

(No Model.)

2 Sheets—Sheet 1.

D. WILLIAMSON.  
FILTERING APPARATUS.

No. 477,727.

Patented June 28, 1892.

Fig. 1.

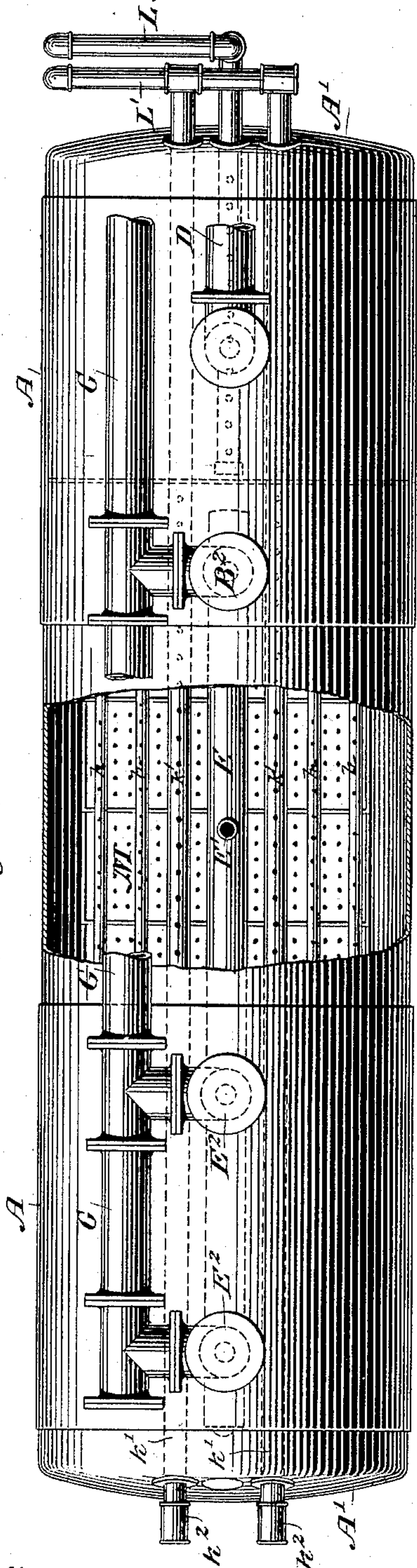
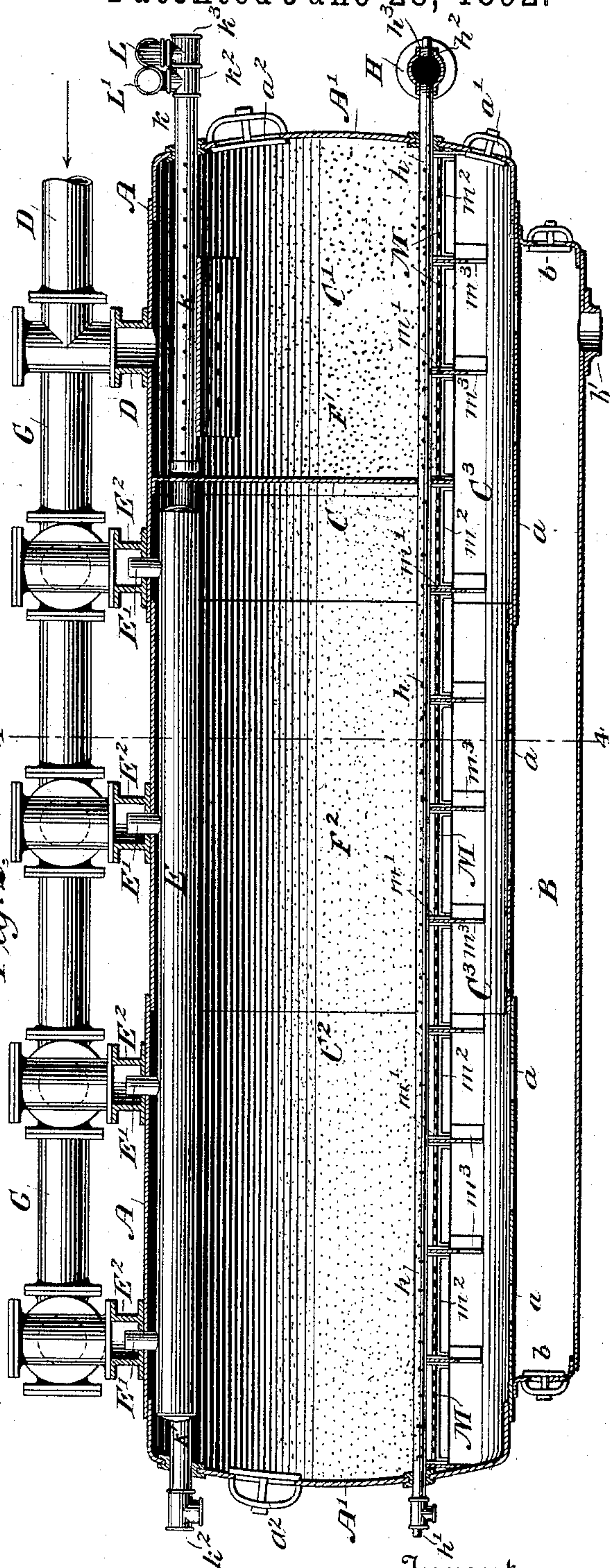


