G. F. RENDALL.

APPARATUS FOR CONCENTRATING.

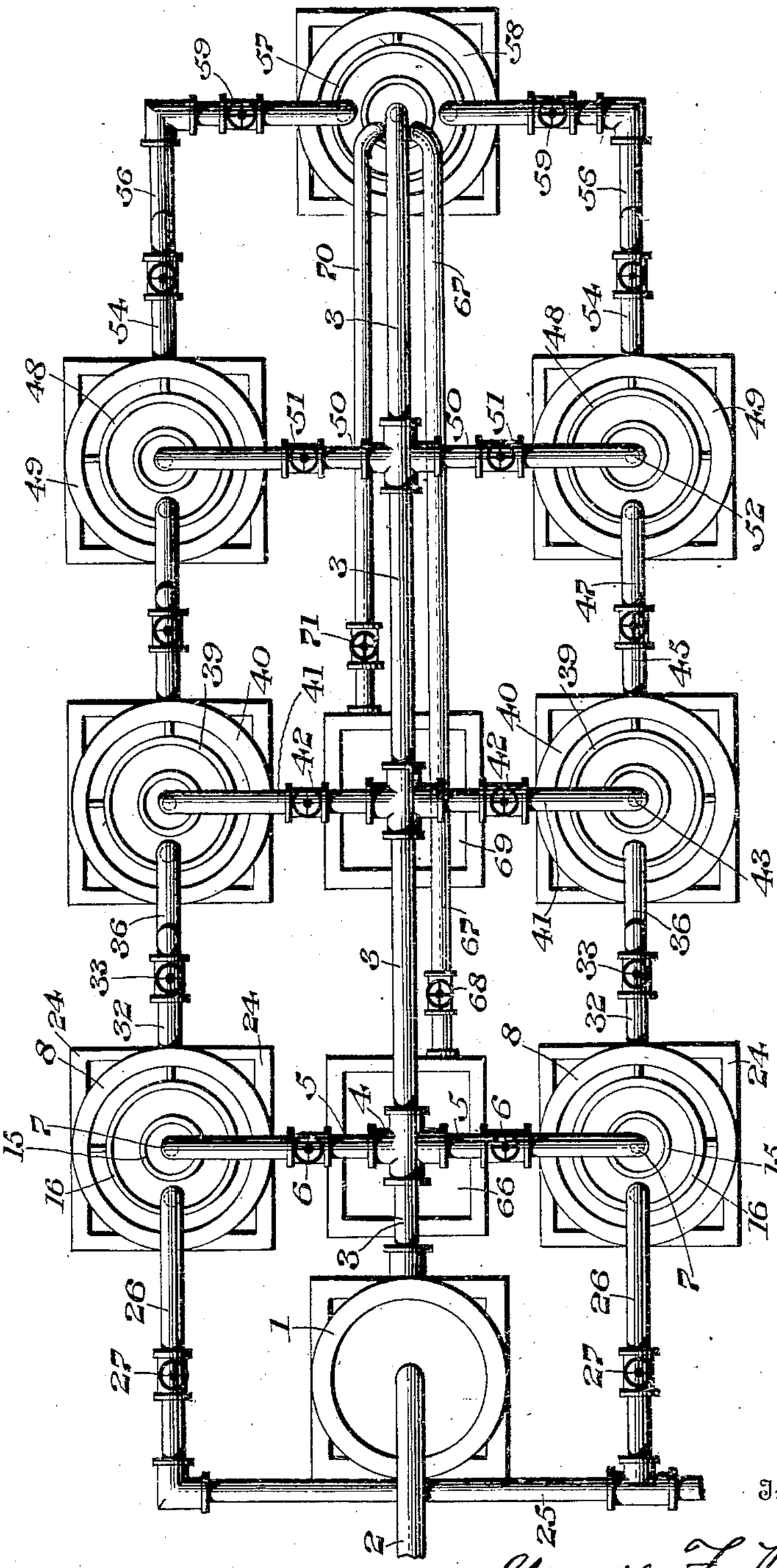
APPLICATION FILED APR. 23, 1906.

936,563.

