

No. 674,153.

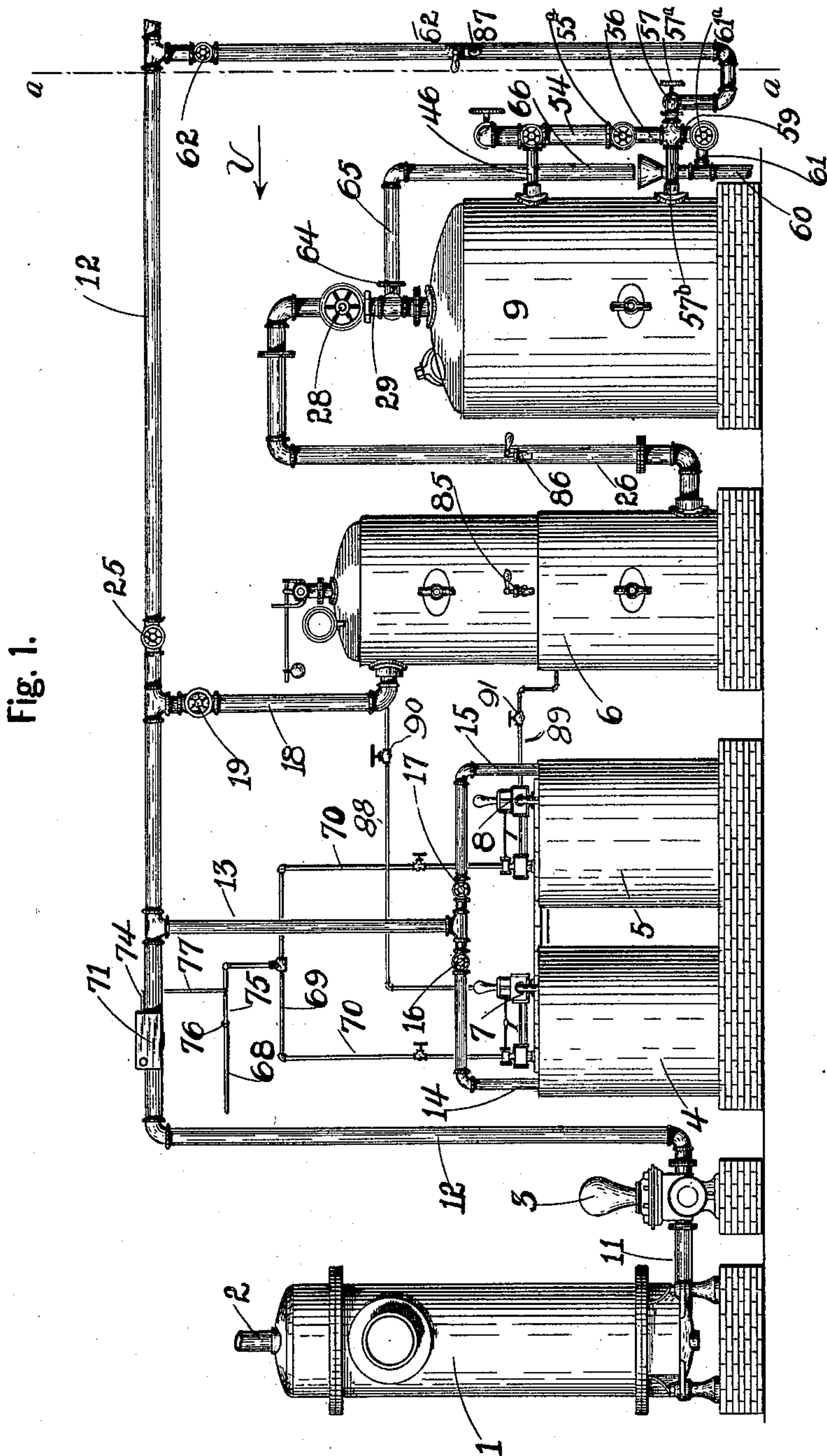
Patented May 14, 1901.

F. E. BACHMAN.  
APPARATUS FOR PURIFYING WATER.

(Application filed Mar. 21, 1900.)

(No Model.)

5 Sheets—Sheet 1.



Witnesses.

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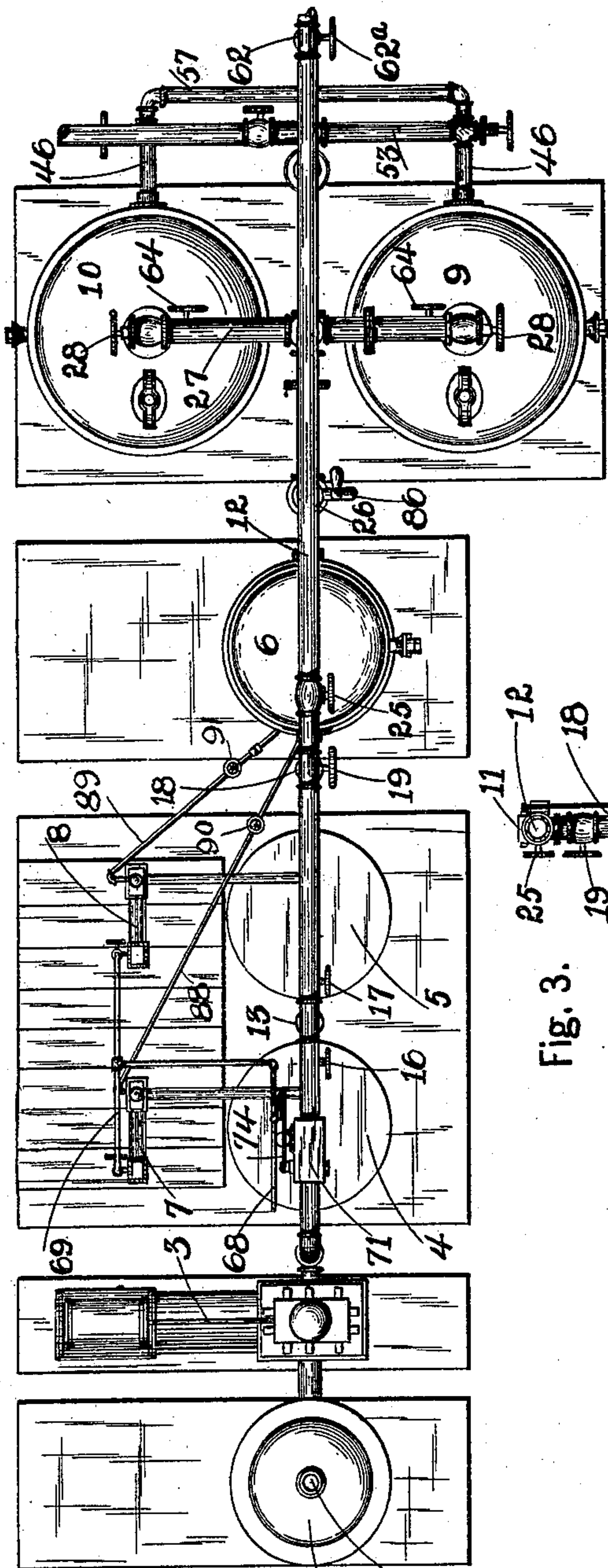


Fig. 2.

Witnesses.

