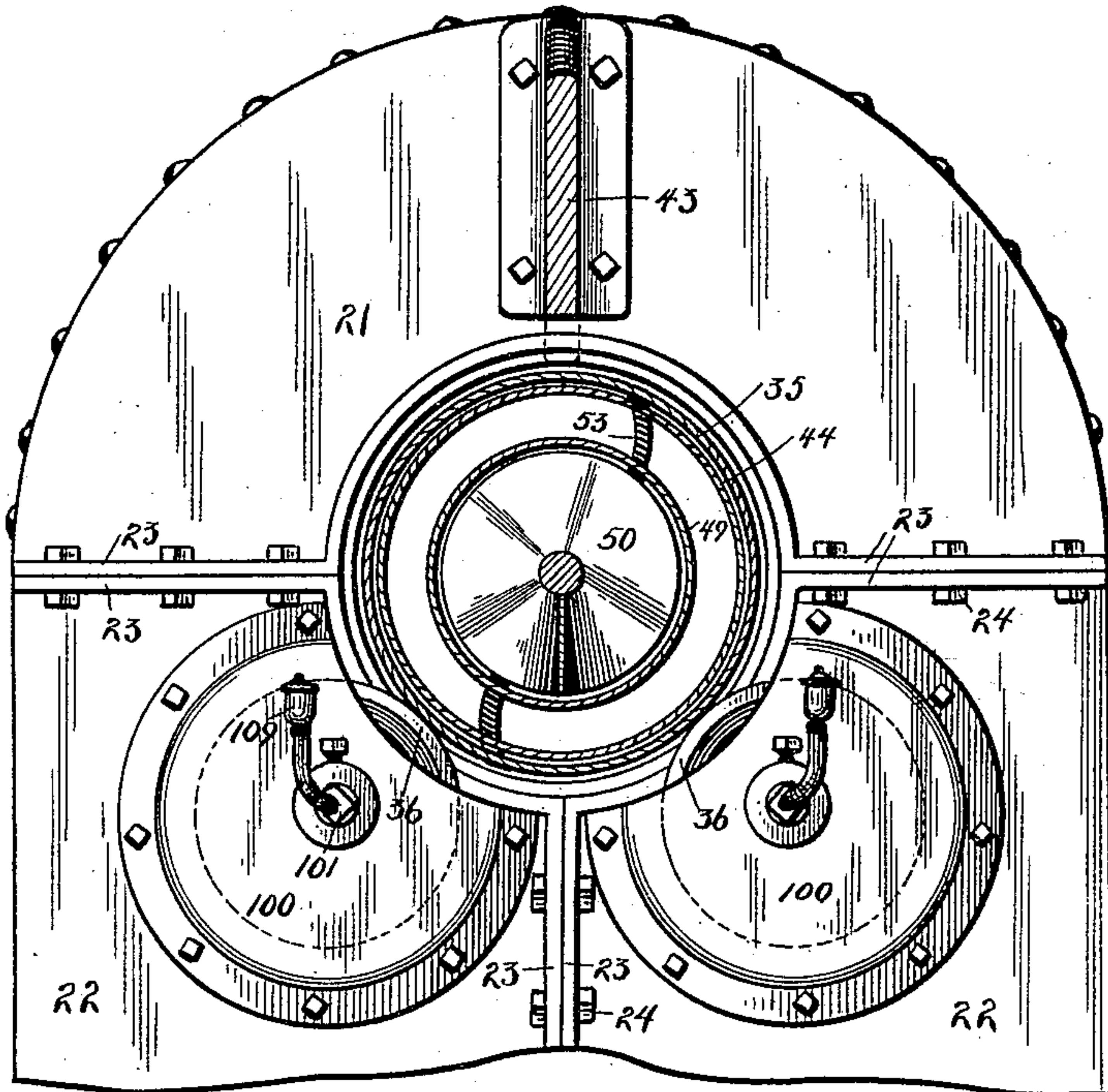
5 Sheets—Sheet 5.