Patented Oct. 12, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



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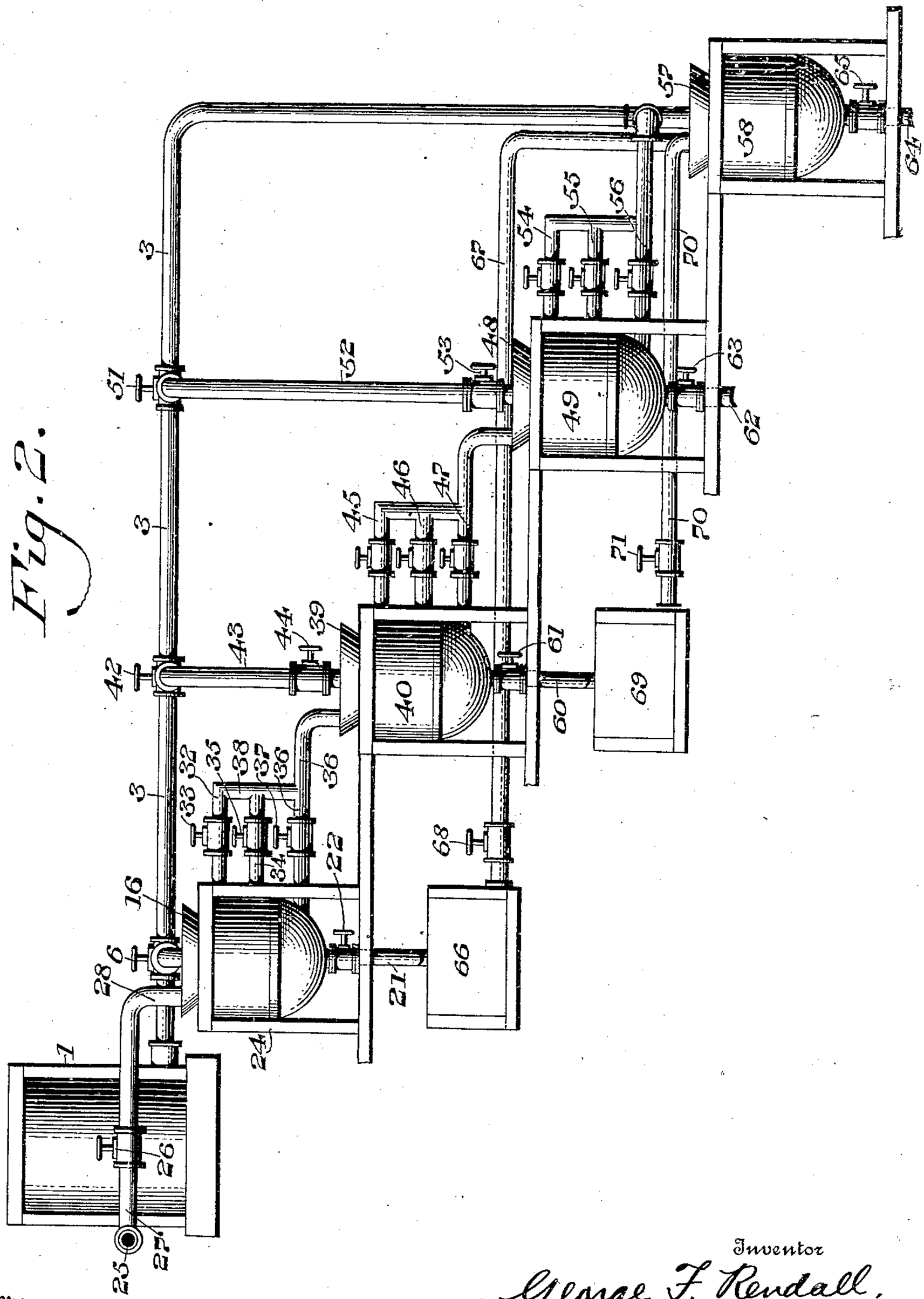
3 SHEETS—SHEET 2.

Fig. 2.



