(No Model.) 2 Sheets—Sheet 1.

R. D. GATES.

APPARATUS FOR CONCENTRATING ORES.

No. 420,933. Patented Feb. 11, 1890.

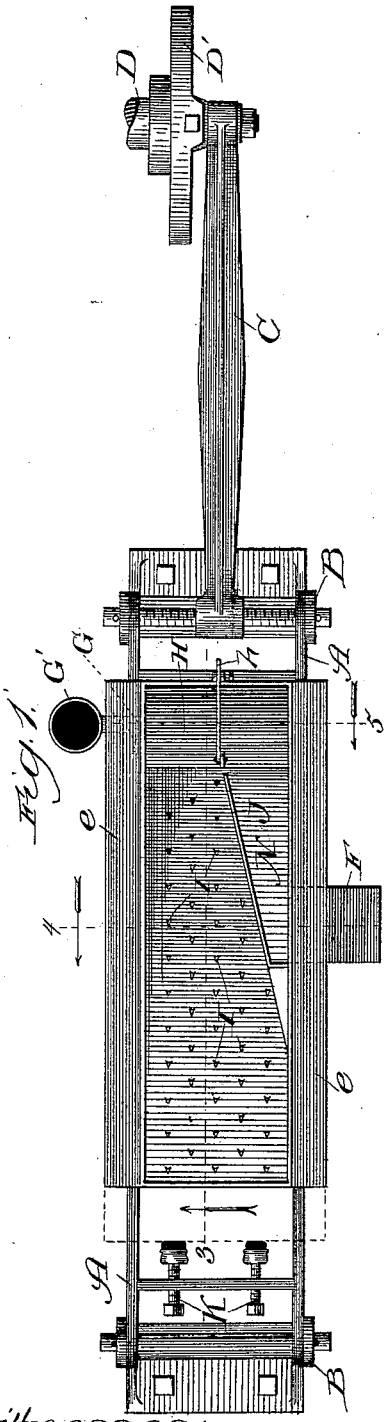

Fig. 1.

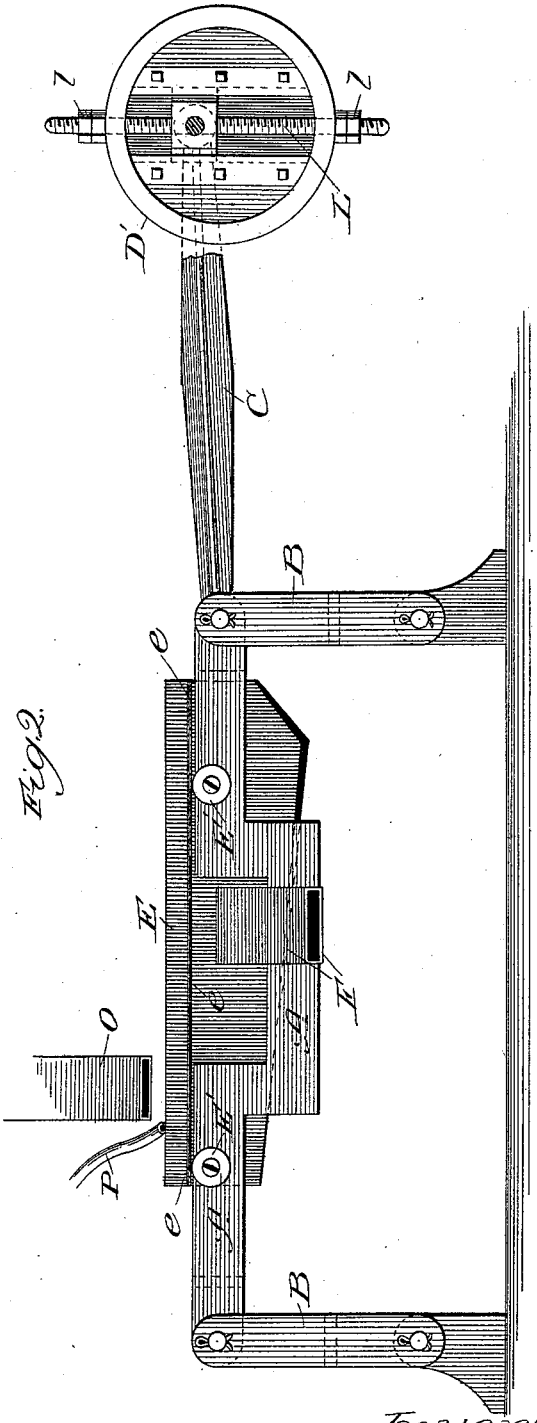

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

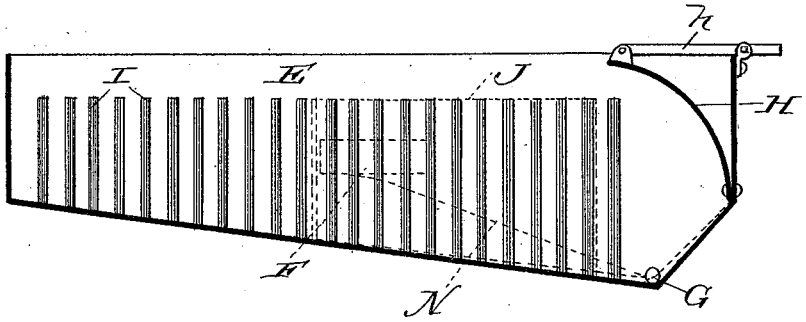

Fig. 4.

