

No. 674,299.

Patented May 14, 1901.

J. H. LANCASTER.

AMALGAMATING AND CONCENTRATING APPARATUS.

(Application filed May 20, 1895. Renewed Oct. 20, 1900.)

(No Model.)

4 Sheets—Sheet 1.

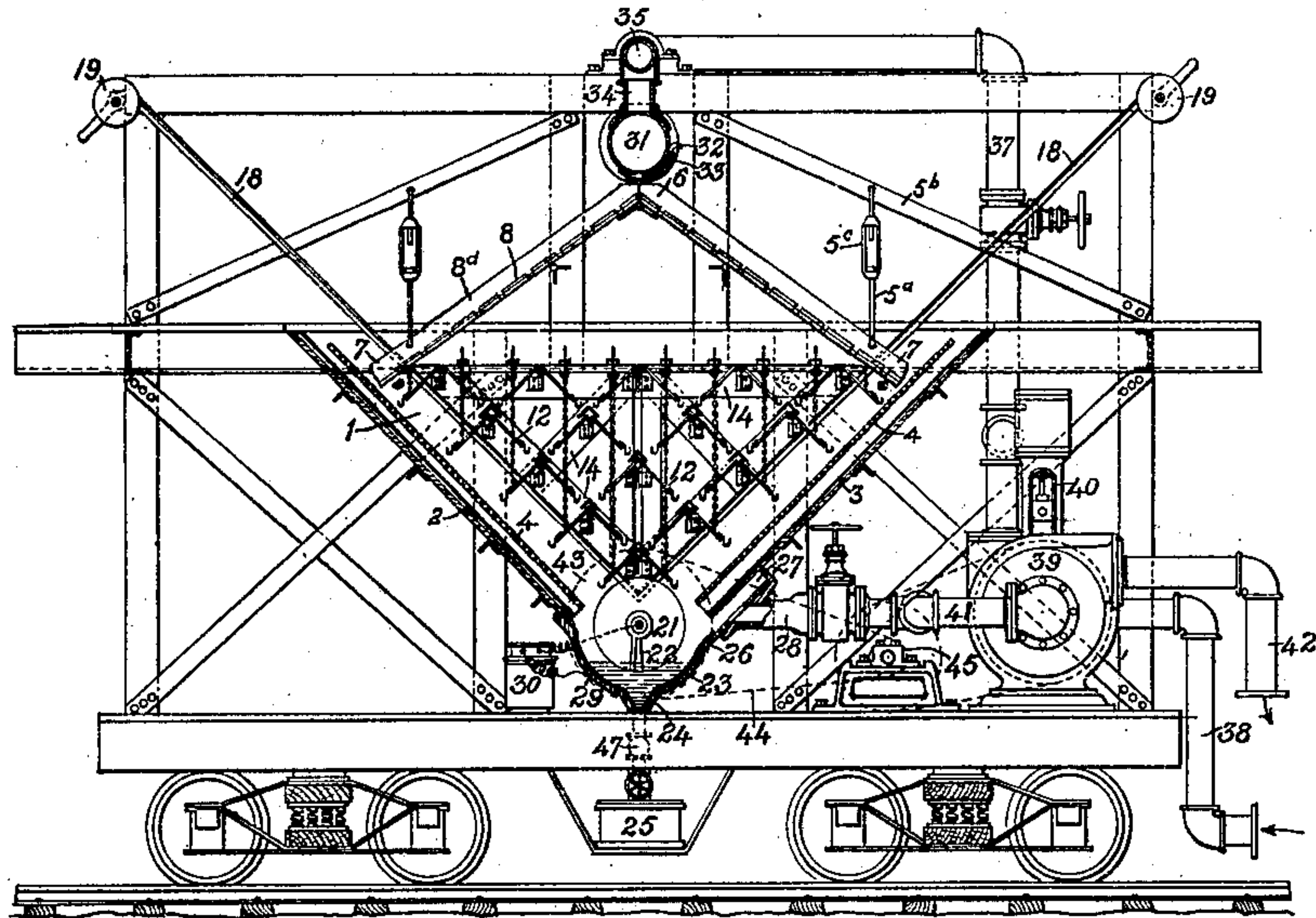


Fig. 1.

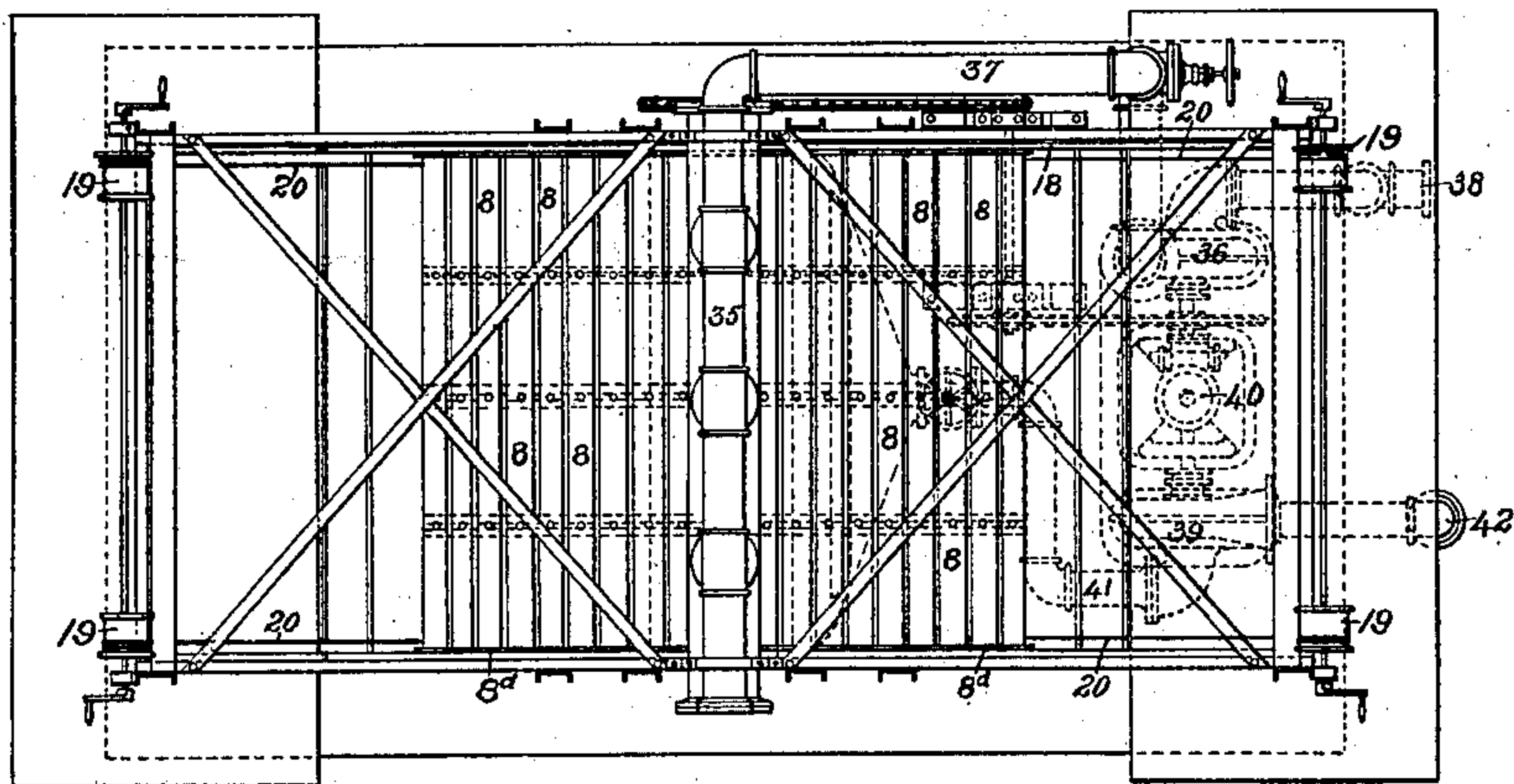


Fig. 3.

