(No Model.)

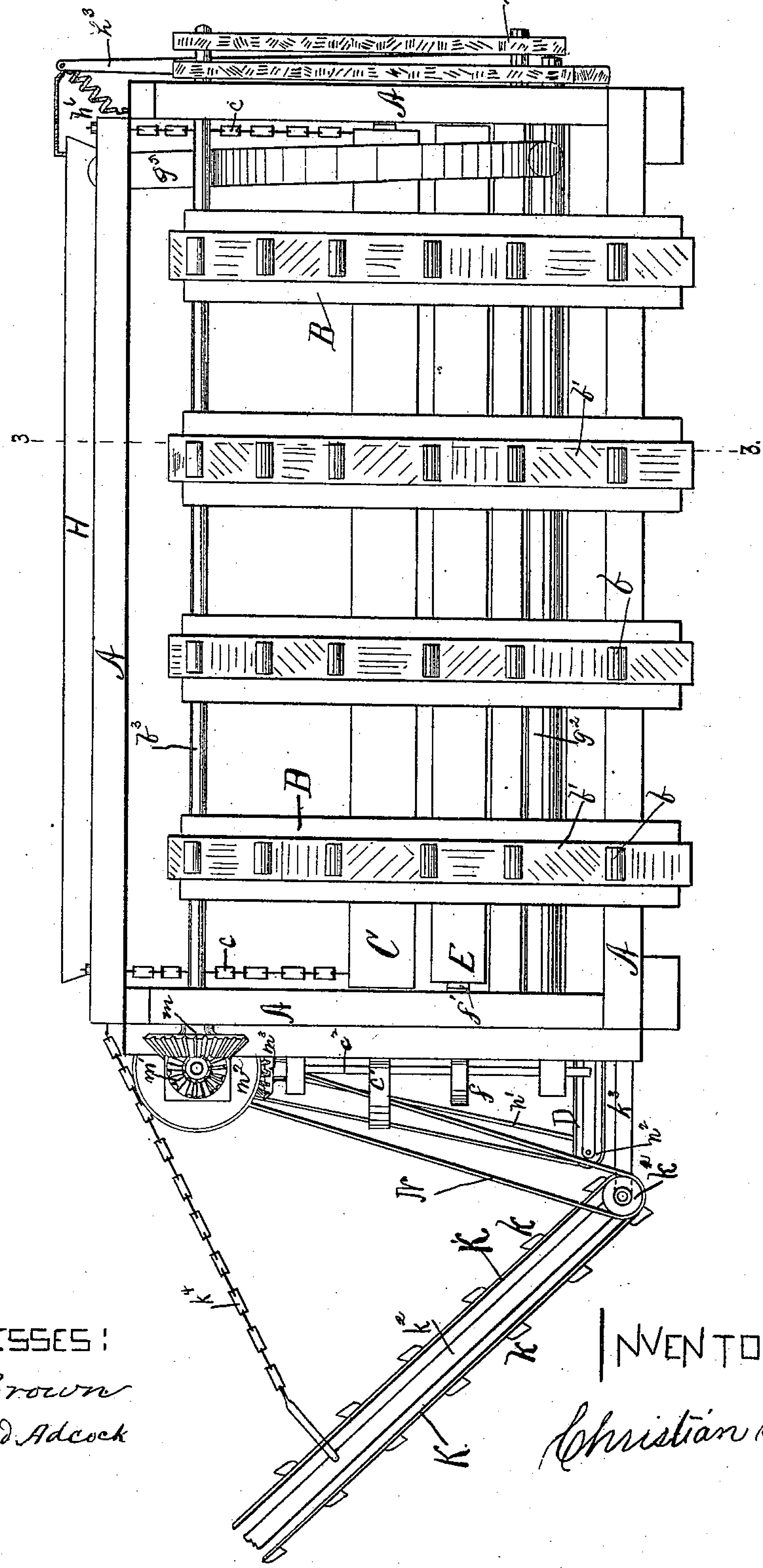
3 Sheets—Sheet 1.