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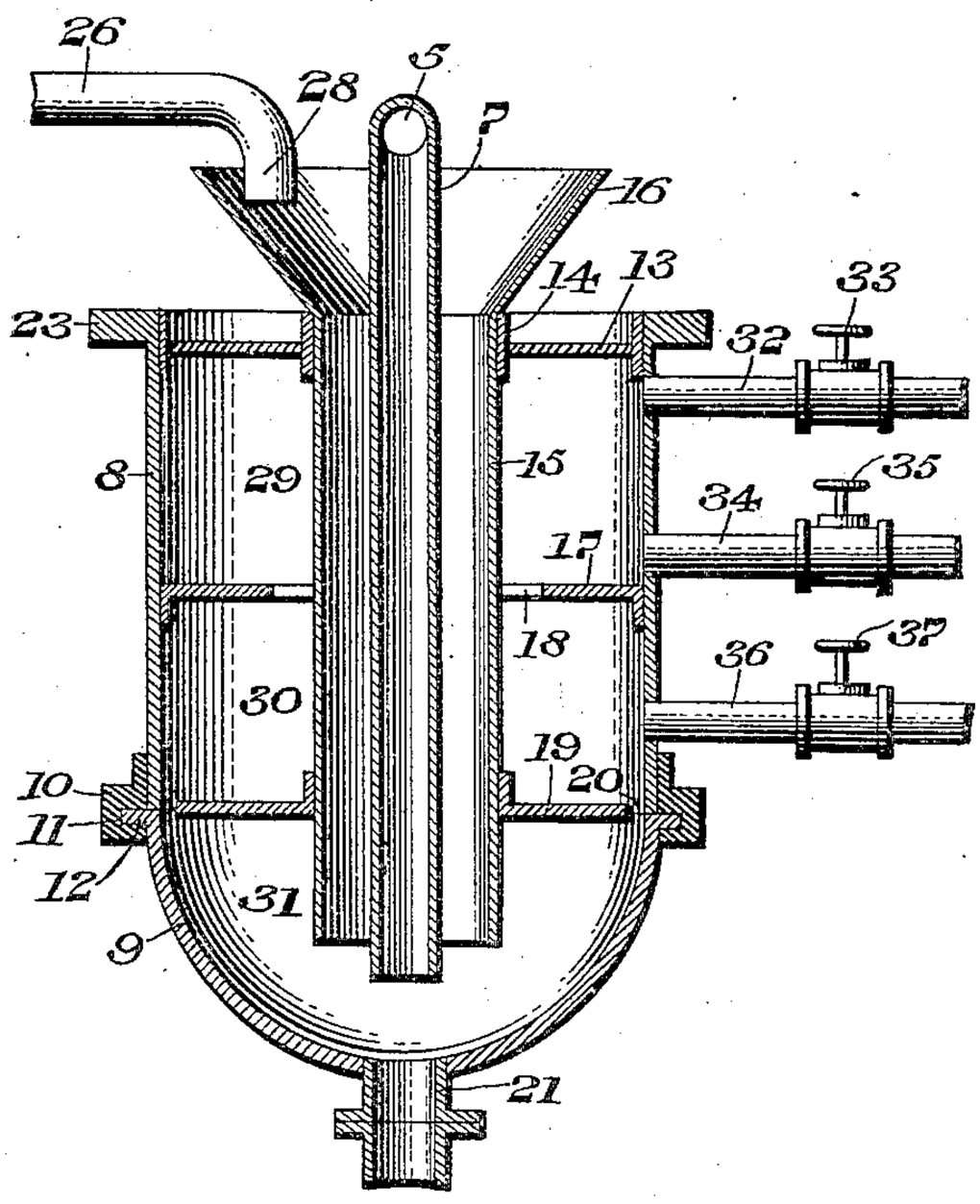
3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR CONCENTRATING.

936,563. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed April 23, 1906. Serial No. 313,122.

To all whom it may concern:

Be it known that I, GEORGE F. RENDALL, a subject of the King of Great Britain, residing in the city and county of New York, State of New York, have invented a new and useful Apparatus for Concentrating, of which the following is a specification.

The object of my invention is to construct an apparatus by means of which ores and minerals may be sized and concentrated without any mechanical aid and for this purpose I employ a series of concentrator units arranged on different levels to each of which water under pressure is conducted to effect the desired separation, thereby greatly reducing the cost of the operation.

To the above ends my invention consists of a novel construction and correlation of concentrator units which in the present instance are shown as being arranged in pairs on different levels or planes, all of these concentrators being adapted if desired to discharge into a main concentrator, which is located on a lower level than the other concentrators, there being a hydraulic head of water independently connected with each concentrator, and the first pair of concentrators or those on the highest plane having a connection or connections leading thereto through which the material to be concentrated is conducted.

My invention further consists of a novel construction of concentrator unit in which the material to be concentrated comes into intimate contact with an ascending body of water.

