2 Sheets—Sheet 1.

W. L. IMLAY.

Ore-Separator or Concentrator.

No. 220,842. **Patented Oct. 21, 1879.**

Fig. 1

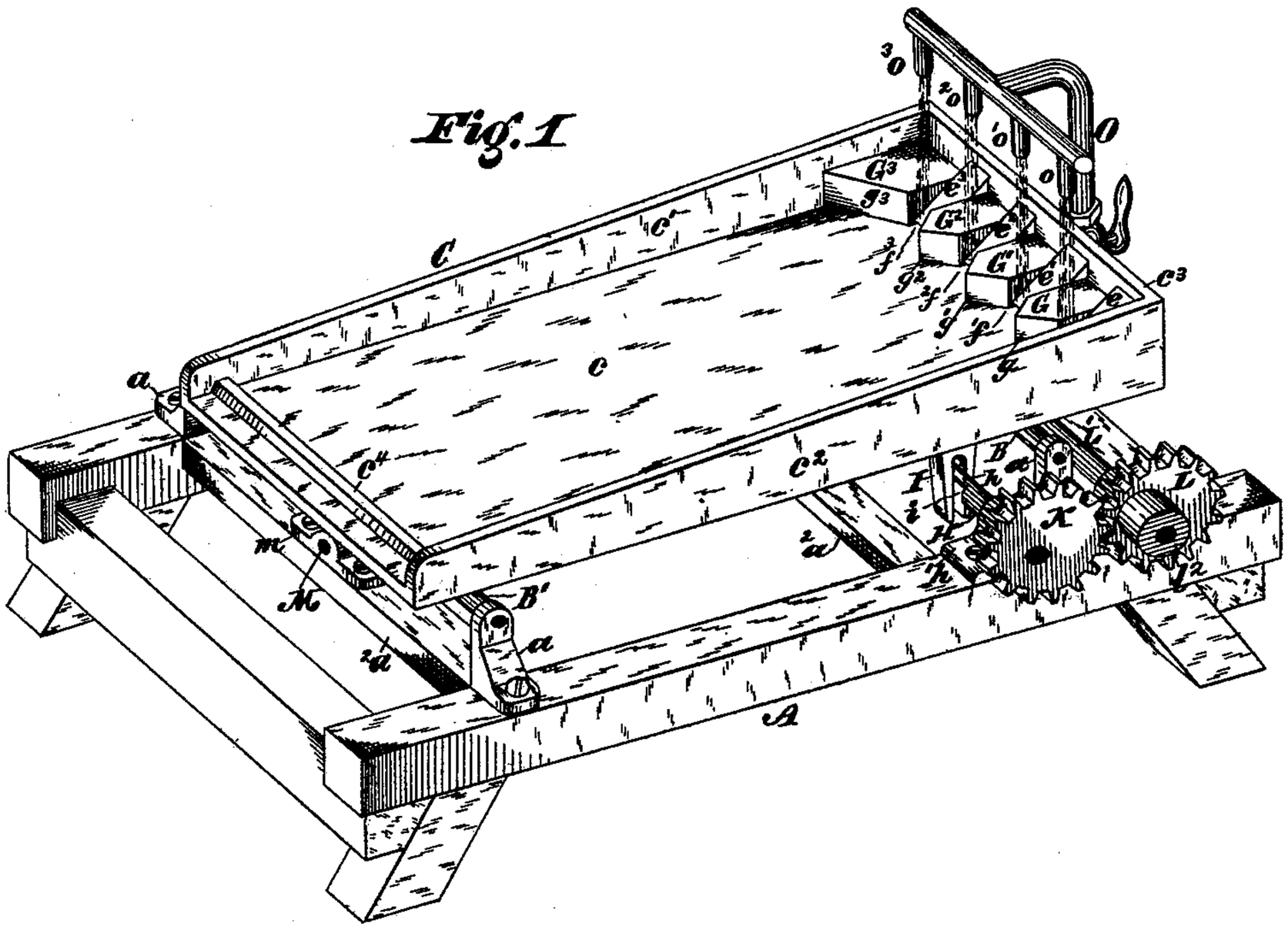
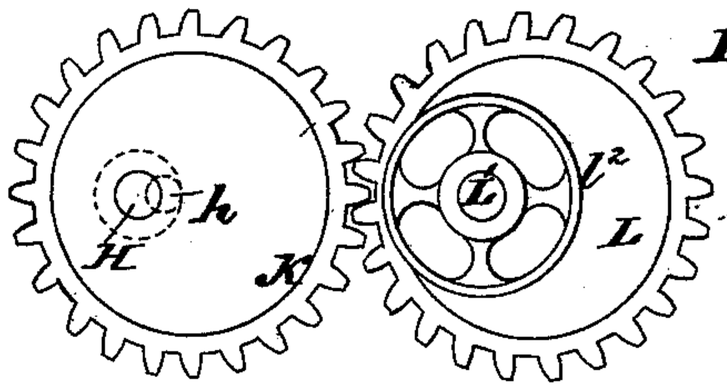


