

(No Model.)

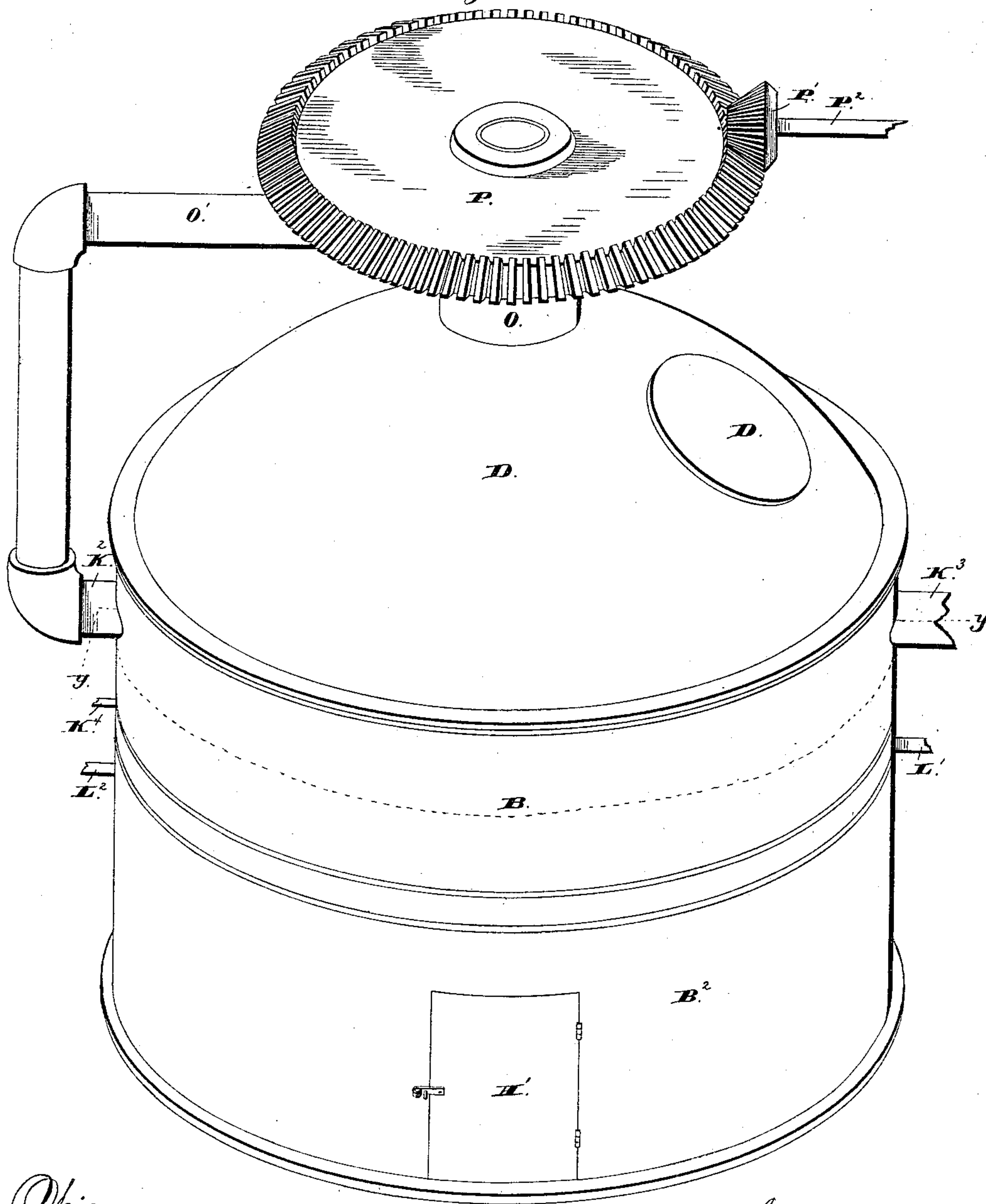
4 Sheets—Sheet 1.

A. B. FRENZEL.  
VACUUM PAN.

No. 338,662.

Patented Mar. 23, 1886.

*Fig 4.*



*Witnesses:*

*Jas. E. Hutchinson.*  
*Henry C. Hazard*

*Inventor.*

*A. B. Frenzel*  
*by Prindle and Russell*  
*his attorneys.*

(No Model.)

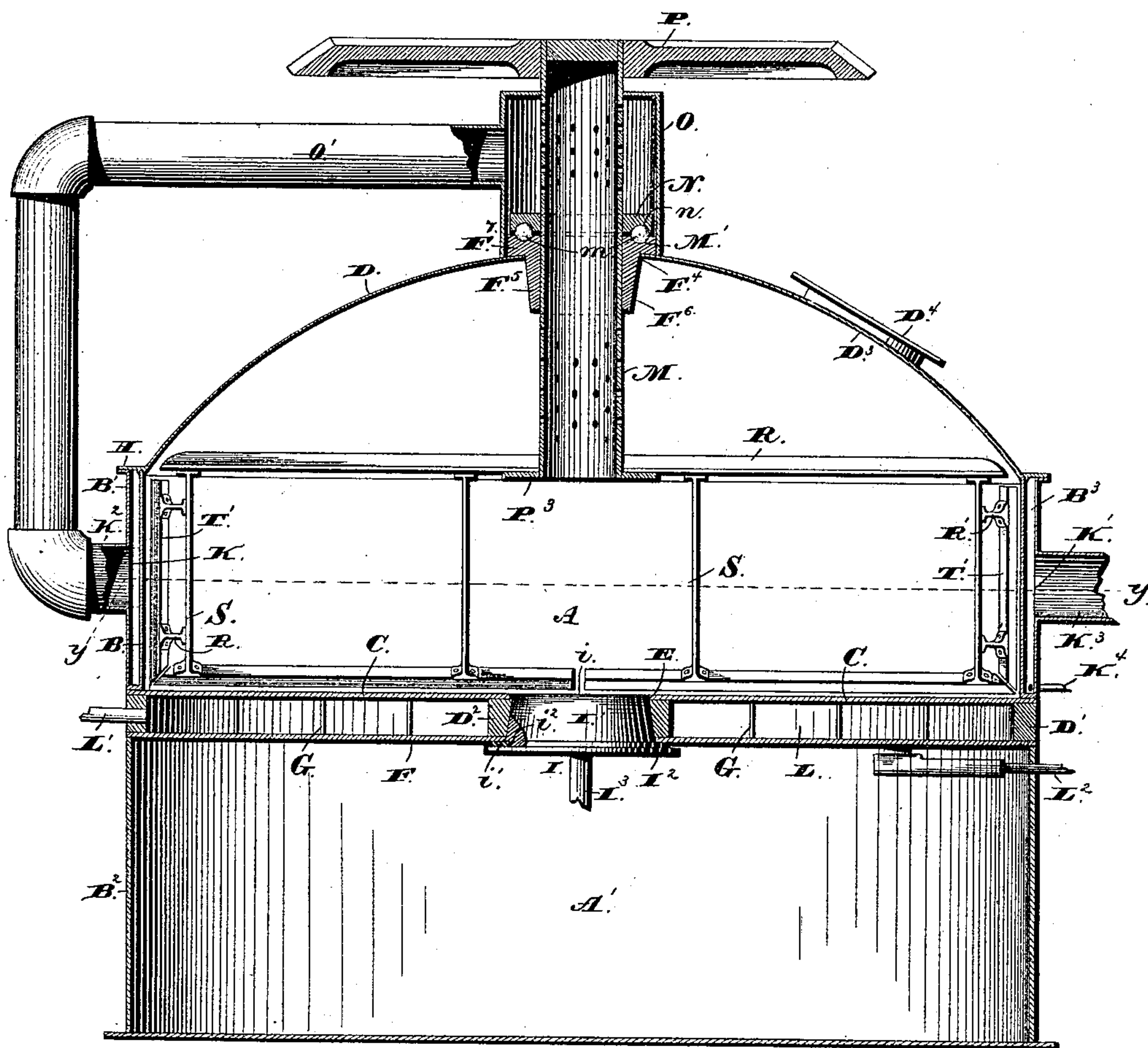
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*Fig. 2.*