Fig. 2.



Witnesses

C. E. Ashley  
J. W. Lloyd.

Inventor

David Williamson  
By his Attorney  
Willard Parker Butler



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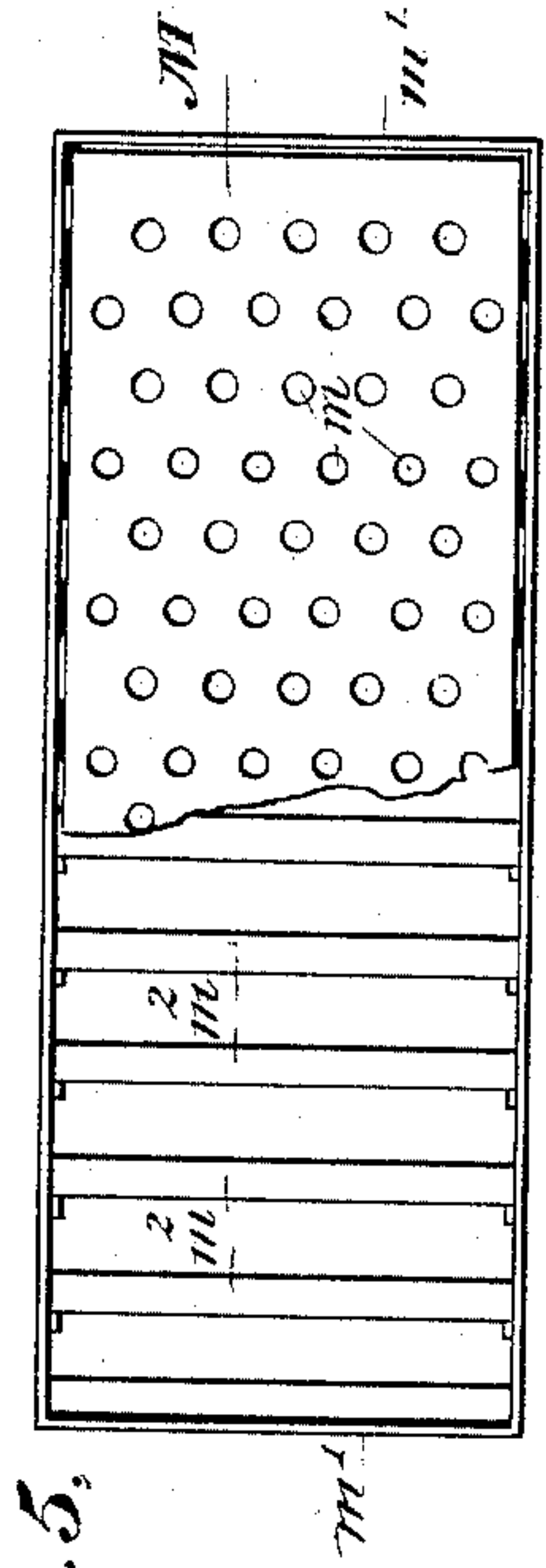


Fig. 5.

