No. 868,277. PATENTED OCT. 15, 1907.

G. M. KNEUPER.

PROCESS OF MAKING FILTERS.

APPLICATION FILED MAY 16, 1905.

2 SHEETS—SHEET 1.

Fig. 3.

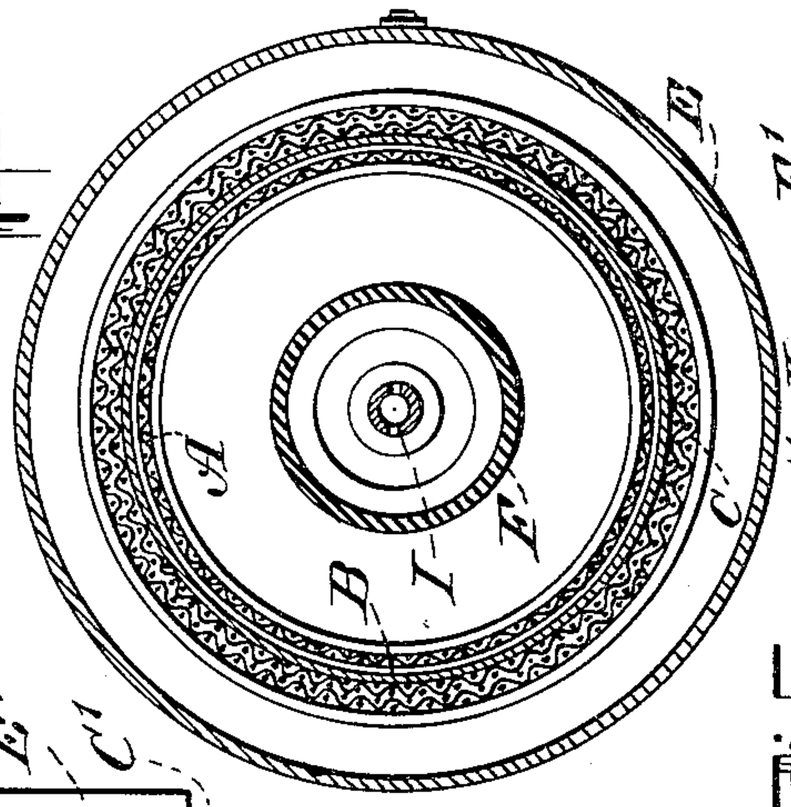


Fig. 5.

