

No. 762,866.

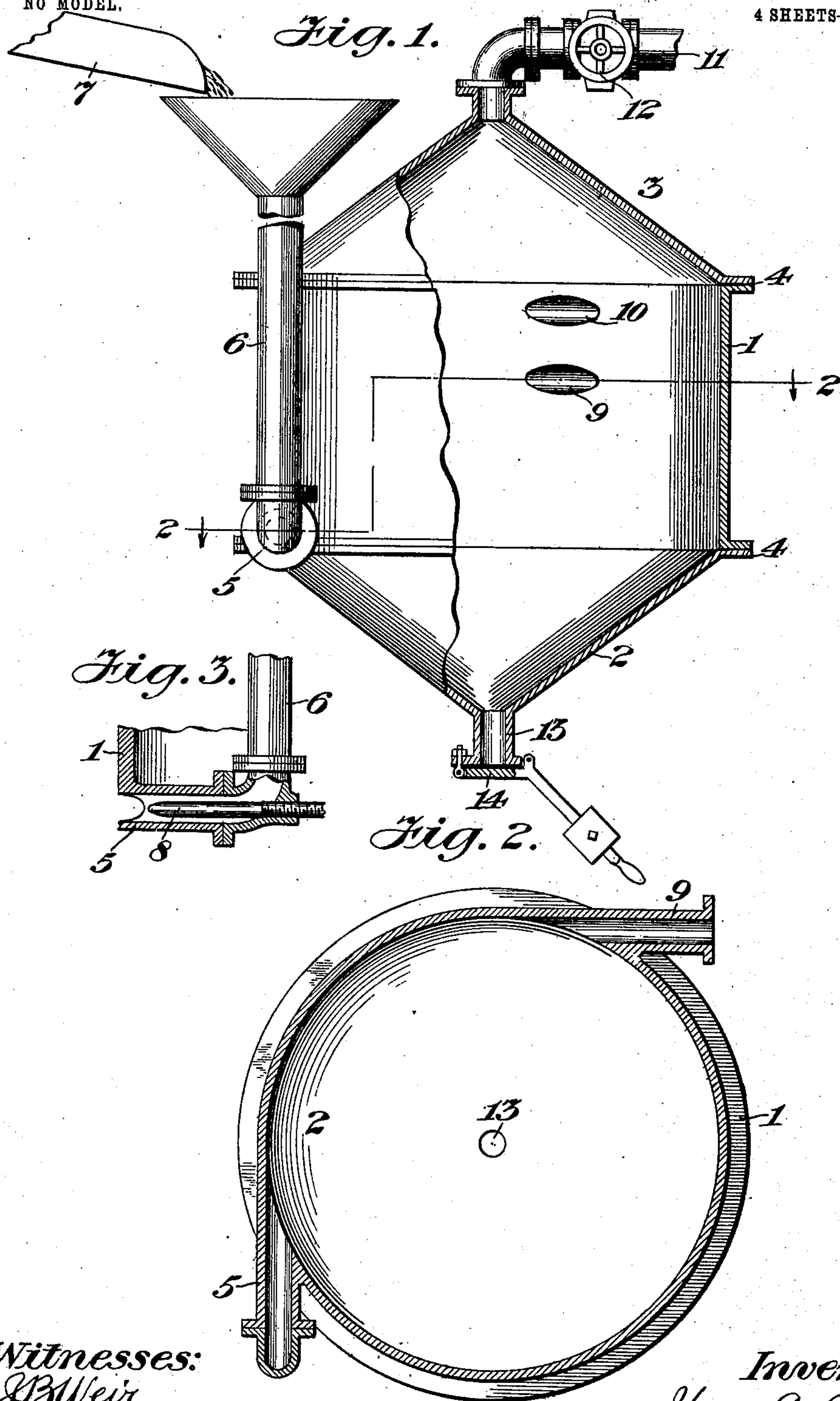
PATENTED JUNE 21, 1904.

H. A. ALLEN.  
ORE SEPARATOR.

APPLICATION FILED AUG. 12, 1901.

NO MODEL.

4 SHEETS—SHEET 1.



Witnesses:  
J. B. Weir  
C. W. Smith

Inventor:  
Henry A. Allen,  
By David H. Fletcher,  
his Atty.

