

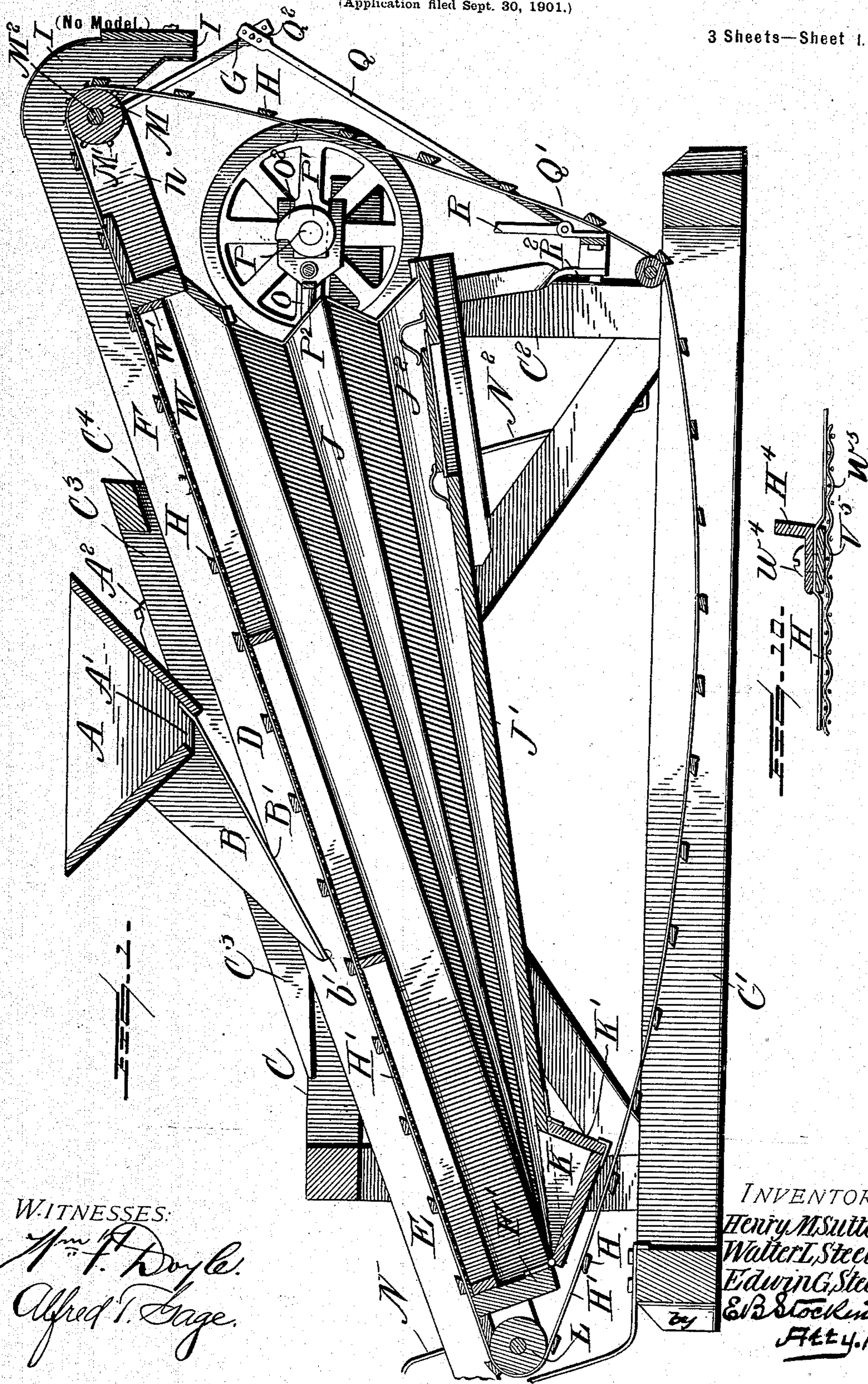
No. 714,257.