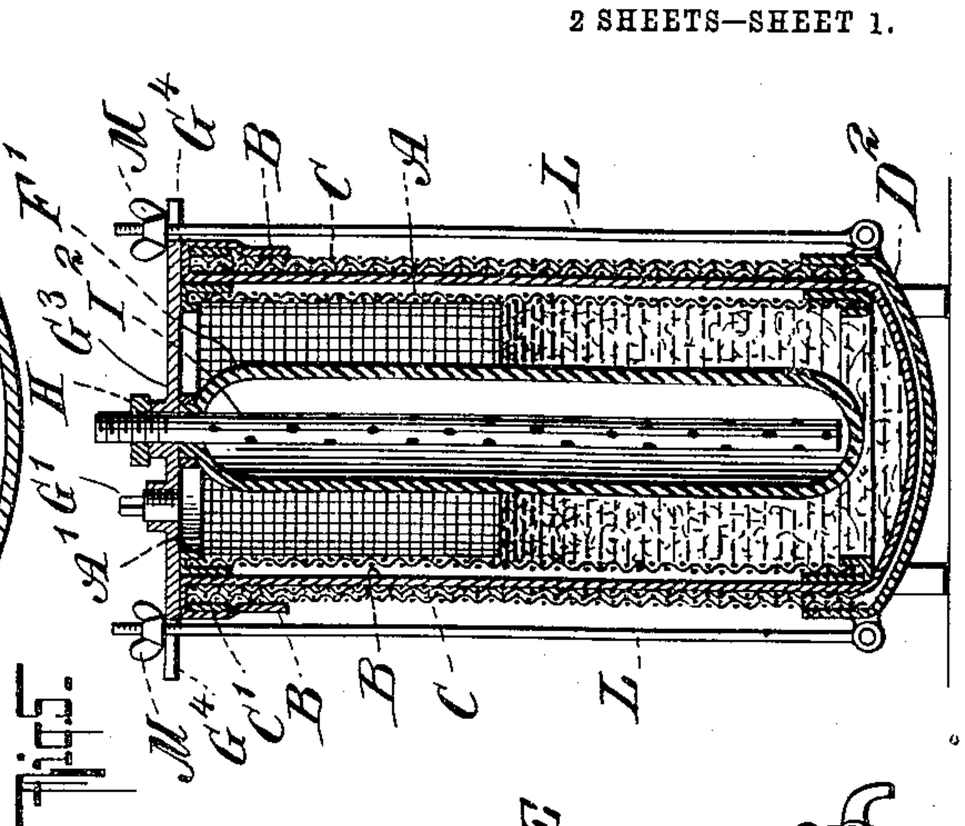


Fig. 2.