Witnesses:  
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Henry C. Hazard.

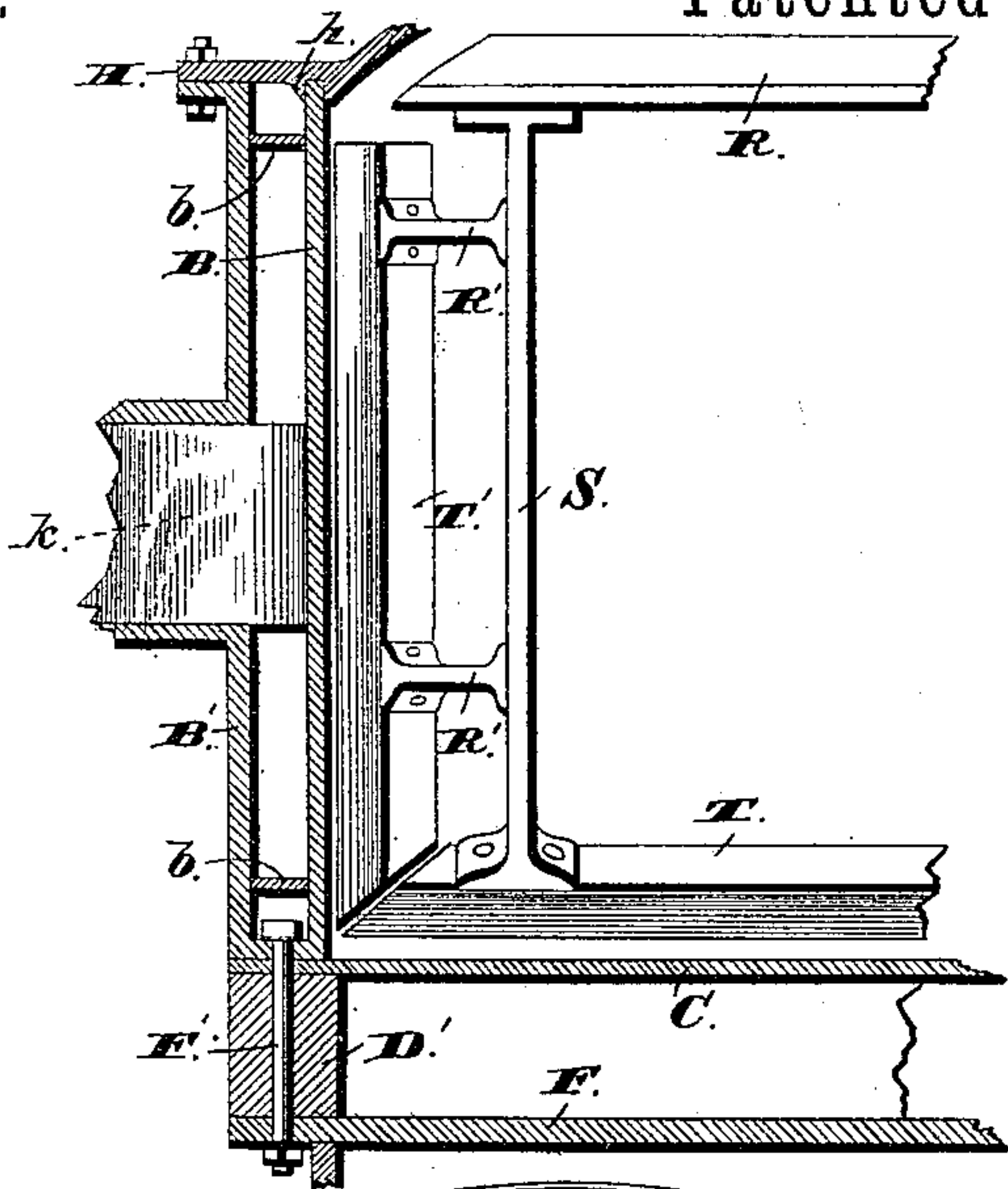
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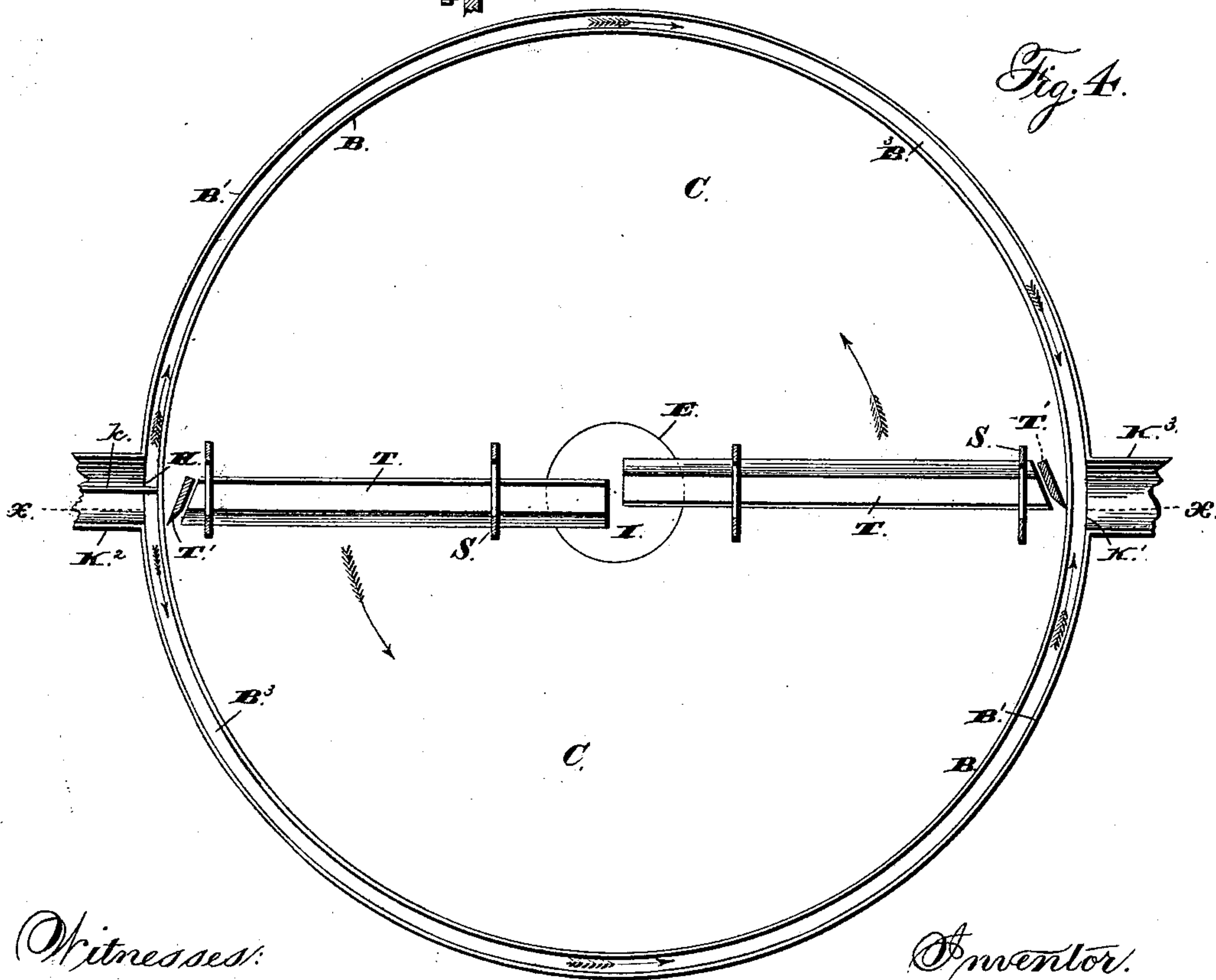
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*Fig. 5.*



