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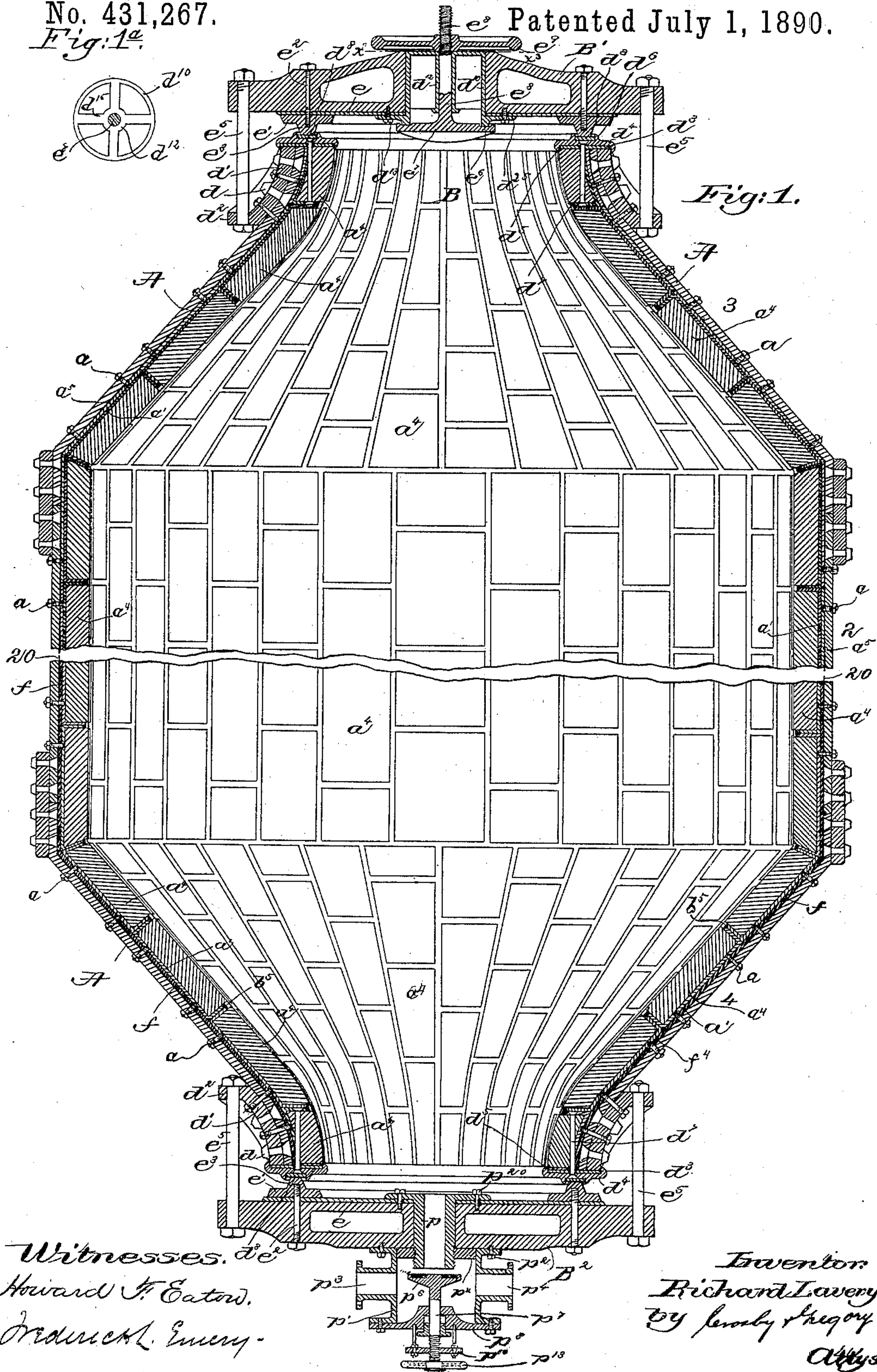
2 Sheets—Sheet 1.

R. LAVERY.
PULP DIGESTER.

No. 431,267.

Fig: 1^a.

Patented July 1, 1890.



