

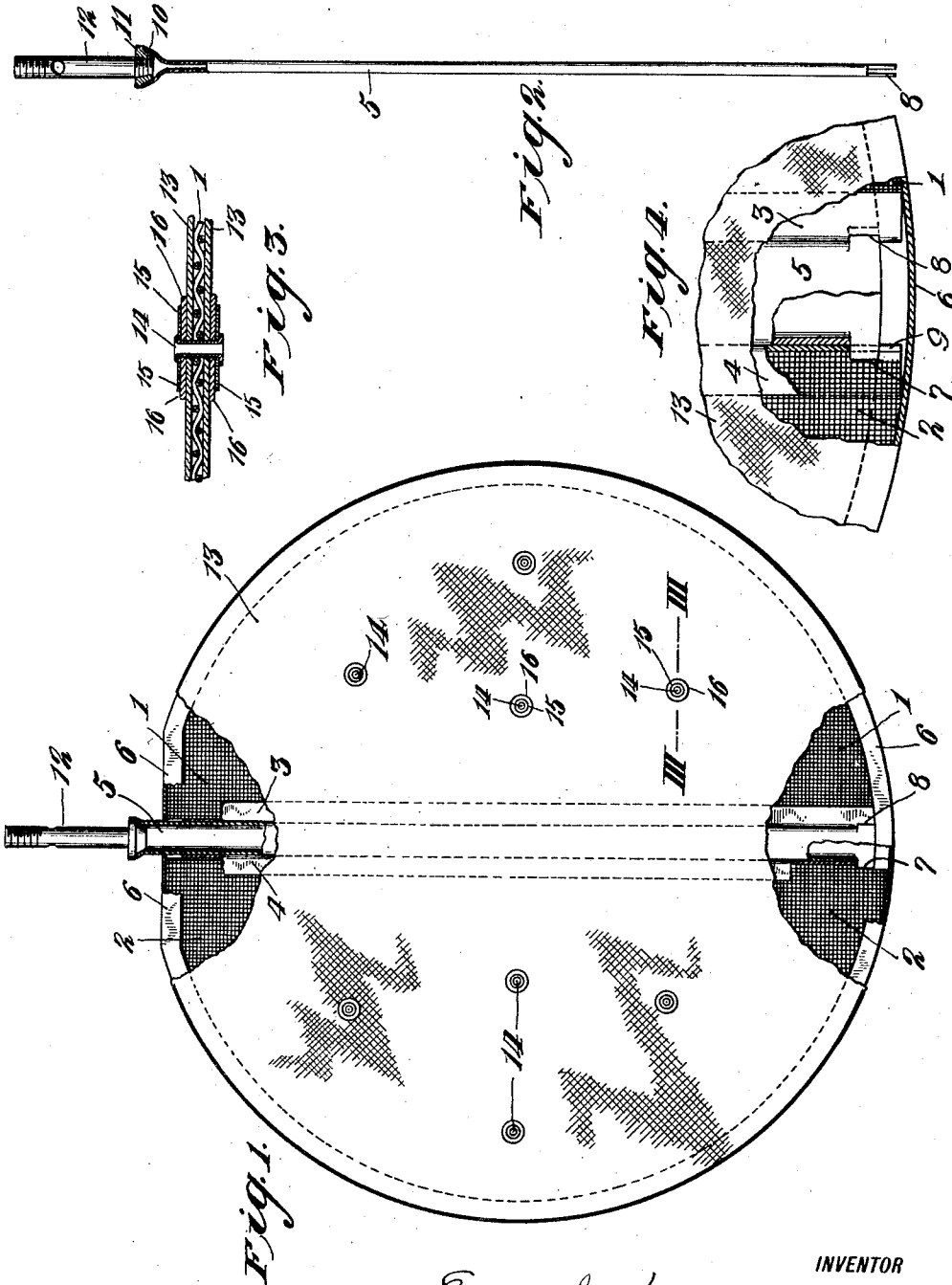
E. J. SWEETLAND.
FILTER.

APPLICATION FILED FEB. 2, 1917.

1,381,944.

Patented June 21, 1921.

2 SHEETS—SHEET 1.



Ernest J. Sweetland
BY

G. E. Jewilliger

INVENTOR

ATTORNEY

E. J. SWEETLAND.
 FILTER.
 APPLICATION FILED FEB. 2, 1917.

1,381,944.

