(No Model.) 2 Sheets—Sheet 1.

J. H. BARR & J. F. JOHNSON.

HYDRAULIC GOLD SEPARATOR.

No. 578,807. Patented Mar. 16, 1897.

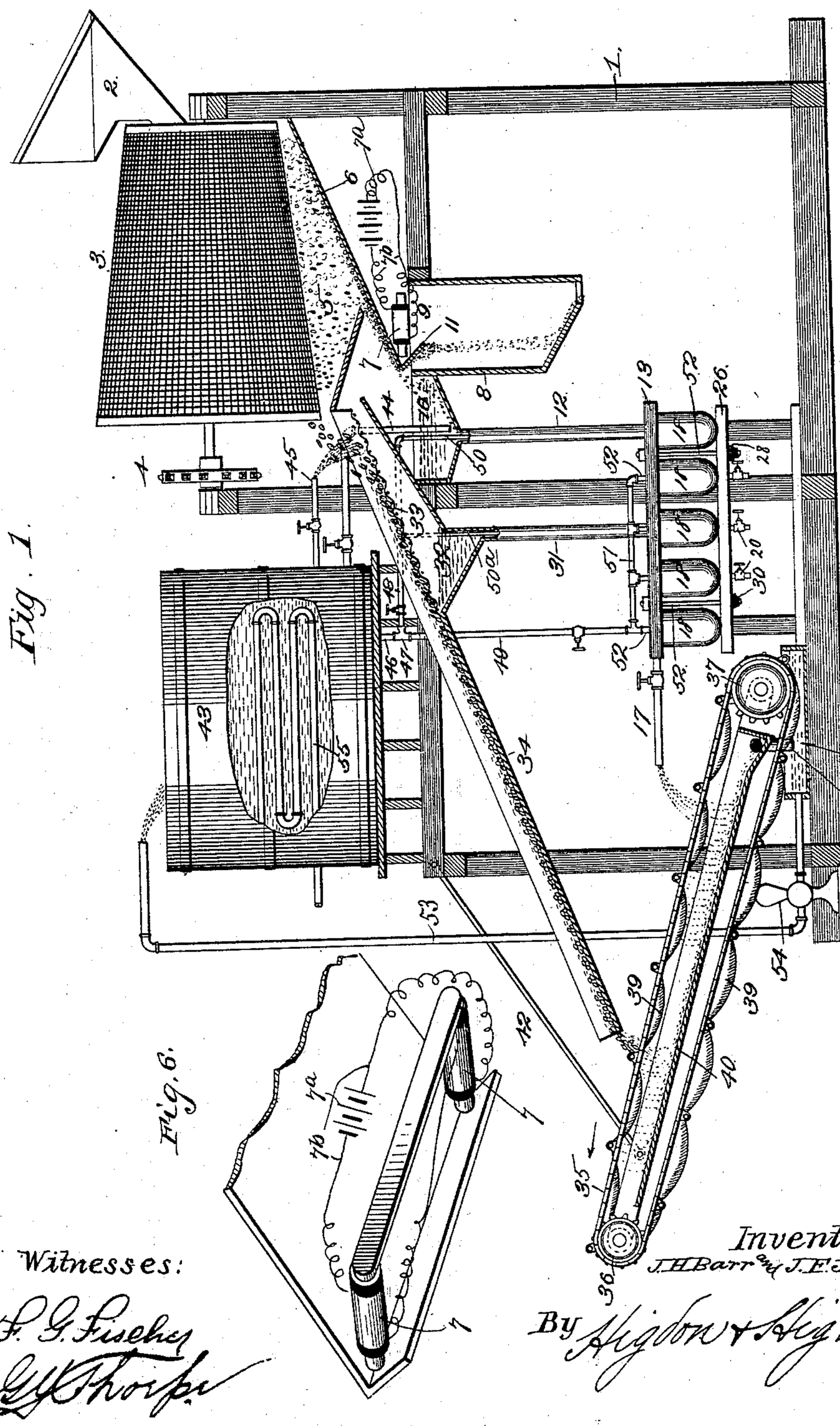

Fig. 1.