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INVENTOR:

James H. Lancaster

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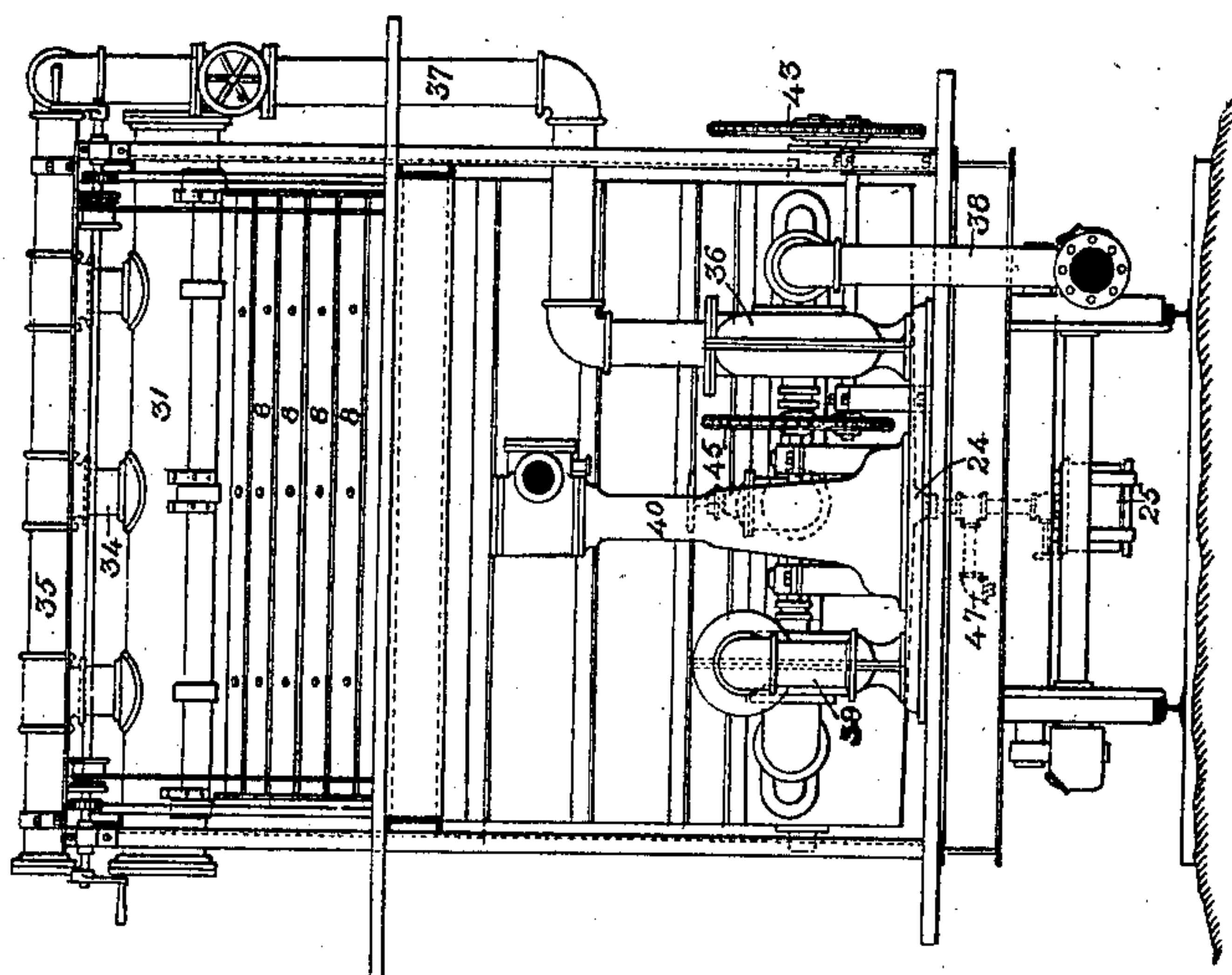


Fig. 4.

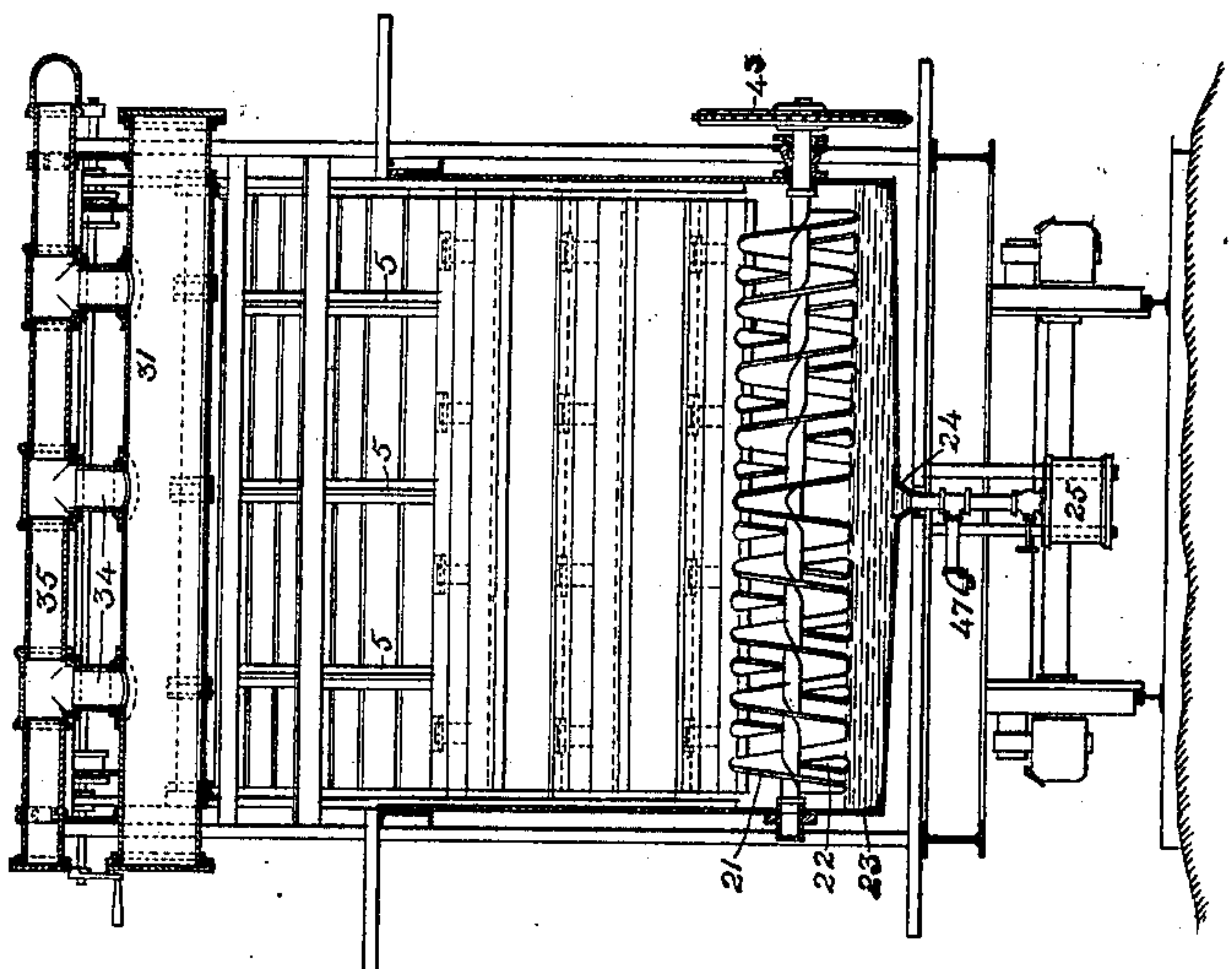


Fig. 2.

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Fig. 11.

