(No Model.)

4 Sheets—Sheet 1.

W. B. FARWELL.

WET ORE CONCENTRATOR.

No. 300,701. Patented June 17, 1884.

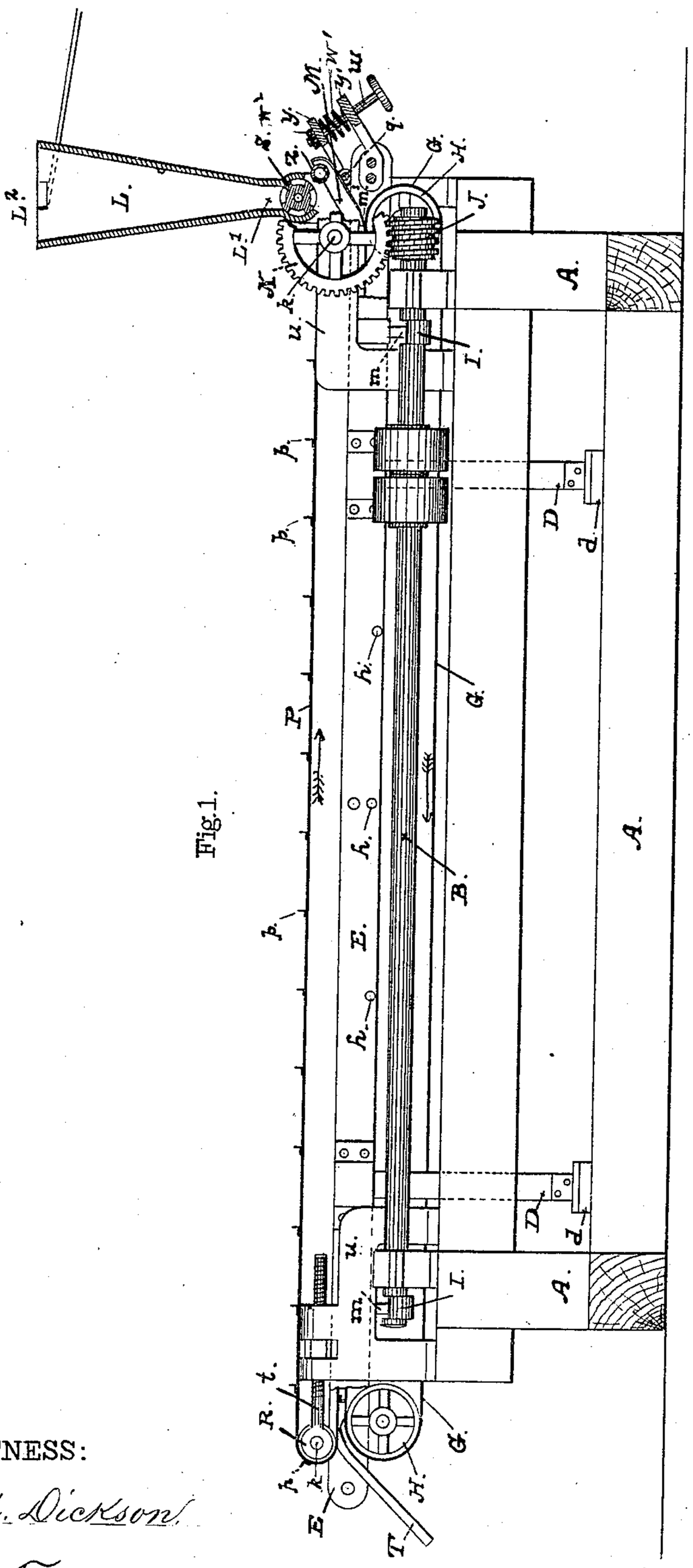

Fig. 1.