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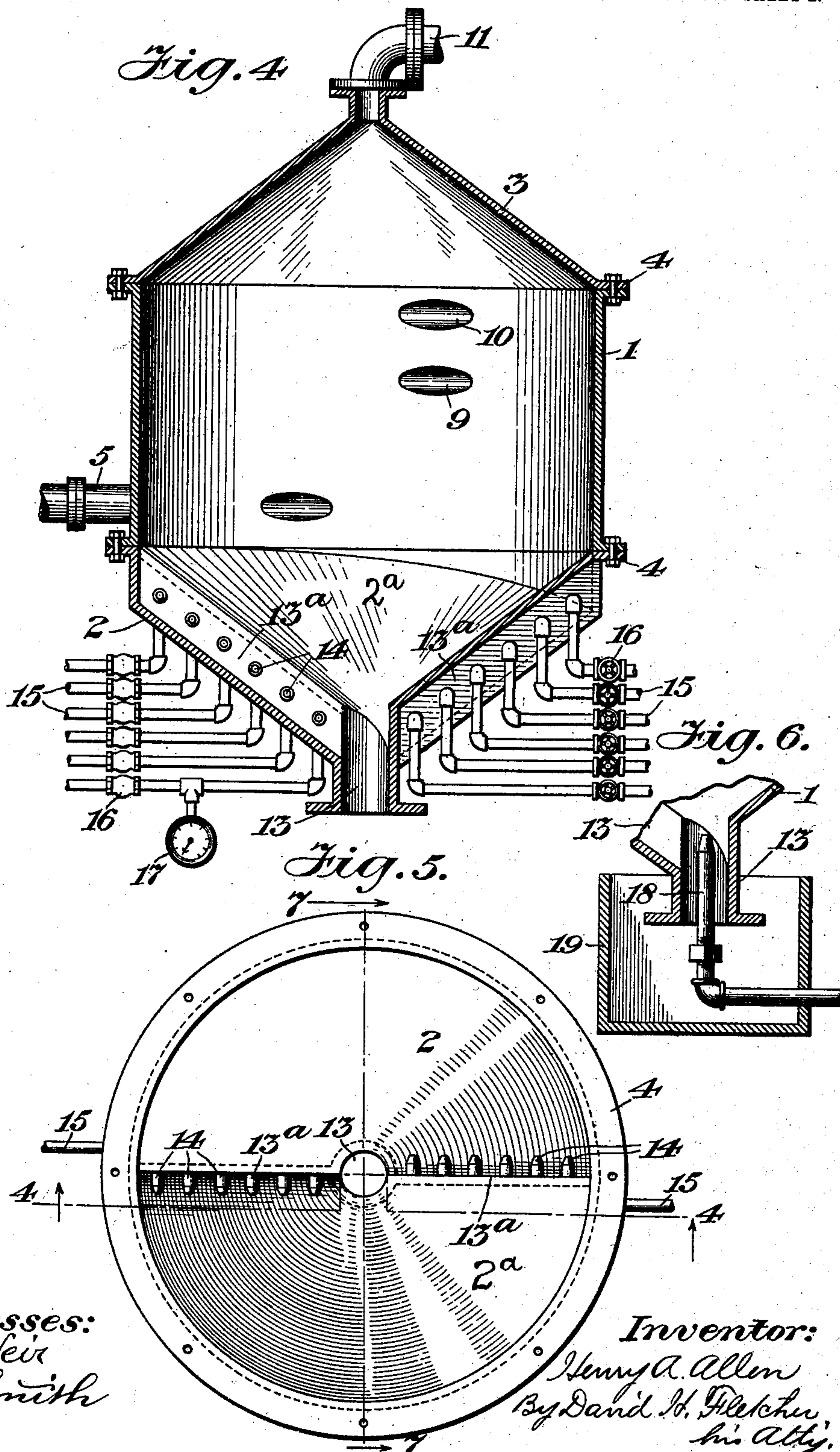
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4 SHEETS—SHEET 2.



