(No Model.) 2 Sheets—Sheet 1.

O. HANSON.

APPARATUS FOR CONCENTRATING ORES.

No. 308,410. Patented Nov. 25, 1884.

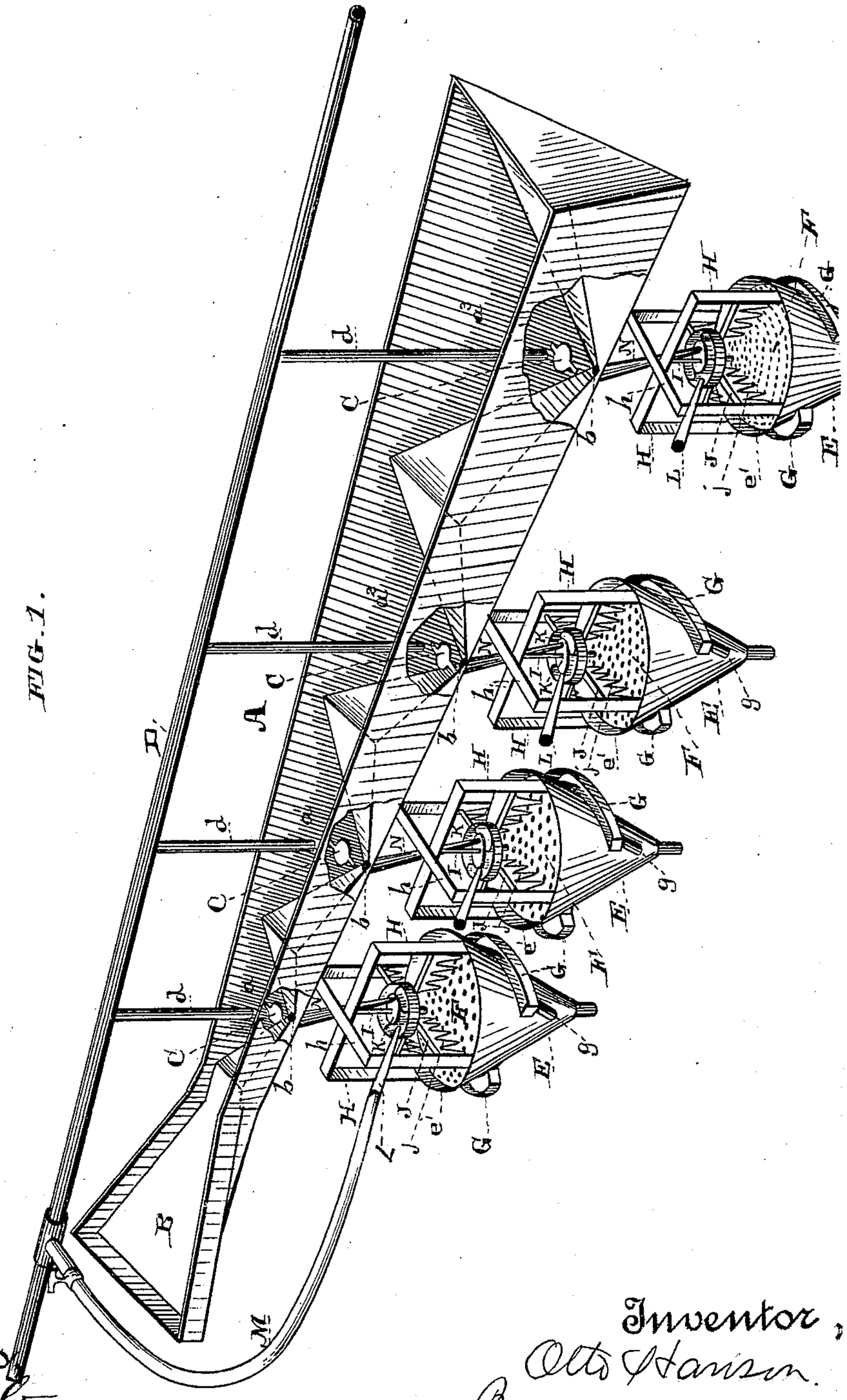

FIG. 1.

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2.