*Fig. 4.*



Witnesses:

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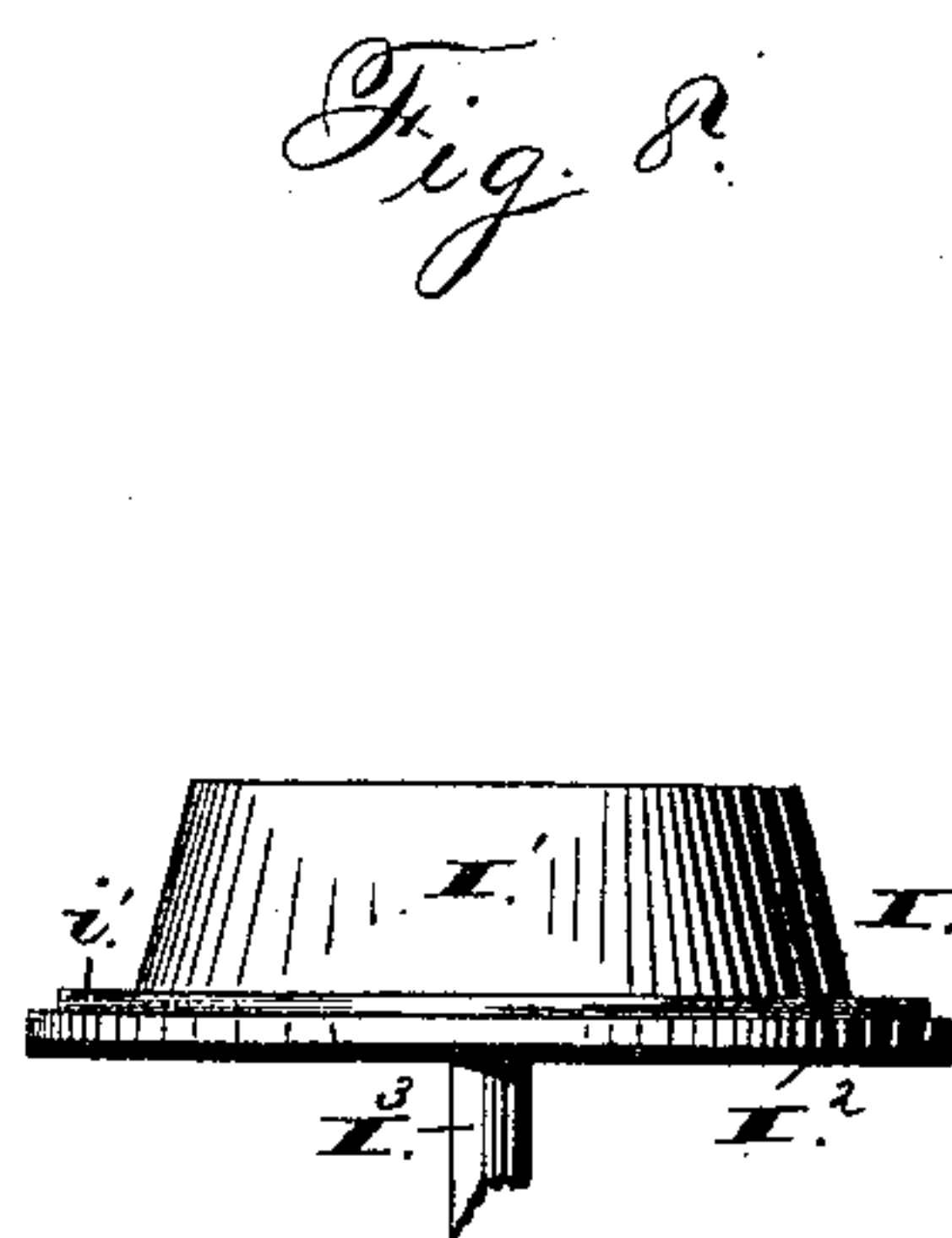