Patented June 21, 1921.

2 SHEETS—SHEET 2.



Fig. 6.

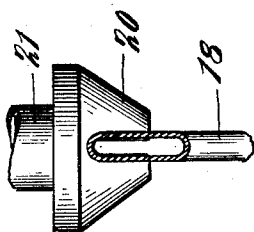


Fig. 7.

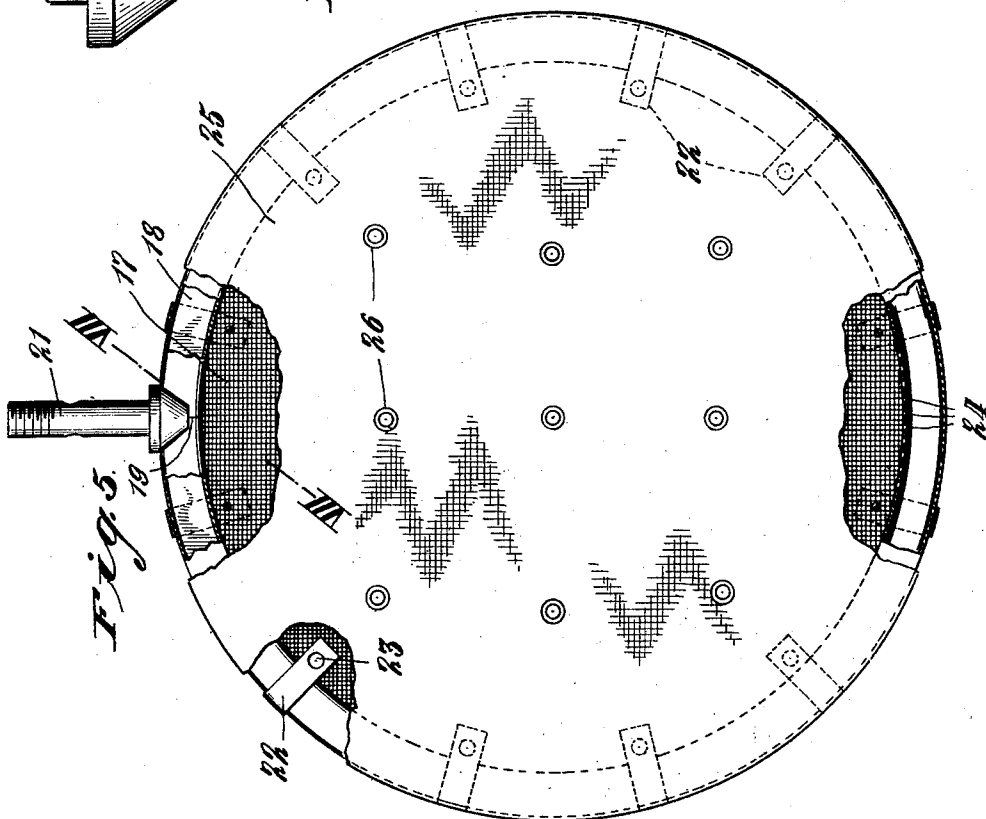


Fig. 5.

INVENTOR

Ernest J. Sweetland

BY

G. E. Derwilliger

ATTORNEY

UNITED STATES PATENT OFFICE.

ERNEST J. SWEETLAND, OF MONTCLAIR, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO UNITED FILTERS CORPORATION, A CORPORATION OF DELAWARE.

FILTER.

1,381,944.

Specification of Letters Patent. Patented June 21, 1921.

Application filed February 2, 1917. Serial No. 146,055.

To all whom it may concern:

Be it known that I, ERNEST J. SWEETLAND, a citizen of the United States, residing in the town of Montclair, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Filters, of which the following is a specification.

My invention relates to filters of the leaf type and has particular reference to certain improvements in the construction of leaves adapted to be used with such filters. These filters of the leaf type commonly comprise an external tank or casing within which is disposed a plurality of independent filter elements or leaves, each leaf comprising an envelop or bag of filter fabric within which is a drainage area and provision is made for communication from the drainage area of the interior of each leaf to a common drainage manifold. Such filters are well known in the art and one type largely used is illustrated and described in my United States Patent No. 1,083,305, granted January 6, 1914.

