

No. 762,867.

PATENTED JUNE 21, 1904.

H. A. ALLEN.
ORE SEPARATOR.

APPLICATION FILED JULY 23, 1902.

NO MODEL.

4 SHEETS—SHEET 1.

Fig. 2.

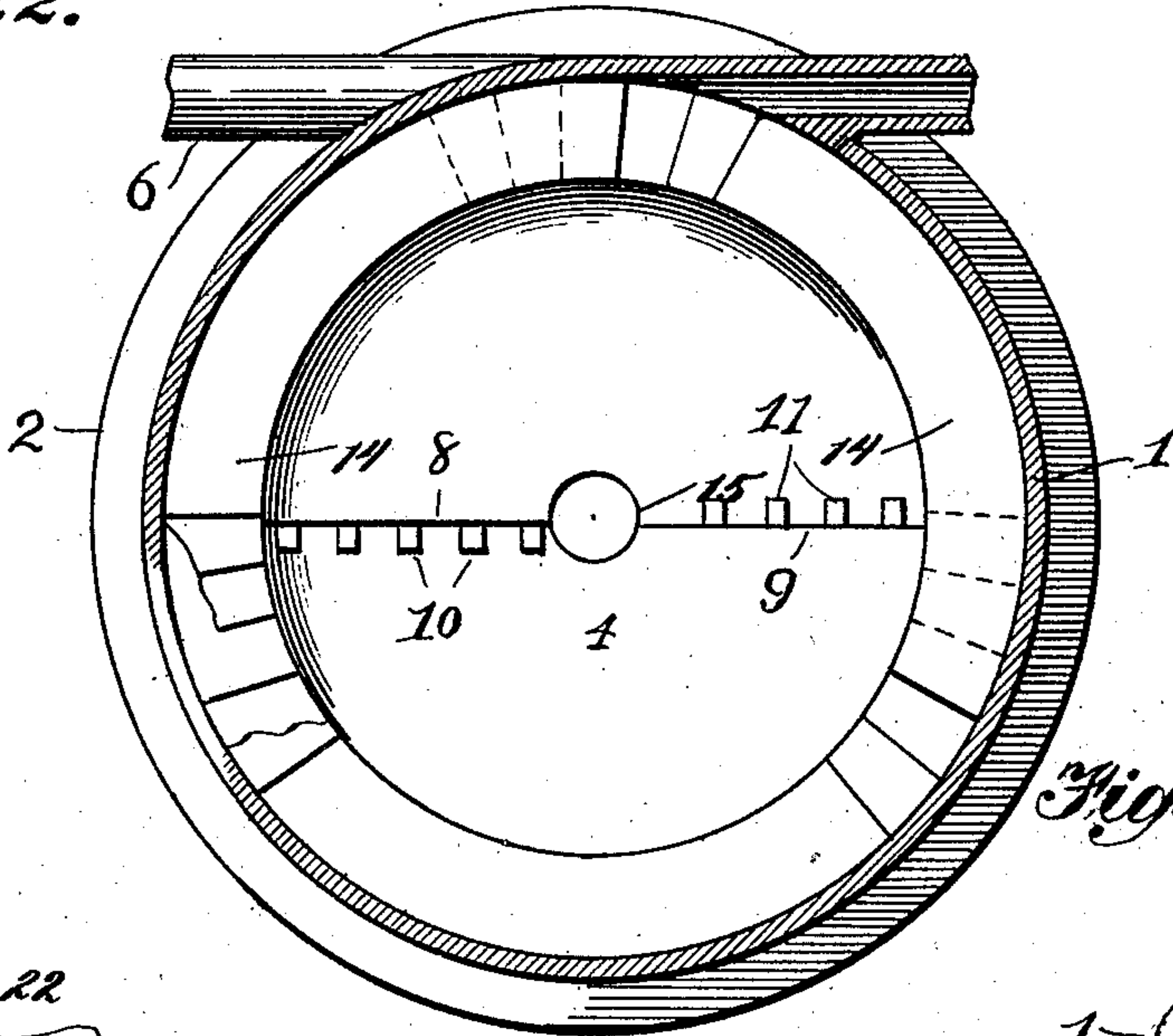


Fig. 3.