C. C. HILL.

ORE WASHER AND AMALGAMATOR.

No. 250,358. Patented Dec. 6, 1881.

FIG. 1.



WITNESSES:

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(No Model.) 3 Sheets—Sheet 2.

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FIG. 2.

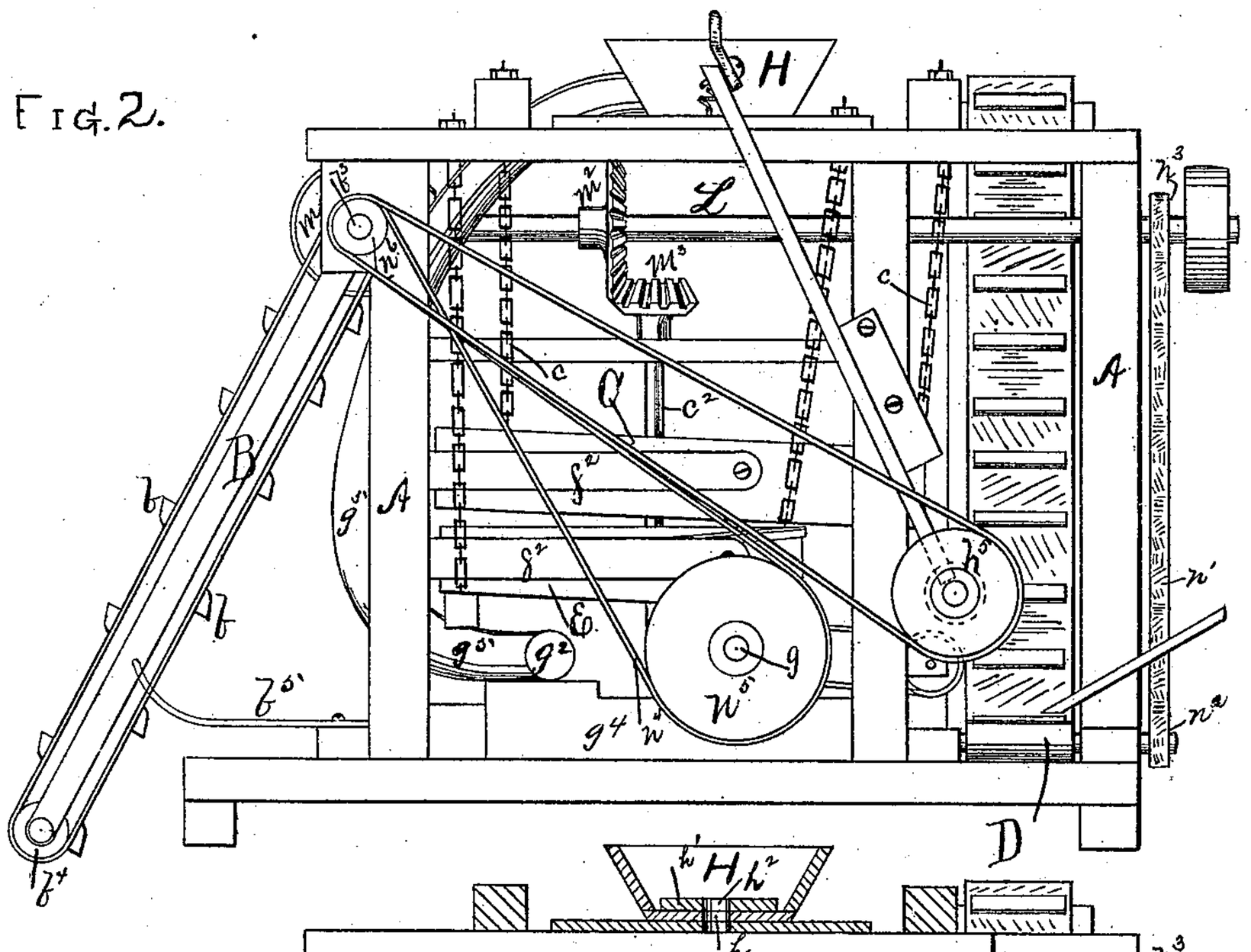

FIG. 3.