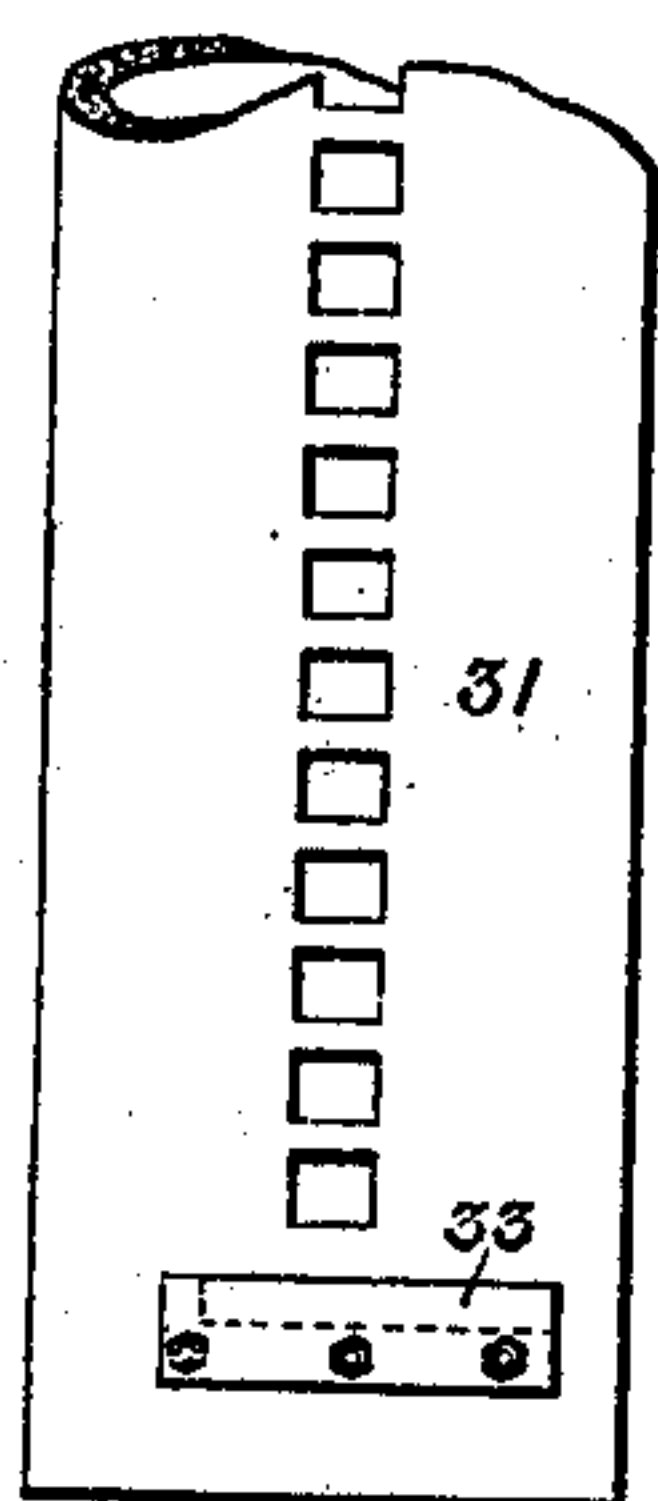


Fig. 10.

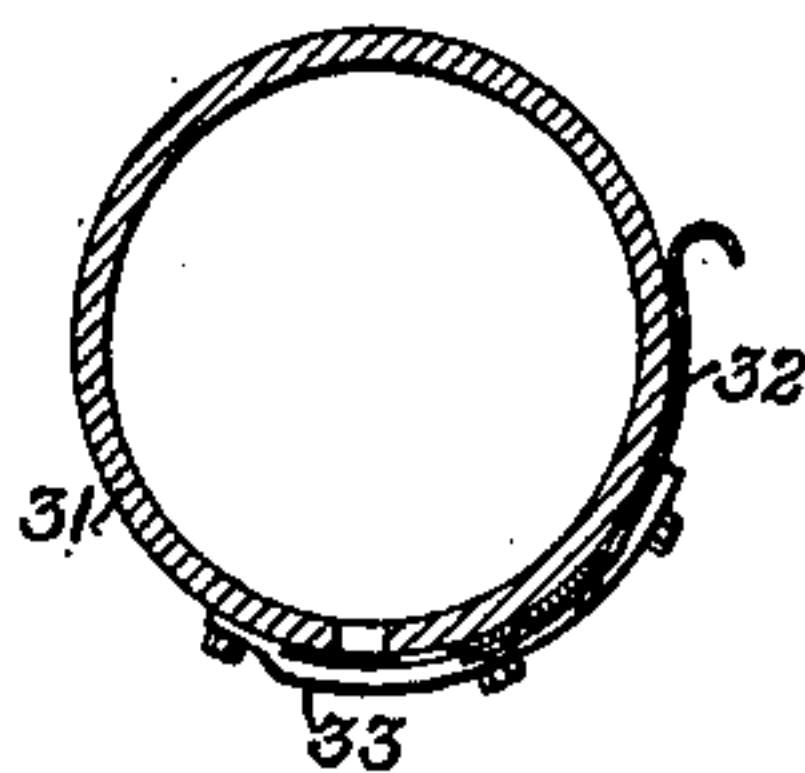


Fig. 9.

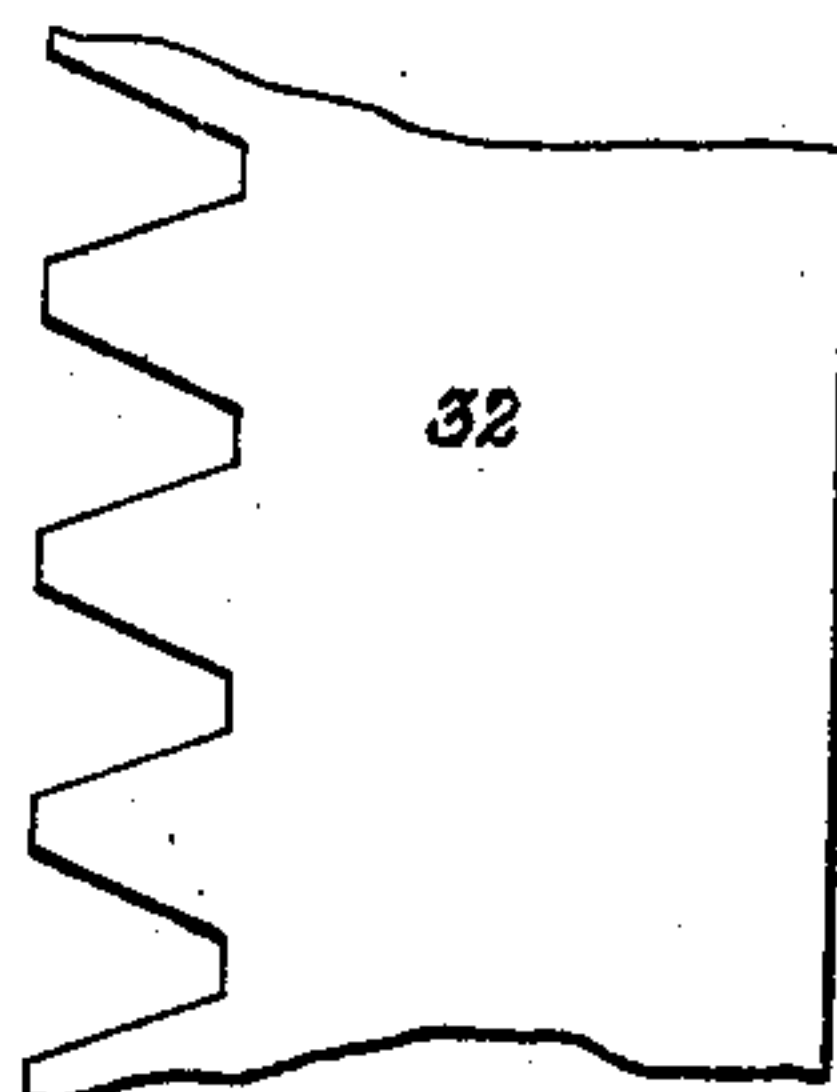
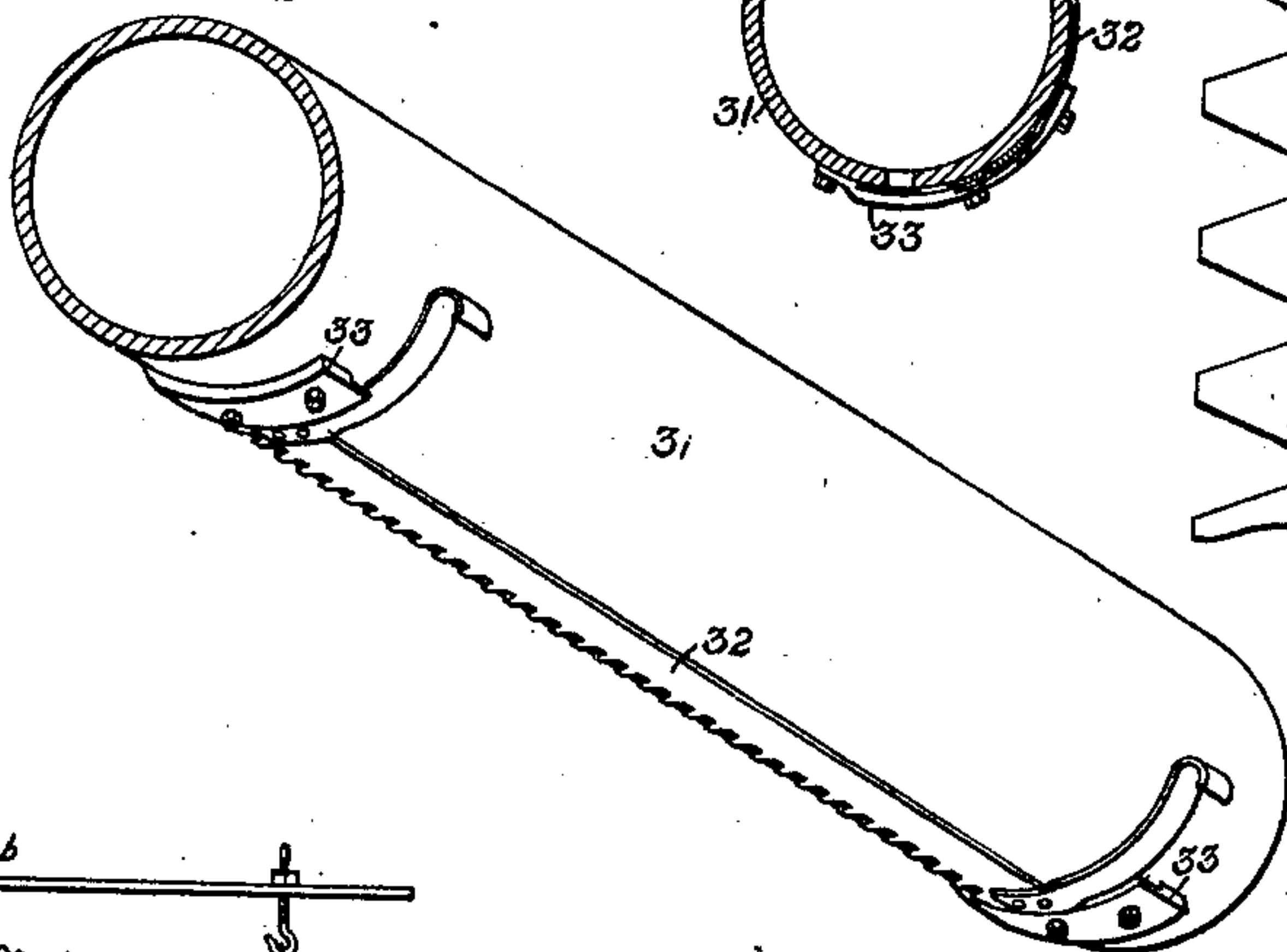


