

L. W. SERRELL.

DUST SEPARATING OR VACUUM CLEANING APPARATUS.

APPLICATION FILED SEPT. 16, 1907. RENEWED MAY 21, 1910.

979,211.

Patented Dec. 20, 1910.

3 SHEETS—SHEET 1.

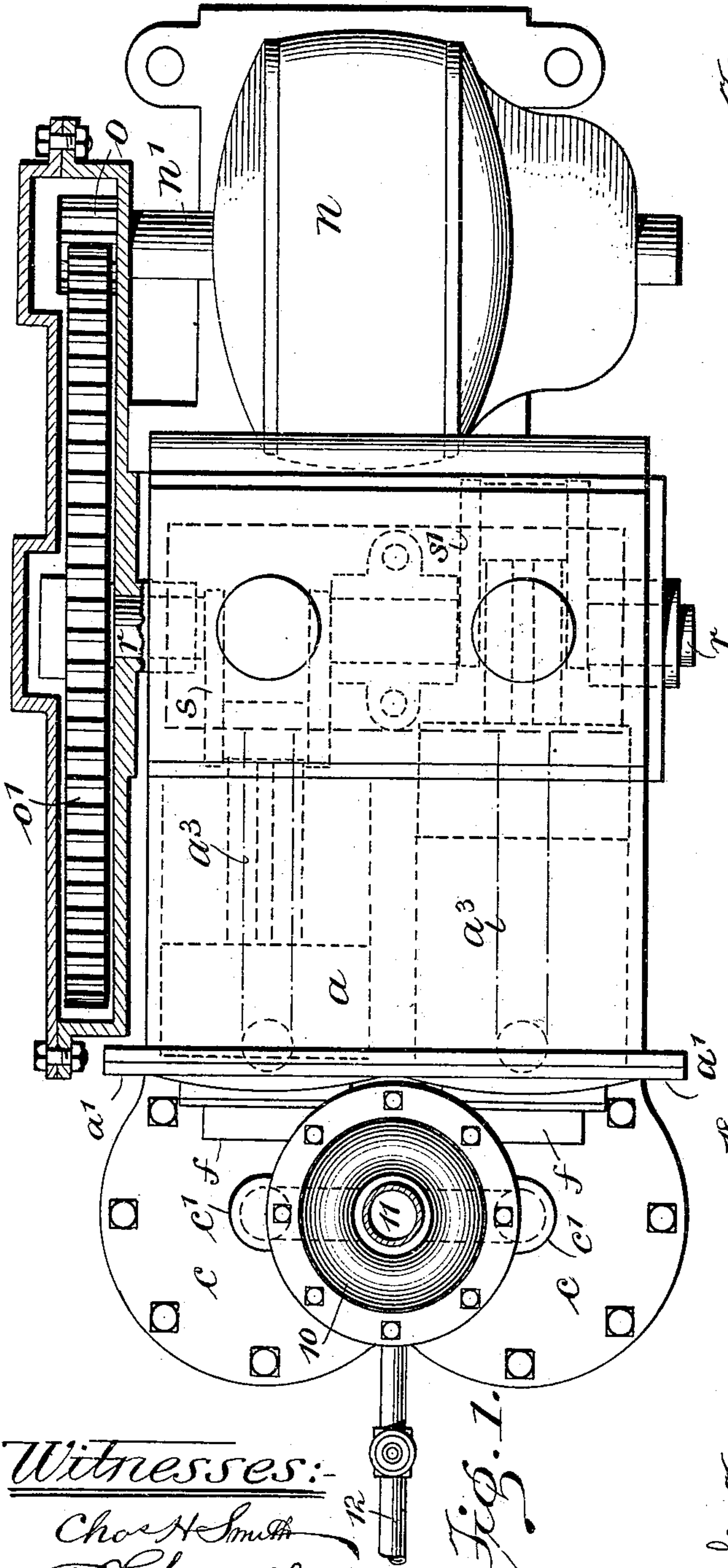


Fig. 1.

