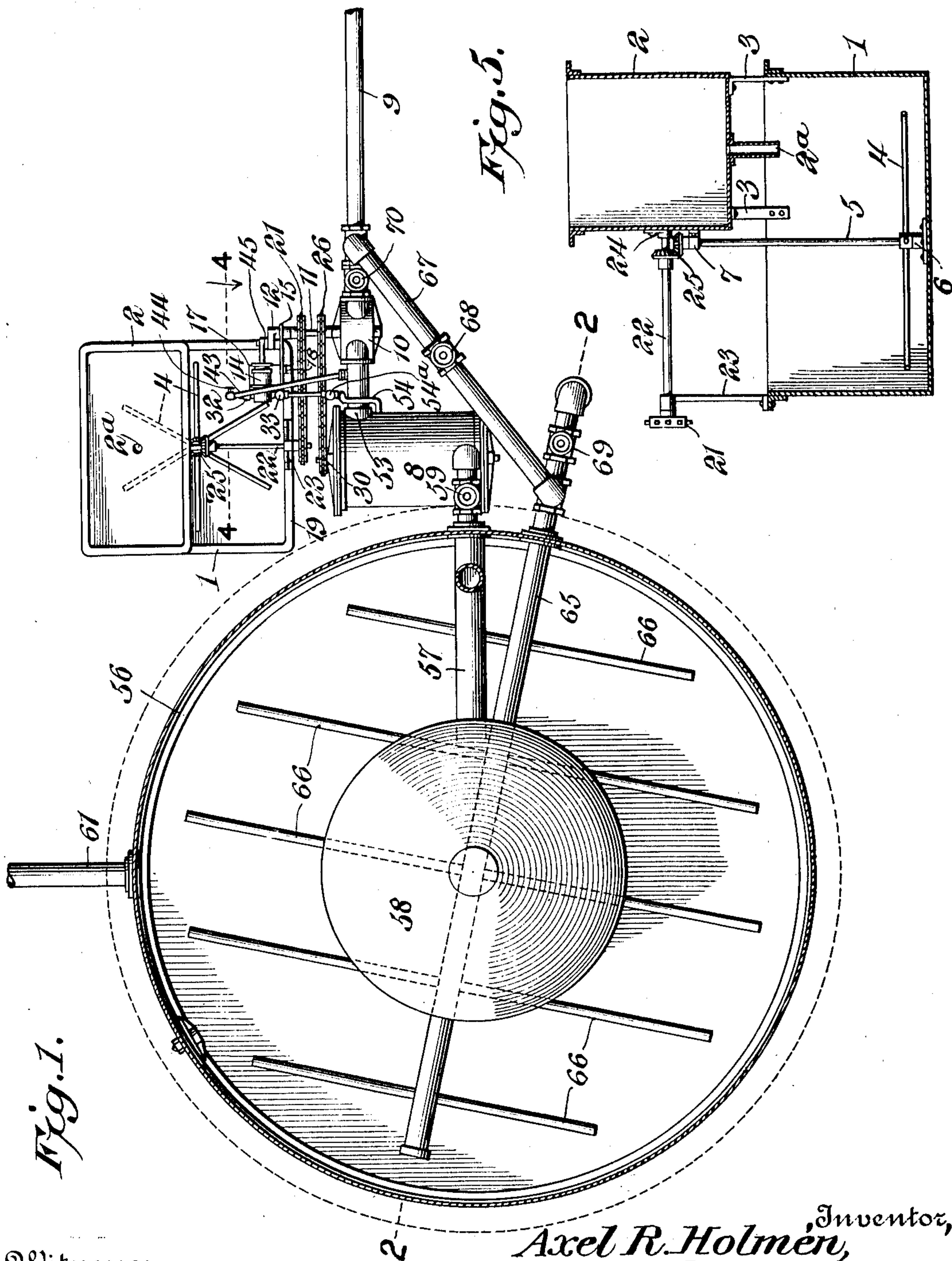


A. R. HOLMÉN.  
 APPARATUS FOR SOFTENING WATER.  
 APPLICATION FILED MAY 10, 1909.

991,990.

Patented May 9, 1911.

4 SHEETS—SHEET 1.



Witnesses  
 Howard D. Orr.  
 H. J. Riley.