Fig. 8.

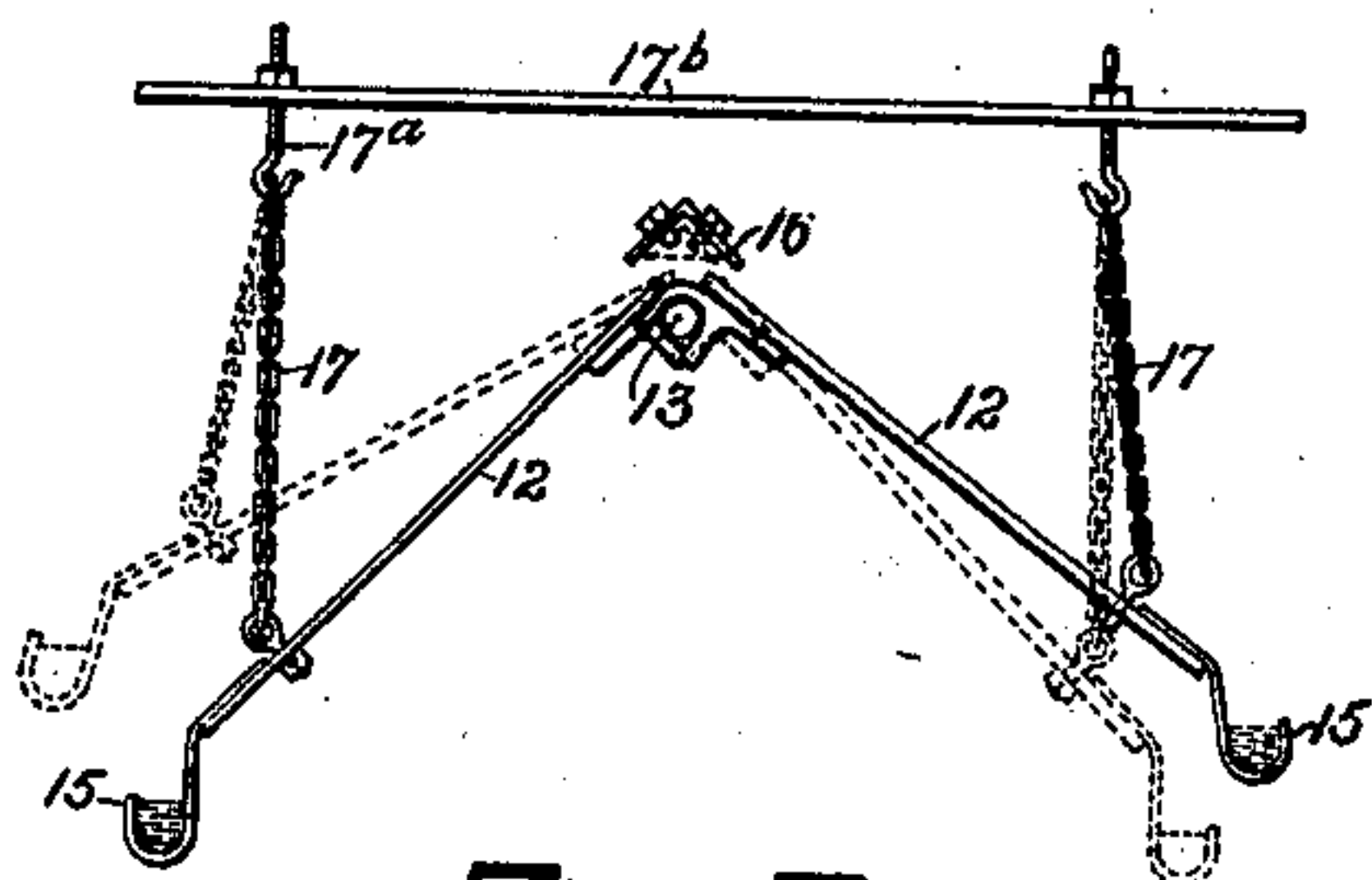


Fig. 7.

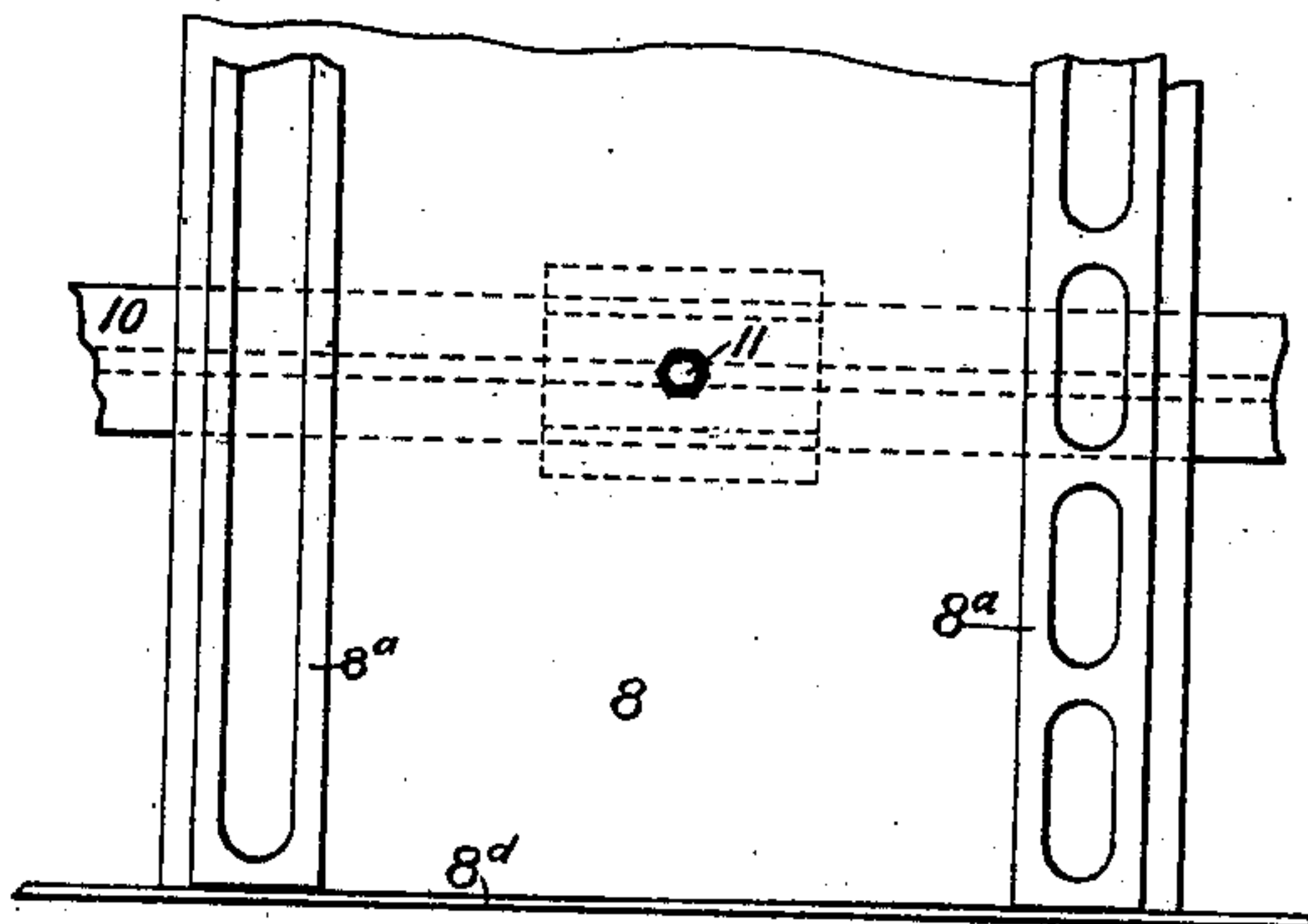


Fig. 12.

