(No Model.) 2 Sheets—Sheet 1.

J. TULLOCH.

CONCENTRATOR.

No. 486,622. Patented Nov. 22, 1892.

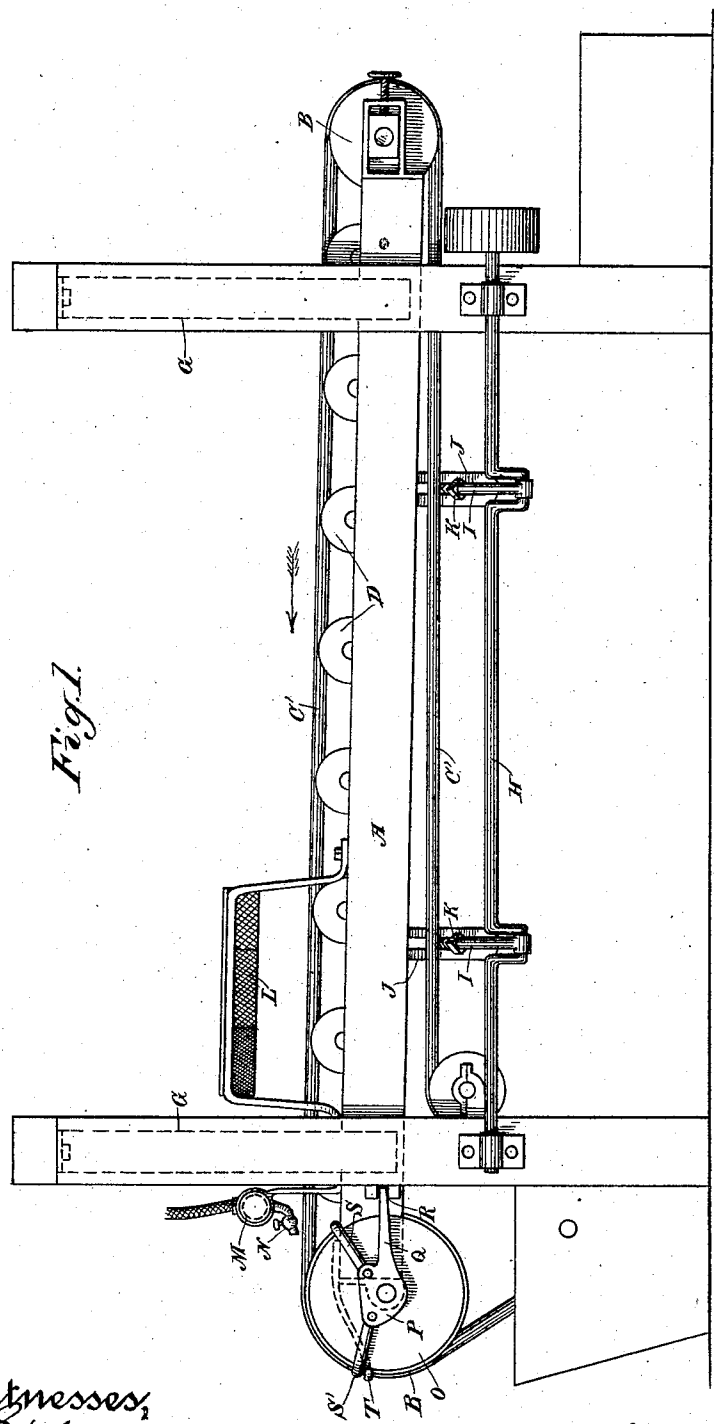


Fig. 1.

Witnesses,
J. H. Krause
H. F. Ascheck

Inventor,
James Tulloch.
By Dewey & Co. Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

J. TULLOCH.

CONCENTRATOR.

No. 486,622. Patented Nov. 22, 1892.

Fig. 2.