Witnesses. ²
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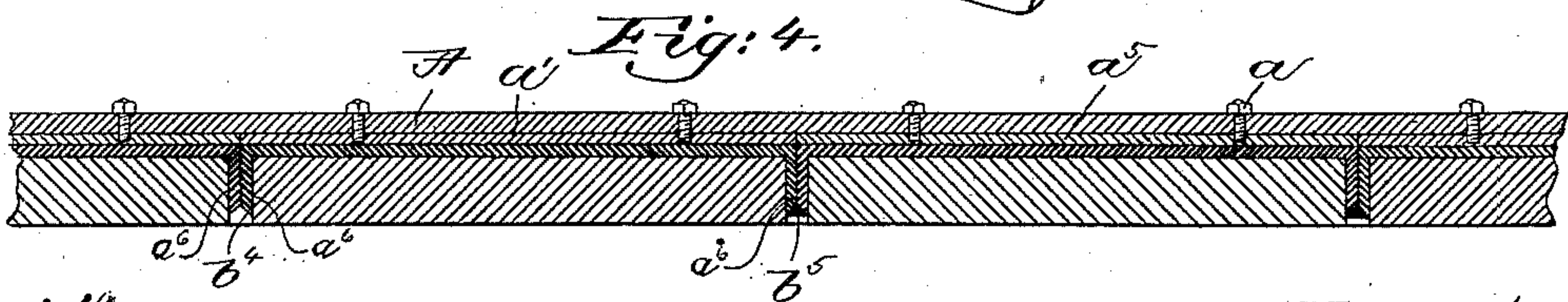