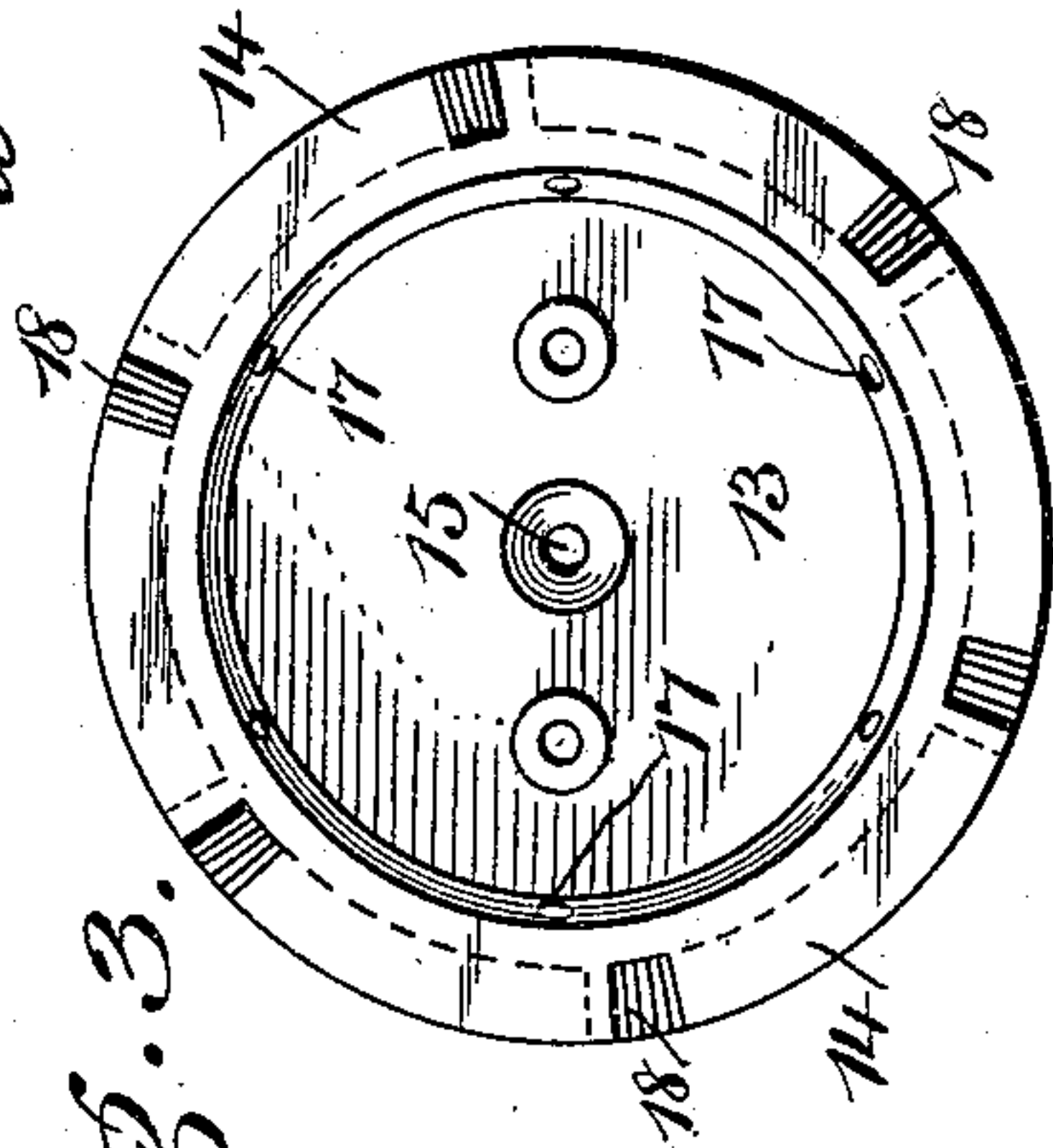
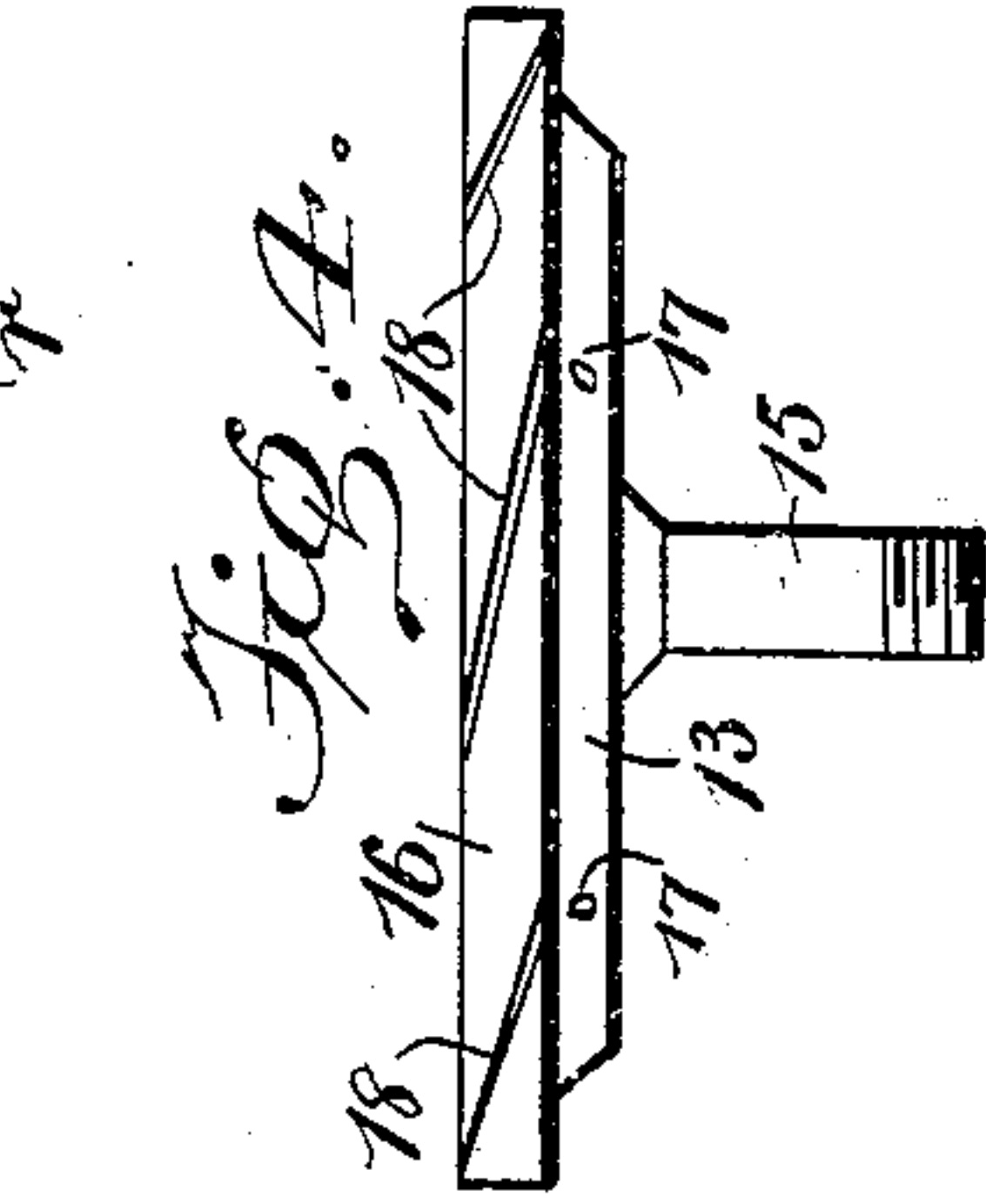