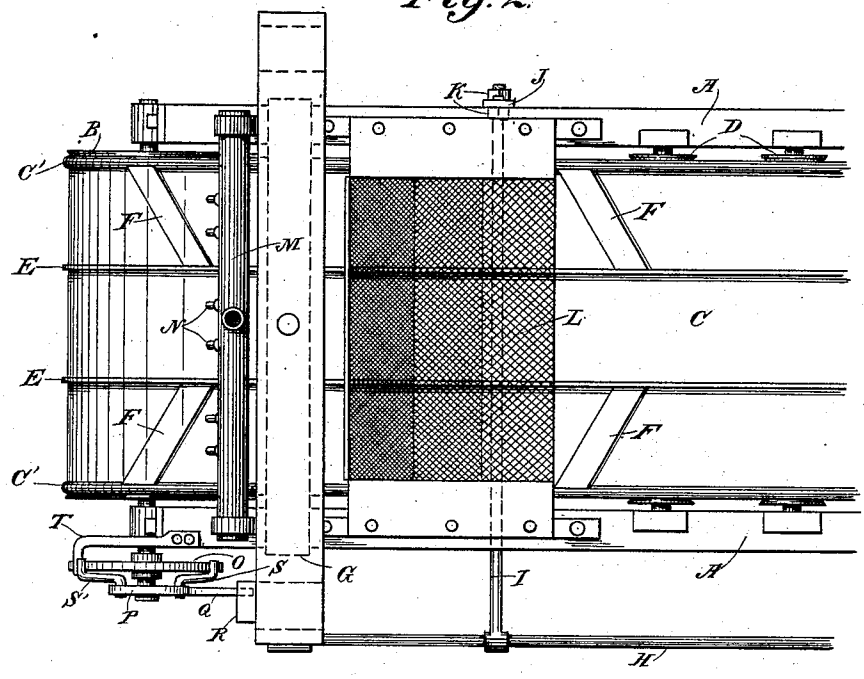
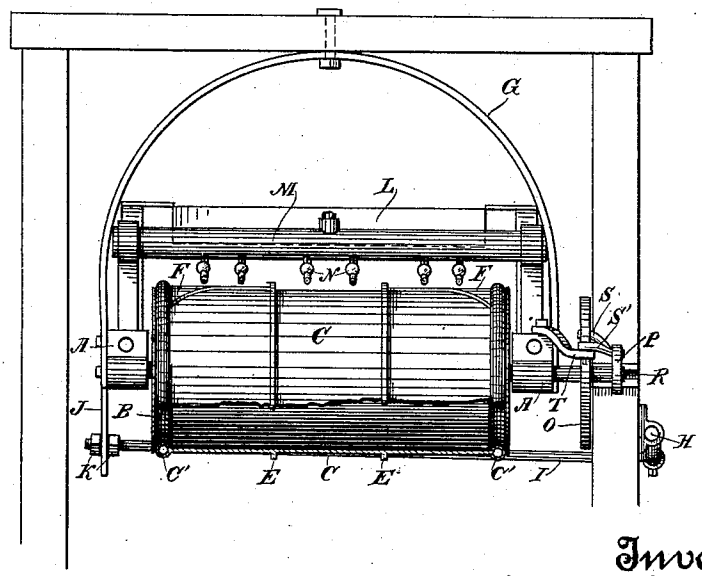


Fig. 3.



Witnesses,
F. F. Ascheck

Inventor,
James Tulloch.
By Dewey & Co.
Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JAMES TULLOCH, OF ANGELS, CALIFORNIA.

CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 486,622, dated November 22, 1892.

Application filed March 9, 1892. Serial No. 424,332. (No model.)

To all whom it may concern:

Be it known that I, JAMES TULLOCH, a citizen of the United States, residing at Angels, Calaveras county, State of California, have invented an Improvement in Concentrators; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in endless traveling-belt concentrators; and it consists in certain details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of my apparatus. Fig. 2 is a plan view of the apparatus. Fig. 3 is an end view showing a transverse section of the belt across the roller at the upper or discharge end and also the device for leveling the belt transversely and for adjusting the amount of oscillation.

A is a framework having drums B at the opposite ends, over which the endles concentrating-belt C is adapted to travel.

D D are supporting-rollers journaled at intervals along the upper side of the frame to support the upper portion of the belt in an approximately-straight line. The belt is preferably made of rubber, having upon the outer edges the endless tubular flanges C′, half of which project above the plane of the belt and half below. The drums B have grooves or channels made around them in the vertical plane of these tubular flanges, so that the lower half of each flange will travel in the grooves made at the ends of the drums and will thus serve to guide the belt and keep it in place, while the upper half of the flange, projecting above the surface of the belt, serves to keep the material from being discharged upon either side. By making these flanges tubular, they will easily flatten when they are extended in passing around the drums at either end, and will again resume their shape as soon as they have commenced traveling in a straight line. Between these outer flanges I have shown the small longitudinal endless ribs E, which project slightly above the surface of the belt and serve to separate the material upon it into distinct bodies and prevent it from moving to one side or the other of the belt. Within the outermost of these channels I form my belt with raised diagonal ribs F. These ribs are about three feet apart and each rib is about two inches in width by about one sixteenth of an inch in depth. The belt travels upon an incline in the usual manner, and these ribs converge from the outer flanges C′ toward the interior ribs or flanges E and toward the lower end of the belt, so that any material which is flowing down the inclined belt in these outer channels will be caused to converge toward the center, and this overcomes the tendency of the material to move toward the outer sides of the belt by reason of its peculiar action. The frame A is supported in an inclined position, so that the belt travels up the incline from the lower to the upper roller B, and the frame is so supported that it may be given a side-oscillating motion in any of the ways usual with this class of belts. In the present case I have shown it suspended by hangers G from a framework overhead, and at one side a crank-shaft H is journaled. This shaft is rotated by a belt or any suitable connection for the purpose, and the cranks have connecting-rods I extending from them beneath the frame A and connecting with the downwardly-projecting arms J, which are secured to the side timbers of the frame A upon the opposite side from the crank-shaft. These hangers are slotted vertically and the ends of the connecting-rods pass through these slots and are screw-threaded at this point to receive the adjusting-nuts K, one of which is upon each side of the hanger J. The table is leveled transversely by adjusting these nuts until it is in the proper position. The amount of motion given to the table depends upon the hangers to which the connecting-rods are secured. If the connecting-rods are moved upward in the slots of the hangers, so as to be very near to the table, it is manifest that the cranks will give the table a greater oscillating motion than if the rods are moved downward to the lower end of the slots, and the amount of motion is thus easily regulated by changing the position of these connecting-rods. The material to be concentrated is delivered in the form of pulp upon the upper end of a screen L, which is mounted upon the top of the frame A and extends across above the belt, as shown. The floor of this screen inclines in the same direction with the inclination of the belt, so that the material is delivered upon its upper end-nearest to the dis-