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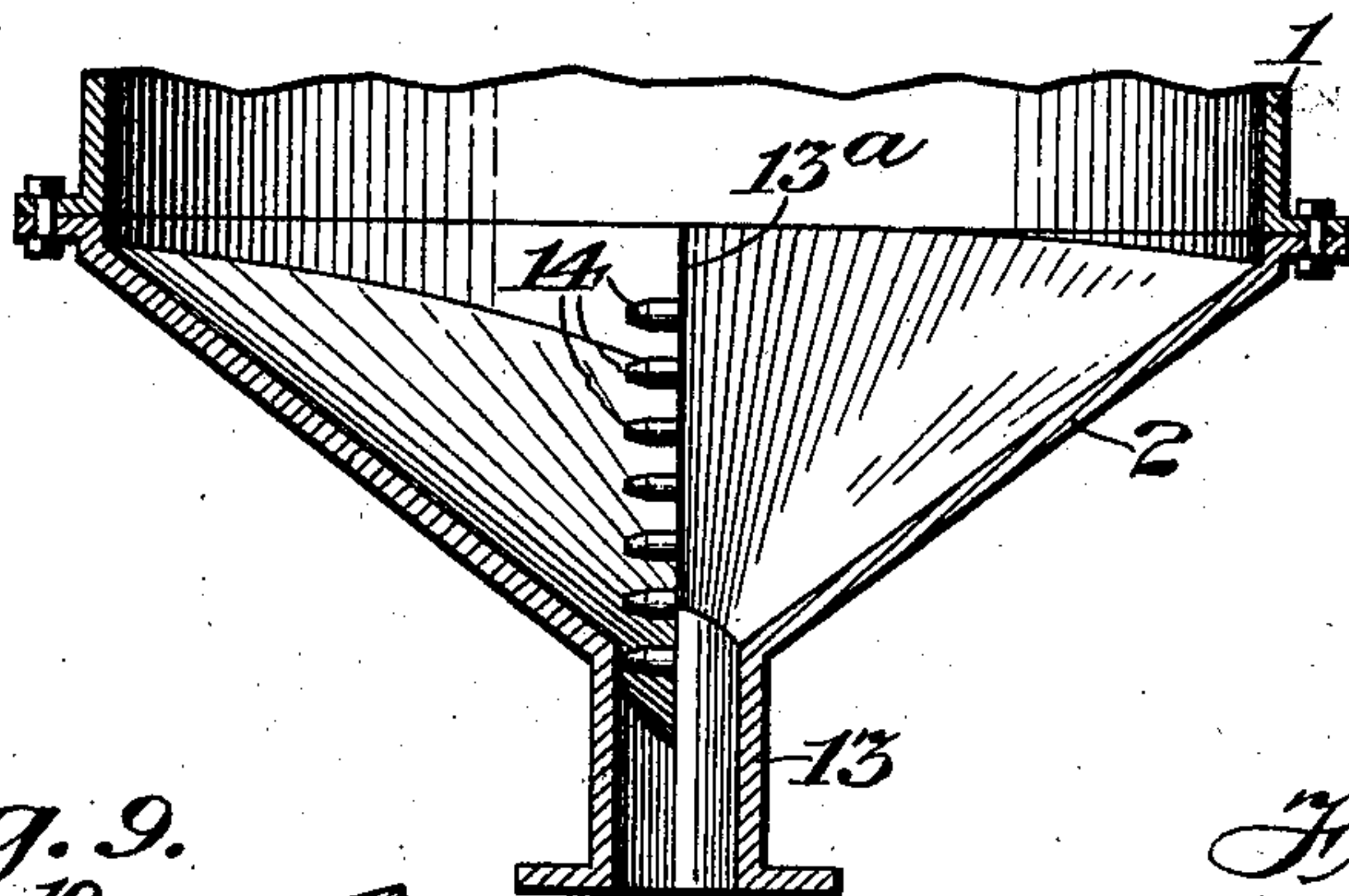
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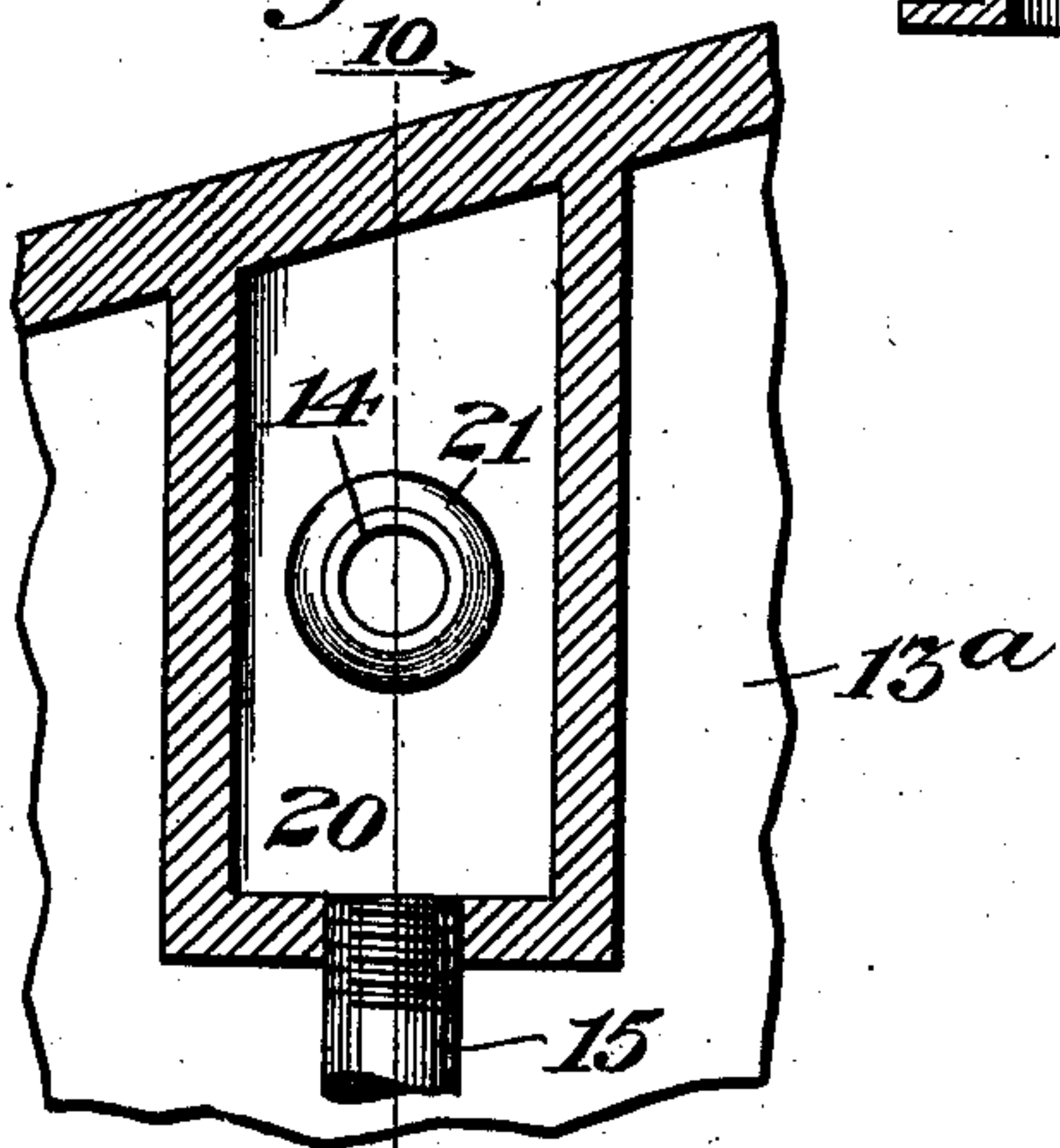
NO MODEL.