In carrying on the operation of filtration, the sludge or liquid containing impurities is usually pumped under pressure into the container or casing. Its only outlet is to pass through the filter fabric of the various leaves into the drainage area or interior of the leaf and thence to the drainage manifold, from which the filtrate is led out of the filter. Meanwhile, the solids which have been held in suspension in the sludge or liquid to be filtered are deposited in the form of a more or less coherent layer upon the surface of each leaf, forming what is generally known in the art as a "filter cake."

My present invention aims to simplify the construction of the individual leaves and at the same time to provide a form of leaf which will be more efficient in operation and which will effect a saving of valuable products when the filter is operated with certain classes of materials.

In the accompanying drawings, which form a part of this specification, Figure 1 is a front elevation of the leaf, parts being shown in section to illustrate the internal construction. Fig. 2 is an edge view of the central drainage tube of the leaf, the upper part being shown in central section. Fig. 3 is a transverse sectional view on line III—III of Fig. 1. Fig. 4 is an enlarged fragmentary view showing the construction at the

bottom of the leaf. Fig. 5 is a view similar to Fig. 1 showing a modified form of construction. Fig. 6 is an edge view of the drainage member used in this type of leaf. Fig. 7 is a sectional view on line VII—VII of Fig. 5.

Referring to the drawings in detail, the numerals 1 and 2 designate substantially semi-circular sections of heavy wire screen or the like adapted to form the central drainage area or section of a filter leaf. These sections may be provided at their inner edges with vertical, substantially U-shaped binding strips 3 and 4 which are immediately adjacent to a central drainage tube 5. A peripheral binding strip 6 also preferably of U-section, encircles the outer edge of both sections and is joined to the tube near its upper end. The drainage tube 5 is preferably constructed of flattened seamless steel tubing, the flattening being in the plane of the leaf. At the bottom of the tube is slit at 7 and 8 and the cut ends are straightened out in the plane of the leaf as shown in Figs. 1, 2 and 4. It will thus be seen that the only opening into the tube within the leaf is furnished at the extreme bottom of the leaf. The binding strips 3 and 4 are preferably secured to the outer edges of the tube 5 by being welded thereto as by the use of oxy-acetylene welding, and at its lowest end the tube is also welded in similar fashion to the adjacent part of the circular binding strip 6, and the flaps formed by slitting the tube at 7 and 8 are welded to the strips 3 and 4. As shown clearly in Fig. 4 the strips 3 and 4 are provided with openings of sufficient size to admit the flaps formed by the slits at 7 and 8, so that a continuous channel 9 is formed from the bottom of the screen or drainage area of the leaf into the interior of the tube 5. The upper end of the tube 5 is preferably expanded at 10 to receive the conical fitting 11 into which is screwed the usual drainage nipple 12 by which the leaf is adapted to be mounted in the filter casing. The tube may be secured to the fitting 11 in any suitable manner as by being welded to it, thus forming a fluid-tight joint.

The screen sections 1 and 2 and that portion of the tube 5 which is between them are covered by an envelop 13 of any suitable filter fabric, such as the cotton filter cloth which is in common use, or a woven metallic

fabric suitable for filtration, such as that shown in my Patent No. 1,147,270 of July 20th, 1915. It will be understood that the sections of cloth forming this envelop or bag are suitably secured together, as by stitching in the case of the cotton fabric, so as to form a tight covering over the drainage sections 1 and 2.

In practice I find it highly desirable to tie the filter cloth to the screen sections at intervals in some suitable manner, preferably by the use of hollow rivets 14. These rivets are preferably of such size that the shank will just be received within the mesh of the screen forming the drainage area, thus eliminating any substantial amount of play. Under each head of the rivet may be placed a broad metallic washer 15 and between this and the filter fabric 13, I prefer to seat a slightly larger compressible washer 16, which may be constructed of cloth, rubber or other suitable material. The provision of these washers not only prevents the seepage of unfiltered liquid past the shank of the rivet into the drainage area formed by the heavy screen, but also prevents tearing of the filter cloth, when the latter is subjected to stresses in a direction perpendicular to the surface of the leaf or parallel thereto.