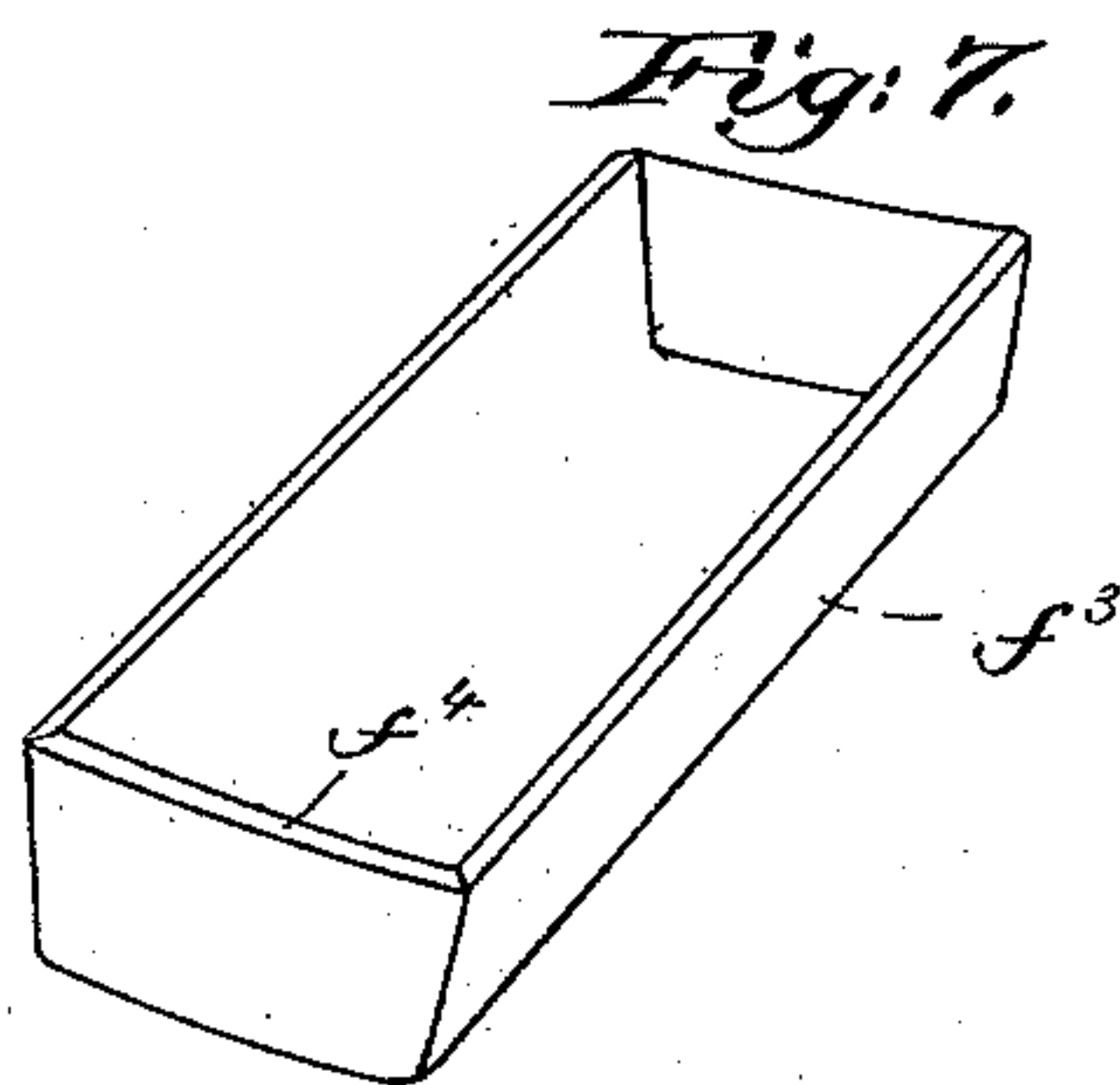
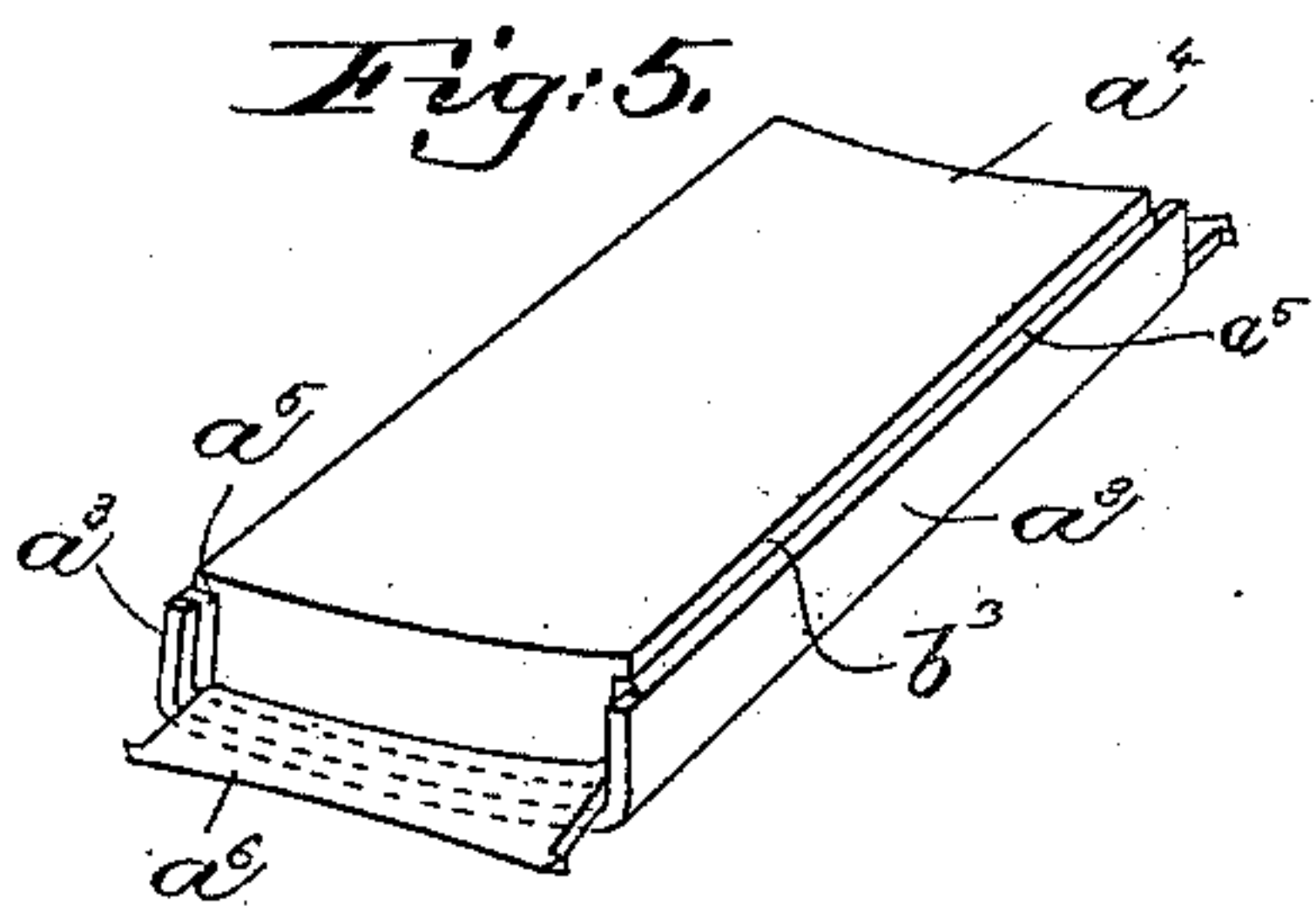
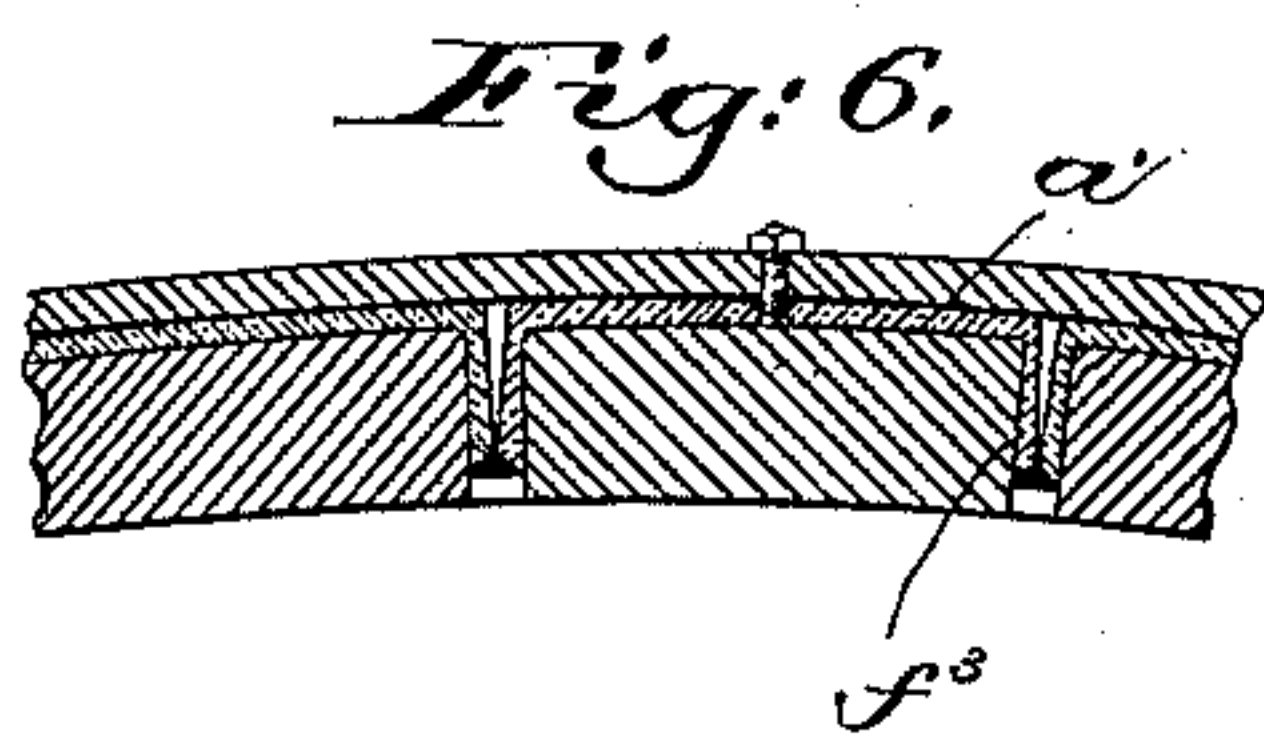