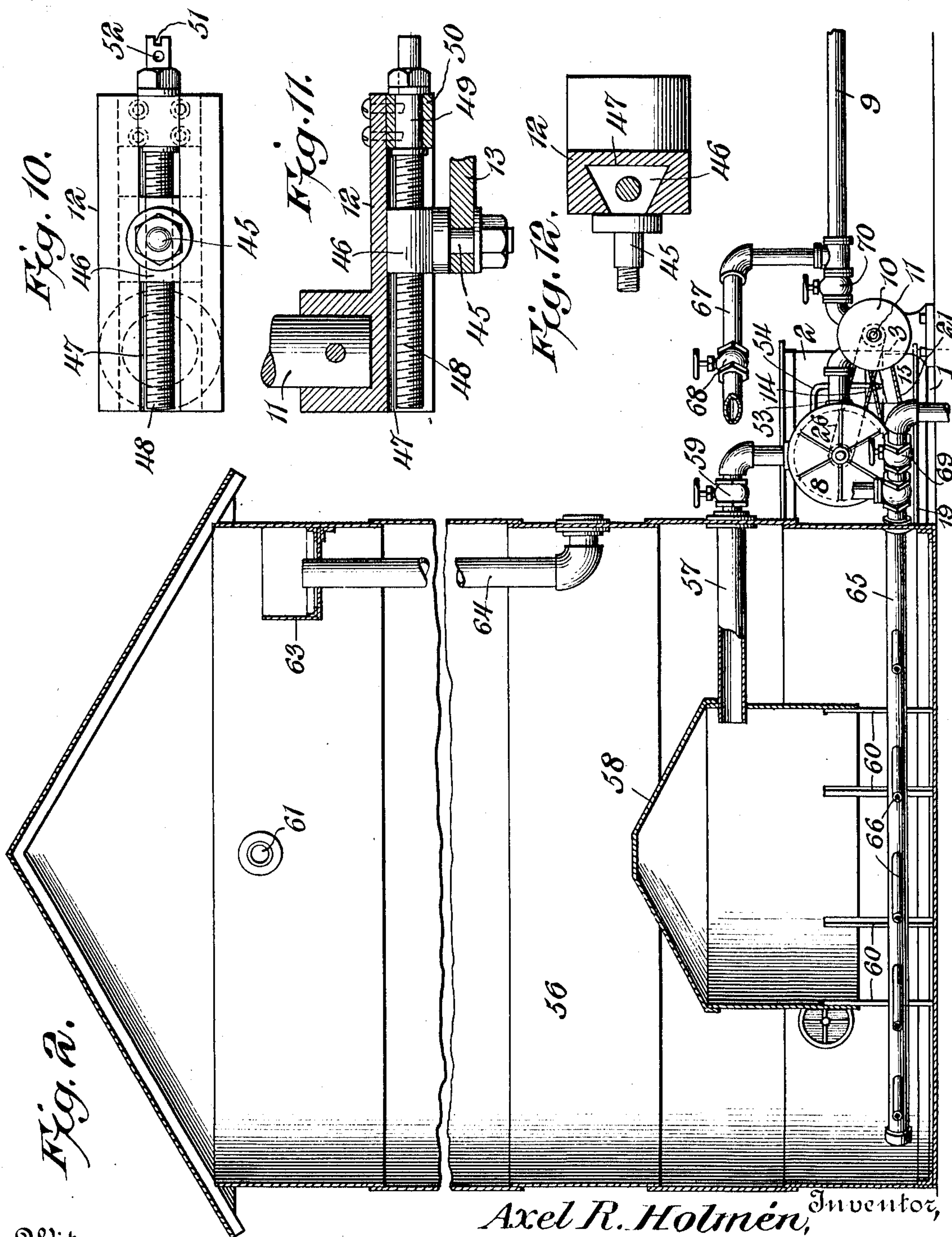
Axel R. Holmén, Inventor,  
 By E. G. Siggers, Attorney

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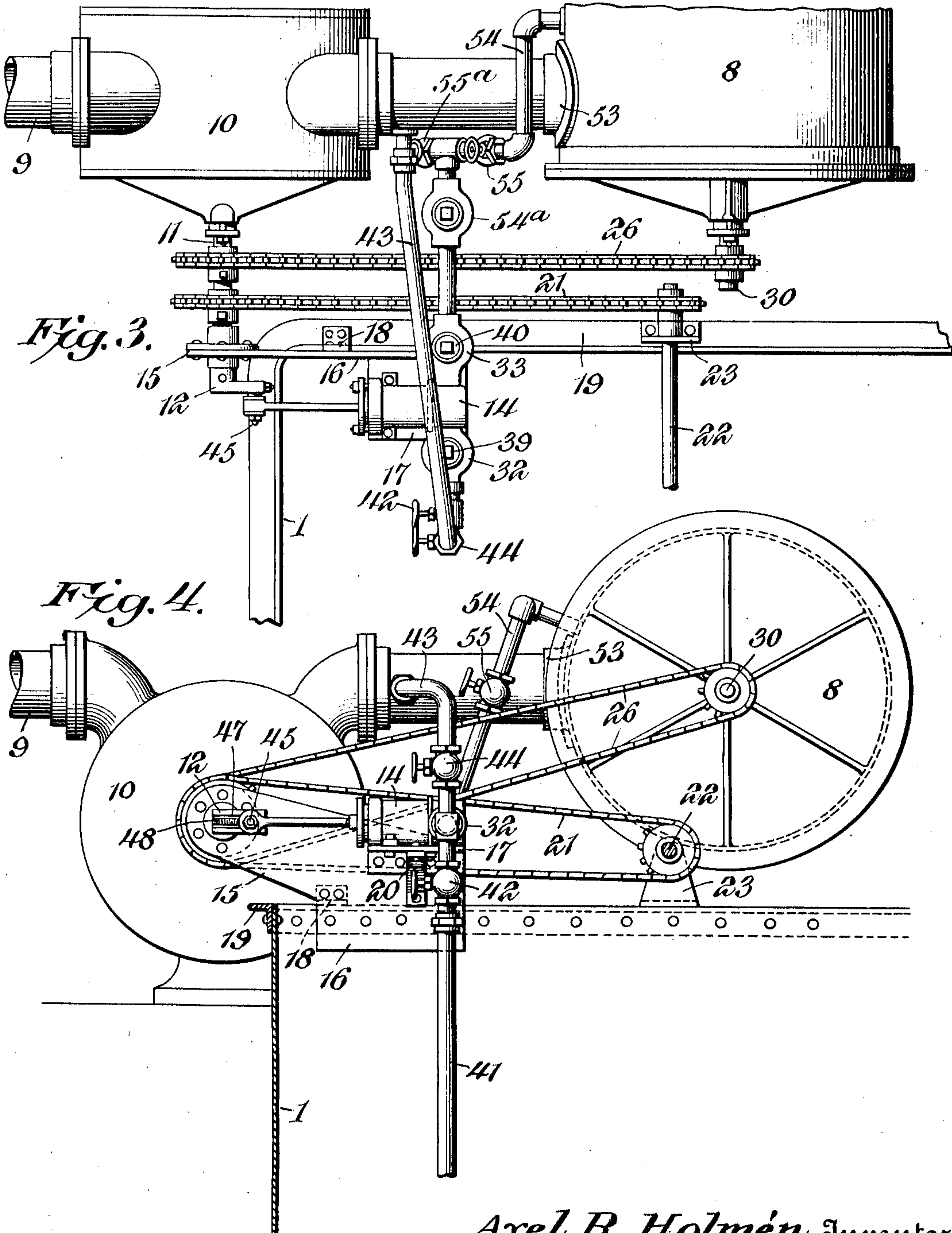