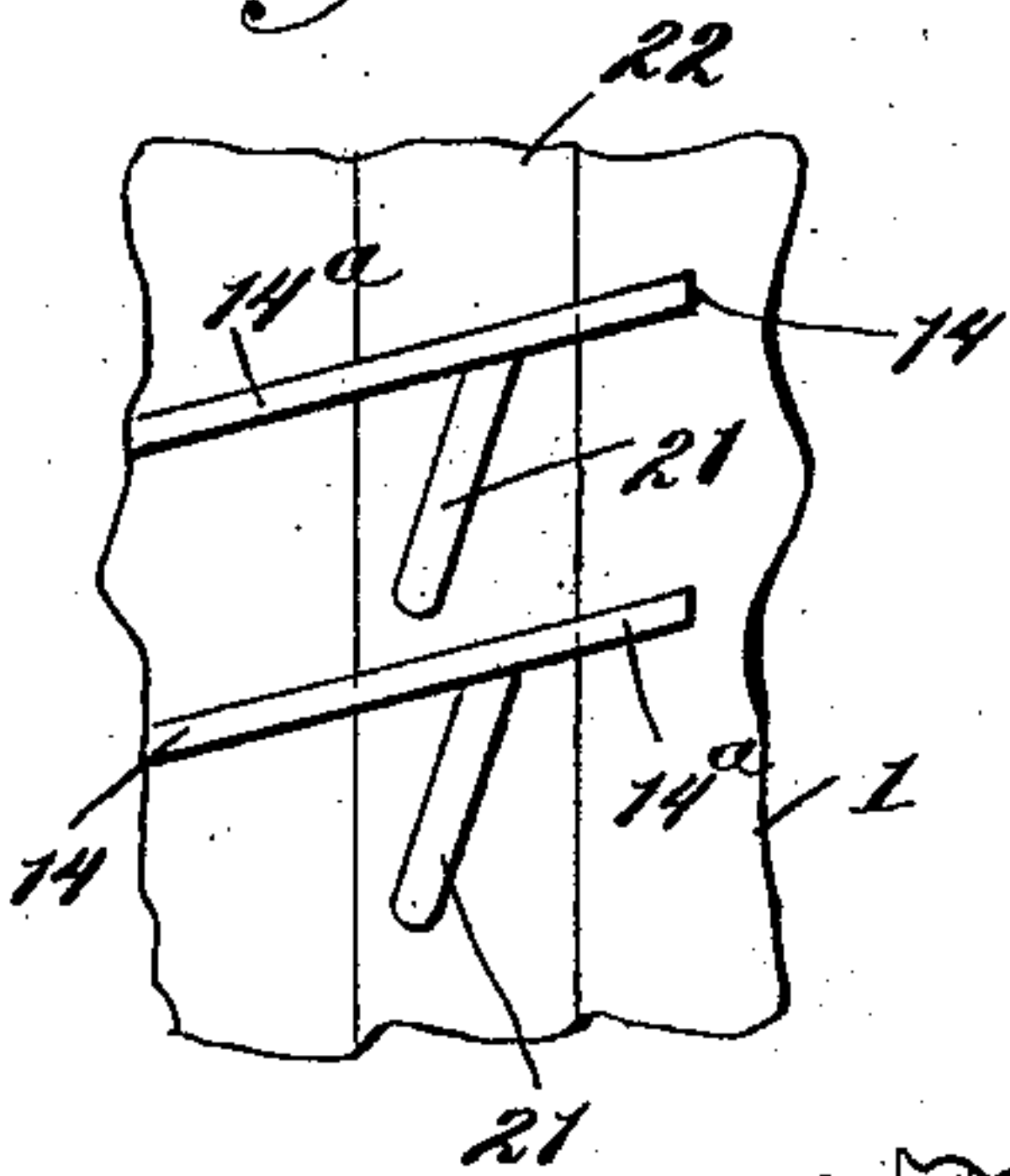
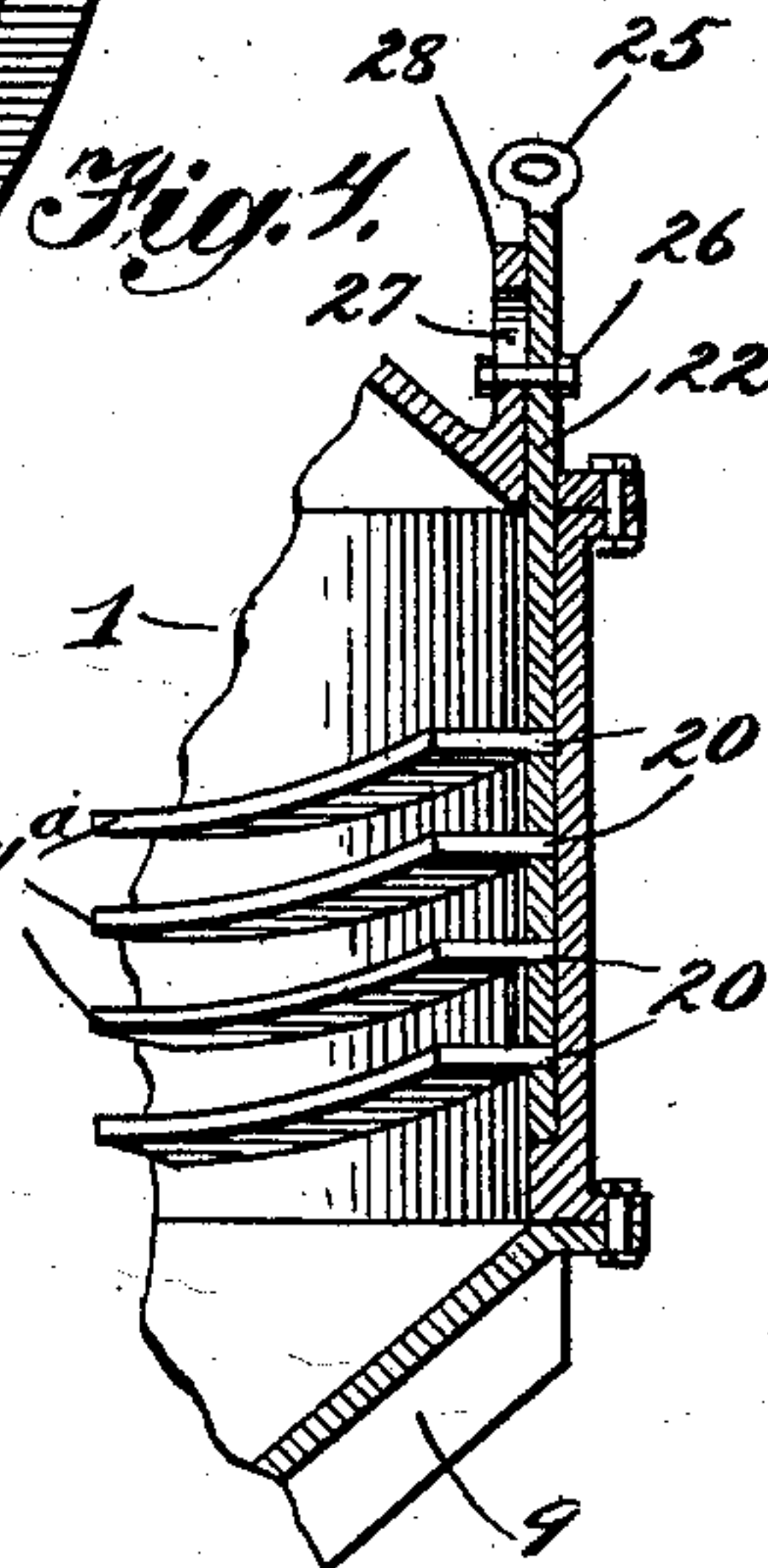
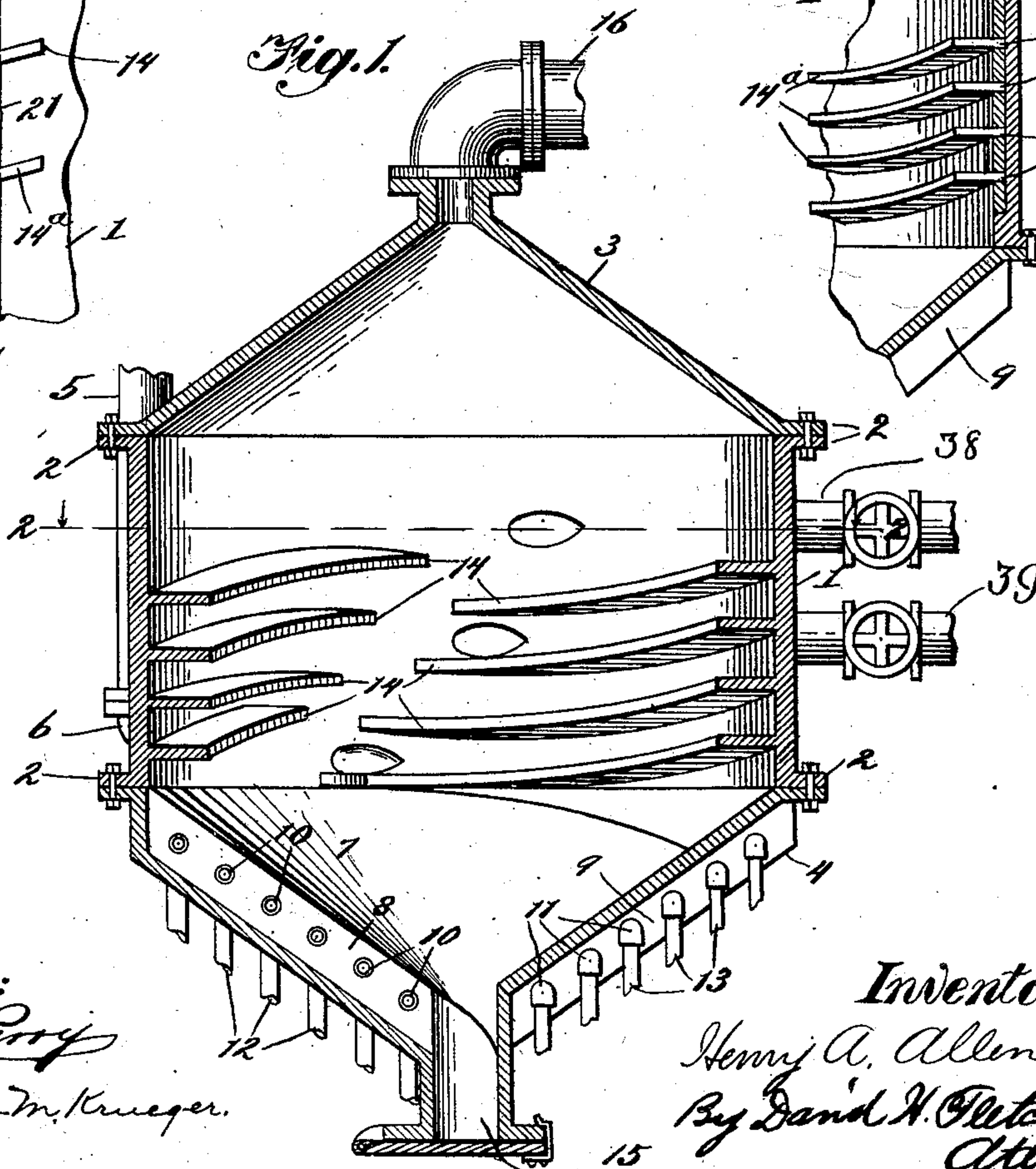


Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 7.

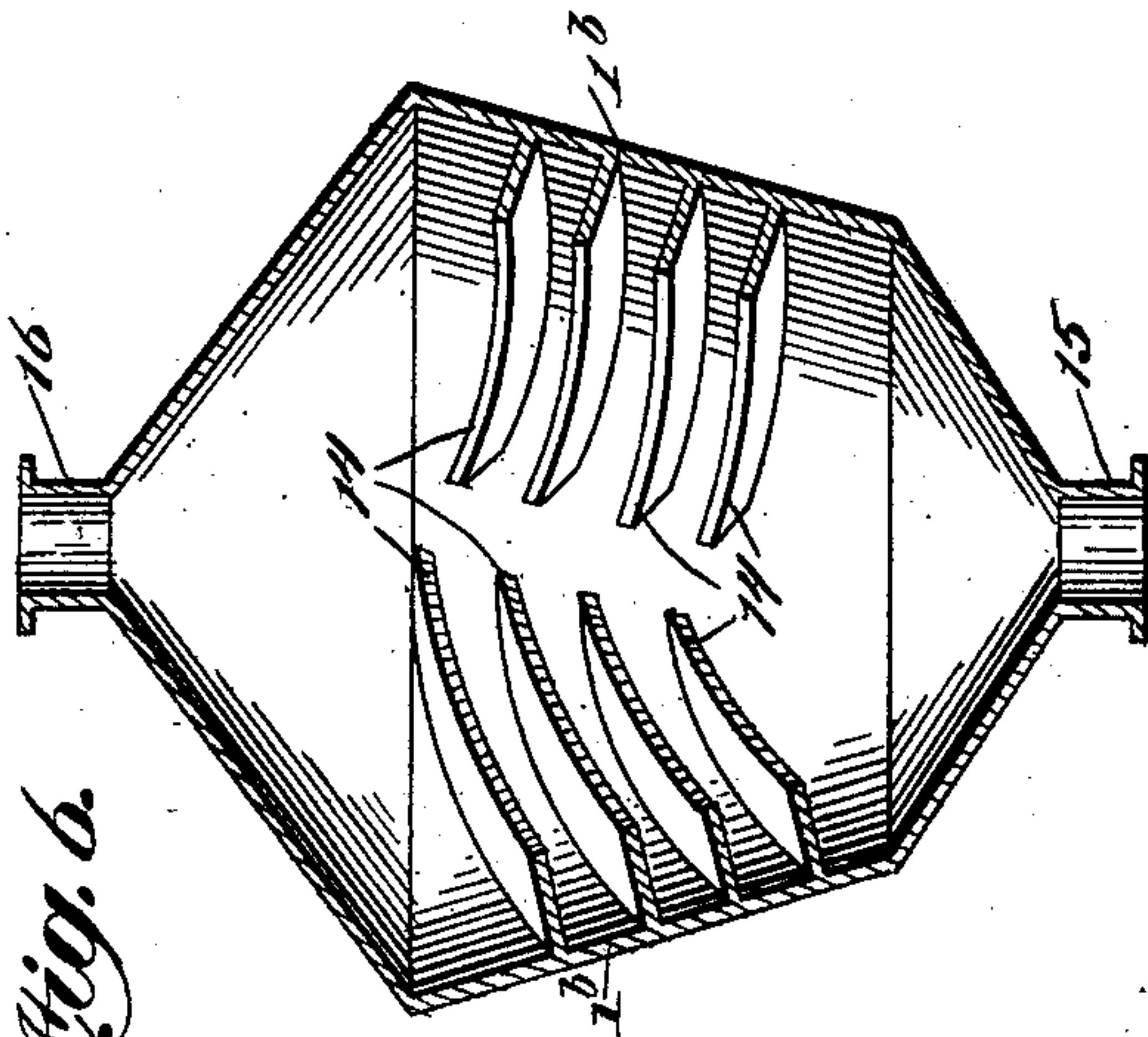
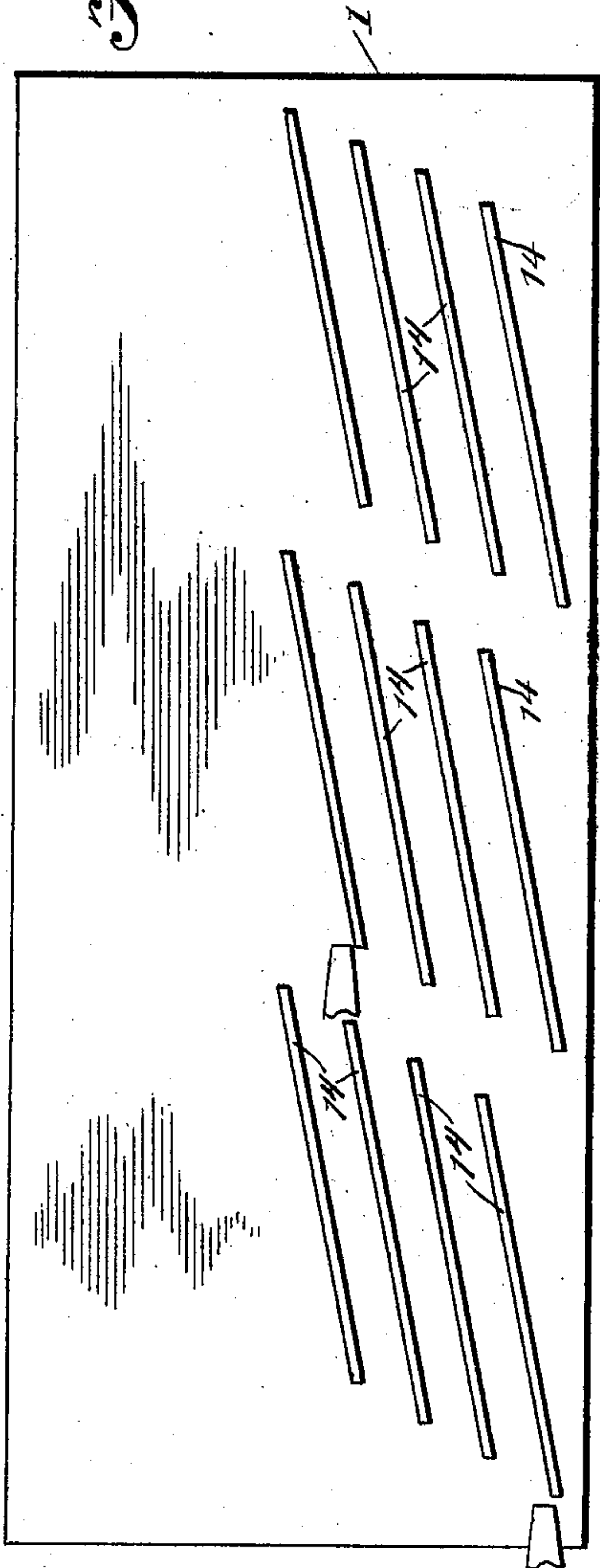