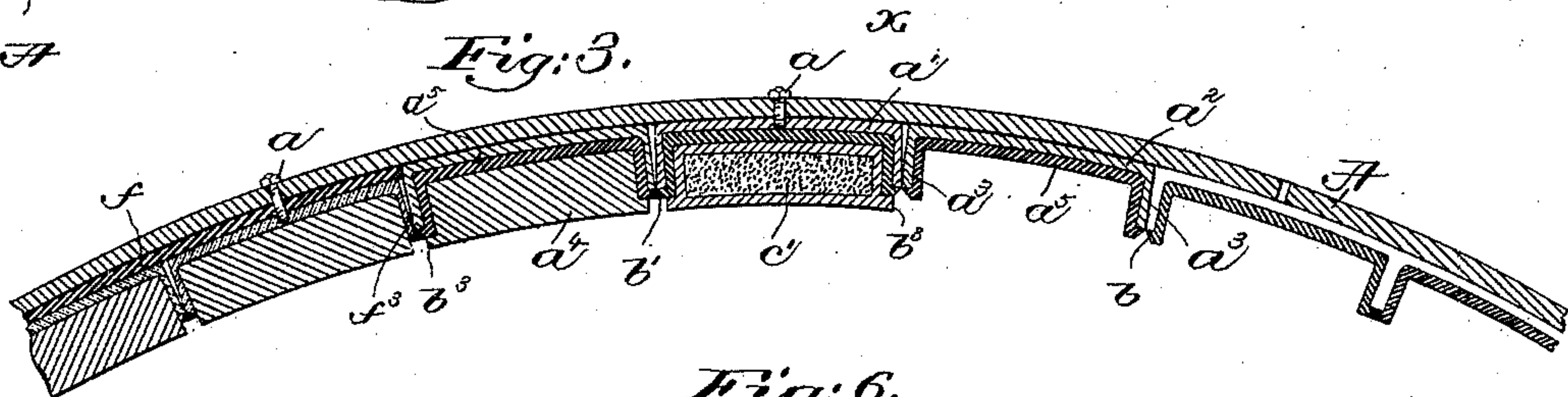
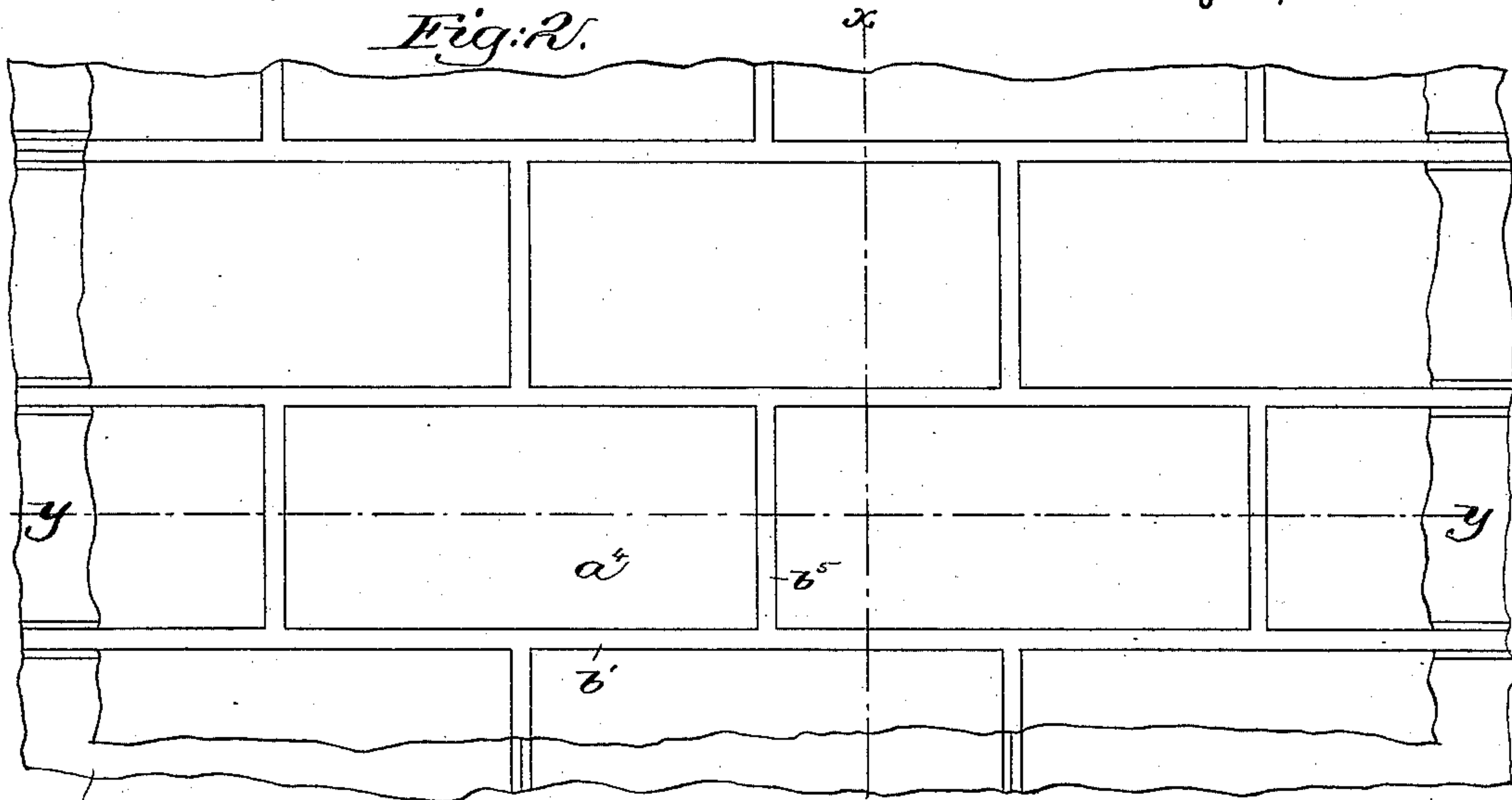
(No Model.)