4 SHEETS—SHEET 3.

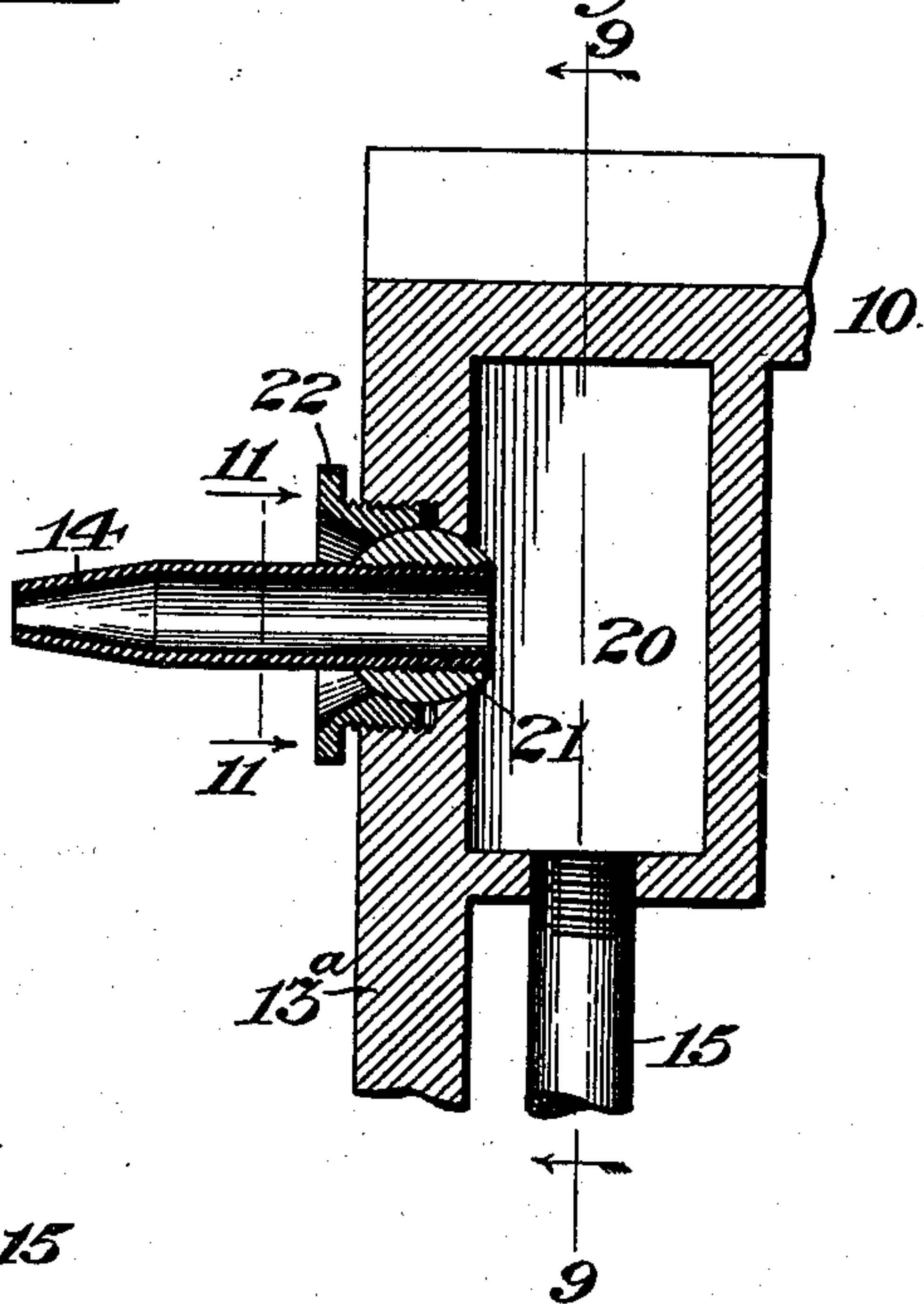
*Fig. 7.*



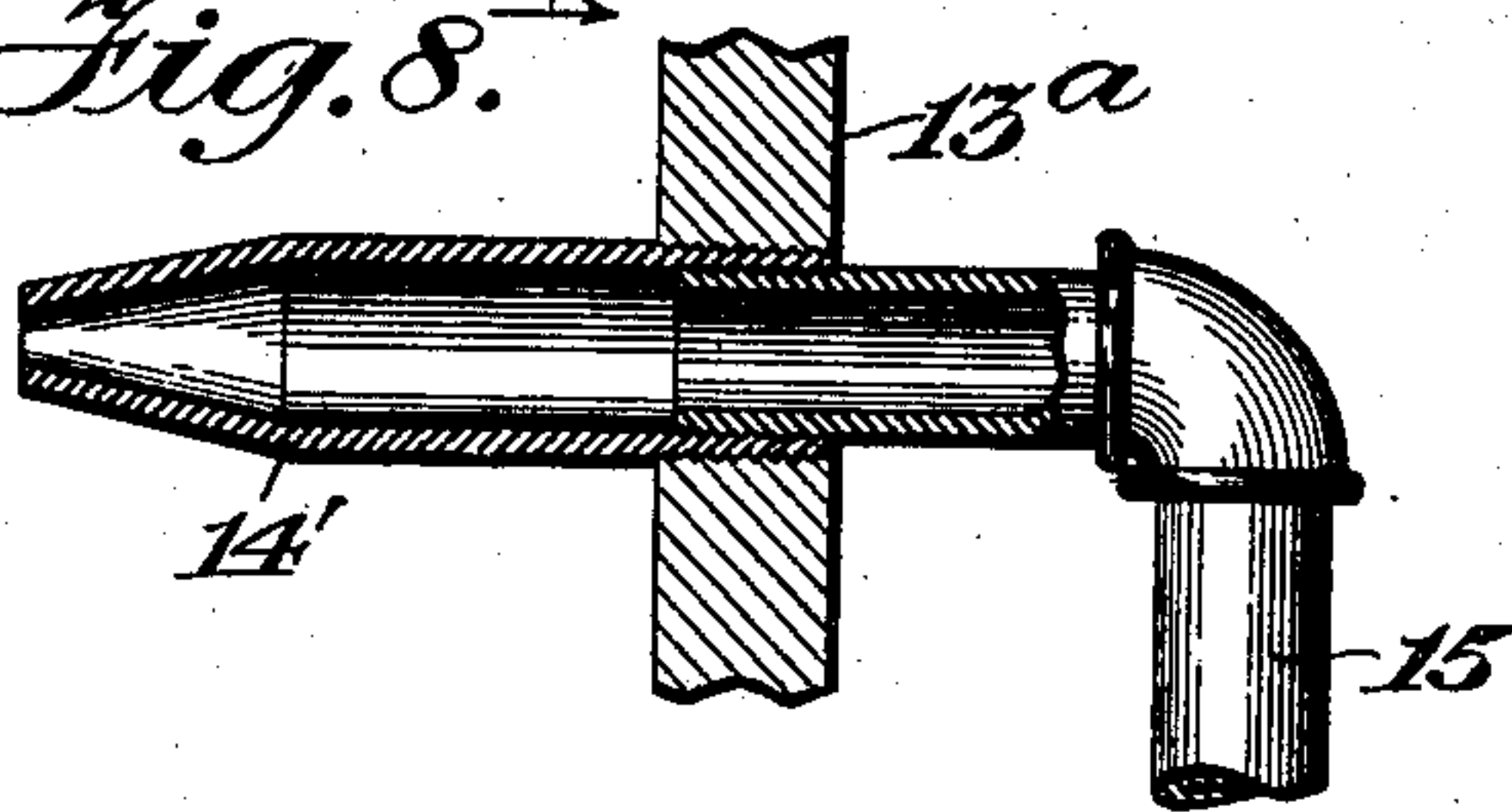
*Fig. 9.*