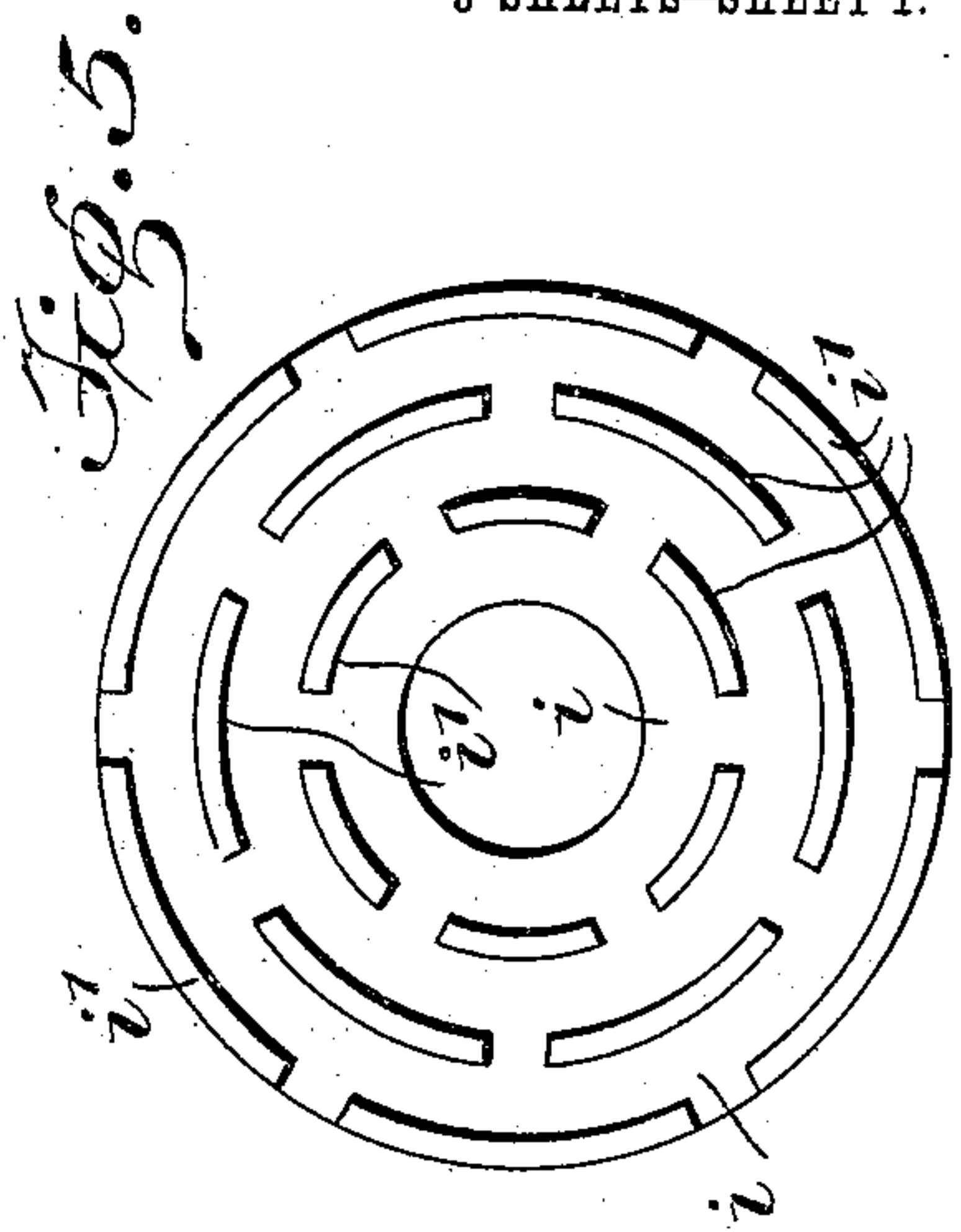