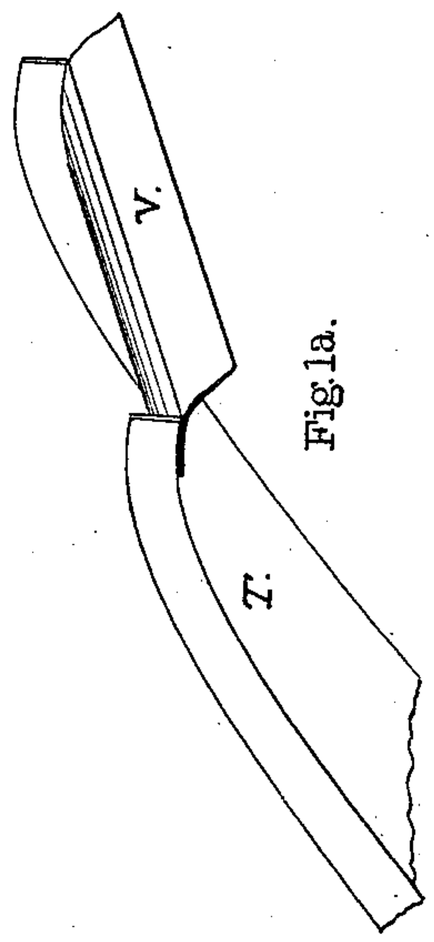

Fig. 1a.

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(No Model.) 