Fig. 6.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

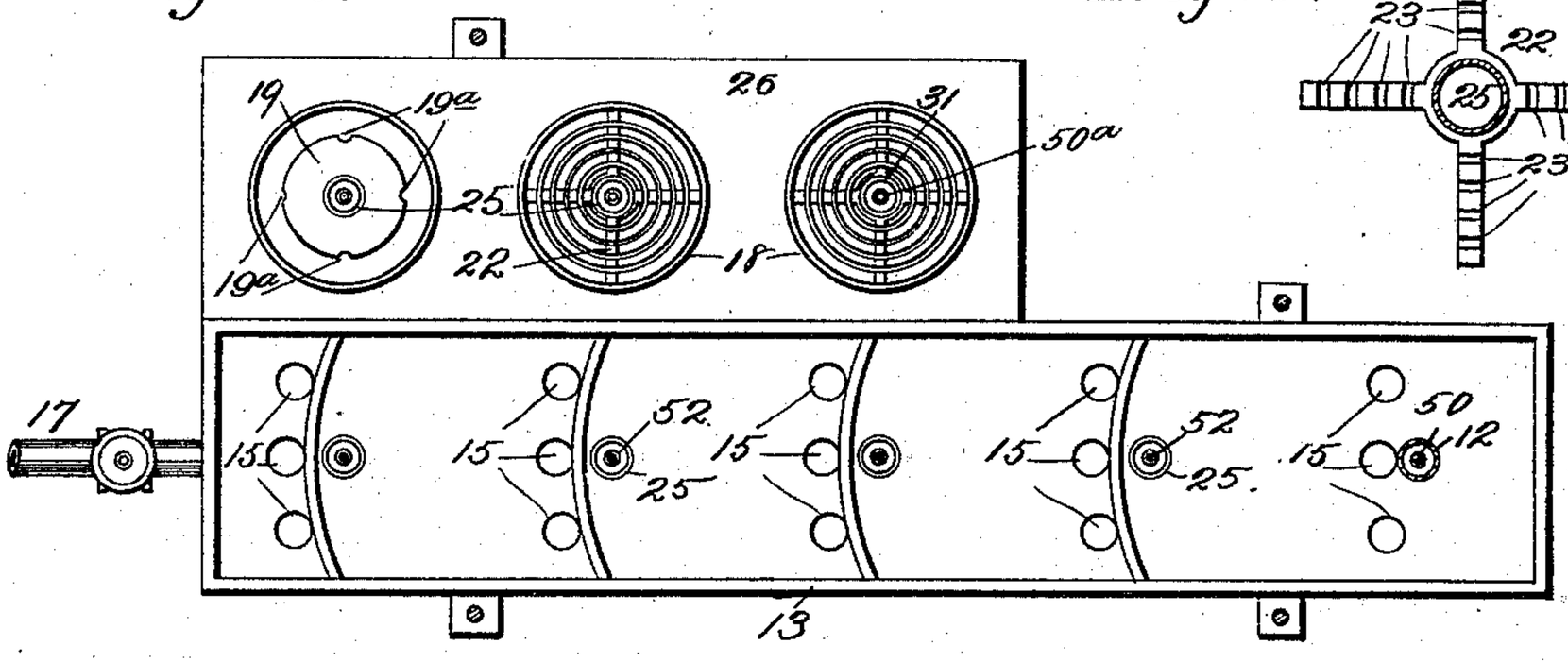


Fig. 5.

Fig. 3.