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4 SHEETS—SHEET 3.



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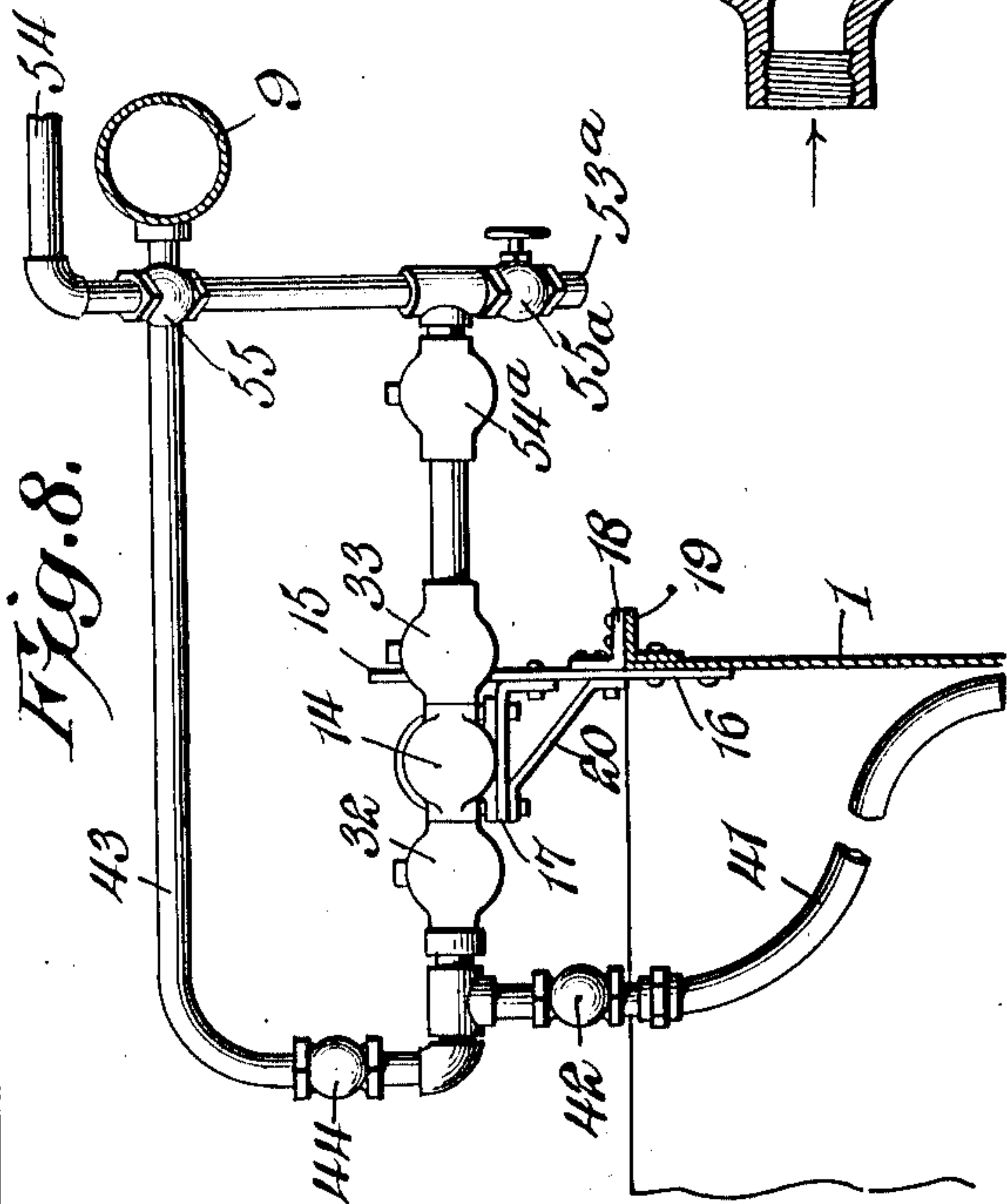
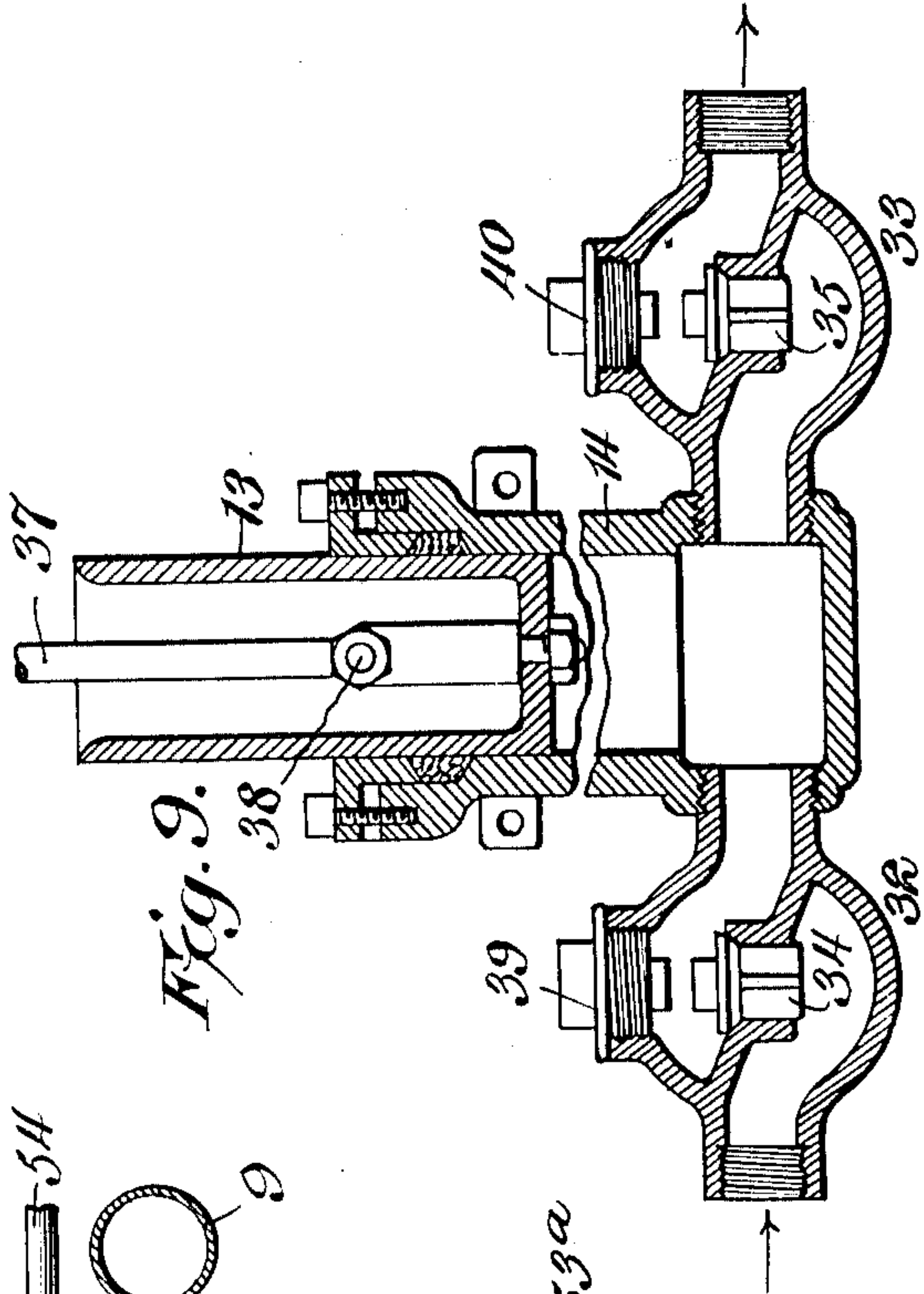