F. A. HETHERINGTON.  
SAND DRIER.

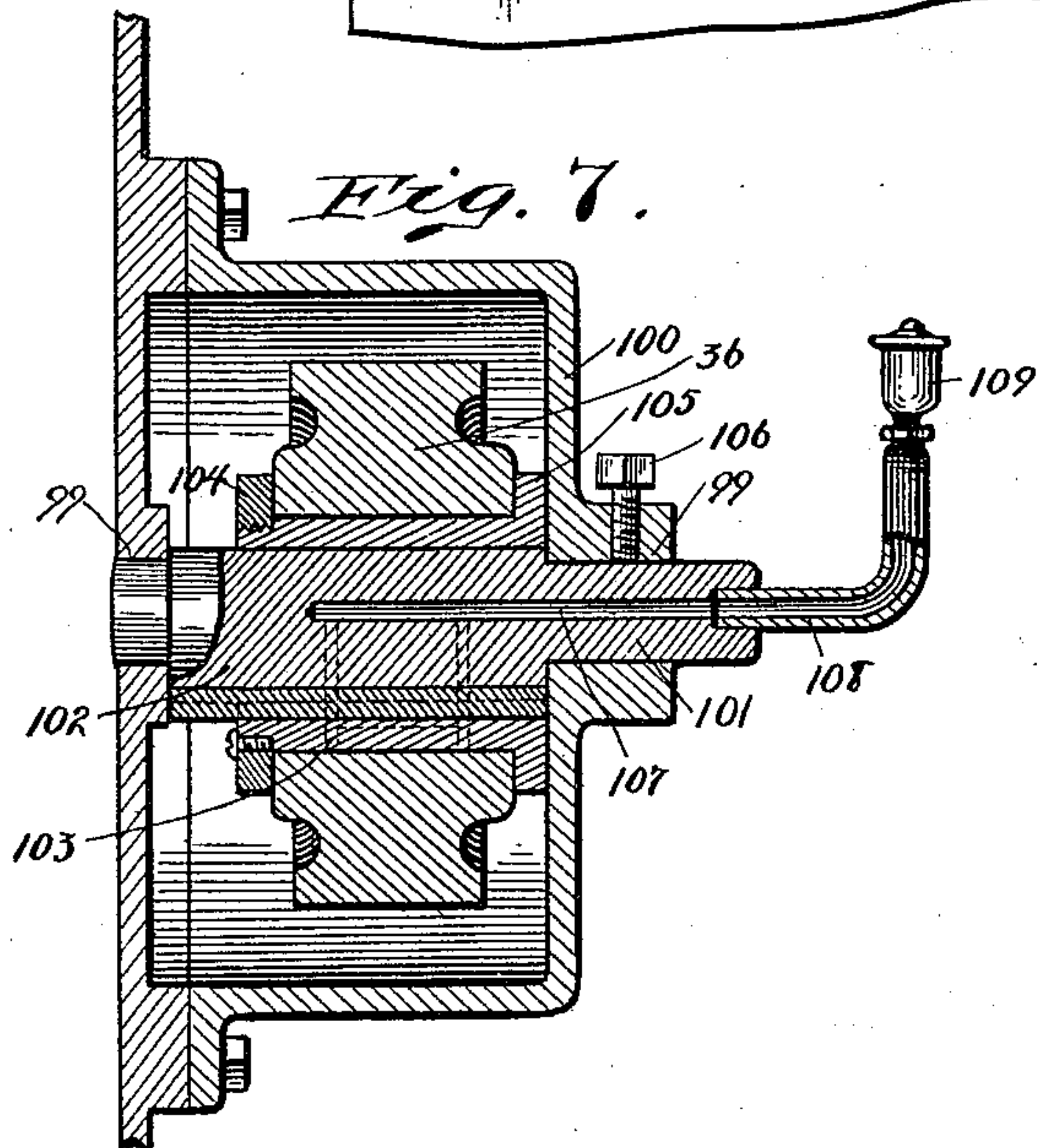
No. 582,353.

Patented May 11, 1897.