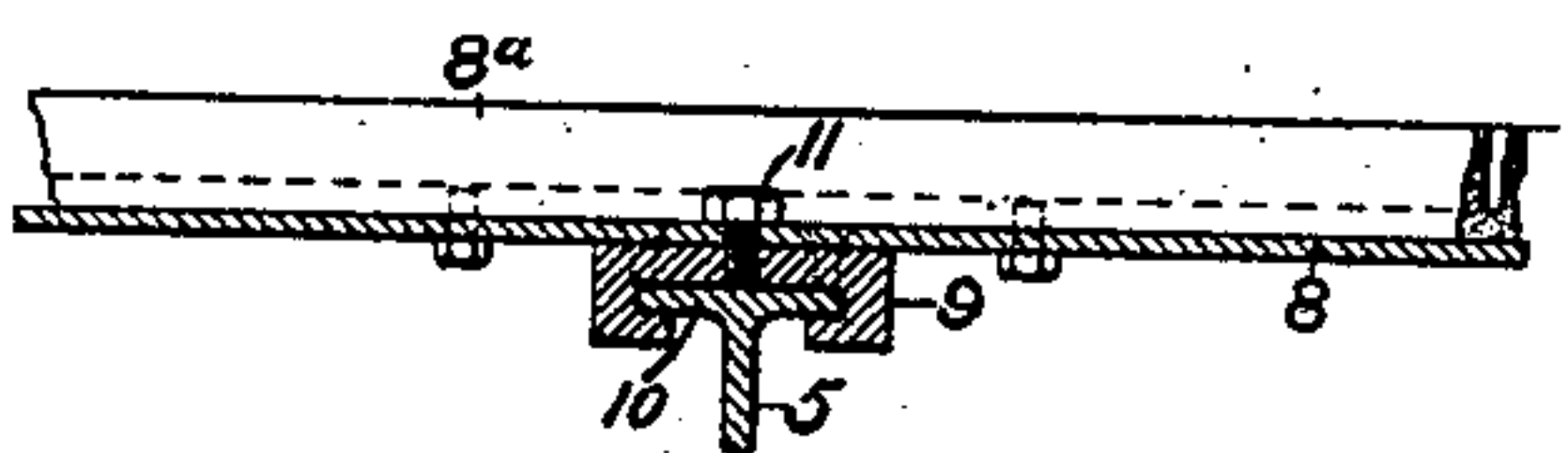


Fig. 5.

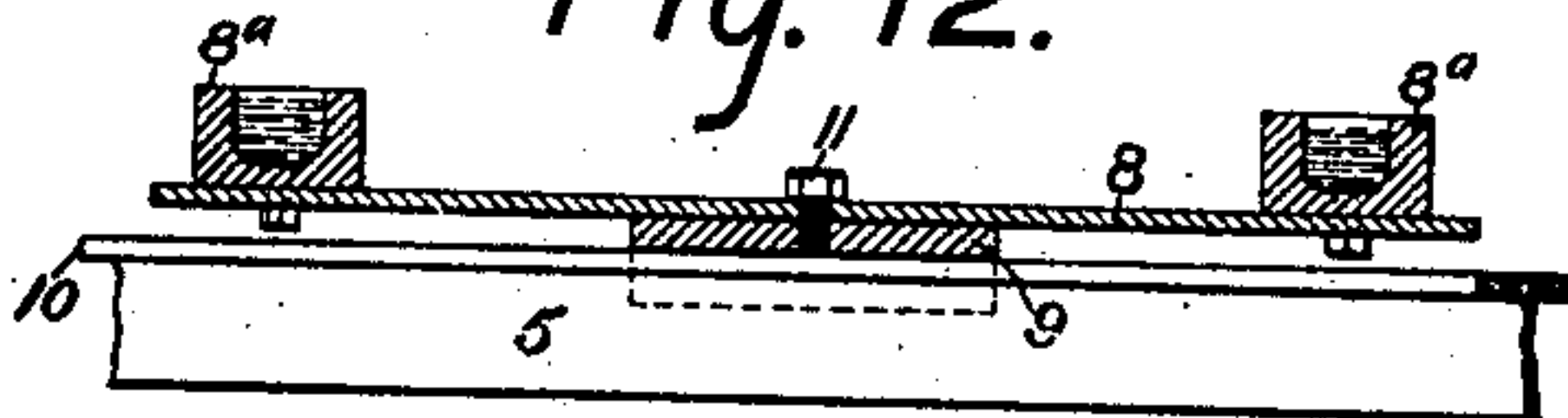


Fig. 6.

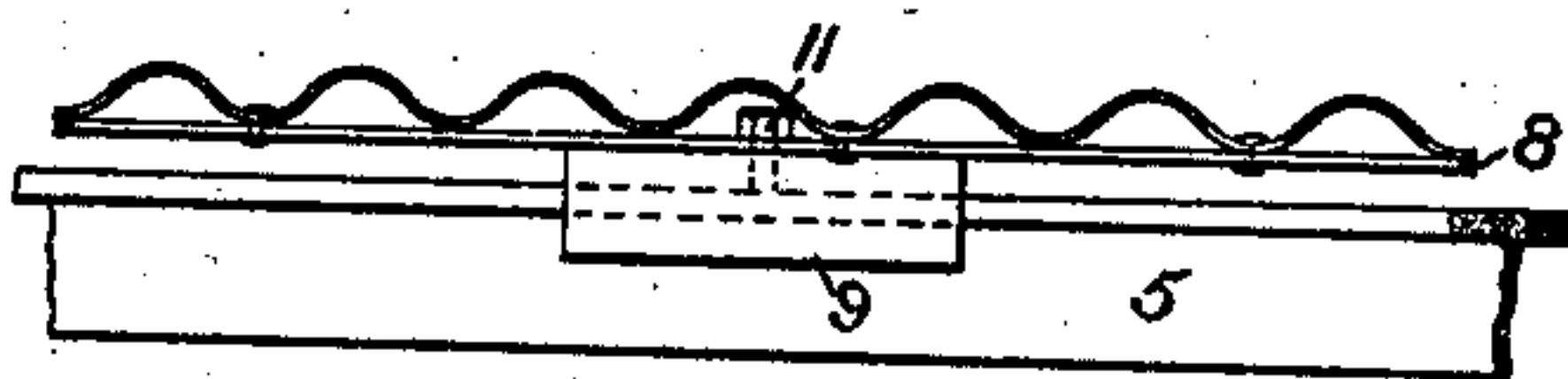


Fig. 13.

