(No Model.)

3 Sheets—Sheet 1.

L. R. TULLOCH.

ORE CONCENTRATOR.

No. 561,629. Patented June 9, 1896.

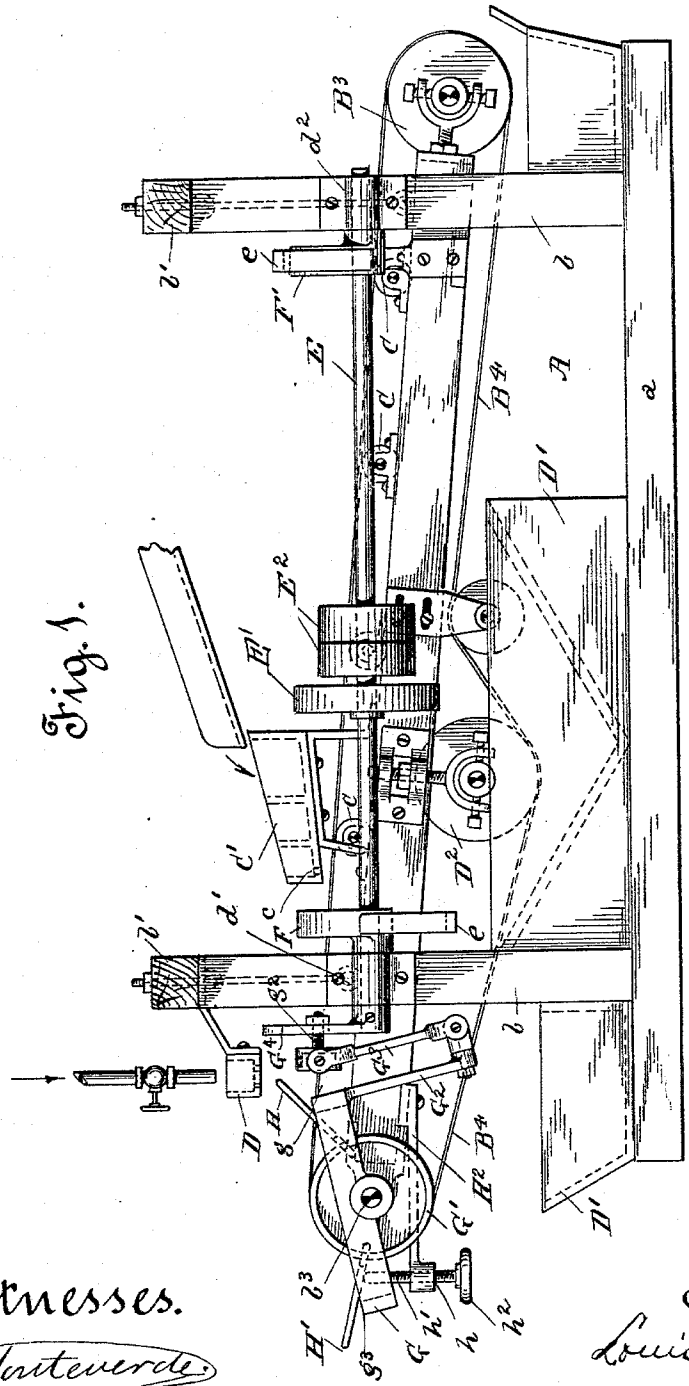

Fig. 1.

Witnesses.
H. Montenerde.
M. G. Locfler.

Inventor.
Louis R. Tulloch
by Walker
Atty

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(No Model.) 3 Sheets—Sheet 2.