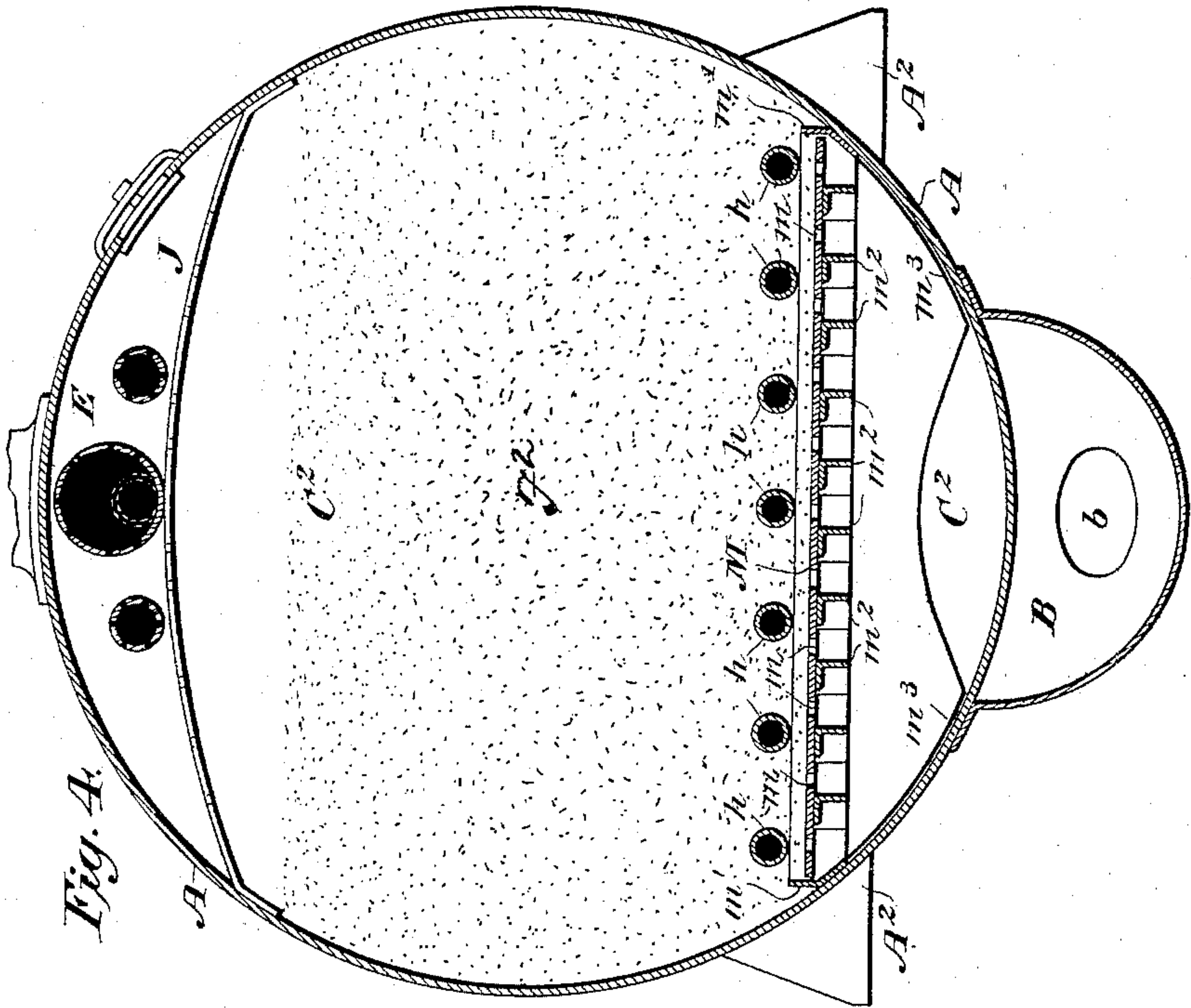


Fig. 4.