*Fig. 6.*



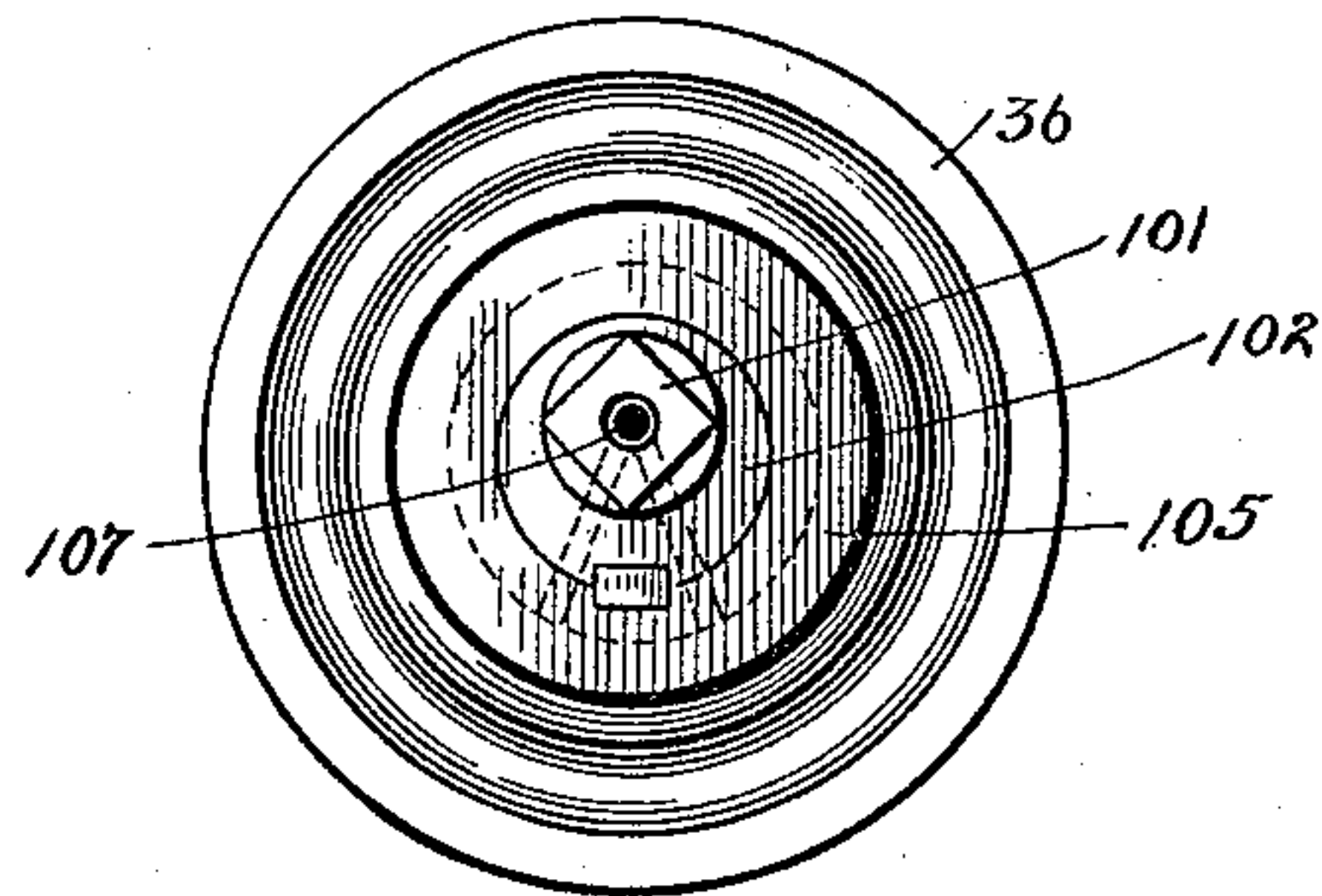
*Fig. 7.*



WITNESSES:

*H. S. Nealy*  
*H. C. Hendrickson*

*Fig. 8.*



INVENTOR  
*Frederick A. Hetherington*

BY  
*H. T. Hood & Son*

ATTORNEYS



# UNITED STATES PATENT OFFICE.

FREDERICK A. HETHERINGTON, OF INDIANAPOLIS, INDIANA.

