W. F. M. McCARTY.

HYDRAULIC CONCENTRATING AND AMALGAMATING APPARATUS.

APPLICATION FILED FEB. 10, 1912. RENEWED NOV. 4, 1912.

1,047,673. Patented Dec. 17, 1912.

2 SHEETS—SHEET 1.

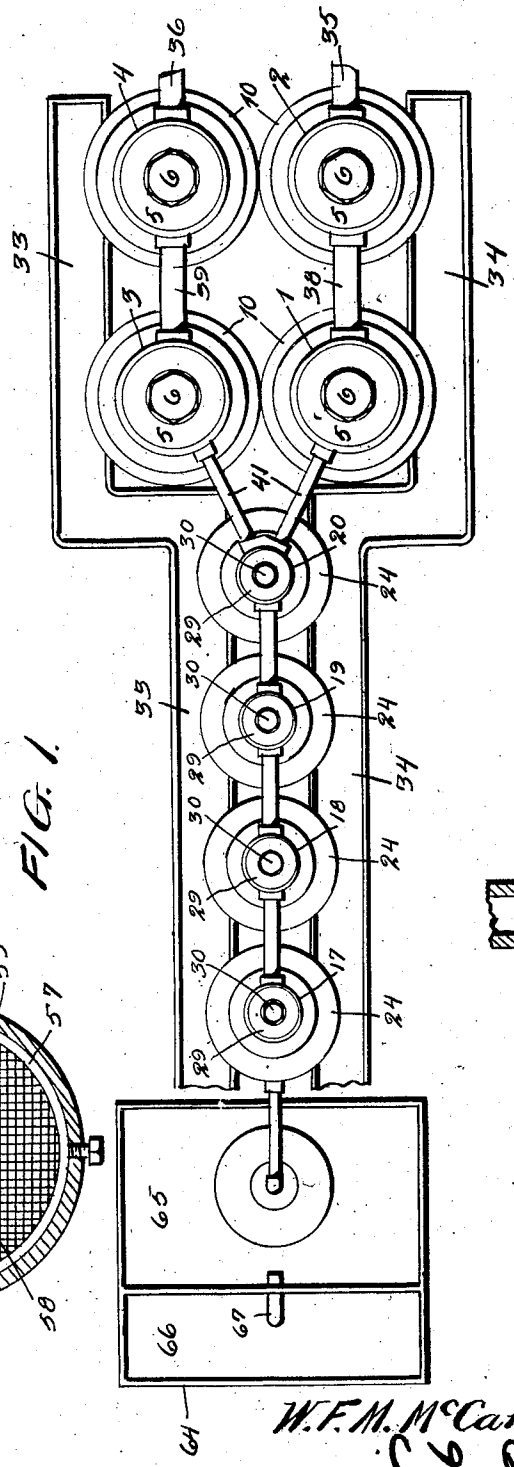

FIG. 1.

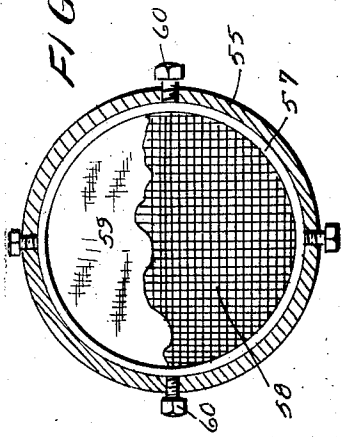

FIG. 5.

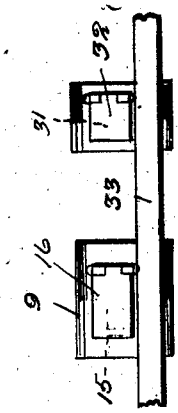

FIG. 4.

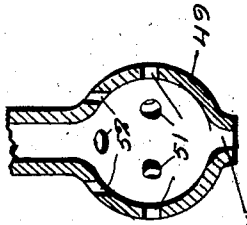

FIG. 3.

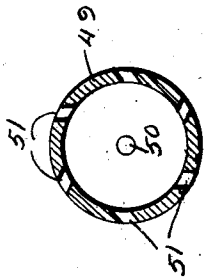

FIG. 2.