4 Sheets—Sheet 2.

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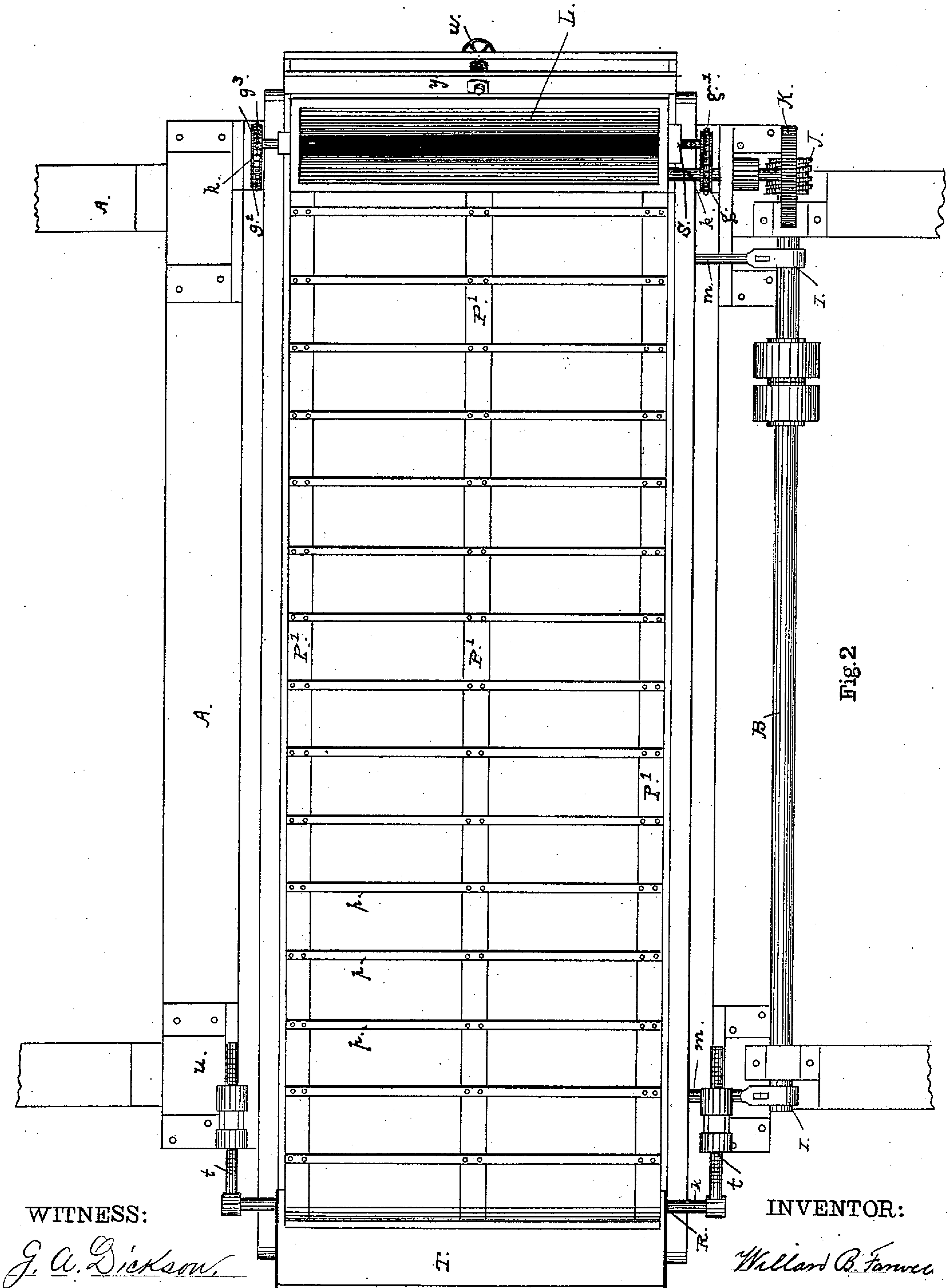