2 Sheets—Sheet 2.

R. LAVERY.
PULP DIGESTER.

No. 431,267.

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UNITED STATES PATENT OFFICE.

RICHARD LAVERY, OF BOSTON, MASSACHUSETTS.

PULP-DIGESTER.

SPECIFICATION forming part of Letters Patent No. 431,267, dated July 1, 1890.

Application filed March 9, 1889. Serial No. 302,616. (No model.)

To all whom it may concern:

Be it known that I, RICHARD LAVERY, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Pulp-Digesters, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to pulp-digesters or boilers in which wood or other fibrous material is subjected to the action of a chemical solution to bleach it and reduce it to pulp.

Prior to my invention the iron or steel shells of pulp digesters or boilers have been covered on their inner side, to obviate the injurious action of the chemical solution, with a lining of lead, and also with a lining composed, essentially, of acid-resisting tiles secured by seams of lead as a tamping, the said seams or tamping being secured to the boiler-shell by bolts. Tiles have also been used as a lining secured by means of a tamping of cement and interlocked with each other.

My invention relates more particularly to a lining for pulp-digesters composed of acid-resisting tiles or blocks, and has for its object to provide means, as will be described, by which the tiles or blocks are more effectually secured in place within the boiler, the said tiles being capable of being readily removed for repair or other purposes.

My invention therefore consists, essentially, in the combination, with a boiler-shell and an acid-resisting lining therefor, composed of tiles or blocks, of independent metallic boxes or cradles secured to the said shell, and in which the said tiles or blocks are secured, substantially as will be described. The boiler-shell on its inner side may and preferably will have applied to it a coating or film of acid-resisting material, preferably ozocerite or its refined product, ceresin, and when the boxes or cradles are made of phosphor-bronze or other acid-resisting metal a layer of sheet-lead will preferably be interposed between the said phosphor-bronze or acid-resisting metal boxes or cradles and the boiler-shell, the coating or film of ozocerite being applied to the said shell so as to form a cushion for the sheet-lead. The boxes or cradles when made of iron or steel will pref-

erably be covered on their inner and outer sides with ozocerite.

Other features of my invention will be pointed out in the claims at the end of this specification.

