

(No Model.)

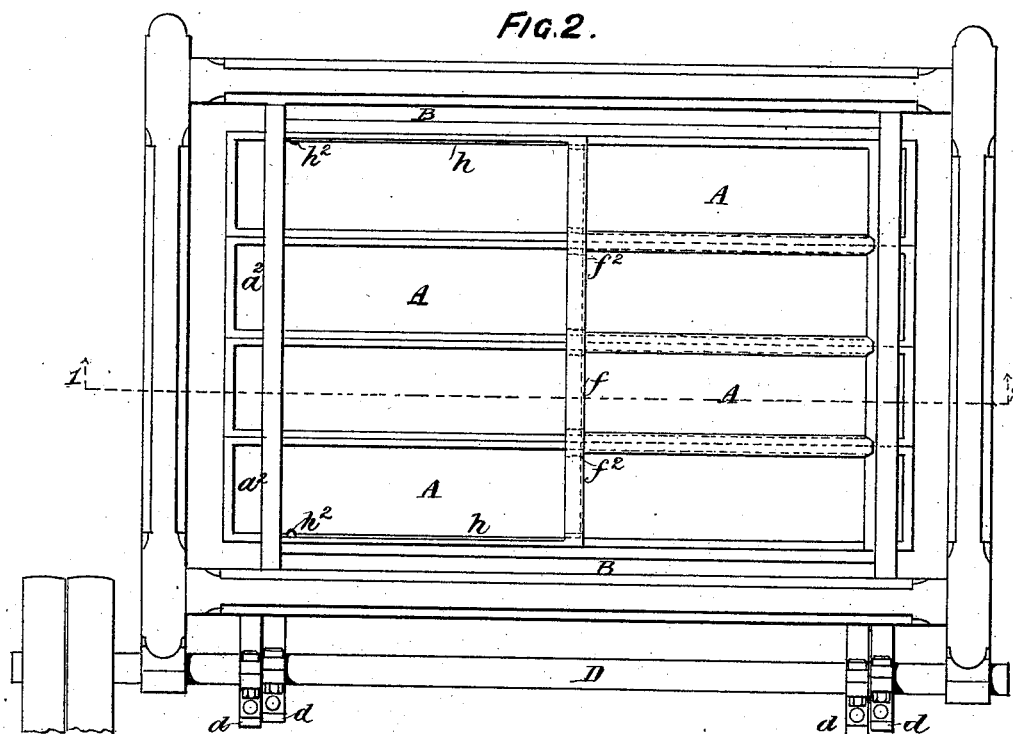
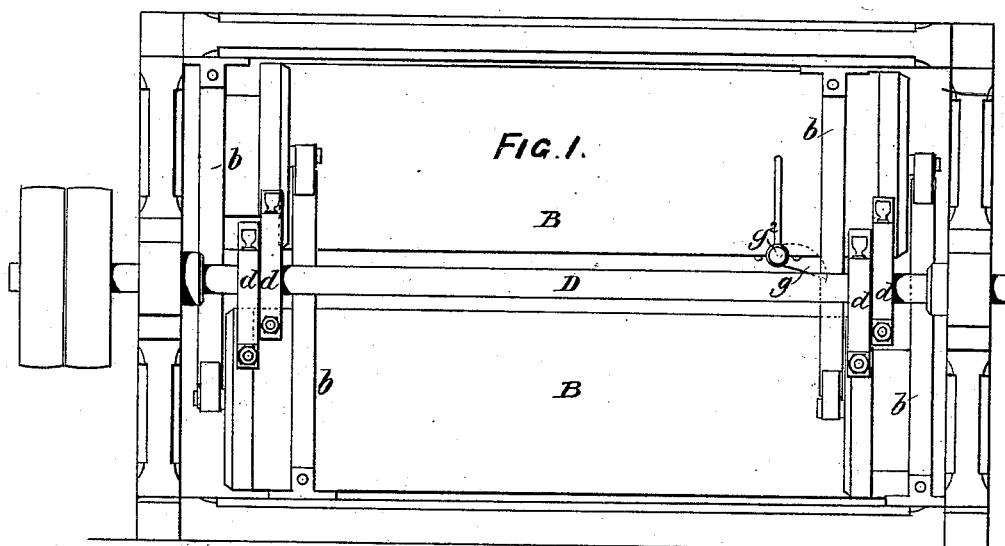
2 Sheets—Sheet 1.

M. CRAWFORD.

SEPARATION OF METALS FROM THEIR ORES.

No. 420,377.

Patented Jan. 28, 1890.



Witnesses

John Revell
George Baumann

Inventor

Middleton Crawford
By his Attorneys
Howe and Howe

(No Model.)