Fig. 2

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WET ORE CONCENTRATOR.

No. 300,701. Patented June 17, 1884.

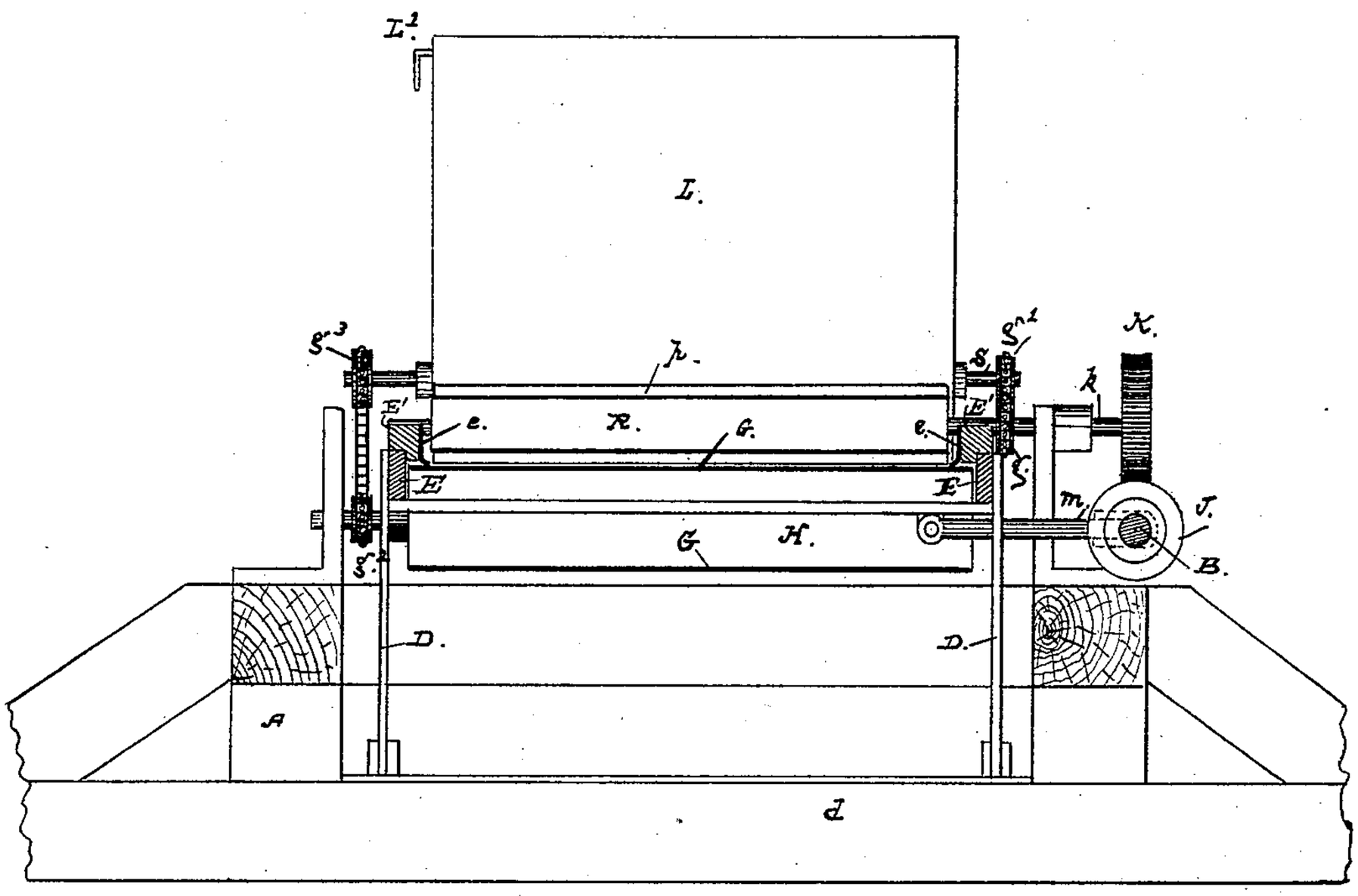

Fig. 3.

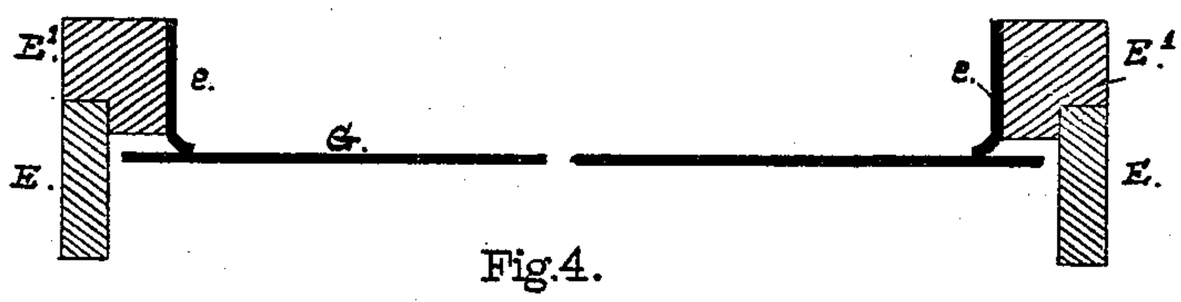

Fig. 4.

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No. 300,701. Patented June 17, 1884.