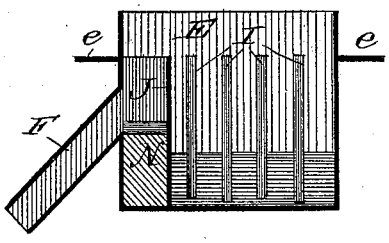

Fig. 5.

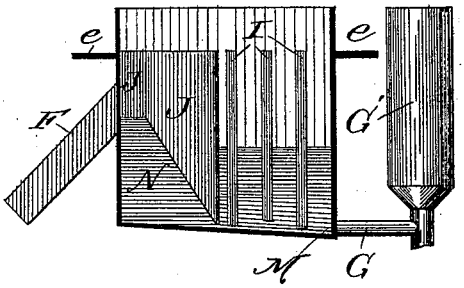

Fig. 6.

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UNITED STATES PATENT OFFICE.

RYERSON D. GATES, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE GATES IRON WORKS, OF SAME PLACE.

APPARATUS FOR CONCENTRATING ORES.

SPECIFICATION forming part of Letters Patent No. 420,933, dated February 11, 1890.

Application filed September 7, 1889. Serial No. 323,301. (No model.)

To all whom it may concern:

Be it known that I, RYERSON D. GATES, a citizen of the United States, residing at Chicago, Illinois, have invented a new and useful Improvement in Apparatus for Concentrating Ores, of which the following is a specification.

The specific gravity of the various metals—tin, iron, silver, &c.—is much greater than that of the substances in combination with which such metals are found—such as different varieties of quartz, spar, &c.—and it is the purpose of my invention to separate the metals from the quartz, &c., or concentrate them by means of a machine which in its operation makes use of the difference in specific gravity of the constituents of the ores to be treated; and the invention consists of the features and details of construction hereinafter described and claimed.

In the drawings, Figure 1 is a plan view of a machine embodying my invention; Fig. 2, a side elevation thereof; Fig. 3, a vertical longitudinal section on line 3 of Fig. 1; Fig. 4, a vertical cross-section on line 4 of Fig. 1, and Fig. 5 a cross-section on line 5 of Fig. 1, all looking in the direction of the arrows; and Fig. 6, a plan view of one of the pins on an enlarged scale.

A is the frame of the machine; B B, the rocker-arms for supporting the same; C, the crank-arm for connecting the frame with the eccentric D′; D, the driving-shaft; E, the oscillating trough or agitator; *e*, flanges on the same; E′, friction-rollers on which the trough runs; F, a spout for discharging the "gangue" or refuse; G, the discharge for concentrated metal; G′, the vessel into which it is received; H, an adjustable deflector; *h*, an arm and set-screw for adjusting the same; I, pins fastened to the bottom of the trough; J, a partition dividing the trough, and K K adjustable bumpers.

In constructing my device I first make the frame. This is made of wood, iron, or other suitable material and of any desired dimensions. It is supported on rocker-arms B B, as shown, in such manner as to allow of its being moved back and forth as desired. In order to thus move or oscillate the frame, I provide the shaft and eccentric D′ and connect the latter to the frame by arm C. In order to increase or diminish the travel of the frame, I prefer to make the connection between the arm C and the eccentric an adjustable one. In the drawings, Figs. 1 and 2, I have shown one way in which this may be done. A screw-threaded rod is passed through the sides of the eccentric and the end of the crank and provided with nuts at each end, so that as the nuts are loosened at one end and screwed up at the other the end of the crank-arm C is moved to or from the center of the shaft and the stroke increased or decreased accordingly. I next make, of any suitable material, the trough or vessel E. This is made wide enough to fit between the sides of the frame A, and is provided with flanges *e e* along each of its sides. These flanges rest on friction-rollers E′ E′, fastened to the sides of the frame A. The trough is made somewhat shorter than the frame, so that as the latter is rocked to and fro the trough can move back and forth inside of it. The frame is provided with bumpers K, of rubber or other suitable material, supported on screw-threaded rods, so as to allow of their being adjusted to increase or diminish the distance the trough can move in the frame. There may be bumpers at both ends of the frame, if desired, although I have shown them at one end only. The bottom of the trough inclines downward from one end to the other, as shown in Fig. 2. The amount of this inclination is not material, so that it can accomplish the object for which it is intended, as hereinafter set forth. At the lower end of the trough the bottom also has an inclination toward one side, as shown in Figs. 2 and 5, so that the corner M, in Fig. 5, where the discharge-spout G is placed, is the lowest point of the trough. I next make the partition J and place it in the position shown in Figs. 1, 4, and 5. This partition is of substantially equal height with the sides of the trough, is arranged in a vertical position, and runs from a point near the lower end of the trough diagonally to one side thereof, as shown, and is so shaped as to prevent the lodging of sediment against the upper end. That part of the bottom of the trough that is between this partition and the side (marked