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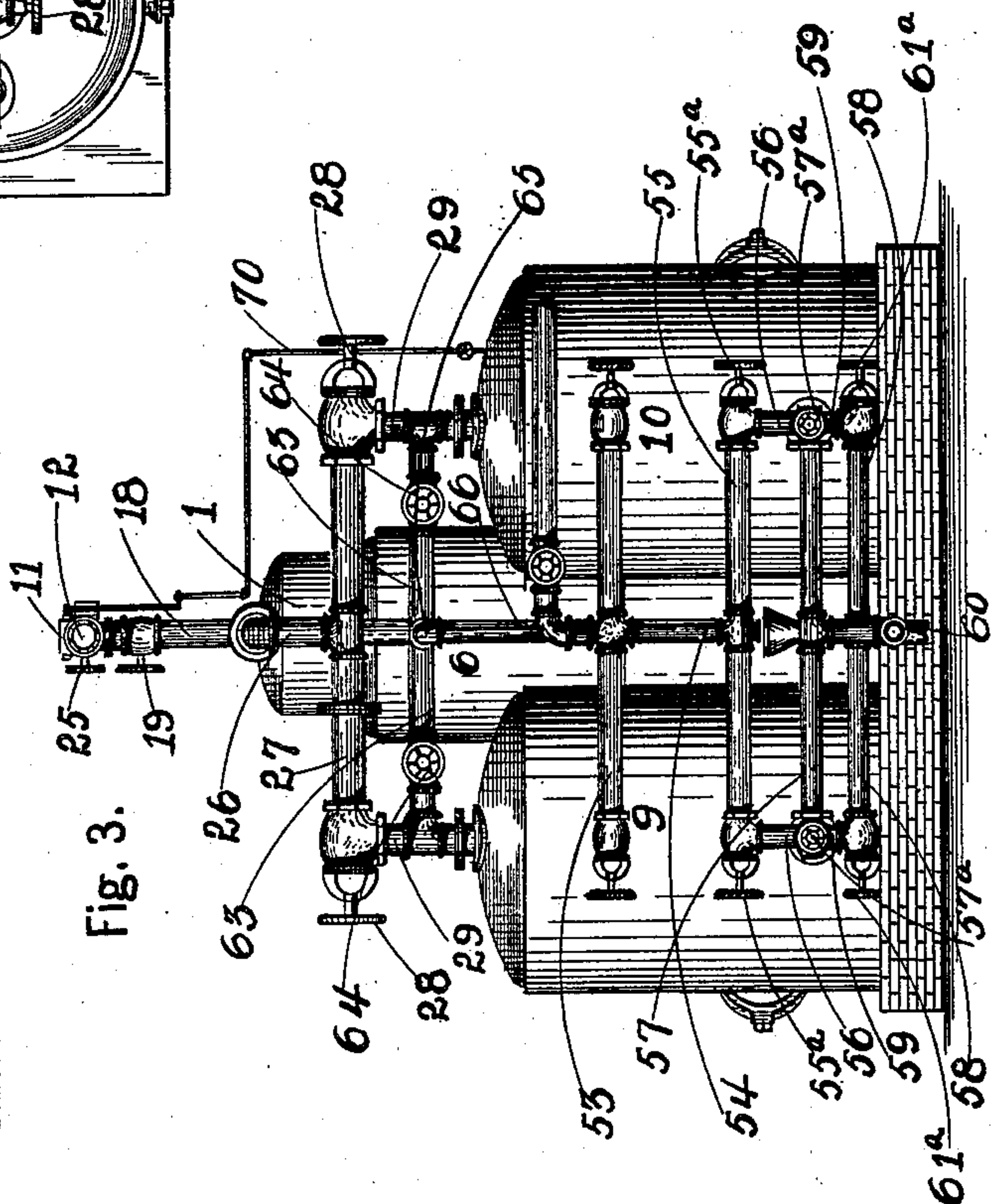


Fig. 3.

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Fig. 5.

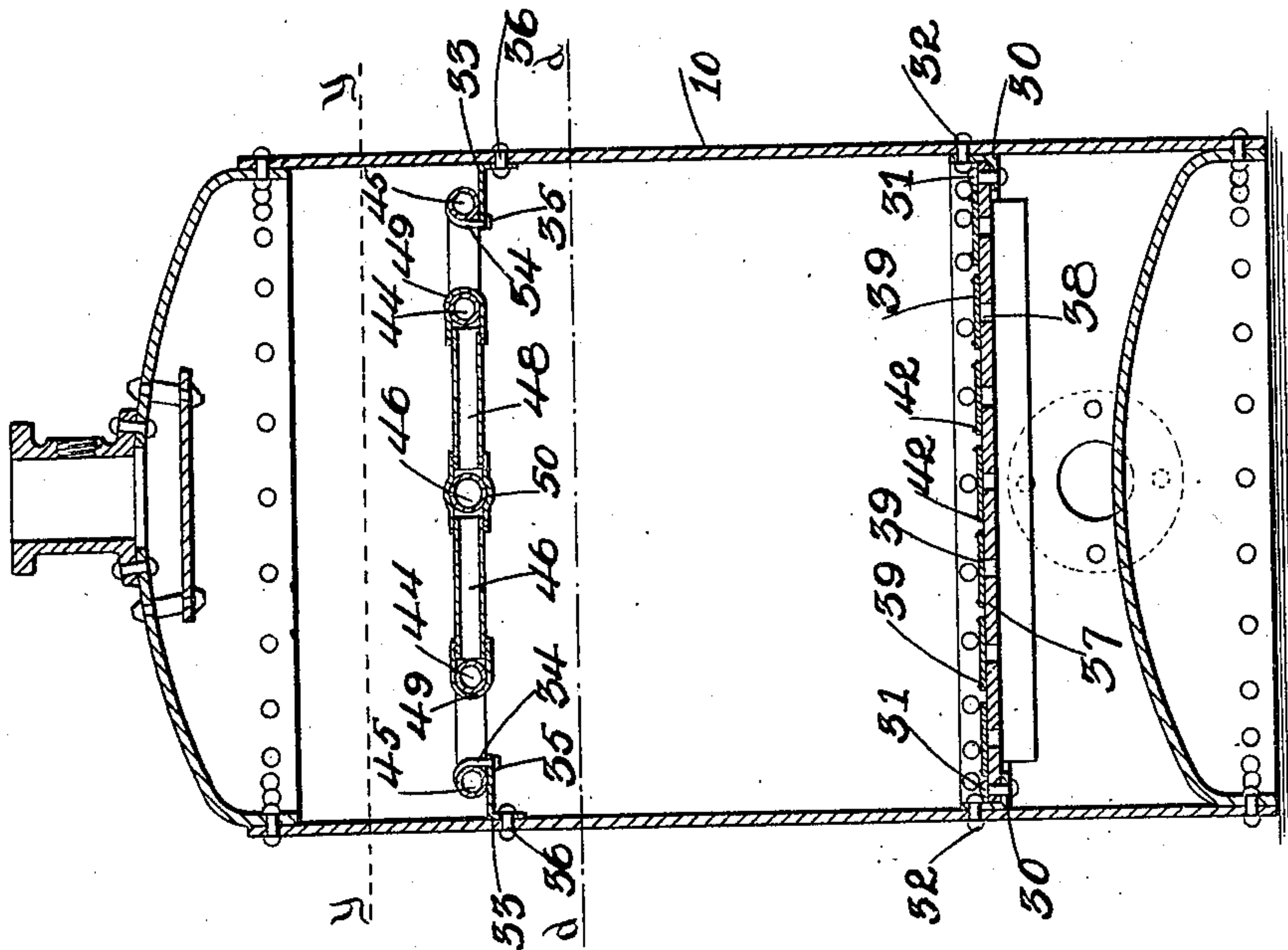
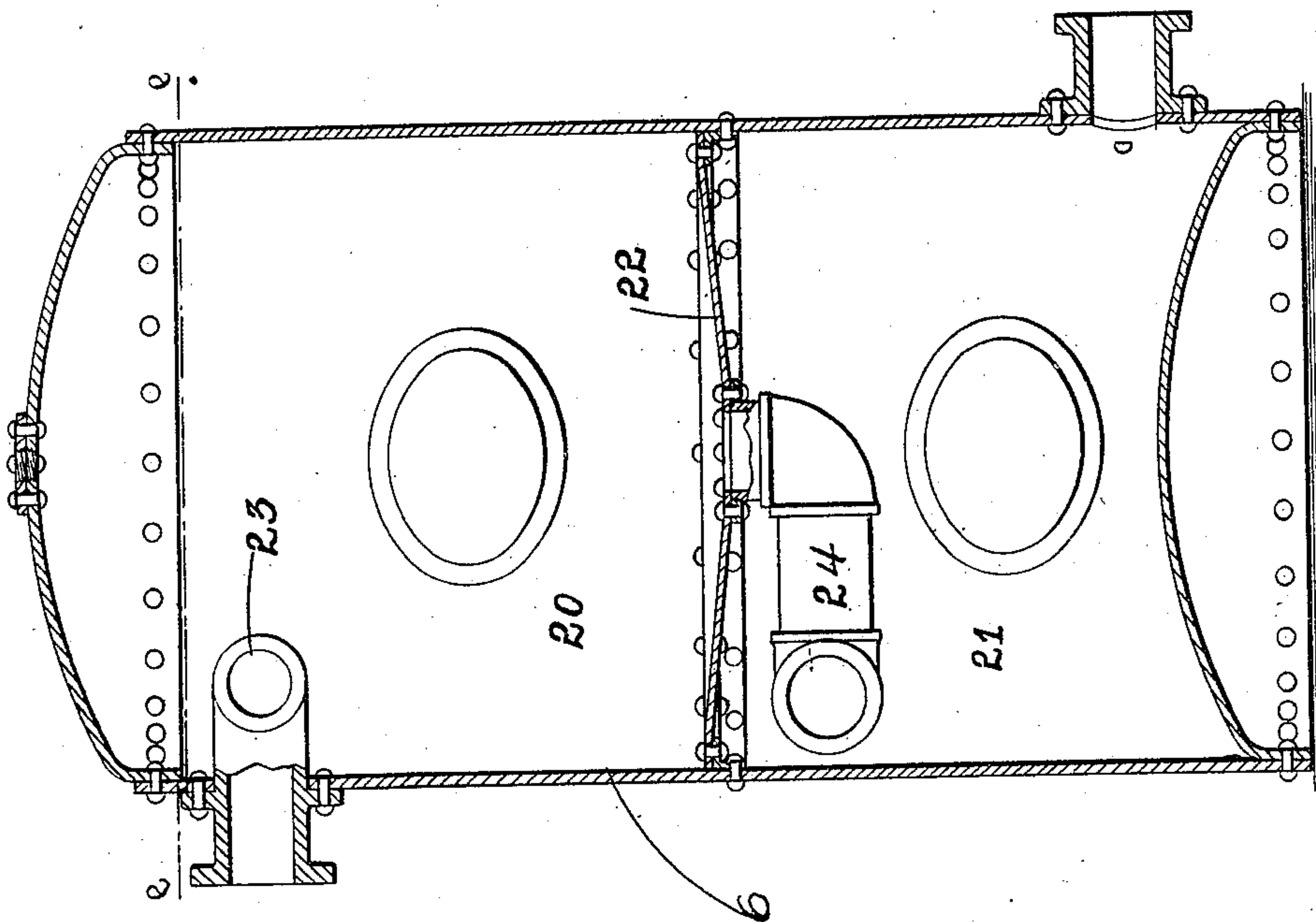


Fig. 4.



