

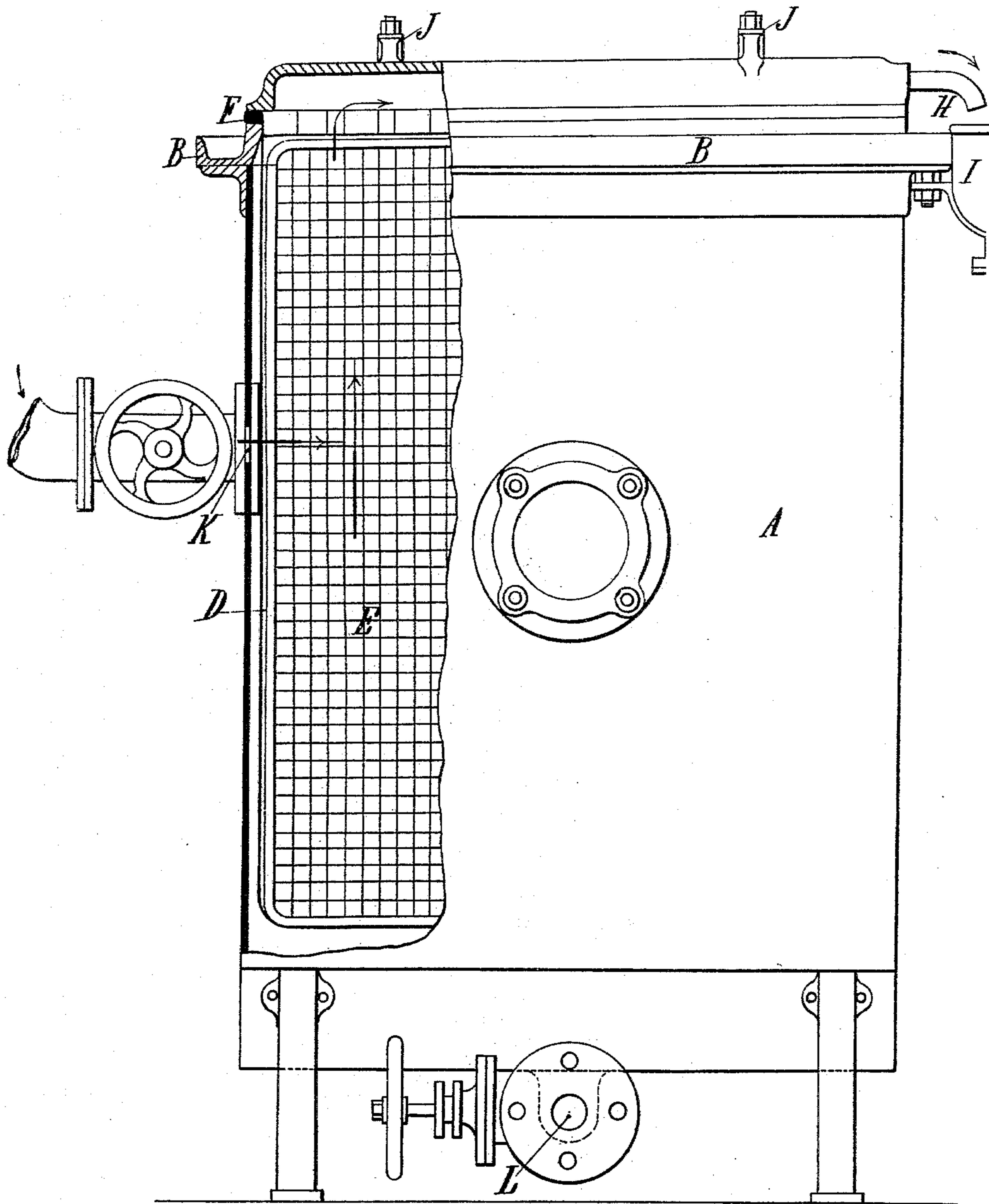
(No Model.)

10 Sheets—Sheet 1.

L. A. PHILIPPE.  
MECHANICAL OR BAG FILTER.

No. 546,343.

Patented Sept. 17, 1895.  
FIG. 1.



Witnesses:  
L. M. Hacheklager,  
Geo. E. Moore

Inventor  
Louis Alfred Philippe,  
By Briesen & Knauff  
his attorneys.

(No Model.)

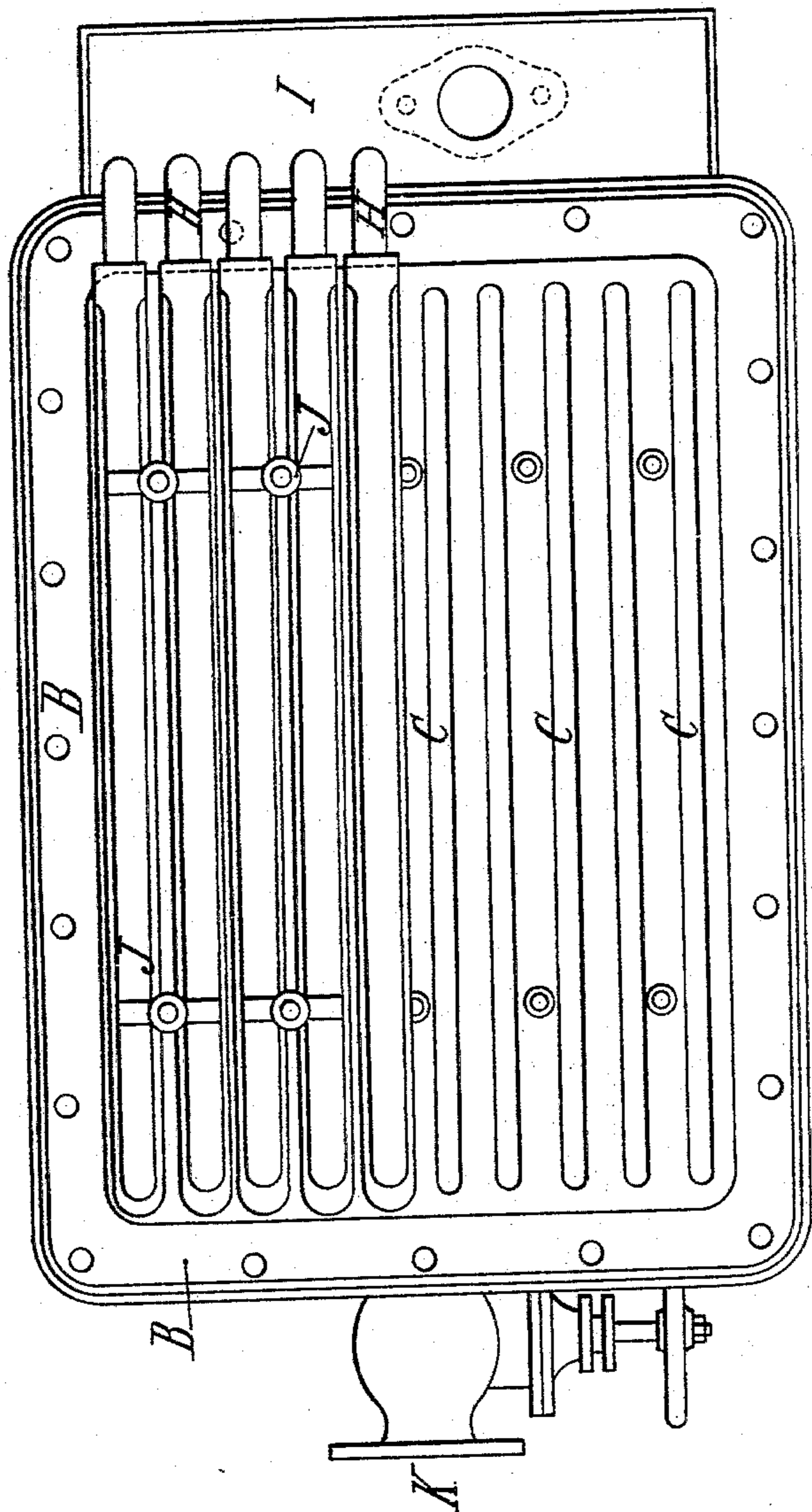
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L. A. PHILIPPE.  
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Patented Sept. 17, 1895.

FIG. 2.



Witnesses:  
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(No Model.)