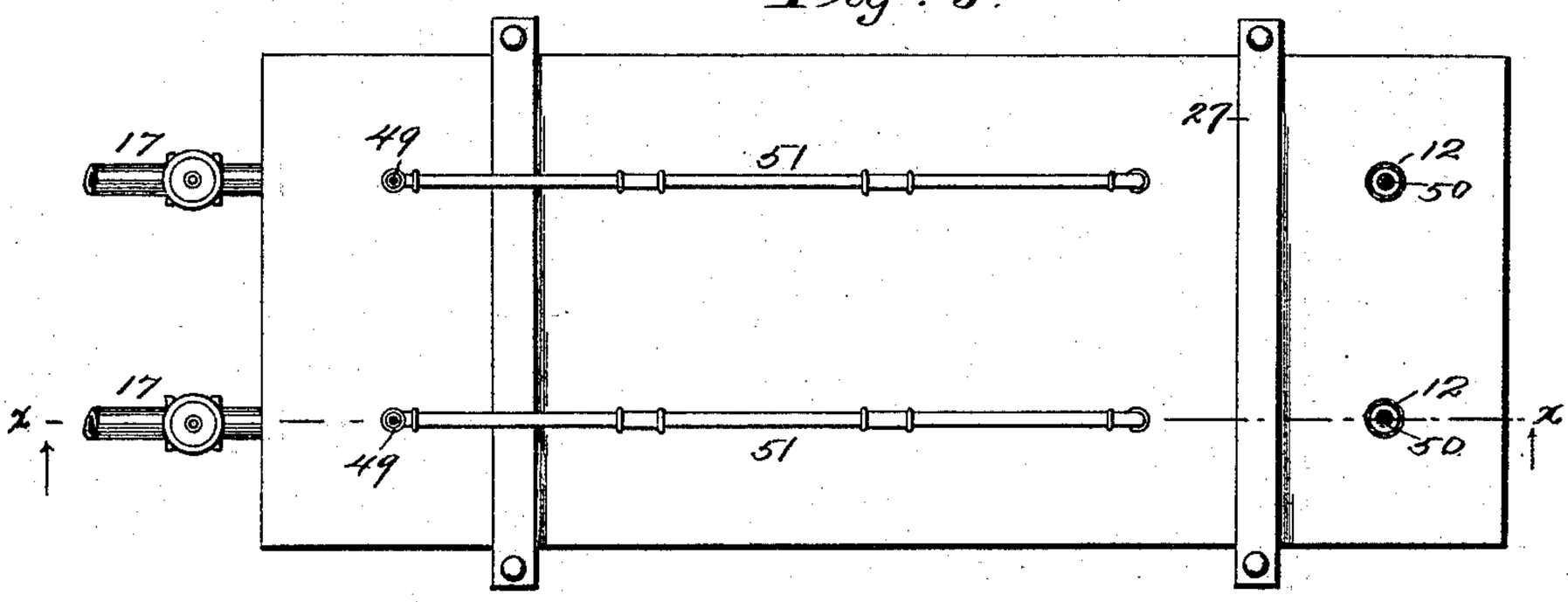
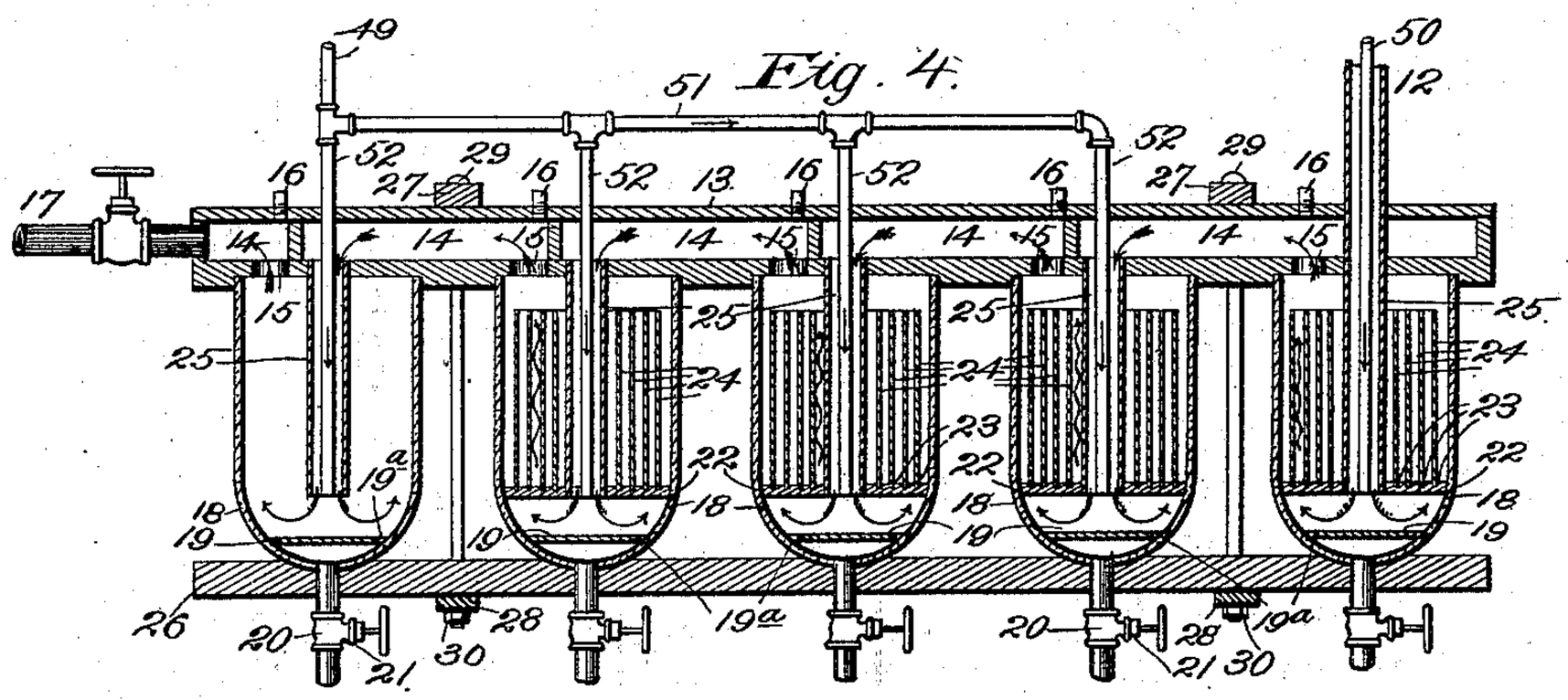