charge end of the belt and is delivered off the screen at a point farthest from the discharge end of the belt. In this respect the arrangement differs from that of other feed apparatus, which usually delivers in the direction in which the belt is traveling and toward the discharge end instead of away from it. The floor of my screen is perforated with different-sized holes, so as to form a mesh or screen opening, which is finer near the upper end and becomes coarser toward the lower or discharge end. I prefer to make the openings near the upper end of the screen of about the size known as "fifty meshes to the inch." The intermediate portion of the surface may have the mesh of forty and the lower end thirty to the inch. The pulp is delivered upon the table, and the very finest portion will pass through the upper end of the screen and fall upon that portion of the upwardly-traveling belt which is just beneath. This carries, also, the finest of the sulphurets, and they are thus separated at once from the coarser material and are not subjected to the influence of this heavier material, which is more liable to carry them away. The next coarser matter will fall through the middle portion of the screen while that which is still coarser will fall through the lower part of the screen, and any which is too coarse to fall through the screen will pass over the lower edge. I thus accomplish a separation of the different grades upon the screen before they fall upon the belt, and they are delivered upon the belt in the order of their fineness, the finest uppermost and the coarsest at the lower end. Between this screen and the upper and discharge end of the belt is a transverse water-pipe M, extending across above the belt. From the bottom of this pipe a great number of short curved pipes N project with faucets in them by which the water is allowed to drip very slowly from these pipes upon the belt, the mouths of the pipes being as close to the belt as possible to prevent too great an agitation of the fine floury sulphurets which are passing beneath. This water is sufficient to separate the lighter valueless slime from these sulphurets, the latter remaining upon the belt and being gradually carried over its upper end to be delivered below in the usual manner. In order to settle these heavy sulphurets upon the surface of the belt and bring the lighter deposits above the sulphurets, I give the belt a longitudinal shaking motion in addition to the transverse shaking motion which is produced by the suspension of the belt-frame and the crank-shaft connections with it, previously described. This longitudinal shaking motton is produced as follows: The shaft of the roller B, at the upper or discharge end, passes through the frame A, and has upon its outer end a disk O. Outside of this disk, upon the shaft, is loosely journaled a cam P, having an arm Q, which extends into a horizontal slot R upon the side of one of the frame-timbers. To opposite sides of the cam P are pivoted arms S and S′, which extend outwardly in opposite directions and are bent over so as to clasp the rim of the disk O. When the table is caused to oscillate by the motion of the crank-shaft, as before described, the arm Q slides in the horizontal slot R, and as the side of the table swings upwardly when it moves toward that side, the arm remaining horizontal, will turn the upper part of the cam toward the guide-post. This causes the hook or clutch-arm S to engage the rim of the disk O and rotate it, the shaft, and the drum B, so as to give the belt a small backward motion. When the crank turns so as to oscillate the table in the opposite direction the side adjacent to the guide swings downwardly, and as the arm Q travels in the horizontal slot R, the tendency is to rotate the cam away from the guide, because the cam is depressed with reference to the arm moving in the guide. This causes the hook or clutch S′ upon the rear side of the disk O to engage with it and cause the disk and the belt to travel forward. It is manifest that without any other connections the forward and backward motion of the belt would always be the same and the belt would not advance. In order to overcome this I have fixed an arm or stop T to the side of the oscillating frame, and it is bent so as to project beyond the front edge of the disk in such a position that the clutch-arm S′ will strike it and be disengaged from the rim O before the rim has accomplished its full forward stroke. This, however, allows the rearmost clutch S to act so as to give the belt a full forward movement; but when the table swings back again this arm or stop T, having prevented the clutch S′ from dropping to the full distance, it only swings the disk a portion of the backward stroke. The proportion of the forward and backward strokes may be made to suit the condition of the material to be concentrated. I have arranged it so that the forward stroke would be twice as much as the backward stroke, and I therefore have an oscillating motion of the belt in the direction of its length and at the same time the belt is gradually traveling upward to carry the concentrates over the upper drum or roller and deliver them at that end of the machine. By this means I am enabled to produce a more perfect concentration than heretofore.