Figure 1 is a vertical longitudinal section of a pulp boiler or digester provided with an acid-resisting lining embodying my invention, the said boiler being broken out to save space in the drawings, the upper part of the boiler being provided with an acid-resisting lining differing from that of the lower part of the boiler, as will be described. Fig. 1^a is a detail to be referred to. Fig. 2 represents the inner side of a sufficient portion of the boiler to enable my invention to be understood, the lining being partially broken out. Fig. 3 is a section of the portion of the boiler shown in Fig. 2 on line *x x*; Fig. 4, a section of the boiler on line *y y*, Fig. 2; Fig. 5, a detail in perspective of one of the boxes to more clearly show the manner of constructing the same outside the boiler; Fig. 6, a section of a modified form of lining to be referred to, and Fig. 7 a detail of the phosphor-bronze or acid-resisting metal box or cradle.

A represents the outer steel or iron shell of a boiler or digester, having a cylindrical body 2 and a conical top 3 and bottom 4, provided with extensions forming man-holes.

In accordance with my invention the boiler-shell has secured to it on its inner side, as by threaded bolts *a*, a lining made of independent detachable sections, each comprising an acid-resisting tile *a*⁴ and a metallic box or cradle *a*¹, the said metallic boxes or cradles being preferably of iron or steel; but they may be of phosphor-bronze or other like acid-resisting composition. When made of iron or steel, the boxes or cradles will preferably be covered on their inner and outer sides with ozocerite.

The detachable metallic boxes or cradles *a*¹ are made substantially shallow, as shown in Figs. 3 and 5, and are composed of a bottom *a*² and sides *a*³, and each box or cradle has placed within it the acid-resisting tile *a*⁴, preferably of glass, porcelain, or other silicious material, the said box or cradle when made of iron or steel being preferably made without ends, as shown in Fig. 5, and having placed in it a layer *a*⁵ of lead or other acid-

resisting material, which is made to conform to the shape of the said box or cradle, the said layer being interposed between the said box and the tile therein. The layer a^5 of lead is provided with end flaps a^6 , (see Fig. 5,) which in practice are bent or turned up against the ends of the tile, so that when the box or cradle and its tile a^4 are ready to be placed in position in the boiler the said tile a^4 will have its sides incased in lead.

The shallow boxes or cradles are placed within the boiler so that they abut at the upper or inward edges of their sides, the opening between the sides being shown as exaggerated in Fig. 3, and the end flaps a^6 of lead abut against each other, as shown in Fig. 4. The lead layers are not shown in Fig. 1 in order to avoid confusion in the drawings. The sides of the lead layers a^5 are bent over so as to lie upon the edge of the sides a^3 of the boxes, and are preferably beveled, as at b , (see Fig. 3,) so that a channel is formed by the beveled sides of adjacent layers, into which lead fused by the action of a blow-pipe is run, the flame of the said blow-pipe also fusing the edges of the aforesaid adjacent lead layers, as indicated at b' , thus firmly uniting the sides of adjacent layers a^5 with the fused lead and forming a liquid-tight joint.

The tiles a^4 are provided, as shown, with side flanges b^3 , (see Fig. 3,) which overlap and rest upon the lead layer a^5 , the said flanges of adjacent tiles coming near together and leaving between them but a substantially small space, as clearly shown in Figs. 3 and 5, so that only a small area of lead surface in the boiler is exposed to the heat of the boiler, thereby obviating creeping of the lead. The end flaps a^6 of each layer a^5 are also preferably beveled, as at b^4 , (see Fig. 4,) and the abutting end flaps of adjacent sections form a channel into which lead is fused by the flame of a blow-pipe, as indicated at b^5 , Fig. 4, the said flame of the blow-pipe fusing the aforesaid adjacent sections together, and with the additional lead making the whole integral, and thereby forming a liquid-tight joint.

Instead of making the tile a^4 of glass, porcelain, brick, &c., it may be made of an acid-resisting composition—such, for instance, as a composition of seven parts lead and one part antimony—the said tile being made as a hollow shell, (see Fig. 3,) into which a filling c' of plaster-of-paris and a hardening material—such as sand or other suitable material—is packed for the purpose of sustaining the pressure within the boiler while in operation.

When the boxes or cradles are composed of phosphor-bronze or like acid-resisting composition, the lead layers a^5 may be omitted and the tile rest directly on the said boxes, as shown in Fig. 6, and also in Fig. 1, the said boxes being provided with upturned sides f^3 and ends f^4 , (see Fig. 7,) so that the upper or inward edges of the sides and the ends of adjacent boxes substantially abut, and are rendered liquid-tight by burning or fusing a

suitable hard solder upon the exposed edges of the said boxes, whereby all the boxes or cradles in the boiler or digester are made integral and an acid-proof protection to the outer shell of the digester obtained. As shown in Fig. 1, the lower half of the boiler or digester is lined in this manner. As an additional protection I may cover the inner surface of the shell of the boiler with sheet-lead prior to bolting in place the phosphor-bronze or acid-resisting metal boxes or cradles, as indicated at f in the left of Fig. 3 and in the lower half of Fig. 1.