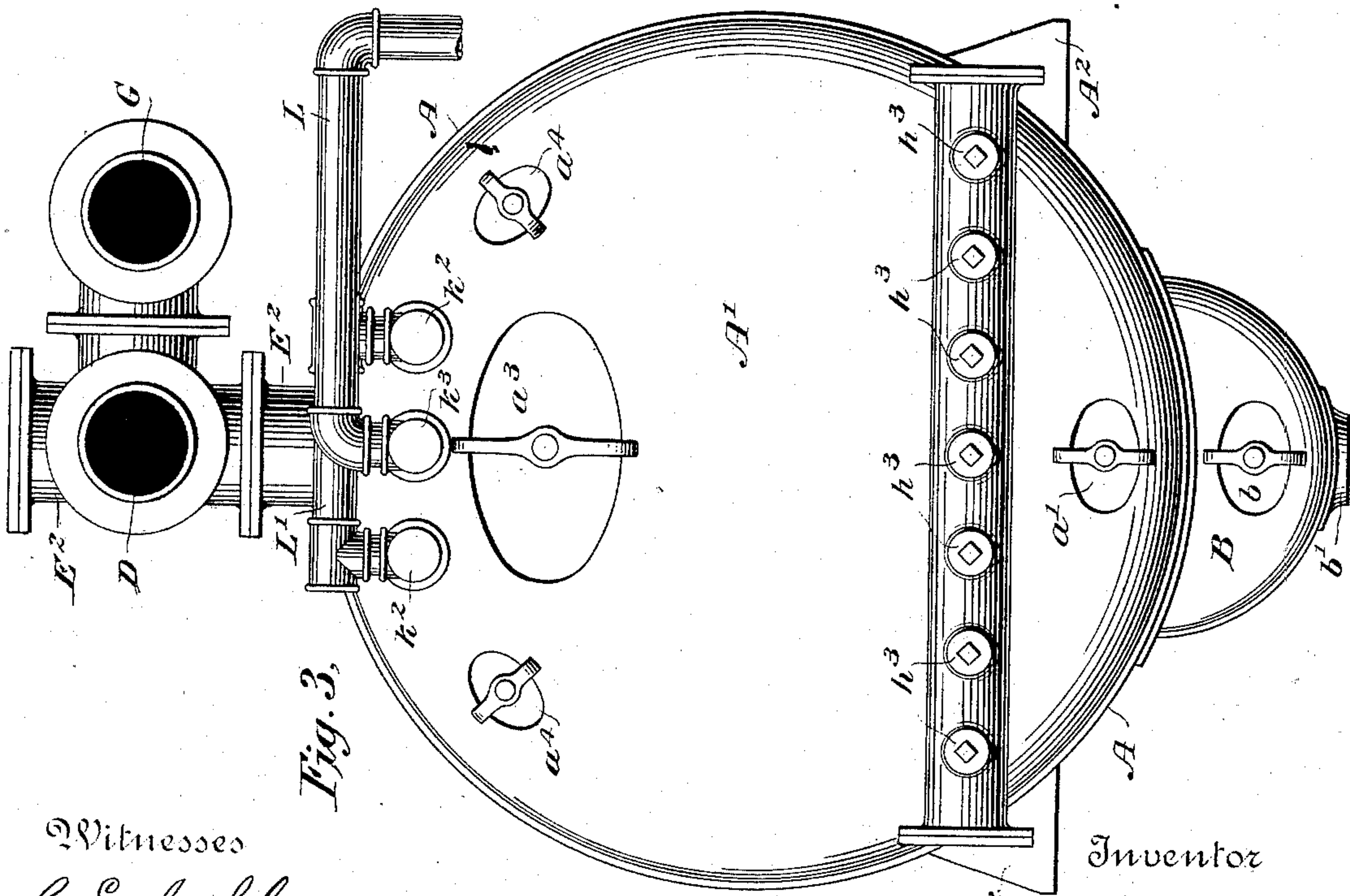


Fig. 3.

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Willard Parker Butler



# UNITED STATES PATENT OFFICE.

DAVID WILLIAMSON, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE CONTINENTAL FILTER COMPANY, OF WEST VIRGINIA.

## FILTERING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 477,727, dated June 28, 1892.

Application filed July 3, 1891. Serial No. 398,345. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID WILLIAMSON, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Filtering Apparatus, of which the following is a specification.

My invention relates to improvements in apparatus for filtering all kinds of liquids, and particularly to that class of filtering apparatus which are known as "high-pressure" filters, in which the liquid to be filtered is forced through the apparatus by means of pressure.

The invention relates more particularly to that class of filters in which the filtration is conducted in two operations—first, in a downward direction in one chamber, and, second, in an upward direction in another chamber—and also to that class of filters which employ auxiliary devices for cleansing of the filter-beds.