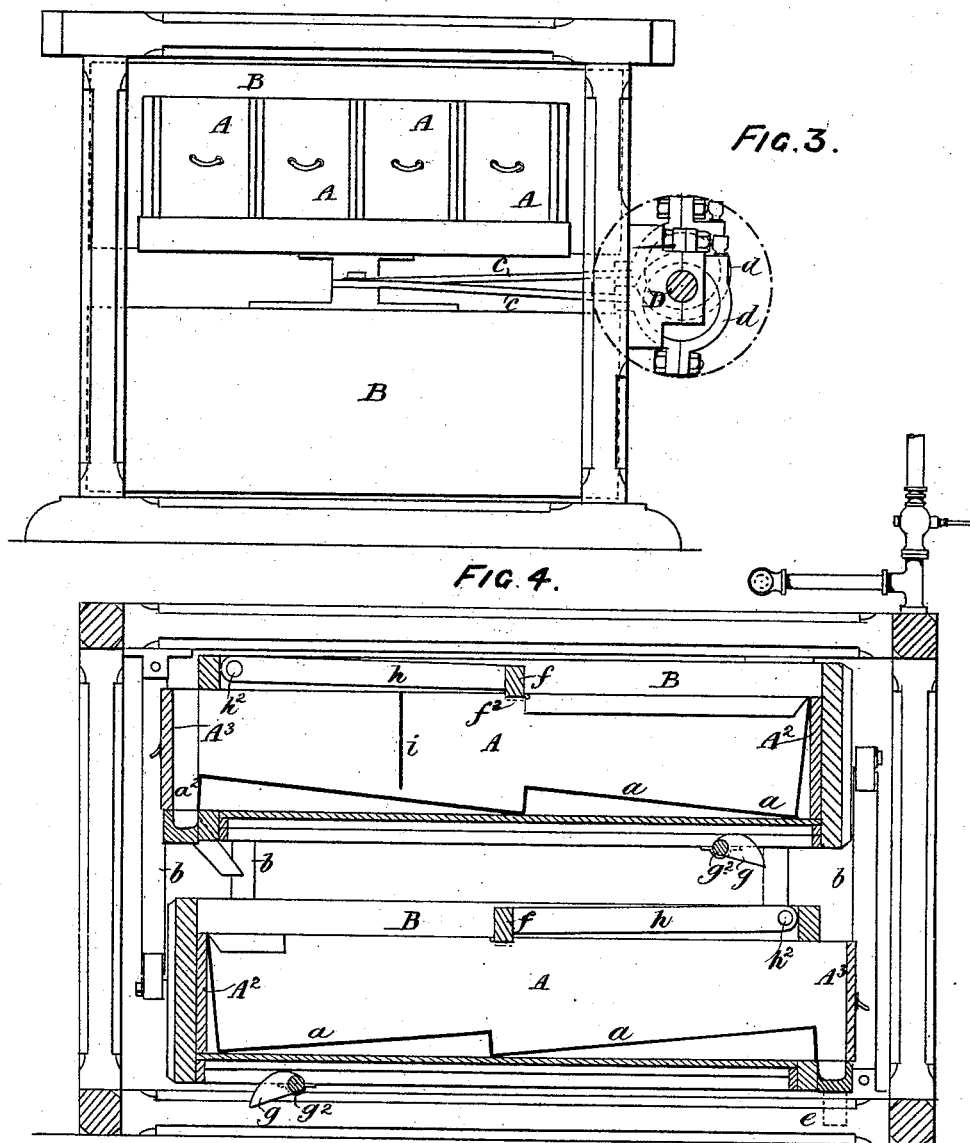
2 Sheets—Sheet 2.

M. CRAWFORD.

SEPARATION OF METALS FROM THEIR ORES.

No. 420,377.

Patented Jan. 28, 1890.



Witnesses

John Revell

George Bauman

Inventor

Middleton Crawford

By his Attorneys

Howson and Howson

UNITED STATES PATENT OFFICE.

MIDDLETON CRAWFORD, OF LIVERPOOL, COUNTY OF LANCASTER,
ENGLAND.

SEPARATION OF METALS FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 420,377, dated January 28, 1890.

Application filed December 3, 1889. Serial No. 332,370. (No model.) Patented in England May 27, 1889, No. 8,789.

To all whom it may concern:

Be it known that I, MIDDLETON CRAWFORD, engineer, a subject of the Queen of Great Britain, residing at 3 Oxford Street, Liverpool, in the county of Lancaster, England, have invented certain improvements in means for effecting the separation of particles of different specific gravities, more especially intended for the separation of gold and other metals from crushed or divided ores, (for which I have applied for a patent in Great Britain, No. 8,789, dated May 27, 1889,) of which the following is a specification.

My invention has for its object to provide means whereby the separation of particles of different specific gravities is effected in a very ready, complete, and efficient manner, and by the employment of apparatus which is inexpensive in first cost, while it may be successfully and easily worked.

My said invention is more especially intended for use in the separation of gold and other metals from crushed ores containing them without necessitating the amalgamating or chlorinating of the mass in the manner hitherto employed.

I will describe my invention with reference to the accompanying drawings, which represent an apparatus constructed according to my invention.

Figure 1 is a side elevation, Fig. 2 a plan, and Fig. 3 an end view, of the said apparatus; and Fig. 4 is a longitudinal section thereof on the line 1 2, Fig. 2. In these figures I have shown two tiers of four troughs each; but I wish it to be understood that I do not limit myself to any particular number of either tiers or troughs.