L. R. TULLOCH.

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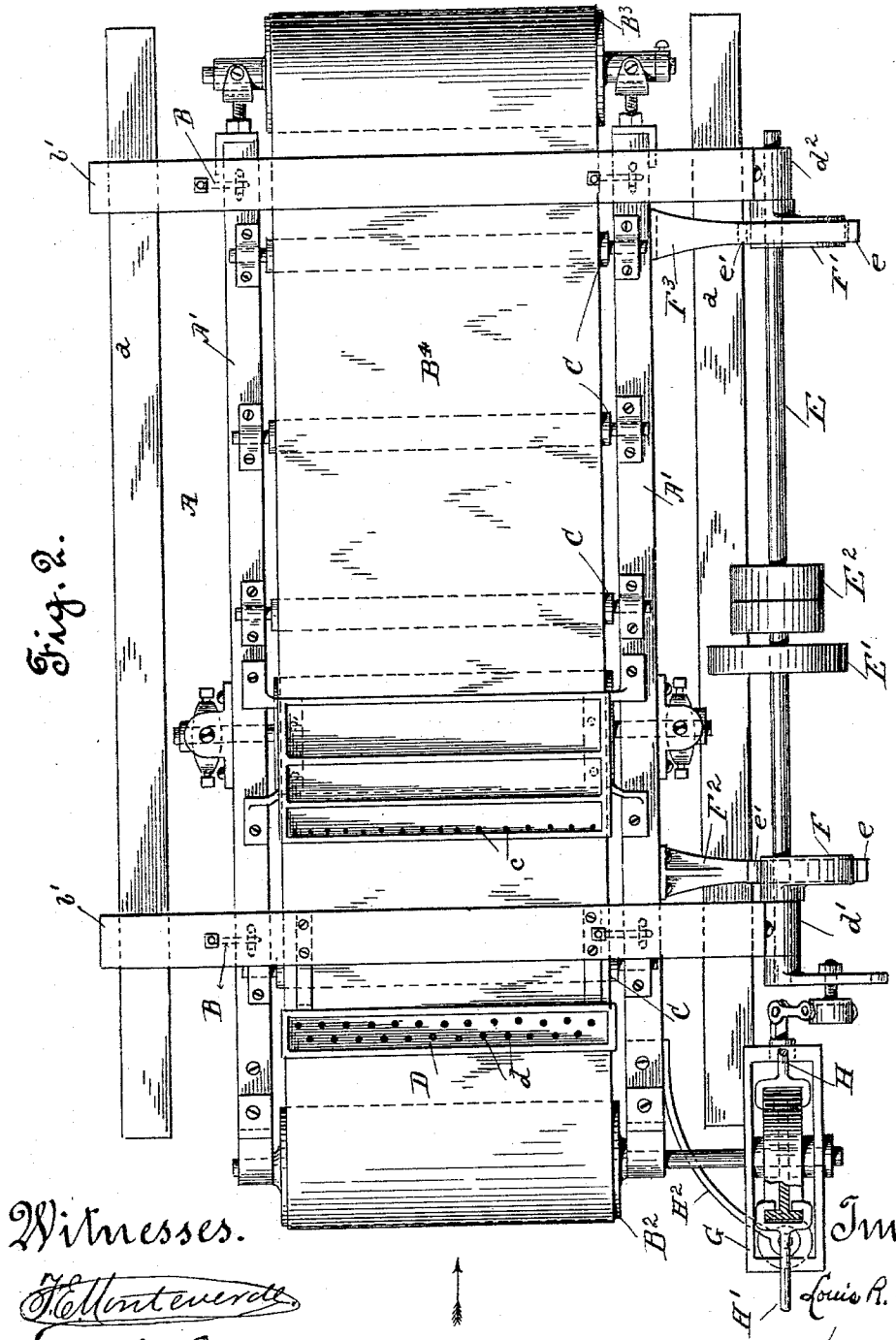

Fig. 2.

Witnesses.

H. Montevercle

M. G. Loefler.

Inventor.