It will be understood that in the type of filter with which this leaf is best adapted to be used, a common method of cleaning the leaf or dispelling the filter cake from it, consists in "reversing the flow," that is, shutting off the supply of sludge in the tank or container in which the leaf is placed and admitting a current of wash water, steam or compressed air to the filtrate manifold. This supply of cleansing fluid will enter each leaf through the nipple 12 and will find its way out of the leaf through the pores of the filter cloth in a direction opposite to that which the clear filtrate has taken during the process of filtration. The counter pressure thus established dislodges any filter cake which may adhere to the outer surface of the filter fabric. Unless some means is provided, however, this reversal of flow will produce the undesired effect of distending the filter fabric away from the drainage area or central screen, and since the filter leaves are relatively close together in this filter, this bulging action may defeat the purpose of the reversal flow by causing the cakes on the adjacent leaves to be compressed together instead of dislodging each cake separately into the space which normally is present between the leaves. The use of the spaced rivets 14, preferably distributed in a symmetrical fashion over the surface of the leaf, effectively prevents this outward bulging when pressure is applied to the interior of the leaf. The rivets are easy to apply to the leaves, do not reduce the effective filtration area to any appreciable extent and not

only prevent the outward bulging of the filter cloth when reversal of flow takes place but have the additional beneficial action of fastening the cloth to the heavy central screen so as to prevent the cloth from stretching or sagging in a direction parallel to the plane of the leaf under the influence of the weight of any filter cake which may adhere to the outer surface of the cloth.

In Figs. 5, 6 and 7, I have shown a modified form of construction in which the leaf is composed of a central circular section 17 of heavy screen, which is welded at suitable intervals to the inner periphery of a flattened tube 18 completely encircling the screen. The ends of the flattened tube are brought together at 19 where they are preferably welded or otherwise suitably fastened together to form a fluid-tight joint and are partially cut away to form a wedge-shaped opening to receive a conical outlet fitting 20, which is likewise welded or otherwise suitably secured to the adjacent parts of the tube so as to form a unitary water-tight structure. Into this fitting may be screwed the usual outlet nipple 12. In many cases the spot welding of the periphery of the screen to the inner edge of the flat tube at intervals will form a sufficiently strong structure, but either in addition to the welding or as a substitute therefor, I may provide a plurality of radial U-shaped clips 22, which are looped over the tube 18 and have their inner free ends extending beyond the tube over a portion of the screen 17. The ends may be suitably secured together, as by means of screws or rivets 23 passing through the screen. For a short distance at the bottom of the leaf, the inner edge of the tube 18 is pierced with a plurality of holes 24 through which the filtrate enters the tube from the drainage section formed of screen 17, or, conversely, through which wash water, steam or compressed air may be admitted to the interior of the leaf from the tube 18. As in the case of the leaf above described, the leaf is completely covered by an envelop or bag 25 of suitable filter fabric and rivets 26 are preferably symmetrically disposed at intervals over the surface of the leaf for the same purpose as that achieved by the rivets 14.

In the case of both types of leaves, the outlet for the clear filtered liquid or filtrate from the drainage area of the leaf is through a drainage tube having its inlet at the bottom of the leaf. This has an important function. With this type of leaf, the filtrate tends to flow by gravity toward the point at which it is collected from the drainage area of the leaf, whereas, in the form of leaf that has been most commonly used, for instance that shown and described in my prior United States Patent No. 1,083,305, the outlet for the filtrate has been at the

top of the leaf, and the pressure under which the filtrate enters the leaf has been utilized to cause the filtrate to seek this outlet. It will be apparent, however that no
 5 filtrate will flow out of such a leaf until the entire drainage area is filled with liquid under pressure. Consequently when the operation of filtering is suspended and it is desired to reclaim all of the filtrate as is
 10 frequently the case in chemical or metallurgical filtration when the filtrate contains some valuable substance, it is necessary to follow up the sludge which has been fed into the filter with a sufficient amount of
 15 wash water to displace the filtrate occupying the drainage area of the leaf at the instant filtration is suspended, that is, at the instant the supply of sludge is cut off. This is inefficient, since the use of this wash water tends to dilute the filtrate in the leaf and make the eventual reclamation of the valuable products it may contain more difficult. Furthermore, the fact that the suspension of filtration leaves the leaf in a state where
 20 the drainage area is filled with filtrate means that the relief of pressure within the filter, which occurs when no more sludge is pumped into the filter casing, will produce a tendency to dislodge the filter cake on the
 25 outer surface of the filter fabric by reason of the hydrostatic head produced by the vertical column of filtrate within the drainage area and now tending to seep back into the filter casing through the filter fabric. These
 30 disadvantages are all done away with by the use of a bottom drainage leaf such as the types above described, in which the filtrate is collected from the drainage area at the bottom of the leaf, so that when filtration is suspended the leaf may be readily
 35 cleared of all the filtrate merely by applying suction to the filtrate manifold or pressure to the exterior of the leaf, as by admitting compressed air to the casing, from which it
 40 will be communicated to the drainage tube 5 or 18 as the case may be.