Fig. 6.

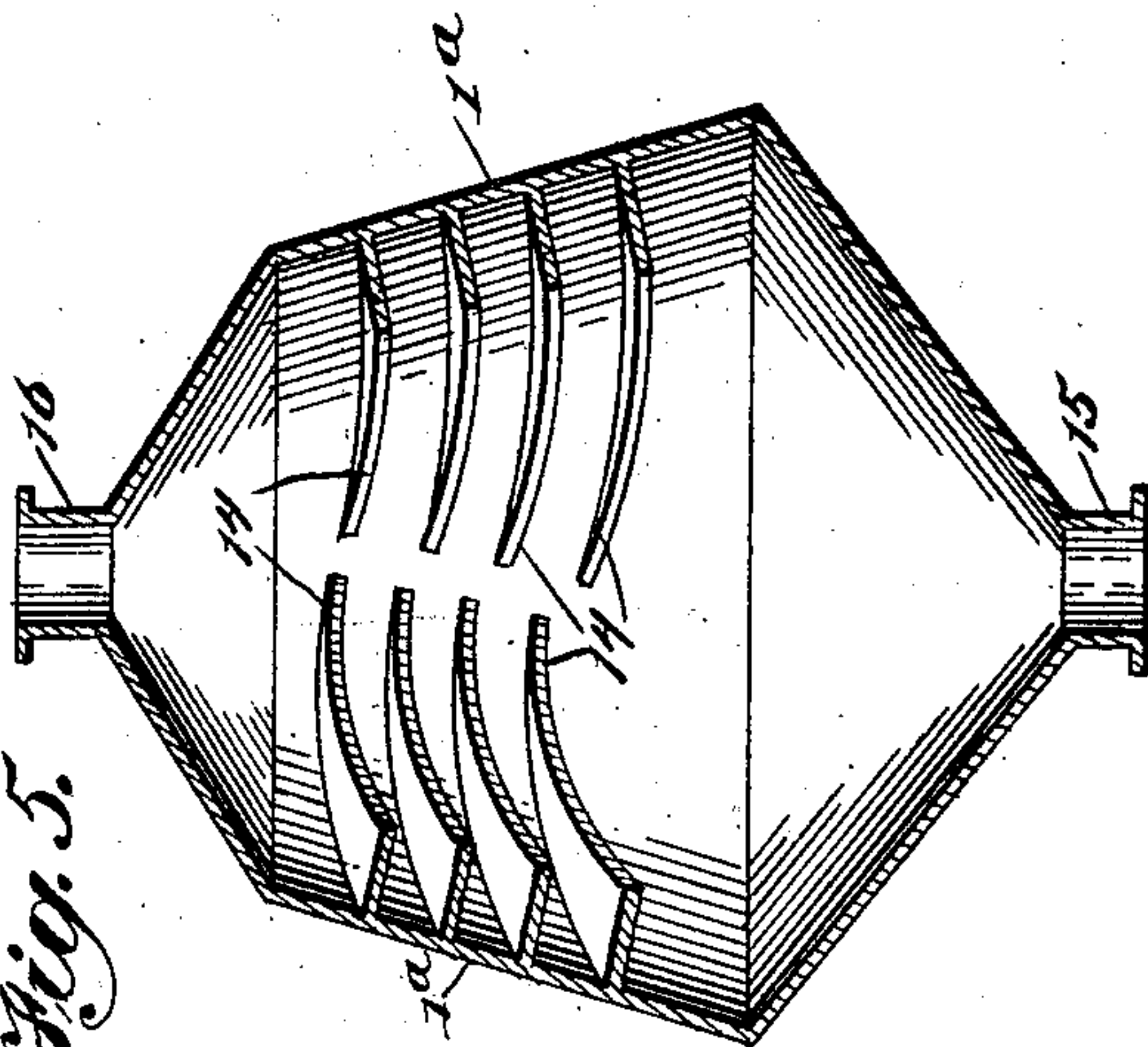


Fig. 5.

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4 SHEETS—SHEET 3.

Fig. 10.