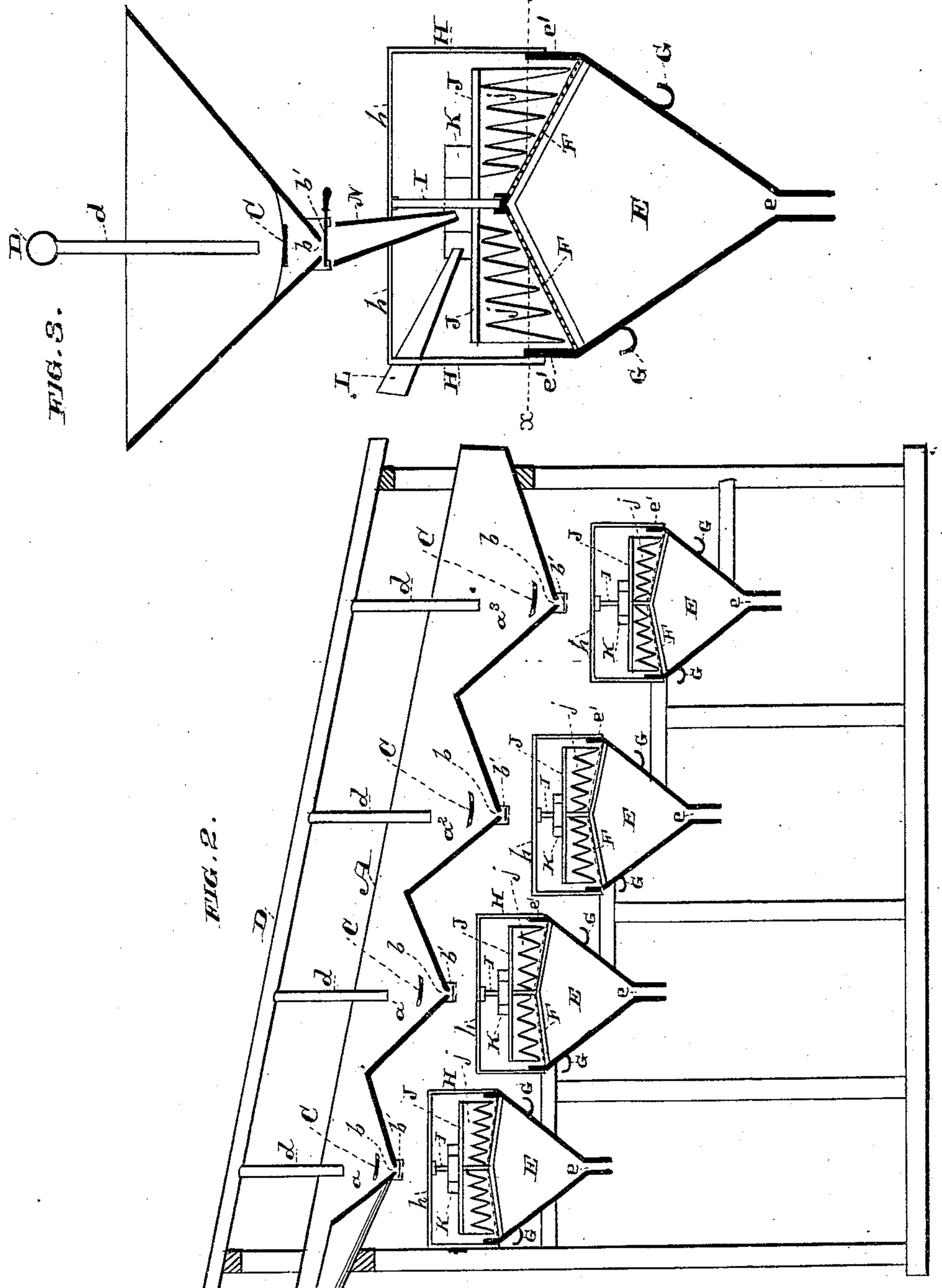

FIG. 3.

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UNITED STATES PATENT OFFICE.

OTTO HANSON, OF SACRAMENTO, CALIFORNIA.

APPARATUS FOR CONCENTRATING ORES.

SPECIFICATION forming part of Letters Patent No. 308,410, dated November 25, 1884.

Application filed June 20, 1884. (No model.)

To all whom it may concern:

Be it known that I, OTTO HANSON, of the city and county of Sacramento, and State of California, have invented an Improvement in Apparatus for Concentrating Ores; and I hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a new and useful apparatus for the concentration of ores. The apparatus includes an inclined vessel having a series of downwardly-tapering successive chambers or compartments increasing in capacity and communicating with each other, a water-pipe adapted to discharge within said compartments, and peculiar screen-vessels under the discharge of each compartment to receive the concentrations and size them, all of which I shall hereinafter fully explain and claim.

The object of my invention is to work over the tailings of mills, or any crushed ore, or earth, sand, or gravel containing precious metals, or any other ore-pulp, and to concentrate therefrom the precious particles.

Referring to the accompanying drawings, Figure 1 is a perspective view of my apparatus. Fig. 2 is a longitudinal vertical section of same. Fig. 3 is a transverse vertical section.