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN H. BARR AND JAMES F. JOHNSON, OF KANSAS CITY, KANSAS, ASSIGNORS OF ONE-THIRD TO WILLIAM E. HARVEY, OF ROSEDALE, KANSAS.

HYDRAULIC GOLD-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 578,807, dated March 16, 1897.

Application filed July 11, 1896. Serial No. 598,875. (No model.)

To all whom it may concern:

Be it known that we, JOHN H. BARR and JAMES F. JOHNSON, of Kansas City, Wyandotte county, Kansas, have invented certain new and useful Improvements in Gold Extracting or Separating Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part thereof.

Our invention relates to apparatus for extracting gold, and more particularly for extracting gold from free-bearing particles—that is, from placer material and from what is known as "free-milling" quartz, or quartz which is not refractory and need not be smelted.

The principal object in view is to provide an apparatus whereby the gold may be forced by hydraulic pressure through quicksilver.

A further object of the invention is to produce a machine of this character whereby the magnetic sand is separated from the other gold-bearing particles before the latter is treated to the mercurial bath hereinbefore mentioned, which consequently increases the capacity of the machine, because a considerable portion of the material usually consists of such sand. This sand is caught in suitable receptacles and is smelted in the customary manner, or in any preferred manner, to extract the gold.

With these objects in view and others, as will hereinafter appear, the invention consists in certain novel and peculiar features of construction and combinations of parts, as will be hereinafter described and claimed.

In order that the invention may be fully understood, we will proceed to describe it with reference to the said accompanying drawings, in which—

Figure 1 represents, partly in side elevation and partly in section, a hydraulic gold-separating machine embodying our invention. Fig. 2 represents a plan view of the inner set of gold-separating jars. Fig. 3 is a plan view of the casing which forms the cover for and communicates with the gold-separating jars. Fig. 4 represents a vertical section taken on the line x x of Fig. 3. Fig. 5 represents a plan view, on an enlarged scale, of one of the amalgam plates supporting spiders. Fig. 6 is a perspective view of part of the apparatus.

In the said drawings, 1 designates a suitable framework.