Fig. 3



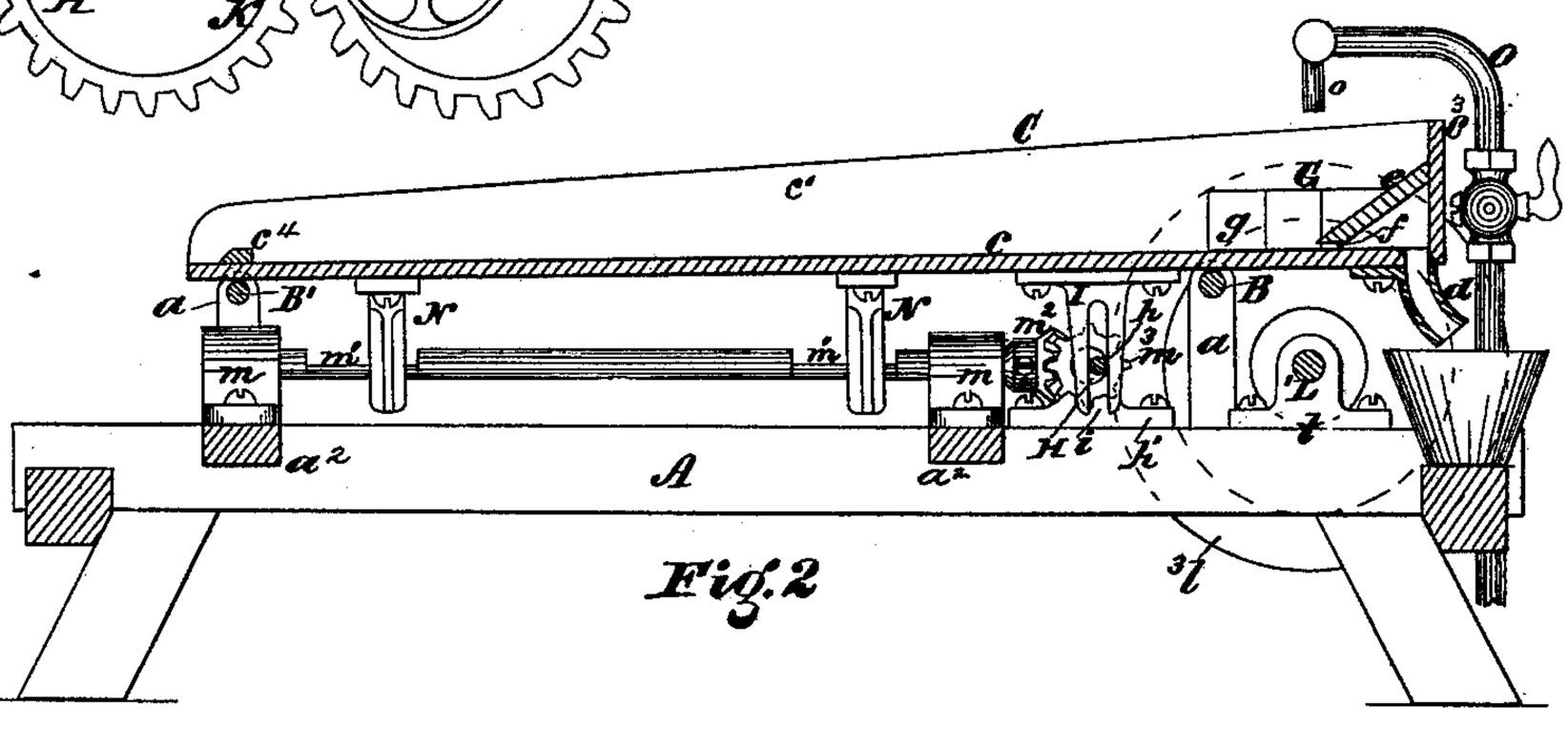


Fig. 2

WITNESSES:

Samb. J. Vanstavoren

Alex. Scott

INVENTOR

William L. Imlay,

By Connolly Bros.,

ATTORNEYS

2 Sheets—Sheet 2.

W. L. IMLAY.

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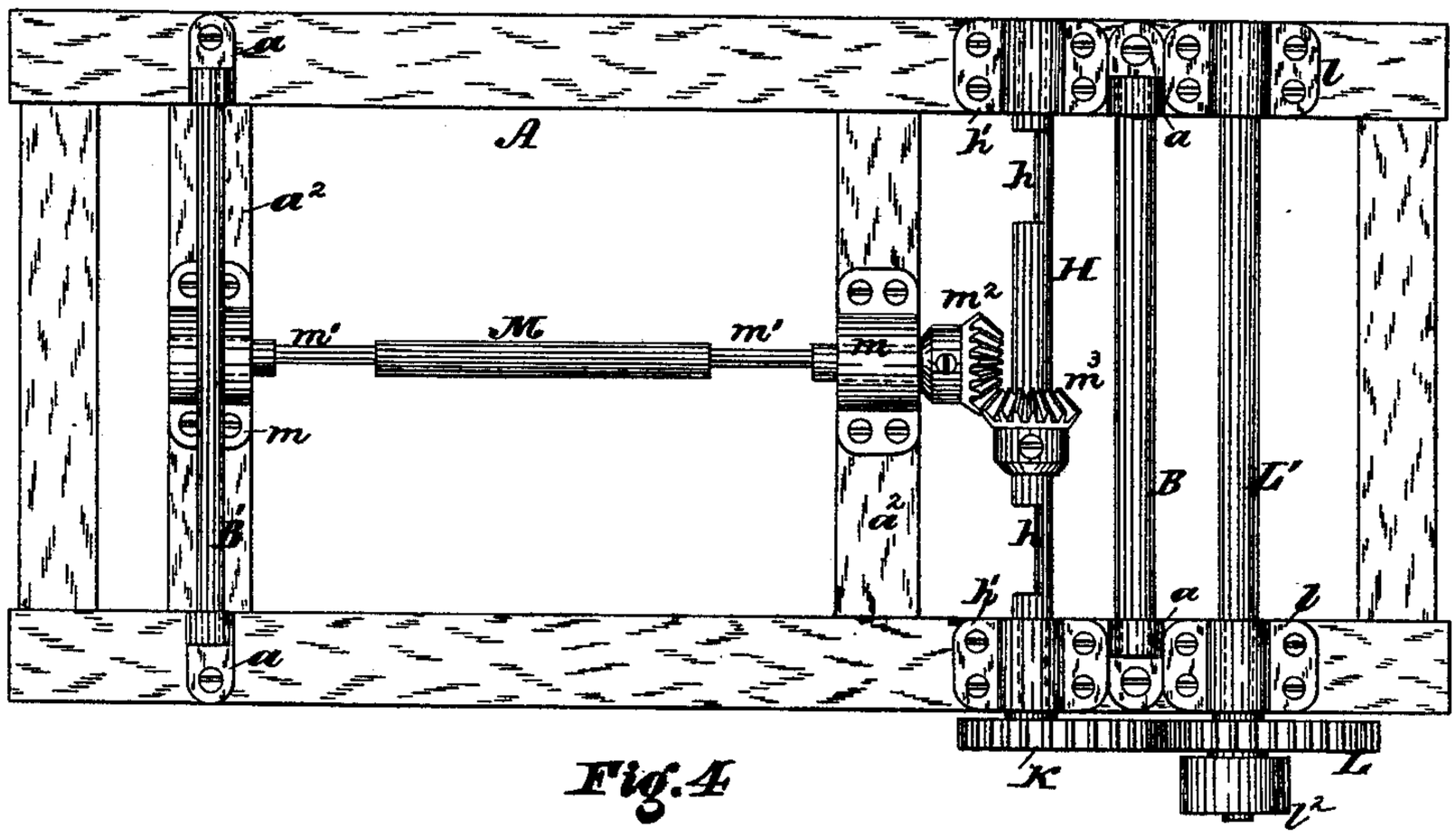