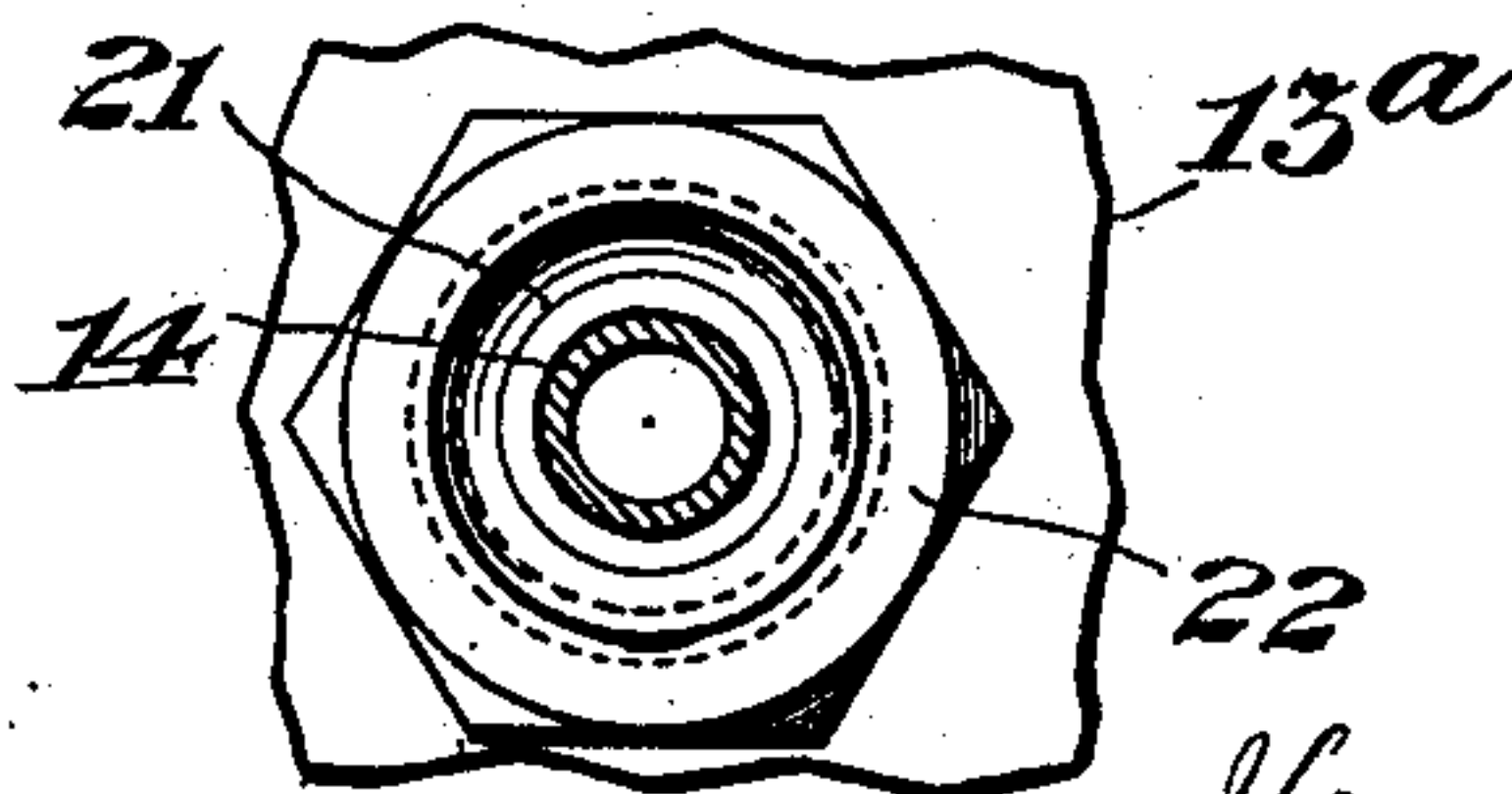
*Fig. 10.*



*Fig. 8.*



*Fig. 11.*



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