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(No Model.) 3 Sheets—Sheet 3.

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FIG. 4.

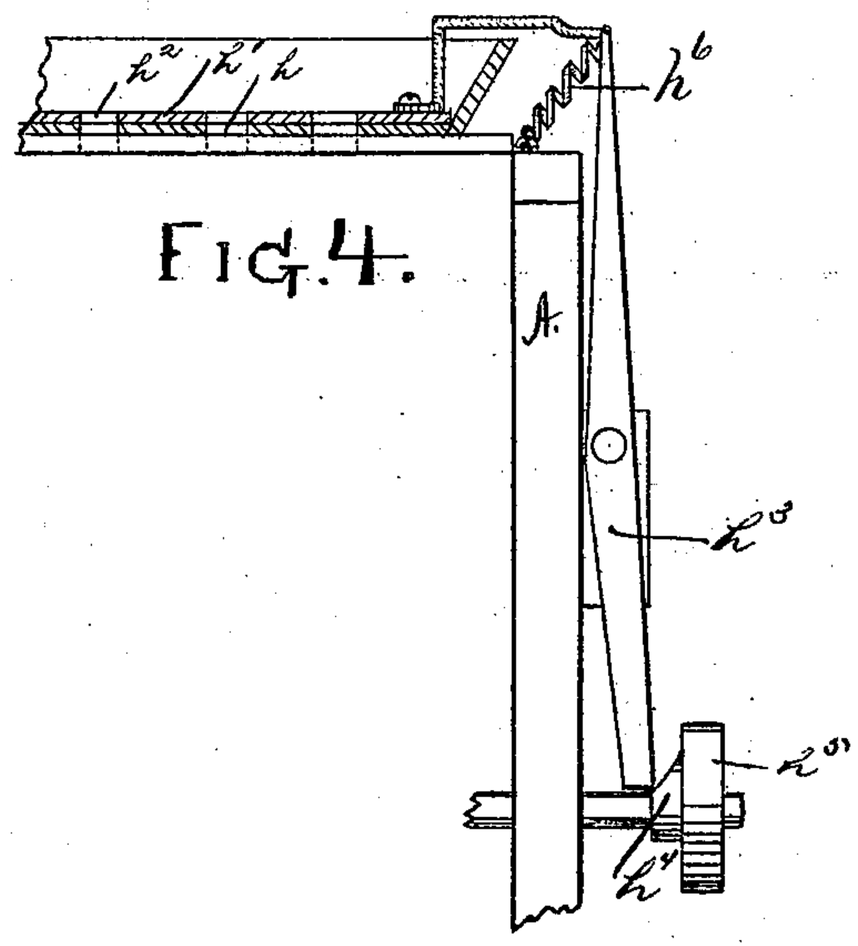


FIG. 5.