## SAND-DRIER.

SPECIFICATION forming part of Letters Patent No. 582,353, dated May 11, 1897.

Application filed September 28, 1896. Serial No. 607,146. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK A. HETHERINGTON, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Sand-Drier, of which the following is a specification.

My invention relates to an improvement in sand-driers.

10 The object of my invention is to produce a sand-drier particularly adapted for use in asphalt plants in which it is desirable that the sand be uniformly dried and heated.

The accompanying drawings illustrate my invention.

15 Figure 1 is a central vertical longitudinal section. Fig. 2 is a section on line 2 2 of Fig. 1. Fig. 3 is a section on line 3 3 of Fig. 1. Fig. 4 is a section on line 4 4 of Fig. 1. Fig. 5 is a section on line 5 5 of Fig. 1. Fig. 6 is an end elevation of the bearing for one end of the drier-cylinder. Fig. 7 is a cross-section of one of the bearing-rollers. Fig. 8 is an end elevation thereof. Fig. 9 is a detail of one of the ventilating-openings. Fig. 10 is a detail of one of the lining-tiles. Fig. 11 is a cross-section of the delivery-chute and the sand-elevator.

20 In the drawings, 15 indicates an ordinary fire-brick furnace-setting provided with the usual grate 16 and firing-doors 18.

Mounted at one end of the setting 15 is a front-plate 19 and at the other end a similar plate 20, the two plates being substantially the same in general construction and each consisting of an upper portion 21 and two lower portions 22 22, a portion of each of said parts being cut away and each of said portions being provided on their adjacent edges with flanges 23, through which bolts 24 may be passed to secure the three portions together, the arrangement being such that an opening is formed in each plate through which the ends of the drier-cylinder may be projected.

45 The drier-cylinder consists of a central drum 25, the rear end of which is secured to an annular flange 26, carried by a head 27, provided with a central stud 28, which projects through the opening in plate 20, the said stud forming a journal for one end of the

drum and resting in a bearing 29, secured to plate 20. The forward end of drum 25 is secured to an annular flange 30, carried on the inner face of an annular plate 31, which is also provided on its inner face with a pair of annular flanges 32 and 33, which are concentric with flange 30.

55 Secured to plate 31 by means of a flange 34 is a bearing-ring 35, which projects through the opening in plate 19 and rests upon a pair of rollers 36, which are mounted one upon each portion 22 of plate 19. Formed integral with head 27 is a flange 37, to which is secured the flange 38 of a ring 39, which is concentric with flange 26 of head 27. Secured to ring 39 is one end of the intermediate drum 40, the other end of said drum extending into flange 32 of plate 31. Drum 40 is somewhat shorter than the distance between flange 34 and plate 31, and the forward end thereof merely enters and lies loosely in flange 32.

70 Secured to the rear end of drum 40 and concentric therewith by means of a series of U-shaped springs 41 is the outer drum 42, the forward end of said drum resting loosely within flange 33 of plate 31, a short space being left between the forward end of said drum and plate 31.

80 Secured to plate 19 and projecting over and in front of the opening therein is a bracket 43, to the lower end of which is secured a drum 44, which projects through the bearing-ring 35 into the interior of drum 25. Secured to and partially closing the outer end of drum 44 is a ring 45, to which is secured a cylindrical box 46, the outer end of which is closed by means of a plate 47. Leading into the upper part of box 46 is a sand-chute 48. Secured to the inner end of box 46 and forming a continuation thereof is a conveyer-chute 49, which extends through drum 44 and projects beyond the inner end thereof into drum 25. Mounted in chute 49 is a spiral conveyer 50, the outer end of the shaft of which projects through plate 47 and is supported by means of a bearing 51, secured to said plate. The inner squared end 52 of the conveyer-shaft fits into an opening in the middle of a cross-bar 53, the ends of which are secured to drum 25. By this construction the conveyer is rotated directly by the drier-cylinder, and the



only bearing for the shaft is placed outside of said cylinder, so that it is not affected by the sand and dust.