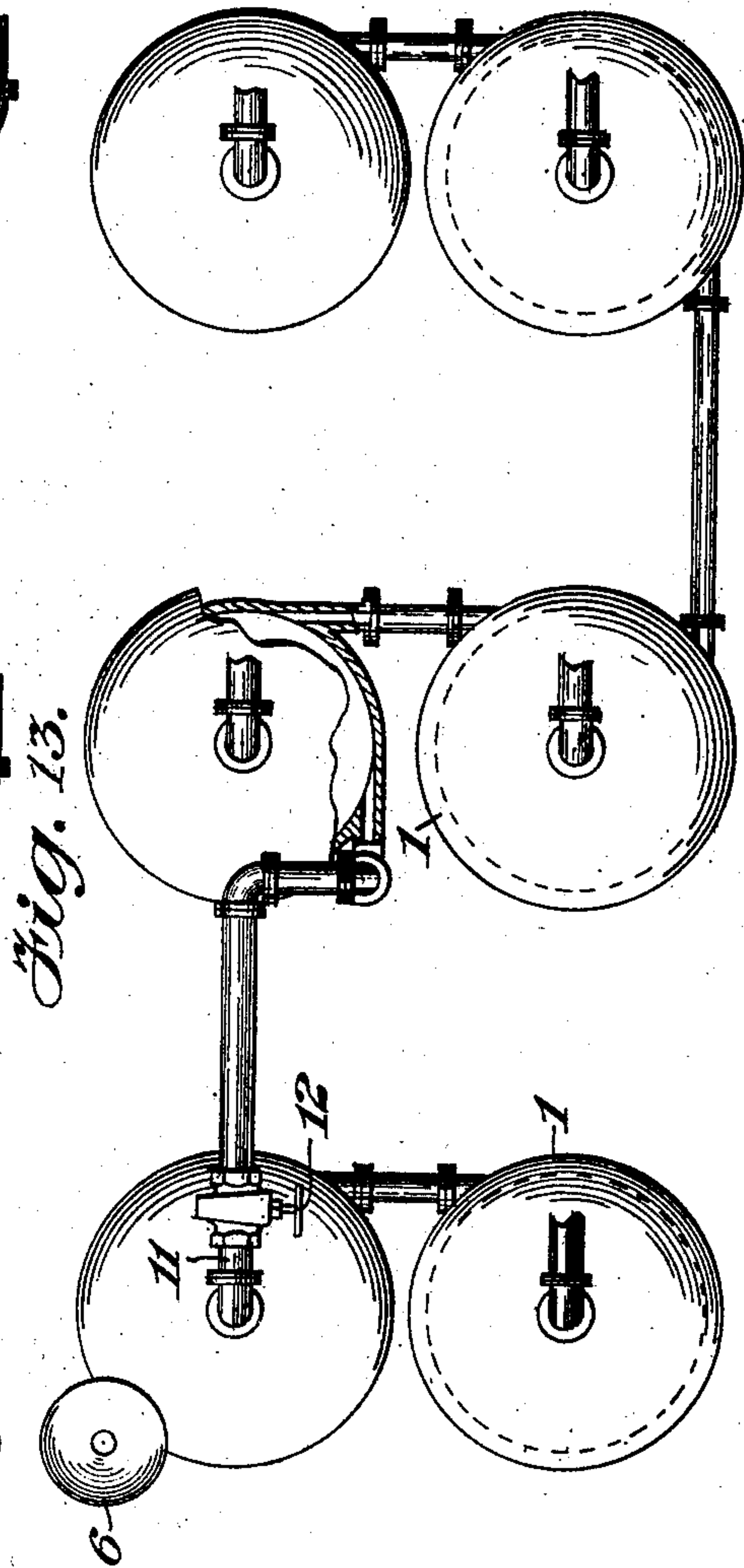
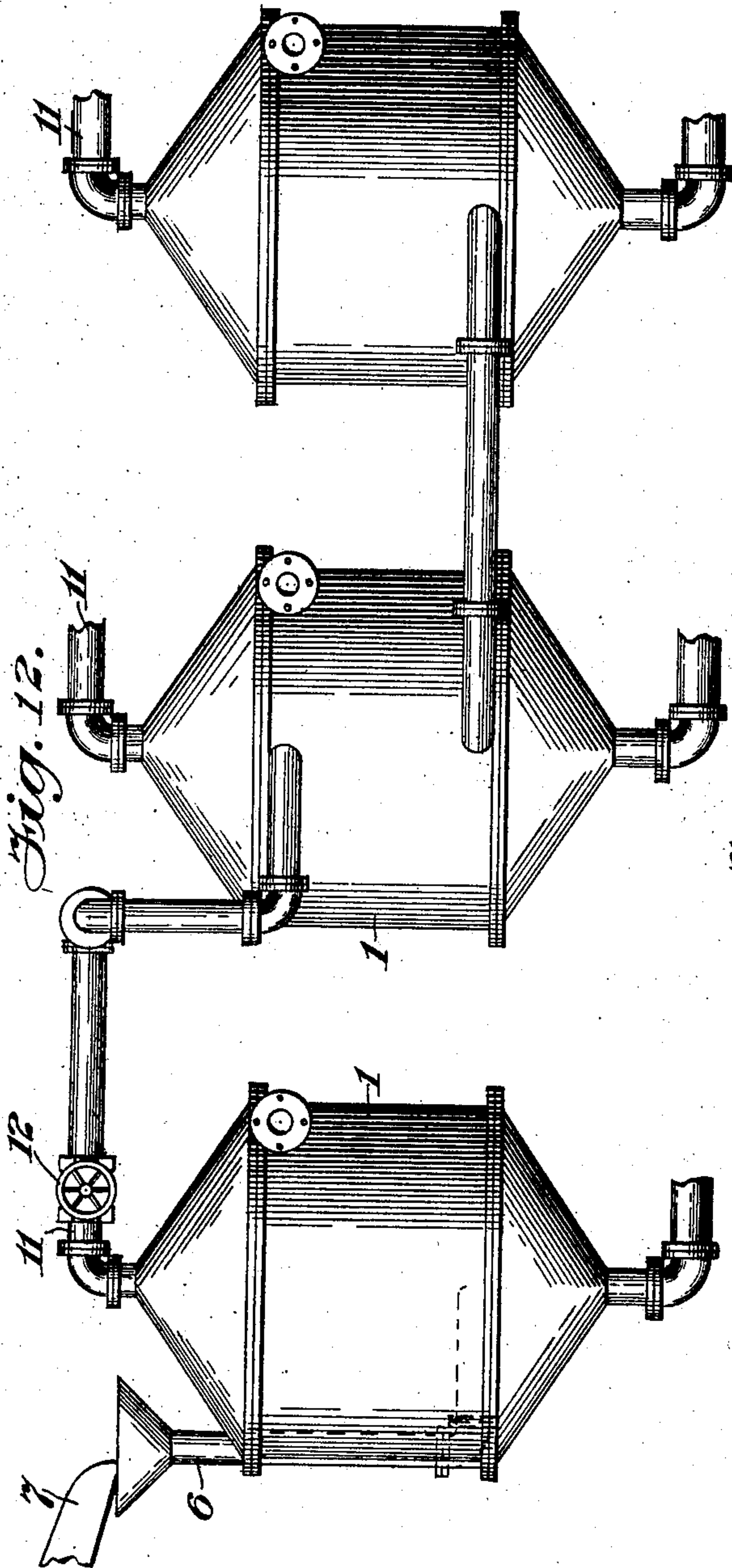
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NO MODEL.