The object of the invention is to produce most particularly the following results: first, simplicity in construction of the parts which support the filter-bed and facility in removing and replacing any part of the same without removing the entire bed; second, greater efficiency in cleaning and washing out the bed and more complete disintegration of the bed during the operation of cleaning; third, greater economy in construction of the "mud-drum," so called, or chamber in which the heavier particles of the impurities are collected, and greater relative collecting area to the size of the apparatus, accompanied with convenience of location and simplicity of parts; fourth, complete distribution of the liquid to be filtered over the entire surface of the filter-bed of the primary filter-chamber; fifth, more perfect discharge of the filtered liquid by reason of the size and arrangement of the discharge-pipes; sixth, more perfect joining of the interior parts with the exterior parts and consequent reduction of leakage and expansion; seventh, greater facility in washing out the bed and cleansing the pipes by which the operation of washing out is effected.

The invention will be best understood by reference to the accompanying two sheets of

drawings, forming a part of this specification, in which—

Figure 1 is a plan view of the apparatus, showing a portion of the top broken away. 55 Fig. 2 is a vertical longitudinal section; Fig. 3, an end view looking from the right-hand end of Fig. 1; Fig. 4, a vertical section on the line 4 4 of Fig. 2, and Fig. 5 a view of a detail of the plates. 60

Similar letters refer to similar parts throughout the several views.

In the drawings, A represents the shell of the filter, which is composed of boiler-iron or other suitable material and which is cylindrical in shape, with spherical end walls A' A' and of any convenient dimensions. It may be supported at either end upon any suitable frame or bed of wood or masonry on the wings or shoulders of iron A<sup>2</sup> A<sup>2</sup>. The bottom of the shell is provided with any convenient number of openings *a* of convenient shape and size, and beneath the openings and longitudinally throughout the entire length of the shell is attached a semicircular trough of sheet metal B, which serves to collect the heavier portion of the impurities in the material filtered and which is termed the "mud-drum." The mud-drum B is attached to the shell in any convenient manner and is provided with the hand-holes *b b* at either end, closed in any convenient manner, and with one or more discharge-openings *b'* at either end for discharging the collected material. 80

The filter-bed is supported within the shell 85 by means of a series of removable plates of sheet metal M, provided with the perforations *m*, of convenient size and arrangement, which are supported within a series of frames *m' m'*, made of angle-iron upon a series of lateral angle-irons *m<sup>2</sup> m<sup>2</sup>*, bolted within the frames *m' m'*, as shown in Figs. 1, 4, and 5. The frames *m' m'* are formed to fit the curvature of the shell, as shown in Fig. 4, and are supported in turn by a series of girders *m<sup>3</sup> m<sup>3</sup>*, 95 provided with the angular flanges *m<sup>4</sup> m<sup>4</sup>*, which are bolted or riveted to the shell A. The girders *m<sup>3</sup> m<sup>3</sup>* are cut away at the bottom in the middle, as shown in Fig. 4, to permit of the passage of the liquid being filtered. 100 The frames *m' m'*, when correctly constructed, and the plates *m m*, which are supported



thereby, will be substantially of the same general size, and thus may be used interchangeably in any part of the bed and only one style or size of plate or frame need be kept on hand to effect replacement or renewal on the greater part of the bed, although the end plates and frames differ slightly in size and are curved to fit the spherical ends. The interior of the shell is divided by a vertical diaphragm C into two chambers or compartments C' and C<sup>2</sup> of convenient size. The diaphragm C is a plate of boiler-iron extending vertically downward from the top of the shell to the plates M M, which support the filter-bed, as shown in Fig. 2, and is securely riveted to the sides of the shell. The compartment C' is the primary filtering-compartment, and in it is placed a filter-bed F', composed of gravel, sand, charcoal, or other suitable material of homogeneous character, the particles of which are sufficiently large to be held upon the plate M M without passing through the openings therein. The material composing the filter-bed may fill the whole or any part of the chamber C'; but in practice it will be found convenient to fill it to about that proportion of its height which is shown filled in the drawings. The liquid to be filtered enters at the top of the chamber C' through a suitable supply-pipe D, which is connected with any suitable source of supply by which the liquid is forced into the chamber under pressure.