For the purpose of feeding the sand through the various drums of the drier-cylinder I mount in each of said drums a continuous spiral conveyer 54, secured to the walls thereof, the conveyers in drums 25 and 42 being formed so as to feed from front to rear, while the conveyer in drum 40 feeds from rear to front. A series of openings 55 communicate from the rear end of drum 25 to the rear end of drum 40, and a similar series of openings 55' communicate from the forward end of drum 40 to the forward end of drum 42. With a single conveyer in drum 25 the sand, as it falls from the inner end of the conveyer-chute 49, would gather in a large pile thereunder and would tend to work forward and out through the forward end of the bearing-ring 35. For the purpose of preventing this leakage and of more evenly distributing the sand in the forward end of the drum 25 a second conveyer 56 is mounted in the forward end of said drum and extends for a short distance toward the rear thereof.

It often occurs that the sand which is to be dried is very wet. It is practically impossible to dry such sand uniformly unless some means is provided to agitate it as it passes through the drier-cylinder. For this purpose a series of breakers 57 is mounted in each drum between the turns of the conveyer. In the two outer drums these breakers extend from one end to the other thereof, but in drum 25 it is advisable to leave a short portion of the forward end thereof free from said breakers in order to prevent the flying sand particles from being drawn into drum 44 and down into the fan.

Drum 42 is considerably shorter than the other drums, and mounted under the rear end thereof in position to catch the sand which is forced therefrom is a conveyer-trough 58, in which is mounted a spiral conveyer 59. Leading downward from the delivery end of trough 58 is a chute 60, which leads into the boot 61 of the sand-elevator 62. A valve 63 is placed in chute 60 in order to prevent air from being drawn in through said chute.

It is desirable that the dryness and temperature of the sand be tested as it leaves the drier, and for this purpose an opening 64, which is normally closed by a sliding door 65, is formed in the bottom of the delivery end of trough 58. An opening 66 is formed in the bottom of boot 61 in order that the sand may be easily withdrawn from the drier, and said opening is normally closed by means of a sliding door 67, mounted in ways 68 on the bottom of said boot, a handle 69 being secured to said door and extending up within convenient reach.

In order to protect those portions of the inner surfaces of plates 19 and 20 which are not covered by the furnace-setting the said inner surfaces are provided with a pair of

concentric flanges 70 70, the outer one being provided with an internal rib 71 and the inner one being provided with an external rib 72, the said ribs 71 and 72 being preferably placed so as to register one with the other. Mounted between the flanges is a series of segmental tiles 73, the said tiles being provided upon their outer and inner peripheries with grooves 74, which are adapted to receive ribs 71 and 72.

If desired, the outer lips 75 of the tile may be extended so as to cover the exposed ends of flanges 70. Tiles 73 may be placed in position by first removing portion 21 of the plates 19 and 20 and then slipping the tiles into one end or the other of the semicircular spaces formed by the flanges 70.

It is desirable that all of the heat from the furnace be used to dry and heat the sand and that as little as possible be allowed to escape to the outer air. For this purpose the furnace-setting extends up to about the center of the drier-cylinder on each side thereof, and the said setting is faced upon its outer sides with metal sheets 76.

Secured to the upper end of each facing is an angle-iron 77, one flange of which extends upward, so as to form a channel 78 between the said flange and the upper end of the facing. The upper portion of the inner face of plates 19 and 20 is provided with a semicircular flange 79, thus forming a semicircular channel 80 between said flange and the outer flange 70.