2 designates a hopper through which the gold-bearing particles are introduced into the smaller end of the horizontally-arranged frustum-shaped screen 3, mounted upon a shaft journaled in the upper end of said framework and rotated by a chain (not shown) engaging the sprocket-wheel 4 or in any other suitable manner. Below said revolving screen is a hopper 5. One side of the bottom of said hopper consists of a plate 6, forming a part of a magnetic circuit, the poles of an electro-magnet 7 and their connection completing the said circuit. The magnet is energized by a battery 7^a or other source of electric energy, the connections being suitable conductors 7^b. Said plate extends downwardly below the other side of the bottom of the hopper and terminates vertically above the wall 8, which separates the hoppers 9 and 10, the hopper 9 being below the plate 6, while the hopper 10 is forward of the same, and depending at an angle from the lower end of the plate 6 back into the hopper 9 is the plate 11, the arrangement being such that the magnetic sand which sifts through the screen and travels down upon the plate 6 is caused, by magnetic attraction of said plate and of its extension 11, to follow the latter and pass into the hopper 9, dropping from said plate 11 into said hopper and passing thence into any suitable receptacles placed to receive it, while the free-gold-bearing particles, by reason of the fact that the lower end of the plate 6 is vertically above the partition-wall 8, are discharged positively and reliably into the hopper 10. Said hopper is provided with a vertical discharge-pipe 12, which extends through the casing 13, divided by partitions into a number of separate chambers 14. The bottom of said casing is provided with one or more perforations or passages 15, communicating with each chamber, and vertically above one of each set of said perforations or passages the top of the casing is provided with holes closed by screw-plugs 16, the object of which will be hereinafter referred to. At its front

end the casing 13 is provided with a valve-controlled discharge-pipe 17, which valve will preferably be of a kind which may be operated to permit the volume of discharge to be increased or diminished at will. The bottom of the casing is provided with recesses corresponding in number to the chambers 14, and fitting in said recesses at their upper ends are a number of jars 18 of glass or copper, preferably the former, such connection being made water-tight. Said jars are preferably semispherical at their lower ends, and arranged horizontally therein are plates or disks 19, provided with notches 19^a in their edges, so as to afford communication with the chambers below said plates or disks. Communicating with said chambers below said plates or disks are the vertical discharge-pipes 20, provided with controlling-valves 21.

22 designates a number of spider-frames, which are fitted within said jars and rest horizontally by their own weight at the junction of the vertical and curved walls of same a suitable distance above the plates 19. Said spiders are provided with grooves 23, arranged in concentric series, and resting within said grooves are a corresponding number of copper amalgam plates 24, of circular form. These spiders and amalgam plates are placed, preferably, in all of the jars except the last one, and each of the jars communicates by way of the passages 15 with one of the chambers 14, as shown clearly in Fig. 4. The amalgam plates of the first jar surround also the vertical pipe 12 hereinbefore referred to, the lower end of which terminates in the plane of said spiders, preferably.

A short vertical pipe 25, corresponding in function to the pipe 12, also depends vertically and centrally within each of the remaining jars and communicates at its upper end with one of the chambers 14.

The jars rest at their lower ends upon the base-board 26, and in order to clamp them firmly and reliably between said base-board and the casing 13, so that one set of jars or a double set of jars, with their appurtenances, may be rendered conveniently portable, we arrange transversely upon said casing or double casing, as shown in Fig. 3, the bars 27, and at the lower side of the base-board 26, as shown in Figs. 2 and 4, the bars 28, and connect them by vertical tie-bolts 29, engaged at their lower ends by clamping-nuts 30.