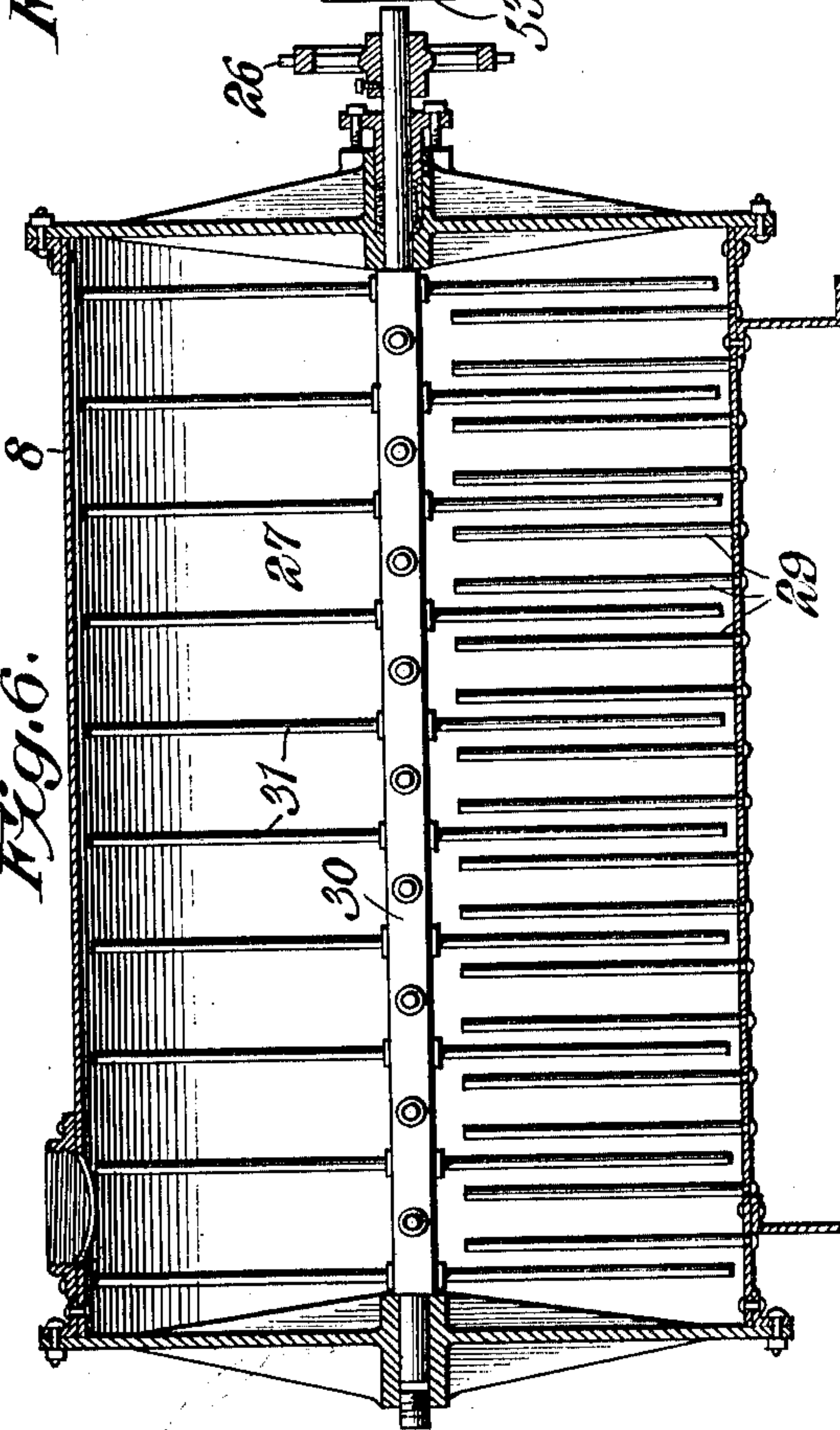
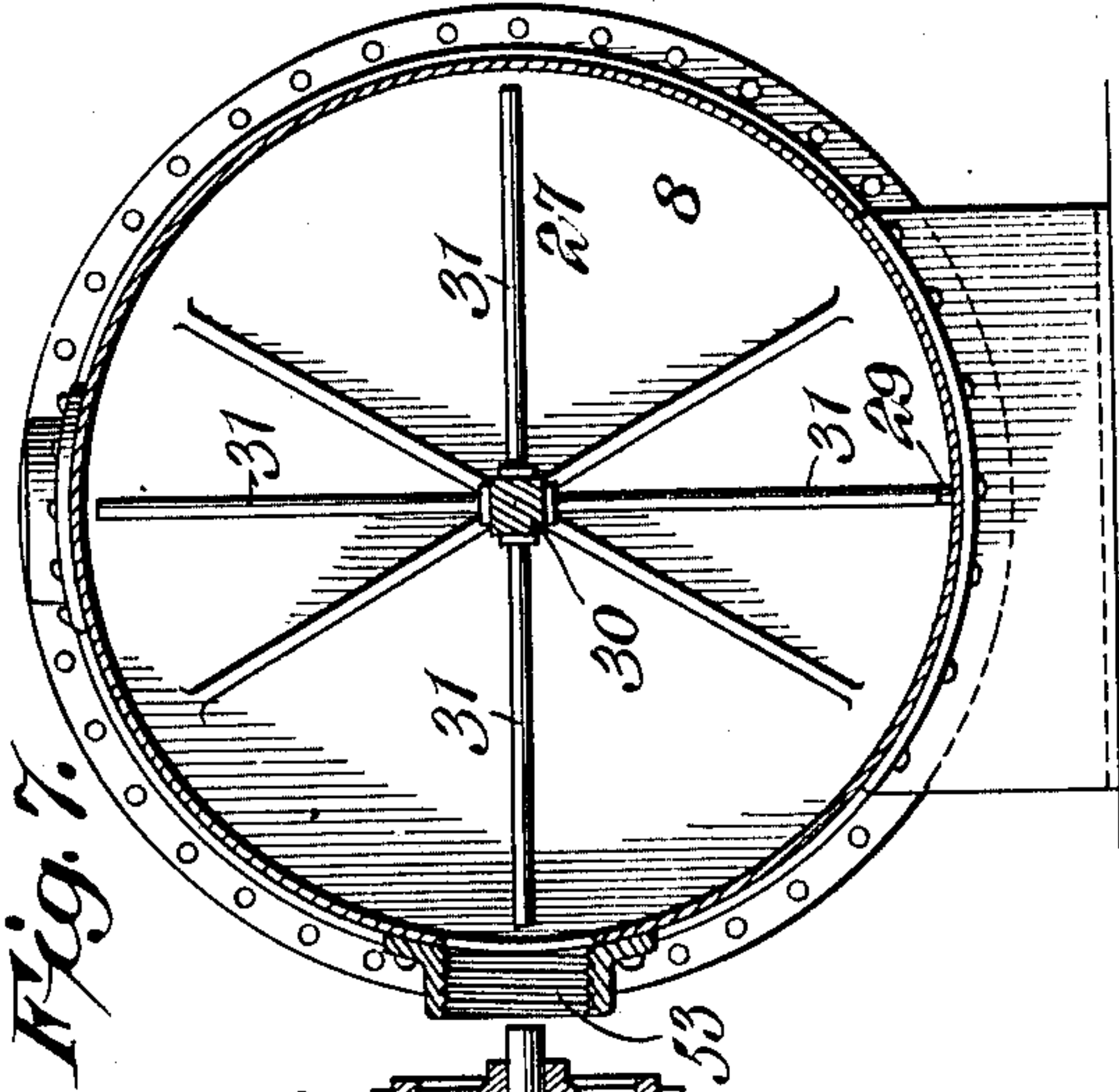
Attorney