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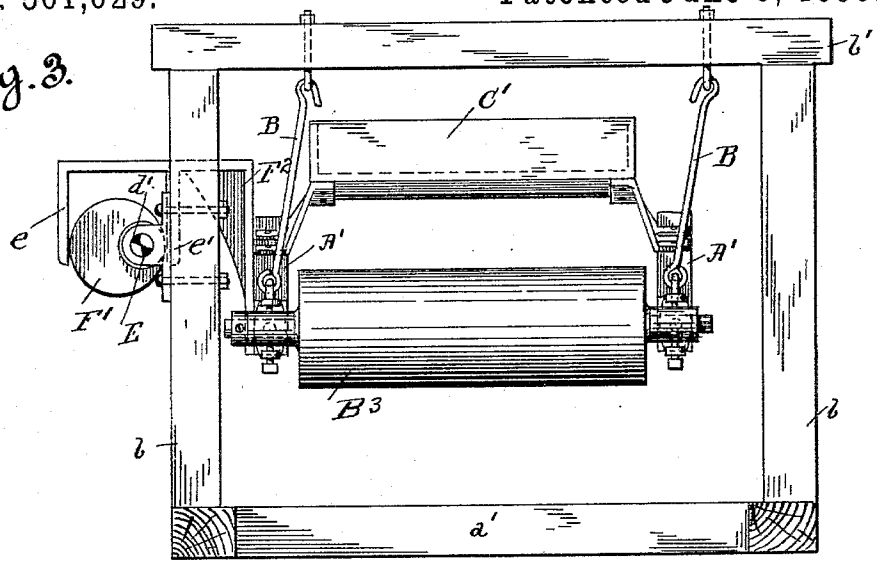
(No Model.) 3 Sheets—Sheet 3.

L. R. TULLOCH.

ORE CONCENTRATOR.

No. 561,629. Patented June 9, 1896.

Fig. 3.



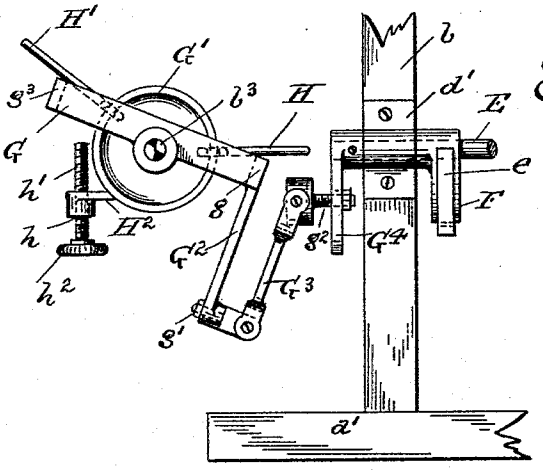


Fig. 4.

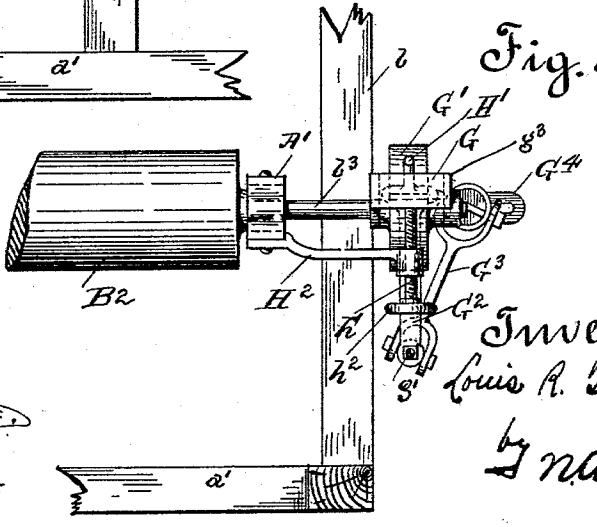


Fig. 5.

Witnesses.

F. Montevercle.

M. G. Loefler.

Inventor.

Louis R. Tulloch

by N. A. Acker

Atty

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

UNITED STATES PATENT OFFICE.

LOUIS R. TULLOCH, OF ANGEL'S CAMP, CALIFORNIA.

ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 561,629, dated June 9, 1896.