31 designates a vertical pipe which corresponds in function to the pipe 12 and communicates at its upper end with a hopper 32, which hopper is bridged by the inclined stationary coarse screen 33, which is arranged to receive from the revolving screen the particles too large to pass through the interstices of the same, and said pipe communicates at its lower end with the first of a smaller series of gold-separating jars, which may or may not be provided with the amalgam plates and the supporting-spiders. Such smaller series, communicating with the pipe 31, are shown in the upper portion of Fig. 2 and are of precisely the same construction throughout and are provided with the same appurtenances as the jars shown in Fig. 4. The reason for employing a smaller series is that the great mass of gold obtained passes through the hopper 10 and the larger series of gold-separating jars, while only a comparatively small quantity, such as small nuggets (too large to pass through the interstices of the rotating screen) and a limited amount of gold-dust which adheres to the larger particles and is discharged with them consequently from the enlarged end of the revolving screen upon the screen 33, which nuggets pass through said screen together with such adhering particles or dust into the hopper 32, the separation of the dust or particles being insured by discharging a stream of water upon the mass as it escapes from said cylinder in the manner to be presently explained. In fact the disproportion is so great that we have found it necessary, as a rule, to employ three of the larger series to one of the smaller series, as is represented in Figs. 2 and 3, where it will be noticed that valve-controlled discharge-pipes 17 project at one end from the casing or casings and each in alinement with a longitudinal series of chambers of said casing or casings, while the corresponding discharge-pipe of the smaller series does not appear, because the casing corresponding to the casing 13 has been omitted to more clearly expose the internal arrangement of the jars.

The inclination of screen 33 is continued by a chute 34, over which the waste particles, or those which are not treated to a mercurial bath, travel, and are discharged upon the inclined conveyer of the "Burlap" type. This conveyer comprises endless chains 35, engaging sprocket-wheels 36 and 37, the latter of which is partly submerged in the water-tank 38, mounted upon the framework 1. Connecting said chains, and of width to accommodate the discharge of all of the pipes 17, are a series of pockets 39, of fibrous or other material, which will permit water to seep or percolate therethrough, but which will retain the particles of gold which are discharged with the waste from the chute 34 into said pockets. At certain intervals this gold is obtained by the well-known method of burning said fibrous material. As the elevator moves continuously in the direction indicated by the arrow, Fig. 1, the waste is discharged from its elevated end. The water which is discharged upon the conveyer from the pipes 17 and from the chute 34 escapes into the chute 40, arranged within said conveyer and communicating at its lower end by means of the pipe 41 with the water-tank 38. Said chute 40, which also forms a bearing at its opposite ends for the upper shaft of the conveyer, is supported at its outer end by means of the inclined brace-rods 42, one only of

which is shown. Mounted upon the framework at a suitable point is a water-reservoir 43.

44 designates a valve-controlled pipe, which is arranged to discharge water from the reservoir 43 into the hopper 10, and 45 designates a second valve-controlled pipe which projects from said reservoir and is adapted to discharge a stream of water upon the gold-bearing material escaping from the enlarged end of the rotating screen, as shown clearly in Fig. 1. 46 designates a third pipe, which projects from said reservoir and carries a T-coupling 47, from which extends the valve-controlled pipes 48 and 49. The pipe 48 communicates with a vertical injection-pipe 50, which extends downwardly through the pipe 12, and connected to the pipe 49 is a horizontal pipe 51, from which vertically depends a series of injection-pipes 52, which extend vertically downward through the short pipes 45. An injection-pipe 50^a, corresponding to the pipes 50, also extends downwardly through the pipe 31, and pipes corresponding to the pipes 52 downward through the short pipes 25 of the smaller series of separating-jars.

The water-tank 38 is connected by means of a pipe 53 with the reservoir 43, and water is pumped from the former into the latter by way of said pipe by means of an ordinary pump 54.

When the apparatus is to be put in operation, the plugs 16 are removed from the casings 13 and mercury introduced therethrough into the jars until its level is above the spiders 22. The placer or crushed free-gold-bearing quartz is then introduced through the hopper into the screen 3, which is revolved and the water permitted to stream from the pipes 44 and 45 into the hoppers 10 and 32, and the various valves are manipulated, so that the water may accumulate to about the levels shown in said hoppers and thereby provide a continuous and uniform head-pressure of water, which is sufficient to overcome the resistance of the mercury within the jars, and consequently cause the latter to boil up around and within the amalgam plates 24. This head-pressure is also sufficient to force the gold passing into the hoppers downward into the body of mercury, so as to give it a thorough mercurial bath in order that the particles which boil up with the mercury will amalgamate with or cling to the amalgam plates 24. The mass of gold amalgamates with the mercury and passes down by way of the notches 19^a below the plate or disk 19, and in such chamber the mercury is in a state of rest in comparison with that above the chamber. The water follows the direction indicated by the arrows and causes particles to rise tortuously into the amalgam cylinders or plates, as indicated by arrows in Fig. 4, so that they will be positively and reliably caught at some point by said plates before their upper ends are reached. The water from the first jar passes up through the opening 15 into the first chamber 14 and downward into the second jar by way of its pipe 25, then upward into the next chamber 14, and, finally, it passes from the last chamber 14 through the valve-controlled pipe 17, and is discharged upon the conveyer, hereinbefore referred to. By passing the gold or gold-bearing particles through a plurality of such separating-jars it is obvious that all or substantially all of the gold is obtained.