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4 SHEETS—SHEET 4.



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Witnesses

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# UNITED STATES PATENT OFFICE.

AXEL R. HOLMÉN, OF COLUMBUS, OHIO.

## APPARATUS FOR SOFTENING WATER.

991,990.

Specification of Letters Patent.

Patented May 9, 1911.

Application filed May 10, 1909. Serial No. 495,033.

*To all whom it may concern:*

Be it known that I, AXEL R. HOLMÉN, a subject of the King of Sweden, residing at Columbus, in the county of Franklin and State of Ohio, have invented a new and useful Apparatus for Softening Water, of which the following is a specification.

The invention relates to improvements in apparatus for softening water.

10 The object of the present invention is to improve the construction of apparatus for softening water, more especially that illustrated and described in Patent No. 819,885, granted to me the 8th day of May, 1906, and 15 to simplify and increase the efficiency of the said construction and enable the chemicals, employed for softening water, to be arranged in a single solution and delivered by a single feeding device into a chamber where 20 the hard or raw water is subjected to the action of the chemicals.

Another object of the invention is to provide simple means for enabling the amount of chemical solution delivered to the raw 25 water to be readily regulated and controlled.

With these and other objects in view, the invention consists in the construction and novel combination of parts hereinafter fully 30 described, illustrated in the accompanying drawings, and pointed out in the claims hereto appended; it being understood that various changes in the form, proportion, size and minor details of construction, within the scope of the claims, may be resorted 35 to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:—Figure 1 is a plan 40 view, partly in section, of an apparatus for softening water, constructed in accordance with this invention. Fig. 2 is a vertical sectional view, taken substantially on the line 2—2 of Fig. 1. Fig. 3 is an enlarged plan 45 view of a portion of the apparatus, illustrating the arrangement of the solution tank, the mixing drum, the motor, and the means for feeding the solution from the tank to the mixing drum. Fig. 4 is an enlarged sectional view on the line 4—4 of 50 Fig. 1. Fig. 5 is a detail vertical sectional view of the solution tank and the lime slaking tank. Fig. 6 is a longitudinal sectional view of the mixing drum. Fig. 7 is a transverse sectional view of the same. Fig. 8 is 55 a detail view, illustrating the construction

for feeding the solution for controlling the strength of the same. Fig. 9 is a sectional view, illustrating the construction of the pump, the valves, the valve casings being 60 turned at right angles for convenience of illustration. Figs. 10 to 12 are detail views, illustrating the construction of the adjustable crank for controlling the length of the stroke of the piston of the pump. 65

Like numerals of reference designate corresponding parts in all the figures of the drawings.

The apparatus is equipped with a solution tank 1, which in practice will contain all the 70 chemicals necessary for the softening of water. The water is softened by the application of soda ash and milk of lime solution, the chemical action being the same as that explained in the aforesaid patent, the 75 difference consisting in subjecting the raw water to the action of a solution of soda ash and milk of lime in the present invention instead of feeding the milk of lime solution and the soda ash solution separately to the 80 water to be softened. The soda ash solution is supplied to the tank 1, and the lime is slaked in a superimposed tank 2, mounted upon and located above the tank 1 and provided at its bottom with a depending outlet 85 2<sup>a</sup>, as clearly illustrated in Fig. 5 of the drawings. The tank 2 is supported by brackets 3, consisting of L-shaped metallic 90 pieces having short horizontal arms to fit against the bottom of the tank 2 and provided with depending vertical arms, which are secured to the inner faces of the walls of the solution tank 1.

The solution tank is equipped with a stirrer or agitator, consisting of a plurality of 95 horizontal arms 4 and a vertical shaft 5, stepped at its lower end in a suitable bearing 6 of the bottom of the solution tank and journaled at its upper end in a bracket 7, secured to the superimposed tank 2. The 100 arms 4, which are radially arranged, are located close to the bottom of the solution tank and are adapted to cause a thorough mixing of the elements of the solution contained in the tank 1. 105

The raw water to be treated is delivered under pressure to a mixing drum 8 through a supply pipe 9, with which a rotary motor 10 is connected. The rotary motor 10 is provided with a shaft 11, having a terminal 110 crank 12, which is connected with a plunger 13 of a pump 14. The motor may be of any



suitable type, but a rotary motor is preferable as with this type of motor the amount of water supplied with each rotation of the piston of the motor may be controlled. The outer portion of the motor shaft is supported by an inclined arm 15 of a plate 16, forming a bearing bracket and provided at the inner portion of the arm 15 with a horizontal shelf 17 for supporting the cylinder of the pump. The shelf 17 is provided with a depending attaching flange, which is riveted or otherwise secured to the plate 16, and the latter is secured to the inner face of one of the side walls of the tank 1, as clearly illustrated in Fig. 4 of the drawings. The plate 16 is provided at its outer face with horizontally projecting lugs 18, formed by L-shaped pieces and arranged to rest upon the ledge 19, projecting outwardly from the upper edge of the solution tank. The shelf 17 is supported by an inclined brace 20, extending from the vertical plate 17 to the side edge of the shelf. The motor shaft is connected by sprocket gearing 21 with a horizontal counter shaft 22, extending inwardly over the solution tank to the superimposed tank 2, and supported at its outer end by a bearing bracket 23 and having its inner end journaled in a suitable bearing of a plate 24. Motion is communicated from the horizontal shaft 22 to the vertical stirrer shaft 5 by beveled gears 25. Motion is also communicated from the motor shaft by sprocket gearing 26 to a stirrer 27 of the mixing drum 8. The mixing drum, which is cylindrical, is equipped at its bottom with upwardly extending vertical arms 29, preferably consisting of rods, arranged as shown, but instead of employing a single row, as illustrated in Figs. 6 and 7 of the drawings, a plurality of rows may be utilized as shown in the aforesaid patent.