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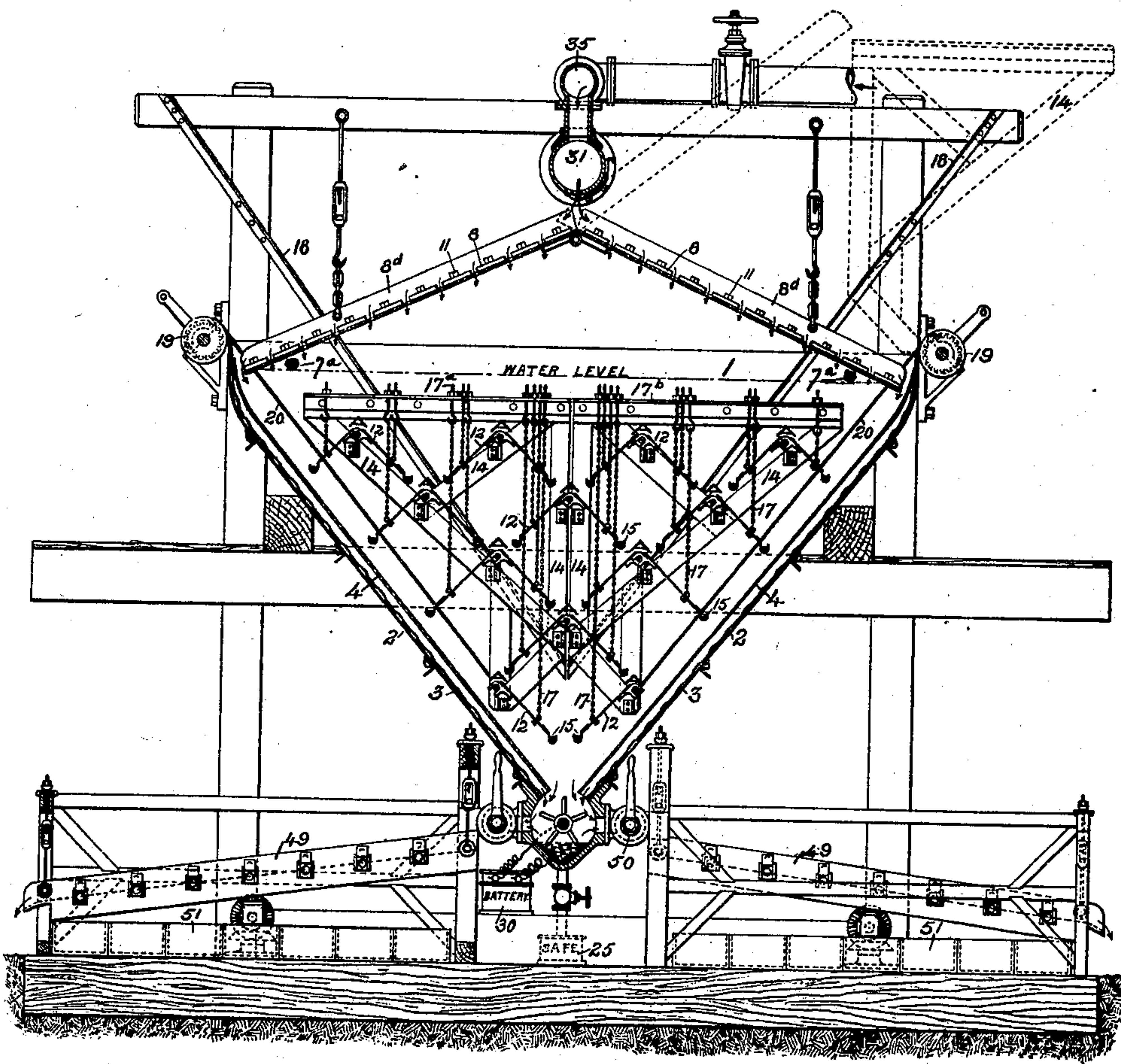


Fig. 14.

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# UNITED STATES PATENT OFFICE.

JAMES H. LANCASTER, OF NEW YORK, N. Y.

## AMALGAMATING AND CONCENTRATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 674,299, dated May 14, 1901.

Application filed May 20, 1895. Renewed October 20, 1900. Serial No. 33,780. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES H. LANCASTER, a citizen of the United States, and a resident of New York city, in the county and State of New York, have invented certain new and useful Improvements in Amalgamating and Concentrating Apparatus, of which the following is a full, clear, and exact specification thereof.

The purpose of the present invention is the production of an amalgamating apparatus which shall be compact, easily portable, simple in construction and operation, and of large capacity and high efficiency.

With the above objects in view my improved apparatus embraces an amalgamating-tank of novel construction, a motor, and usually a pump or pumps driven thereby for introducing water and material to the tank through a distributing-pipe and for removing waste products.

The construction of the amalgamating-tank and its roof and the disposition of the various parts is such as to secure effective amalgamation mainly by the force of gravity.

In the drawings accompanying this specification, Figure 1 is a vertical longitudinal section of an amalgamating apparatus embodying my invention and representing the same as being mounted on a railway-car. Fig. 2 is a central transverse vertical sectional view of the apparatus illustrated in Fig. 1. Fig. 3 is a plan, and Fig. 4 an end view, of the same. Figs. 5 and 6 are respectively a transverse sectional detail and longitudinal sectional detail view showing the arrangement by which the roof-plates, with riffles and amalgam-plates, are adjustably secured. Fig. 7 is a detail view illustrating, on an enlarged scale, the arrangement for adjusting the chains suspending the transverse amalgamating-plates. Fig. 8 is a similar view showing a portion of the serrated edge of the valve-plate of the distributing-pipe. Figs. 9 and 10 are a detail perspective of and a cross-sectional view through the distributing-pipe and its valve-plate. Fig. 11 is an inverted plan view showing a distributing-pipe modified to operate in connection with a plain valve-plate. Fig. 12 is a detail plan view of one of the core-plates, showing the same provided with mercury-receptacles. Fig. 13 is a transverse detail section

showing one of said plates provided with a supplemental amalgam-plate; and Fig. 14 is a vertical sectional view of the amalgamating apparatus modified to adapt it for treating free-milling quartz, old tailings, and the product of stamp-mills.

The tank 1, which is sustained by a suitable framework upon the car, has its sides 2, which converge toward the bottom, lined with removable amalgam-plates 3, protected by screens 4, said plates and screens sliding obliquely in suitable guides. Two or more pairs of upwardly-converging T-bars 5 are hinged together at their upper ends 6 and at their lower ends 7 are supported within the tank by resting on cleats 7<sup>a</sup>, so disposed as to not interfere with the vertically-moving guided parts within the tank. Transverse plates 8, intermittently disposed, each have bolted to the under side clips 9, provided with threaded perforations and so recessed as to engage the horizontal portions 10 of the supporting T-bars and permit the clamping of the clips and their plate thereto. A set-screw 11, bearing in the threaded perforation of each clip 9 and against the upper surface of the horizontal portion 10 of the T-bars 5 beneath, secures its plate in position and permits its adjustment. Narrow strips 8<sup>a</sup>, preferably of wood, are removably and transversely secured on the plates 8 and constitute riffles against and over which the descending material flows. Each of these strips is provided with vertical recesses or cavities containing mercury and serving as pockets to assist in intercepting the gold contained in the material descending on the cover-sections. The size, shape, and number of riffle-strips carried by each plate may be varied to suit the character of the material under treatment.

For some purposes it may be found desirable to secure a transverse gutter or gutters of mercury to each plate 8, and, if necessary, amalgam copper plates with or without gutters may be removably attached thereto.

The arrangement of bars 5 and plates 8 is such as to present a tank-covering in the form of a ridge roof so hinged at the apex that either half may be opened by lifting it. Suspending-links 5<sup>a</sup>, depending from inclined brace-bars 5<sup>b</sup> of the supporting-frame, are connected to the cover sections or halves, as



shown in Fig. 1, each link including a turn-buckle 5<sup>c</sup>, by which it may be shortened or lengthened to adjust the position of the half beneath and vary the inclination of the same.

5 Each hinged cover-section is provided with side bars 8<sup>a</sup>, which prevent the water and material from escaping over the side.

Amalgamating-plates 12 are disposed within the tank principally in hinged pairs, each  
10 plate being independently removable. There are two series of plates 12 carried by the transverse bars 13 of two frames, one for each series. Each plate 12, as shown, is provided at its lower edge portion with a mercury-gutter  
15 15, closed at the ends. An angle-guard 16 extends along and removably rests upon the upper contiguous portions of each pair of plates 12 and protects the hinges and the opening thereat. The upper surfaces of the  
20 angle-guards 16 are also amalgamated. Chains 17, adjustably engaged with hooks 17<sup>a</sup>, carried by rigid bars 17<sup>b</sup>, depend within each frame 14 and sustain the plates 12 thereof, so that all or any particular one may be supported at any desired inclination. The hooks  
25 17<sup>a</sup> are adjustable in the bars 17<sup>b</sup>, so that they can be set to provide for close adjustment of the plates. When the frames 14 are in position, as shown in Fig. 1, each upper plate 12  
30 overhangs an oppositely-inclined plate beneath it for the purpose of delivering thereto. Each frame, with its plates, is located in upwardly-projecting guides 18, along which, after the corresponding cover-section has  
35 been raised, it may be withdrawn by operating a windlass 19, the cable connection 20 of which is connected to the frame.