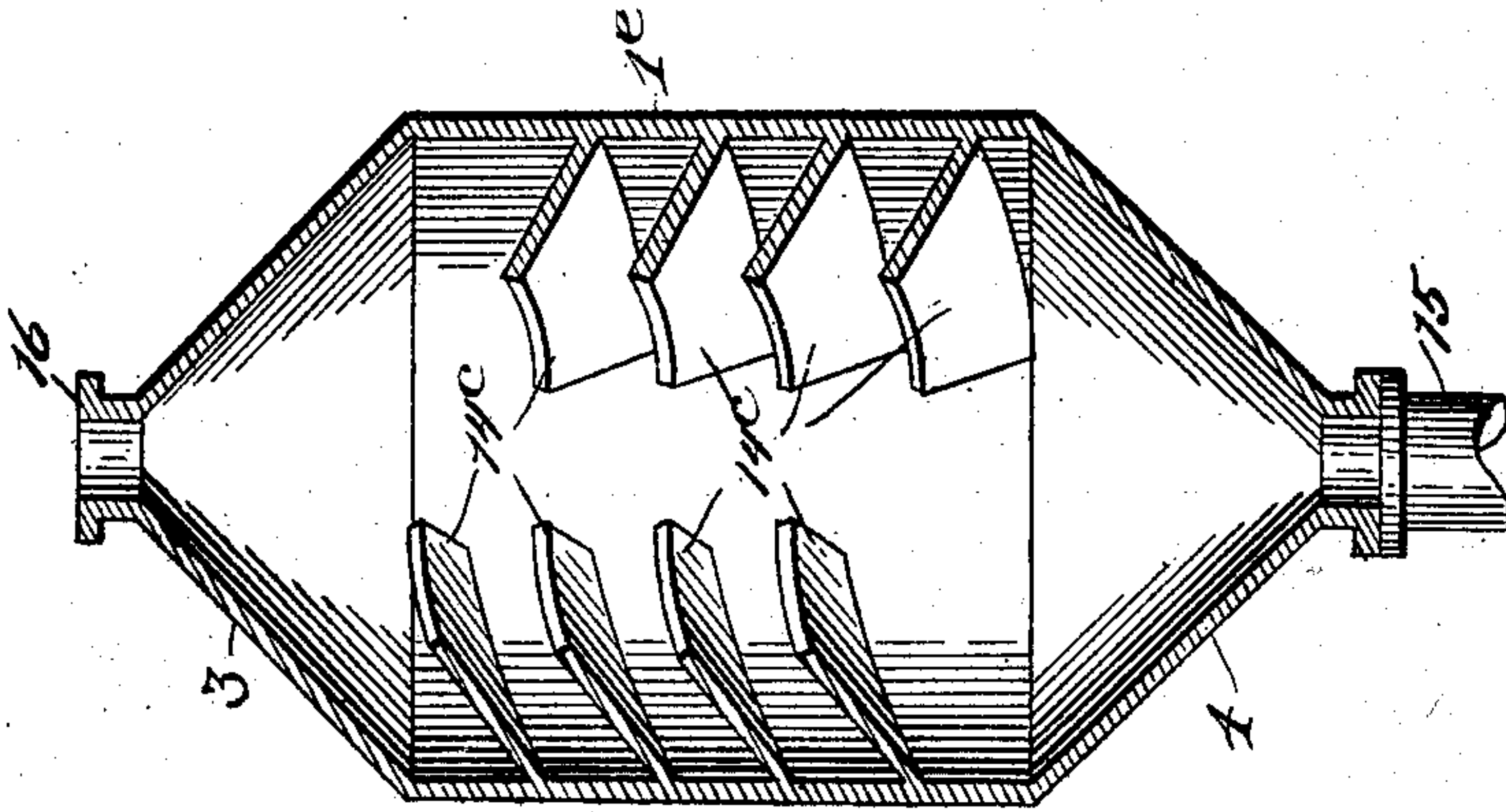


Fig. 9.