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

1. In a concentrator, an endless traveling belt, a suspended frame having drums at opposite ends over which the belt passes, a crank-shaft at one side of the frame, connecting-rods extending from the crank-shaft to hangers which are secured to the opposite side of the frame, said hangers being perforated to admit the ends of the connecting-rods, and nuts fitting the screw-threaded ends of the connecting-rods, whereby they may be

lengthened or shortened so as to level the belt transversely, substantially as herein described.

2. In a concentrator, an endless belt, drums mounted at opposite ends of a suspended frame over which the belt passes, a crank-shaft journaled at one side of the framework, hangers secured to the opposite side of the frame and having vertical slots made in them, and connecting-rods extending from the cranks, having screw-threaded ends passing through the slots in the hangers, and lock-nuts by which the connecting-rods are raised or lowered in the slots and secured so as to increase or decrease the side oscillation of the suspended frame and belt, substantially as herein described.

3. In a concentrator, an endless inclined upwardly-traveling belt passing around drums at opposite ends of a suspended frame and a mechanism by which said frame is caused to oscillate from side to side, in combination with a screen-surface mounted upon the belt-frame with the bottom having the same inclination as the belt and formed with meshes or perforations which are finest at the upper end and gradually increasing in size from that point to the lower or discharge end of the screen, substantially as herein described.

4. A concentrator consisting of an endless traveling inclined belt passing around drums journaled transversely at opposite ends of a suspended frame, a mechanism by which the frame and belt are given an oscillation from side to side, a screen-surface mounted upon the belt-frame so as to stand above the surface of the belt and having the same general inclination with the belt, and perforations which are finer at the upper and receiving end of the screen and larger at the lower and discharge end, a water-pipe extending transversely above the belt and just above the upper end of the screen, a series of small discharge-pipes extending from said water-pipe down to a point close to the surface of the belt, and cocks or faucets whereby the discharge from these pipes is controlled, substantially as herein described.

5. A concentrator consisting of an endless traveling belt passing around rollers journaled transversely upon a suspended frame which is oscillated from side to side about its points of suspension, in combination with a disk O, clutch-arms S S′, and an actuating mechanism whereby the belt is caused to alternately advance and recede in the direction of its length and during the transverse oscillations, substantially as herein described.

6. In a concentrator, an endless traveling belt passing around drums journaled transversely at the ends of a suspended oscillating frame, a disk fixed upon the shaft of one of the drums, a cam having clutch-arms extending to the front and rear edges of the disk, with which they engage alternately, an arm projecting from the cam, and a horizontal guide-slot in which it travels, whereby the cam is oscillated upon the shaft by the side oscillations of the belt-carrying frame and the clutches are caused to engage alternately with the front and rear edge of the disk, whereby the belt is given an oscillating motion longitudinally, substantially as herein described.

7. In a concentrator, an endless traveling inclined belt passing around drums at opposite ends of a suspended transversely-operating frame, a disk fixed to the shaft of one of the drums, a cam journaled loosely upon the shaft, having clutch-arms extending in opposite directions to engage the front and rear edges of the disk, a guide-frame T, projecting from the belt-frame, a transverse horizontal guide in which the end of the cam-arm slides during the transverse oscillations of the belt-frame, whereby the cam is caused to oscillate upon the shaft and cause the front and rear clutches to engage the rim of the disk alternately, in combination with an arm or stop T, projecting from the side of the belt-carrying frame and engaging one of the clutch-arms to prevent its making a full stroke, whereby the longitudinal oscillations of the belt are greater in one direction than the other and the belt is thus caused to gradually advance during its side oscillations, substantially as herein described.

8. In a concentrator, drums journaled transversely at opposite ends of an oscillating frame, an endless traveling inclined belt passing around said rollers, having tubular flanges at the edges and intervening longitudinal ribs raised above the surface, and diagonal raised bars converging from the sides of the belt toward the central ribs and toward the lower end of the belt, substantially as herein described.

In witness whereof I have hereunto set my hand.

JAMES TULLOCH.

Witnesses:
S. H. NOURSE,
J. A. BAYLESS.