If in practice the tiles in the central portions of the body, top, and bottom of the boiler become broken, they may be readily removed individually by melting the hard solder or lead joint b' , (as by means of a blow-pipe,) so as to loosen the said joint and permit the cradle or box and its tile to be removed without disturbing the rest of the lining. When the tiles at the angle formed by the junction of the cylindrical body 2 and the conical top and bottom 3 4 are to be removed, the adjacent tile above or below the broken one must first be removed, and then the cradle containing the broken tile may be moved into the space thus left vacant and removed therefrom. The last two tiers of tiles in the top and bottom must also be removed in like manner. The box or cradle may be removed from the boiler and the broken tile replaced in the box by a new tile, and the said box and its tile again placed in position within the boiler.

Referring to Figs. 1 and 2, it will be seen that the iron-shell A in practice is protected by a continuous sheet of lead and the lead by the tiles.

Referring to Fig. 1, the boiler-shell A at its upper man-hole has secured to it, as by rivets d , an annular ring d' , provided with a flange d^2 . The upper end or edge of the ring d' is preferably flush with the end or edge of the boiler-shell A and the boxes or cradles a' , and tiles a^4 , and the said ring, boiler-shell, tiles, and boxes, are covered with an annular strip or ring d^3 of lead, upon which rests an annular cap d^4 of phosphor-bronze or other acid-resisting composition, provided with side flanges d^5 , which overlap the lead sheet d^3 .

The annular cap d^4 is provided with an annular socket or groove in its upper face, formed as shown by flanges d^6 , and the said cap is secured to the shell of the boiler and the upper boxes or cradles by bolts d^7 , having their lower ends engaging with said boxes or cradles, and having their upper ends embedded in the said groove or socket, and covered with an annular strip or washer d^8 of lead.

The upper man-hole, in practice, is closed by a cover composed of a metallic shell B', having a central opening, into which is fitted a casting or sleeve d^{10} , having a central boss or hub d^{12} , joined to the sleeve by arms d^{15} , (see Fig. 1^a,) the said casting being extended

below the under face of the cover B', and provided with a flange d^{25} , between which and the said cover is clamped by means of screw-bolts d^{13} one edge of an annular sheet e of lead or other acid-resisting material, the outer end or edge of the said sheet being clamped to the said cover by an annular ring e' of phosphor-bronze secured by bolts e^2 , the said annular ring having an annular projection e^3 , which fits into the groove in the cap d^4 and is forced against the lead washer d^8 to effect a liquid-tight joint by the bolts e^5 , extended through the flange d^2 and the cover B'.

The edge e^6 of the casting or sleeve d^{10} forms a seat for a valve e^7 , having its stem e^8 extended through the boss or hub d^{12} , the said valve-stem beyond the cover being provided with a screw-thread to be engaged by the threaded hub of a wheel e^9 , the said wheel in practice being rotated in one direction to force the valve e^7 to its seat e^6 . When the boiler is in use, the pressure within will keep the said valve firmly seated, so that when the bleached and cooked pulp is ready to be discharged the wheel may be rotated in the opposite direction and run up on the threaded valve-stem, so as to permit the valve to be instantly opened by the atmospheric pressure, the weight of the wheel assisting at the moment the pressure within the boiler is reduced and before a vacuum can be formed, whereby collapsing of the lining is obviated.

Instead of the hand-wheel e^9 , I may use a nut. It will be noticed that the hand-wheel acts as a weight to assist the atmospheric pressure to open the valve substantially in an instant and before a vacuum is formed.

I have herein shown the valve as located in the cover B'; but it is evident it may be located in other parts of the boiler.

The lower man-hole is provided with a cap or cover B², similar to the cap or cover B', and the said man-hole is rendered liquid and gas tight in a similar manner to the upper man-hole, like parts being designated by like letters.

The cap or cover B² is provided with a preferably central opening, through which is extended a thimble or sleeve p , secured to the cover B², as by bolts p^{20} , and provided, as shown, with screw-threads to be engaged by a threaded nut p^x , over which is slipped a casting or fitting p' , secured to the said cover, as by bolts or screws p^2 .

The casting or fitting p' is provided, as shown, with two ports p^3 p^4 , with which may communicate outlet-pipes. (Not shown.)

The casting or fitting p' forms the valve-chest for a valve p^6 , (shown as a disk-valve,) having its valve-stem p^7 extended through a cover p^8 for the said valve-chest, the said valve-stem being provided, as shown, with screw-threads to engage a threaded opening in a bar p^{10} , secured to the cover p^8 , as by bolts p^{12} , the said valve-stem beyond the bar p^{10} being provided with a suitable hand-wheel p^{13} .

The outer end of the thimble or sleeve p forms the seat for the valve p^6 .

It will be noticed that the acid-resisting lining of tiles is extended through the man-holes and forms an acid-resisting covering for the inner walls or sides of the said man-holes.

The finished product of the digester is blown out and the digester emptied through the thimble p .