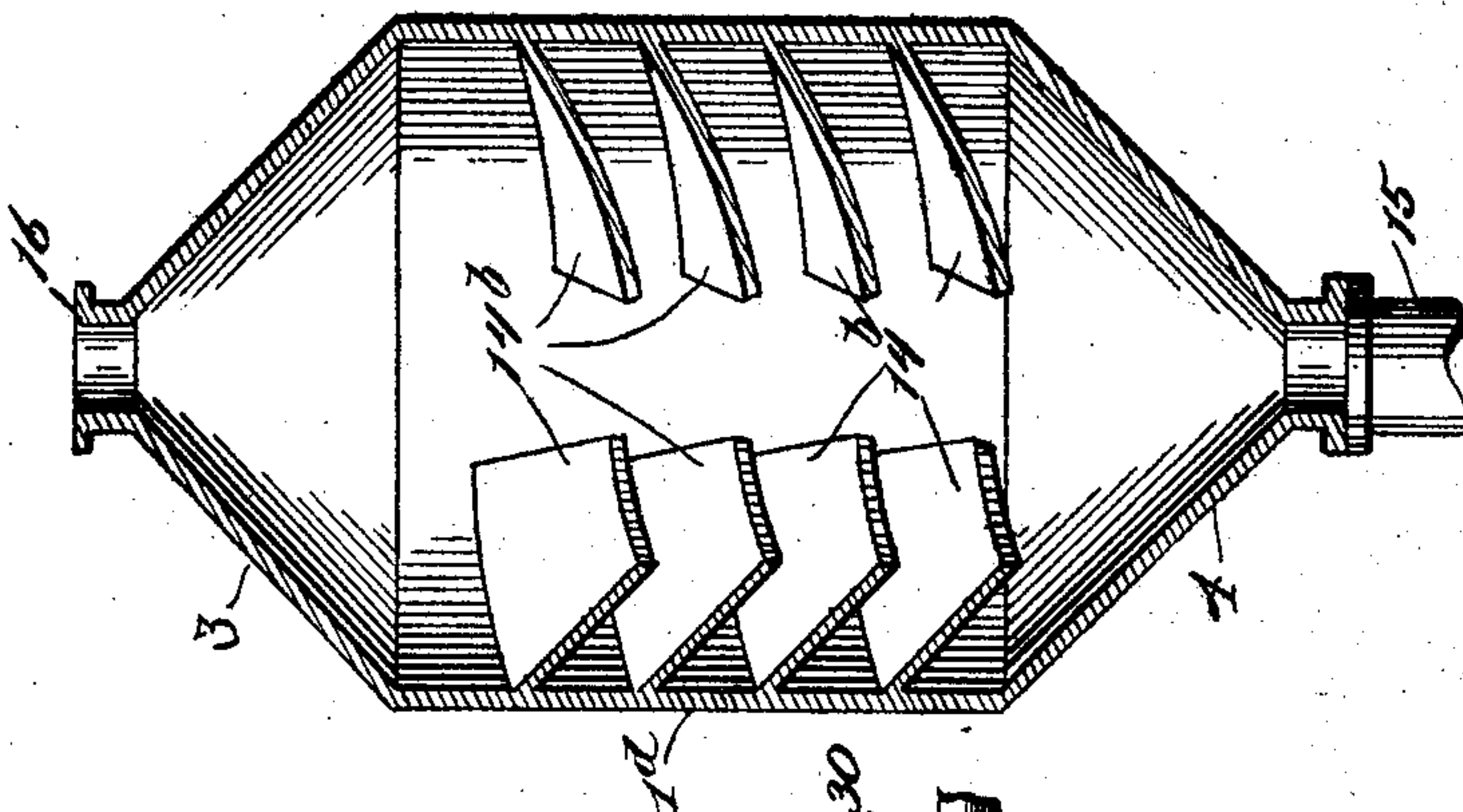
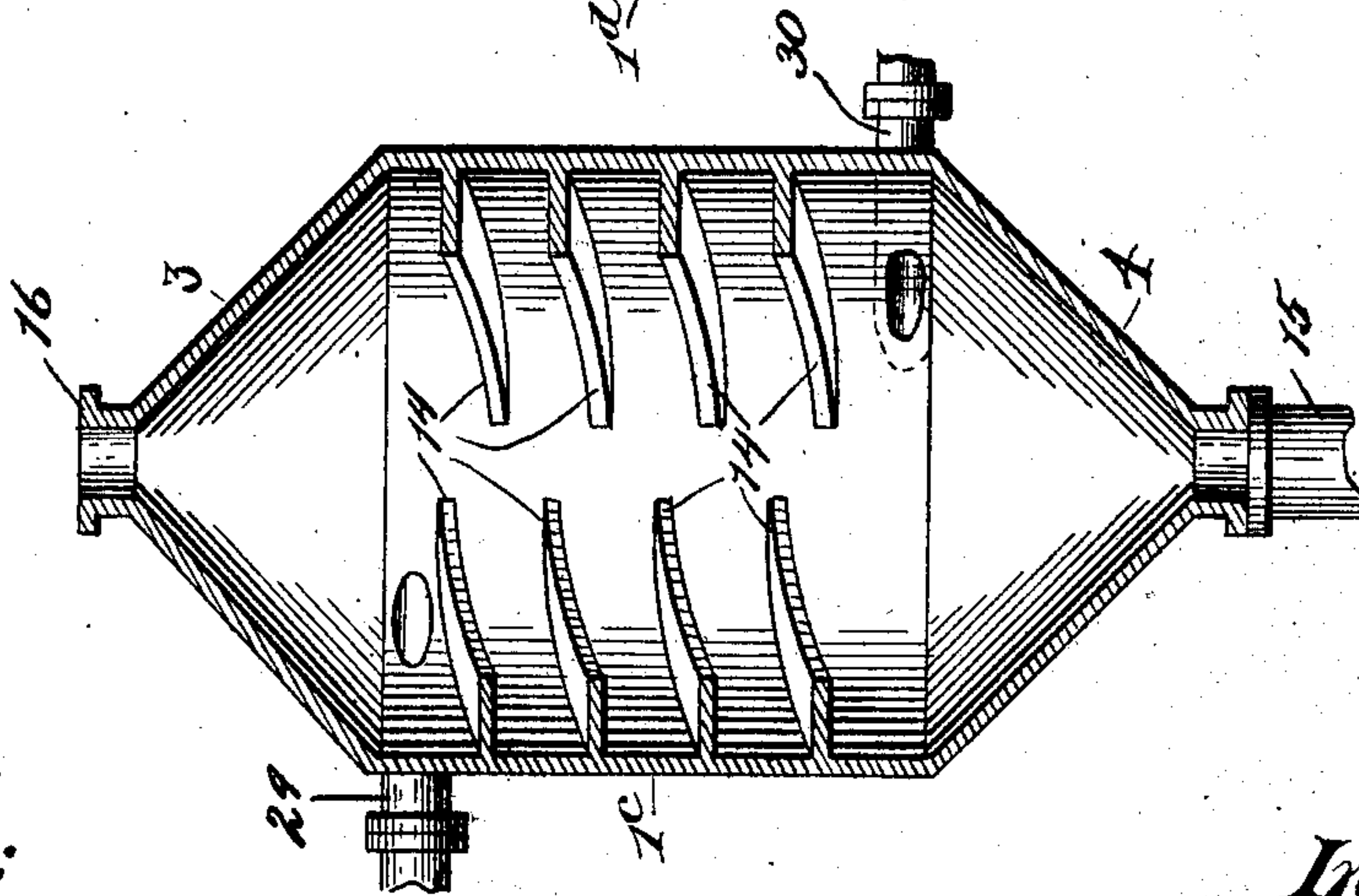


Fig. 8.