Application filed February 13, 1895. Serial No. 538,218. (No model.)

To all whom it may concern:

Be it known that I, LOUIS R. TULLOCH, a citizen of the United States, residing at Angel's Camp, in the county of Calaveras and State of California, have invented certain new and useful Improvements in Ore-Concentrators; and I do hereby declare the following to be a full, clear, and exact description of said invention, such as will enable others skilled in the art to which it most nearly appertains to make, use, and practice the same.

The present invention relates to a certain new and useful improvement in that class of ore-concentrators known as "endless-traveling-belt" concentrators, which consists in the arrangement of parts and details of construction, as will be hereinafter fully set forth in the drawings and described and pointed out in the specification.

The invention relates more especially to certain mechanism for imparting a transverse or lateral shaking motion to the movable frame and concentrating-belt and an independent longitudinal shaking motion to the said belt during transverse motion thereof, the forward longitudinal shake or movement imparted to the belt being greater than the rear movement, in order that the concentrating-belt will steadily be advanced forward, so as to cause the discharge of the concentrates or sulfurets at that end of the machine.

By giving the concentrating-belt a longitudinal shake or jolt, in addition to the transverse shake imparted thereto by the movement of the shaking or suspended frame, I find that I secure better results in the separation of the precious metal from the base material, for the reason that a thorough disintegration of the ore and a greater precipitation of the heavier or precious metal take place while the concentrating-belt travels from one end of the machine to the other, with its compound lateral and longitudinal shake, than where the belt is permitted only a single motion. By imparting to the belt this compound motion I not only secure the precipitation of the heavy concentrates, but the lighter ones as well. Consequently the tailings of the machine will contain the minimum of precious metal, if any at all.

In order to thoroughly understand my invention and the working thereof, reference must be had to the accompanying drawings, forming a part of this application, wherein—

Figure 1 is a view showing an ore-concentrator in side elevation, the eccentric cams for imparting lateral motion to the movable frame of the concentrator being shown at their highest point. Fig. 2 is a top plan view of the concentrator, the eccentric cams being shown upon their full outward throw. Fig. 3 is a rear end elevation of the mechanism illustrated by Fig. 2. Fig. 4 is a view showing a detail side elevation of the clutch mechanism for imparting a forward-and-backward motion to the concentrator-belt, showing the position of the clutch mechanism when the eccentric cams are at their lowest position; and Fig. 5 is a detail broken front end elevation of the mechanism illustrated by Fig. 2, viewed in direction of the arrow.

In the drawings the letter A indicates the fixed or stationary supporting-frame of my machine, which may be of any suitable style, but in the drawings being shown as consisting of the longitudinal beams *a a*, cross-pieces *a' a'*, uprights *b*, and cross connecting-pieces *b' b'* for the uprights, and A' the movable or swinging frame. In the present instance I have shown the movable frame suspended from the top cross-pieces *b' b'* of the fixed or stationary frame by means of the links or rods B, four in number, one supporting each corner of the movable frame. This feature of my machine is immaterial, for the movable frame, if desired, may be supported in any other desirable manner.

Between the uprights of the fixed or stationary supporting-frame, as shown in the present instance, swings the movable belt-frame, which frame has a lateral or side shake imparted thereto by the hereinafter-described mechanism.

Over end rollers B^2 B^3, which work in bearings secured to the end of the side beams of the swinging frame, works or travels the endless concentrating-belt B^4. The movable frame is so hung or suspended that the concentrating-belt travels upon a gradual incline from the roller B^3 to roller B^2, the roller B^2 being placed at a higher elevation than roller B^3, due to the forward end of the movable frame being hung so as to stand a greater distance above the base of the fixed or sta-

tionary frame than the opposite end thereof. The inclination at which the movable frame stands may be increased or decreased by shortening or lengthening the length of the forward pair of supporting-links, by means of which the said frame is suspended.