The boiler-shell will preferably have applied to it on its inner side a coating or film of acid-resisting material, preferably ozocerite or its refined product, ceresin, as indicated by heavy dark line 20, Fig. 1^a.

I claim—

1. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell and an acid-resisting lining therefor composed of tiles or blocks, of independent metallic boxes or cradles secured to the said shell, and in which the said tiles or blocks are placed, substantially as described.

2. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell and an acid-resisting lining therefor composed of tiles or blocks, of independent metallic boxes or cradles secured to the said shell, and composed of a bottom a^2 and sides a^3 , and a layer a^5 of lead or acid-resisting material interposed between said boxes or cradles, and tiles or blocks, substantially as described.

3. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell and an acid-resisting lining therefor consisting of tiles made as of hollow shells, provided with a filling c' in said hollow shells, of metallic boxes or cradles secured to the said boiler-shell and consisting of a bottom a^2 and sides a^3 , and a layer of acid-resisting material between said boxes and tiles, substantially as described.

4. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell and an acid-resisting lining therefor composed of tiles, of independent metallic boxes or cradles secured to the said boiler-shell, and composed of a bottom a^2 and sides a^3 , and a layer a^5 of lead interposed in said box or cradle between the said tile and cradle, and having end flaps a^6 to be turned up against the end of the tile, substantially as described.

5. The combination, with the shell of a digester, of tiles, metallic cradles for holding said tiles, and means for rigidly securing the cradles to the shell, substantially as described.

6. The combination, with the boiler having a man-hole and provided with an acid-resisting lining composed of tiles and metallic boxes or cradles, of an annular cap for said man-hole secured to said boxes, and a cover provided with an annular ring to engage said cap to form a liquid-tight joint, and means, substantially as described, to secure said cover to the boiler, as and for the purpose set forth.

7. The combination, with a boiler having a man-hole and provided with an acid-resisting lining composed of tiles and metallic boxes or cradles, of an annular cover for said man-hole secured to said boxes and provided with a groove, a lead ring or washer in said groove, a metallic cover B' , provided with a lining e of lead, and an annular ring e' , secured to said cover and provided with a projection e^3 to enter the groove in the said annular cap, substantially as described.

8. The combination, with the boiler having a man-hole, of an acid-resisting lining composed of tiles and metallic boxes or cradles covering the inner side of the boiler and the inner wall or side of the man-hole, a cover for said man-hole, and means to secure said cover to the boiler, substantially as described.

9. The outershell of a digester for the manufacture of pulp, comprising a cylindrical body provided with a conical bottom and top or ends, and with cylindrical extensions forming man-holes in the said bottom and top or ends, in combination with an acid-resisting lining for the inner walls of the said shell and man-holes of said digester, made of a series of independent detachable sections comprising an acid-resisting tile, a metallic box or cradle secured to the said shell of the digester, as by bolts a , and having a bottom a^2 and sides a^3 , in which the said tile is placed, and a layer a^5 of lead or other acid-resisting material interposed between the said box or cradle and the acid-resisting tile, covers for said bottom and top man-holes, and means to secure said covers to the said digester-shell, substantially as described.

10. The outer shell of a digester for the manufacture of pulp, comprising a cylindrical body provided with a conical bottom and top or ends, and with cylindrical extensions forming man-holes in the said bottom and top or ends, in combination with an acid-resisting lining for the inner walls of the said shell and man-holes of said digester, made of a series of independent detachable sections, each comprising an acid-resisting tile and an acid-resisting metallic box or cradle secured to the shell of the digester, as by bolts a , and having a bottom a^2 , sides a^3 , and ends a^4 , in which

the said tile is secured, and a layer f of lead or other acid-resisting material interposed between the said acid-resisting metallic boxes or cradles and the said shell of the digester, covers for the said man-holes, and means to secure said covers to the shell of the said digester, substantially as described.

11. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell, of an acid-resisting lining therefor made of independent detachable sections, each comprising an acid-resisting tile and a box or cradle having a bottom a^2 and sides a^3 , in which the said tile is placed, and a coating of ozocerite applied to the boiler-shell, substantially as described.

12. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell, of an acid-resisting lining therefor made of independent detachable sections, each comprising an acid-resisting tile and a box or cradle having a bottom a^2 and sides a^3 , in which the said tile is placed, and a coating of ozocerite applied to the said boxes or cradles, substantially as described.

13. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell, of an acid-resisting lining therefor made of independent detachable sections, each composed of an acid-resisting tile or block and a box or cradle to hold the same, and a layer of acid-resisting material between said box and boiler-shell, substantially as described.

14. In a boiler or digester for the manufacture of pulp, the combination, with the boiler-shell, of an acid-resisting lining therefor made of independent detachable sections, each composed of an acid-resisting tile or block and a box or cradle to hold the same, and a layer of acid-resisting material between said box and boiler-shell, and a coating of ozocerite applied to the interior of said boiler-shell, substantially as described.

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

RICHARD LAVERY.

Witnesses:

JAS. H. CHURCHILL,
MABEL RAY.