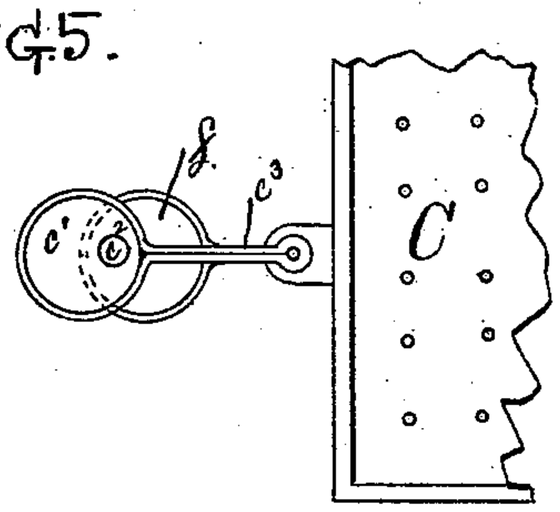
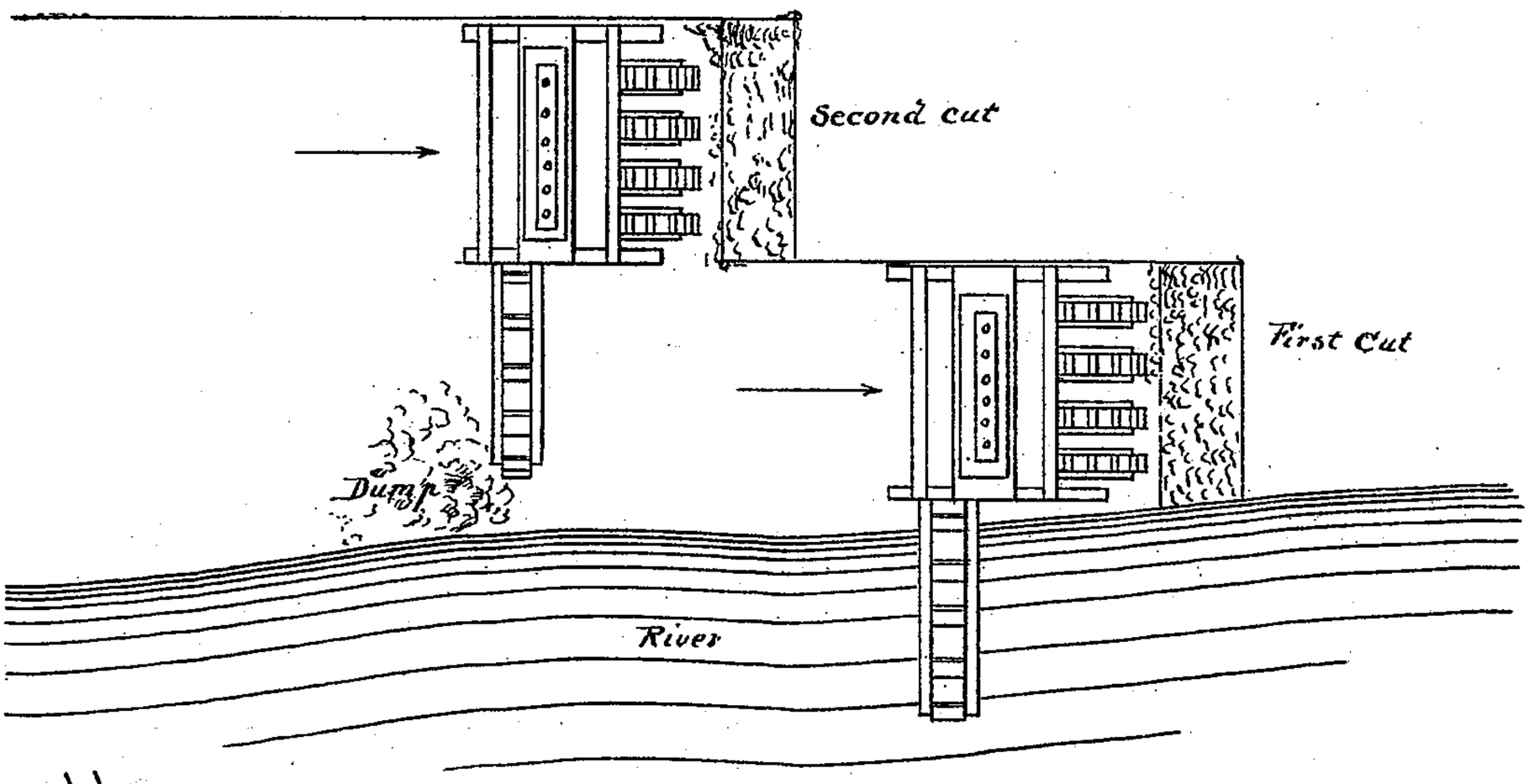


FIG. 6.