Fig. 4

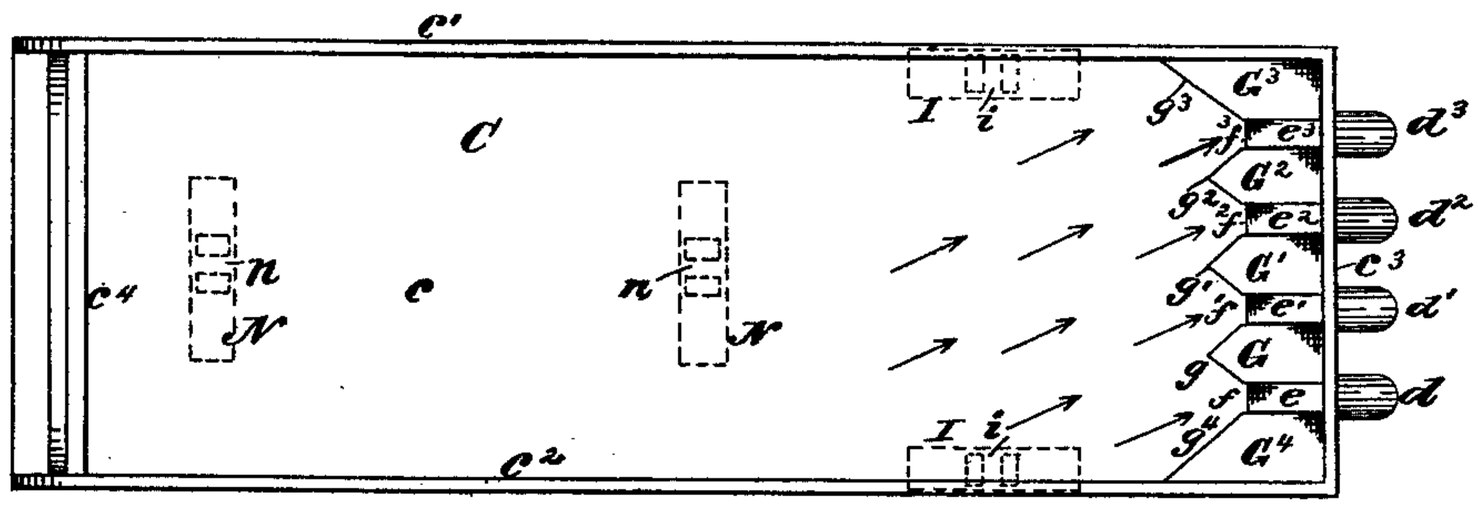

Fig. 5

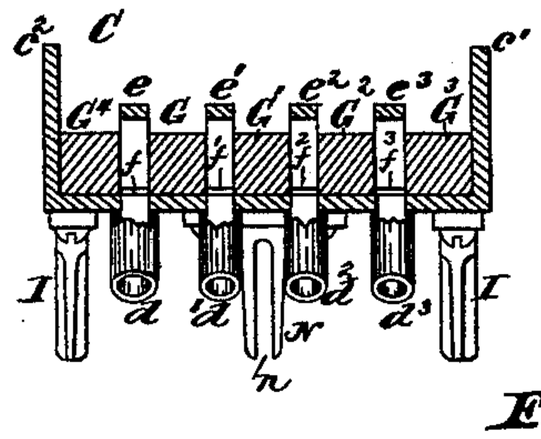

Fig. 6

WITNESSES:

Saml. J. VanStavoren

Alex. Scott

INVENTOR,

William L. Imlay,

By Connolly Bro.

ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM L. IMLAY, OF CAMDEN, NEW JERSEY.

IMPROVEMENT IN ORE SEPARATORS OR CONCENTRATORS.

Specification forming part of Letters Patent No. **220,842,** dated October 21, 1879; application filed July 25, 1879.

To all whom it may concern:

Be it known that I, WILLIAM L. IMLAY, of Camden, in the county of Camden and State of New Jersey, have invented certain new and useful Improvements in Ore Separators or Concentrators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a perspective of my invention; Fig. 2, a longitudinal vertical section of the same. Fig. 3 is a detail side elevation of the eccentric gearing. Fig. 4 is a plan of operating mechanism, the pan or tray being removed. Fig. 5 is a plan of the tray, and Fig. 6 is a transverse vertical section of the tray immediately in front of its rear end, c^3.

My invention has for its object to provide means for separating or concentrating the mineral portions of fine ores—those, for example, which will pass through a mesh of fifty holes and upward to the inch.