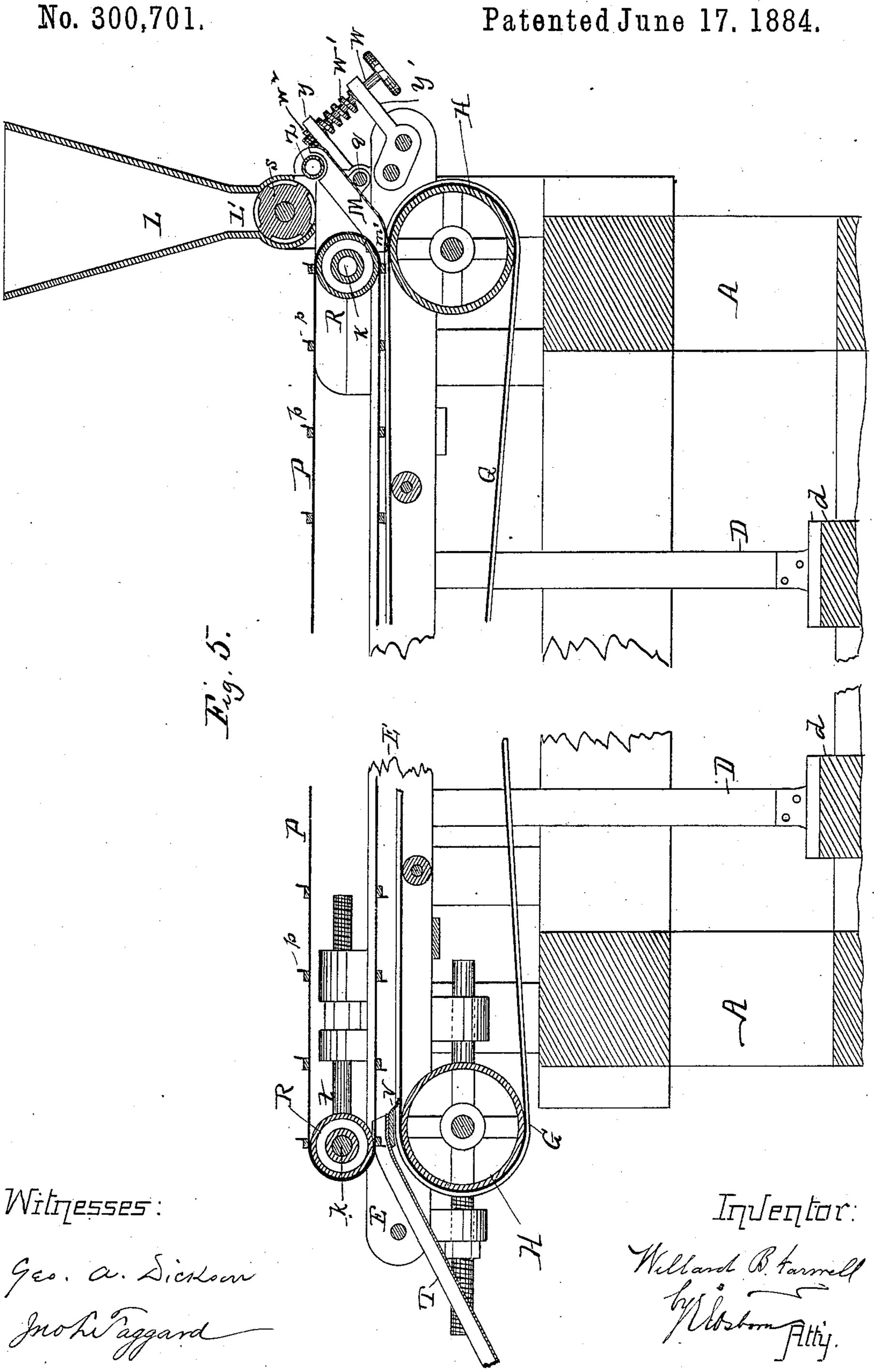

Fig. 5.

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Willard B. Farwell

by Wilson Atty.

UNITED STATES PATENT OFFICE.

WILLARD B. FARWELL, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO FANNIE M. FARWELL, OF SAME PLACE.

WET ORE CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 300,701, dated June 17, 1884.

Application filed September 5, 1883. (No model.)

To all whom it may concern:

Be it known that I, WILLARD B. FARWELL, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Wet Ore Concentrators; and I do hereby declare that the following is a full, clear, and exact description of the same, the accompanying drawings being referred to as a part of the specification.

My invention relates to ore-concentrating apparatus of that class known as "wet concentrators," and to that particular kind in such class having a vibrating or shaking motion imparted to an endless traveling belt or apron.

The following description fully explains the manner in which I construct and use my said improvements.

Figure 1 is a longitudinal vertical section through a concentrating-machine constructed according to my invention. Fig. 1ª is a detail view, on a larger scale, of the tail-spout. Fig. 2 shows a top view or plan of Fig. 1. Fig. 3 is a vertical cross-section taken at about the center. Fig. 4 is a detail cross-section showing the construction of the ledges or sides to the traveling concentrating-surface. Fig. 5 is a vertical longitudinal section of the apparatus, a central portion being broken away to allow the parts to be shown on a larger scale.