Patented Nov. 25, 1902.

H. M. SUTTON & W. L. & E. G. STEELE.
DRY ORE CONCENTRATOR.

(Application filed Sept. 30, 1901.)

3 Sheets—Sheet 1.



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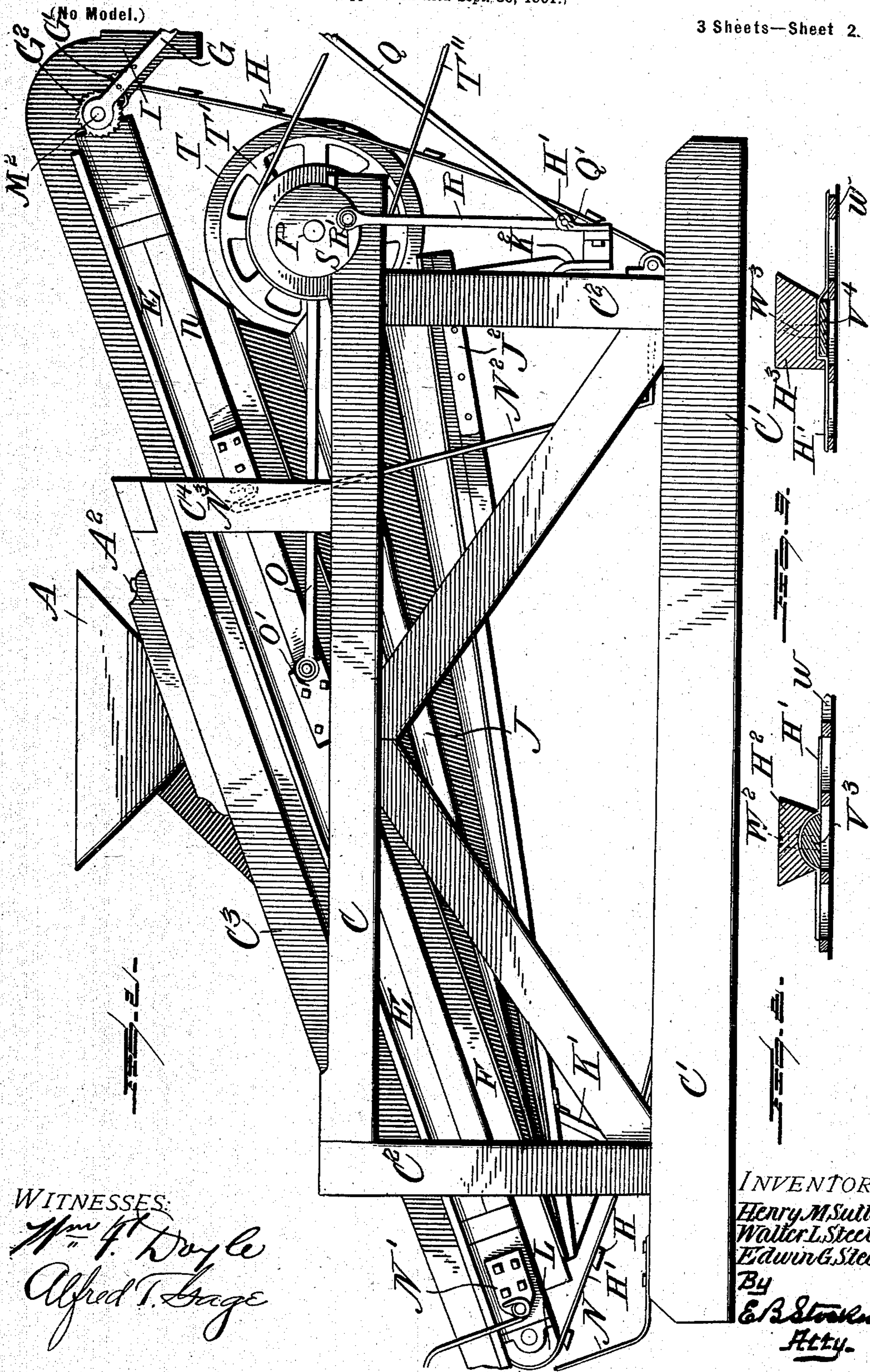
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3 Sheets—Sheet 2.