I take the ore or material from which the gold or other metal is to be separated, and if it be not already in a finely-divided condition, I reduce it to that condition in stamps or any suitable apparatus adapted for the purpose. I then place the divided ore or material in receptacles A A, the bottoms of which are inclined, as shown at a , the said receptacles being in the form of troughs with sides and with ends $A^2 A^3$ or ends only at A^3 . These troughs are placed side by side in a container B. The containers have imparted to them

a sidewise movement, which can conveniently be effected by supporting the said containers by spring-hangers $b b$, and connecting them by rods or strips $c c$ with the straps of eccentrics $d d$ on a shaft D, to which motion is imparted from any convenient prime mover or by hand, so that by rotating the said shaft the eccentrics impart a to-and-fro sidewise movement to the containers and the troughs which they carry. Water is supplied at the ends of the troughs nearest to or toward the lower parts of the inclines. The top series of troughs have openings at $a^2 a^2$ discharging into the lower series of troughs, which have in them discharge-openings which open into a passage leading to one common outlet at e . The troughs are preferably made so that they can be readily withdrawn from the containers for removal of the deposited matter. In order to keep the said containers in position, I may employ a rod or bar f , entering recesses in the trough sides and provided with lugs f^2 , which embrace the sides, so as to keep the troughs in position both sidewise and vertically. The inclination of the troughs can be regulated by means of the cams g on the shafts g^2 , so that by partially rotating the shafts the cams raise or lower the ends of the troughs to alter their inclination, and to allow of this movement the rods f are carried by arms h led to the ends of the troughs opposite to those at which the cams are situated, the said arms being centered at h^2 to allow of the said adjustment of the troughs.

When the crushed ore or material is placed in the troughs and the water is admitted, the downward inclination of the bottoms of the troughs and the passage of the water in the direction the reverse of the incline, combined with the regulated movement of the contents of the trough by the sidewise motion aforesaid, effect the required washing and separation of the matters under treatment, the particles consisting of or containing the heavier or metallic portions descending and passing back toward the lower ends of the inclined surfaces, which lower ends constitute wells or receivers for the said portions, from which the deposit can be emptied, either by removing the troughs or by tipping them up, or by caus-

ing the bottoms of the troughs to move forward toward the outlet ends of the said trough.

My improved troughs may be used singly or in any suitable number, preferably placed side by side and either in one plane or in two or more planes or tiers, the series above discharging into the series beneath, and the troughs may have one or more inclines at bottom.

I have found that in order to obtain the best results certain proportions are requisite, and that the best effect is obtained if the troughs have imparted to them a sidewise movement of about one-third of the width of the troughs. About six inches is a very convenient width for the troughs, and their sides should be of or about the same height. The inclines at the bottom of the troughs are preferably about one in twelve, and the length of each incline is preferably about twelve inches; but some variation is permissible in the dimensions. For instance, although the best effects are obtained by the aforesaid dimensions, good effects are obtainable if the trough be as low as three or as high as nine inches in depth and width, and the inclines may vary from one in twelve to one in forty-eight or three in sixteen, and the length of the inclines may be as low as four or six inches, or they may be longer than twelve inches up to, say, about twenty-four inches. The sidewise movement of the troughs should not vary in extent beyond one-quarter inch greater or less than a third of the width of the troughs, although results superior to those hitherto obtained may be attained if the said sidewise movement be as low as one-twelfth or as high as two-thirds the width of the trough.

When the machine is at work, the agitation effected by the sidewise movement of the troughs causes a thorough washing and separation of the refuse from the particles which are to be retained, which latter, owing to the inclination of the bottoms of the troughs, settle in the pockets formed by the lower ends of the inclines. Moreover, the sides of the troughs cause the water to splash back over

the surface of the contents of the troughs, so causing the carrying down of any floating particles which it is desired to recover, but which would otherwise pass off with the water. In order to facilitate the precipitation of the particles, I find it advantageous to use a dipping-board or baffle, as at *i* in the drawings, Fig. 4, which enters the water, but leaves a space between itself and the bottom of the trough. In cases where it is difficult or impracticable to obtain a supply of water for working my arrangement of troughs they may be used without water.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a machine or apparatus for separating materials of different specific gravities, the combination of a fixed frame and a movable trough or troughs having an incline or inclines at the bottom, with devices, substantially as described, for imparting a reciprocating sidewise movement to the trough or troughs to an extent of about one-third of the width of such trough, substantially as described.

2. In an apparatus for separating materials of different specific gravities, the combination of a trough or troughs having an incline or inclines at the bottom, with a water-supply at that end of the trough or troughs having the downward end of the incline, and a discharge for the water at the opposite end of the trough or troughs, and devices, substantially as described, for imparting a sidewise reciprocating movement to the said trough or troughs, all substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MIDDLETON CRAWFORD.

Witnesses:

EDWD. GEO. DAVIES,

WILLIAM F. UPTON,

Both of 47 Lincoln's Inn Fields, London, W.C.