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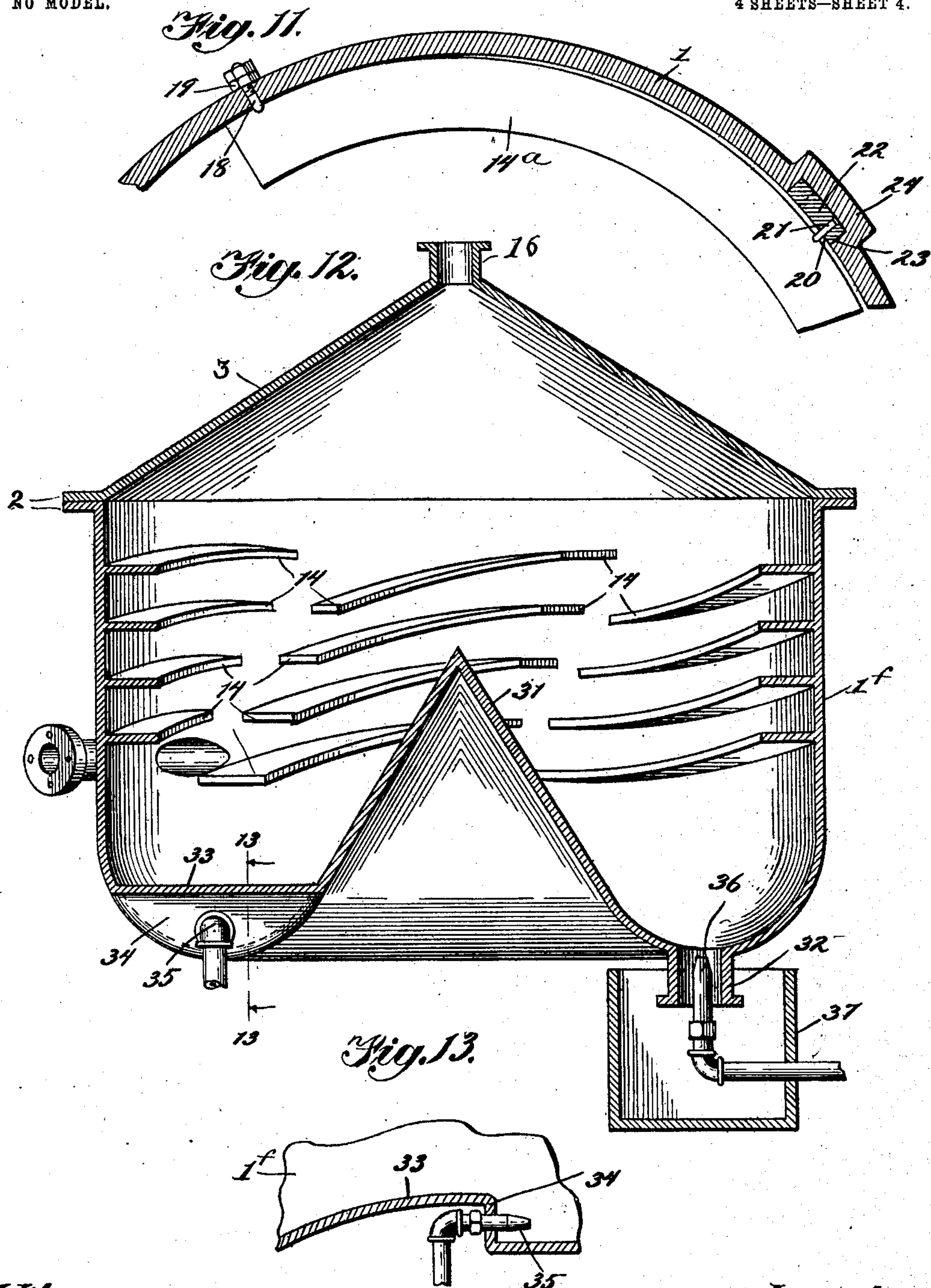
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4 SHEETS—SHEET 4.



Witnesses:
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UNITED STATES PATENT OFFICE.

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ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 762,867, dated June 21, 1904.

Original application filed August 12, 1901, Serial No. 71,758. Divided and this application filed July 23, 1902. Serial No. 116,671.
(No model.)*To all whom it may concern:*

Be it known that I, HENRY A. ALLEN, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful
 5 Improvements in Ore-Separators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, this application being a division of an appli-
 10 cation heretofore filed by me as Serial No. 71,758.

My invention has for its object to utilize the principle of the vortex whirl for the separation of particles of varying specific gravities, and particularly of ores; and it consists, primarily, in providing a closed vessel with a series of inclined intermittent ledges upon its inner wall or periphery so disposed with reference to each other that the discharge end of one shall be slightly above the receiving end of another, suitable induction and eduction pipes, the former arranged tangentially to the wall of the vessel, and means for introducing the material to be separated, together with a
 25 liquid, either or both being under sufficient pressure to cause a rapid vortex whirl in the vessel, whereby the material or materials to be separated may be acted upon in such a way that the particles of heavier may be separated
 30 from those of lighter gravities.

A further object is to provide means for rendering said ledges adjustable, so that the incline thereof may be varied at will to meet varying conditions, all of which is herein-
 35 after more specifically described and claimed.

In the drawings, Figure 1 is a central vertical sectional view of an ore-separator embodying the features of my invention. Fig. 2 is a horizontal sectional view thereof in plan, taken
 40 upon the line 22, Fig. 1. Fig. 3 is a side view in detail of a portion of the inner wall, showing means for adjusting the incline of the vanes. Fig. 4 is a vertical sectional view taken at right angles thereto. Figs. 5 and 6 are central ver-
 45 tical sectional views showing modified forms of vessels and modified constructions of vanes. Fig. 7 is a diagrammatic view showing the manner of placing the interrupted vanes.

Figs. 8, 9, and 10 are central vertical sectional views of vessels, showing modified forms of construction. Fig. 11 is a horizontal sectional view in plan, showing a portion of the mechanisms for adjusting the vanes. Fig. 12 is a central vertical sectional view of a modified form of separating vessel; and Fig. 13 is a
 50 sectional view in detail, taken upon the line 13 13, Fig. 12.

Corresponding characters of reference in the different figures indicate like parts.

Referring to the drawings, 1, Fig. 1, represents a closed vessel, preferably formed from metal, the main body of which is cylindrical and is provided with flanges 2 2, to which end pieces or heads 3 4, having like flanges, are bolted, as shown. Said vessel is vertically disposed
 60 and is provided with an inlet-pipe 5, the lower portion 6, Figs. 1 and 2, being preferably connected with the main body of the vessel and arranged tangentially thereto. Said inlet-pipe may be of indefinite length; but if grav-
 65 ity is depended upon to produce pressure upon the material fed to the separator its length should be sufficient to impart the requisite pressure or "head" to the material.

The bottom 4 is preferably made auger-shaped, as shown at 7, Fig. 1, and is provided, preferably, with two vertical ledges 8 9, into which nozzles 10 11 are inserted, said nozzles being severally connected with pipes 12 and 13, respectively, which in turn are connected
 75 with a source of water or other liquid supply under pressure.

Ledges 14 are secured to or formed upon the interior of the body 1 of the separating vessel, said body being shown in Fig. 7 as flat-
 80 tened to more clearly illustrate the arrangements and relation of the several ledges, each of which is so inclined that its forward or discharging end is above the level of the receiving end of the next ledge in the series. The
 85 relative position of said ledges with respect to each other is clearly indicated in full and dotted lines in Figs. 2 and 7, which latter figure is diagrammatic, as stated, and is not an accurate development of the vanes as
 90 shown in Fig. 2. A discharge-conduit 15 is

provided at the bottom for particles of a heavier gravity and a central discharge-pipe 16 at the top for particles of lighter gravity.

The operation of my improved separator is as follows: The material from a suitable trough or launder or from a hydraulic pump of any improved construction is fed through the pipe 5 to the separator. At the same time water is introduced through the nozzles 10 and 11 not only to cause a more thorough dilution of the material, but to induce a vortex whirl in the contents of the vessel. The heavier particles tend to move toward the walls of the vessel, where they are brought into contact with the intermittent or interrupted ledges 14. As the particles pass from the end of one ledge they are influenced by the action of gravity, and moving in a forward and downward motion they fall upon succeeding ledge or ledges or to the bottom part of the device, the operation being continued until they fall into the lower discharge-pipe 15. At the same time the particles of lighter gravity are carried upwardly, the entire mass, so to speak, being arranged in a succession of layers of different specific gravities.