Fig. 3.

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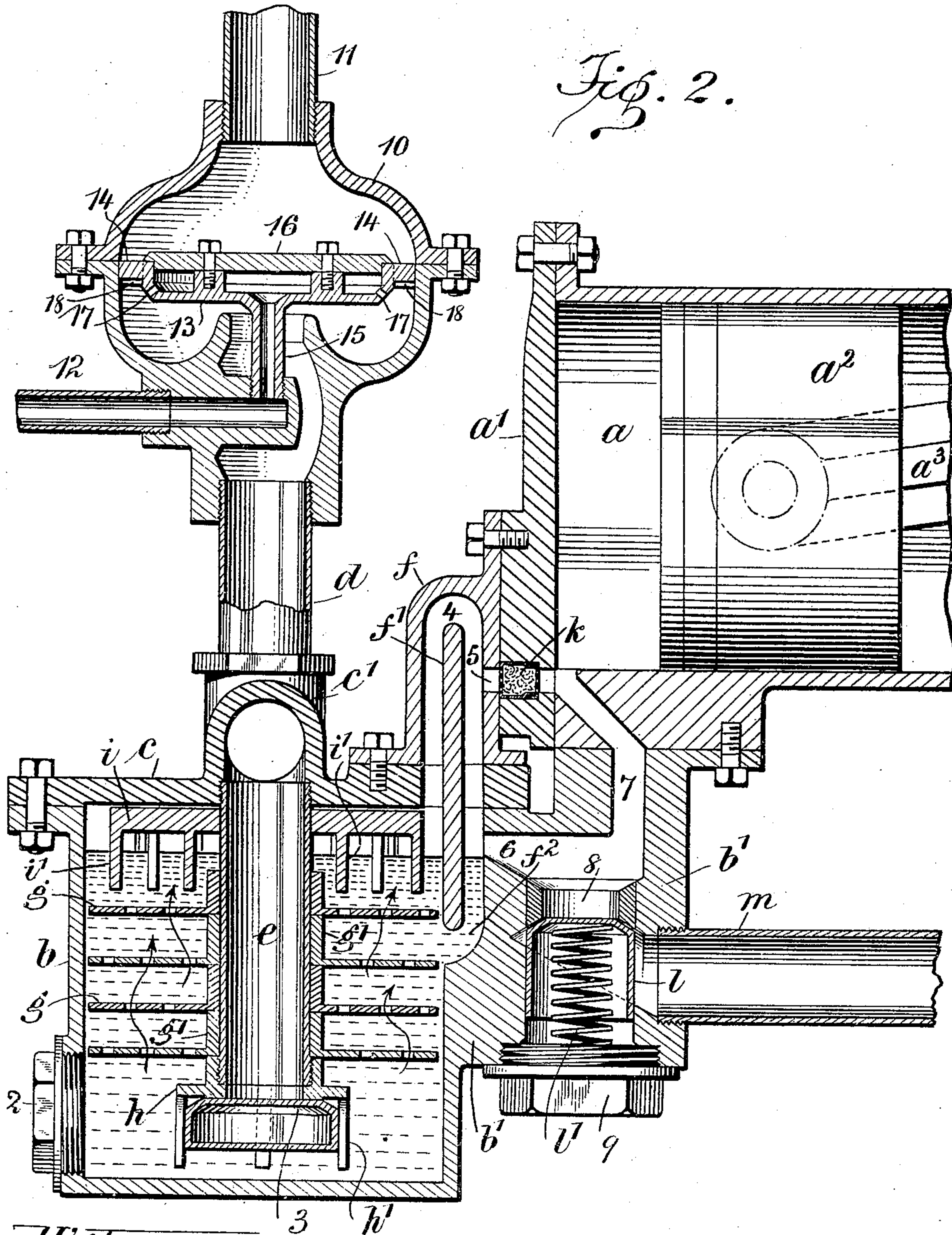
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