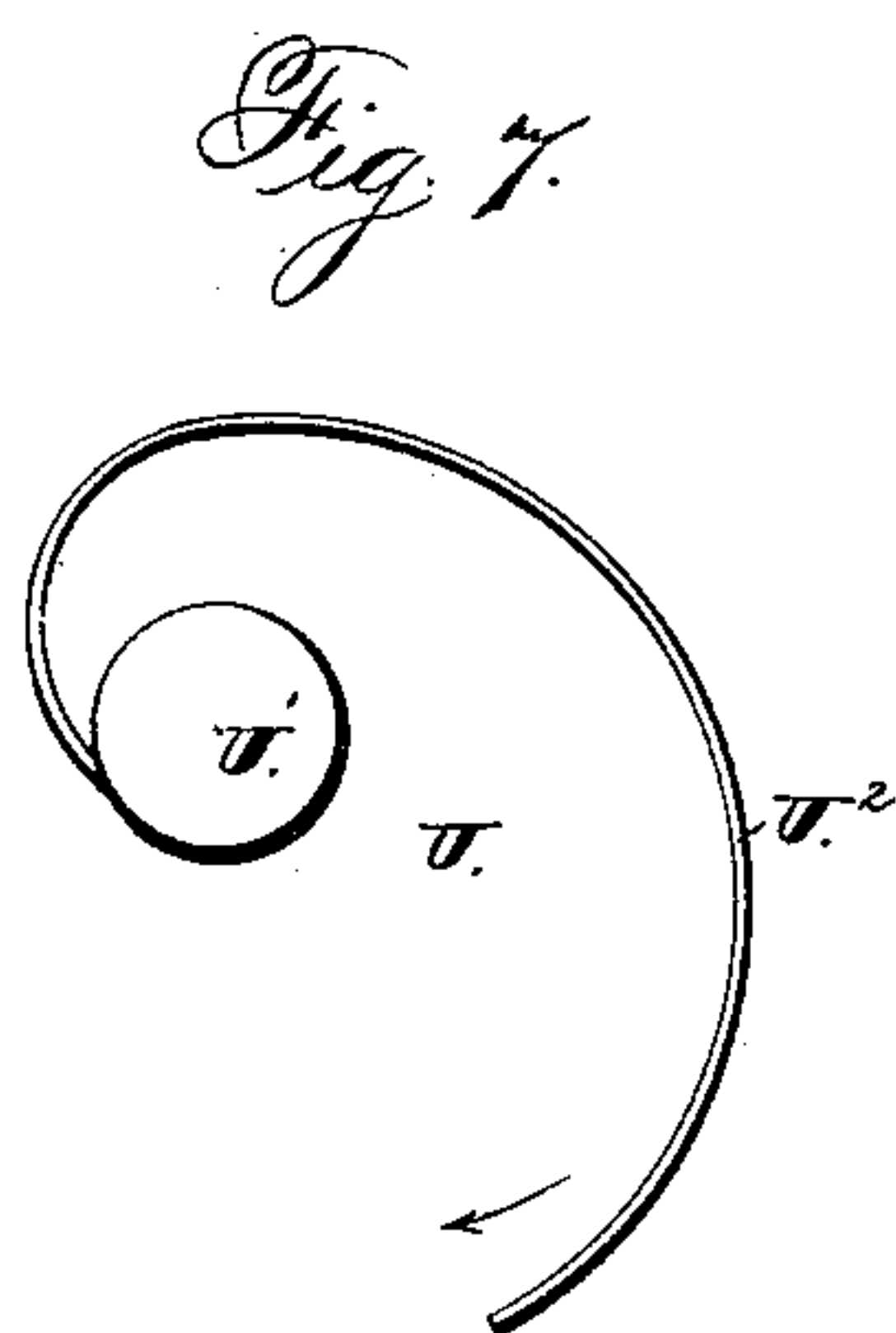
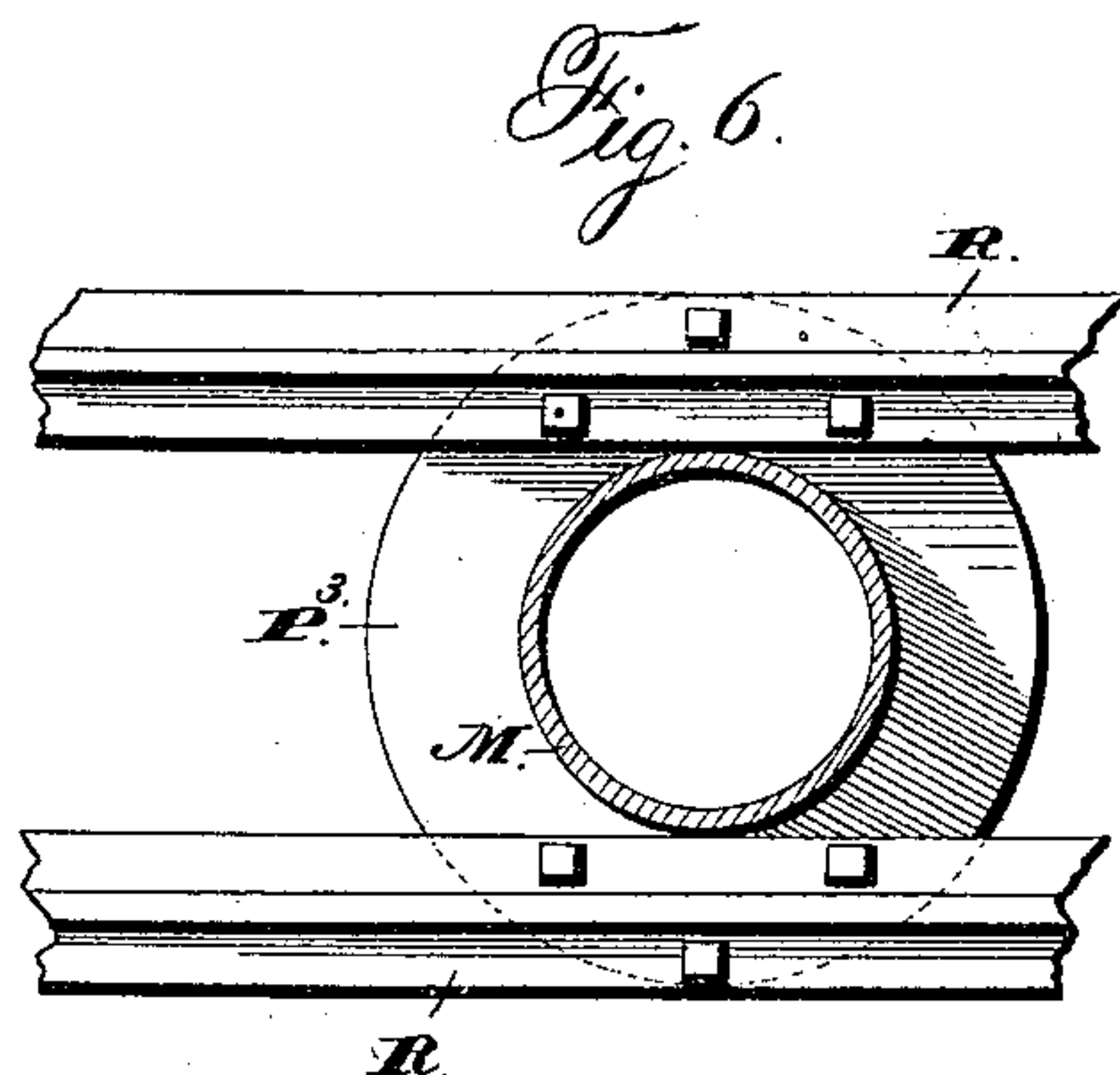