WITNESSES:
Everett Brown.
Edmund Adcock

INVENTOR:
Christian C. Hill

UNITED STATES PATENT OFFICE.

CHRISTIAN C. HILL, OF CHICAGO, ILLINOIS.

ORE WASHER AND AMALGAMATOR.

SPECIFICATION forming part of Letters Patent No. 250,358, dated December 6, 1881.

Application filed February 4, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN C. HILL, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Ore Washers and Amalgamators, of which the following is a specification.

My invention relates to improvements in placer-mining machinery, or machinery for working alluvial deposits and collecting the precious metals therefrom.

Heretofore in working such alluvial deposits it has been customary to set the mining apparatus at such elevation in relation to the bed of the river as may be necessary in order to provide a descent for the discharge of the tailings, and to remove the apparatus to another place after such natural discharge or "dump" becomes filled up, so that by the means hitherto known and in use it has been impracticable to work such deposits to any great distance back from the edge of the river, and also only to limited depths, and this although the lower strata are usually supposed to be the richest. The gold contained in such alluvial deposits, or part of it, is often in such a finely-subdivided state that it will float in water, even when there is little or no current; and sometimes it is even so finely powdered that it is carried about in the air. All hitherto-known methods have failed to secure such finely-subdivided gold to any practicable extent. Such deposits also usually contain more or less "rusty gold," and a quantity of black sand composed mostly of magnetic oxide of iron, which latter is valuable for use as a flux in various metallurgical operations. By the term "rusty gold" is meant gold so combined as not to be readily amalgamated.

It is the object of my invention to provide an automatic machine for working such alluvial deposits and securing the precious metals and valuable products they may contain, whether found as free grain gold, "free flour gold," which is the name usually given to finely-subdivided gold or rusty gold, or gold mechanically combined with magnetic oxide of iron, and a machine by which the whole of such deposits may be worked independent of the physical condition of the country, excepting a supply of water, whether it be stagnant or running.

I am aware that where the gold is not so finely subdivided as to be properly designated as "flour-gold" hydraulic mining may be successfully carried on if the physical conditions of the country are favorable. These conditions, however, are so numerous that a mere fraction of such auriferous alluvial deposits existing in the United States are available for hydraulic operations. Moreover, but a small proportion of the gold contained in many such alluvial deposits can be secured by hydraulic mining, as is illustrated by the fact that often, while a man working with an ordinary hand rocker or cradle will secure from twenty-five to forty cents' worth of gold to the ton of alluvium operated upon, a hydraulic miner operating on the same bar will secure but from three to four cents to the ton.

My invention is specially designed for operating upon the poorer class of alluvial deposits in which it is necessary to separate all, or nearly all, the valuable products from the alluvium in order that the deposit may be profitably worked; and my invention consists, in a mining-machine, in the novel devices and combinations of devices herein described for excavating and delivering the alluvium to the machine; for elevating and dumping the tailings at a height, if necessary, equal to the height of the bar or bank from which it is taken, so that the machine is made to cut its own way as it goes, and therefore may be continuously operated independent of any natural descent or dumping-ground; and the devices for washing, separating, and collecting the precious metals and valuable products contained in the alluvium.

It also consists, in combination with the screen and amalgamating mechanism, in providing an intermittent supply of water to disintegrate and wash the alluvium as it is delivered upon the reciprocating screen, so that the flow of the water upon or over the amalgamated plates below the screen will be alternately checked or arrested and the water intermittently drained off said plates, thus causing the particles of gold to come in contact with the plates and be amalgamated, as the water, when being drained off, spreads itself out into a thin film over the surface of the plate. I prefer to give to the amalgamated plates a reciprocat-

ing motion, instead of a rocking or tilting motion, as in the ordinary rocker or cradle, whereby I am enabled to utilize the entire surface of the plates, instead of only the central portion thereof, as is the case in the rocker or cradle.