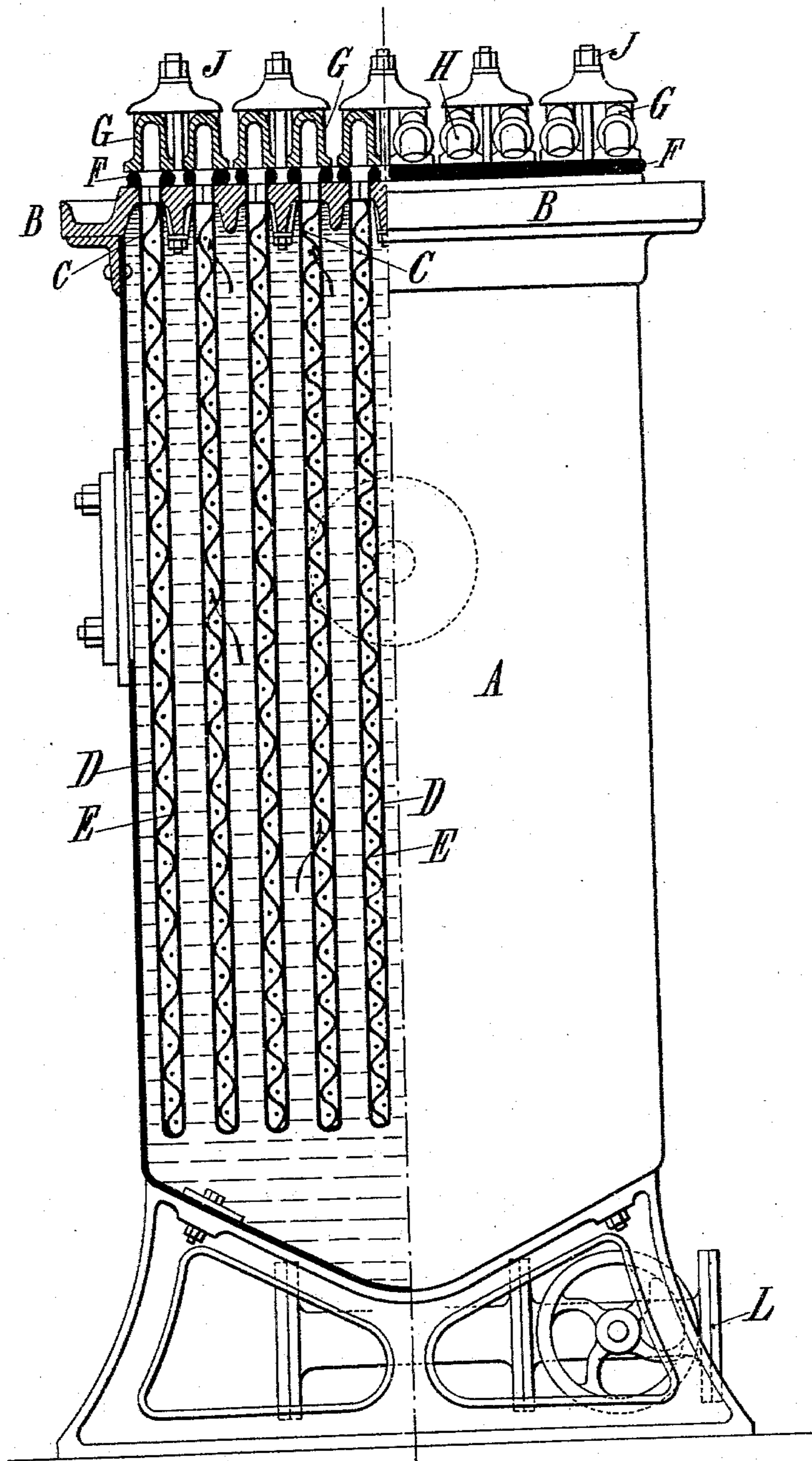
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L. A. PHILIPPE.  
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No. 546,343.

Patented Sept. 17, 1895.

FIG. 3.



Witnesses:  
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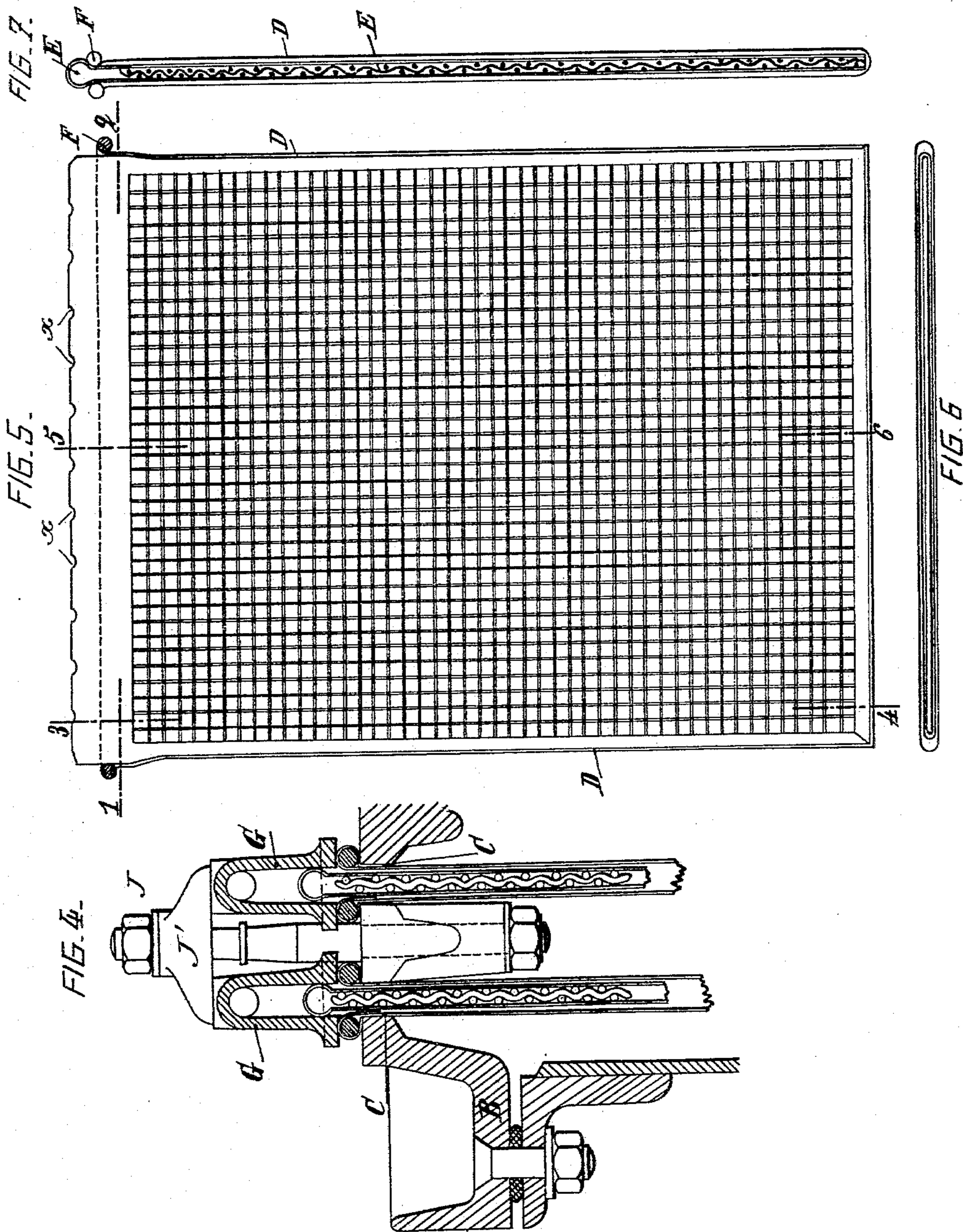
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L. A. PHILIPPE.  
MECHANICAL OR BAG FILTER.

No. 546,343.

Patented Sept. 17, 1895.



Witnesses:  
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(No Model.)