The stirrer 27 consists of a horizontal shaft 30, journaled in suitable bearings of the ends of the mixing drum and provided at intervals with projecting arms 31, arranged to operate between the fixed arms 29 of the mixing drum.

The pump 14 is provided with a cylinder or barrel, having lateral ports at one end with which are connected valve casings 32 and 33, containing check valves 34 and 35. The plunger 13 reciprocates in the pump cylinder and is connected with the crank of the motor shaft by a rod 37, having a pivotal connection at its inner end 38 with the plunger 13. When the plunger is moved outward, the liquid is drawn inward into the pump through the casing 32, and when the plunger is moved inward the liquid contained within the pump is forced out through the casing 33, the valve 35 thereof opening in this operation while the other valve is held firmly on its seat by the internal pressure. The valves 34 and 35 are arranged

vertically and the valve casings are equipped with suitable bonnets 39 and 40, adapted to afford access to the valves 34 and 35. The inlet end of the pump is connected with a pipe 41, extending downwardly into the solution tank, as clearly illustrated in Fig. 8 of the drawings. This pipe 41 is equipped at its upper portion with a hand valve 42 for controlling the flow of the solution through the pipe 41 into the pump 14. A by-pass pipe 43 extends from the raw water supply pipe 9 at a point between the motor and the mixing drum, and it is connected with the upper end of the pipe 41 at a point above the hand valve 42 thereof. The pipe 43, which is provided with a hand valve 44, is arranged for cleaning the valves of the pump mechanism, as hereinafter fully explained.

The quantity of solution forced into the mixing drum at each stroke of the pump may be varied by varying the stroke of the plunger of the pump. This is effected by means of an adjustable wrist pin 45, extending from an adjustable slide 46, oppositely beveled to taper it outwardly to fit a longitudinal dove-tailed groove 47 of the crank arm of the shaft of the motor. The dove-tailed groove extends the entire length of the crank arm, and the slide is adjusted by means of a screw 48 having a smooth portion 49 swiveled to a tapered block 50, which is secured within one end of the dove-tailed groove. The screw is extended outward beyond the bearing block 50, and is provided with a groove 51 and a perforation 52, adapted to receive a suitable tool for rotating the screw to adjust the wrist pin to vary the stroke of the pump.

The raw water enters the mixing drum near one end thereof through an inlet 53, and the chemical solution from the pump is conducted to the mixing drum through a pipe 54, connected with the discharge end of the pump and provided with an upper hand valve 55 and piercing the wall of the mixing drum adjacent to the inlet 53. A check valve 54<sup>a</sup> is arranged in the pipe 54, which is also provided below the valve 55 with an outlet extension 53<sup>a</sup> having a lower hand valve 55<sup>a</sup>. When it is desired to clean the valves of the pump and the check valve 54<sup>a</sup> of any sediment accumulating on the valve seats, the valve 42 of the pipe 41 and the upper valve 55 of the pipe 54 are closed, and the valve 44 of the by-pass pipe 43 and the lower hand valve 55<sup>a</sup> of the extension 53<sup>a</sup> of the pipe 54 are opened, which will cause the water to flow through the valves and the cylinder of the pump and also through the check valve 54<sup>a</sup> and out through the valve 55<sup>a</sup>. The outlet extension 53<sup>a</sup> of the pipe 54 may be connected with any suitable means for conveying away the water used for cleaning the valves. The chemicals meet the raw water



in the mixing drum, and they flow together through the same where the water is agitated for about one minute before passing into a settling tank 56. The chemically treated water flows from the end of the mixing drum opposite that at which the inlet 53 is located, through a pipe 57 into a bell 58, located at the lower portion of the settling tank a short distance above the bottom thereof. The pipe 57, which is provided with an exterior hand valve 59, pierces the wall of the settling tank and the adjacent side of the bell, which has a dome-shaped top, as clearly illustrated in Fig. 2 of the drawings. The bell is supported by rods 60, or other suitable means, secured at their upper ends to the inner faces of the sides of the bell and supported at their lower ends upon the bottom of the settling tank. The thorough mixing of the water and chemicals under pressure hastens the chemical action so that it is completed before leaving the bell, which prevents a direct flow of water from the pipe 57 to an outlet or over-flow pipe 61. The water flows from only the lower edges of the bell, and the capacity of the settling tank is more completely utilized for settling the chemically treated water. The bell also operates to concentrate or collect the precipitate, which finally settles to the bottom of the tank. The over-flow pipe is connected with suitable supply tanks, but, if desired, the settling tank may be connected with filters and for this purpose an upper rectangular casing 63 and an outlet pipe 64 are preferably employed. The pipe 64 pierces the wall of the settling tank, and will be connected by suitable piping with the filters, which may be of any preferred construction. The water may then be conducted from the filter or filters to the storage tanks.