A A represent the timbers of a suitable frame, upon which are provided supports and bearings for a principal shaft, B. The feet or lower ends of four flat metal spring bars or standards, D D, are fixed on cross-timbers *d d* on the frame, in position to support upon their free upper ends a vibrating frame formed of side bars, E, and overhanging rails E′, Fig. 3. This frame carries the endless concentrating-surface G, and for this purpose it has bearings for the journals of two drums or large rollers, H H, at the ends, and the usual intermediate supporting-rollers, *h h*, placed at intervals across the frame. This frame is so set that the concentrating-surface, while traveling longitudinally and while receiving vibration or shaking motion, is practically horizontal. The belt receives vibratory motion transversely or at right angles to its progression through the medium of short cranks or offsets I I on the shaft B, and rods *m m* connecting the cranks and frame E together. (Seen in Figs. 1, 2, 3.) The standards D are sufficiently elastic or flexible to permit play of the vibrating frame within the stationary frame.

An endless traveling scraping device is operated above the concentrating-belt, both as a distributer to take the pulp from the supply-hopper L and distribute it over the concentrating-surface, and as a carrier or scraper to move the upper part or stratum of the pulp off from the concentrating-surface at its tail end. This device operates in the place of gravity and a sharply-inclined concentrating-surface, as used in other machines of the kind, and the results obtained from the improvement are a more even distribution of the heavier metallic particles over the concentrating-surface and a more regular and perfect separation and discharge of the worthless or lowest portion of matter than can be obtained by inclining the surface of the belt and effecting the discharge by gravity and the force of the current alone. This "scraper," as I have termed it, is formed by securing a number of strips, P, with projecting scraping edges or blades *p*, transversely across three endless belts, P′, so that the scraping-edges are substantially at right angles with the concentrating-surface beneath. Such a scraper is readily produced by bending up strips of sheet metal and fastening them to runner-belts of leather, rubber, or other suitable flexible material. Rollers R R, having shafts K K, are set in bearings in brackets *u u* at each end of the frame, directly over the drums H H. Proper tension of the belts is insured by mounting the shaft of one roller in movable boxes *t t*. Figs. 1 and 2 show this construction of adjustable boxes. The shaft of the opposite roller, R, is the driver both for the traveling scrapers and the concentrating-belt, motion being obtained from the principal shaft B by a worm, J, and a gear, K, on the end of the shaft K. At this end of the machine is located the feed-hopper. The distribution of the pulp and the discharge of the concentrates take place at the same end of the belt. The pulp is delivered by mechanical means upon an inclined plate or apron, whence