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L. A. PHILIPPE.  
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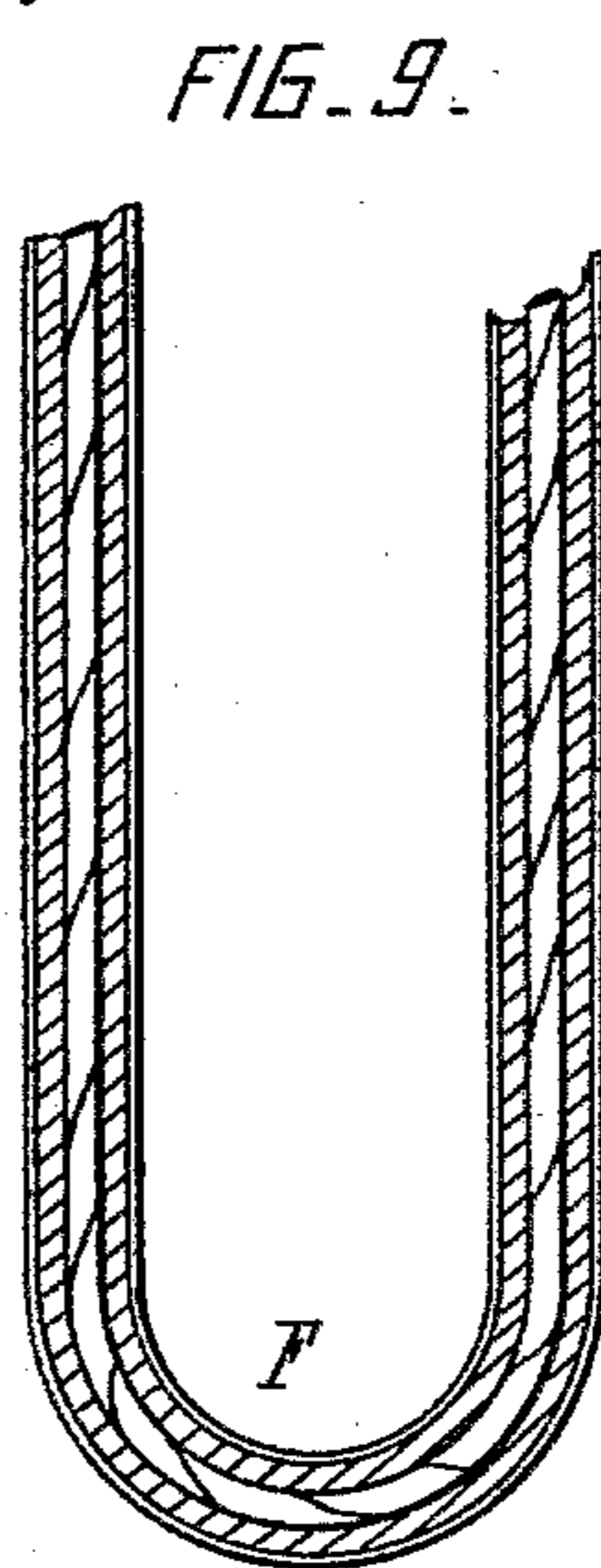
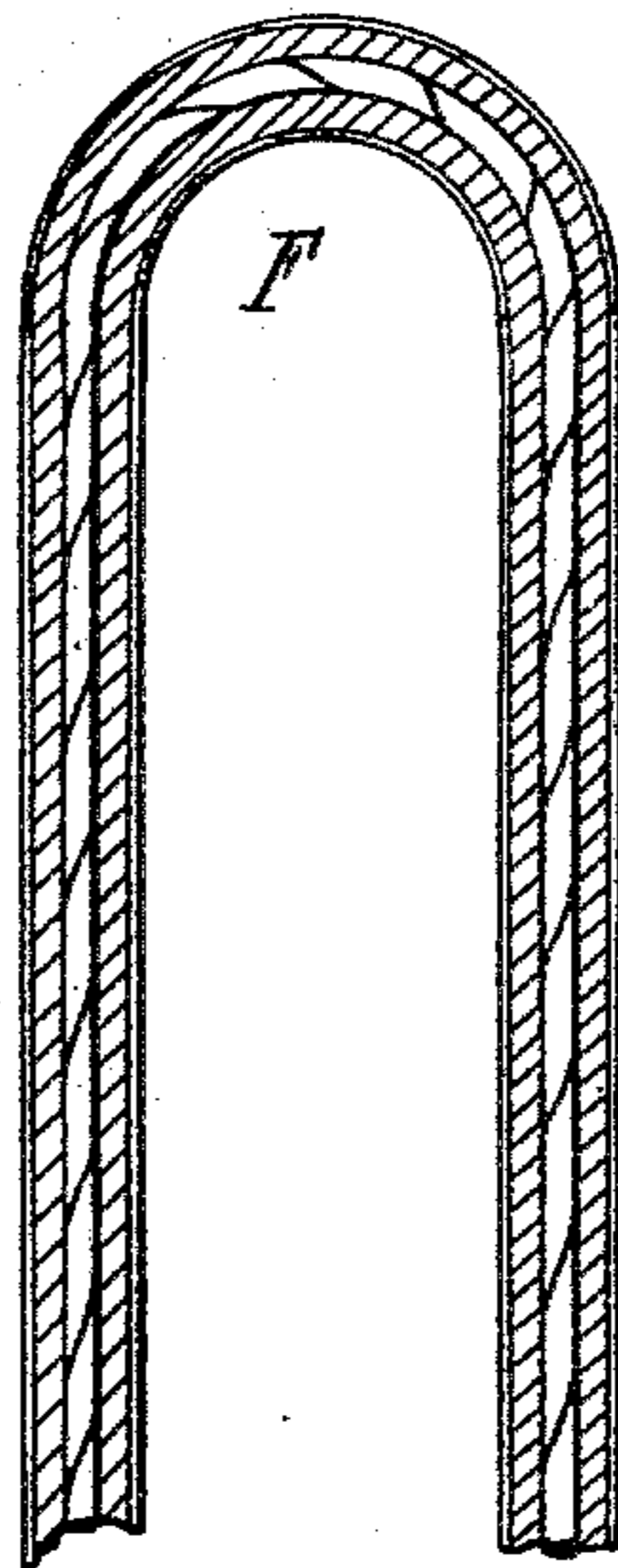
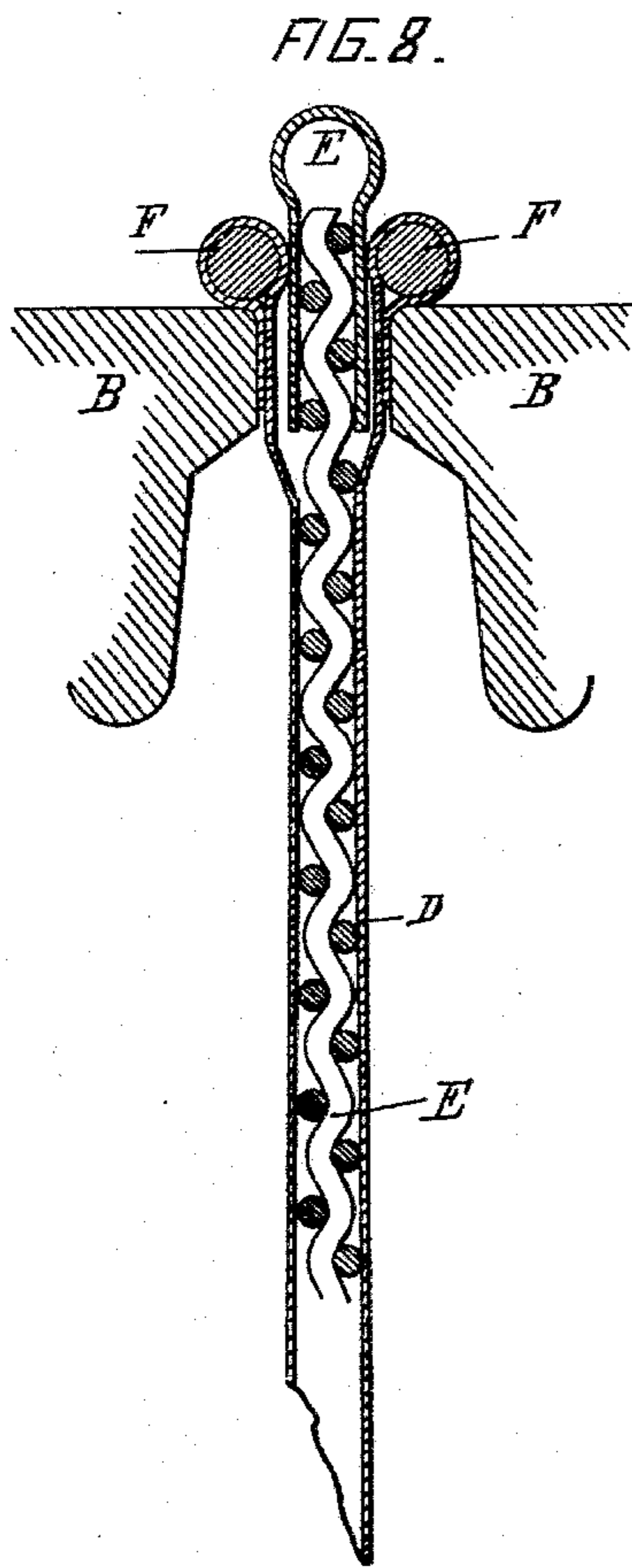
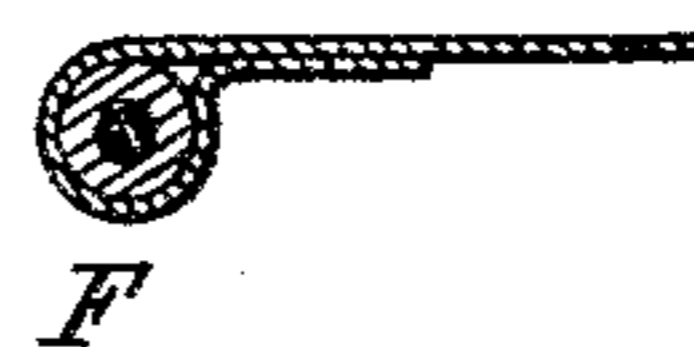


FIG. 10.