It further consists of a novel construction of concentrator unit in which a series of diaphragms or baffle plates are employed to cause a more intimate separation and sizing of the material.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

Figure 1 represents a plan view of a concentrating apparatus embodying my invention. Fig. 2 represents a side elevation thereof. Fig. 3 represents a sectional elevation of one of the concentrators in detached position.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates a tank or water receptacle which is suitably supplied with water by means of a conduit 2 leading thereto.

3 designates a connection leading from the water tank 1 and communicating with the joint or fourway connection 4 from which the conduits 5 extend, said conduits being provided with suitable controlling valves 6. Each conduit 5 has at its end a downwardly extending portion 7 which extends into a concentrator 8, there being in the present instance two of these concentrators 8 located on the same plane. These concentrators 8 are provided with a bowl-shaped bottom 9 secured thereto in any suitable manner as by means of the flanged ring 10 suitably connected with the casing of the concentrator 8, said ring having a recess 11 therein in which is seated the flange 12 extending from the upper portion of the bowl 9.

13 designates a diaphragm at the upper end of the concentrator casing 8, said diaphragm or closure having a collar or ring secured thereto which closely engages the cylindrical conduit 15, at the upper end of which is a hopper 16. It will be seen from Fig. 3 that the cylindrical conduit 15 terminates at a suitable distance from the bottom of the concentrators and the downwardly extending water pipe 7 passes through said conduit 15 and terminates at a point below the termination of said conduit 15.

17 designates a diaphragm or partition located intermediate the top and bottom of the concentrator and provided with an annular opening 18 which leaves an open space around the cylindrical conduit 15 through which the ascending material may pass, said diaphragm 17 being suitably secured with respect to the concentrator casing 8.

19 designates a diaphragm suitably secured to the cylindrical conduit 15 near its lower end and as seen in Fig. 3, there is a space or passage 20 between the outer perimeter of the diaphragm 19 and the adjacent wall of the casing.

21 designates a conduit leading from the bowl 9 provided with a suitable controlling valve 22.

23 designates a flange extending outwardly from the upper portion of the casing 8 which is adapted to be seated on the uprights or supporting standards 24.

25 designates a conduit through which the material to be separated flows having lead-

ing therefrom the conduits 26 provided with suitable controlling valves 27, said conduits being bent downwardly at their outer ends as at 28 and terminating above the hopper 16.

It will be seen that each concentrator is divided by means of the diaphragms 17 and 19 into compartments 29, 30 and 31.

32 designates a pipe extending through the casing 8 near the upper end of the chamber or compartment 29, said pipe being provided with a suitable controlling valve 33. 34 designates a similar pipe extending through the casing 8 near the lower end of the chamber 29 and above the diaphragm 17, said pipe 34 being also provided with a suitable controlling valve 35.

36 designates a pipe extending through the casing 8 and opening into the chamber 30, said pipe being provided with a suitable controlling valve 37. As seen in Fig. 2, the pipes 32 and 34 communicate with the pipe 38, which is in communication with the pipe 36, which latter discharges into the hopper 39 located above the concentrator 40.

Since the construction of the different concentrators is substantially the same, I have deemed it unnecessary to describe in detail each concentrator, since they would all be preferably constructed according to the construction shown in Fig. 3.

41 designates pipes leading from the water pipe 3 and provided with suitable controlling valves 42, the pipes 41 extending downwardly as seen at 43 and provided with a controlling valve 44, said pipes extending downwardly through the cylindrical conduit, not shown, which is in communication with the hopper 39, as will be readily understood from the construction heretofore described, as seen in Fig. 3.

45, 46 and 47 designate valved pipes extending from the concentrator 40 in a similar manner to the pipes 32, 34 and 36 extending from the concentrator 8, the pipes 45 and 46 communicating with the pipe 47, as seen in Fig. 2, and the pipe 47 discharging into the hopper 48 carried by the concentrator 49.

50 designates pipes leading from the water pipe 3 and having suitable controlling valves 51. These pipes 50 are each provided with a downwardly extending portion 52 which has a suitable controlling valve 53, said pipe 52 extending through the cylindrical conduit, not shown, connected with the hopper 48, as will be readily apparent from the description of the unit shown in Fig. 3.

54, 55 and 56 designate valved pipes leading from the concentrator 49 in a similar manner to that hereinbefore described in connection with the concentrators on the higher plane, the pipes 54 and 55 communicating with the pipe 56 which empties into the hopper 57 supported or carried by the concentrator 58. These pipes 56 discharge into the hopper 57 and are provided with suitable controlling valves 59.