WITNESSES

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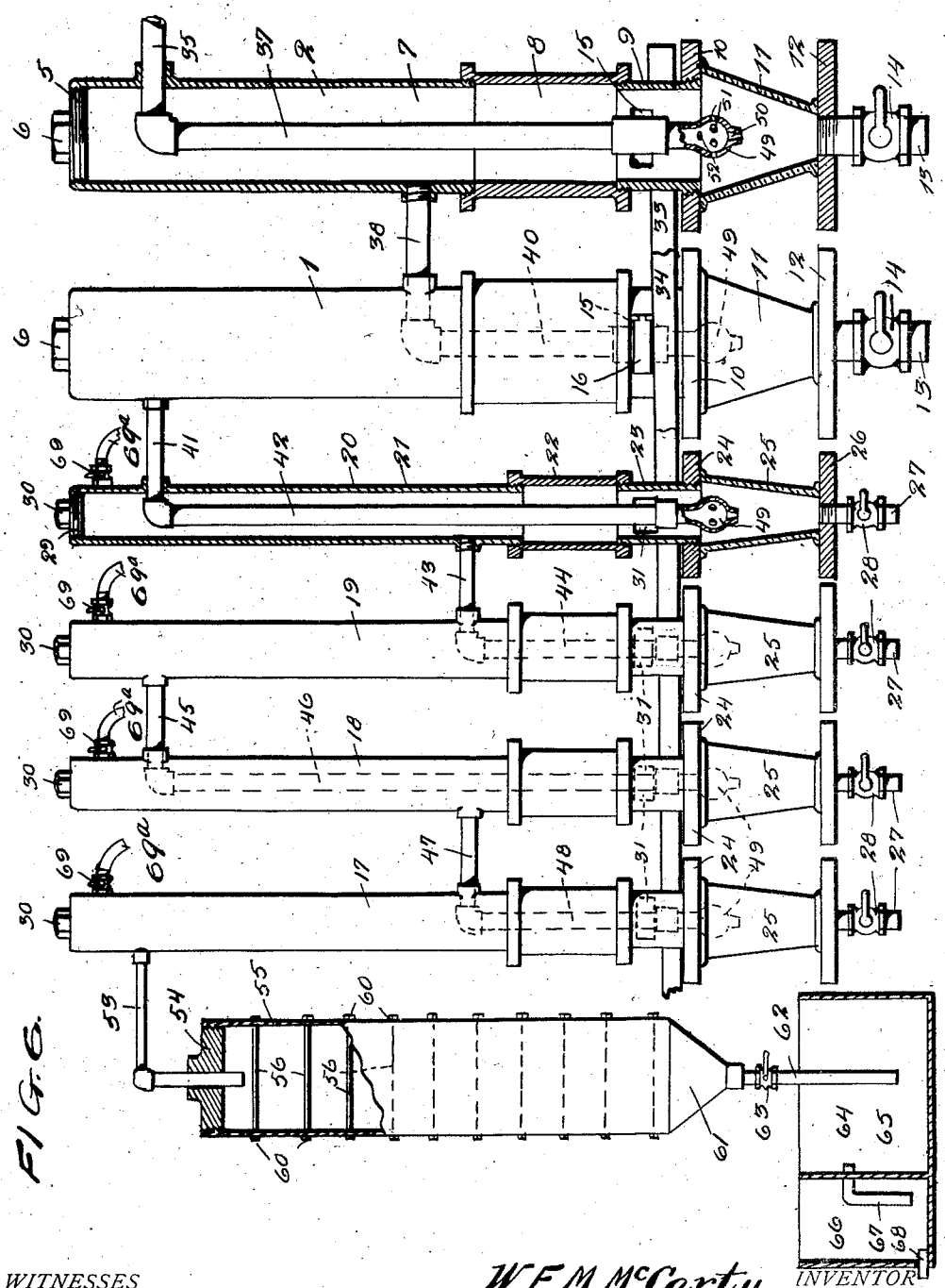

FIG. 6.

WITNESSES

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HYDRAULIC CONCENTRATING AND AMALGAMATING APPARATUS.

1,047,673. Specification of Letters Patent. Patented Dec. 17, 1912.

Application filed February 10, 1912, Serial No. 676,791. Renewed November 4, 1912. Serial No. 729,546.

To all whom it may concern:

Be it known that I, WILLIAM F. M. McCARTY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Hydraulic Concentrating and Amalgamating Apparatus, of which the following is a specification.

The present invention relates to a hydraulic concentrating and amalgamating apparatus, for use in separating precious metals from their ores or sands.

An important object of this invention is to provide an apparatus of the above mentioned character, which will separate, classify, and concentrate materials of different specific gravities, such as finely pulverized ore or sand carrying fine particles of gold or other precious metals intimately mixed therewith.