A series of rollers C, I journal in the movable frame, between the end rollers B^2 B^3, which rollers serve to support the endless concentrating-belt between the end rollers B^2 B^3 and prevent the sagging thereof by the weight of the ore deposited thereon.

Above the concentrating-belt, beyond the medial line thereof, is located the pulp or ore receptacle C′, which may be of any suitable style, and into which the ore may be fed from the stamp-mill in any well-known manner, the ore being discharged from the pulp-receptacle and distributed upon the surface of the endless traveling concentrating-belt through the orifices *c*. In advance of the ore-distributer is located the water-tank D, from which the water makes its escape and is discharged upon the concentrating-belt, immediately in front of the ore deposited thereon, through the openings *d*. The outlet or outflow of water from the water-tank may be controlled in any suitable manner.

Near the forward end of the fixed frame and below the movable or swinging frame is located the receiving-tank D′, into which the precious metal carried by the concentrating-belt over the forward roll of the movable frame is deposited during the travel of the endless belt. Within this tank is suspended the roll D^2, over which the said endless belt travels as carried toward the rear roll B^3. This roll D^2 is adjustably connected to the side pieces of the movable frame and acts as an idler for the concentrating-belt. As the said roll is raised or lowered the tension of the concentrating-belt is decreased or increased.

To one side of the fixed or stationary supporting-frame is located the shaft E, which shaft runs parallel with the movable or swinging frame and works in bearing plates or boxes d' d^2, secured to the outer face of the uprights of said fixed supporting-frame. Upon the drive-shaft I secure the fly-wheel E′ and the drive-belt wheels E^2, over which wheels travels a drive-belt. This belt is operated by any suitable mechanism and serves to rotate the parallel shaft. Near each end of said shaft is secured an eccentric cam F F′. These cams, as the parallel shaft is rotated, serve to impart a side shake or lateral movement to the movable or suspended concentrator-frame.

From one of the side pieces of the movable or swinging concentrator-frame project the brackets F^2 F^3, each of which is provided with the arms *e e′*. These arms embrace the eccentric cams secured upon the shaft E. Consequently, as said shaft is rotated, the eccentric portion of said cams contacts with the arms *e e′*, and thus imparts a side throw or stroke to the movable concentrator-frame. As the eccentric portion of the cams engage the arms *e* the movable frame of the concentrator will be thrown away from the parallel shaft, and when said eccentric cams engage with the arms *e′* the movable concentrator-frame will be drawn toward the said shaft. By means of these eccentric cams the movable frame has imparted thereto a side or lateral oscillatory motion. This oscillatory or lateral swing of the movable frame may be varied, if desired, by a change of the eccentric cams.

As the movable frame is swung from side to side the concentrating-belt is carried therewith. This movement of the belt causes a partial distribution of the ore and separation of the precious metal. However, in order to secure a thorough separation and distribution it is necessary that the concentrating-belt be given a longitudinal shake or jolt during its oscillation and forward movement. This movement is accomplished in the following manner: The shaft or axle b^3 of roll B^2 extends beyond one of the side pieces of the movable or swinging frame and has loosely secured to the end thereof the frame G, within which works the disk G′, said disk being rigidly affixed to the shaft or axle b^3. From the end *g* of the frame G depends the arm G^2, the lower end of which is connected to the pitman or connecting-rod G^3 by pin *g′*, the upper end of said rod being secured to the crank-arm G^4 of the shaft E by pin g^2, which pin is adjustably secured within an elongated slot cut through the crank-arm G^4. As the shaft E is rotated the crank-arm G^4 is carried around, which, during its movement, through its connecting parts causes the frame G to oscillate upon the shaft or axle b^3. As this frame is oscillated or raised up and down the disk G′ is given a forward-and-back movement, which disk, being rigidly secured to the axle or shaft b^3, imparts a similar movement thereto and to the roll B^2, the movement of which roll causes the concentrating-belt to move forward and backward with a jolting motion. The disk is caused to rotate through the medium of the clutch-arms H H′, the inner end of each arm being bent so as to embrace the periphery or rim of the disk G′. The outer ends of said arms, when the frame G stands in a horizontal plane, rest upon the upper edge of the end pieces *g* g^3 of the frame G. As the end *g* of this clutch-frame is elevated by the before-described mechanism the arm H is carried therewith. As the outer end of this clutch-arm is elevated the inner end binds against the periphery or rim of the disk G′ and causes the said disk to rotate in a forward direction, the movement of which causes a similar rotation to be imparted to the roll B^2 and a forward advancement to the concentrating-belt. As the end *g* of the frame G is lowered the opposite end is elevated, which carries the clutch-arm H′ therewith. As the outer end of this arm is elevated the inner end binds against the periphery or rim of the disk