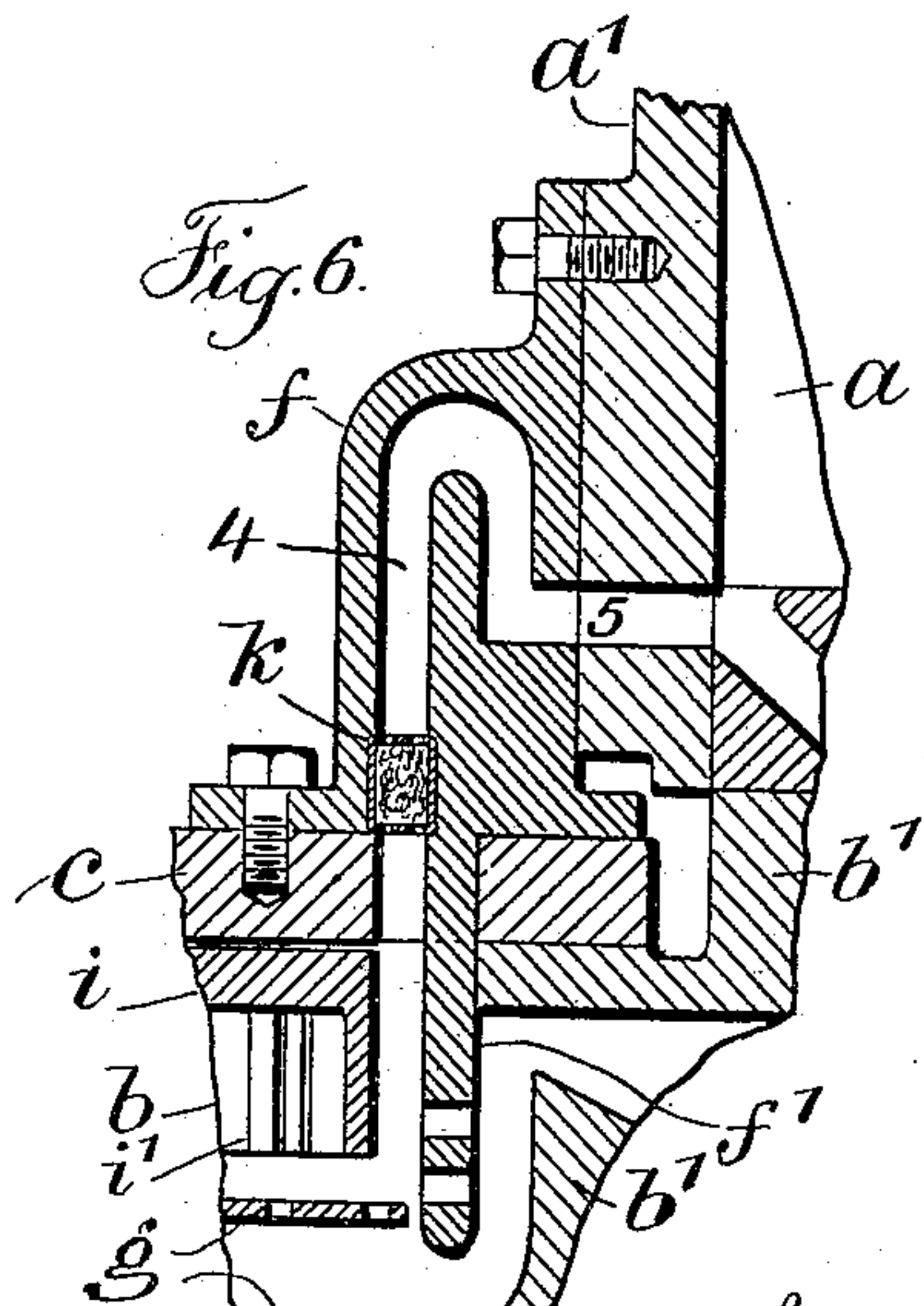
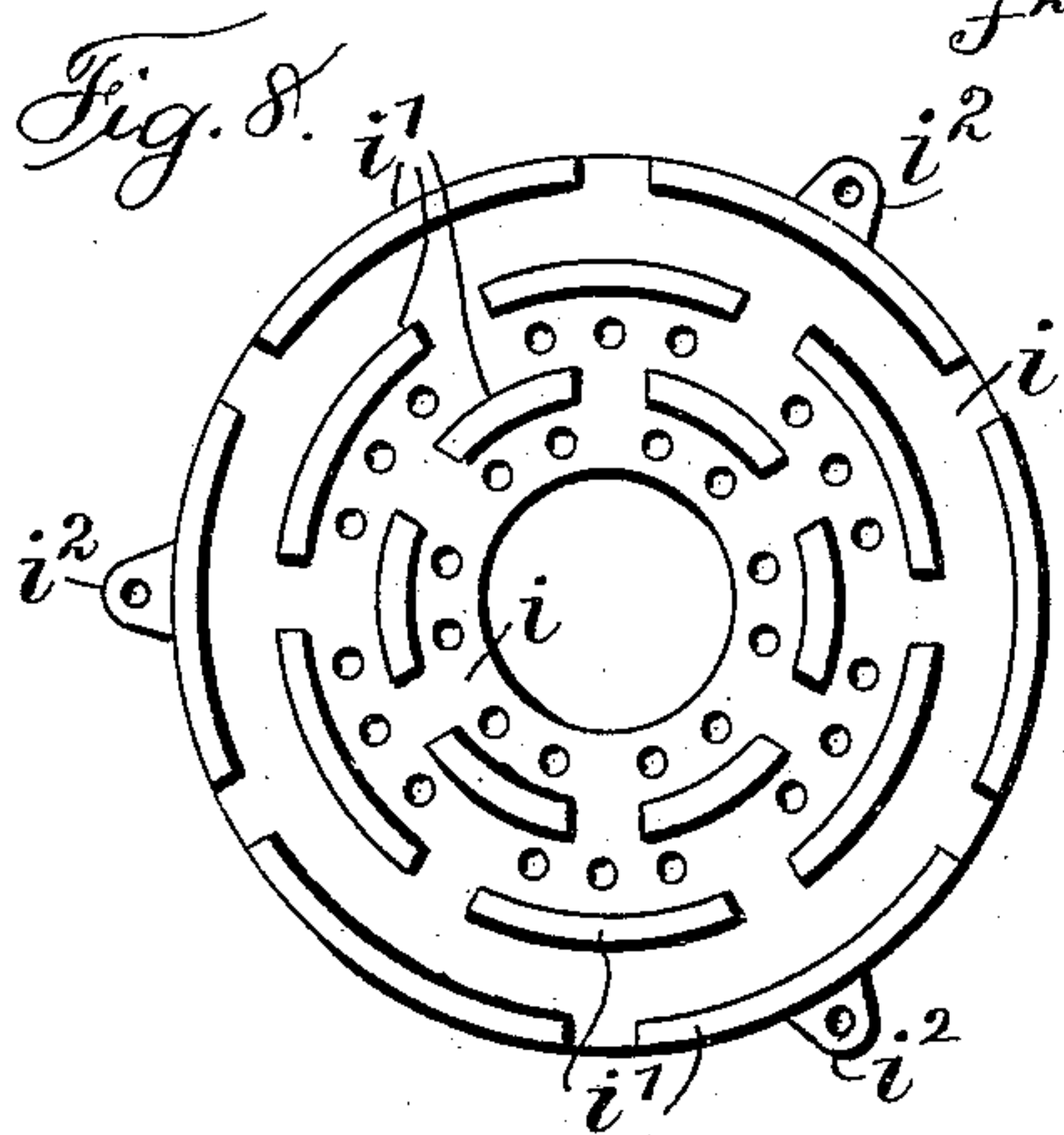
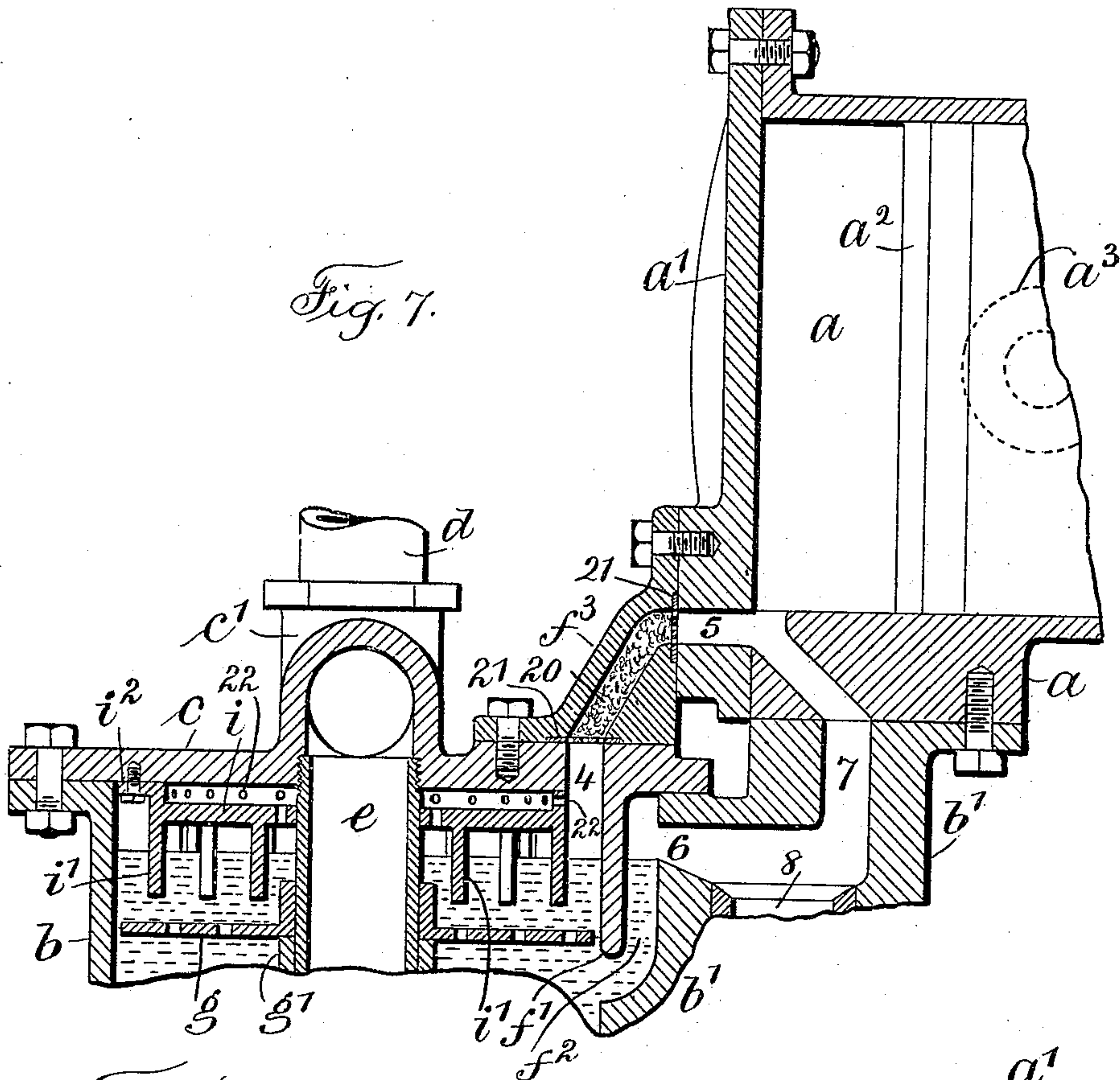
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