My invention has for its further object to provide means whereby finely-ground but unsized ores may have their mineral portions sized while being separated or concentrated, said means operating also to divide minerals of different specific gravities from each other while concentration or separation from the sand is proceeding.

My invention consists in the peculiar construction and combination of parts hereinafter fully described, having particular reference to the following points: first, to the construction of a vanning-pan or separator-tray having separate discharges at one and the same end for minerals of different sizes or different specific gravities; second, to the combination, with a vanning-pan or separator-tray, of an eccentric or crank shaft having an eccentric-pinion meshing with an eccentric driver-wheel, whereby a variable motion—*i. e.*, faster in one direction than in the other, positive in both directions lengthwise of the pan or tray—is communicated to the latter; third, to the combination, with a pan or tray having a variable but positive lengthwise movement communicated by a transverse crank-shaft and eccentric-gears, of a longitudinally-arranged eccentric or crank shaft for giving a lateral motion to said pan or tray while being moved longitudinally; fourth, to certain details of construction hereinafter fully set forth.

Referring to the accompanying drawings, A indicates a bench or support of any suitable character, on which are mounted four standards, *a a a a*, affording bearings for two rollers, B and B′. The roller B′ is located a trifle lower in plane than the roller B, so that the tray or pan C, which rests on said rollers, will incline slightly from B to B′. Said pan or tray consists of a bottom, *c*, with two sides, c' c^2, and an end, c^3. It is also shown as provided with a dam, c^4; but this may be dispensed with under certain circumstances. At the upper end of the pan C are outlets or discharge-conduits d d' d^2 d^3. Over these outlets are inclines e e' e^2 e^3, which extend downwardly from the end piece, c^3, reaching nearly to the bottom *c*, but not touching the latter, spaces f f' f^2 f^3 being left for the passage of the concentrations, as hereinafter stated.

G G′ G² G³ represent dividing-blocks having tapered ends g g' g^2 g^3. These blocks separate or isolate the discharge-openings d d' d^2 d^3 from each other, as also the inclines e e' e^2 e^3, forming also flaring entrances between their tapered ends to the passages f f' f^2 f^3.

H is a shaft having cranks or eccentrics h h, and sustained in bearings h' h' on the support A. I I are hangers fastened to the bottom of the pan C, and having vertical slots i i for the eccentrics or cranks h h. K is an eccentric gear-wheel or pinion on the shaft H, and L is another eccentric gear-wheel or driver meshing therewith, said wheel L being fast on a shaft, L′, which is sustained in bearings l l on the support A. l^2 is a pulley for the reception of a belt to communicate power to the shaft L′, and l^3 is a fly-wheel on the other end of said shaft. M is an eccentric or crank shaft extending lengthwise of the frame A, sustained on cross-bars a^2 a^2 thereof, and having bearings in boxes m m, secured to said cross-bars. m' m' are the cranks or eccentrics of said shaft, which work in vertical slots n n in hangers N N, fastened, as shown, to the bottom of the tray C, and m^2 m^3 are bevel-gears, whereby motion is obtained from shaft H.

In addition to the foregoing parts, means for affording a water-supply are required, and these should consist of ports o o' o^2 o^3, which may proceed from a common pipe, O. One of these ports is designed to be located over and in front of each of the inclines e e', &c., and each port should be provided with a cock or other means for controlling or graduating its flow, as hereinafter set forth.

The operation is substantially as follows: Ore containing the mineral or minerals to be separated is fed onto the tray or pan by any suitable means, the point or place where the feeding takes place being, by preference, immediately below the line of the crank-shaft H. As the feeding takes place water is permitted to flow through the ports o o' o^2 o^3, and motion is communicated by a belt to the pulley l^2 and shaft L'. The shaft H is thereby moved through the medium of the eccentric-gears K L, and the shaft M from said shaft H through the bevel-gear m^2 m^3. As the cranks or eccentrics move in the hangers I N peculiar motions are communicated to the pan or tray C. The shaft H causes a longitudinal reciprocation, positive in both directions, the speed being variable, faster in one direction—*i. e.*, when the tray is moving downwardly or toward the sand-discharge end—than when moving upwardly or toward the ore-discharge end or other direction. The shaft M causes the tray while thus being reciprocated longitudinally to be also vibrated or moved laterally, such lateral movement being also positive and in equal time in both directions.