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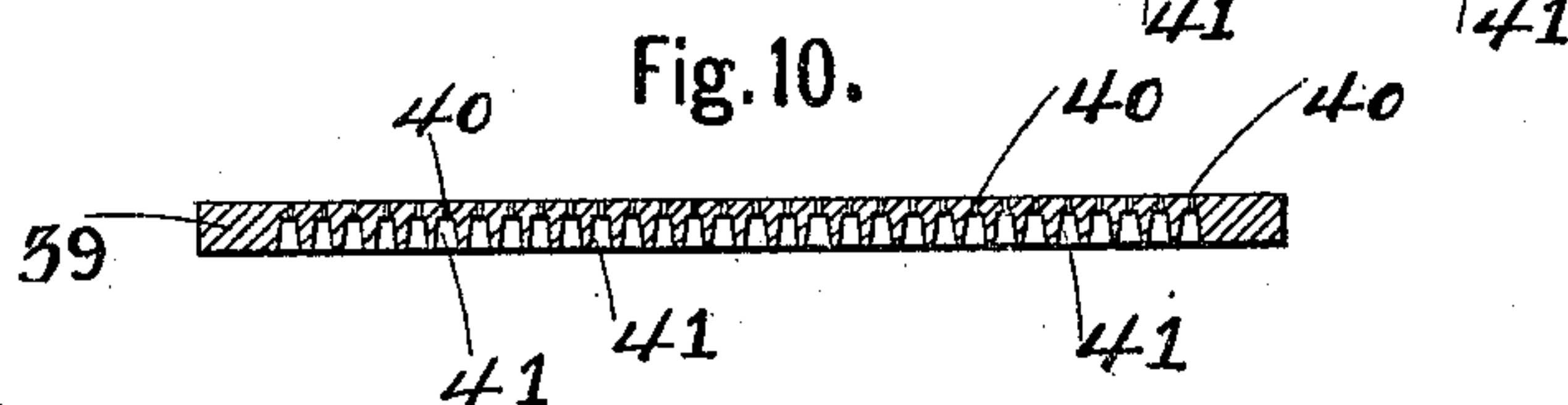
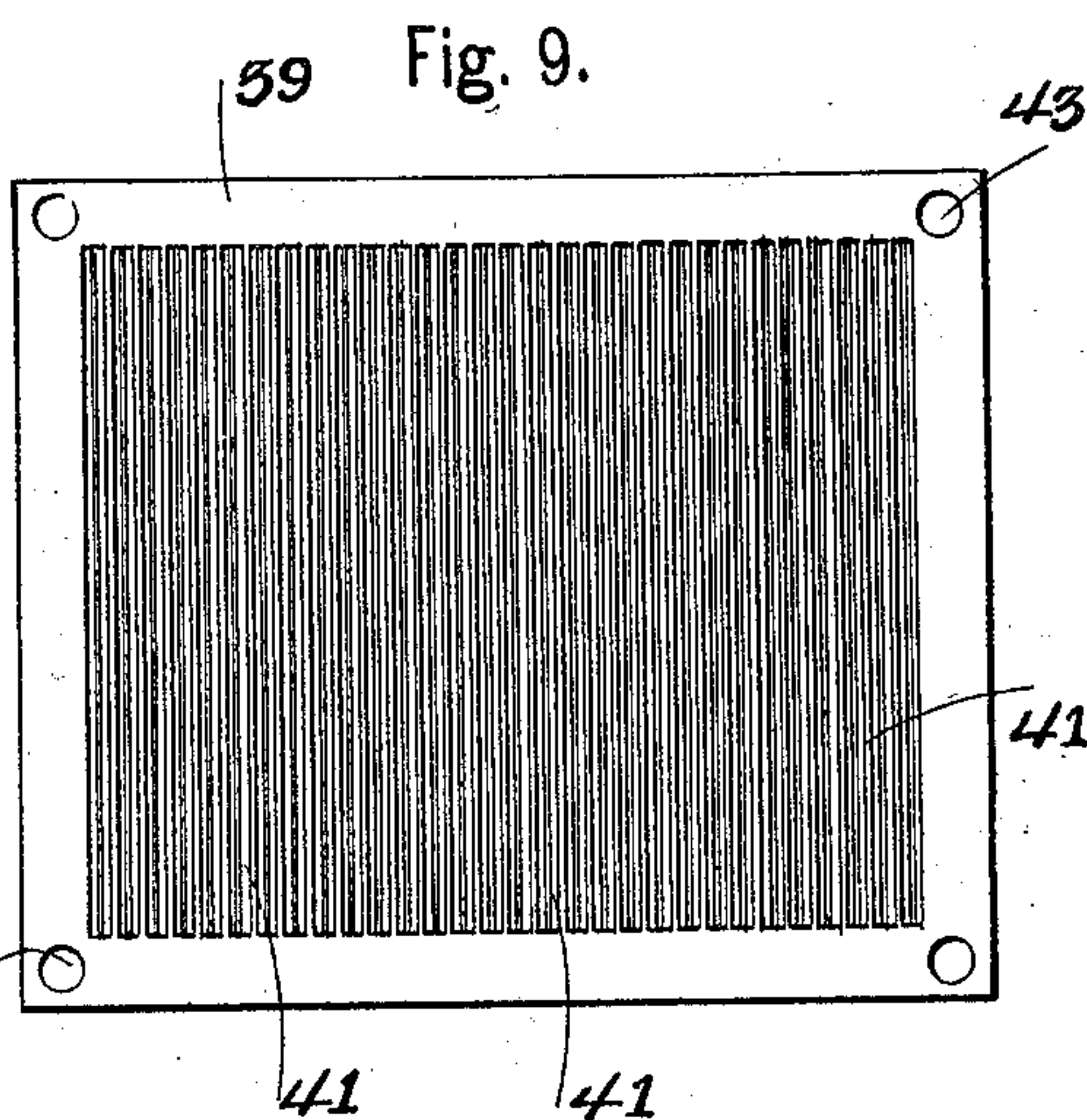
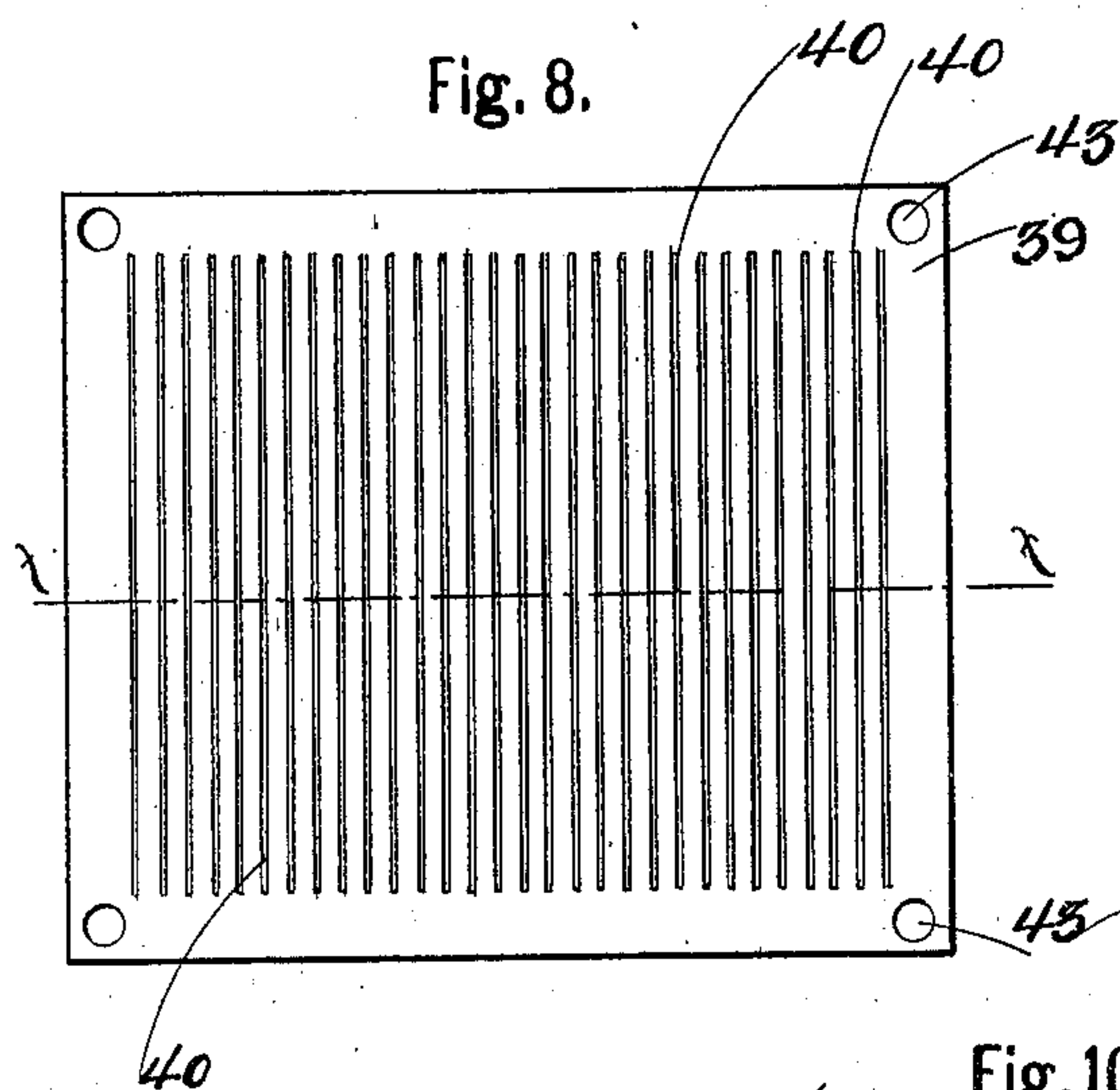