It will be understood that all of the concentrators are provided with suitable discharge pipes through which the concentrated or sized material may be withdrawn, the concentrator 40 having a pipe 60 leading therefrom, said pipe being provided with a suitable controlling valve 61. The concentrator 49 is provided with a discharge pipe 62 having a suitable controlling valve 63 therefor. The last concentrating tank 58 is likewise provided with a discharge pipe 64 which is provided with a suitable controlling valve 65. In order to reconcentrate the material left in the different concentrators on the highest plane, I provide a sluice box 66 into which the pipes 21 discharge.

67 designates a pipe having a suitable controlling valve 68, said pipe leading from the sluice box 66 and discharging into the hopper 57 of the concentrator 58 which is the finishing concentrator and the one located on the lowest plane or level. The residue left in the concentrators 40 on the next lowest plane may be discharged through the pipe 60 into the sluice box 69 from which the material therein may be discharged into the hopper 57 through the pipe or conduit 70 provided with a suitable controlling valve 71. The concentrator 49 on the next level may be likewise connected with a sluice box which would discharge into the last concentrator although in the present instance, I have not deemed it necessary, to show the same since the construction and operation would be precisely similar to that hereinbefore described.

The operation will be readily apparent. The supply tank 1 is filled with water which discharges thereinto through the pipe 2. The water passes from the supply tank 1 and through the pipe 3 and the two branches 5 leading therefrom, thence through the downwardly extending portion 7 which discharges the water against the bottom of the bowl 9. The amount of water flowing through the pipes 5 may be regulated as desired by means of the valves 6. The material to be concentrated is conducted through the pipe 25 thence through the pipes 26 leading therefrom which discharge into the hopper 16. The material to be concentrated passes from the hopper 16 into the cylindrical conduit 15 and discharges into the chamber 31 of the bowl 9, it being seen in Fig. 3 that the discharge mouth of the conduit 15 is above the discharge mouth of the water pipe 7. The material to be concentrated is carried upwardly by the ascending current of water which forces this material against the baffle plate or disk 19 and causes it to come into intimate contact with the water, the heavier particles being precipi-

tated according to their specific gravities. The material then passes between the baffle plate 19 and the wall of the casing, through passage 20 into the chamber 30 thence through the annular passage 18 into the chamber 29. In the present instance, I have shown the concentrators as arranged in pairs and in four different planes.

The force of the water entering the concentrators 8 may be regulated as desired by means of the controlling valve 6 in the pipes 5. The heaviest particles will be left in the chamber 31, the heavier particles according to their specific gravities passing into the chamber 30 and chamber 29.

The material in the chambers 29 and 30 is conducted through the pipes 32, 34 and 36 and discharged into the hopper 39 secured in the concentrator 40 where it comes into contact with an ascending body of water in precisely the same manner as hereinbefore described, in the construction seen in Fig. 3. It will be apparent that the pipes 32, 34 and 36 may all be opened or only one or more of these pipes may be used as desired.

The force of the water entering through the pipe 43 may be regulated as desired by means of the valves 42 and 44. The heavier particles in the two upper chambers in the concentrator 40 may be conducted therefrom by means of the pipes 45, 46 and 47 and discharged into the hopper 48 in the reconcentrator units 49 in which the same action takes place as that already described in connection with the concentrators on the higher level, the lighter particles in the concentrator unit 49 may be conducted therefrom through one or more pipes 55 and 56 and discharged into the hopper 57 of the last concentrator unit 58. The heavier particles which have been left in the chamber 31 of the bowl 9 in the first concentrator unit 8 may be withdrawn through the pipe 21 into the sluice box 66 and thence through the pipe 67 to the hopper 57 of the last unit 58. In a similiar manner the heavier particles contained in the bowl of the concentrator unit 40 may be discharged through pipes 60 into the sluice box 69 from whence they may be led through the pipe or conduit 70 and discharged into the hopper 57 of the last unit 58. The material contained in the bowl of the last unit may be withdrawn as desired through the pipe 64.