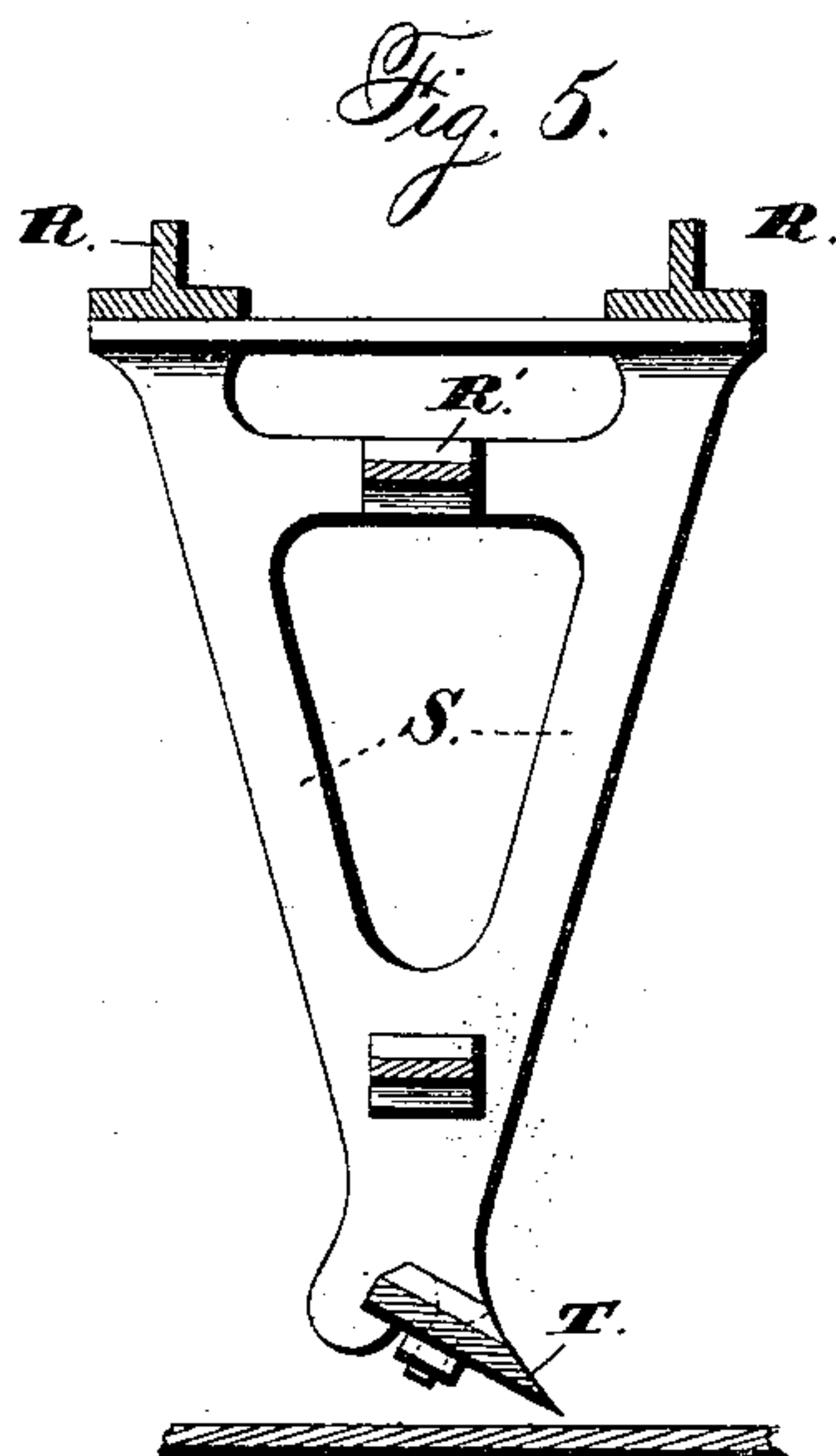
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4 Sheets—Sheet 4.