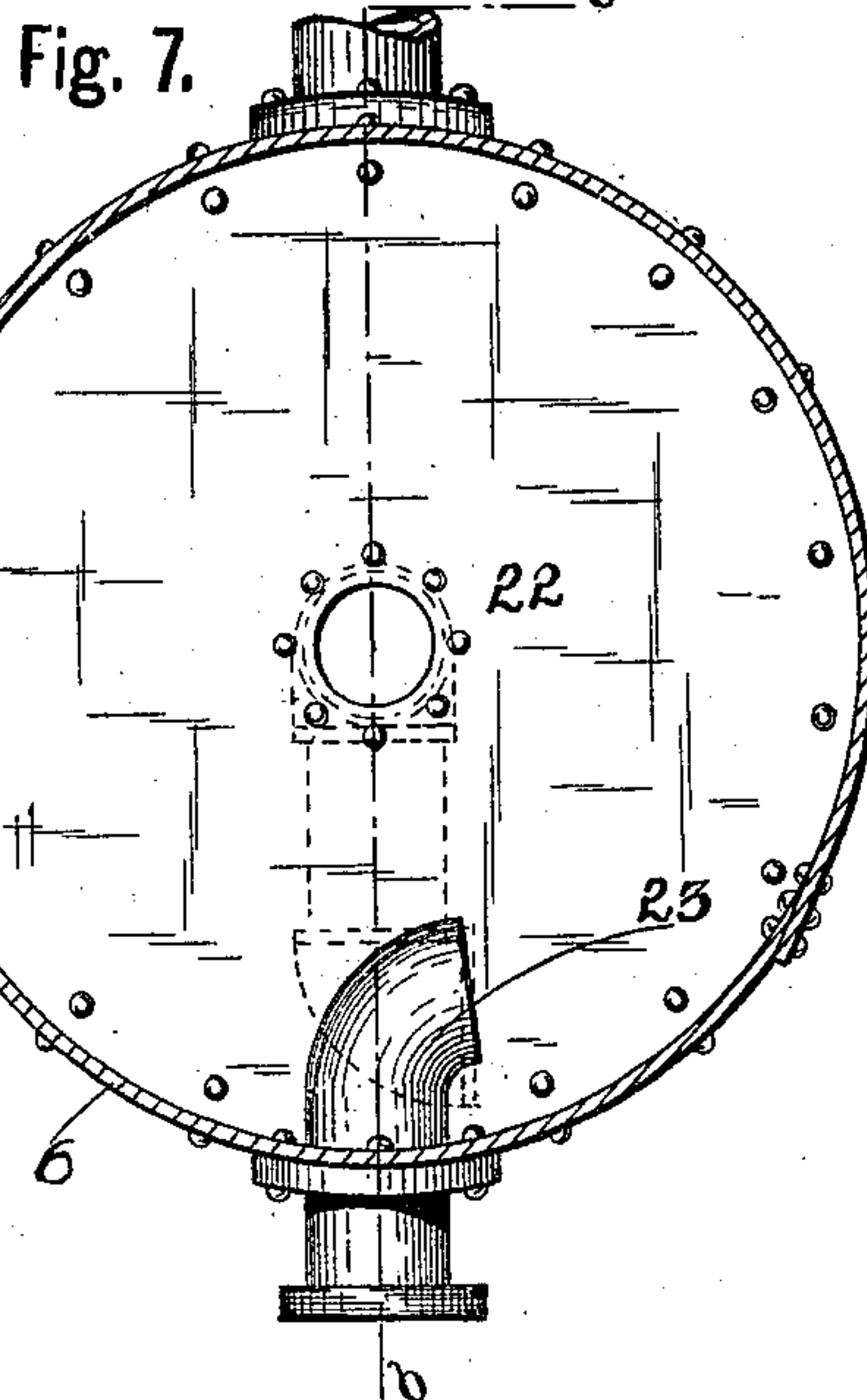
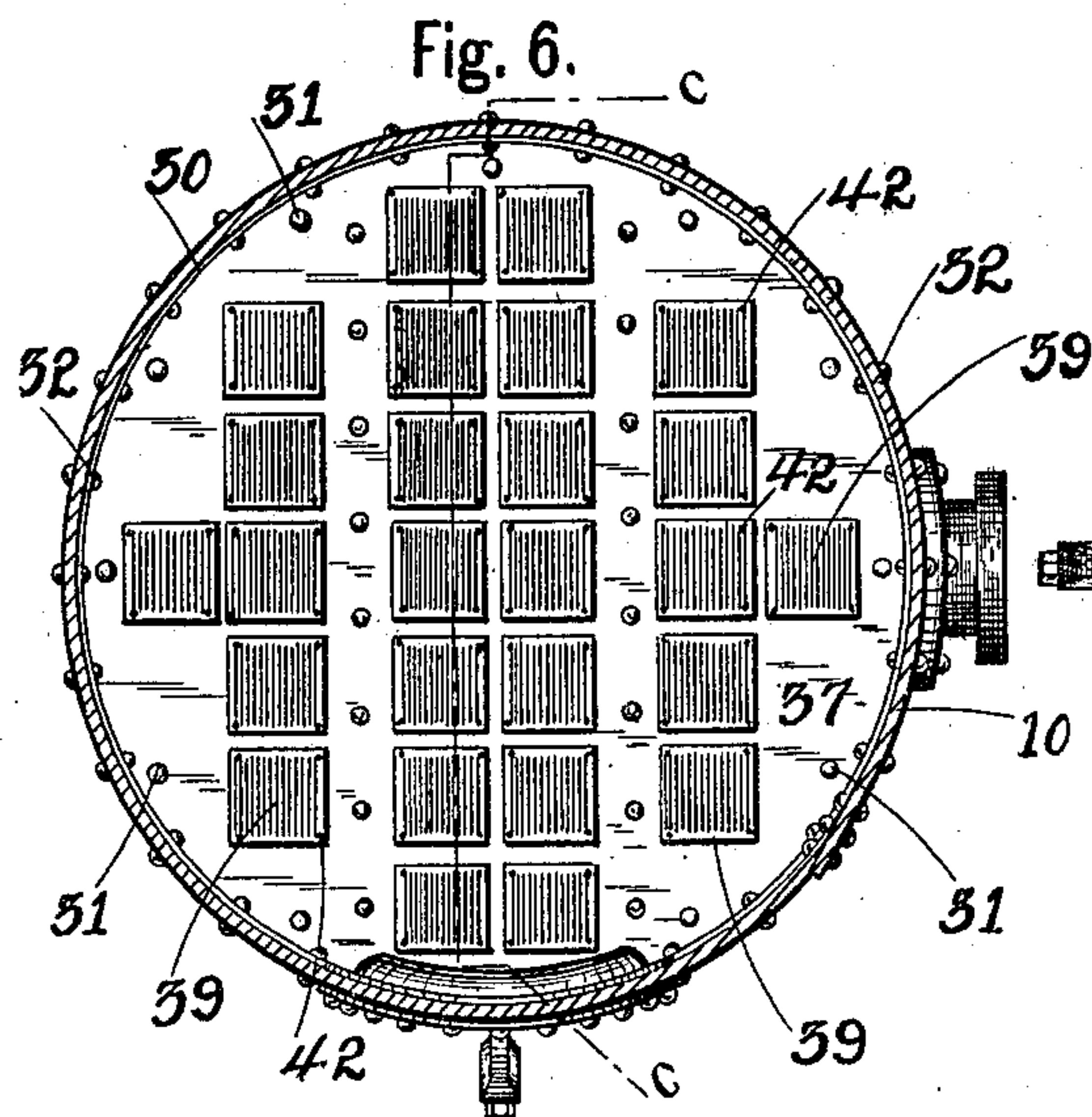
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(Application filed Mar. 21, 1900.)