G' and imparts a backward rotation thereto, the movement of which carries the roll B^2 therewith and causes the concentrating-belt to recede. This movement of the concentrating-belt, in addition to the side vibratory movement, causes a perfect separation of the precious metal from the base material and enables me to procure a much better concentration of the ore than heretofore. Without any further connections than that which I have described it is manifest that the forward-and-backward movement of the concentrating-belt would be uniform. Hence there would be no advancement of the said belt. This I overcome by limiting the backward movement of the disk G'. For this purpose I secure to one of the side pieces of the swinging frame the forwardly-curved arm H^2, the outer end of which extends beneath the forward portion of the oscillatory frame G. Within the outer end of the arm or bracket is cut the screw-threaded opening *h*, through which extends the screw-threaded rod *h'*. This rod is adjusted up and down by the handle h^2. The upper end of this screw-threaded rod projects within the frame G and is in line with the clutch-arm H'. As the outer end of the frame G descends the upper end of the screw-threaded rod *h'* engages the under face of the clutch-arm H' and prevents the downward movement thereof and disengages the inner end from locked engagement with the rim of the disk. The moment the clutch-arm is released from engagement with the rim of the clutch-disk the said disk ceases to rotate and the movement of the concentrating-belt stops. By regulating the position of the screw-rod *h'* the backward movement of the concentrating-belt may easily be controlled so as to adapt the movement of the belt to meet the requirements of various kinds of ore to be treated. I have arranged the screw-rod so that the forward stroke or movement of the concentrating-belt will be twice as much as the backward stroke or movement.

In the present machine I have so connected the parts that the mechanism which imparts a forward-and-backward movement to the concentrating-belt will be operated by the movement of the parallel shaft E; but it is obvious that any suitable mechanism may be employed for this purpose.

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

1. In an ore-concentrator, the combination with a movable concentrator-frame and its belt, mechanism for moving the frame, and means for imparting an independent reciprocating movement to the belt, comprising clutch mechanism, and a connection between the clutch mechanism and the frame-moving mechanism.

2. In an ore-concentrator, the combination with a concentrating-belt and its frame, mechanism for moving the frame, means for independently reciprocating the belt and an actuating crank connection connecting said reciprocating means with the moving mechanism.

3. In an ore-concentrator, the combination with a concentrating-belt and its frame, of mechanism for moving the frame, means for independently reciprocating the belt, comprising an oscillating frame, a disk within the oscillating frame, clutch-arms embracing the disk and engaging the frame, and jointed crank mechanism between the oscillating frame and the mechanism for moving the belt-frame.

4. In an ore-concentrator the combination with an endless traveling concentrating-belt, and its swinging frame, of mechanism for imparting a lateral throw or side shake to the frame, and means connected with and actuated by the moving mechanism for independently reciprocating the endless traveling belt forward and backward during its continuous travel, the forward movement being greater than its backward movement, so that the belt positively advances toward the front end of the machine.

In testimony whereof I affix my signature in presence of two witnesses.

LOUIS R. TULLOCH.

Witnesses:
N. A. ACKER,
LEE D. CRAIG.