4 SHEETS—SHEET 4.



Witnesses:  
J. B. Weir  
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# UNITED STATES PATENT OFFICE.

HENRY A. ALLEN, OF CHICAGO, ILLINOIS.

## ORE-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 762,866, dated June 21, 1904.

Application filed August 12, 1901. Serial No. 71,758. (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, in which similar numerals of reference in the  
 10 different figures indicate like parts.

The object of my invention is to so construct a hydraulic separator for the separation of ores or other materials of varying specific gravities that in addition to the vortex whirl  
 15 produced by the inflowing body of water and material a series of fine jets of water may be so introduced as to agitate the heavier particles upon the bottom of the receptacle and produce a more thorough separation.

20 To this end my invention consists in the combination of elements hereinafter more particularly described and claimed.

In the drawings, Figure 1 is a view of a separating device, partly in elevation and  
 25 partly in central vertical section. Fig. 2 is a sectional plan thereof, taken upon the line 2 2, Fig. 1. Fig. 3 is a detail view showing a nozzle in connection with the gangue supply or feed pipe, the latter being shown in ver-  
 30 tical section. Fig. 4 is a central vertical sectional view showing a modified form of separator, said view being taken upon the line 4 4, Fig. 5. Fig. 5 is a plan view thereof in which the upper portion is removed to show the in-  
 35 terior. Fig. 6 is a sectional view in detail of the outlet-pipe, showing a modified construction in which a vertical nozzle is employed. Fig. 7 is a vertical sectional view in detail taken upon the line 7 7, Fig. 5. Fig. 8 is an en-  
 40 larged vertical sectional view in detail of one of the water-nozzles projected into the separating vessel. Fig. 9 is a sectional view in detail showing an adjustable nozzle in con-  
 45 nection with a portion of the walls of the separating vessel, taken upon the line 9 9, Fig. 10. Fig. 10 is a vertical sectional view thereof, taken upon the line 10 10, Fig. 9. Fig. 11 is a like view taken upon the line 11 11, Fig. 10. Fig. 12 is a side view of a series or bank  
 50 of separators. Fig. 13 is a plan view thereof.

Referring to the drawings, my improved separator consists of a closed vessel, the main body 1 of which I prefer to make in the form of a cylinder, as shown in the principal views, the bottom 2 and the top 3 being tapered, 55 preferably in the form of a cone, and provided with suitable flanges 4 4, by which they are bolted or otherwise connected to corresponding flanges upon the body 1.

An inlet-pipe or feed-pipe 5 is in communi- 60 cation with the casing 1, as clearly shown in Figs. 1 and 2, said pipe being arranged preferably tangentially thereto. A vertical pipe 6, having a suitable hopper at the top, is connected with the pipe 5 in any well-known way 65 and is intended for the introduction of the ore or material or materials to be separated, which may be supplied by means of the trough or launder or any other well-known construction 7. I prefer to place in the induction pipe or 70 conduit 5 a nozzle 8, Fig. 3, which may be rendered adjustable therein. The nozzle is intended to be connected with a fluid-supply pipe in any well-known way.