For the purpose of effecting complete distribution of the liquid to be filtered over the entire upper surface of the filter-bed F' a perforated apron or diaphragm J is used, made of curved boiler-iron, which is attached to the upper side walls of the shell A within the compartment C', as shown in Figs. 2 and 4, and upon which the liquid emerging from the pipe D impinges and is caused to flow or trickle over and through the apron and be distributed over the surface of the filter-bed.

The compartment C<sup>2</sup> is the secondary filtering-chamber, and in it is placed a filter-bed F<sup>2</sup>, composed of any suitable material, and the perforation of the plates M M, which support the same, are sufficiently small to prevent the passage of the particles of the material composing the bed through them. The filter-bed F<sup>2</sup> in the chamber C<sup>2</sup> may be made of any convenient depth, according to the character of the liquid to be filtered.

The discharge of the filtered liquid from the chamber C<sup>2</sup> is effected by means of a horizontal pipe E, extending longitudinally through the entire upper part of the chamber, as shown in Figs. 2 and 4. This pipe is of any convenient diameter, extending longitudinally through the entire chamber and is perforated throughout its entire length, so as to take up the filtered liquid throughout the entire length of the chamber. This pipe is provided on its upper edge with any convenient number of connecting T-pipes E' E', which pass upward into the connections E<sup>2</sup>

E<sup>2</sup> in the top of the shell, which in turn are connected with a manifold discharge-pipe G, through which the liquid entering through the pipes E' E' is discharged. By arranging the discharge from the pipe E at a number of different points it is possible to effect much more rapid removal of liquid through the pipe E, and consequently more perfect distribution and more rapid discharge from the chamber C<sup>2</sup>.

For the purpose of effecting thorough and easy washing of the filter-beds F' and F<sup>2</sup> a series of cross-current, blow-off, or cleaning pipes h h are employed, which are placed in the extreme lower section of the filter-beds immediately above the perforated plates which extend longitudinally through the entire apparatus M M. Any number of these pipes may be used, and they are arranged to pass directly through the diaphragm C, as shown in Fig. 1, and through the end walls A' A' of the shell A and terminate in a horizontal manifold pipe H at one end, while at the other end they are closed by an ordinary screw-cap h', all as shown in Figs. 2, 3, and 4. The manifold pipe is supplied with an opening opposite each pipe closed by a suitable screw-cap h<sup>3</sup>, which enables the pipes to be opened and cleaned throughout their entire length. The pipes h h are perforated throughout their entire length with a number of fine perforations, so that liquid entering through them will be forced upward and through the filter-beds F' and F<sup>2</sup> at a great number of points, so effecting thorough and perfect cleansing.

At the top of the chamber C' and C<sup>2</sup> are placed independent blow-off pipes for the removal of the liquid injected into the bed for the purpose of cleansing. These pipes are arranged as will be seen by reference to Figs. 1, 2, 3, and 4. In these figures L and L' are exterior manifold pipes connected with a suitable discharge at any convenient point. k is a perforated pipe which passes from the pipe L into the chamber C' through the end wall A' and extends throughout the entire length of the chamber to the division-wall C. k' k' are two smaller pipes, which pass from the pipe L' through the end walls A' and through the chamber C' and also the division-wall C and then traverse longitudinally the entire upper part of the chamber C<sup>2</sup> on either side of the discharge-pipe E, as shown in Figs. 1 and 4. Within the chamber C<sup>2</sup> these pipes are provided with perforations, through which the liquid entering the chamber from the lower blow-off pipes h h can be discharged or drawn off at pleasure. In their passage through the chamber C' the pipes k' k' are not provided with perforations. Hence the pipes k' k' serve to discharge liquid from the chamber C<sup>2</sup> only. They are supported in the chambers in any convenient manner, and the various joints may be made tight also in any convenient manner without reference to precise construction. The extremities of the pipe k' k' are constructed to pass out of the end wall of the shell at either end, as shown, and are



closed by screw-caps  $k^2$ , similar to the caps  $h'$   $h^3$ , and the pipe  $k$  as it emerges from the chamber  $C'$  is connected with the discharge-pipe and the extremity of the pipe is closed by a similar cap  $k^3$ . By arranging the pipes in this manner it is possible to open the same from time to time from the exterior of the apparatus and clean them out without in any wise disturbing the filter-beds or the interior of the apparatus.