While I have illustrated and described only certain specific embodiments of my invention, I realize that it is susceptible of
 50 wide adaptation and I do not desire to be limited to the precise structures shown and described.

Having thus described my invention, I claim:

55 1. A filter leaf comprising a central drainage area, a cover of filter fabric thereover and a drainage tube provided with an outlet exterior to the leaf and having communication with the drainage area thereof only
 60 at a part of said tube most remote from its outlet.

2. A filter leaf comprising a central drainage area, a covering of filter fabric thereover and a drainage tube of such length as to
 65 reach the furthestmost zone of the drain-

age area and having communication with said drainage area only at said zone.

3. A filter leaf of circular form comprising a central drainage area, a covering of fabric thereover and a drainage tube of a
 70 length not less than substantially the diameter of the leaf, said tube having communication with said drainage area only at a point most remote from the outlet of said tube.

4. A filter leaf comprising a central drainage area, a covering of filter fabric thereover, and a drainage tube provided with means for supporting the leaf in vertical
 75 position, said drainage tube leading to the furthestmost extremity of the leaf and communicating with the drainage area only at said extremity.

5. A filter leaf provided with means for supporting it in vertical position and having
 80 a central drainage area, a covering of filter fabric thereover and a drainage tube leading to the bottom of the leaf and having no other communication with the drainage area.

6. A filter leaf provided with means for supporting it in vertical position and having
 85 a drainage area, a covering of filter fabric thereover and a flattened tube rigidly incorporated in said leaf to support the same, said tube extending to the bottom of the drainage area and communicating therewith.

7. A filter leaf comprising a central drainage area, a covering of filter fabric thereover and a drainage tube leading to the bottom
 90 of the leaf, said tube having an extension at the top of the leaf to furnish a combined outlet and support for the leaf.

8. A filter leaf comprising a central drainage area, a covering of filter fabric thereover and a drainage tube leading to the bottom
 95 of the leaf and having no other communication with the drainage area, said tube having an extension at the top of the leaf to furnish a combined outlet and support for the leaf.

9. A filter leaf comprising a drainage area, a covering of filter fabric thereover and a flattened tube rigidly incorporated in said
 100 leaf to support the same, said tube extending to the bottom of the drainage area and communicating therewith, and having an extension at the top of the leaf to furnish a combined outlet and support for the leaf.

10. A filter leaf comprising a drainage area, a covering of filter fabric thereover and a flattened tube rigidly incorporated in said
 105 leaf to support the same, said tube extending to the bottom of the drainage area and communicating therewith only at that point, and having an extension at the top of the leaf to furnish a combined outlet and support for the leaf.

11. A filter leaf provided with means
 130

for supporting it in vertical position and comprising a drainage area, a covering of filter fabric thereover and a tube flattened in the plane of the leaf and rigidly incorporated therein to support the leaf, said tube extending to the lowest section of the drainage area and communicating therewith only at that point, and having an extension at the top of the leaf to furnish a combined outlet and support for the leaf.

12. In combination, a plurality of filter leaves, a container, means for supporting said leaves in said container parallel and close to each other but with their faces out of contact, each of said leaves comprising a frame, filtering fabric inclosing said frame and forming therewith an interior drainage chamber, means for conducting the liquid to be filtered into said container so that the same will pass through the filter fabric of the leaves into the interior drainage chambers thereof, means for at times conducting fluid into the interior drainage chambers of the leaves for dislodging, by flow of fluid through said leaves in the reverse direction, filter cake collected on the exterior surfaces of the fabric, and means distributed over the surface of the fabric for holding the same close to the frame so as to prevent the compression and sustaining of the filter cake between the surfaces of adjacent leaves during said reverse flow.