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(No Model.)

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FIG. 12.

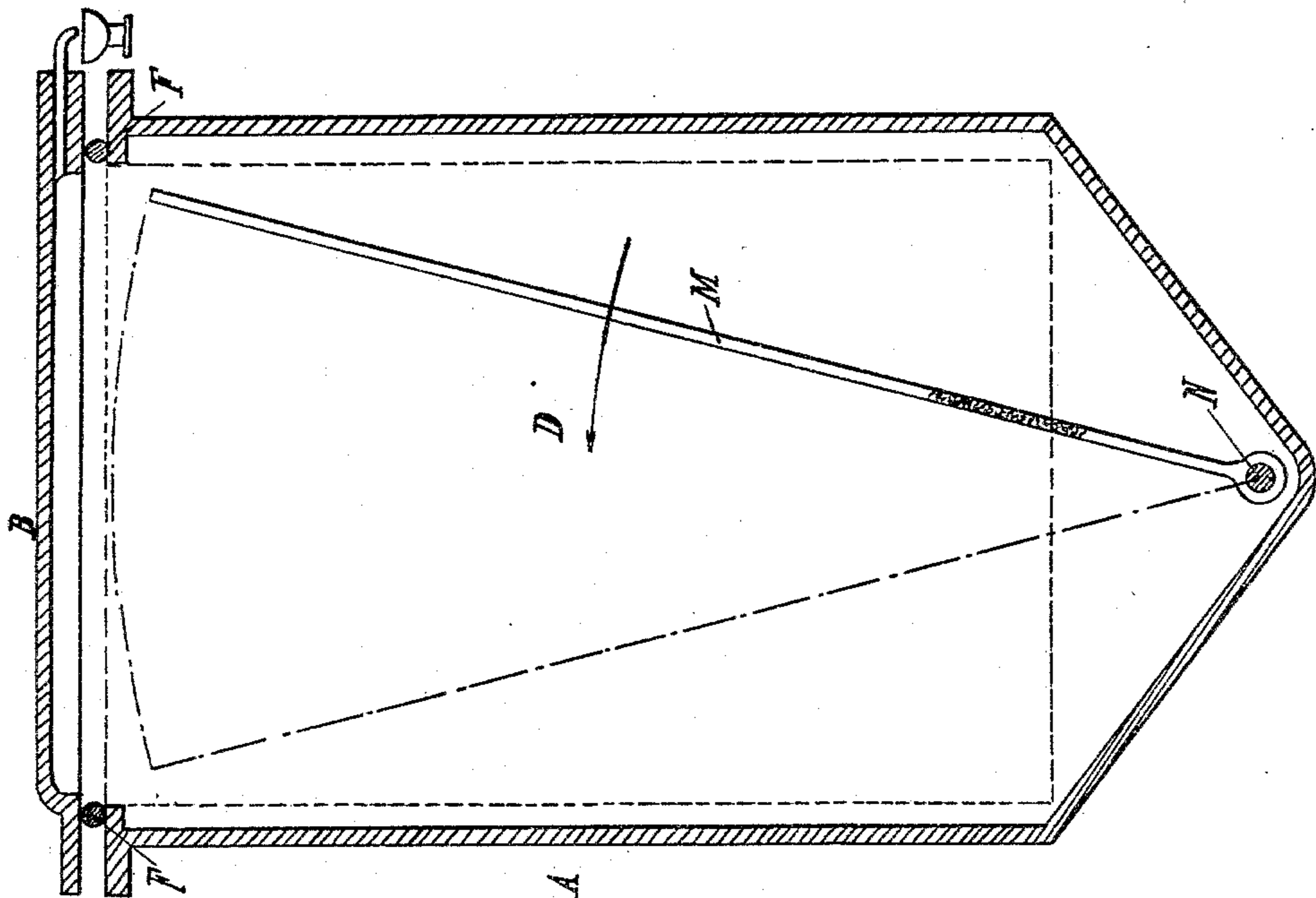
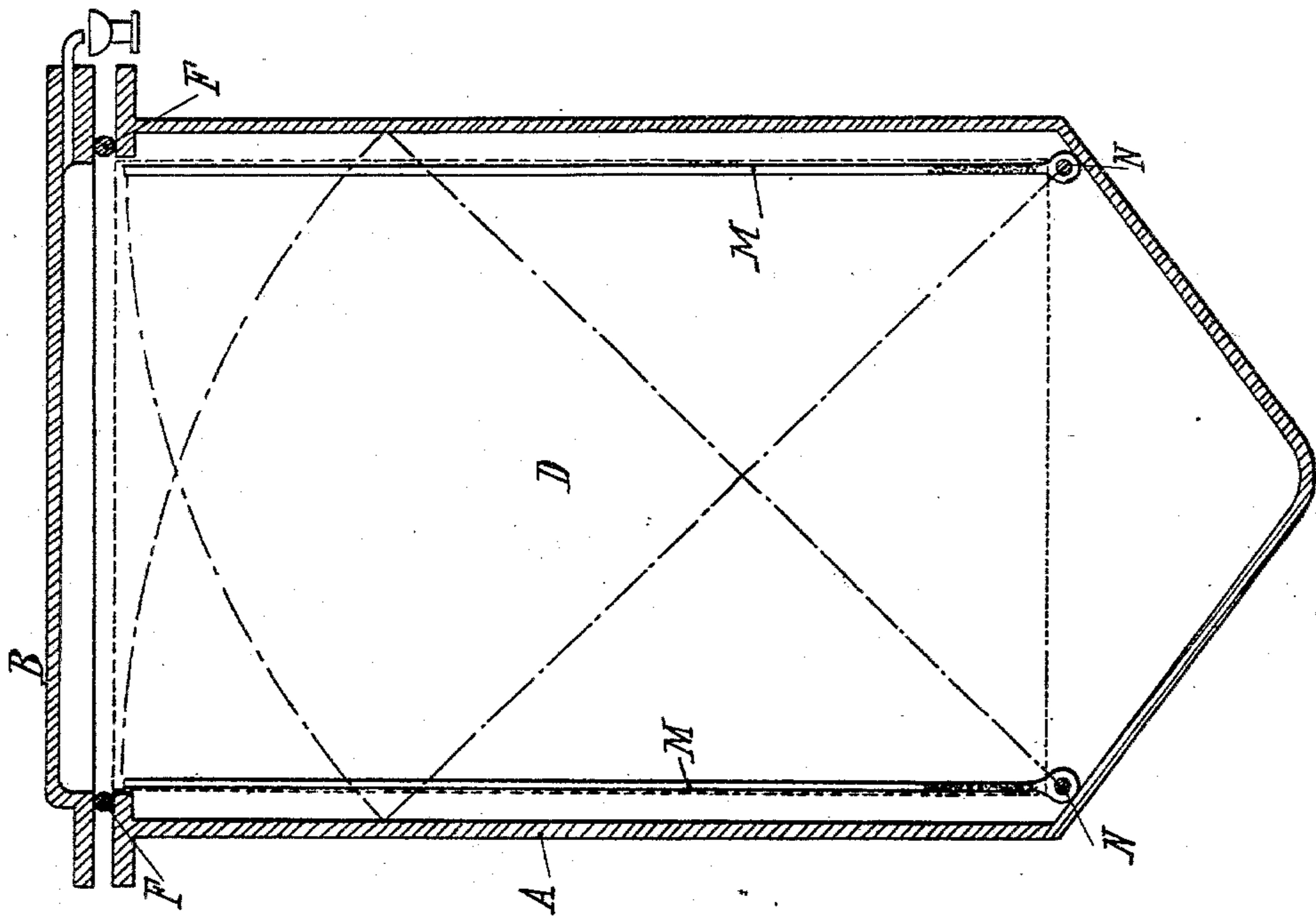


FIG. 11.



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(No Model.)