For the purpose of entirely covering the drier-cylinder I provide a series of semicylindrical sections 81, 82, 83, and 84, each of which is composed of a pair of metallic plates 85 and 86, the said plates being held a short distance apart by means of blocks 87 inserted between the ends thereof, the thickness between the outsides of the two plates being equal to the width of the channels 78 and 80. The space between the plates 85 and 86 may be filled with asbestos or other non-conductor, if desired. Section 81 is provided at one end with an overhanging plate 88, and section 83 is provided at each end with a similar overhanging plate 88'. By means of this construction the covering for the drier-cylinder may be placed in position after all of the other parts are assembled in the following manner: Section 81 is placed so that its ends rest in channels 78, the end carrying plate 88 being placed farthest from plate 19. The whole section may then be slid along until one end thereof passes into channel 80 of plate 19. Section 82 is then placed with its ends resting in channels 78 and is slid along until its forward end passes under plate 88 of section 81. Section 84 is then placed in position and its rear end forced into channel 80 of plate 20, after which section 83 is placed between sections 82 and 84, the plates 88' of said section overlapping the adjacent edges of sections 82 and 84. By this means an air-space is formed over and about the drier-cylinder, but said cylin-



der may be easily reached or removed without disturbing the furnace-setting.

As previously stated, plates 19 and 20 are for economy made from the same pattern, and in order to fill the annular opening between the stud 28 of head 27 and the opening in plate 20 a bushing is inserted therein, said bushing consisting of a pair of annular plates 89 89, between which is secured a packing of asbestos or other similar non-conductor, the said bushing being secured in position by means of a series of angle-irons 90.

Leading from the forward end of drum 44 is an air-conduit 91, which leads into an exhaust-fan 92.

For the purpose of regulating the temperature of the air and gases as they pass from the furnace through the drums of the drier-cylinder a number of openings 93 are formed through plate 20 and the lining thereof, and each of said openings is provided with an adjustable cover 94, pivoted at 95 and adapted to be secured in a number of angular positions over said openings by means of a rack 96, provided with a series of teeth, which may be engaged by the handle of the cover.

In order to force the heated gases to pass into the lower part of drum 42 of the drier-cylinder, a semiannular baffle-plate 97 is secured to the inner surface of section 84 of the cover and extends down so as to cover the upper half of the open end of said drum.

Secured to the outer end of stud 28 is a gear 98, by means of which the drier-cylinder may be rotated.

As previously described, the bearing-ring 35 rests upon a pair of rollers 36. By this construction the drier-cylinder, as it expands and contracts, is prevented from binding in its bearings. After the machine has been in use for some time, however, the rollers cut a groove in the bearing-ring and thus cause the cylinder to bind in its bearings. In order to prevent this trouble, I provide for a longitudinal movement of the rollers in the following manner: Mounted in suitable bearings 99 in plate 19 and in a casing 100, secured thereto, is a shaft 101, the central portion 102 of which is eccentric to the ends thereof, the said eccentric portion extending between the bearings 99. Keyed to the eccentric portion of the shaft and longitudinally movable thereon between the bearings 99 is a bushing 103, upon which is rotatively mounted the roller 36, the said roller being retained in position on the bushing by means of the collar 104 and the flange 105. One end of shaft 101 extends out through the casing, and said outer end is squared, so as to receive a wrench, by means of which the eccentric may be angularly adjusted, thus adjusting the position of the drier-cylinder. Shaft 101 may be retained in any of its angular positions by means of a set-screw 106, mounted in casing 100. In order to keep roller 36 and bushing 103 properly lubricated, a longitudinal opening 107 is bored into shaft 101, and a number

of holes lead from said opening out to the outer diameter of bushing 103. Rotatively mounted in the outer end of opening 107 is a pipe 108, to the upper end of which is secured an oil-cup 109.