LEMUEL WILLIAM SERRELL, OF PLAINFIELD, NEW JERSEY, ASSIGNOR TO THE
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DUST-SEPARATING OR VACUUM CLEANING APPARATUS.

979,211.

Specification of Letters Patent.

Patented Dec. 20, 1910.

Application filed September 16, 1907, Serial No. 392,980. Renewed May 21, 1910. Serial No. 562,768.

To all whom it may concern:

Be it known that I, LEMUEL WILLIAM SERRELL, a citizen of the United States, residing at Plainfield, in the county of Union and State of New Jersey, have invented an Improvement in Dust-Separating or Vacuum Cleaning Apparatus, of which the following is a specification.

My invention relates to a pneumatic or vacuum cleaning apparatus or dust separator adapted for general use, but particularly for installation for private use in domestic cleaning plants.

The object of my invention is to provide devices adapted for removing the dust collected in air resulting from the operation of cleaning and then automatically separating the dust from the air in a wash box or liquid holding vessel; also collecting dirty or soapy water resulting from the operation of scrubbing or wet cleaning, and conveying the same to said wash box or liquid holding vessel and separating the dust and water from the air in said wash box and automatically discharging the dirty water in said wash box into a sewer or other convenient pipe or vessel for disposing of the same and returning the purified air to the atmosphere and at the same time preventing the entrance into the vacuum pump cylinder of the dirty water of the wash box or vessel and also renewing the water in the wash box by the addition of clean water.

In carrying out my invention, I provide a pipe for the dust laden air or dirty water and by which the same enters a liquid holding vessel or wash box substantially at the axial center thereof, and I provide a pipe for clean water entering the said pipe to replenish the water in said vessel and cause an overflow which carries off the dirty water. This entering water further moistens the dust in suspension in the entering air and I may provide means for agitating the dust laden air and entering water where they commingle. This pipe for the dust laden air or liquid employed in cleansing, passes down into the wash box or liquid holding vessel to near the bottom thereof and is closed by a float or other form of valve which normally keeps out of the said pipe the liquid in said vessel and is only opened when the pressure of the dirty water or dust laden air exceeds the pressure of the water in the vessel. Within this vessel and

surrounding said pipe, I provide series of overlying perforated plates or diaphragms, through which the dirt and air rise and part company in the wash box, and I further preferably provide a series of depending, 60 concentric segment flanges dipping into the liquid and between which the air escapes. I also provide an air outlet port from said vessel to the vacuum pump or pumps above the level of the liquid and an overflow port 65 for the liquid at the predetermined level of the liquid and a discharge port and valve below the liquid level by which the overflow of liquid escapes to the sewer, all of which will be hereinafter more particularly de- 70 scribed.

In the drawing, Figure 1 is a general plan view of the device of my invention. Fig. 2 is a vertical longitudinal section through the essential features of my invention and par- 75 ticularly through one of the vacuum devices or pumps. Fig. 3 is a plan and Fig. 4 an edgewise view of the device shown in Fig. 3 hereinafter particularly described with reference to the moistening of the dust in the 80 air and Fig. 5 is an inverted plan showing depending concentric segment flanges which dip into the liquid in the wash box and between which the air escapes by suction to the vacuum producing device. Fig. 6 is a 85 vertical section through the air suction and liquid delivery ports showing a form of my invention. Fig. 7 is a vertical section through parts of modified construction showing a form of my invention, and Fig. 8 is 90 an inverted plan of the plate with depending flanges and openings, all of which are hereinafter more particularly described.

Referring particularly to Fig. 2, *a* represents one end of one of the cylinders of the 95 vacuum pump; *a*¹ a cylinder head; *a*² the piston and *a*³ the connecting rod.

The wash box *b* is provided with a top plate or cover *c*. *b*¹ represents a portion of the body of said wash box extended at the 100 right hand. A plug 2 is removable for cleaning the wash box and the top plate *c* is suitably bolted to the body of the wash box as is also the cylinder head *a*¹ to the cylinder *a*, and this top plate *c* is formed with a cen- 105 tral boss *c*¹ into the upper edge of which screws a pipe *d* and into the lower end of which screws a pipe *e*, and where there are two vacuum cylinders and two wash boxes as shown in Fig. 1, the top plate *c* extends 110

over both wash boxes and the pipe d is a central pipe and the central boss c^1 extends above both wash boxes so that at its ends there are two pipes e , one entering each wash box,—but this is a detail forming a convenience for construction but no necessary part of my invention.