A is a vessel divided into a number or series of chambers or compartments, which, beginning at the head, are designated by *a a'* a^2 a^3, respectively. These compartments are of a downwardly-tapering shape, occasioned by their converging sloping walls formed by the sides of the vessel and the intervening cross-partitions; and it will be observed that from the head to the foot the compartments increase in capacity, the one at the foot being the largest and that at the head being the smallest of the series. The vessel A is set, as shown, at a downward inclination from head to foot, and is provided at its head with a feed-chute, B, communicating with compartment *a*. This chute may represent the end of a tail-race, or it may receive the end of whatever device is used to feed the tailings or ore to it. The bottom of each of the compartments is provided with a discharge-opening, *b*, controlled by a gate, *b'*, and just above the discharge-opening is secured in a horizontal plane by suitable arms a slightly-concaved disk, C, which is greater in diameter than the opening, and guards it.

D is a water-pipe, which may be supposed to be supplied with water from any suitable source. From this pipe extend downwardly into each compartment discharge-pipes *d*, which terminate a short distance above the disks C. Under each compartment is a vessel, E, supported by a suitable frame-work. This vessel has the shape of an inverted cone, having a discharge-opening, *e*, at its bottom. Its top is provided with an encircling flange, *e'*.

F is a slightly-convexed screen, supported within the top of vessel E upon suitable radial ribs. The apex or center of the screen is about on or just above the level of the top of the encircling flange, and its periphery is on a level with and joins the base of the flange. There is but one point of difference to be noted in the several vessels E, which is that the screen of that vessel which is under compartment *a* is of a coarser mesh than the screen of that vessel which is under compartment *a'*, and that the screens become finer under the succeeding compartments, the last one under compartment a^3 being the finest of the series, Fig. 1.

Around the exterior of the vessel E is a discharge-trough, G, having a downward inclination and a waste-spout, *g*, Fig. 1. From the flange *e'* rise standards H, having cross-strips *h* at their tops, in the center of which is journaled a shaft, I, the base of which is stepped in a suitable bearing in the center of the screen. From this shaft extend radially arms J, provided with pendent stirrers *j*, made of some suitable flexible material, such as leather, rubber, &c. The length of these stirrers increases from center to outer end, in order to conform to the surface of the screen over which they revolve without necessarily touching it, though they are of course long enough to reach the pulp or concentrations which are fed to the screen. Upon the shaft above the radial arms, and supported thereby, if necessary, is an annular water-wheel, K, against the buckets of which a nozzle, L, is adapted to discharge its water, to effect not only the revolution of the wheel and stirrers, but also to supply a fresh quantity of water to the sieve. The nozzle L is supplied with water from a pipe, M, which may be supposed to be con-

nected either with the water-pipe D above or with any suitable source of supply.

N is a chute, one end of which is adapted to receive the discharge of the compartment under which it is situated, and the other end extends downwardly at an inclination, and is adapted to discharge its contents through the open center of the water-wheel upon the center of the screen.

The operation of my apparatus is as follows: The pulp, either tailings or other crushed ore, or sand, earth, or gravel, carrying precious metals from which it is desired to separate the precious particles, is fed into the chute B at the head of vessel A. It passes first into and fills compartment *a*, thence into *a'*, *a*², and *a*³, successively, as the supply is kept up. The water discharged from pipes *d*, falling upon the disks C, creates and maintains a certain amount of agitation, from which results an upward current, which, being to a certain extent in opposition to the onward current, has the effect of retarding the heavier and more precious particles, which gradually sink out of the agitation and pass through the bottom discharges of the compartments. In this separation the inclined walls dividing the compartments have a beneficial effect in preventing the heavier particles from passing onward. As the pulp passes into each compartment, the current becoming gradually slower and the agitation decreasing on account of the increased capacity of each succeeding compartment, finer particles are separated, until at the end of the vessel very little but worthless stuff or gangue is wasted. Therefore, in compartment *a* the particles saved are the heaviest and largest and are of about the same weight; in *a'* they are less heavy, and so on, being the least heavy and the smallest in compartment *a*³, the particles in all being about the same in weight. This fact necessitates the use of the vessels E, which are not concentrators in the proper sense of the term, but are simply "sizers," as I term them, from the fact that because of their different meshed screens they are adapted each for its own material. Take now the first of the vessels E, having the coarsest screen. The concentrations from compartment *a* are not necessarily all precious. The agitation in said compartment may have been so great that a quantity of the worthless material may have been saved; but this material, though heavy, must necessarily be of greater size than the precious particles of the same weight. Therefore this must be run off. The same result is obtained in each of the compartments, the difference in the material saved being only in the size of the particles. Now, it will be seen that if I took the concentrations from all the compartments and after mixing them attempted any supplementary concentrating process, I would necessarily lose many of the smaller precious particles, and if I screened them through a single screen I would lose either the great precious particles or would have to save much of the worthless stuff. Thus, if I used a screen such as is in the first of vessels E, having a mesh adapted to let pass the largest of the precious particles, it is obvious that all the smaller worthless particles saved in the larger compartments would also pass through, and if, on the other hand, I used a fine mesh, I would lose the larger precious particles. Therefore I have found it best to use screens having different mesh, as I have hereinbefore described. The concentrations from the compartments falling into chutes N are discharged upon the centers of the screens and spread out over their surfaces. The water from nozzles L, acting upon the wheels K, causes the rotation of the stirrers *j* to assist the sifting. The nozzles also supply enough water to the vessels E to maintain the level of water at about the line *x x*, whereby undue suction is prevented and the discharge of the worthless stuff or gangue facilitated. The revolution of the stirrers forces outwardly the gangue, which passes over the flange *c'* into the trough G, from which it is discharged. The precious particles sift through the screen, and after sinking through the vessel discharge at *e*, and are collected in suitable vessels.