The precipitate is moved from the bottom of the settling tank through a sludge pipe 65, arranged horizontally a short distance above and in spaced relation with the settling tank and provided with a plurality of tubes 66, extending laterally from opposite sides of the sludge pipe. The sludge pipe is connected with the raw water supply pipe at a point beyond the motor by a by-pass pipe 67. The by-pass pipe and the sludge pipe are provided with hand operated valves 68 and 69, and the raw water inlet pipe is provided at a point between the by-pass pipe and the motor with a hand operated valve 70. When it is desired to remove the sludge from the bottom of the settling tank, the flow of water to the motor is cut off and the valve of the pipe 57 is also closed. Raw water is then permitted to flow through the by-pass pipe into the settling tank through the sludge pipe and the laterally extending tubes thereof. This stirs or agitates the sediment, which, with the raw water, may be

drawn off through the sludge pipe thereby cleaning the settling tank. The valve 68 of the by-pass pipe is closed, and the valve 69 of the sludge pipe is opened to permit the water and the sediment to escape from the settling tank.

Although the apparatus is designed primarily for the softening of water, it will be apparent that it may be advantageously employed for purifying or similarly treating water.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. An apparatus of the class described including a settling tank, a mixing chamber arranged exteriorly of the settling tank and connected therewith, means for supplying water under pressure to the mixing chamber, a motor connected with and operated by the water supply, a solution tank also arranged exteriorly of the settling tank, a pump operated by the motor and connected with the mixing chamber and having an inlet pipe communicating with the solution tank, and a by-pass pipe extending from the water supply to the inlet pipe.

2. An apparatus of the class described including a settling tank, a mixing chamber arranged exteriorly of the tank and connected therewith, a motor connected with the mixing chamber, means for supplying water under pressure to the motor for actuating the same and for supplying the mixing chamber, a solution tank also arranged exteriorly of the settling tank, a pump operated by the motor and communicating with the mixing chamber and having an inlet pipe connected with the solution tank, and a valve controlled by-pass pipe extending from the inlet pipe to the water supply and connected with the latter at a point between the motor and the mixing chamber.

3. An apparatus of the class described including a settling tank, a mixing chamber arranged exteriorly of the tank and connected therewith, means for supplying water under pressure to the mixing chamber, a solution tank also arranged exteriorly of the settling tank, means operated by the motor for feeding the solution to the mixing chamber, a bell arranged within the settling tank in spaced relation with the bottom of the tank, and a pipe extending from the mixing chamber to the bell and communicating with the upper portion of the same.

4. An apparatus of the class described including a settling tank, a mixing chamber arranged exteriorly of the tank and connected therewith, means for supplying water under pressure to the mixing chamber, a solution tank also arranged exteriorly of the settling tank, means operated by the motor for feeding the solution to the mixing cham-



ber, a bell arranged within the settling tank and provided at its walls with downwardly extending supporting rods arranged upon the bottom of the settling tank and supporting the bell in spaced relation with the bottom thereof, and a pipe extending from the mixing chamber to the bell and communicating with the interior thereof at the upper portion of the same.

5. An apparatus of the class described including a settling tank, a mixing chamber arranged exteriorly of the settling tank and connected therewith, means for supplying water under pressure to the mixing chamber, a motor operated by the water supply, means actuated by the motor for feeding the solution into the mixing chamber, a sludge pipe arranged at the bottom of the settling tank, and a valve controlled by-pass pipe connected with the sludge pipe and with the water supply at a point beyond the motor.

6. An apparatus of the class described including a mixing chamber, means for supplying water to the mixing chamber under pressure, a motor connected with and operated by the water supply, means actuated by the motor for feeding to the mixing chamber a solution containing all the ingredients for the treatment of water, a settling tank provided with an interiorly arranged bell spaced from the bottom of the tank, a pipe extending from the mixing chamber to the interior of the bell, a sludge pipe arranged at the bottom of the settling tank, and a by-pass pipe connecting the sludge pipe with the water supply.

7. An apparatus of the class described including a mixing chamber, means for supplying water to the mixing chamber under pressure, a motor connected with and operated by the water supply, means actuated by the motor for feeding to the mixing chamber a solution containing all the ingredients for the treatment of water, a settling tank connected with the mixing chamber, a sludge pipe arranged at the bottom of the settling tank and provided at opposite sides with tubes, and a by-pass pipe connected with the sludge pipe and with the water supply beyond the motor.

8. An apparatus of the class described including a mixing drum having a rotary stirrer, means for supplying water to the

mixing drum under pressure, a solution tank provided with an agitator and adapted to contain all the ingredients for the treatment of water, a motor connected with and operated by the water supply, a pump communicating with the solution tank and with the mixing drum for feeding the solution to the drum, means for connecting the pump, the stirrer and the agitator with the motor, a settling tank provided with a bell, a pipe extending from the bell to the mixing chamber, a sludge pipe having branched tubes and arranged at the bottom of the mixing chamber, and pipe connections between the sludge pipe and the water supply.

9. An apparatus of the class described including a mixing drum, means for supplying water to the mixing drum under pressure, a solution tank, a pump having a pipe communicating with the solution tank for containing all the ingredients for the treatment of water, a pipe extending from the pump to the mixing chamber and provided with an outlet and having valves for controlling the passage of water through the outlet and to the mixing drum, a by-pass pipe extending from the water supply to the pump, and valves for controlling the flow of water through the by-pass pipe and the flow of the solution to the pump.

10. An apparatus of the class described including a mixing drum having a rotary stirrer, means for supplying water to the mixing drum under pressure, a solution tank provided with an agitator and adapted to contain the ingredients for the treatment of water, a motor connected with and operated by the water supply, a pump communicating with the solution tank and with the mixing drum for feeding the solution to the drum, means for connecting the pump, the stirrer, and the agitator with the motor, a settling tank provided with a bell, and a pipe extending from the mixing drum to the bell.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

AXEL R. HOLMÉN.

Witnesses:

C. E. JUSTICE,  
F. E. COLLING.