Located across the tank, near the bottom, is a worm conveyer 21, supported in suitable  
40 insulated bearings and of the differential type working toward the center. To secure a slight agitating effect and prevent clogging, the agitating blades 22, Fig. 2, carried by the conveyer-shaft, are interposed between the turns of the spiral blade thereof. A shallow curved  
45 mercury-trough 23 extends beneath the conveyer and forms the bottom of the tank by being bolted to the lower edge portions of the sides thereof. This trough has a central pocket  
50 24, communicating with a mercury-safe 25 below through the medium of a valve-controlled pipe. The mercury-trough 23 at one side is configured to constitute an offset 26, which, in connection with the lower portion  
55 of the adjacent tank side, presents a shallow recess 27, extending the entire width of the tank, an extended horizontal opening in the offset affording communication with an external chamber 28, bolted to the offset and  
60 contracting from the ends of the horizontal opening to the place of its connection with the exhaust. The trough 23 has a lining 29, of "fibroid" or other electric-non-conducting material, through which passes a wire adapted  
65 to electrically contact with the mercury in the trough in which its terminal is immersed and which leads to and connects with the neg-

ative pole of a generator 30, the positive pole of which is electrically connected with the conveyer. The fibroid or other electric-non-  
70 conducting lining serves to protect the metal in the trough 23 from contacting with the metal forming the body of the same in order that electrolytic action, which might cause great loss of gold, may be avoided.

75 Transversely across the tank and above the ridge of the covering thereof is located a distributor composed of two pipes, the lower of which, 31, has a slot extending along its under side, which slot is controlled by a slid-  
80 ing valve-plate 32, curved to conform to the exterior of the pipe and moving in suitably-curved guides 33, formed by straps of metal, the lower end of each of which is secured to the pipe adjacent to one side of the opening,  
85 thus serving as a limiting-stop for the valve-plate. The lower edge of this valve-plate is so situated that when it partially closes the slot-opening a series of triangular orifices is presented along the lower surface of the dis-  
90 tributing-pipe, the size of which orifices may be varied by the movement of the plate. The advantage presented by these variable openings is that when properly controlled they do not permit too much material to pass at any  
95 one place while admitting coarse material, thus making the desired distribution more thorough. The pipe 31 may be supplied directly or by tubular inlets 34, connecting with a pipe 35 above and parallel therewith, the  
100 latter pipe, as shown, communicating with a centrifugal supply-pump 36 through a valve-controlled pipe 37. The intake of the pump 36 is furnished with a pipe 38, designed to be placed in communication with a washing and  
105 screening apparatus or other source of hydraulic supply. A second centrifugal pump 39, operated by the same motor 40 which drives the pump 36, has its intake connected by a valved pipe 41 with the contracted out-  
110 let of the chamber 28, adjacent to the trough-offset, while it discharges through a pipe 42.

The conveyer 21 receives motion by one end portion of its shaft extended through a side of the tank and carrying a sprocket-wheel 43,  
115 suitably geared by chain belt 44 with a sprocket-pinion 45, driven from the motor.

In operating the machine the gold-bearing material in a properly graded or reduced condition suspended in water passes through the  
120 orifices of the distribution-pipe 31 onto the ridge of the tank-covering, where it divides and flows down the inclines, entering the tank in vertical sheets of the required volume. The plates 8 of the cover-sections are so adjusted  
125 that their narrowest interopenings are nearest the top of the covering, and each succeeding opening is somewhat wider than that above in order that the finest and richest material shall fall through the openings most nearly  
130 above the middle of the tank, while the coarser material shall enter near the sides. The fine material in its descent toward the bottom of the tank must follow a zigzag course, pass-



ing successively over several of the inclined amalgamating-surfaces of the plates 12, giving up its fine or flake gold to the mercury thereon and leaving the larger particles in the gutters 15. The previously-described adjustment of the roof-plates 8 causes all the coarse gravel and sand to reach the protecting-screens in front of the side amalgamating-plates, by which it is guided to the mercury-trough at the bottom, scouring of the side amalgamating-plates 3 being so avoided. All the amalgamating-surfaces are kept submerged by regulating the water-level in the tank by valves in the supply and exhaust pipes 37 41. The large body of water in the tank breaks the fall of the material, retards its descent, and reduces the scouring and flouing effect. The level of the mercury in the fibroid-lined trough 23 is so maintained as to collect all coarse or shot gold not previously saved. The moderate agitation or churning action of the conveyer 21 does not impair or sicken the mercury, owing to the passage of the electric current through it. The conveyer operates to prevent choking and to deliver all precipitates to the exhaust for discharge, the spread form of the chamber 28, in connection with the upwardly-extending recess 27, resulting in the effective withdrawal of the precipitates without any undue agitation or clogging in the bottom of the tank.

The portable character of the machine permits it to be easily transported from one locality to another and operated under widely-varying conditions. If desired, it can be located on the deck of a scow. Its design and general arrangement of parts is such that as compared with prior machines for similar uses it is capable of more close adjustment and regulation. All the parts can be readily removed for repair, substitution, or cleaning.

The fact that the machine operates chiefly by gravity obviates the necessity for expensive pressure-pumping, insures uniform and perfect working, and permits coarse grades of material to be treated.

The pipe connecting the mercury-trough 23 with the safe 25 has a discharge-bend 47, usually closed by a threaded cap. If the mercury in the trough has become unduly sickened and the valve controlling the safe is closed, the cap of the discharge-bend 47 may be removed to permit the sickened mercury to be drawn off for purification.

Where the material is in the form of pulverized free milling-quartz, but one pump will be required, and pumps may be dispensed with entirely when the fall of water is sufficient to permit the water, with the suspended material, to be supplied to the distributing-pipe under a suitable head, the level of the water within the tank being maintained by a proper adjustment of the valves.

Fig. 14 illustrates the amalgamating apparatus as being modified by the presence of a concentrating attachment, which permits

concentrates to be obtained from pulverized quartz or old tailings from stamp-mills to be reworked. The material first passes through the amalgamating-tank, where all the free gold is saved, whence, together with the water, it is received upon either or both of the diverging inclined gyratory concentrating-tables 49 and equally distributed across the entire width of the same. The feed of the water and material to the tables is regulated by suitable valves 50. The motion of each table separates the material and delivers the different grades into a divided receptacle or separate boxes 51. The degree of concentration is changed by varying the inclination of each table.

As illustrated in Fig. 14, the converging sides of the tank need only be located at its base, its upper portion being vertically extended, so that additional horizontal series of amalgamating-plates may be introduced. When so modified, the guides for the two vertical series of transverse plates will be correspondingly altered.

It will be obvious that the amalgam-plates on the cover-sections as well as those submerged within the tank may be either vertically or horizontally corrugated or otherwise configured instead of plain, as shown. The disposition and size of these plates may be varied and their number increased to meet requirements. The tank may be extended vertically to any desired extent. A convenient arrangement in this respect consists in mounting and connecting vertical sections on the top of the conveying-tank illustrated. For specially rich material this last arrangement will afford the greater amalgam-surface necessary to save the larger percentage of gold in it.

I claim—

1. The combination with the tank having a lower discharge, of a number of alternating and horizontally-separated triangularly-arranged amalgamating-plates uniformly disposed throughout the tank interior as to present at the top thereof, in the same horizontal plane, the inlets of several vertical tortuous passages, together with a top feed and means for continuously circulating the material and water simultaneously downward through said passages to and through the discharge, substantially as set forth.

2. The combination with the tank having a bottom mercury-trough and discharge contiguous thereto, of a number of alternating and horizontally-separated triangularly-arranged amalgamating-plates uniformly disposed throughout the tank interior as to present at the top thereof, in the same horizontal plane, the inlets of several vertical tortuous passages, together with a top feed and means for continuously circulating the material and water simultaneously downward through said passages to and through the discharge, substantially as set forth.

3. In an amalgamating apparatus, the com-



combination with a tank, of a vertically-intercepting series of submerged amalgamating-plates interposed therein and an inclined covering in vertical alinement therewith and to which the material is delivered and which is provided with a series of transverse openings through which the material vertically descends in a separated condition directly to and through the plates, substantially as set forth.

4. In an amalgamating apparatus, the combination with a tank, of a vertically-intercepting series of submerged amalgamating-plates interposed therein, and an inclined covering in vertical alinement therewith and comprising a series of adjustable transverse plates presenting variable openings through which the material passes in vertically-descending sheets directly to the intercepting-plates, substantially as set forth.

5. In an amalgamating apparatus, the combination with a tank, of a vertically-intercepting series of submerged amalgamating-plates therein relatively separated and in the path of a downward current of material, together with an inclined slotted covering for the tank in vertical alinement with said plates, and a distributing-pipe delivering to said covering at the highest point thereof so as to permit the material to flow down said covering and vertically descend through the openings of the same directly to and through the plates, substantially as set forth.