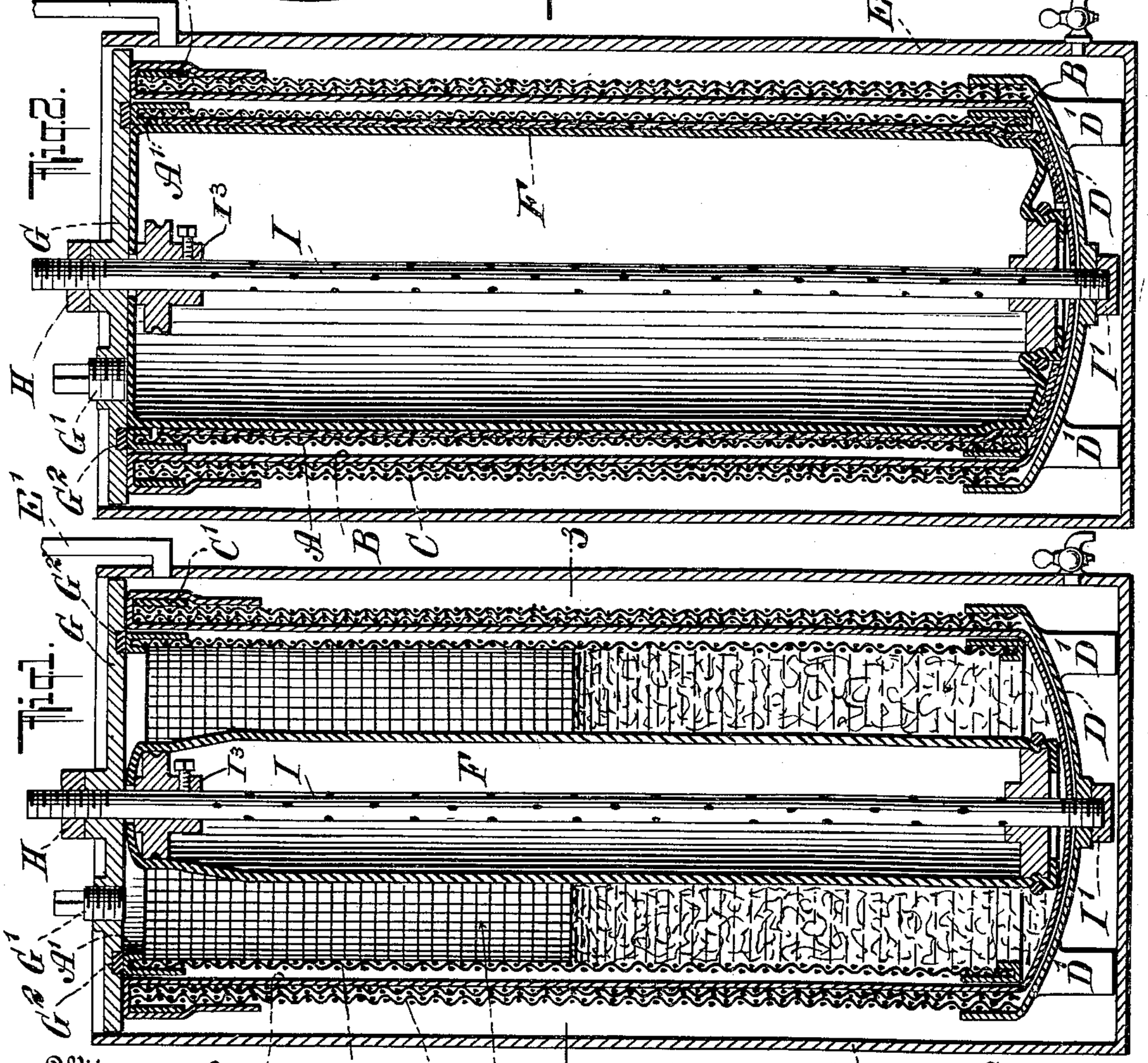


Fig. 1.




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# PROCESS OF MAKING FILTERS.

APPLICATION FILED MAY 16, 1905.

2 SHEETS—SHEET 2.

Fig. 1.

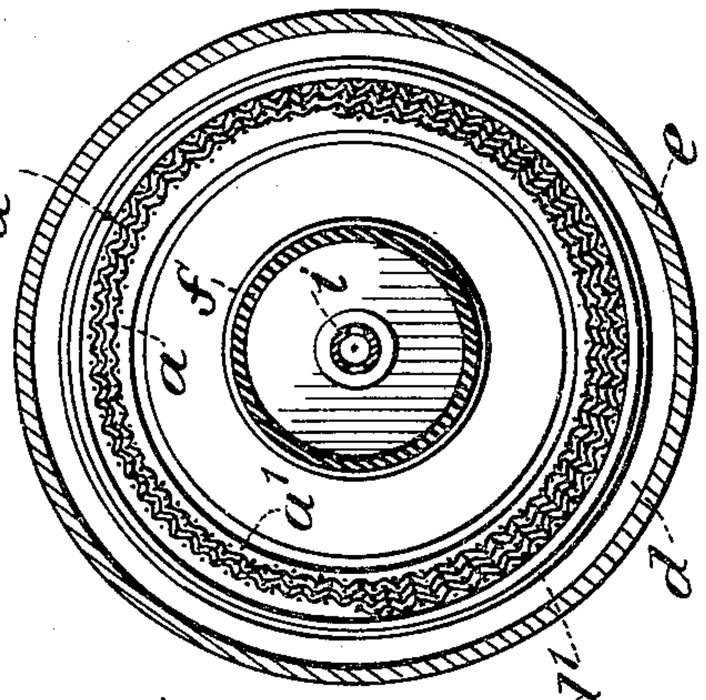



Fig. 5.