It will be seen that the operation of the sizers is automatic, being effected by the water, which is otherwise essential to the concentrating process.

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

1. The combination, in an ore-concentrating apparatus, of a vessel having a series of downwardly-tapering chambers or compartments increasing in size and provided with the disks C, and a water-pipe adapted to discharge its water downwardly upon said disks and within the compartments at or near their bottoms and at right angles with the stream of pulp, substantially as and for the purpose herein described.

2. The combination, in an ore-concentrating apparatus, of a vessel having a downwardly-tapering chamber or compartment through which the stream of ore-pulp passes, a pipe extending from above within said compartment, and adapted to discharge water at or near the bottom thereof, and an underlying screen upon which the concentrations are discharged from said compartment, substantially as herein described.

3. The combination, in an ore-concentrating apparatus, of a downwardly-inclined elongated vessel divided into a series or number of downwardly-tapering chambers or compartments succeeding and communicating with each other, and through which the stream of ore-pulp passes, said chambers or compartments increasing in capacity from the head of the vessel to its foot, a superposed water-pipe having downwardly-extending outlet-pipes passing within each chamber or compartment nearly to its bottom, and a suitable sieve located beneath each of the compartments, substantially as herein described.

4. The inclined vessel A, having the series of increasing downwardly-tapering successive chambers or compartments a a' a^2 a^3, provided with bottom discharges, b, and the superposed disks C over said openings, in combination with the water-pipes D, having outlet-pipes d, extending within the compartments, and adapted to discharge water upon the disks C, substantially as herein described.

5. The inclined vessel A, having the series of increasing downwardly-tapering successive chambers or compartments a a' a^2 a^3, provided with bottom discharges, b, and the superposed disks C, and the water-pipe D, having outlet-pipes d extending within the compartments and adapted to discharge water upon the disks C, in combination with a screening device under each compartment, and adapted to receive its concentrations, the screens in said devices having a mesh graded in fineness from the coarsest under a to the finest under a^3, substantially as herein described.

6. The vessel E, having bottom discharge, e, flange e', the screen F, and the encircling waste-trough G, in combination with the central shaft, I, the radial arms J, having stirrers j, the water-wheel K, the water-nozzle L, and water-pipe M, substantially as herein described.

7. The vessel A, having compartments a a' a^2 a^3, with bottom discharges, b, all as herein described, in combination with the vessels E, the chutes N, by which the concentrations from said compartments are conveyed to said vessels, the graded screens F in said vessels, upon which the concentrations are received, the shafts I, radial arms J, having stirrers j, the water-wheels K, nozzles L, and water-pipes M, all arranged substantially as and for the purpose herein described.

8. An apparatus for concentrating ores, comprising the inclined vessel A, having the succession of increasing downwardly-tapering compartments a a' a^2 a^3, provided with bottom discharges, b, and guard-disks C, the water-pipe D, having outlet-pipes d, adapted to discharge upon disks C, the series of vessels E under the discharges of the compartments, said vessels having chutes N, adapted to receive the concentrations from the compartments, screens F to receive said concentrations, rotating arms J, having stirrers j to agitate the concentrations, bottom discharges, e, to carry off the particles to be saved, and troughs G, to carry off the waste, all arranged substantially as and for the purpose herein described.

In witness whereof I have hereunto set my hand this 12th day of May, A. D. 1884.

OTTO HANSON.

Witnesses:
W. C. FELCH,
HENRY K. SHORE.