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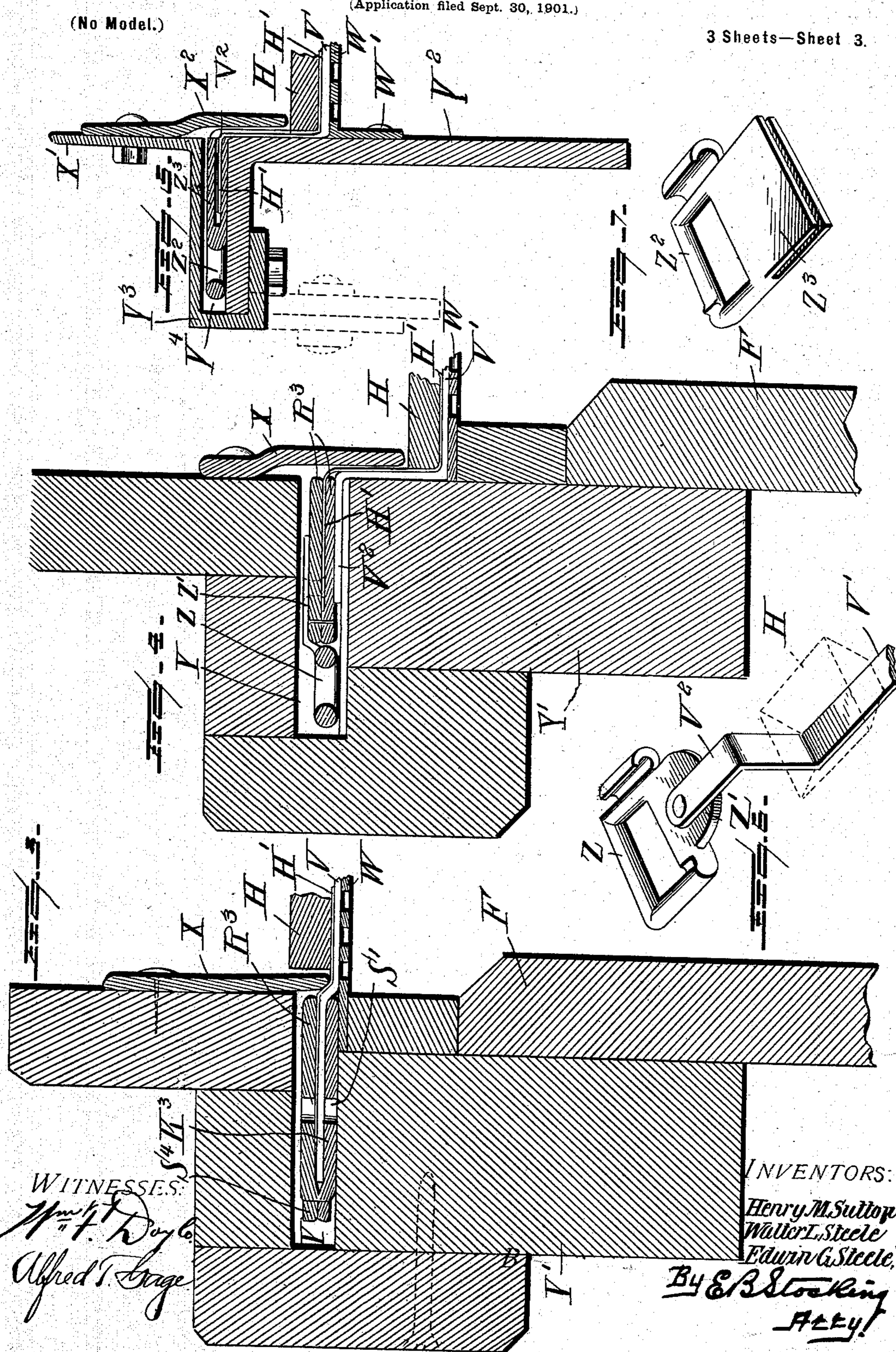
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(No Model.)