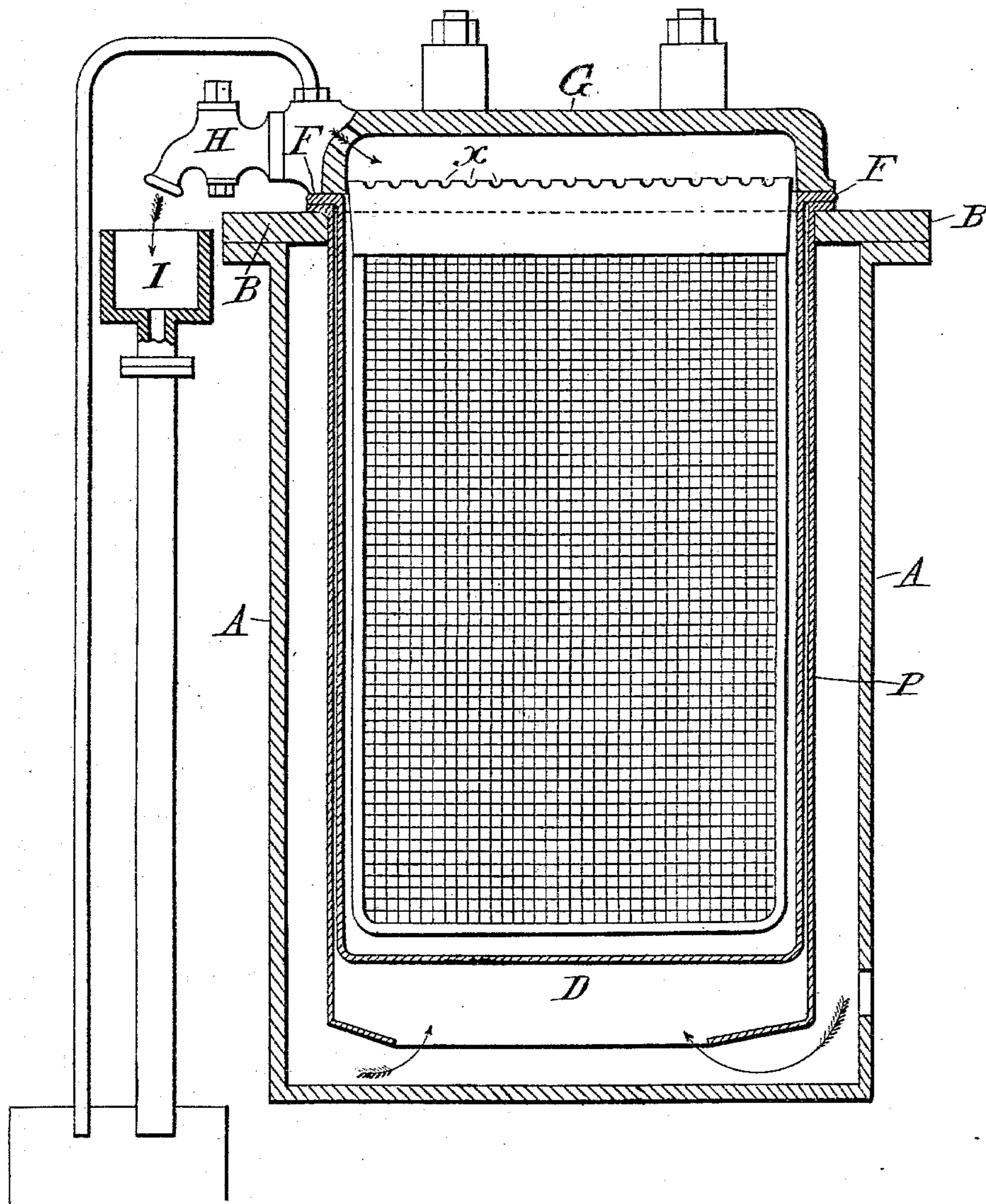
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*Fig. 13.*



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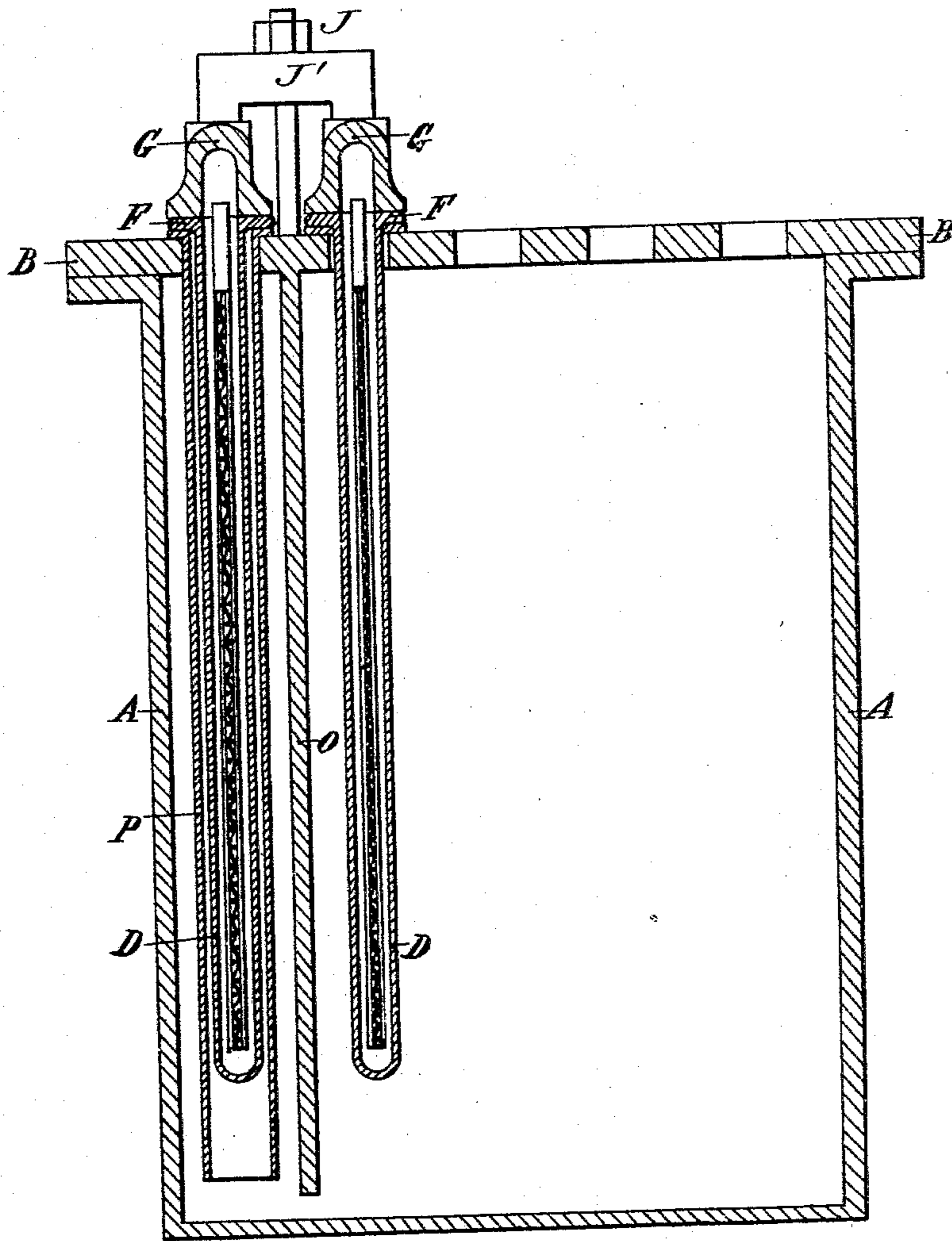
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Patented Sept. 17, 1895.

FIG. 14.



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(No Model.)

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FIG. 16.