I provide a hollow body f with which the diaphragm and lip f^1 are integrally formed, there being a port or passageway 4 within this body f upon both sides of said diaphragm and over the same and this body comes at the intersection of the top plate c and the cylinder head a^1 and is secured to both of said parts, the lip at the lower end of the diaphragm dipping into the water of the vessel or wash box for the purpose of conveying the air from the wash box to the suction cylinder and preventing any splashing of the water into said suction cylinder. At this point I may, if found desirable or advantageous, perforate the lower end of the lip below the predetermined level of the liquid in the wash box, as shown in Fig. 6. This hollow body f is to be secured by suitable bolts to the top plate c and cylinder head a^1 . Each wash box has its separate body f and each body its diaphragm and lip f^1 formed integral therewith and agreeing in width with the width of the port or passageway 4.

Within the wash box and surrounding the pipe e are perforated plates g having flanges g^1 . The plates are in parallel planes and the flanges at right angles to the plates as collars surrounding the pipe e , each plate being supported on the flange of the lower plate and the series of plates with their flanges collectively supported upon a collar h screwed upon the lower end of the pipe e . The end of this collar is made as a valve seat for the float valve 3 and the collar is provided with depending fingers h^1 extending outside of and below the valve so as to keep this float valve in position. Within this wash box and at the upper end of the same surrounding the pipe e , I provide a plate i having a series of depending concentric staggered segmental flanges i^1 . This plate with its flanges is shown by the inverted plan, Fig. 5. It is to be supported in any desired manner, preferably to the under side of the top plate c .

I have shown a port 5 extending through the hollow body f and cylinder head a^1 to communication with the interior of the cylinder a and in this port a filter device k , preferably made of curled hair held in place in a perforated metal box, which I may employ and which serves to insure the vacuum cylinder against the entrance of any of the dirty water in the wash box that may splash up between the diaphragm f^1 and the back of the hollow body to the port 5.

The body b^1 of the wash box extended to

the right hand, Fig. 2, is provided with an overflow port 6 and a rising port 7 therefrom, which port continues through a portion of the cylinder to form an entrance into the cylinder, and this part of the body b^1 is provided for connection with the sewer pipe or overflow pipe m which extends from one side thereof. This body portion b^1 is bored out to receive the conical valve seat 8 and the hollow thimble shaped valve l and is fitted with a screw plug 9 and there is a spring l^1 between the screw plug 9 and the valve l which normally acts to keep the valve to its seat 8.

It will be noticed from Fig. 2 that the inner face of the diaphragm and lip f^1 is in line with the inner surface of the wash box, hence beyond the boundary thereof,—the lip dipping down into the water of the wash box, and that the extended portion of the body b^1 is cut away to form the discharge and overflow port f^2 around and beneath the lower edge of the lip f^1 through which the agitated dirty water rises and overflows by the port 6 into the collecting chamber above the valve l . In this manner the full available interior diameter of the wash box is maintained and neither the lip nor port f^2 curtail the available working area thereof and this port connects with the aforesaid overflow and liquid discharge pipe 6 heretofore described, the air in transit rising freely without risk of passing up the port f^2 . From Fig. 2 of the drawing it will also be apparent that the port or passageway 4 continues down behind the diaphragm and lip f^1 and joins the port 6. The level of the overflow port 6 is at a predetermined point with reference to the desired liquid level in the wash box, as shown in Fig. 2.

In Fig. 1 I have shown a motor n whose shaft n^1 is provided with a gear o meshing with a larger gear o^1 on the shaft r , with which is formed the cranks s s^1 for actuating the connecting rods a^3 of companion pistons and vacuum cylinders, and while these latter parts are employed, they form no necessary part of my present invention. I have also shown in Figs. 2, 3 and 4, a mixing vessel 10 having an entrance pipe 11 and connecting with the pipe d and provided with internal devices for moistening the dust of the dust laden air and which devices comprise the entrance pipe 12 for water, a disk 13 with flanged edges 14, and central pipe 15, which screws into a part of the lower portion of said mixing vessel bored out as a continuous passageway from the pipe 12, there being a top plate 16 over the disk 13 secured thereto with openings 17 through the disk for water which passes from the pipe 12 into the body of the vessel and through the central pipe 15 into the space between the disk and the top plate and discharges through the openings 17 into the vessel, the flanged

edge of the disk being provided with ports 18 through which the dust laden air passes into the lower part of the vessel discharging into said vessel past the openings 17 at which the water immerses to moisten the dust in the air, giving a rotary motion to the air in its passage therethrough. The devices in connection with this mixing vessel however form the subject of a separate application filed by me of even date herewith, Serial No. 392,981, so that the device of my present invention will not be limited to the employment of this special feature and the pipe for the water for the purposes of my present invention, may extend directly into the inlet pipe *d*.

In the operation of the device the dust laden air enters through the pipe *d* and pipe *e*. The dust is moistened by the water in the pipe *d* and the moistened dust and the air pass down the pipe *e*. The operation of the vacuum producing device alternately causes a partial vacuum and pressure on the surface of the water in the wash box and the connections thereto, thereby closing the discharge valve *l* and opening the inlet valve 3 and vice versa. As the inlet valve 3 is opened, the dust laden air and inflowing water commingle with the water in the wash box, the air arising as indicated by the arrows in Fig. 2, passes through the holes in the plates *g*, which plates break up the air bubbles, causing a thorough commingling of dust with the water and the air rises against the under side of the plate *i* and escapes through the openings in the same to the annular space between the plate *i* and the sides of the wash box *b*, through which it is drawn off through the port 4 over the upper end of the diaphragm *f*¹ and through the port 5 into the cylinder of the vacuum producing apparatus, due to the suction said apparatus produces.

The air arising through the water in the wash box produces an agitation to the same which causes a thorough mixture of the dust and the water, while the volume of the water therein is added to by the amount of water flowing into the pipe *d* which causes an overflow through the port *f*² and the port 6 into the chamber above the top of the valve *l*.