6. In an amalgamating apparatus, the combination with a tank, of a series of submerged amalgamating-plates in the path of a downward current of material, together with an inclined slotted covering for the tank, and a slotted distributing-pipe delivering to said covering and provided with a serrated valve-plate, substantially as set forth.

7. In an amalgamating apparatus, the combination with a tank, of a vertically-intercepting series of submerged amalgamating-plates in the path of a downward current of material, together with an inclined slotted covering for the tank in vertical alinement with said plates, and a distributor comprising a lower discharge-pipe and an upper pipe connected thereto by tubular sections and adapted to deliver material to said covering to permit the same to descend in vertical streams through the slots thereof, substantially as set forth.

8. In an amalgamating apparatus, the combination with a tank, the sides of which converge toward the bottom, of a series of submerged amalgamating-plates therein in the path of a downward current of material, together with a tank-covering composed of upwardly-converging sections having transverse openings, said covering adapted to receive the material at its apex, substantially as set forth.

9. In an amalgamating apparatus, the combination with a tank, the sides of which converge toward the bottom, of a series of sub-

merged amalgamating-plates in the path of a downward current of material, together with a covering composed of upwardly-converging sections having a series of transverse openings increasing in width from the apex of the covering toward the tank side, substantially as set forth.

10. In an amalgamating apparatus, the combination with a tank, the sides of which converge toward the bottom, of a series of submerged amalgamating-plates in the path of a downward current of material, together with a covering composed of upwardly-converging sections, each comprising adjustable plates presenting transverse interspaces, and a distributor for delivering material at the apex of the covering, substantially as set forth.

11. In a covering for amalgamators, the combination with one or more T-bars, of transverse plates having under clips engaging and sliding on the horizontal portion of the bar or bars, and a bolt bearing in each plate and clip to bite the T-bar beneath, substantially as set forth.

12. In an amalgamating apparatus, the combination with a tank, having an inclined side internally faced with an amalgamating-plate, a guard-screen located contiguous thereto, a series of submerged amalgamating-plates in the path of a downward current of material, together with a slotted covering for the tank inclined opposite to the side of the latter, the arrangement being such that the material which does not fall through the covering-slots will come in contact with the vertical screen and the material passing through the same, descend in contact with the side amalgamating-plate, substantially as set forth.

13. In an amalgamating apparatus, the combination with a tank, having an inclined side internally faced with a removable amalgamating-plate, a removable guard-screen located contiguous thereto, a series of submerged amalgamated plates in the path of a downward current of material, and a tank-covering, transversely slotted and sloping toward the removable side screen and amalgamated plate, substantially as set forth.

14. In an amalgamating apparatus, the combination with a tank, of vertically-intercepting amalgamating-plates supported in upwardly-converged pairs presenting two or more series, one above the other and sustained by relatively independent supports, the converged plates being detachable to permit the removal of each independently of the other pair or pairs in the same horizontal plane, substantially as set forth.

15. In an amalgamating apparatus, the combination with a tank, of a series of submerged amalgamating-plates in the path of a downward current of material and detachably supported in upwardly-converged pairs, together with means for adjusting said plates to secure a varied inclination of the same, substantially as set forth.

16. In an amalgamating apparatus, the com-



5 combination with a tank of a series of submerged amalgamating-plates in the path of a downward current of material and detachably supported in upwardly-converged pairs, together with means for varying the inclination of any plate independent of its companion, substantially as set forth.

10 17. In an amalgamating apparatus, the combination with a tank, of a vertically-intercepting series of transverse amalgamating-plates therein, each pivotally connected at one edge and having an individual suspending connection attached thereto and to one of a series of adjustable engaging hooks located in the upper part of the tank, substantially as set forth.

15 18. In an amalgamating apparatus, the combination with a tank, of a series of submerged amalgamating-plates in the path of a downward current of material and detachably supported in upwardly-converged pairs, together with a removable angle-guard supported contiguous to the upper edges of each pair of plates, substantially as set forth.

20 19. In an amalgamating apparatus, the combination with a tank, the sides of which converge toward the bottom, and are provided with inner guideways, of a pair of frames adapted to oppositely move on said guideways, each of said frames carrying a series of amalgamating-plates and supporting the same submerged within the tank, and in the path of a downward current of material, substantially as set forth.

25 20. The combination with a tank having a lower discharge and spiral conveyer adapted to revolve contiguous thereto, of a number of alternating and horizontally-separated triangularly-arranged amalgamating-plates uniformly disposed throughout the tank interior as to present at the top thereof, in the same horizontal plane, the inlets of several vertical tortuous passages, together with a top feed and means for continuously circulating the material and water simultaneously downward through said passages to and through the discharge, substantially as set forth.

30 21. The combination with the tank having a horizontally-extended lower outlet-opening, of a vertically-intercepting series of alternating and relatively-separated amalgamating-plates triangularly arranged as described and uniformly disposed throughout the tank interior, as to present at the top thereof, in the same horizontal plane, the inlets of several vertical tortuous passages, a lower exhaust-chamber 28, in juxtaposition to said outlet-opening and contracting to the point of its discharge, and a stirrer adapted to revolve in the lower part of the tank, substantially as set forth.

35 22. The combination with the tank having a mercury-trough at the bottom lined with non-conducting material, of circuit-terminals, and a series of alternating and separated amalgamating-plates disposed throughout the tank interior as to present at the top there-

of, in the same horizontal plane, the inlets of several vertical tortuous passages, together with a top feed and means for simultaneously circulating the material downward through the tortuous passages, substantially as set forth.

40 23. In an amalgamating apparatus, the combination with an amalgamating-tank containing a vertically-intercepting series of submerged amalgamating-plates and having at its bottom, a mercury-trough presenting an inner surface of an electric non-conducting material, of a conveyer or stirrer also in the lower part of the tank and revoluble in insulated bearings, and an electric generator having its positive pole connected with the conveyer or stirrer and its negative pole with the mercury in the trough, substantially as set forth.

45 24. In an amalgamating apparatus, the combination with a vertically-extended tank, of a vertically-intercepting series of amalgamating-plates relatively separated and arranged in the path of a downward current of material, a mercury-trough having an offset, forming in connection with one of the tank sides, an upwardly-inclined passage, which communicates with a contracting exhaust-chamber 28, substantially as set forth.

50 25. The combination with a tank having the mercury-trough forming its bottom and a revoluble agitator operating both above and below the mercury-level, of a series of alternating and separated adjustable amalgamating-plates triangularly arranged as described and uniformly disposed throughout the tank interior, substantially as set forth.

55 26. In an amalgamating apparatus, the combination with a tank, of a series of vertically-intercepting inclined amalgamating-plates arranged in the path of a downward current of material, each plate having a lower free-edge gutter, substantially as set forth.

60 27. In an amalgamating apparatus, the combination with an amalgamating-tank, of an inclined slotted covering for the same pivotally connected at its upper portion, together with means for adjusting the inclination of said covering, and a feed for delivering material at the highest portion of the same, substantially as set forth.

65 28. The combination with an amalgamating-tank, of a cover therefor transversely slotted as described, and including an adjustable transverse plate provided with a riffle-strip, substantially as set forth.

70 29. The combination with an amalgamating-tank, of a cover therefor transversely slotted as described, and including a transverse plate provided with a riffle-strip having vertical recesses or cavities adapted to serve as mercury-pockets, substantially as set forth.

75 30. The combination with an amalgamating-tank, of a cover therefor comprising transverse plates forming transverse openings, said plates having amalgamated plates re-



movably secured thereto, substantially as set forth.

31. The combination with the tank and concentrating-table adapted to be supplied from  
5 a bottom valved discharge of the same, of a series of alternating and separated horizontal amalgamating-plates triangularly arranged and uniformly so disposed throughout the tank interior as to present at the top thereof  
10 and in the same horizontal plane, the inlets of several vertical tortuous passages together with a top feed for delivering directly to said inlets, substantially as set forth.

32. The combination with a tank, a vibrating concentrating-table delivering to a series  
15 of grading-compartments and adapted to be supplied from a bottom valved discharge located contiguous to a bottom mercury-trough

of the tank, of a number of alternating and separated horizontal amalgamating-plates 20 triangularly arranged as described and uniformly so disposed throughout the tank interior as to present at the top thereof, in the same horizontal plane, the inlets of several vertical tortuous passages, together with a top 25 feed for continuously and simultaneously delivering the material and water to said inlets, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 11th day of 30 May, 1895.

JAMES H. LANCASTER.

Witnesses:

J. R. GROVE,  
E. LANCASTER.