(No Model.)

5 Sheets—Sheet 4.



Witnesses.

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5 Sheets—Sheet 5.

Fig. 11.

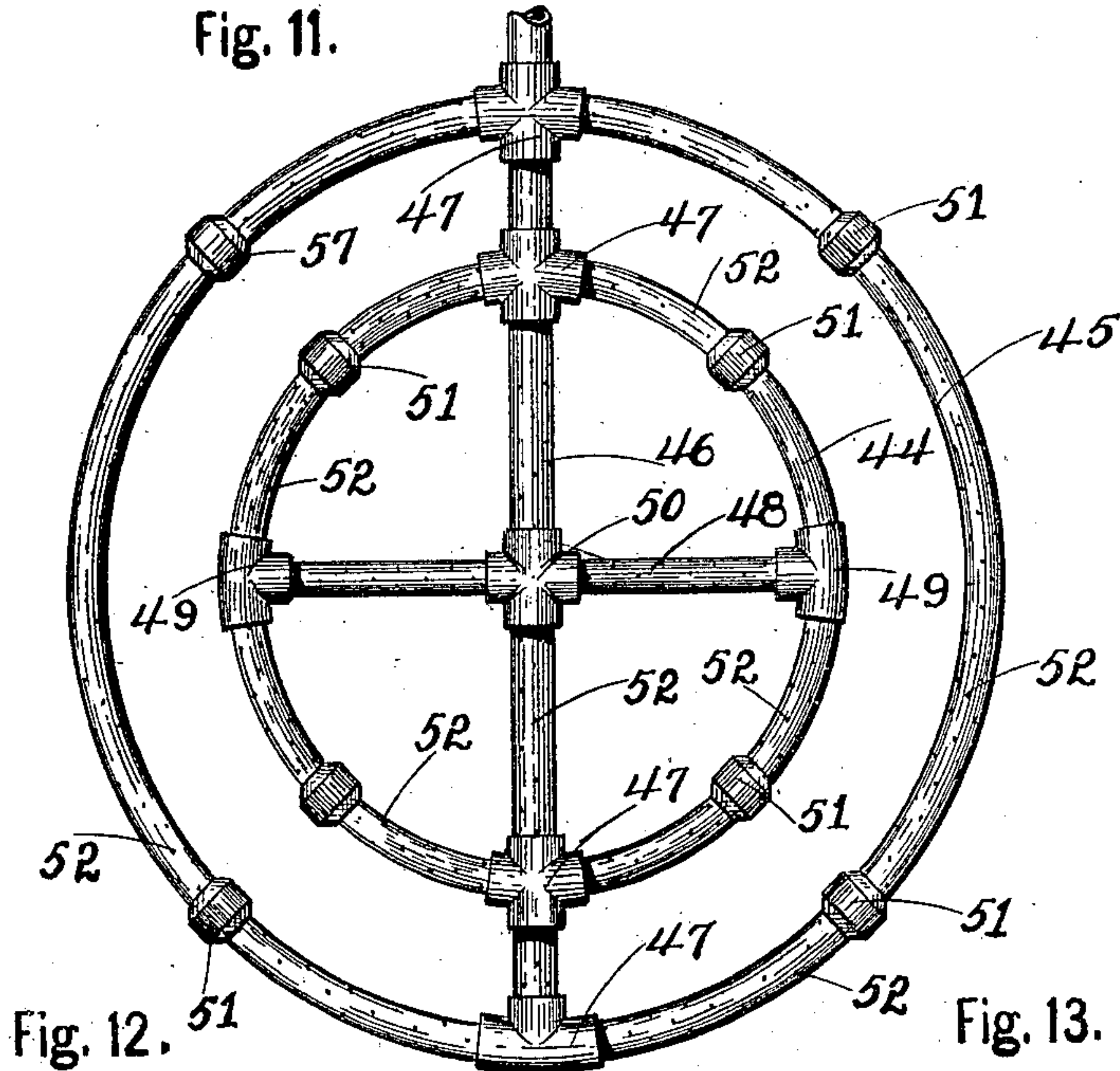


Fig. 12.

Fig. 13.