It also consists in combining with the other parts of the machine, as hereinafter claimed, an amalgamated revolving cylinder arranged in relation to the stream of discharge of water and sand that has passed over the amalgamated plates, so that the surface of water will dam up or form a slight eddy against the cylinder, so that the amalgamated surface of the cylinder will secure such very minute particles of flour-gold as may have been floated over the plates.

It also consists in providing an endless apron, made of felt, corduroy, or cloth, or like material having a pile, fibrous, or ribbed surface, arranged under the lower edge of the bottom amalgamated plate, and mounted on suitable rollers, so that the sand and water, as they are discharged from the plate above, will fall upon this apron; and as the black sand or magnetic oxide of iron and particles of rusty gold have much greater specific gravity than the ordinary sand or earthy matter, the former will fall into the interstices or fibers of the material composing the apron, and be protected by the pile or fibers of the cloth from the current of water passing over, while the lighter and more bulky matters will pass over in the current of water and be discharged with it. This apron is arranged at a slight inclination, so as to facilitate the discharge of the water and refuse material, and is given a slow motion in the direction opposite to the current of water, so that the black sand and particles of precious metals it may have collected will be carried under the edge of the amalgamated plate and on around to the back roller on which the apron is mounted, at which points jets of water are made to impinge against the apron and wash the black sand and particles collected out of the cloth, whence they fall into a box below provided for the purpose.

In the accompanying drawings, which form a part of this specification, and in which similar letters of reference indicate like parts, Figure 1 is a side elevation of a device embodying my invention. Fig. 2 is an end view of the same. Fig. 3 is a transverse section on line 3 of Fig. 1. Fig. 4 is a detail view, showing device for producing intermittent flow of water. Fig. 5 is a detail showing eccentrics for giving reciprocating motions to the screen and plates. Fig. 6 is a plan showing method of operation in making successive cuts along the edge of the deposit.

In said drawings, A represents the frame of the machine.

B B are the frames upon which the excavating apparatus is mounted. *b b* are the excavating and elevating buckets, secured to endless belts or chains *b'*. These belts are driven by pulleys b^2, secured to the shaft b^3, to which the upper ends of the frames B are hinged, the frames being provided with similar pulleys, b^4, at their lower ends, for the belts carrying the excavating-buckets. The frames B may be set or adjusted at any desired inclination by means of the braces b^5. The alluvium is delivered by these excavating-buckets *b* upon the reciprocating screen or perforated plate C, which is supported and swung upon chains *c* from the top of the frame, its reciprocating motion being imparted to it by means of an eccentric, *c'*, on the vertical shaft c^2, and the connecting-strap c^3. This screen is swung at a slight inclination, so that the tailings and coarse particles or gravel will be discharged from the same into or upon the horizontal conveyer-belt D, arranged on the opposite side of the machine from the excavating apparatus.

E is the reciprocating frame in which the amalgamated plates F and F' are mounted. The upper plate, F, is arranged at an inclination opposite to that of the screen, and the under or broader plate, F', has an inclination similar to that of the screen, so that the finer and heavier particles which fall through the screen, and which contain the gold and valuable products, will pass over the surface of the plates from one edge to the other. These plates are given their reciprocating motion by an eccentric, *f*, on the vertical shaft c^2, connected to the frame E by means of a strap, *f'*. The eccentrics *c'* and *f* are arranged on the vertical shaft so as to shake or move the screen and the plates in opposite directions at the same time, so that the two vibrations will, in a measure, counteract each other and prevent a shock to or vibration of the whole machine. To secure a steady even motion, I also provide flat springs or straps f^2 at each end of the reciprocating screen and frame E, one end of the straps f^2 being secured to the frame A, and their other ends to the reciprocating screen and frame E.