After the machine has been in operation a sufficient length of time and it is desired to obtain the gold the valves 21 are operated and the amalgamated gold and mercury from the chambers below the plates 19 is drawn off through the pipes 20.

To remove the gold from the amalgam plates or cylinders, it is necessary to unscrew the nuts 30 and lower the base-board 36, together with the jars, until the lower ends of the injection-pipes and the pipes surrounding the same are cleared, as will be readily understood. The jars may be as easily resecured in position by reversing this operation.

After the machine has been shut down for a time the sand passing through settles down in quantity upon the mercury in the jars and presents a resistance too great to be overcome by the natural head-pressure, hereinbefore referred to, of water within the hoppers 10 and 32, and consequently the mere starting up of the machine cannot reëstablish the circulation. In order that this may be accomplished easily and quickly, however, we have employed the injection-pipes hereinbefore described, so that by simply permitting the water under heavy pressure from the tanks 43 to escape from said pipes into the body of mercury within the jars, it forces its way up through the mercury and sand above and through the openings 15, following the course already traced. This immediately, by placing the sand in a state of semisuspension, reestablishes the circulation, the head-pressure being turned on again at the same time, as will be readily understood.

It will be noticed that all of the water employed is saved, except a very small percentage which escapes by evaporation, and is used over and over again.

In very high altitudes, that is, where snow-water or very cold water is employed, the mercury, as well known, would become inactive. To overcome this objectionable feature, we employ a heating-coil 55 within the reservoir to keep the water employed up to temperature sufficient to keep the mercury very active and in good working condition.

From the above description it will be apparent that we have produced a machine wherein the gold is subjected to a thorough mercurial bath by hydraulic pressure, thereby saving it, and it is also apparent that by the employment of the magnetized plate forming the bottom of the hopper 5 to withdraw the black or magnetic sand the capacity of the machine is increased materially.

It is to be understood, of course, that various changes in the form, detail construction, or combinations of parts may be resorted to without departing from the spirit and scope of our invention.

Having thus described the invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a hydraulic gold-separating machine, the combination of a number of jars adapted to contain a quantity of mercury, notched partition-plates within said jars and dividing them each into an upper and a lower chamber, valve-controlled pipes communicating with the chambers below said partitions, a casing divided into chambers and resting upon and closing the upper ends of said jars, and provided with perforations, which connect said chambers with said jars, pipes depending from said casing within said jars, and certain of them communicating each with a chamber of said casing, and the one of them which communicates with the first jar of the series extending up through the casing and adapted to discharge under pressure liquid containing gold and gold-bearing particles into the mercury of said jar, and a valve-controlled discharge-pipe, communicating with the chamber of the casing which communicates with the last jar of the series, substantially as described.

2. In a hydraulic gold-separating machine, the combination of a number of jars adapted to contain a quantity of mercury, notched partition-plates within said jars, and submerged in said mercury, valve-controlled pipes communicating with the chambers below said partitions, spider-frames within certain of said jars, amalgam plates carried thereby, a casing divided into chambers and resting upon the upper ends of said jars, and having perforations which connect said chambers with said jars, pipes depending from said casing within said jars, and certain of them communicating each with a chamber of said casing, and one of them extending up through the casing, a hopper communicating with said extended pipe, a valve-controlled discharge-pipe for water communicating with said hopper, and a valve-controlled discharge-pipe communicating with the chamber of the casing with which no pipe 25 directly communicates, substantially as described.