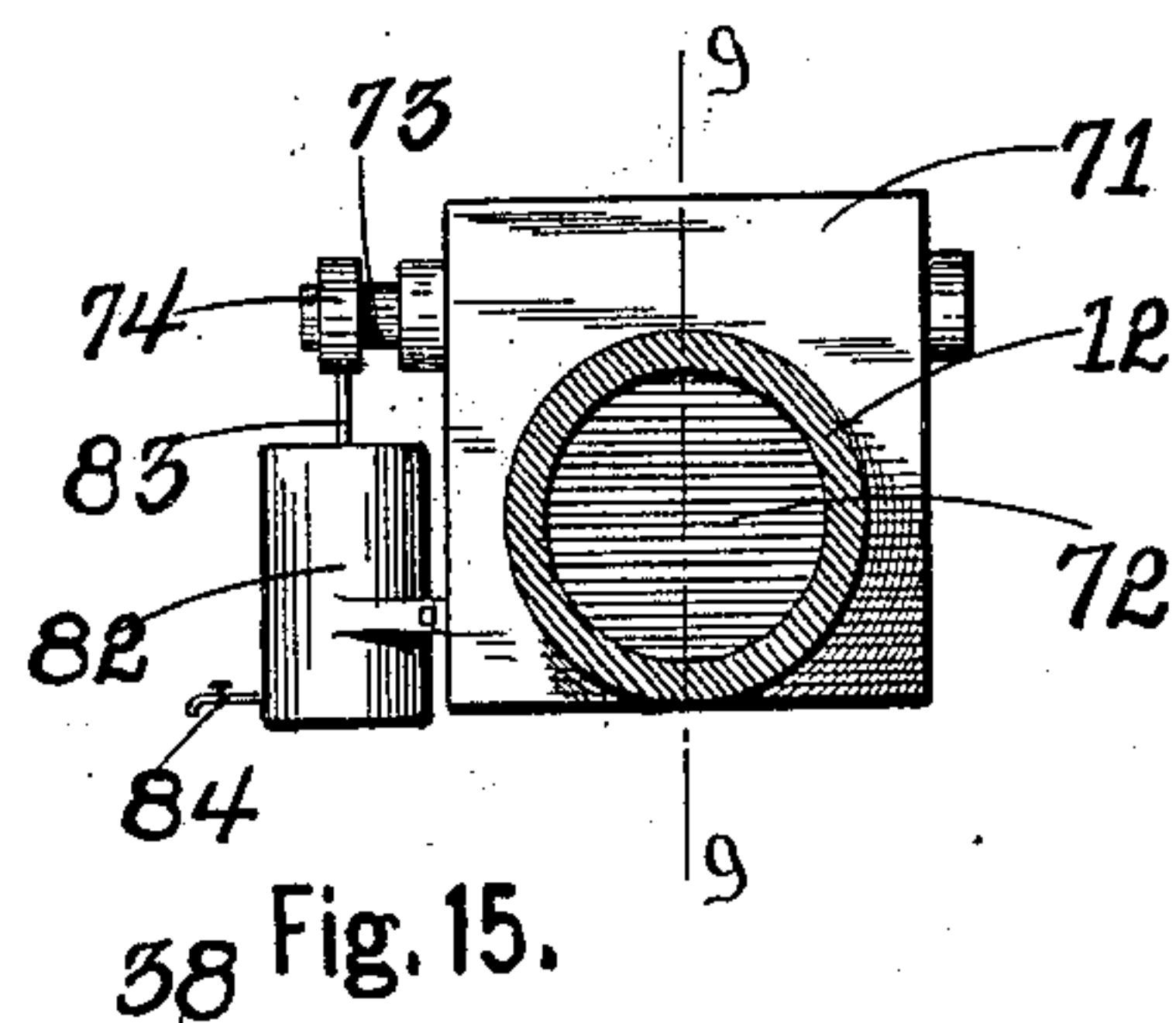
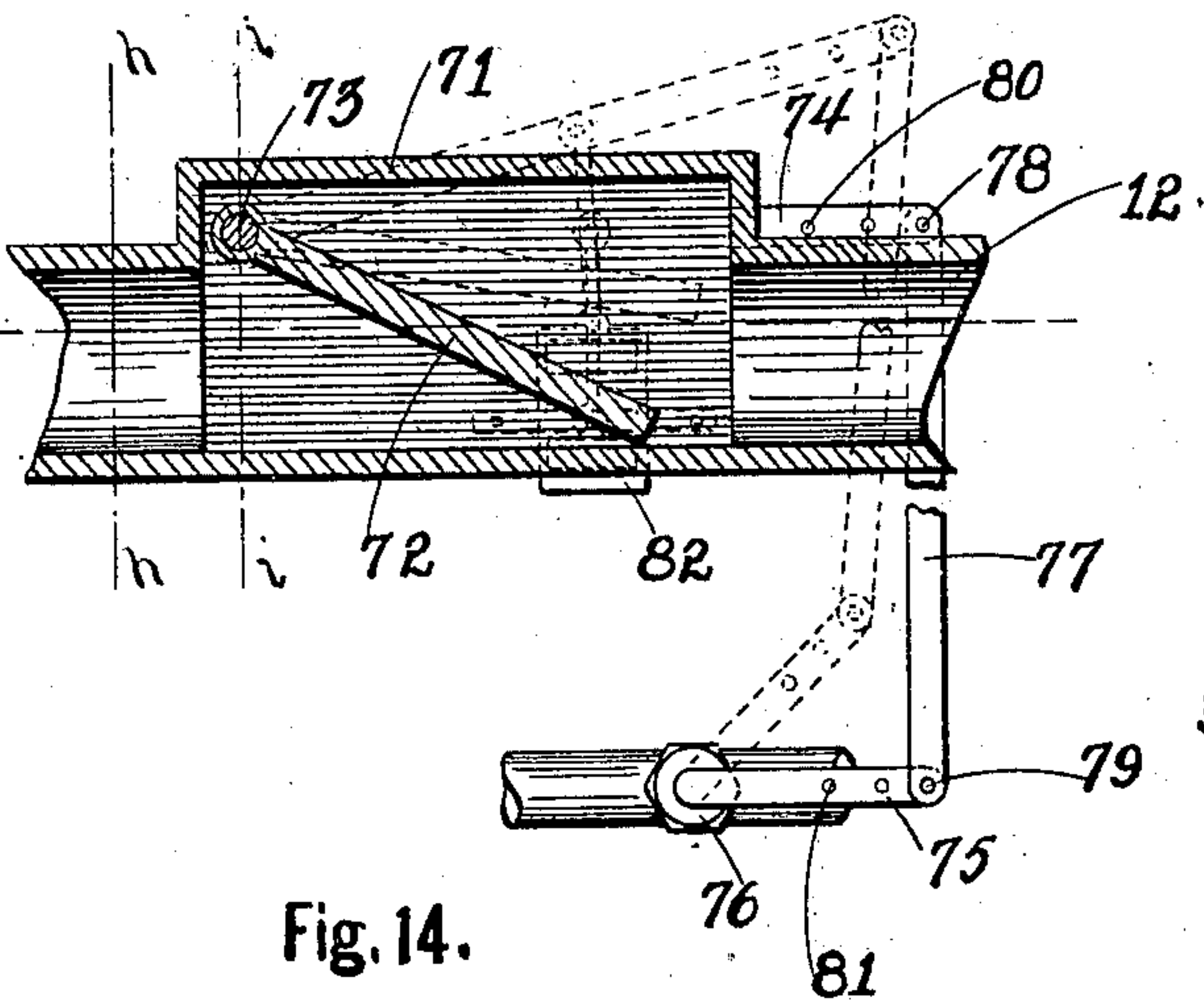
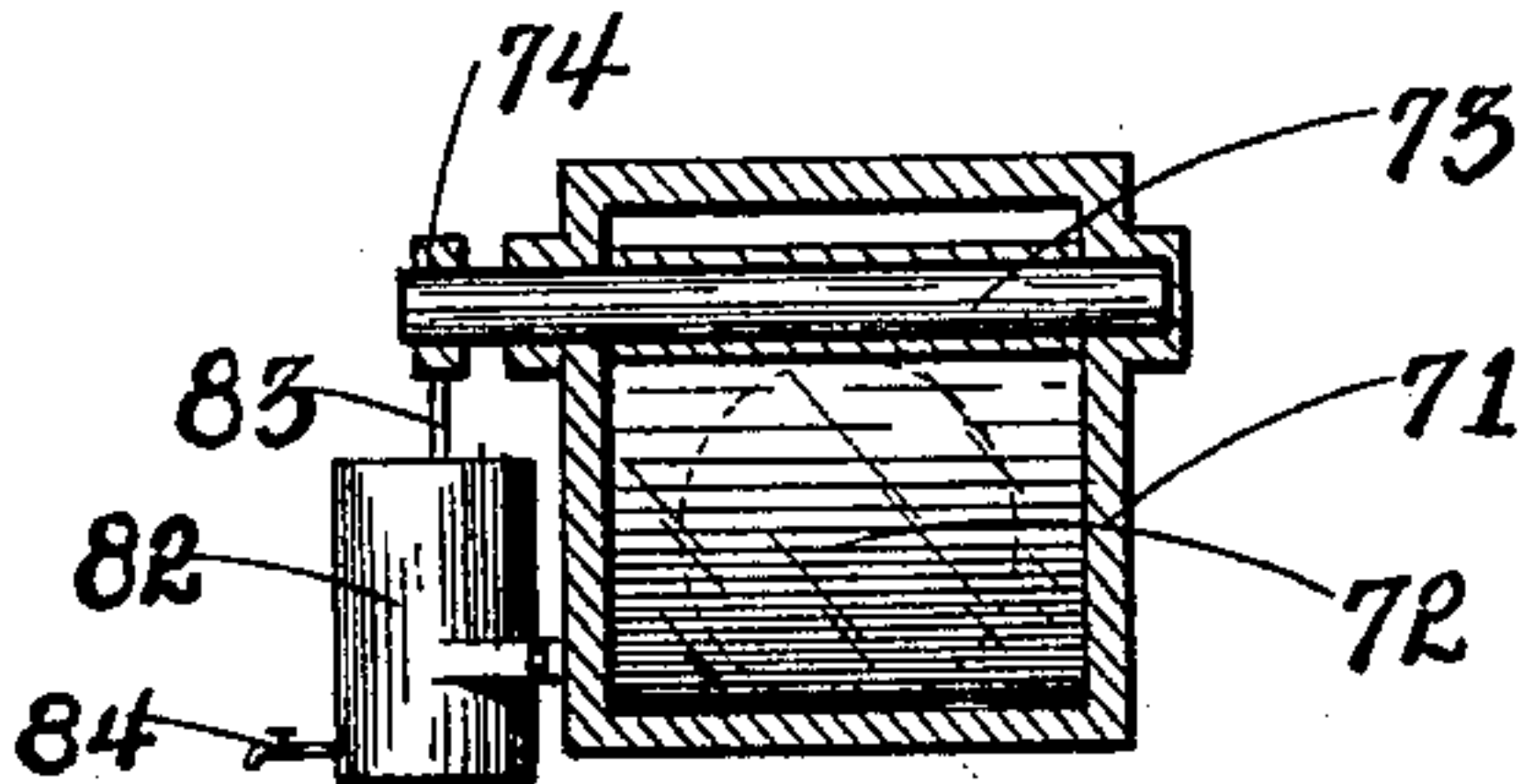


Fig. 14.