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# UNITED STATES PATENT OFFICE.

ARTHUR B. FRENZEL, OF NEW YORK, N. Y., ASSIGNOR OF ONE-THIRD TO  
C. H. DELAMATER & CO., OF SAME PLACE.

## VACUUM-PAN.

SPECIFICATION forming part of Letters Patent No. 338,662, dated March 23, 1886.

Application filed December 21, 1883. Renewed May 22, 1885. Again renewed January 30, 1886. Serial No. 190,383. (No model.)

*To all whom it may concern:*

Be it known that I, ARTHUR B. FRENZEL, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Vacuum-Pans; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

10 Figure 1 shows a perspective view of my machine; Fig. 2, a vertical section of the same on line *xx*; Fig. 3, an enlarged detail sectional view of one side of the machine, showing the construction of the side and bottom and the arrangement and construction of the scraper and stirrer blades; Fig. 4, a horizontal section of the machine on line *yy* of Fig. 1; Fig. 5, a detail sectional view of one of the scraper and stirrer blades and its supporting-arm; Fig. 6, 15 a detail plan view of the lower end of the tubular shaft with the scraper-arms attached; Fig. 7, a plan view of the discharging-plow which I contemplate using with my machine, and Fig. 8 a detail view of the stopper for closing 25 the bottom of the drying-chamber.

Letters of like name and kind refer to like parts in each of the figures.

The object of my invention is to provide an improved apparatus or machine for drying 30 paint, blood, scrap, pulp, chemicals, charcoal, and other powdered, pulverized, or disintegrated substances; and to this end it consists in the construction, combination, and arrangements of parts, as hereinafter clearly described and set forth.

35 In the drawings, A designates a cylindrical drying-pan, having the vertical double sides B B', which are U-shaped in cross-section, the bottom plate, C, and the dome-shaped top D. The two cylindrical shells forming the double walls of the pan are connected at their bottoms, so that a transverse vertical section of the walls of the pan will appear U-shaped, as set forth above. The sides and top are 45 formed of sheet or cast metal, while the bottom is made of a steel plate having a central opening, E. This bottom plate rests upon the ring D', extending around its outer edge, and upon the ring D<sup>2</sup>, around the edge of the 50 central openings, E.

Below plate D is a metal plate, F.

Bolts F', passing through the bottom of the V-shaped sides of the pan, the ring D', and the plate F, serve to fasten the bottom and sides together and the plates D and F to the 55 top and bottom of the ring D', respectively.

The two plates are to be fastened in any desirable way to the top and bottom of the ring D<sup>2</sup>.

Braces G G between the plates serve the 60 purpose of strengthening and stiffening the bottom of the drying-chamber, so that it will stand considerable pressure.

The flange H, around the edge of the dome-top, is, as shown, provided with the annular 65 flanges or ribs *h h*, between which is received and held the upper edge of the inner chamber-wall, B. The outer wall, B', of the pan is at its upper edge formed with a flange, *b'*, to which is bolted the flange on the dome. 70

Between the walls B and B' are braces *b b*, which serve to strengthen and stiffen the side of the chamber and to keep the walls a fixed distance apart. A cylindrical chamber, A', whose sides are preferably also of sheet or 75 cast metal, is below the bottom plate, F. Its sides B<sup>2</sup> support the rest of the apparatus upon their upper edge, as shown in the drawings, said edge just coming under the outer ring, D'. They can be fastened in any de- 80 sired way to bottom plate, F, or to the ring D'.

In the side of the lower chamber, A', is a door, H'.

The central ring, D<sup>2</sup>, around the opening E, in the bottom of chamber or pan A, is, as 85 shown, made with its inner sides flaring downward. Within this ring fits the stopper I, which has the frustum-of-a-cone-shaped part, I', adapted to fit the ring closely, and when inserted in place to have its upper face, *i*, 90 flush with the upper and inner face of the plate C.

Around the base of the part I' is a flange, I<sup>2</sup>, upon the upper face of which is an annular packing, *i'*, of any suitable material. In 95 such base is cut a groove, *i''*, just above the flange I<sup>2</sup>, into which groove is sprung or extends the inner edge of the packing or gasket. Said packing, when the stopper is inserted in place, comes against the lower face of plate F, 100 around the edge of the opening therein, and makes a tight joint. The stopper can be fast-



ened when so inserted in any desired way. A handle,  $I^3$ , is provided, extending from its lower face, by which it can be removed or replaced. Diametrically opposite each other  
 5 are the openings  $K K'$  in the outer wall,  $B'$ , of the casing of chamber A, and from these openings extend the short pipes  $K^2 K^3$ , respectively. Between the inner and outer walls, B and  $B'$ , is then a jacket-space,  $B^3$ , extending entirely around the chamber A, and closed at the top and bottom, as shown. Into  
 10 this space open the pipes  $K^2 K^3$ . Within the pipe  $K^2$  is a longitudinal vertical partition,  $k$ , which extends beyond the end of the pipe to the inner wall, B, of the chamber A, so that  
 15 any vapor entering the space  $B^3$  by the pipe will be divided and caused to pass around in such space in opposite directions, as indicated by arrows in Fig. 4.

20 For drawing off any moisture which may condense in space  $B^3$ , a small outlet-pipe,  $K^4$ , is provided, situated at or near the bottom edge of wall  $B'$ , below the pipe  $K^3$ .

Between the two plates C and F, forming  
 25 the bottom of the chamber A, is an annular jacket-space, L, closed around its outer edge by the ring  $D'$ , and around its inner edge by ring  $D^2$ . Into the outer side of this space extends the pipe  $L'$ .

30 At a point diametrically opposite to the pipe  $L'$ , another pipe,  $L^2$ , extends up through the plate F into the space L.

The dome-top D is provided with a feed-opening,  $D^3$ , through which the charge of material to be dried is put into chamber A. This  
 35 opening is closed by cap  $D^4$ , which can be of any construction and fastened in any way desired.

Through the center of the dome is an opening,  $F^4$ , in which is inserted the cylindrically-bored bearing  $F^5$ , for the vertical tubular shaft  
 40 M. This bearing has the neck  $F^6$ , extending down within the dome, and the flange  $F^7$ , extending over the edges of opening  $F^4$  and resting upon and fastened to the dome-top.  
 5 The upper face of flange  $F^7$  is provided with the annular groove  $M'$ , in which roll the balls  $m m$ .