The operation is as follows: The drier-cylinder is rotated in the direction indicated by the arrow thereon by any suitable means through gear 98, the rotation of said cylinder also causing a rotation of conveyer 50. Conveyer 59, elevator 62, and fan 92 are also rotated in the directions indicated by any suitable means, and a fire is started in grate 16. Sand is then introduced through chute 48 and is forced through the conveyer-chute 49, from which it drops into drum 25 of the drier-cylinder and from this point is forced toward the rear of said drum by means of conveyer 54, the short conveyer 56 assisting in spreading the sand and preventing it from leaking out of the forward end of the drum. As the sand passes toward the rear of the drum it is successively engaged by the breakers 57 and by them is carried a portion of the way up and around and then falls off, thus becoming thoroughly mixed and stirred. At the rear end of drum 25 the sand passes down through openings 55 into drum 40, where it is engaged by the conveyer 54 of this drum and forced forward, at the same time being stirred and mixed by the breakers 57. At the forward end of drum 40 the sand passes through openings 55'' into drum 42 and from there is forced toward the rear by conveyer 54 and again stirred by means of the series of breakers. The sand as it reaches the rear of drum 42 drops into trough 58 and is forced by conveyer 59 into chute 60, from which it passes into boot 61 and from there is carried by elevator 62 into the mixing-kettle. The sand, as it passes through the various drums of the drier-cylinder, comes in contact with the heated walls thereof and is thereby heated and dried. Fan 92 causes the heated gases from the furnace to be drawn toward the rear, then forward through drum 42, up through openings 55'', rearward through drum 40, up through openings 55, and forward through drum 25, and out through drum 44 and around conveyer-chute 49, through air-conduit 91, and through the fan, the temperature of the said gases being controlled by introduction of more or less cold air through openings 93.

The three drums of the drier-cylinder, being at different distances from the fire and the inner drums being further protected by the greater humidity of the sand which passes through them, expand different amounts. By securing one end only of each of the two outer drums and allowing the opposite ends of each of said drums to rest loosely in the flanges of plate 31 each one of the three drums may expand and contract independently of the others, thus preventing any tendency to shear the rivets. Again, the outer drum being directly subjected to the intense heat of the



furnace expands in diameter much more than the intermediate drum to which it is secured. By interposing the U-shaped springs between the two drums provision is made for the difference in diametrical expansion.

It will be noticed that the construction is such that the drums of the drier-cylinder may be easily separated and that the various parts of the entire structure may be easily and quickly assembled and separated.

I claim as my invention—

1. In a drier, the combination with the central drum, of a second drum surrounding said central drum and secured thereto at one end only, means for supporting the opposite end of said second drum, and communicating passages between said drums, substantially as described.

2. In a drier, the combination with the central drum, of a second drum secured thereto at one end only, means for supporting the opposite end of said second drum, a third drum surrounding the second drum and secured thereto at one end only, means for supporting the opposite end of said third drum, and communicating passages between the first and second and between the second and third drums, substantially as described.

3. In a drier-cylinder, the combination with the central drum, of a second drum secured thereto at one end only, means for supporting the opposite end of said second drum, a conveyer-chute extending into one end of said central drum, a conveyer mounted therein, means for supporting one end of the conveyer-shaft outside of the conveyer-chute, and means carried by the drier-cylinder for engaging the other end of said conveyer-shaft, substantially as described.

4. In a drier-cylinder, the combination with the central drum, of a head secured to one end of said drum, a journal carried by said head, a second drum surrounding the central drum and secured to the head thereof, an annular plate secured to the opposite end of the central drum, an annular flange carried by said plate and adapted to support the free end of the second drum, a conveyer carried by each of said drums, and a communicating passage between said drums, substantially as and for the purpose set forth.

5. In a drier, the combination of the central drum, a head secured to one end of said drum, a journal carried by said head, a flange carried by said head, a flanged ring secured to said flange, a second drum surrounding the first drum and secured to said flanged ring, an annular plate secured to the opposite end of the central drum, a bearing-ring secured to said plate, a pair of annular flanges formed on one face of said annular plate, the inner one of said flanges being adapted to receive and support the free end of the second drum, a series of springs secured to the periphery of said second drum near one end thereof, a third drum surrounding said second drum

and secured at one end to the free ends of said springs, the other end of said drum being adapted to enter and to be supported by the outer flange of the annular plate, communicating passages formed between the central and the second drum and between the second and third drums, and a suitable conveyer mounted in each of said drums, all combined and arranged to cooperate substantially as and for the purpose set forth.