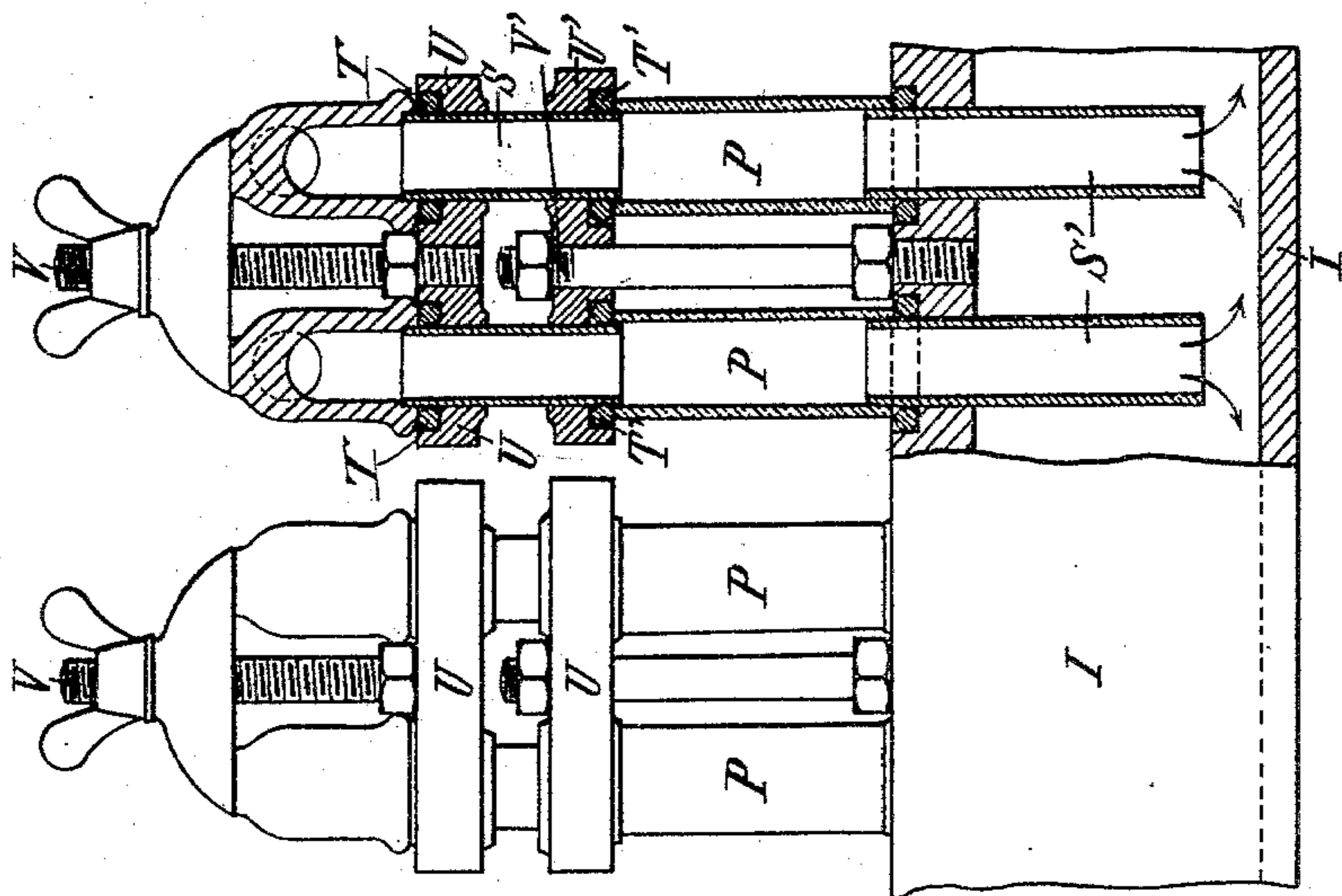
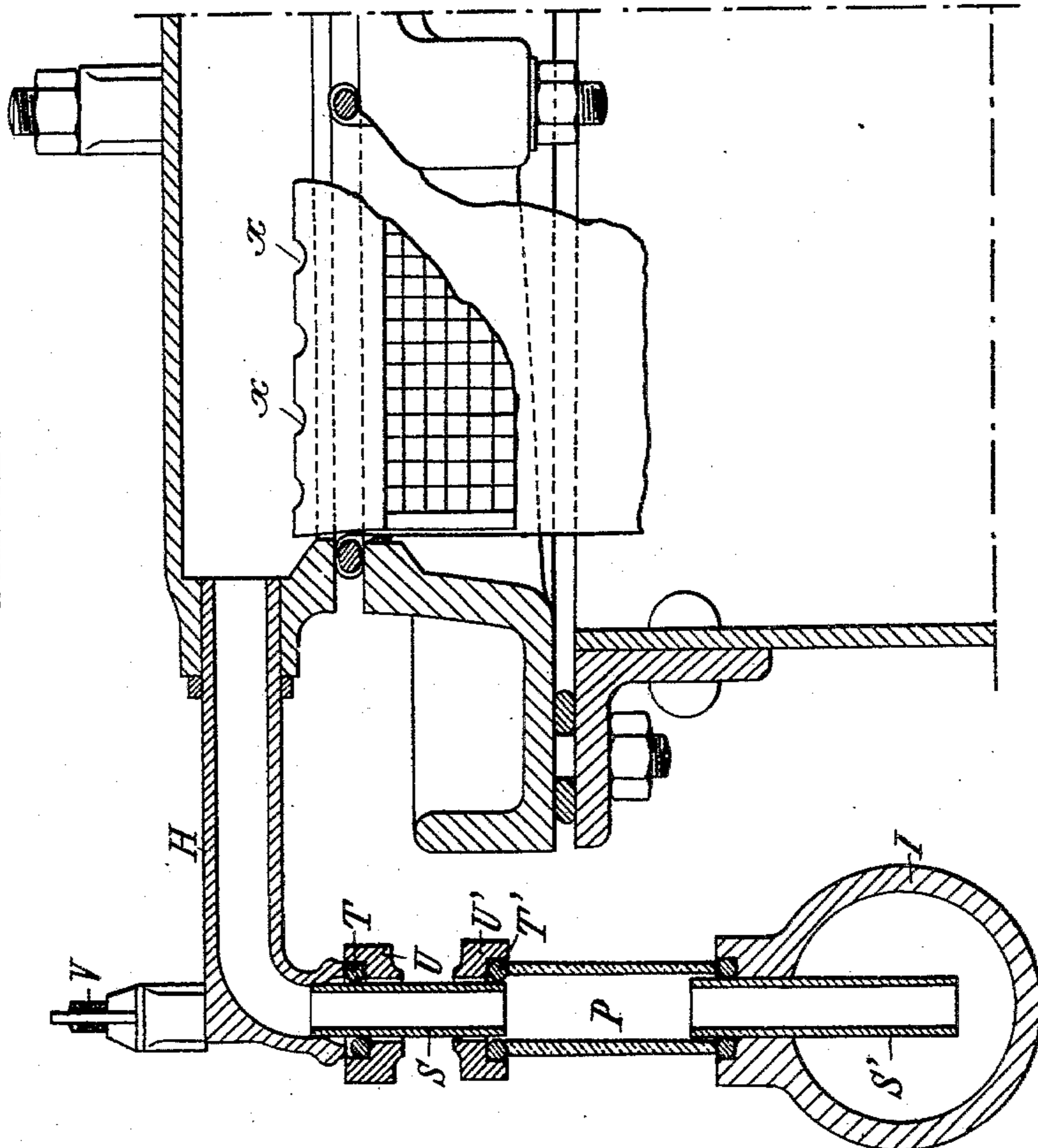


FIG. 15.



Witnesses:  
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(No Model.)

10 Sheets—Sheet 10.

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Patented Sept. 17, 1895.

FIG. 17.