Upon the shaft M is fixed a collar or flange,  
 45 N, having on its under face a groove,  $n$ , corresponding to groove  $M'$  and adapted to receive the upper portions of the balls  $m m$ . An anti-frictional bearing is thus formed, adapted to support the shaft vertically and  
 5 allow of its easy rotation without friction.

Attached to the top of the dome and surrounding bearing or bushing  $F^5$  is a hood, O, from one side of which, near its top, extends a pipe,  $O'$ , connected with pipe  $K^2$ , as shown.  
 50 The tubular shaft M passes up through the top of the hood, any suitable kind or means of packing being used to prevent escape of any vapor from the inside of the hood around the shaft while allowing of rotation of the latter. The upper end of the latter is closed, as  
 5 shown, and has fixed upon it the bevel gear-wheel P, with which meshes the gear  $P'$  on a

drive-shaft,  $P^2$ , driven by suitable connections from any desired form of motor. The shaft  
 70 M is provided with a series of openings through its sides above and below the bearing-piece  $F^5$ . The sum of the combined areas of the openings in each part of the shaft is preferably equal to the area of the bore  $m'$  of the shaft itself. Upon the lower end of the shaft  
 75 is a rigid annular flange or collar,  $P^3$ . Bolted or otherwise fastened upon this collar or flange on opposite sides of the shaft are the horizontal parallel bars R, preferably made of iron  
 80 of an inverted-T shape in cross-section. Instead of two such bars, obviously a greater number can be used, attached to the flange, so as to stand at angles to those already described. To the lower flat sides of these bars  
 85 are attached the upper ends of the V-shaped standards or arms S S, one leg of the V being attached to each bar R, so that the standards extend downward at right angles to the  
 90 arms R. On each side of the shaft M are two of these vertical standards or arms—one near the shaft and one near the outer ends of bars R.

To the lower ends of arms S are bolted or otherwise fastened the scraper-blades T. Each  
 95 of these blades, as shown, extends from one inner arm S to the corresponding outer one, with its edge parallel to and just above the bottom plate, C, of the chamber. The body of the blade is inclined downward from its back in the direction of the movement of said  
 100 blade, the lower ends of the arms S being so shaped as to admit of their being fixed thereto in such inclined position. To the sides of the outer arms are fixed the short horizontal arms  
 105  $R' R'$ , to the outer ends of which are bolted or otherwise fastened the vertical blades  $T' T'$ , the edges of which are parallel with and close to the side wall, B, of the chamber A. These  
 110 blades are, as were the horizontal ones, inclined outward in the direction of their movement. The horizontal and vertical knives will, as situated, serve to scrape the material being dried from the bottom and sides of the cylindrical chamber, respectively, and will keep it well stirred up.

I contemplate attaching to or suspending  
 115 from the bars R in any desired way a spiral-shaped plow, U, which is adapted to be swung down to rest on the bottom plate, C, when in operation, or to be thrown out of operation  
 120 by being swung upward and held or fastened against the bars. When down, if it is turned in the direction shown by the arrow in Fig. 7, the material on the bottom plate, C, will obviously be carried or forced inward by it  
 125 toward the center of the plate, where the discharge-opening E is.

The special construction of this plow I do not describe in this application, as I intend to cover the same in a future application. Broadly, it consists of the central annular  
 130 portion,  $U'$ , by which it is attached to the bars R R and the spiral blade  $U^2$ , a portion of which at least is adapted to rest on the plate E when the plow is let down. As indicated



hereinbefore, this plate is preferably made of steel, as it can then be made quite thin, while being strong enough to stand the steam-pressure to which it may be subjected. It is desirable to have it as thin as possible, in order that heat may pass through it with the greatest possible facility.

The operation of my drying apparatus is as follows: The stopper, being inserted and fixed in place within the ring  $D^2$ , closes the central opening through the bottom of the chamber A. The material to be dried is loaded into the chamber through the opening  $D^3$ , and such opening is then closed by the cap or cover  $D^4$ . The pipe  $K^3$  is connected with some suitable apparatus for producing a vacuum or suction. Steam is admitted through the pipe  $L'$  into the space L, between the steel plate C, forming the bottom of chamber A, and the plate F, and circulates throughout such space, passing out, together with any moisture which may be condensed from it, through the exhaust or discharge pipe  $L^2$ . The heat from this steam, passing up through the plate C, heats the mass of material resting thereon. The shaft M is rotated by the gearing described, and the bars R R and scraper-blades I I' are carried around within the chamber A, the blades scraping the material from the bottom and sides of the chamber and stirring it up thoroughly. A suction is applied at the opening  $K'$  and pipe  $K^3$ . The heated vapors from the material will be drawn up through the tubular shaft M, entering through its lower end and the openings in its sides near that end. From the shaft they will pass out through the openings therein above the shaft-bearing and into the hood or drum O. From the hood they are drawn down through pipes  $O'$  and  $K^2$ , and then pass around through the space  $B^3$  on opposite sides of the chamber A and out through the suction-pipe  $K^3$ . The volume of vapor entering space  $B^3$  through pipe  $K^2$  is divided by the partition in such pipe, and the two parts of it pass in opposite directions around the pan or chamber A to meet and be drawn out together through the pipe  $K^3$ . As the heated vapor passes around through the jacket-space  $B^3$ , some of the moisture carried by it will be condensed. Such moisture of condensation is drawn off by means of the pipe  $K^4$ . The heated vapor as it passes around outside of the cylindrical wall B of the drying-chamber heats such wall and the material within the chamber in contact with the wall. Such utilization of the heat of the vapor arising from the material being dried to aid in heating such material makes my apparatus much more economical than those heretofore in use, in which the heated vapor was either discharged or allowed to escape directly into the air, or was drawn off and away from the drying pan or cylinder. It is advantageous to have the sides of the chamber or pan warmed, as well as the bottom, in order that the upper and outer portions of the mass of material may not be cooled by contact with cool sides,

and to prevent any of the moisture of the vapor within the chamber being condensed upon the inner face of such sides. The scraper and stirrer blades scrape the material from the bottom and sides, and stir it about continually bringing portions of it in contact with different parts of the heated surface of the pan. Thus burning of the material and sticking of the same to the bottom and sides of the pan are prevented, and the whole mass is heated equally and thoroughly throughout.