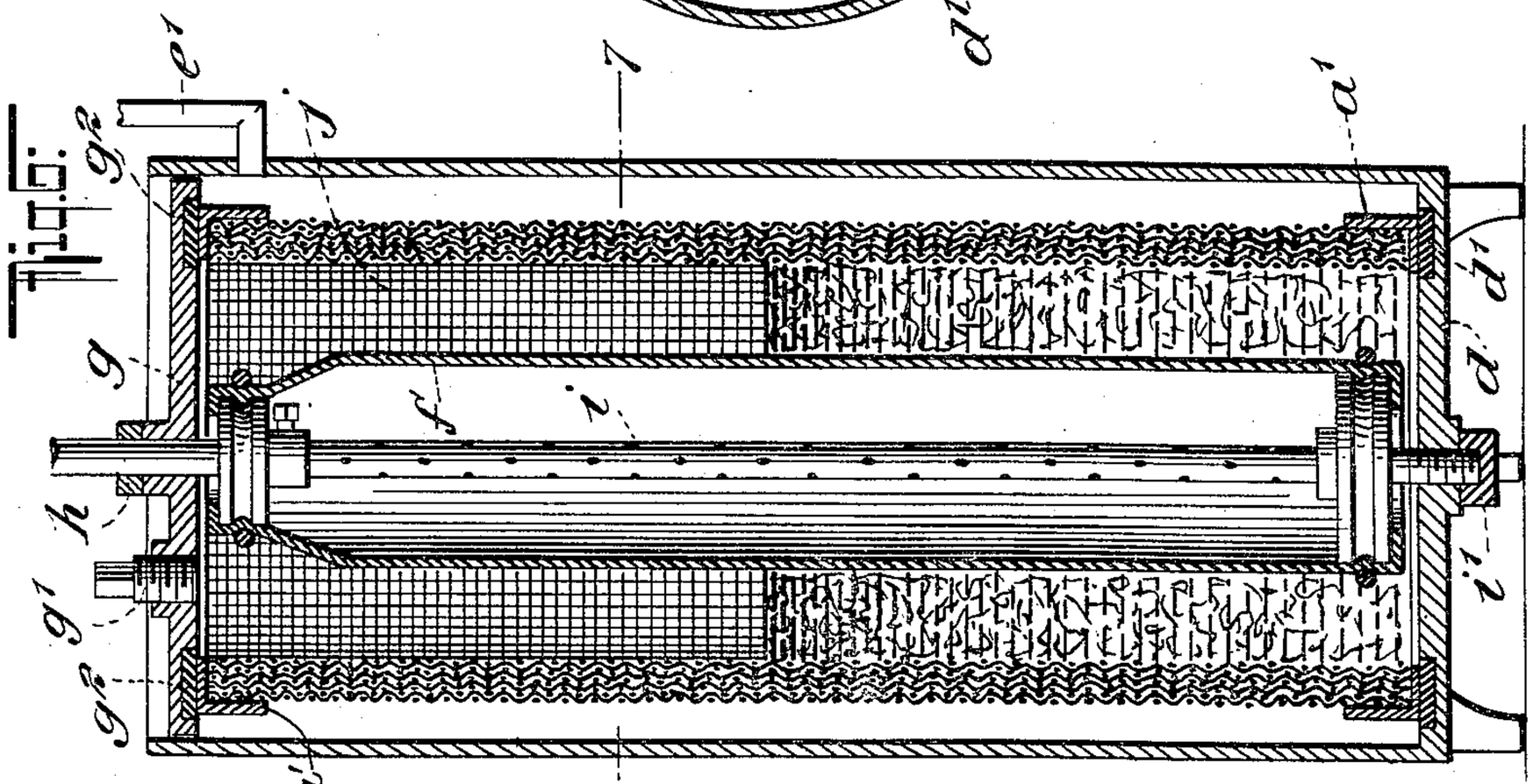
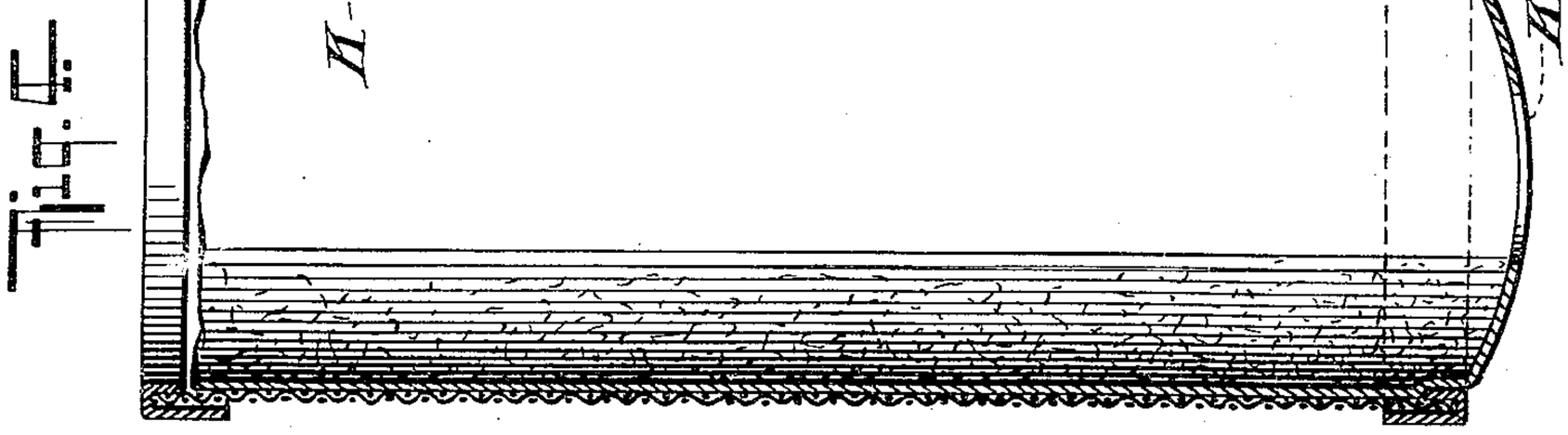