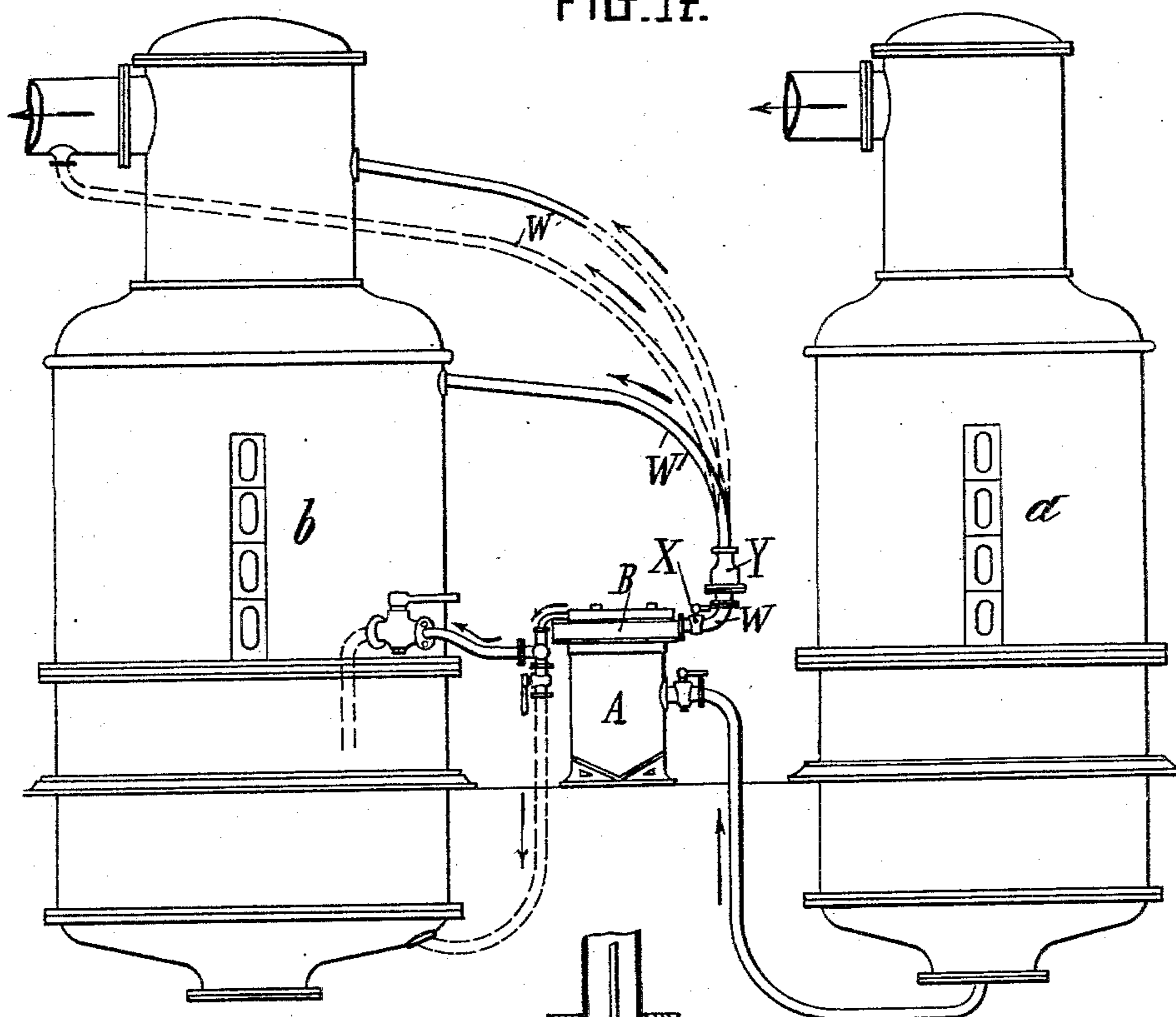
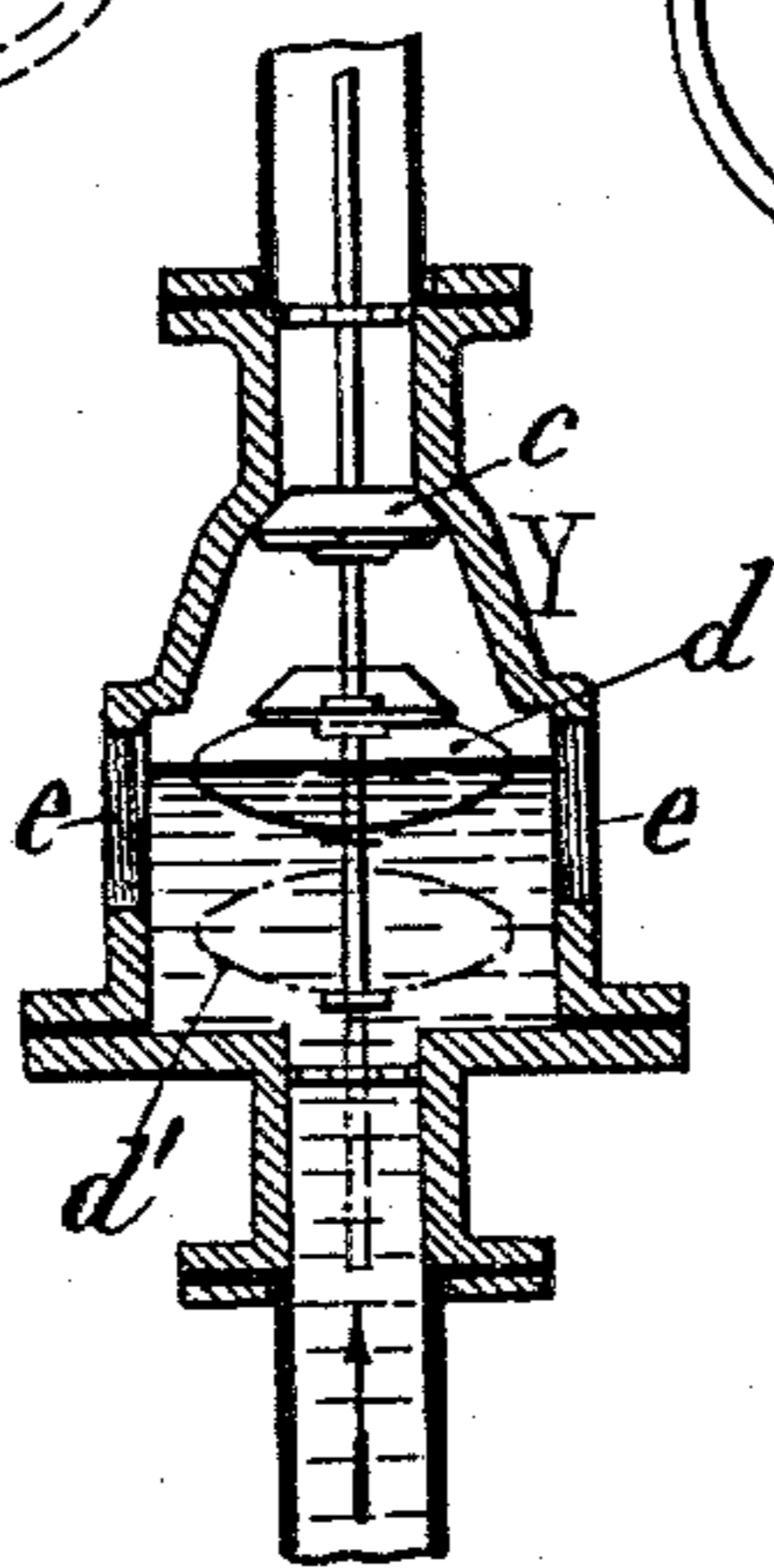


FIG. 18.



Witnesses:  
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Geo. E. Moore,

Inventor  
Louis Alfred Philippe  
By Brieson Knaut  
his attorneys.

# UNITED STATES PATENT OFFICE.

LOUIS ALFRED PHILIPPE, OF PARIS, FRANCE.

## MECHANICAL OR BAG FILTER.

SPECIFICATION forming part of Letters Patent No. 546,343, dated September 17, 1895.

Application filed September 7, 1894. Serial No. 522,314. (No model.) Patented in France July 4, 1890, No. 206,813; in Belgium July 5, 1890, No. 91,153; in England January 10, 1891, No. 534; in Spain March 3, 1891, No. 11,655, and in Austria-Hungary November 28, 1891, No. 29,645 and No. 50,652.

To all whom it may concern:

Be it known that I, LOUIS ALFRED PHILIPPE, of the city of Paris, France, have invented Improvements in Mechanical or Bag Filters, (for which I have obtained Letters Patent in France for fifteen years, dated July 4, 1890, No. 206,813; in Belgium for fifteen years, dated July 5, 1890, No. 91,153; in England for fourteen years, dated January 10, 1891, No. 534; in Spain for ten years, dated March 3, 1891, No. 11,655, and in Austria-Hungary for fifteen years, dated November 28, 1891, No. 29,645 and No. 50,652,) of which the following is a full, clear, and exact description.

My invention relates to improvements in mechanical or bag filters for the filtration of all kinds of liquids either at the atmospheric pressure or *in vacuo*, or under increased or diminished pressure; and it consists in the novel construction and combination of the parts of the filter, as will be hereinafter described, and specified in the claims.