The suction apparatus is designed to draw off the moisture-containing vapors within the apparatus very rapidly. As the tubular shaft M extends downward from the center of the dome into the pan, the vapors arising from the drying material will be drawn off rapidly from the center of the chamber, and condensation of moisture upon the inside of the dome will be reduced to its minimum, if not prevented, as such vapor does not in its upward and outward passage rise up against and flow along the inner face of the dome. As is obvious and well known, it is advantageous also to have within the pan the partial vacuum produced by the action of the suction apparatus for drawing off the vapors, as evaporation of the moisture in the material is much accelerated by such vacuum or diminished pressure. When the material has become sufficiently dried, the scraper-arms are stopped, the steam shut off, and the suction apparatus is disconnected or its action stopped. When the material has cooled, the door in the bottom chamber is opened and the stopper is removed from the central opening through the double bottom of the pan. The spiral plow or discharger U is then swung down and the shaft M is caused to revolve again. The dried material will, by the action of this plow or discharger, be gathered or forced inward toward the center of the pan-bottom, where it falls through the opening E down into the chamber below.

If poisonous substances—as arsenic, white lead, &c.—are being dried by my apparatus, the door in the chamber below the pan is kept closed during the discharging operation and until all dust has settled within such chamber. If the stopper be put back to close the discharge-opening E, a new charge can be put into the pan and be operated upon while the dust is settling in the lower chamber. Heat radiating from the steam-space below the pan will then act to still further dry the discharged load.

Having thus described my invention, what I claim is—

1. In a drying apparatus, a vacuum-pan, in combination with a stirrer carried on a tubular shaft, through which the vapors within the pan are drawn off, substantially as shown and described.

2. In a drying apparatus, the closed pan, in combination with the hollow shaft carrying the stirrer, and means for drawing off the vapors within the pan through the shaft, substantially as and for the purpose described.



3. In a drying apparatus, in combination with a vacuum-pan, a tube through which the air and vapors within the pan are exhausted, extending into said pan and below the top thereof, substantially as and for the purpose described. 5
4. In a drying apparatus, in combination with a vacuum-pan having a dome-shaped top, an exhaust-tube, through which the air and vapors in the pan are drawn off, extending down through the dome, and adapted to take the air and vapors from a point within the pan and below the top of the dome, substantially as shown and described. 10
5. In a drying apparatus, in combination with a vacuum-pan, an exhaust-tube extending down within the pan to take the air and vapor from a point well within the pan and away from the top thereof, having the open end and a series of apertures in its sides near its end, substantially as and for the purpose described. 15
6. A vacuum-pan having on its top a hood connected with a suction apparatus, in combination with a rotary tubular shaft extending through the hood down into the pan, and carrying on its lower end an agitator, and provided with a series of openings through its portion which is within the hood, substantially as and for the purpose described. 25
7. In combination with the closed pan having a hood on its top connected with a suction apparatus, the rotary hollow stirrer-shaft extending through the hood and top, open at its lower end and provided with a series of openings through the sides of its portions which are within the hood and below the top of the pan, substantially as and for the purpose described. 30
8. In combination with a pan having in its top bearings for a stirrer-shaft, and above such bearings a hood connected with means for producing a vacuum therein, a rotary hollow shaft extending through the hood and down into the pan, perforated along its portion contained within the hood, open at its lower end, and carrying thereon means for stirring the contents of the pan, substantially as and for the purpose described. 40
9. A vacuum-pan provided with means for heating it at its bottom, and having a jacket-space around its sides, in combination with means for causing the heated vapors from the interior of the pan to pass around through the jacket-space to heat the sides of the pan, substantially as and for the purpose described. 45
10. In combination with the vacuum-pan provided with the steam-space below its bottom and a jacket around its sides, the discharge-pipe for drawing off the heated vapors from within the pan, connected with and discharging into the jacket-space, substantially as shown and described. 50
11. In combination with the vacuum-pan having in its top a tubular bushing for the stirrer-shaft, and above such bushing a hood, the hollow rotary shaft carrying at its lower end means for stirring the contents of the pan, and at its upper end within the hood provided with a series of perforations, the collar on the shaft resting on anti-friction bearings on the top of the shaft-bushing, and the exhaust-pipe connecting the hood with means for producing a vacuum, substantially as and for the purpose described. 70
12. A vacuum-pan provided with a jacket, a pipe for admitting heated vapor to the jacket, having a partition to divide the volume of the vapor and cause portions of it to pass around through the jacket-space in opposite directions, and with a discharge-pipe for allowing the escape of the vapor from the jacket-space on the opposite side of the pan from the entrance-pipe, substantially as shown and described. 80
13. In combination with the stirrer-shaft, the bars attached thereto, the vertical arms depending from said bars, and the sharp-edged scraper and stirrer blades carried on the lower ends of the vertical bars and adapted to scrape up and stir the material resting on the bottom of the pan, substantially as shown and described. 85
14. In combination with the stirrer-shaft provided with a flange, the parallel bars fastened to such flange, the vertical arms attached to the bars, and the scraper and stirrer blades extending between and attached to the lower ends of the arms, substantially as shown and described. 90
15. The rotary stirrer provided with sharp-edged scraper and stirrer blades moving close to the surface of the pan with which the material to be dried is in contact and inclined toward such surface in the direction of their movement, substantially as shown and described. 95
16. In a drying apparatus, the vacuum-pan provided with a closed heating-chamber below its bottom for the reception of the dried contents of the pan, substantially as shown and described. 100
17. A vacuum-pan having a discharge-opening through its bottom, means for closing and unclosing the same, and a chamber below its bottom for the reception of the dried contents of the pan, substantially as shown and described. 105
18. A vacuum-pan having a discharge-opening through its bottom, a spiral plow, in combination with means for rotating it to cause the contents of the pan to be brought to and discharged through the opening, substantially as shown and described. 110
19. In combination with a vacuum-pan provided with an opening through its bottom, a spiral plow connected with the rotary stirrer-shaft, adapted when it is let down upon the pan-bottom to force the material on the pan-bottom toward the central discharge-opening, substantially as shown and described. 115



20. In combination with the stirrer-shaft  
provided with a flange, the parallel bars at-  
tached to the flange, the arms depending from  
the same and carrying blades for scraping up  
5 the material on the bottom of the pan, and the  
short horizontal arms attached to the outer  
depending arms, and carrying the vertical  
knives adapted to scrape the material from

the sides of the pan, substantially as shown  
and described.

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Witnesses:

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