13. In combination, a plurality of filter leaves, a container, means for supporting said leaves in said container parallel and close to each other but with their faces out of contact, each of said leaves comprising a frame and filtering fabric completely inclosing said frame and forming therewith an interior drainage chamber, a discharge tube for each of said leaves communicating with the said interior drainage chamber, means for conducting the liquid to be filtered into said container so that the same will pass through the filter fabric of the leaves into the interior drainage chambers thereof, means for at times conducting fluid into the interior drainage chambers of the leaves for dislodging, by flow of said fluid through said leaves in the reverse direction, filter cake collected on the exterior surfaces of the fabric, and means distributed over the face of the leaf for preventing compression and sustaining of the filter cake between the surfaces of adjacent leaves during said reverse flow, said means comprising members forming enlarged bearing surfaces on opposite faces of the leaves and means for uniting said bearing members.

14. In combination, a plurality of filter leaves, a container, means for supporting said leaves in said container parallel and close to each other but with their faces out of contact, each of said leaves comprising a wire screen, filtering fabric completely in-

closing said screen and forming therewith an interior drainage chamber, discharge tubes for said leaves communicating with the said interior drainage chambers and leading to the exterior of the said container, means for conducting the liquid to be filtered into said container so that the same will pass through the filter fabric of the leaves into the interior drainage chambers thereof, means for at times conducting fluid through said discharge tubes into the interior drainage chambers of the leaves for dislodging, by flow of said fluid through said leaves in the reverse direction, filter cake collected on the exterior surfaces of the fabric, and means for each of said leaves for preventing sustaining of the filter cake between the adjacent surfaces of neighboring leaves during said reverse flow, said means being distributed over the faces of the leaves and comprising members passing through said leaves and provided with enlarged heads for bearing on the surfaces of the leaves, and means for preventing leakage past said members into the drainage chambers.

15. A filter leaf comprising a screen, a filtering fabric for inclosing said screen and forming therewith an interior drainage chamber for filtered liquid drawn through the opposite faces of the leaf, and a discharge tube communicating with the interior of said leaf, said discharge tube being adapted to permit a cleaning fluid to be forced into the interior of the leaf and outwardly through the filter fabric to dislodge the filter cake collected on the outer surfaces of the said fabric, in combination with means distributed over the face of the leaf for preventing bulging of the said fabric during the said reverse operation, said means comprising fastening members extending through the holes in said screen, said members having diameters substantially equal to the meshes of the screen and being provided with enlarged heads for engaging the outer surfaces of the fabric.

16. A filter leaf comprising a foraminous plate, a filtering fabric for inclosing said plate and forming therewith an interior drainage chamber for filtered liquid drawn through the faces of the leaf, a discharge tube individual to said leaf and communicating with the interior drainage chamber thereof, said discharge tube being adapted to permit a cleaning fluid to be forced from the interior of the leaf outwardly through the filter fabric to dislodge the filter cake collected on the outer surfaces of the said fabric, in combination with means for preventing bulging of the said fabric and the compression of the said filter cake between the fabrics of adjacent leaves during the said reverse operation, said means comprising hollow shank rivets distributed over the face of said leaf and extending therethrough,

said rivets being provided with metallic washers for forming enlarged bearing surfaces and with compressible washers for preventing leakage past the shanks of the rivets.

- 5 17. A filter leaf comprising an intermediate member formed of heavy wire interwoven to present an open work structure, capable of sustaining outer filtering fabric under the weight of accumulated filter cakes,
10 said filtering fabric inclosing said intermediate member and forming therewith an interior drainage chamber for the filtered liquid drawn through the fabric on the opposite faces of the leaf, means distributed

over the face of the leaf for securing the 15 outer fabric members to the intermediate member, comprising fastening devices extending through the mesh openings of the intermediate member and having diameters substantially equal to the mesh to prevent 20 movement and stretching of the fabric members, when caked, face-wise of the leaf, said devices having enlarged heads for engaging the outer fabric members to prevent movement or stretching in the direction away 25 from said face, and a tube communicating with the interior of the drainage chamber.

E. J. SWEETLAND.