One or more eduction-pipes 9 10, Figs. 1, 75 2, and 4, at a higher level in case feed is at or near the bottom, are connected with the body of the vessel and arranged tangentially thereto for the purpose of carrying off particles of lighter gravities, thus permitting the 80 apparatus to be used as a classifier, while connected with the top 3, at the center or apex thereof, is an eduction-pipe 11, which I prefer to provide with a regulated valve 12. A discharge-pipe 13 is provided at the bottom for 85 the discharge of the particles of heavier gravities or concentrates and may be provided with a hinged cover 14 or other suitable closing device, with any approved means for fastening the same when closed. 90

The operation of the simpler form of my improved device is as follows: Assuming the ore to be admitted to the separator in the manner indicated in Fig. 1, together with a supply of water from the trough 7, the ma- 95 terial and water are by preference introduced tangentially to the inner surface of the circular wall of the vessel and produce a swirl or vortex in the latter, the speed or force of which is proportionate to the extent of the 100



fall in the pipe 6, which may be of any length required to produce the necessary "head" or pressure. This action causes the heavier to separate from the lighter particles and settle in the bottom, from whence they may be discharged through the pipe 13 at will, the lighter particles, according to their varying specific gravities, being carried off through the eduction-pipes 9, 10, and 11, respectively, or as may be desired. In case the head or pressure obtainable by the position of the ore feed pipe or launder is not sufficient to develop the necessary velocity of rotation a higher speed may be obtained by introducing a fluid under the required pressure through nozzles, one of which is shown at 8, Fig. 3. Additional nozzles may be used in like manner, as hereinafter described. The ore may be introduced by means of the well-known hydraulic pump or injector.

In Figs. 4 to 7, inclusive, I have shown a modification of said invention in which the bottom 2<sup>a</sup> is inclined spirally, like the leaves of an auger, so as to form steps or ledges 13<sup>a</sup>, through the vertical members or plates of which I insert a series of nozzles 14, connected with supply-pipes 15, having controlling-valves 16 therein. I also prefer to connect therewith a pressure-gage 17. The jets from the several nozzles 14 serve to thoroughly wash the ore as it is driven forwardly over the several ledges caused by the spiral inclines, and as the particles fall over the ledges the separation is rendered more complete and settling prevented.

A vertical and adjustable nozzle 18 may be inserted within the discharge-pipe 13 and directed upwardly, as shown in Fig. 6, thereby serving to lift any lighter particles that may still be retained in the mass of concentrates passing into the discharge-pipe. A receptacle 19 is placed beneath the discharge-pipe to receive the concentrates.

This device may be more readily understood by describing it as a hydraulic sizer or separator. Its use will enable the discharge from the separator to be practically automatic, and when used the gate or closing device may be dispensed with. The amount and pressure of the fluid used in this nozzle can be controlled by a valve or other means. (Not shown.)

In Figs. 8 to 11, inclusive, I have shown modified forms of nozzles, that in Fig. 8 being an enlarged detail view of the form shown in Figs. 4, 5, and 7. In Figs. 9 and 10 a chamber 20 is formed behind the vertical member 13<sup>a</sup> of the ledge, with which the several service-pipes 15 may be connected. In case it is desired to regulate the velocity of the fluid issuing through such nozzle this chamber

should be divided so as to provide a separate chamber for each nozzle.

Should it be required, the nozzles may be adjusted as to direction of discharge. In such case the member 13<sup>a</sup> is provided with a suitable opening and seat or socket adapted to receive a ball 21, formed upon the nozzle 14, said ball being held in position by means of annular nut 22, Figs. 10 and 11, the loosening of which enables the nozzle to be adjusted to any required angle, in which position it may be secured by the tightening of the nut.

In Figs. 12 and 13 I have shown a series of separators connected one with another in such a way that the same or similar vortex and attendant actions may be continued. In the illustration shown the device may be used as a "classifier" to separate and classify the different gravities.

It will be observed that in Fig. 12 the discharge from the first separator is led into the top of the second and from the bottom of the second into the bottom of the third. In other words, it is not my intention to limit myself as to the position of the feed nozzle or nozzles.

Having thus described my invention, I claim—

1. A hydraulic ore-separator in which is combined a closed vessel having a tangentially-arranged inlet-opening near the bottom for feeding the materials thereto for separation, an outlet-opening above said inlet-opening, means for discharging at the bottom, and an auger-shaped bottom provided with a series of small juxtaposed inlet-nozzles directed upon said bottom, whereby the heavier materials accumulating at the bottom may be kept in motion and thoroughly washed by means of said small streams.

2. A hydraulic separator of the class described, in which is combined a closed circular receptacle having a main tangentially-disposed induction-opening near the bottom of the main body for feeding the materials thereto for separation, a discharge-outlet above said opening, an auger-shaped bottom having steps or shoulders leading from one spiral bottom surface to another, and a series of relatively small juxtaposed inlet-nozzles projected through said steps and upon said bottom, said nozzles being in operative connection with a source of liquid-supply.

In testimony whereof I have signed this specification, in the presence of two subscribing witnesses, this 9th day of August, 1901.

HENRY A. ALLEN.

Witnesses:

D. H. FLETCHER,  
H. F. WALLMANN.