The method of operation of the apparatus is as follows: The liquid to be filtered enters under pressure through the pipe  $D$  into the compartment  $C'$ , is discharged upon the apron  $J$ , and distributed by it over the upper surface of the filter-bed  $F'$ . It passes downward through the space and through the perforated plates  $M M$  into the space  $C^3$  under the plates. All fine and heavy material is separated in the bed  $F'$  and, passing through the perforations of the plates  $M M$ , passes through the openings  $a a$  into the mud-drum  $B$ , where it collects and may be removed from time to time as it accumulates. The pressure in the chamber then forces the liquid upward through the perforations in the plates  $M M$  below the filter-bed  $F^2$  in the chamber  $C^2$  and through the filter-bed  $F^2$ , where it is subjected to a further filtration and is eventually discharged as it rises to the top of the chamber  $C^2$  through the pipe  $E$ . When it is desired to cleanse the filter-beds, the supply of liquid to be filtered is shut off and water is blown or forced into the bottom of the beds through the pipes  $h h$ . This water disintegrates the beds and the impurities collected therein, and the water so forced in, with the impurities collected in it in its passage through the beds, is blown off through the pipes  $k$  and  $k' k'$  at the top of the beds. This operation may be repeated from time to time, as may be found desirable. When the pipes  $h h$  and  $k k' k'$  become clogged or in any wise obstructed, the screw-caps  $h' h^2$  and  $k^2 k^3$  are removed and a rod or bar inserted, and the pipes are thus cleaned out throughout their entire length.

I claim as my invention—

1. In a filtering apparatus, the combination, substantially as hereinbefore set forth, with the discharge-chamber, of a perforated interior discharge-pipe extending throughout the entire length of the chamber, a manifold discharge-pipe on the exterior of the same, extending longitudinally along the same throughout the length of the chamber and parallel with the interior discharge-pipe, a series of vertical branch pipes connecting the manifold pipe with the interior of the shell, and a vertical pipe passing from the interior discharge-pipe and discharging within each of the vertical branch pipes, substantially as set forth.

2. In a filtering apparatus, a floor for supporting the filter-bed, composed of a series of

movable perforated sheet-metal plates, and independent frames of angle-iron fitting into the shell of the filtering apparatus into which said plates fit, said plates and frames being of such shape and size that the plates may be used interchangeably.

3. In a filtering apparatus, the combination, with the shell, of a floor for the filter-beds, composed of a series of independent movable rectangular frames made of angle-iron and provided with longitudinal cross-girders of angle-iron and a plate of perforated metal fitting into each frame.

4. In a filtering apparatus, the combination, with the shell, of a horizontal exterior settling-trough placed beneath the shell on the outside of the same and extending through its length and connected therewith by suitable openings for retaining the finer material passing through the primary filter-bed, and an opening for removing the accumulated material from time to time.

5. In a filtering apparatus, the combination, with the independent filter-beds, of the wash-out-pipes placed at the bottom of the beds, extending longitudinally through the end walls of the apparatus and arranged to be opened and cleaned from the outside, and the independent blow-off pipes at the top of the beds similar in construction, whereby the wash-water from each chamber may be removed separately.

6. In a filtering apparatus, the combination, with the filter-beds, of the washout-pipes  $k$ , placed at the top of the chamber  $C'$ , the pipes  $k' k'$ , passing through the chamber  $C'$  into the secondary chamber  $C^2$  and perforated only in the latter chamber and extending longitudinally through the end walls of the apparatus and arranged to be opened and cleaned from the outside, and an exterior discharge-pipe in which said discharge-pipes terminate.

7. In a filtering apparatus, the combination, substantially as hereinbefore set forth, of a horizontal cylindrical shell divided into two adjacent vertical filtering-chambers, a horizontal settling-chamber in the bottom of the shell, placed under the filter-beds and connecting the two chambers, and an auxiliary settling-trough outside of and below the shell, extending longitudinally throughout its length and connected with the settling-chamber by suitable openings, and an opening in the exterior trough for removing the accumulated material therefrom.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 2d day of July, 1891.

DAVID WILLIAMSON.

Witnesses:

HENRY B. ANDERSON,  
WILLARD PARKER BUTLER.