A further object of my invention is to provide apparatus of the above mentioned character, which is characterized by extreme simplicity of structure, automatic and thorough operation, and cheapness in cost of manufacture.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same, Figure 1 is a plan view of the apparatus as a whole, Fig. 2 is a detail horizontal sectional view through the nozzle, Fig. 3 is a detail vertical sectional view through the same, Fig. 4 is a detail view showing one of the discharge portions and associated elements, Fig. 5 is an enlarged sectional view through the strainer tank, showing one of the strainers, and, Fig. 6 is a side view of the entire apparatus, parts being shown in section.

In the drawings wherein for the sake of illustration, I have shown a preferred embodiment of my invention, the numerals 1, 2 and 3, 4 designate sets of upstanding or vertical concentrating tanks. These tanks have their upper ends internally screw-threaded for engagement with an externally screw-threaded plug or cap 5, provided with extensions 6 to be engaged by a suitable tool such as a wrench, whereby the plugs or caps may be turned. Each of the concentrating tanks is preferably formed in a plurality of sections 7, 8 and 9, disposed in end to end relation and having screw-threaded engagement, as shown. The lower section 9 of each of these concentrating tanks is externally screw-threaded at its lower end for engagement with an internally screw-threaded ring 10, to which is connected a transparent concentrate basin 11. This basin may preferably be formed of glass and is substantially inverted frusto-conically shaped. Attached to the lower end of the concentrate basin 11 is a plate 12, having a central opening formed therethrough for receiving a draw-off pipe 13, which leads into the concentrate basin at the lower end thereof. This draw-off pipe is provided with a cut-off valve 14 of any well known or preferred type. Each of the concentrating tanks is provided near its lower end above the concentrate basin 11 and preferably in the section 9, with a sand or ore discharge opening 15, which is normally closed by a swinging door 16 or other device.

The numerals 17, 18, 19 and 20 designate upstanding or vertical concentrating tanks forming a single set for receiving material from the two sets of concentrating tanks above referred to. The tanks in this third set are much smaller in diameter than the concentrating tanks in the first two sets, as shown. Each of the concentrating tanks 17, 18, 19 and 20 is preferably formed in sections 21, 22 and 23 disposed in end to end relation and having screw-threaded engagement, as shown. The lower section 23 has its lower end internally screw-threaded for engagement with an internally screw-threaded ring 24 having connection with a depending transparent concentrate basin 25. This concentrate basin 25 is preferably formed of glass, is substantially inverted frusto-conically shaped, and of much smaller diameter than the concentrate basin 11. At its lower end the transparent concentrate basin 25 is connected with a plate 26, provided with a central opening for receiving a draw-off pipe 27, which leads into the lower end of this basin. Each of these draw-off pipes 27 is provided with a cut-off valve 28 of any well known or preferred type. The upper section 21 of each of these smaller concentrating tanks is internally screw-threaded at its upper end for engagement with an externally screw-threaded cap or plug 29, provided with an extension 30 adapted to be engaged by a suitable tool or wrench whereby

the cap may be turned. Each of the smaller concentrating tanks is provided near its lower end above the concentrate basin 25 and in the section 23 with a sand or ore discharge or waste opening 31, which is normally closed by a swinging door 32 or other equivalent element. The discharge openings 15 of the tanks 3 and 4 and the discharge openings 31 of the tanks 17 to 20 inclusive, discharge into an inclined trough 33, extending near one side of these tanks. The discharge openings 15 of the concentrate tanks 1 and 2 discharge into an inclined trough 34, disposed near the opposite sides of the concentrating tanks, as shown.

Supply pipes 35 and 36 lead respectively into the upper portions of the concentrating tanks 2 and 4 and are each therein connected with a depending pipe 37, which extends axially of the concentrating tank. The tanks 1, 2, and 3, 4 are connected with horizontal pipes 38 and 39, which extend through the sections 7 near the lower ends thereof. Each of the pipes 38 and 39 is connected with a depending pipe 40, extending axially within the concentrating tank. The concentrating tanks 1 and 3 have connection near their upper ends with converging horizontal pipes 41, which extend within the upper end of the smaller concentrating tank 20 and are therein both connected with a depending pipe 42, which extends axially within the tank 20. The concentrating tanks 19 and 20 are connected substantially midway their ends by a horizontal pipe 43, having connection with a depending pipe 44 which extends axially through the tank 19. The upper ends of the tanks 18 and 19 are connected by a horizontal pipe 45, which is connected with a depending pipe 46, extending axially within the tank 18. A horizontal pipe 47 connects the concentrating tanks 17 and 18 substantially midway the ends thereof and this pipe is connected with a depending pipe 48, which extends axially within the tanks 17, as shown.