it flows onto the belt under the roller of the scraper-belt. A feed-roller, S, with longitudinal grooves or pockets fills the mouth of the hopper and receives continuous rotary motion from the cross-shaft *k* through the medium of the pulleys *g g'* and a belt on the same side of the machine where the gearing is located. The belt-carrying roller H is driven from the shaft of the pocketed feed-roller S through the pulleys and belt g^2 g^3. This connection is employed, however, for the purpose of obtaining a long belt, as the motion could be taken directly from the shaft *k* to the shaft of the belt-driving roller H; but the supports of this roller having a lateral vibration, there would be an objection attending the use of a short belt, and therefore a belt from the highest shaft is used. A high narrow hopper is employed for the purpose of consolidating the solid matter of the incoming stream and removing excess of water before the matter is fed to the concentrating-belt. The hopper has a long narrow throat, L', an overflow-spout, L^2, at the top to lead off surplus water, and its mouth or outlet is filled by the feed-roller. The delivery of material from the hopper is then controlled by the roller, and as this revolves with regular movement the pockets or cavities in the periphery deposit the matter upon the inclined feed-plate. At this point the traveling scrapers are set to take and carry over and spread the material upon the concentrator-belt. At this point, also, the lowest stratum, consisting of the concentrates, is carried by the progression of the concentrating-belt under the edge of the inclined plate M, and is discharged over the roller at the head of the machine. For this purpose the tops of both belts G and P move toward the hopper. The edge of this plate is adjustable with respect to the surface traveling under it, in order to regulate the depth of the concentrates to be carried out, as the thickness of this stratum to be discharged will vary with the character of the ore being treated and the completeness of the concentrating operation at any time. All the top portion of the matter not reached by the traveling scrapers, and being above this cut-off edge, is caught up on the inclined plate or apron and carried back and redistributed by the scrapers as new matter, together with the material being supplied down from the hopper. This cut-off apron has raised edges across the back and on the two sides. It is fixed to a cross-rod, *q*, pivoted between the sides of the vibrating frame, and is moved and set at a greater or less degree of inclination by means of the regulating-screw *w*, which works through a fixed bar, *y'*, on the frame E, and into a cross-bar, *y*, fixed at the back of the apron. The screw *w* is surrounded by a spring, *w'*, which lies between the cross-bar *y* and the fixed bar *y'*, and by its expansive force tends to prevent the shaking of the machine from lowering the bar *y* upon the screw. The screw works with engaging threads in the fixed bar *y'* and loosely through the movable bar *y*, on top of which it is provided with a nut, w^2, into which it is turned. The nut may be fixed upon the screw after it is once set in place, as the engagement between the bar *y'* and screw will be sufficient to move the plate M, while the spring *w'* keeps the movable bar *y* in close contact with the under side of the nut w^2. The center of movement of this inclined surface M is then at the point *q*, and the lower cut-off edge, *m'*, is moved up or down by turning the regulating-screw in the required direction. The cross-bar *y* is rigidly secured to the plate M, and the said plate turns on the point *q* as a center when operated through the medium of the cross-bar *y* from the screw *w*. The perforated water-pipe *z* is set across the top of the inclined apron in position to distribute water against the lower face of the feed-roller, as well as upon the material being deposited on the inclined plate or apron. The quantity flowing from the pipe is regulated by a suitable stop-cock in the supply-pipe to produce a proper consistency of pulp, or that diluted condition necessary for effective action of the vibrating motion upon the pulp. The concentrating-surface is a flat, smooth, endless belt without ledges or flanges on the sides, so that it is always in condition to travel smoothly around the propelling and guiding rollers; but to confine the pulp and water within the limits of the working-surface, stationary flaps or flexible strips *e e* are fixed to the inner face of overhanging rails E' along the tops of the side bars of the vibrating frame, and in such position that the lower edges of the flaps or strips bear against and rest upon the surface of the belt along each side and just within the edge. These strips are of sufficient width to lie upon the belt in a curved or bent-up position, with their under faces in close contact with its surface, and as the belt is held up and kept at about a uniform tension by its rollers, a close and practically water-tight joint is produced between these flaps and the belt-surface. While the edges of the belt move forward beneath the overhanging rails of the frame, the matter resting on its surface is effectively confined between the stationary flexible strips that thus form the raised edges to the concentrating-surface.

In Fig. 4 of the drawings is seen a cross-section in detail of this construction and application. The side bars of the vibrating frame have the overhanging top rails, E', secured upon them. The edges of the belt run beneath and as close as practicable to the under faces of the rails.