The effect of these movements, combined with the action of the water, is to produce a separation of the mineral contained in the ore from the sand or earthy matter. The mineral portions pass up along the bottom c and beneath the inclines c c', &c., and thence through the discharge-openings d d', &c., while the water and sand flow over the dam and out at the end c^4. If the ore be unsized or contain minerals of different specific gravities, the concentrations will be sized, or the different minerals divided from one another in the act of separation from the sand, the coarser particles or those having the greatest gravity passing to the outlets d^3, while the other particles, as they decrease in size or gravity, will pass to the other outlets, d^2 d' d. When treating such ore—*i. e.*, unsized ore, or ore having minerals of different gravities—the flow of water at each port o, &c., must be graduated accordingly, so as to proportion the fluid resistance to the size or weight of the grains separated. Where sized ore containing only one kind of mineral is to be separated the lateral movement of the pan or tray is unnecessary, and in such case the shaft M may be unshipped or rendered inoperative by removing the hangers N N. The longitudinal movement of the tray will then be alone produced, and the same size ore will pass out of the various discharges d d', &c. In this case the flow of water through the ports o o', &c., should be uniform.

I have shown only one tray; but two or more, of similar construction and operation, may be employed, being relatively so arranged that the second or subsequent tray or trays may receive the tailings from the first or preceding tray or trays and concentrate the mineral matter, if any therein, as in some cases, owing to difference in sizes or gravities, there may be a slight escape of mineral with such tailings.

The rate of speed at which the tray or trays should be run will depend upon the quality and character of the ore, and must be governed and regulated by the skill of the operator. Running at one hundred and twenty revolutions of the driving-shaft L' per minute, I have successfully concentrated magnetic iron ore containing about fifteen per centum of mineral matter, the ore being sufficiently fine to permit it to pass through a sieve of fifty meshes to the inch.

I have shown and described the tray as supported and moving upon rollers; but I do not limit my invention to this form of support, as swinging rods or equivalent means for sustaining the tray and permitting the described movement to be communicated to it by the means set forth may be substituted for such rollers.

I am aware that a vanning-pan or ore-separator caused to reciprocate longitudinally by means of a cam, which moved it in one direction, and a spring, which reversed the motion, is not new, and that pans or trays have also been vibrated laterally while reciprocating longitudinally; but what distinguishes my movement peculiarly from all others is that the longitudinal motion is positive in both directions, and is variable—*i. e.*, faster in one direction than in the other.

Another peculiarity is that with such a positive variable longitudinal movement I cause the tray to be vibrated or moved laterally, producing a compound motion, which, assisted by the action of the water, not only effects concentrations, but divides minerals of different gravities or sizes from each other while such concentration is taking place.

What I claim as my invention is—

1. A vanning pan or tray having independent outlets at the end at which the ore is fed upon the tray, said outlets being on the same horizontal plane and for the discharge of ores of different specific gravities, and having vertical partitions or dividing-boards arranged longitudinally of said tray and dividing or separating said outlets, substantially as set forth.

2. The vanning-pan or separator-tray C, having independent discharges d d' d^2 d^3, inclines e e' e^2 e^3, and dividing-blocks G G' G^2 G^3, whereby minerals of different gravities may be discharged separately from the same tray, substantially as shown and described.

3. In combination with the tray C, supported on rollers B B', or other described supports, and having slotted hangers I N, the crank or

eccentric shaft H, caused to revolve with variable speed by means of the eccentric gear-wheels K L, whereby the tray is moved in one direction of its path at a changing velocity, differing in periods from that of its movement in the reverse direction, substantially as shown and described.

4. In combination with a tray or pan, C, supported on rollers B B′, or other described supports, an eccentric or crank shaft, H, and means, substantially as specified, for causing said shaft to revolve at a changing velocity, whereby said tray or pan is reciprocated longitudinally at a variable speed, substantially as set forth.

5. In combination with tray C and eccentric shaft H and eccentric-wheels K L, the eccentric or crank shaft M and hangers I N, whereby said tray is moved laterally and compound motions are produced for effecting separation of the minerals from the sand and division of the concentration according to sizes or gravities.

6. In combination with tray C, supported on rollers B B′, and provided with hangers I N, crank-shaft H, eccentric-gears K L, shafts L′ and M, and bevel-gears m^2 m^3, substantially as shown and described.

In testimony that I claim the foregoing I have hereunto set my hand this 23d day of July, 1879.

WILLIAM L. IMLAY.

Witnesses:
AL. P. BURCHELL,
THOS. P. CONNOLLY.