Each of the depending pipes 37, 40, 42, 44, 46, and 48 is provided with a substantially bulbous-shaped nozzle 49. These nozzles are of the same shape and construction except that the nozzles disposed in the concentrate basins 25 are smaller than the nozzles disposed in the basins 11, as shown. Each of these nozzles 49, as more clearly shown in Figs. 2 and 3, is provided with a lower axial opening 50, an intermediate horizontal ring of openings or apertures 51, and an upwardly discharging set of openings 52. The ring or set of openings 51 are horizontally inclined with respect to the radius of the nozzle to impart a rotary movement to material passing therethrough. The upper openings 52 discharge the sand or crushed ore upwardly, so that the same is held in suspension in the water. The construction of the nozzle is an important feature of the invention as by its employment the sand or crushed ore in the presence of water, is thoroughly agitated, scrubbed, and washed, in a more advantageous manner than has heretofore been accomplished.

Connected with the upper end of the concentrating tank 17 is a discharge pipe 53, passing through an opening formed in the head or cap 54, which is externally screw-threaded for engagement with the upper end of a vertical shell or casing 55. Arranged in this shell or casing in spaced superposed relation are strainers 56. Each of these strainers comprises an annular frame 57, to which is secured a section of wire screen or netting 58, serving to support a strainer cloth 59, upon which mercury is preferably sprinkled. The frames 57 of these strainers are rigidly connected with the shell 55 by means of bolts 60 or the like, as shown. The shell 55 has its lower end inverted frusto-conically shaped, as shown at 61, to which end is connected a draw-off pipe 62, preferably provided with a cut-off valve 63 of any well known or preferred type.

The numeral 64 designates a settling tank formed in two compartments 65 and 66, as shown. The draw-off pipe 62 discharges into the compartment 65 and a pipe 67 serves to establish communication between the two compartments. Connected with the compartment 66 of the tank 64 is a pipe 68, preferably having connection with a pump (not shown), which supplies water to the pipes 35 and 36 or to the tank with which these pipes are connected.

Each of the tanks 17, 18, 19 and 20, which may be of any suitable number and form a third set of tanks, is provided near its upper end with a pressure relief valve or stop cock 69, which is connected in a pipe 69, which discharges its material onto a suitable strainer (not shown). It is thus seen that when the valves or stop cocks 69 are in operation they allow of the discharge or flow of the water from the tanks through the pipes 69ª, whereby the pressure in these tanks is reduced.

The operation of the device is as follows: The auriferous sand or crushed ore may preferably be introduced into the tanks 2 and 4 by the removal of the plugs or caps 5. These plugs or caps are then of course returned to their closed position. The water is now supplied through the pipes 35 and 36, preferably at about the pressure of sixty pounds to the square inch. The water then discharges through the pipe 37 and through the nozzle 49. This water now passes through the openings of the nozzle in the concentrate basin 11, such water being discharged in all directions, upwardly and downwardly through openings 50 and 52 and laterally through the opening 57. At-