The ledges 14 may be either permanently fixed to the walls of the vessel or they may be rendered adjustable, so as to enable the incline thereof to be varied. The latter may be accomplished by supporting the ledges at or near the respective ends. In Fig. 11 a pivot-pin 18 is shown as being attached rigidly to the adjustable ledge 14^a and extended through a bore in the wall of the vessel, being secured in place by means of jam-nuts 19. At or near the opposite end there is rigidly attached to the ledge a similar pin 20, Figs. 4 and 11, which is extended through a slot 21, formed in a vertical bar 22, loosely fitted in a groove or guideway 23, formed in the side of the vessel by means of an offset 24, so as to cause the bar 22 to be flush with the inner surface of the vessel. A handle 25, Fig. 4, upon the upper end of the bar 22 enables said bar to be raised or lowered to any desired position, where it may be secured by means of a bolt 26, passing through said bar and through a vertical slot 27, formed in an upwardly-projecting lug 28, said bolt having a suitable tightening-nut thereon.

In various figures of the drawings I have shown modified constructions of the separating vessel, all of which are included within the same general principle—viz., that of providing a closed vessel so constructed that a vortex whirl may be imparted to the material fed therein in such a way as to cause the particles of different gravities to be so separated that they may be discharged at different levels with respect to each other.

In Fig. 5 the body 1^a of the vessel is shown as being tapered upwardly, while in Fig 6

this construction is reversed. In both the ledges are arranged at right angles to the wall, thus imparting a downward slant in the former and an upward slant in the latter.

In Figs. 8 to 10, inclusive, the body of the receptacle is cylindrical. While in the former figure the ledges are the same as in Fig. 1, the inlet-pipe 29 is placed at the top of the cylindrical portion of the vessel and a discharge-pipe 30 at the bottom thereof. One or more such pipes may be used, if desired, for purposes of classification to supplement the central discharge-pipe at the bottom, said pipes being arranged, for example, as indicated by 38 and 39 in Fig. 1.

In Fig. 9 it will be observed that the ledges 14^b are shown as having a marked downward incline, while the ledges 14^c in Fig. 10 are inclined upwardly to a corresponding degree.

In Fig. 12 a central cone-shaped projection 31 is extended upwardly from the bottom of the vessel 1^e, thereby leaving an annular trough in said bottom to receive the particles of heavier gravity, which may be discharged through an outlet 32 formed therein. This discharge may be facilitated by inclining a portion of the bottom upwardly, as shown at 33, Figs. 12 and 13, so as to form a step therein, and inserting a nozzle 35 through the wall thereof, said nozzle being connected with a source of water-supply under pressure. A jet from said nozzle would tend to wash the particles in the annular trough to the opening 32, in which latter I prefer to place an upwardly-projecting adjustable nozzle 36, connected with a like source of water-supply, a jet from which would tend to lift such lighter particles as might still be retained in the mass of concentrates passing into the discharge-opening. A receptacle 37, Fig. 12, is provided to receive the concentrates.

By means of my improved device I am enabled to utilize the force of gravity, which is rendered more effective by the use of the interrupted ledges, to produce separation, and inasmuch as the pressure and velocity of the incoming fluid or fluids may be varied at will, while the incline of the ledges may also be adjusted, it is obvious that a very effectual separation may be made of materials of varying gravities, it being understood that any predetermined pressure may be maintained therein.

Having thus described my invention, I claim—

1. An apparatus of the class described, in which is combined a stationary circular closed receptacle, an inlet-pipe arranged tangentially thereto, discharge-openings above and below the level of the inlet-opening, and a series of spirally-inclined ledges arranged with the forward end of one ledge above the rear end of the next succeeding ledge, the lower end of one ledge being below the level of the inlet-

opening, whereby the material fed to the receptacle may be directed upwardly upon the inclined ledges while the heavier particles may be free to fall between said ledges.

5 2. An apparatus of the class described, in which is combined a stationary closed receptacle, an inlet-pipe arranged tangentially thereto, a series of spirally-inclined ledges arranged in groups, the forward ends of the
10 ledges in the one group being slightly above the rear ends of the ledges in the next succeeding group, a discharge-opening at the bottom and one or more discharge-openings above the level of the inlet-opening, substantially as described.

15 3. An apparatus of the class described, in which is combined a closed receptacle having a tapered bottom consisting of a plurality of surfaces inclined to a plane at right angles to the axis of the receptacle, inlet-pipes projecting through the vertical members of the stepped portions, means for admitting the ore to the body of the vessel, a discharge-opening at the bottom and one or more discharge-openings upon a higher level than that at which
20 the ore is admitted, substantially as set forth.

4. In an apparatus of the class described, the combination of a vessel, an inlet-opening arranged tangentially thereto, a discharge-opening at the bottom, one or more discharge-openings above the level of the inlet-opening, a series of interrupted spirally-inclined ledges secured to the inner wall of the receptacle and means for adjusting the incline thereof,
25 30 substantially as specified.

5. An apparatus of the class described, in which is combined a stationary circular receptacle having an inlet-conduit disposed tangentially thereto, discharge-openings at
35 40 the bottom and top respectively, and a series of upwardly-inclined spiral ledges upon the inner periphery of said receptacle, said ledges commencing beneath said inlet-opening, the

beginning of each ledge commencing at a level below the upper end of the next succeeding ledge. 45

6. An apparatus of the class described, in which is combined a stationary circular receptacle, a tangentially-arranged inlet-opening for admitting the material to be separated, 50 means for discharging the separated material at different levels, a series of inclined interrupted ledges or vanes formed upon the interior periphery of said receptacle a tapered bottom in the form of a broken spiral having 55 interposed vertical steps, and a series of inlet-nozzles directed upon said tapered bottom.

7. An apparatus of the class described, in which is combined a stationary circular receptacle, means for admitting the material to 60 be separated, means for discharging the separated materials at different levels, a series of interior peripheral interrupted vanes or ledges, and a plurality of nozzles.

8. The combination in a device of the class 65 described, of a circular receptacle having an inlet-opening, a tapered bottom in the form of a broken spiral, having interposed vertical steps, and a series of inlet-nozzles projecting through the rise in said steps, and a series of 70 interrupted inclined peripheral vanes.

9. The combination in a device of the class described, of a separating receptacle having feed and discharge openings respectively, of a series of interior peripheral spirally-arranged interrupted or intermittent ledges and a plurality of tangentially-arranged fluid-inlet nozzles directed upon said vanes, substantially as described. 75

In testimony whereof I have signed this 80 specification, in the presence of two subscribing witnesses, this 21st day of July, 1902.

HENRY A. ALLEN.

Witnesses:

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C. E. JORDAN.