It will be apparent that in every instance the different conduits are provided with suitable valves in order that the flow of the material to and from the different units may be varied according to conditions and requirements. In the present instance I have shown the concentrators on the different levels as being arranged in pairs and having their discharge pipes connected with a suitable sluice box whereby the concentrated material contained in said concentrators may be automatically conducted to the final concentrator 58. It will be further apparent that the pressure of the water in the tank 1 may be varied as desired by varying the location of said tank with respect to the first set of concentrators and that the concentrators may be arranged in a single series. While in the present instance, I have shown three pairs of concentrators, arranged on different levels, the number of concentrators employed and also the number of different planes on which the different concentrators are arranged may be varied according to the conditions and requirements and still be within the scope of my invention. It will be further apparent that the respective size of the water discharge pipe 7 and the cylindrical conduit 15 may be varied as desired and that the respective size of the chambers 29, 30 and 31 may also be varied if desired by varying the location of the diaphragms 17 and 19. The bowl 9 may be readily removed from the concentrator casing when desired, it being simply necessary to remove the ring 10 from its connection with said casing. It will be further apparent that in my novel construction and correlation of concentrator units all of the parts may be readily assembled and disassembled and that while the apparatus is very simple and durable it may be very cheaply constructed.

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

1. In a concentrator, a casing, a cylindrical conduit in said casing and terminating near the bottom thereof, a closure at the upper end of said casing, a water pipe extending through said conduit and discharging beneath the discharge mouth thereof, a diaphragm supported by said conduit, there being a space between the outer perimeter of said diaphragm and the walls of said casing, and a diaphragm supported intermediate said closure and said first diaphragm and having a passage therethrough surrounding said conduit, said diaphragm forming chambers, and separate means for conducting the concentrated and sized material from said chambers.

2. In a concentrator, a casing, a cylindrical conduit supported therein, a closure at the upper end of said casing, a water pipe extending through said cylindrical conduit and discharging beyond the discharge mouth thereof, a diaphragm supported by said conduit, there being a space between the outer perimeter of said diaphragm and the walls of said casing, a diaphragm supported intermediate said closure and said first diaphragm and having a passage therethrough surrounding said conduit, said diaphragms forming chambers, and separate means for conducting the concentrated and sized material from said chambers.

3. In a concentrator, a casing, a cylindrical conduit supported therein, a closure at the upper end of said casing, a water pipe extending through said cylindrical conduit and discharging beyond the discharge mouth thereof, a diaphragm supported by said conduit, there being a space between the outer perimeter of said diaphragm and the walls of said casing, a diaphragm supported intermediate said closure and said first diaphragm and having a passage therethrough surrounding said conduit, said diaphragms forming chambers, separate means for conducting the concentrated and sized material from said chambers, a hopper carried by said conduit, and means for discharging the material to be concentrated thereinto.

4. In a concentrator, a casing having a bowl-shaped bottom, a controllable conduit leading from said bottom, a cylindrical conduit extending into said casing, a lower diaphragm carried thereby having a less diameter than the inner diameter of said casing, an upper diaphragm carried by said casing and having an aperture surrounding said cylindrical conduit, said diaphragm forming upper and lower compartments, a controllable conduit leading from one of said compartments, and two controllable conduits leading from the upper and lower portions of the other of said compartments, said last two conduits communicating with said first conduit, and means for discharging water beneath the discharge outlet of said conduit.

5. In a concentrator, a casing having a bowl-shaped bottom, a controllable conduit leading from said bottom, a cylindrical conduit extending into said casing, a lower diaphragm carried thereby having a less diameter than the inner diameter of said casing, an upper diaphragm carried by said casing and having an aperture surrounding said cylindrical conduit, said diaphragm forming upper and lower compartments, a controllable conduit leading from one of said compartments, and two controllable conduits leading from the upper and lower portions of the other of said compartments, said last two conduits communicating with said first conduit, and means for discharging water beneath the discharge outlet of said conduit, said means extending through said cylindrical conduit.

6. In a concentrator, a casing having a bottom removably secured thereto, a diaphragm at the lower end of said casing and having a less diameter than the inner diameter of said casing, a closure at the upper end of said casing, an apertured diaphragm located intermediate said first diaphragm and said closure thereby forming an upper and a lower compartment, a conduit communicating with the lower of said compartments, a plurality of conduits communicating with the upper and lower portions of the upper of said compartments, a cylindrical conduit carried by said closure and to which said lower diaphragm is secured, means for discharging the material to be concentrated into said cylindrical conduit, and means extending through and beyond said cylindrical conduit for discharging water into said casing.

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