The invention has for its objects to render physically impossible the mixing of the liquid to be filtered with the effluent or filtrate, to facilitate the cleaning and replacement of the bags, to enable the action of each element of the filter to be constantly overlooked and controlled, whether the filtrate be delivered at the atmospheric pressure or under pressure or *in vacuo*, to enable the whole of the liquid contained in the filter to be filtered, to enable the filtrate to be conducted into reservoirs placed above the filter, and to permit of the discharge of the air and gases which accumulate in certain cases in the upper part of the tank containing the liquid to be filtered and form a more or less considerable dead space, which impedes and may even arrest the filtration.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a side elevation of the filter with a portion of the outer casing broken away to show one of the filtering elements. Fig. 2 is a plan view of the filter with one-half of the tubular caps removed. Fig. 3 is a half-sectional end view of the filter with the collector for the filtrate removed. Fig. 4 is a

detail section, on a larger scale, of a portion of the filter-cover, and of two caps and their connection with two of the filtering elements. Fig. 5 is a longitudinal vertical section of one filter-bag, showing the inner frame which holds apart the sides of the bag. Fig. 6 is a longitudinal section of the same on line 1 2, Fig. 5. Fig. 7 is a vertical section on line 3 4, Fig. 5. Fig. 8 is a vertical section, on a larger scale, taken on line 5 6, Fig. 5, showing the bag and its frame inserted in one of the apertures of the filter-cover. Figs. 9 and 10 show longitudinal and transverse sections of the beaded upper edges of the bags. Fig. 11 is a section of an element of the filter provided with a brush for cleaning the bag. Fig. 12 shows a modification of the same. Fig. 13 is a longitudinal section, and Fig. 14 a transverse section, showing a sheath provided with flanged edges forming a bed for the head of the bag, the sheath serving to enable the extraction of the whole of the liquid contained in the filter. Fig. 14 also shows a partition separating the several elements, and which may be employed instead of the sheath. Fig. 15 is a sectional side elevation, and Fig. 16 a part sectional front elevation, of an arrangement for enabling the outflow of the filtrate to be constantly watched in cases where the filtering is effected, first, without access of air, second, under pressure, or third, *in vacuo*, so as to show the working of each element of the filter throughout the entire operation, as when the filtrate flows out in the ordinary way. Fig. 17 represents a filter for filtering *in vacuo* and more especially saccharine liquids between two vacuum-pans—as, for example, between the second and third pans of an ordinary “triple” or “quadruple” effect apparatus. Fig. 18 is a section of a self-acting valve on the pipe leading from the filter to one of the vacuum-pans for allowing the escape of air and gases which are to be expelled from the filter-tank without permitting the unfiltered liquid to escape.

A represents the filter-tank, which may be made of any suitable metal and is surmounted by a fixed cast-iron cover B, formed with openings C to admit and support the elements or bags D within the tank A. E E are frames filled with wire-trellis and are preferably pro-

vided with apertures  $x$  at the upper portion thereof, as represented in Figs. 5, 13, and 15. These frames, which are represented in detail in Figs. 5, 6, and 7, are placed within the bags to keep their sides at the proper distance apart. The bags D are made of horsehair, hemp, ramie, cotton, or other suitable fabric, and their mouths are provided with a flexible and elastic bead or flange F, which serves to support the bag D, together with the contained frame E, in a suspended position upon the cover B and to form the external joint of the bag. The bead is constructed, as shown in Figs. 9 and 10, of a core of cord, leather, or other flexible material covered with india-rubber, leather, or other flexible or elastic material.

G G are removable hollow metal caps, each provided with a nozzle-pipe H, which may be furnished with a cock for the delivery of the filtrate into a common channel or collecting-trough I.

J J' are respectively nuts and bridge-pieces for clamping the caps upon the flanges F of the bags.

The action of the apparatus is as follows: The liquid to be filtered is introduced under a certain pressure at cock K, so as to completely fill tank A, and after having passed from the exterior to the interior of the bags constituting the filtering elements the filtrate rises up therein, as indicated by the arrows in Figs. 1 and 2, and is discharged at the top above the level of the unfiltered liquid through the nozzles H of caps G into a common trough I, as before explained. Under these conditions no mixing of the filtrate with the unfiltered liquid can possibly take place, while should one or more of the filtering elements fail to work properly, which can only happen by the tearing of the filtering fabric, the defective element can be at once put out of action by shutting off the cock on the corresponding nozzle H; but it is preferable to cut off the supply of liquid, unscrew the nuts J, and remove the caps G, so as to enable the damaged bags to be removed and replaced, which operation can be effected in about a minute by any unskilled person, and needs no special knowledge. The impurities of the liquid under filtration are arrested upon the exterior surface of the fabric of the bags D, and when they adhere but slightly thereto they fall to the bottom of tank A, whence they are extracted by means of the sluice-valve L. Should the impurities adhere too firmly to the pockets, which depends upon the nature of the liquids being filtered, I may employ one or other of the arrangements represented in Figs. 11 and 12. These arrangements consist in disposing upon each face of the pocket a kind of brush M, operated from the exterior by means of a rock-shaft N placed at the lower part of vessel A, which shaft receives oscillating motion by means of a lever or its equivalent, whereby the brush is caused by its angular motion to clean the greater por-

tion of the surface of the bag. In the arrangement shown in Fig. 11 two shafts and brushes act alternately in opposite directions, whereby a much larger portion of the surface is cleaned.

In order to extract as filtrate all the liquid remaining in the filter and in the residues, one or more of the bags D is inclosed, as shown in Figs. 13 and 14, in a compartment formed either by a partition O or a sheath P, the compartment being in either case only open at bottom of the tank A. As the width of the sheath or compartment is greater than that of the bag, all the liquid remaining in the filter may easily be extracted in a filtered state by suction, by siphoning out, or by air, vapor, or gas pressure.

When the filtrate is run off under pressure or *in vacuo* or out of contact with air, outlet-tubes of glass are provided to permit the working of the apparatus as regards the rate or cessation of flow from any of the elements or the clearness or turbidity of the filtrate to be readily seen.

Figs. 15 and 16 show how the tubes are arranged. H is the outlet-pipe for the filtrate, provided or not with a valve or cock. P is a tube of glass or other transparent material connected to the outlet H of each filter element by a union S, a water-tight joint being made by a rubber or leather packing T T', placed upon a pair of sliding collars U U'. The collar U is pressed upward by the bolt and nut V, while a second collar U' is tightened by a bolt and nut V', and presses the packing-rings T' upon the glass tubes P P, so as to form a water-tight joint between them and the metallic or other dip-pipes S', which discharge the filtrate into the collecting-pipe I. The course of the filtrate is indicated by the arrows. By means of this arrangement the filtrate may be conducted into reservoirs placed above the filter, the filtration being performed under pressure.

To filter saccharine liquids—for example, *in vacuo*—one or more filters would be placed between two vacuum-pans *a b*, as shown in Fig. 17—say between the second and third pans of a “triple effect” apparatus. The filter may then act, first, either under pressure produced by a pump, injector, compressed air, or gas, &c., second, or under a diminished pressure produced by a pump, ejector, siphon, &c., and, third, or under a more or less perfect vacuum, more especially when the filter is used for the filtering *in vacuo* saccharine liquids under concentration in “double effect” “triple effect” or “quadruple effect” apparatus.

Some liquids when under filtration disengage by reason of their nature, pressure, diminished pressure, temperature, or other cause, air or generate vapors or gases, which being lighter than the liquid collect at the upper part of the filter and form a cushion or dead-space which retards and even arrests temporarily or permanently the filtering action. To prevent this the part of the filter at

which the air, gas, or vapor collects is connected with a vessel containing an atmosphere at a lower pressure than that of the liquid to be filtered. For this purpose a pipe W is connected at one or more points to the side of the cover B at as high a point as possible, but below the caps, and leads, as shown at W', either to the upper part of the body or into the dome of the pan *b* or into the pipe leading therefrom, as shown by the dotted lines, so as to provide an outlet for the gases lodged in the upper part of the filter-tank into the pan *b*, where the atmosphere is in a more rarefied condition.

The automatic valve Y (shown in vertical section in Fig. 18) is placed upon the pipe W to prevent any liquid being carried off along with the air or gases into the vacuum-pan *b* or air-pump. It comprises a valve *c*, float *d*, and glazed peep-holes *e*. The float is normally in the dotted position *d'*, the valve *c* being open; but should the liquid to be filtered rise in pipe W the float *d* rises and closes valve *c*, cutting off the communication with pan *b*.

When the excessive agitation or other cause which produced the excessive inflow into the tank A has ceased, the valve and float fall again to the position *d'* and open a free passage to the air and gases.

I claim—

1. In a mechanical or bag filter for filtering all kinds of liquids either at the atmospheric pressure *in vacuo* or under pressure or di-

minished pressure, the combination with the filter tank and with the bags placed therein of the hollow caps upon the cover of the tank bridge pieces and nuts for securing said caps upon the cover and outlet nozzles for the delivery of the filtrate above the level of the liquid to be filtered, as described.

2. In the herein described filter, the combination with the bag of a flange or bead around the mouth having a core of cord, leather or other flexible material covered with rubber leather or other material as described.

3. In the herein described filter, the combination with the bag of an interior frame formed of metallic trellis supported by a frame apertured at its upper part to hold the sides at the desired distance apart, as described.

4. In the herein described filter, the combination with a plurality of bags an unobstructed filter tank into which said bags project, of divisions forming one or more compartments inclosing one or more of the bags and open to the tank at the lower end only for the purpose of extracting the whole of the liquid contained in the filter as described.

The foregoing specification of my improvements in mechanical or bag filters signed by me this 11th day of August, 1894.

LOUIS ALFRED PHILIPPE.

Witnesses:

CLYDE SHROPSHIRE,  
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