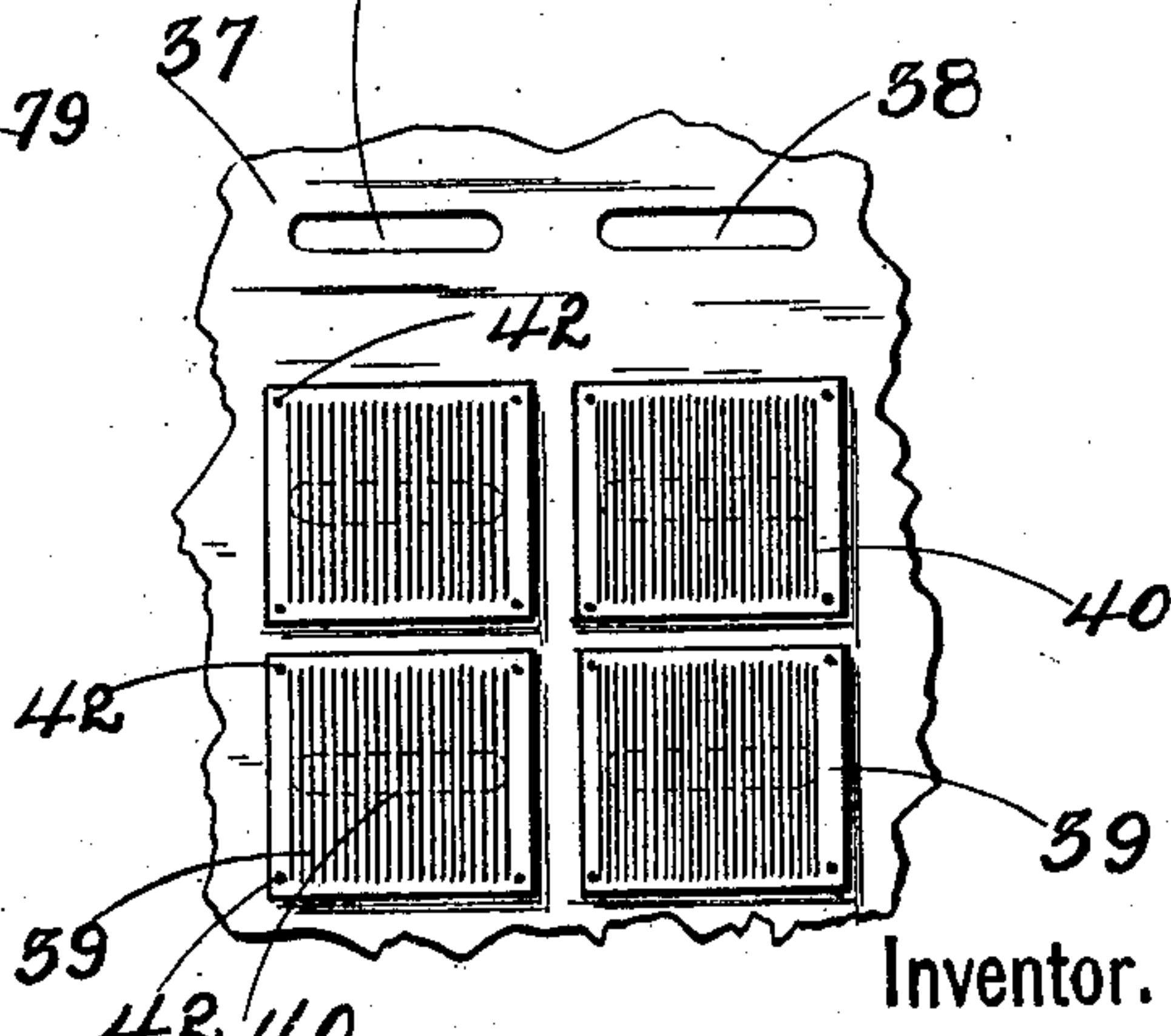


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Fig. 15.



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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR PURIFYING WATER.

SPECIFICATION forming part of Letters Patent No. 674,153, dated May 14, 1901.

Application filed March 21, 1900. Serial No. 9,524. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK E. BACHMAN, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Apparatuses for Removing Impurities from Water, of which the following is a specification.

My invention relates to an improved apparatus for filtering water, and is principally adapted to be used in removing scale-forming impurities from water used in boilers or for like purposes.

The main object of the invention is to produce a simple, efficient, and practical apparatus in which the operation is continuous.

For a full understanding of the merits and advantages of the invention reference is to be had to the accompanying drawings and the following description.

The invention is susceptible to various changes in the form, proportion, and minor details of construction without departing from the principle or sacrificing any of the advantages thereof, and to a full disclosure of the invention an adaptation thereof is shown in the accompanying drawings, in which—

Figure 1 represents a side elevation of the preferred construction of my apparatus. Fig. 2 is a top plan view. Fig. 3 is a vertical section on or about line *a a*, Fig. 1, looking in the direction of the arrow *V*. Fig. 4 is a vertical central section on or about line *b b*, Fig. 7. Fig. 5 is a vertical section on or about line *c c*, Fig. 6. Fig. 6 is a horizontal section on or about line *d d*, Fig. 5. Fig. 7 is a horizontal section on or about line *e e*, Fig. 4. Fig. 8 is an enlarged top view of one of the strainer-plates. Fig. 9 is an enlarged bottom view of one of the strainer-plates. Fig. 10 is a section through one of the strainer-plates on or about line *f f*, Fig. 8. Fig. 11 is an enlarged detached top view of the perforated cleaning device. Fig. 12 is a section through a fragment of the water-supply pipe on or about line *g g*, Fig. 13, to show the action of the leaf-valve controlling the valve admitting steam to the pumps. Fig. 13 is a transverse section on or about line *h h*, Fig. 12. Fig. 14 is a transverse section on or about line *i i*, Fig. 12. Fig. 15 is an enlarged fragmentary

top view of a portion of the slotted filter-plate.

In referring to the drawings in detail like numerals designate like parts.

My improved apparatus preferably comprises a heating-tank 1 for heating the water to a suitable temperature, having a connection 2, extending to a suitable source of water-supply, a main pump 3, solution-tanks 4 and 5, a mixing-tank 6, auxiliary pumps 7 and 8 for pumping the solutions from the solution-tanks into the mixing-tank, and filtering-tanks 9 and 10. A pipe 11 extends from the heating-tank 1 to the main pump 3, and a main pipe 12 extends from the main pump to the boiler or other device. A pipe 13 extends from the main pipe and has branches 14 and 15, which communicate with the solution-tanks. Stop-cocks 16 and 17 are placed in these branches, so that water can be supplied to both tanks or shut off from one or both, as desired. A pipe 18 also extends from the main pipe into the upper part of the mixing-tank and has a shut-off cock 19.

The mixing-tank 6 is divided into upper and lower compartments 20 and 21 by a diaphragmatic plate 22. The end 23 of the pipe 18 within the upper compartment 21 of the mixing-tank 6 curves, so as to give a swirling motion to the water, and a pipe 24 extends through an opening in the diaphragmatic plate 22 to afford connection between the two compartments and is likewise curved to give a swirling motion to the water in the lower compartment. (See Fig. 4.) The main pipe extends beyond the connection with the pipe 18 and has direct connection with the boiler or other device requiring water-supply, so the water may be supplied without filtration in emergencies. A shut-off cock 25 is located in the portion of the pipe beyond the pipe 18 and serves to cutoff the water-passage through that portion of the pipe directly to the device to which the water is to be supplied. A pipe 26 extends horizontally from the lower portion of the mixing-tank for a short distance, then bends vertically upward, then horizontally forward to a position directly above the filtering-tank, and finally downward into connection with a horizontal pipe 27, which has a cock or valve 28 at each end,



and short vertical pipes 29 extend from the horizontal pipe 27 into the top of the filtering-tanks 9 and 10. (See Fig. 3.)

The filtering-tanks 9 and 10 are preferably constructed as shown in Fig. 5, having a cylindrical body, a concavo-convex bottom and top, an inlet in the top, into which the lower ends of one of the pipes 29 extend, a perforated filter-plate arranged horizontally a short distance above the concavo-convex bottom and rigidly riveted or bolted to the horizontal inner portion of the annular angle-iron 30 by the rivets or bolts 31, the angle-iron being riveted or bolted to the interior of the cylindrical body by rivets or bolts 32, and a wash-out or clean-out device is arranged above the filter-plate and rigidly fastened to the inner horizontal portion of an annular angle-iron 33 by the curved rods 34 and nuts 35, the angle-iron 33 being bolted or riveted to the interior of the body by the bolts or rivets 36.

The preferable construction of the filter-plate is shown in Figs. 6 and 15, in which a main circular filter-plate 37 is provided with a series of elongated slots or openings 38 and a plurality of small strainer-plates 39, corresponding in number to the elongated slots, each strainer-plate being adapted to be placed on the circular filter-plate over one of the elongated slots and having a series of long narrow parallel openings, which are arranged as shown in the section in Fig. 10, having the top portion 40 extremely narrow in width to prevent the passage of the material of the filter-bed and widening into the larger bottom portion 41. The strainer-plates 39 are preferably arranged so that their narrow parallel openings extend at right angles across the elongated slots in the large circular filter-plate, and they are detachably secured in place by the bolts 42, which pass through holes 43 in the strainer-plates into the filter-plate to afford means for removing and cleaning or replacing clogged or defective plates.

The preferable construction of the wash-out or clean-out device is shown in Fig. 11, in which two perforated pipes 44 and 45 are arranged concentrically with each other and are connected together by a cross-pipe 46, which extends diametrically with respect to the circular pipes and is connected to each pipe on either side by the T's 47. Another cross-pipe 48, extending at substantially right angles to the cross-pipe 46, is connected at each end to the smaller circular pipe 44 by T's 49, and a four-way connection 50 is arranged centrally with respect to the concentric circular pipes and connects the pipes 46 and 48 at their crossing-point. Both of the pipes 44 and 45 are preferably formed in sections or segments, which are connected together by the sleeves 51, and the main cross or connecting pipe 46 extends through the side of the filter-body, as will be more specifically described hereinafter.

The circular concentric pipes and the cross-

pipes are each provided with a plurality of apertures or orifices 52, and the filter is preferably filled with filtering material up to the horizontal dotted line *y* in Fig. 5, the filter-bed being supported upon the circular filter-plate 37.

Two filters are preferably employed and are arranged side by side, as shown in Fig. 3, and the main cross-pipe 46 of each filter extends through the side of the filter and into connection with an upper transverse horizontal pipe 53, which in turn connects at or near its middle with a vertical pipe 54. The vertical pipe 54 connects at its lower end to an intermediate transverse horizontal pipe 55, which is provided at each end with a shut-off cock 55<sup>a</sup>, and a short vertical pipe 56 extends from each end of the pipe 55 downward into connection with a second intermediate horizontal pipe 57, from which short horizontal pipes 57<sup>b</sup> extend into the filter-tank below the circular filter-plate 37. The second intermediate pipe 57 is provided with shut-off cocks 57<sup>a</sup>. A lower horizontal pipe 58 is connected to the second intermediate horizontal pipe 57 by short vertical pipes 59 and to a waste-pipe 60 by a short horizontal pipe 61. (See Fig. 1.) The pipes 58 are provided with shut-off cocks 61<sup>a</sup> at each end. A pipe 62 extends from the second intermediate horizontal pipe 57 and connects with the main pipe 12. The pipe 62 is provided with a shut-off cock 62<sup>a</sup>. A horizontal pipe 63 connects the short vertical pipes 29 below the main horizontal pipe 27 and has two shut-off cocks or valves 64, and a horizontal pipe 65 connects to said pipe 63, extending forward at substantially right angles and then bending and extending vertically downward in front of the filter, as shown at 66 in Fig. 1, its lower end being arranged directly above the funnel mouth of the wash-pipe 60. (See Figs. 1 and 3.)