A tail-spout, T, fixed at the lower end of the machine, performs the office of carrying the refuse matter or tailings over the roller at that end of the machine. Its front or upper edge extends across the frame from side to side above the surface of the belt, and to its edge is fixed a dam or inclined apron, V, formed of

a strip of material of sufficient stiffness to keep always in contact with the surface of the belt, and of sufficient flexibility to yield or rise and fall with the vertical play or movement of the belt. It is inclined from the vertical, so that it presents a slanting surface to the matter being moved backward by the traveling scraper and to the water or top fluid portion of the stratum confined on the bed. The height of the edge of the spout above the surface of the belt determines the depth of the pulp on the belt, and the inclined apron constitutes a dam across the end opposite the hopper of the machine, to prevent the escape of any particles of matter that may be carried backward by the discharging stream immediately upon wet surfaces. By the continuous progression of the belt the concentrates are carried against the inclined edge of the apron at the head of the machine, and while the uppermost portion of matter is caught and held back by the apron M, the lowest portion, consisting of the heaviest particles, is carried under the edge of the apron and discharged over the roller H at the hopper end of the machine. The space then left between the belt G and the cut-off edge m' determines the proportion of the concentrated matter that shall pass out of the machine, and this is regulated by means of the hand-screw. Whatever depth of matter is held back by the plate M is then caught by the scrapers p, and is carried toward the tail end of the machine, and during its progression toward the end of the machine opposite the hopper any metallic particles remaining in the portion of the pulp thus removed from above the richest part of the concentrates will be acted on by the joint vibration of the belt and the agitating and progressing movement of the scrapers before reaching the tail-spout at the discharge end.

By making the scraping-blades of belt P of copper and amalgamating their surfaces, they will constitute an effective device to prevent the escape of float-gold, for by their peculiar movement through the surface of the pulp, produced by the lateral movements of the belt G and the longitudinal travel of the scraper-belt, these amalgam surfaces are brought into thorough contact with the surface of the moving pulp. In this construction of machine the movement and flow of the water and lighter matter are effected mainly by the action of the traveling scrapers, so that an even distribution of the pulp of uniform depth is maintained over the concentrating-surface, and the worthless matter is constantly worked against the travel of the concentrating-belt and discharged from the tail-spout. The conjoint action of the longitudinal moving scrapers and the transverse vibration given to the concentrating surface or belt effects a free separation and loosening of the solid matter, and produces that homogeneous mingling of particles and water necessary to perfect concentration. It is evident that by inclining the surface of the concentrating-belt, removing the scrapers, and retaining all the other features of the machine a better and more rapid system of concentration can be obtained than by any of the known methods where the endless belt is used without the apron or dam at the discharge end. This dam is of advantage in preventing the escape of amalgam and other valuable particles at the lower end, while the essential advantage also remains of being able to draw off at the feed end just as thick a stratum of concentrations as may be desired.

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

1. The combination, with the endless traveling concentrator-belt, of endless traveling scrapers and mechanism for imparting to the same a movement over the said concentrating-surface in a direction contrary to its general movement, as set forth.

2. The combination, with the endless concentrator-belt and means for imparting thereto a vibratory and longitudinal progressive motion, of the endless scraper-belts having scraping-edges, and mechanism for imparting to said belts a movement over said concentrating-surface from end to end in a direction contrary to its general movement, as set forth.

3. The combination of the endless concentrating-belt, means for imparting thereto a vibratory and progressive movement, the endless traveling scrapers moving over the concentrating-surface in a direction opposed to its general travel, the inclined apron, mechanism for adjusting its edge with respect to the surface of the concentrating-belt passing beneath it, and the feed-hopper, substantially as hereinbefore described.

4. The combination of the feed-hopper, inclined apron, pocketed feed-roller, mechanism for operating said feed-roller, and the water-distributing pipe located near the top of the surface of the inclined apron.

5. The combination, with the endless traveling concentrating-belt, of the endless traveling scrapers and the tail-spout, substantially as hereinbefore described.

6. The combination, with the endless traveling concentrating-belt, of the apron V, formed of yielding material and set in an inclined position, and the tail-spout T, substantially as set forth.

7. In an ore-concentrating machine, the combination, with the endless traveling concentrating-belt having lateral vibration, of the endless traveling scraping-blades having continuous movement over the belt, the rollers, and the stationary bearings above the vibratory belt-carrying frame, substantially as described.

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