Fig. 4.

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# UNITED STATES PATENT OFFICE.

GEORGE M. KNEUPER, OF NEW YORK, N. Y., ASSIGNOR OF ONE-THIRD TO GEORGE KNEUPER AND ONE-THIRD TO KATE KNEUPER.

## PROCESS OF MAKING FILTERS.

No. 868,277. Specification of Letters Patent. Patented Oct. 15, 1907.

Original application filed August 12, 1904, Serial No. 220,450. Divided and this application filed May 16, 1905. Serial No. 260,677.

*To all whom it may concern:*

Be it known that I, GEORGE M. KNEUPER, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Processes of Making Filters, of which the following is a specification.

My invention relates to processes for the manufacture of filters, and has for its object to provide a rapid and inexpensive means of making efficient filters.

The invention will be fully described hereinafter, and the features of novelty pointed out in the appended claim.

The present application is a division of one filed by me in the United States Patent Office August 12th, 1904, Serial Number 220,450, on which Letters Patent No. 817,252 were granted to me April 10, 1906.

Reference is to be had to the accompanying drawings, in which

Figure 1 is a sectional elevation of an apparatus for making filters according to my invention, showing said apparatus at the initial stage of the operation; Fig. 2 is a similar view, showing the apparatus at the final stage of the operation; Fig. 3 is a sectional plan on line 3—3 of Fig. 1; Fig. 4 is a longitudinal section of form of filter made with the apparatus shown in Figs. 1, 2 and 3; Fig. 5 is a sectional elevation of another form of filter making apparatus constructed according to my invention; Fig. 6 is a sectional elevation of still another form of filter making apparatus embodying my invention, and Fig. 7 is a sectional plan taken on line 7—7 of Fig. 6.

In making my improved filter, I employ a vessel having a perforated wall, so that the liquid may pass therethrough, and adjacent to this perforated wall I locate an expansible body adapted to be forced toward said wall. If the vessel is filled with paper pulp, suspended in water, and if then the expansible body is distended, or blown up quickly, the water will be forced through the perforated wall, but the pulp will remain compressed between the expansible body and the perforated wall, and will form a continuous sheet or lining against said wall. In detail the procedure may be as follows:

In Figs. 1, 2 and 3, A indicates the operative inner wall of the apparatus, which may be cylindrical, and may consist of perforated sheet metal or of wire netting. B is a pouch made of suitable porous or pervious material such as canton flannel; the upper edge of this pouch is folded over the outer wall C which, as shown, may consist of two connected wire screens of cylindrical shape; the outer wall C is secured to a bottom D which may be slotted or perforated; this bottom D is preferably provided with lugs D′ so that the entire receptacle may be conveniently set within a tank E or the like. Within the perforated wall A is arranged an expansible body F, for which purpose I generally employ a rubber bag. This bag extends substantially the entire length or height of the receptacle, and is fastened at its top to a cover G. This cover G may be provided with an opening for filling, which is closed by a plug G′. The said cover G is normally held down against a flange A′ at the top of the inner wall A by means of a nut H, which screws upon a perforated tube I extending through the cover G and within the receptacle. Between the cover G and a collar $I^3$ secured to this tube I is clamped the upper end of the bag F; the lower end of the tube may be free within the receptacle, or, if preferred, the lower end of the tube may, as shown, be passed through the rubber bag, and through the bottom D, being secured there by a nut I′. A flange C′ for strengthening is preferably located at the upper end of the outer wall.

In operation, the above described apparatus is placed in a tank which is either empty, or filled with water; pulp, suspended in water, is poured into the central chamber J. Air is then blown into the tube I, so as to issue through the perforations thereof into the bag F. By the application of suitable pressure, the bag is quickly expanded in every direction against the inner wall A into substantially the form shown in Fig. 2. The water is quickly driven out through the perforated walls A and C and the pervious pouch B, but the pulp is retained against the inner surface of the inner wall A, and forms a continuous compressed lining thereon. The pressure will of course cause some of the pulp lining to enter into meshes of the wall A, and the said wall and its pulp lining will therefore be securely connected so as to render them available for use as one structure. If desired, however, the lining may be separated from the wall A and used alone. After the lining is formed on the inner wall, as described, the receptacle is removed from the tank.

The compressed lining K produced on the perforated wall A constitutes an efficient filter, either alone or together with said wall as a carrying frame. This filter (Fig. 4) may be removed from the apparatus by unscrewing nut H, removing the cover G, grasping the flange A′ at the top of the inner wall and lifting the inner wall, together with the compressed pulp lining K, from the receptacle. This inner wall with the compressed lining thereon may then be used as a filter in any suitable apparatus.

It will be seen that one face of the lining engages the

perforated wall A, the other face being freely exposed so that the lining is permitted to expand in one direction in case it should swell while in use. I consider it preferable, when using the filter, to have the liquid pass in through the exposed inner surface of the lining, and out through the meshes of the perforated wall. Another inner wall of like construction is then put in the receptacle, and a filter lining is formed thereon in the same manner as above described, and thus the apparatus may be used for producing a great number of filters.

It will be understood that after the receptacle has been removed from the tank, and before the inner wall is removed, the rubber bag should be deflated. It is not absolutely necessary to use the pouch B, but the use of said pouch prevents the fibers from passing to, and through the outer wall C when the perforations of the inner wall are beyond a certain size; an easy separation of the inner wall A from the other parts of the apparatus is thus insured after the pulp lining has been made. The pouch B, and even the outer wall C, may be dispensed with if the meshes of the inner wall are sufficiently close. In any event, however, the top or cover G should be securely connected with the bottom D, so as to prevent any leakage at the edges of the inner wall A. A rubber gasket $G^2$ may be applied to the cover so as to engage the flange A′. In order to provide a receptacle for the water expelled by the inflation of the bag F, without making the tank E of unduly increased height, the latter may be made with a standpipe E′ extending upwardly beyond the cover G. The use of this standpipe is also useful in providing an increasing counterpressure on the outer side of the filter lining, that is on the side opposite to that engaged by the expansible bag F. Thus the filter lining, being subjected to pressure on both sides, will be of a very close texture.

It will be obvious that in the operation above described, an opening K′ will be produced at the bottom of the filter lining K. (See Fig. 4). In cases where it is desired to produce a filter having a closed bottom, the pipe $I^2$ would terminate above the bottom $D^2$ of the receptacle and within the bag F′. (Fig. 5). In this case the cover $G^3$ could be removed, together with the pipe $I^2$ and bag F′ after the production of the filter, and then the bottom of the lining would be entirely closed by the end portion. As in this case the pipe $I^2$ does not extend through the bottom $D^2$, different means from those used in Figs. 1, 2 and 3 must be provided for holding down the cover $G^3$. For instance screw rods L may be hinged to the bottom $D^2$, and fitted into slotted ears $G^4$ of the cover, the tension being produced by means of winged nuts M.