The auxiliary pumps 7 and 8 are supplied with steam from a pipe 68, connected to any suitable source of steam-supply, said pipe connecting to a horizontal pipe 69<sup>a</sup>, from which branch pipes 70 extend vertically into connection with the auxiliary pumps.

The pipe 12 has a valve which is automatically operated by the pressure of the water in the main supply-pipe 12 to regulate the steam-supply to the pumps, and thus in a great measure regulate the amount of solution supplied to the mixing-tank and the rapidity of the supply to the volume of water received from the pipe 12 and the rapidity of the water-supply. This affords an automatic means for supplying a solution in approximate proportion to the amount of water supplied. The preferred construction of this portion of the invention is shown in Figs. 12, 13, and 14, the pipe being enlarged at one point to form a box or valve-casing 71, substantially square in cross-section, in which a leaf-valve 72 is rigidly mounted on a horizontal shaft 73, journaled in the upper portion of one of the ends of the box. A crank-arm 74 extends



from the extreme end of this shaft and is connected to a crank 75, controlling a valve 76 in the pipe 67 by a connecting-rod 77, said connecting-rod being pivoted to the crank-arm 74 by the pivotal pin 78 and to the valve-operating crank 75 by the pivotal pin 79 and the crank-arm and valve-operating crank, each having a longitudinal series of holes or apertures 80 and 81, in any of which the respective crank-pins are adapted to be placed, thereby providing different means of adjustment. A dash-pot 82 is supported on one side of the box 71 and has a piston-rod 83 connected at its upper end to the crank-arm 74, substantially as shown in Figs. 12, 13, and 14. The dash-pot is provided with a cock 84, which serves to regulate the volume of air discharge under pressure of the descending piston.

The operation of the apparatus is as follows: Water is conducted to the heater 1 through the pipe 2 and is pumped therefrom by the main pump 3 into the main pipe 12, which when the valve or cock 25 is closed and the valve or cock 19 is open passes through the pipe 18 into the upper compartment of the mixing-chamber. A lime or similar solution is added to the water in the upper compartment, being pumped by one of the auxiliary pumps from one of the solution-tanks heretofore described. The combined water and solution now passes through the pipe 24 in the plate 22 into the lower compartment, where it receives a second solution, preferably a soda, and from thence passes through the pipes 26, 27, and 29 into the top of one of the filter-tanks 9 and 10. From the filter-tank the water passes through the series of pipes heretofore described into the main pipe leading to the boiler or other water-using device or machine. Water is supplied to the solution-tanks by opening the cocks 16 and 17. The water can be conducted directly to the water-using device or machine without passing it through the mixing-tank and filters by closing the cock 19 and opening the cock 25.

One of the filters can be cleaned out while the other is in operation or both may be cleaned by closing the cocks 28, and thus preventing the passage of water into the top of the filter. The cocks controlling the passage of water into the upper horizontal pipe 53 are opened and the water flows into the perforated clean-out device, cleansing the upper portion of the filter-bed, where most of the impurities collect, and passes out from the filter, the cocks 63 being opened, through the pipes 29, 62, and 64 into the funnel mouth 66 of the waste-pipe 60.

Test-cocks 85, 86, and 87 are attached to the mixing-tank 6, the pipe 26, and the pipe 62, the two first-mentioned pipes affording means for testing the condition of the water to determine if the proper amount of solution has been added and the third permitting an examination of the water after it leaves the filter to ascertain the condition of the filtration.

Pipes 88 and 89, extending from the auxiliary pumps 7 and 8 to the mixing-tank 6, serve to conduct the solution to said mixing-tank, the pipes 88 connecting the pump 7 to the upper compartment of the mixing-tank and the pipe 89 connecting the pump 8 to the lower compartment of the mixing-tank. Both of the pipes 88 and 89 are provided with shut-off cocks 90 and 91.

I claim as my invention—

1. An improved apparatus for purifying water, comprising two vessels containing the required chemical solutions, a pumping device, a filter, and a mixing vessel located between the pumping device and the filter divided into two communicating compartments; each compartment having separate connection with one of the chemical-containing vessels.

2. An improved apparatus for purifying water, comprising a heater, two vessels containing precipitating solution, a mixing-tank divided into two communicating compartments and each compartment having separate connection with one of the two vessels, a filter, a main pump for pumping heated water from the heater into the mixing-tank, and two independent auxiliary pumps, each pumping the solution from one of the vessels to one of the compartments in the mixing-tank.

3. An improved apparatus for purifying water, comprising a heater having connection to a source of water-supply, two vessels containing precipitating solution, a mixing-tank divided horizontally into two communicating compartments, a filter, a main pumping device for pumping the water from the heater into the mixing-tank and independent auxiliary pumps for pumping the solution from the solution-tanks into the compartments of the mixing-tank.

4. An improved apparatus for purifying water, comprising tanks containing the required precipitating chemicals, a mixing-tank divided horizontally into two communicating compartments, a water-supply pipe, two separate pipes, one leading from one of said chemical-tanks to one of the compartments in the mixing-tank and the other from the other chemical-tank to the remaining compartment, two auxiliary pumps, each having operative connection with the pipes leading from the chemical-containing tanks to the mixing-tank, a main pump for pumping the water from the source of water-supply to the mixing-tank and a filtering-tank, as set forth.

5. An improved apparatus for purifying water, comprising two vessels containing precipitating chemicals, a mixing vessel divided into two compartments by a diaphragmatic plate having a central communicating opening, a main pump for forcing the water from the source of supply to the mixing-tank, independent auxiliary pumps for separately forcing the chemicals from the two vessels into the two compartments of the mixing-tank and a filtering device, as set forth.



6. An improved apparatus for purifying water, comprising vessels for containing precipitating chemicals, a mixing-tank divided into two compartments by a partition having an opening affording communication between the compartments, pipes leading from the source of supply and one of the vessels containing precipitating chemicals to one of the compartments in the mixing-tank, a pipe leading from the other vessel containing precipitating chemicals to the other compartment, pumping devices having operative connection with said pipes and filtering devices, as set forth.

7. An improved apparatus for purifying water, comprising vessels for containing precipitating chemicals, a mixing-tank divided into an upper and lower compartment by a partition having an opening affording communication between the compartments, a pipe extending from said opening in the partition and bent to give a swirling motion to the liquid, pipes leading from the source of water and one of the vessels containing precipitating chemicals to the upper compartment, the end extending into the interior of the compartment and bending to give a swirling motion to the liquid, a pipe extending from the other tank containing precipitating chemicals to the lower compartment, pumping devices having operative connection with said pipes and a filtering device, as set forth.

8. In an apparatus for purifying water, tanks containing precipitating solution, a mixing-tank, a water-supply pipe communicating with the mixing-tank, pipes between the solution-tanks and the mixing-tank, a swinging leaf-valve in the water-supply pipe, steam-pumps for forcing the solution into the mixing-tanks, a pipe for supplying steam to said pumps, a valve in said pipe and operating connection between said valve and the swinging leaf-valve.

9. In an apparatus for purifying water, a mixing-tank divided into upper and lower compartments, a vessel containing precipitating solution having connection with the upper compartment, a second vessel contain-

ing precipitating solution having connection with the lower compartment, a heater connected to the upper compartment, and a filtering device connected to the lower compartment.

10. In an apparatus for purifying water, tanks containing precipitating solution, a mixing-tank divided into two compartments, a water-supply pipe communicating with the upper compartment of the mixing-tank, pipes separately connecting the solution-tanks and the two compartments of the mixing-tank, a filtering device and a pipe connecting the lower compartment of the mixing-tank to the filtering device.

11. In an apparatus for purifying water, a mixing-tank divided into upper and lower compartments by a diaphragmatic plate having an opening, and a pipe extending from the opening and curved to give a swirling motion to liquid as it passes from the upper compartment to the lower compartment.

12. In an apparatus for purifying water, tanks containing precipitating solution, a mixing-tank, a water-supply pipe communicating with the mixing-tank, pipes between the solution-tanks and the mixing-tank, a swinging leaf-valve in the water-supply pipe, steam-pumps for forcing the solution into the mixing-tanks, a pipe for supplying steam to said pumps, and a valve in said steam-pipe controlled by the swinging leaf-valve.

13. In an apparatus for purifying water, tanks containing precipitating solution, a mixing-tank, a water-supply pipe communicating with the mixing-tank, pipes between the solution-tanks and the mixing-tank, a valve in the water-supply pipe, steam-pumps for forcing the solution into the mixing-tanks, a pipe for supplying steam to said pumps, a valve in said pipe and operating connections between the valve in the steam-pipe and the valve in the water-pipe.

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Witnesses:

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