When the alternate action of the vacuum producing device takes place the pressure above the water in the wash box and in the port connections is increased, thereby closing the valve 3 and opening the valve *l*, thus expelling the exhausted air and the dirty water that has collected in the chamber above the valve *l* together into the pipe *m* from which it is discharged into the sewer or other collecting device. In practice it may be found advisable to let the dirty water drain by gravity from the pipe *m* into the sewer and the air thus expelled discharges freely into the atmosphere.

In the form of my invention shown in Fig. 6, the port 4 only extends to the port 5, and below this point the hollow body *f* is formed in one with the diaphragm *f*¹ and a ledge or shoulder is produced resting upon the wash pot cover *c* which extends on the right hand side of the diaphragm or lip to contact therewith, and the extension *b*¹ of the wash pot body also contacts with the said diaphragm or lip on the same side. In this modification I have shown the filter device *k* as placed at the entrance to the port 4 in the hollow body *f* although I do not limit myself either to the position occupied by the filter device or in fact to the use of a filter device at all.

In the form of my invention shown in Figs. 7 and 8, I have shown a hollow body *f*³ fitting the angle between the cylinder head *a*¹ and top plate *c* of the wash box with an inclined port 20 connecting the port 4 through the cover *c* and the port 5 through the head *a*¹ at the ends of which are perforated plates 21 let into the edges of the port 20 and between these a filling of fibrous material. In these figures the plate *i* is made with a hollow top or air chamber and secured to the under side of the cover *c* of the wash box by lugs *i*² and between the series of depending concentric staggered segment flanges *i*¹ I provide holes through the plate *i* and other holes 22 through the flange forming the hollow top through which the air enters and discharges into the port 4, and employ this device as the equivalent of the hollow body *f* and diaphragm and lip *f*¹, except that in this form of my invention the lip dipping into the wash box is formed with or secured to the cover *c* so as when in place to also produce the passageway *f*². In this form of my invention the air enters the air chamber in the hollow-plate *i* and is drawn through the holes 22 and ports 4 and 5 into the vacuum cylinder, otherwise the operation of the device is the same as hereinbefore described.

From the foregoing description it is quite evident that the entering water into the wash box helps to discharge the dirty water therefrom so that there is no accumulation of dirty water, but there is a constant overflow thereof past the valve *l* into the pipe *m*, also that the air discharged must be entirely relieved of the dust held in suspension not only because of passing through the wash box but because of the moistening of the dust in the air before the same reaches the wash box. It is also quite apparent that the overflow of the dirty water is below the level of the discharge of air in the vacuum cylinder and is also below the level of the top of the wash box, so that none of the dirty water can by any possible way get up to the vacuum cylinders to contaminate or soil the same, the essential features of my invention

therefore being in providing for the overflow discharge of the liquid and simultaneously preventing the same entering the vacuum producing devices.

5 I claim as my invention:

1. In a pneumatic cleaning apparatus and in combination, a liquid-holding vessel, a pipe for the dust-laden air, the lower end of which extends toward the bottom of said
10 vessel, a float valve for automatically closing the lower end of the pipe and alternately opening the same to allow the passage of the air while effecting a working vacuum, and a series of perforated submerged plates within
15 the vessel and surrounding said pipe.

2. In a pneumatic cleaning apparatus and in combination, a liquid holding vessel, a pipe for the dust laden air, the lower end of which extends toward the bottom of the
20 said vessel, a valve for closing the lower end of the pipe, a series of perforated submerged plates within the vessel and surrounding the said pipe, and a top plate to said vessel having depending concentric seg-
25 mental flanges dipping into the liquid.

3. In a pneumatic cleaning apparatus and in combination, a vacuum producing device, a liquid-holding vessel, a pipe for the dust-laden air, an inlet for water in the length
30 of said pipe for dampening the dust in the air before it passes into the liquid-holding vessel, means located in the liquid-holding vessel for periodically and alternately permitting the passage of the air while effect-
35 ing a working vacuum and automatically admitting the dampened dust, air and water, and other means for separating the air therefrom as it passes through the water into said vessel.

40 4. In a pneumatic cleaning apparatus and in combination, a vacuum producing device, a liquid-holding vessel, a pipe for the dust-laden air, an inlet for water in the length of said pipe for dampening the dust in the
45 air before it passes into the liquid-holding vessel, means located in the liquid-holding vessel for periodically and alternately permitting the passage of the air while effect-
50 admitting the dampened air, dust and

water, and other means for separating the air therefrom as it passes through the water, and an annular chamber in the top of said liquid-holding vessel receiving air and from which the same is drawn off.

5. In a pneumatic cleaning apparatus, the combination with a liquid holding vessel and a vacuum producing device, of a vertical inlet pipe for discharging dust laden air below the water or liquid level in said vessel, means spaced apart within said liquid hold-
6 ing vessel and surrounding the vertical inlet pipe for breaking up the air entering said vessel and a top plate to said vessel having depending concentric segmental flanges and
6 which top plate is of less diameter than the interior diameter of said liquid holding ves-
sel, thus producing around said plate and its flanges an air chamber within said vessel and a port opening therefrom and extending
7 to the suction or vacuum producing device.

6. In a pneumatic cleaning apparatus, the combination with a liquid holding vessel and a vacuum producing device, of a vertical in-
7 let pipe for discharging dust laden air below the water or liquid level in said vessel, means spaced apart within said liquid holding ves-
sel and surrounding the vertical inlet pipe for breaking up the air entering said vessel, a top plate to said vessel having depending
8 concentric segmental flanges and which top plate is of less diameter than the interior diameter of said liquid holding vessel, thus producing around said plate and its flanges
an air chamber within said vessel and a
port opening therefrom and extending to
the suction or vacuum producing device, and
said plate being off-set from and secured to
the top of the liquid holding vessel so as to
form a chamber within the same with per-
forations through the plate and with perfo-
rations between the same and the top of said
vessel communicating with said annular
chamber.

Signed by me this 6th day of September 1907.

LEMUEL WILLIAM SERRELL.

Witnesses:

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E. ZACHARIASEN.