3. In a hydraulic gold-separating machine, a series of jars adapted to contain mercury, partition-plates below the mercury-level within said jars and provided with perforations, valve-controlled pipes communicating with the chambers below said partitions, amalgam plates arranged within said jars and having their lower ends submerged in mercury, a pipe to conduct the free-gold-bearing particles into the first jar below the mercury-level, a casing resting upon the upper ends of said jars and divided into chambers which each communicate with a jar, and short pipes depending from all the said chambers except the last one, into the jars below, and adapted to convey successively the free-bearing particles which escape from the preceding jars down into their respective jars below the mercury-level, and means to force said free-gold-bearing particles to follow such course, substantially as described.

4. In a hydraulic gold-separating machine, a series of jars adapted to contain mercury, partition-plates below the level of the mercury within said jars and provided with perforations, valve-controlled pipes communicating with the chambers below said partitions, amalgam plates arranged within said jars and having their lower ends submerged in mercury, a pipe to conduct the free-gold-bearing particles into the first jar below the level of the mercury, a casing resting upon the upper ends of said jars and divided into chambers which each communicate with a jar, and short pipes depending from all of said chambers except the last one into the jars below and adapted to convey successively the free-gold-bearing particles which escape from the preceding jars down into their respective jars below the mercury-level, means for forcing a liquid under pressure successively down through said pipes and up through said jars, in order to give the gold a thorough mercurial bath, a valve-controlled discharge-pipe for such liquid communicating with said casing, and injection-pipes for liquid under pressure, extending downward into the jars below the mercury-level, substantially as and for the purpose set forth.

5. In a hydraulic gold-separating machine, a series of jars, adapted to contain mercury, partition-plates below the mercury-level within said jars and provided with perforations, valve-controlled pipes communicating with the chambers below said partitions, amalgam plates arranged within said jars and having their lower ends submerged in mercury, a pipe to conduct the free-gold-bearing particles into the first jar below the level of the mercury, a casing resting upon the upper ends of said jars and divided into chambers which each communicate with a jar, and short pipes depending from all of said chambers except the last one into the jars below and adapted to convey successively the free-gold-bearing particles which escape from the preceding jars down into their respective jars below the level of the mercury, means for forcing a liquid under pressure successively down through said pipes and up through said jars, in order to give the gold a thorough mercurial bath, a valve-controlled discharge-pipe for such liquid communicating with said casing, injection-pipes for liquid under pressure, extending downward into the jars below the mercury-level, a liquid-tank, an inclined chute to receive the liquid and conduct it to said tank, an elevated reservoir provided with a valve-controlled pipe for discharging liquid under pressure to said jars, a pipe connecting the liquid-tank and the liquid-reservoir,

and means to elevate the liquid from the former up to the latter continuously, substantially as described.

6. In a hydraulic gold-separating machine, a series of jars adapted to contain mercury, partition-plates below the mercury-level within said jars and provided with perforations, valve-controlled pipes communicating with the chambers below said partitions, amalgam plates arranged within said jars and having their lower ends submerged in mercury, a pipe to conduct the free-gold-bearing particles into the first jar below the level of the mercury, a casing resting upon the upper ends of said jars and divided into chambers which each communicate with a jar, and short pipes depending from all of said chambers except the last one into the jars below and adapted to convey successively the free-gold-bearing particles which escape from the preceding jars down into their respective jars below the mercury-level, means for forcing a liquid under pressure successively down through said pipes and up through said jars, in order to give the gold a thorough mercurial bath, a valve-controlled discharge-pipe for said liquid communicating with said casing, injection-pipes for liquid under pressure extending downward into the jars below the mercury-level, a liquid-tank, an inclined chute to receive the liquid and conduct it to said tank, an elevated reservoir containing a heater and provided with a valve-controlled pipe for discharging liquid under pressure to said jars, a pipe connecting the liquid-tank and the liquid-reservoir, and means to elevate the liquid from the former up to the latter continuously, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN H. BARR.
JAMES F. JOHNSON.

Witnesses:
WM. F. POLK,
CHAS. R. MCCOY.