N in the drawings) is made inclining up toward the upper end of the trough. This is apparent in inspecting Fig. 5, where the upper end of the part N is shown more elevated than the upper end of the main portion of the bottom. At the highest point of the space so partitioned off I place the spout F, as shown, made of any suitable material and dimensions. I next make the pins I. These may be made of wood or metal, as desired, and are preferably made as shown in Figs. 1 and 6, wherein they are made with a somewhat triangular cross-section, the apex pointing toward the upper end of the trough and the base being slightly hollowed out. I do not, however, mean to limit myself to such form of pin alone, since they may be made advantageously in any shape, as round, oval, &c. These pins are securely fastened to the bottom of the trough in rows, as shown in Fig. 1, or irregularly, as preferred. As the trough increases in depth the pins increase in height, so that their upper ends may be substantially on a line with each other. (See Fig. 3.) Next I make a deflector H. This preferably consists of a curved plate hinged to the end of the trough and provided with an arm and set-screw, by means of which it may be set at any desired angle. This plate may be made flat, if preferred, but I consider that the curved form gives the best results. At the lowest point of the trough I attach the tube G and connect it with any suitable vessel—such as G′—to receive the concentrated metal. The shape and side of this vessel are immaterial; moreover, the vessel is not essential.

I have herein described what I consider the best form in which my invention has to the present time been embodied; but changes in form, dimensions, and relative proportions may of course be made, as desired, since I do not wish to limit myself to the exact apparatus herein set forth.

The device operates as follows: The ore should first be reduced to a powder in any suitable crusher or pulverizer, and is then fed into the trough through a chute O, while at the same time a stream of water enters through the pipe P. The frame is constantly rocked back and forth by the shaft D and arm C, and the trough not only travels with and partakes of the oscillating motion of the frame, but has a slight bump or jar given it as it strikes first against one end of the frame and then the other, since it is evident that the oscillation of the frame will tend to move the trough to and fro upon the rollers. The powdered ore mixed with water will be gradually forced by gravitation down the inclined plane formed by the bottom of the trough. On its descent the pins L will aid in stirring the ore and also in moving it downward, the shape of the pins being such that as the machine moves toward the left, Fig. 1, they will penetrate the ore without disturbing it, and as it moves toward the right the curving rearward sides will tend to pull the ore down. The specific gravity of the metal exceeding that of the quartz, &c., the former will on the descent sink to the bottom, leaving the lighter particles on top. On reaching the lower end of the trough the water is dashed back by the deflector and the lighter particles washed up the incline N and out of the spout F, while the heavier metal will collect in the lower end of the trough, whence it may from time to time be drawn off as desired through the tube G. By this means I am enabled to obtain the metal in an almost free state, all of the gangue being washed away from it, leaving it ready to be reduced.

The jarring or bumping aids in forcing the powdered ore down the inclined bottom of the trough, and this may be increased as desired by adjusting the bumpers K so as to increase the distance the trough can travel in the frame; but, if desired, the trough may be fastened directly to the frame, thus dispensing with the bumping or shock, since, while I consider the bumping an important feature of the device, it is not absolutely an essential one.

If it be desired, the trough may be made with a bottom not inclined and supported in such manner as to afford the necessary inclination.

I claim—

1. In a machine for concentrating ores, the combination of a rocking frame, a trough loosely mounted therein, and means for rocking such frame, whereby an oscillating and bumping motion is imparted to the trough, substantially as described.

2. In a machine for concentrating ores, the combination of a rocking frame, an inclined trough loosely mounted therein, pins in such trough, and means for imparting an oscillating and bumping motion to said trough, substantially as described.

3. In a machine for concentrating ores, a trough provided with an inclined bottom, a portion of the bottom being inclined at a different angle and partially separated by means of a wall from the remaining portion, substantially as described.

4. In a machine for concentrating ores, the combination of a rocking frame, an inclined trough loosely mounted therein, a portion of the bottom of said trough being inclined at a different angle to the remainder of said bottom, and a wall by which it is partially separated therefrom, and means for oscillating such frame, substantially as described.

5. In a machine for concentrating ores, the combination of a rocking frame, an inclined trough loosely supported therein, a portion of the bottom of such trough being inclined at a greater angle than the remainder of such bottom and provided with a discharge-spout, pins or pegs secured in such trough, and means for rocking the frame, whereby an oscillating and bumping motion is imparted to the trough, substantially as described.

6. In a machine for concentrating ores, the combination of a rocking frame, a trough loosely mounted therein provided with pins or pegs and an adjustable deflector, a portion of the bottom of said trough being inclined at a greater angle than and partially separated from the rest of the trough, and means for rocking such frame, substantially as described.

7. In a machine for concentrating ores, the combination of the frame A, having rollers E', trough E, loosely mounted therein, provided with flanges *e e*, pins I, deflector H, partition J, more steeply-inclined portions N, and spouts F and G, and means for oscillating such frame, substantially as described.

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SAMUEL E. HIBBEN.