6. In a drier, the combination of the central drum, a head secured to one end of said drum, a journal carried by said head, a flange carried by said head, a flanged ring secured to said flange, a second drum surrounding the first drum and secured at one end to said flanged ring, an annular plate secured to the opposite end of the central drum, a bearing-ring secured to said plate, a pair of annular flanges formed on one face of said annular plate, the inner one of said flanges being adapted to receive and support the free end of the second drum, a series of springs secured to the periphery of said second drum near one end thereof, a third drum surrounding said second drum and secured at one end to the free ends of the springs, the opposite end of said drum being adapted to enter and to be supported by the outer flange of the annular plate, communicating passages formed between the central and the second drum and between the second and third drums, a suitable conveyer mounted in each of said drums, and a series of breakers mounted between the turns of the conveyer in one or more of said drums, substantially as described.

7. In a drier-cylinder, the combination of an inner drum, a series of springs secured to the periphery of said drum, and a second drum surrounding the inner drum and secured to the outer ends of the springs, substantially as described.

8. In a drier, the combination with the furnace-setting, of a revoluble drier-cylinder mounted in said setting, the said cylinder consisting of a number of substantially concentric drums communicating one with another, suitable conveyers carried by each of said drums, a fan communicating with the interior of said cylinder and adapted to draw the heated gases from said furnace through said drums, and one or more openings formed through the setting each provided with an adjustable cover, all combined and arranged to cooperate substantially as and for the purpose set forth.

9. In a drier, the combination with the furnace-setting, of a revoluble drier-cylinder mounted in said setting, the said cylinder consisting of a number of substantially concentric drums communicating one with another, suitable conveyers carried by each of said drums, a fan communicating with the interior of the inner drum and adapted to draw the heated gases from the furnace through said drums, and a baffle-plate independent of the



cylinder adapted to cover a portion of the delivery end of the outer cylinder, substantially as described.

10. In a furnace-setting for a drier, a front plate therefor having an opening formed therethrough through which the journal for the drier-cylinder may project, a pair of concentric annular flanges formed about said opening on one face of said plate, oppositely-extending ribs carried one upon each of said flanges, and a series of segmental tiles, each provided on its outer and inner peripheries with grooves adapted to receive said ribs, mounted between said annular flanges, substantially as described.

11. In a furnace-setting for a drier, a front plate mounted at each end thereof, a flange formed on the inner face of each of said plates, a channel formed at the upper end of each side of the setting, and a cover for said setting consisting of a series of sections the ends of each of said sections being adapted to rest in said channels and the sides of the end sections being adapted to engage the flange of one or the other of the front plates, an overhanging plate secured to one side of all but three of the cover-sections, and an overhanging plate secured to each side of one of said three sections, the arrangement being such that each joint between the cover-sections shall be covered by one of the overhanging plates, substantially as described.

12. In an expansion-bearing for a drier-cylinder, the combination with the cylinder, of a bearing carried thereby, a roller adapted to engage said bearing, said roller being adapted to have both a rotary and an axial movement, substantially as described.

13. In an expansion-bearing for a drier, the combination with the cylinder, of a bearing carried thereby, a roller adapted to engage

said bearing, a shaft having an eccentric portion adapted to receive and support said roller, the said roller being allowed both a rotary and an axial movement upon said eccentric, and means for rotatively adjusting said shaft, substantially as described.

14. In an expansion-bearing for a drier, the combination with the drier-cylinder, of a bearing carried thereby, a shaft, having an eccentric portion, mounted in suitable bearings, means for angularly adjusting said shaft, a bushing keyed to the eccentric portion of said shaft and longitudinally movable thereon, and a roller rotatively mounted on said bushing and adapted to engage the bearing carried by the cylinder, substantially as described.

15. A bushing for an opening in the front plate of a furnace-setting, said bushing consisting of a pair of annular plates between which is secured a packing of non-conducting material, and means for securing said bushing in said opening, substantially as described.

16. In a drier, the combination with the drier-cylinder, of a conveyer-trough mounted at the delivery end thereof, a conveyer mounted therein, an elevator-boot, an elevator mounted therein, a chute connecting the delivery end of said trough with said boot, an opening formed in said trough near the delivery end thereof, a door for closing said opening, an opening formed in the bottom of the elevator-boot, and a door for closing said opening, substantially as and for the purpose set forth.

FREDERICK A. HETHERINGTON.

Witnesses:

A. M. HOOD,

R. J. O'CONNOR.