G is the endless apron, provided with a fibrous or corrugated outside surface made of any suitable material—felt, for example—and mounted on suitable rollers, *g* and *g'*, and arranged underneath the lower amalgamated plate so that the water and material passing over said plate will fall upon the apron. I prefer to arrange this apron at about the same inclination as the lower plate, F'. However, if the plate F' is extended so as to project over nearly to the outside roller, *g'*, the apron may be arranged nearly or quite horizontal. The jet-tube g^2 is placed directly back of the roller *g*, with its perforations g^3 facing said roller, so that the jets of water will impinge against the apron as it passes around the roller, and when its fibers are spread apart thereby, so as to thoroughly wash out the heavy particles collected by the apron.

g^4 is a box or receptacle placed under the roller *g*, to receive the black sand and rusty gold as the same are washed out from the apron by the jets of water. The water falling into this receptacle overflows its top, while the black sand,

&c., settles to the bottom. The jet-tube g^2 rests upon the side pieces of the box g^4, and is supplied with water, under suitable pressure, through the connecting-hose g^5 from the reservoir H.

H is the reservoir, located above the screen, into which the water for disintegrating and washing the alluvium is pumped or drawn by any suitable means. The bottom of this reservoir is provided with perforations h, through which the water falls upon the screen below when the slide h', which is provided with corresponding perforations, h^2, is moved so that the two sets of perforations are coincident. The slide h' is intermittently reciprocated by means of the lever h^3, actuated by the cam h^4 on the wheel h^5, and the coil-spring h^6, so as to cause the intermittent supply of water.

J is an amalgamated cylinder, arranged in and above the discharging stream of water and material as it flows from the endless apron, so that the same will dam up or form a slight eddy against its surface for the purpose of securing the light particles of gold that may be floated over the amalgamated plates. This cylinder is mounted in suitable bearings in the main frame, and is given a slow rotary motion by means of the wheel h^5, secured on the end thereof. The tailings and refuse material are delivered from the screen and from the endless apron upon the conveyer D, which is mounted upon suitable rollers, d, at each end of the machine, and are by it delivered to the elevating mechanism, which consists of the endless chain or belt K, carrying buckets k. The belt K is carried upon suitable pulleys, k', mounted in the frame k^2, which is hinged to the main frame at k^3, so that the same may be adjusted to different elevations by means of the chain k^4. The frame k^2 should be of such length that the tailings may be piled up to a height equal to the depth of the deposit, so that the whole of the deposit may be worked.

It is obvious that where the machine is located above the place of discharge the discharging-elevator may be placed in a horizontal position or incline downward.

If preferred, the machine may be placed on top of the bank instead of in the cut, and the excavating mechanism arranged in the rear of the machine, and made long enough to elevate the detritus from the bottom of the cut, in which it is obvious that the discharging mechanism may be simply a horizontal conveyer.

Motion is imparted to the driving-shaft L by a steam-engine or any suitable motive power. The shaft for actuating the excavating apparatus derives its motion from the driving-shaft through the bevel-gears m and m', and motion is communicated to the vertical shaft c^2, which actuates the screen and amalgamated plates by means of the bevel-gears m^2 and m^3. The elevating apparatus is driven by a belt, N, running on a pulley secured to the driving-shaft, and the horizontal conveyer-belt D is driven by belt n', running on pulley n^2, secured to roller d, and pulley n^3, secured to the driving-shaft. The endless apron is actuated by a cross-belt, n^4, running on pulley n^5, secured to the roller g, and pulley n^6, secured to shaft b^3. A pulley on the same shaft b^3 actuates the belt for driving the pulley h^5, secured to the end of the amalgamated cylinder, and which is provided with a cam, h^4, for reciprocating the perforated slide h' in the bottom of the reservoir H.

Any suitable means for pumping or drawing the water into the reservoir may be employed.

Other means may be employed for connecting and imparting motion to the several parts or devices which constitute my improved machine, and I do not wish to limit myself to the particular construction described.