In Figs. 6 and 7, the inner wall *a* is formed by rolling a sheet of wire gauze or the like into cylindrical form, so that there will be two or more layers at certain points, and this cylinder is then held in shape in any suitable manner as by end rings *a′*, L-shaped in cross section, and adapted to engage gaskets *d′* and $g^2$ located respectively on the bottom *d* and cover *g*. The bottom *d* is shown integral with a cylindrical imperforate outer wall *e*, which wall may be provided with a stand-pipe *e′*, corresponding in function to the stand-pipe E′. A plug *g′* normally closes an opening in the cover *g* through which the chamber J may be filled with water in which pulp is suspended. An expansible body *f* is also contained in this chamber, said expansible body *f* being fitted on the pipe *i*, through which air or other suitable medium may be blown or forced into the bag *f* to expand the same. Nuts *h* and *i′* secure the parts of the apparatus together. The operation is exactly the same as with the form of construction first described, with the additional advantage that the pulp lining may be stripped much more readily from the perforated wall upon which it is formed, so that such lining may be taken off and applied to other carriers. By this construction the cleaning of the perforated wall is also much facilitated. While I have described the production of a compressed pulp lining forming a filter on the inner surface of the inner wall, I desire it to be understood that my invention is not restricted to this construction and operation, but that, generically speaking, I may force an impervious surface, (represented in this case by the rubber bag F—*f*) toward one face of a perforated wall, (represented by the wall A—*a*) whether such wall be cylindrical or of any other shape, and whether the surface exerting pressure be located on the inside of the said wall or elsewhere. In each case the impervious surface moving toward the perforated wall forces the liquid through said wall and compresses the pulp into a continuous layer on one surface of said wall.

In all the forms herein shown, it obviously is easy to substitute perforated walls A—*a* of different diameters for those shown in the drawings, so that the same apparatus may be used for making filters of different sizes.

Instead of pulp I may employ any other substance which is capable of being suspended in water or other liquid, and is further capable of being separated from said liquid by forcing the liquid through a perforated wall. If such substance is porous, the resulting sheet or lining may be used for filtering purposes; a lining will be produced in all events which conforms to the shape of the wall, so that my invention, considered broadly, provides means for molding articles of various kinds quickly, and without requiring the application of heat.

Various modifications may be made without departing from the nature of my invention.

What I claim as my invention and desire to secure by Letters Patent is:

1. The herein described process for making articles from substances suspended in liquids, which consists in placing a perforated wall in contact with a liquid having such substances suspended therein, then quickly forcing an impervious surface toward said perforated wall to expel the liquid through said wall and cause the suspended substance to form a compressed lining on said wall, and utilizing the expelled liquid to produce an increasing counterpressure on the side of said wall opposite to that on which the said impervious surface is located.

2. The herein described process for making articles from substances suspended in liquids, which consists in placing a perforated wall in contact with a liquid having such substances suspended therein, then quickly forcing an impervious surface toward said perforated wall to expel the liquid through said wall and cause the suspended substance to form a compressed lining on said wall, and exerting a gradually increasing counterpressure on the

side of said wall opposite to that on which the said impervious surface is located.

3. The herein described process for making articles from substances suspended in liquids, which consists in placing a perforated wall in contact with a liquid having such substances suspended therein, then quickly forcing an impervious surface toward said perforated wall to expel the liquid through said wall and cause the suspended substance to form a compressed lining on said wall, and exerting a counterpressure on the side of said wall opposite to that on which the said impervious surface is located.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GEORGE M. KNEUPER.

Witnesses:

JOHN LOTKA,

JOHN A. KEHLENBECK.