tention is called to the fact that the water discharging through the nozzle 49 is given the same movement as is found in nature when the water flows over rocks and obstructions in a stream, forming riffles, and the water flowing into a pool at the riffles. My apparatus is thus very thorough in operation and it is impossible for the material to pass through the same without being separated, concentrated and seized by gravity. This water passing through the openings 57 is given a rotary movement. It is thus seen that the material in the concentrating tank 2 is thoroughly agitated and washed and as the water level increases in this tank it is carried by the water through the pipe 38 into the pipe 40 which extends within the tank 1. The ore or sand in the water is now discharged into the nozzle 49 carried by the pipe 40 and is agitated, ground, and thoroughly scoured in the nozzle and subsequently discharged through the openings of the same into the concentrate basin 11, wherein it undergoes a further washing. I have thus described the operation of the apparatus in connection with tanks 1 and 2, and it might be stated that the operation of tanks 3 and 4 and 17 to 20 is the same except that the agitation is much more severe in the tanks 1, 2 and 3, 4 than in tanks 17 to 20. The crushed ore or sand together with the water are violently agitated by the high pressure of the water in the first two sets of concentrating tanks, which throws down the larger particles of free gold or any material heavier than the matrix holding it. When the ore and the water have been thoroughly treated in the first and second sets of concentrating tanks they pass into the third set of concentrating tanks (tanks 17 to 20), of which there may be any suitable number. The agitation in this third set of concentrating tanks is not as violent, and gradually decreasing in each succeeding tank to the left. This is due to the fact that some of the water escapes from the upper ends of these tanks through the pressure relief valves or stop-cocks 69, whereby the pressure in this third set of tanks is reduced. The finely divided particles of gold or the like that have passed together with the sand or ore and water through the first two sets of concentrating tanks, wherein, as above stated, the pressure is very high and the agitation violent, now have an opportunity to be separated and settle in the concentrating tanks of the third set. The water that is discharged through the pressure relief valve or stop-cock is conducted through the pipes 69^a onto a suitable filter cloth (not shown). In this way any fine particles of gold which might otherwise be lost, are recovered. It is thus seen that the water carrying the material to be treated may be fed into the first two sets of concentrating tanks at a pressure of about sixty pounds to the square inch and will be discharged into each successive tank of the third set. The pressure in each successive tank of the third set may be lower than that of the preceding tank which is accomplished by providing the pressure relief valves or stop-cocks. The agitation is most severe in the tanks 1 to 4 inclusive, and gradually decreases in each successive tank 20, 19, 18 and 17, to the left, such decrease in agitation being caused by a corresponding decrease in pressure. The pressure in the tank 20 will be less than that in the tank 1 on account of the operation of the valve or stop-cock 69, which permits of the discharge of water through the same, while the pressure in the tank 19 will be still less than that in the tank 20 because such pressure is effected by the two valves or stop-cocks 69, carried by the tanks 19 and 20 and so on. It is thus seen that the finer particles of gold which pass into each of the successive tanks of the third set are separated and allowed to settle. The heavier particles of gold or gold bearing particles gravitate into the transparent concentrate basins wherein is placed a suitable quantity of mercury to cause an amalgamation of the gold. The operator can observe the collection of the concentrates in the transparent basins and when the concentration is continued to a desired point, the concentrates and amalgam may be withdrawn for further treatment by the manipulation of the valves 14 and 28. The water carrying the gold bearing particles finally discharges through the pipe 53 into the upper end of the shell 55 and passing through the strainers 56, the very fine particles of gold or the gold bearing particles are caught by such strainers upon which is preferably sprinkled mercury. The water then discharges through the pipe 62 into the tank 64. Should there remain any fine particles of gold or gold bearing particles in this water, they will settle in the compartment 65, while the very light particles may be carried over into the compartment 66 and there allowed to settle and be collected.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same and that certain changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:—

1. In apparatus of the character described, a concentrating and classifying tank, a nozzle disposed therein and provided upon its upper and lower portions with vertical discharge openings and be-

tween such discharge openings with horizontal discharge openings disposed at angles to the radii of the nozzle, in corresponding directions around the nozzle, and means for supplying a classifying current to said nozzle.

2. In apparatus of the character described, a series of upstanding concentrating and classifying tanks wherein alternate tanks of the series have communication with the adjacent tanks on the outlet side of the apparatus through conduits leading from said alternate tanks near the lower portion thereof into said adjacent tanks near the lower portions of the same, said adjacent tanks having communication with said alternate tanks on the outlet side of the apparatus through conduits leading from said adjacent tanks, near the upper portions thereof, into said alternate tanks, near the upper portions thereof and terminating near the lower portions of the same, means to supply a classifying stream into one of the tanks of the series, and the tanks being provided near their upper ends with restricted discharge means.

3. In apparatus of the character described, a concentrating and classifying tank, a nozzle disposed therein and provided with upwardly and downwardly discharging openings and horizontally discharging openings disposed at angles to the radii of the nozzle, and means to supply a classifying stream to the nozzle.

4. In apparatus of the character described, a concentrating and classifying tank, an approximately spherical nozzle disposed therein and provided at its upper portion with upstanding discharge openings and below them with substantially horizontal discharge openings disposed at angles to the radii of the nozzle, in corresponding directions about the nozzle, said nozzle being further provided at its lower end with a downwardly discharging opening, and means to supply a classifying stream to the nozzle.

5. In apparatus of the character described, a concentrating and classifying tank, a nozzle disposed therein comprising a shell provided with upstanding discharge openings and below them with approximately horizontal discharge openings arranged at angles to the radii of the shell, and means for supplying a classifying stream to the nozzle.

6. In apparatus of the character described, a series of upstanding and classifying tanks wherein alternate tanks of the series have communication with the adjacent tanks through conduits leading from said alternate tanks, near the lower portions thereof, into said adjacent tanks near the lower portions of the same, said adjacent tanks having communication with said alternate tanks through conduits leading from said adjacent tanks, near the upper portions thereof, into said alternate tanks, near the upper portions thereof and terminating near the lower portions of the same, means to supply a classifying stream into one of the tanks of the series, and valves connected with the tanks near their upper ends.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM FITZCHARLES MASON McCARTY.

Witnesses:
SAMUEL B. BRILLHART,
SOLOMON S. LIEBESMAN.