I am aware that heretofore in amalgamators and concentrators for collecting gold from quartz-mills, as appears from the United States Patent (Smith and Johnston) No. 66,499, an endless apron has been employed in connection with amalgamating mechanism for collecting heavy valuable particles, which are carried over the amalgamating mechanism without being secured thereby; but my machine is specially designed for operating upon the poorer class of alluvial deposits, and differs from the apparatus of Smith and Johnston in employing a screening mechanism, the same being an essential feature of my machine and necessary to its successful operation for the purpose designed, as the material operated upon usually contains to the ton of detritus a few bushels of material which it is desirable to pass over the amalgamating mechanism and apron. My machine also differs from that of Smith and Johnston in that the endless apron is inclined in the same direction as the amalgamated plate from which the stream of water pours onto it, so that the direction of the discharging stream is not reversed when it falls upon the apron, and consequently the water is not washed back over the heavier and valuable particles which fall directly under the edge of the plate. This is a matter of great importance in a machine designed to operate upon alluvial deposits, and in which it is necessary to use a large quantity of water.

I do not claim, broadly, the combination of an amalgamated plate with an endless apron for collecting heavy valuable particles, as that is shown in the patent before referred to.

I claim—

1. In a mining-machine, the combination of washing and screening mechanism with amalgamating mechanism, mechanism for automatically excavating and delivering the alluvium to the machine, and mechanism for automatically elevating and discharging the tailings out of the way of the machine in making the next succeeding cut, substantially as described.

2. In a mining-machine, the combination, with amalgamated plate or plates, of screening mechanism and mechanism for giving an

intermittent supply of water thereto, whereby the flow of water on the amalgamated surfaces is caused to rise and fall at intervals, and thus permit the lighter particles of free gold to come in contact with the amalgamated surface, substantially as specified.

3. The combination of the screen, amalgamated plate or plates, mechanism for giving a reciprocating motion to said screen and plates, and mechanism for affording an intermittent flow of water on said plate or plates, substantially as specified.

4. The combination of the screen, amalgamated plate, endless apron provided with fibrous or corrugated surface arranged under the amalgamated plate, from which it receives the discharging stream, and inclined in the same direction therewith, and mechanism for removing from said apron the particles collected therein, substantially as specified.

5. In an automatic mining-machine, the combination of mechanism for excavating and delivering the alluvium to the machine with washing, screening, and amalgamating mechanism for securing the free gold, an endless apron provided with a fibrous or corrugated surface for collecting the rusty gold and black sand, mechanism for removing the particles so collected from said apron, an amalgamated cylinder arranged in and above the discharging stream of water and auriferous material, and mechanism for elevating and discharging the tailings out of the way of the machine in making the next succeeding cut, substantially as described.

6. The combination of the screen, amalgamating mechanism, endless apron provided with fibrous or corrugated surface arranged under the amalgamated plates and inclined in the direction of the discharging stream of water and auriferous material from said plate, mechanism for giving said apron a motion in the contrary direction to that of the discharging stream, and a jet-tube adapted and arranged to cause jets of water to impinge against said apron to remove the particles collected therein, substantially as specified.

7. The combination of the water-reservoir provided with a perforated bottom and reciprocating perforated slide with reciprocating screen and reciprocating amalgamated plates, substantially as specified.

8. The combination of reciprocating amalgamated plate or plates, endless apron provided with a fibrous or corrugated surface, and an amalgamated cylinder arranged in and above the discharging stream, substantially as specified.

9. The combination, in a mining-machine, of mechanism for excavating and delivering the alluvium to the machine, reciprocating screen, reciprocating amalgamated plates, water-reservoir provided with perforated bottom and perforated reciprocating slide, endless apron provided with fibrous or corrugated surface, amalgamated cylinder, and mechanism for elevating and discharging the tailings, substantially as specified.

10. The combination, in a mining-machine, of washing, screening, and amalgamating mechanism, with horizontal conveyer D and a device for elevating the tailings, substantially as specified.

11. The combination of the reservoir H, provided with perforated bottom and perforated reciprocating slide, with lever h^3 and cam h^4, for intermittently actuating said slide, substantially as specified.

CHRISTIAN C. HILL.

Witnesses:
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EDMUND ADCOCK.