3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

HENRY M. SUTTON, WALTER L. STEELE, AND EDWIN G. STEELE, OF
DALLAS, TEXAS.

DRY ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 714,257, dated November 25, 1902.

Application filed September 30, 1901. Serial No. 77,090. (No model.)

To all whom it may concern:

Be it known that we, HENRY M. SUTTON, WALTER L. STEELE, and EDWIN GOODWIN STEELE, citizens of the United States, residing at Dallas, in the county of Dallas, State of Texas, have invented certain new and useful Improvements in Dry Ore-Concentrators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a dry ore-concentrator, and particularly to a structure embodying a pervious belt through which a body of air is passed to act upon the material resting upon said belt.

The invention has for an object to provide an improved structure embodying an intermittently-moving belt having riffles thereon and adapted to pass over a reticulated surface which communicates with a source of air-pressure, whereby the air is adapted to pass through the belt and act upon the material resting thereon.

A further object of the invention is to provide a novel and improved construction of parts for automatically timing the operation of the air-pressure device so that the discharge through the pervious belt shall be at a time when said belt is at rest.

Another object of the invention is to provide an improved construction of parts for feeding the ore to the belt and also for receiving and retaining the fine gold or mineral which may pass through the pervious belt.

Other objects and advantages of the invention will hereinafter appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 represents a central longitudinal section through the concentrator. Fig. 2 is a side elevation thereof. Fig. 3 is a detail vertical section of one means for securing the belt, riffle, and adjacent parts in their operative relation. Fig. 4 is a similar view of a modified construction of the same parts, and Fig. 5 is a similar view of a further modification adapted to secure the same general results. Fig. 6 is a detail perspective of one of the links in the conveyer-

chain shown in Fig. 5. Fig. 7 is a similar view of an adjacent link. Fig. 8 is a vertical transverse section through a reversible form of riffle and means for securing the same in position. Fig. 9 is a similar view of a modified form of riffle, and Fig. 10 is a further modified form showing the application of a metallic riffle above a screen-surface.

Like letters of reference indicate like parts throughout the several figures of the drawings.

Referring to Figs. 1 and 2, the letter C indicates a framework of any desired character—for instance, as shown, composed of a base C' and uprights C², adapted to support the frame C at opposite ends. Upon the frame C an inclined hopper-frame C³ is suitably supported, one end thereof being elevated by means of a standard C⁴, and upon this frame the hopper A is adjustably mounted—for instance, by means of the blocks A² at opposite sides thereof. The hopper A is provided with an opening A' at its lower portion communicating with a chute B, having a slatted or open bottom B', comprising what is known in the art as a "grizzly," which permits the small particles of ore fed from the hopper to drop upon the concentrator before the larger particles reach the same as they pass from the end of the bars B'.

Mounted within the frame C is the rocking working-table E, which may be supported by any desired means—for instance, by means of a spring-arm N at the lower end of the table. This arm is secured to the base at one end and at its opposite end engages a projection or pin N', carried by the lower end of the inclined working-table, while the opposite end portion of the table is supported by a spring N², secured at its lower end to the base C' and adapted at its upper end to engage a pin or projection N³, extending from the working-table E. This table is provided upon its upper face with a reticulated surface W of any desired character—for instance, a perforated plate, as shown in Figs. 3, 4, and 5, or a screen, as shown in Fig. 10. This reticulated surface is supported in position by any desired means—for instance, cross-bars W', located at suitable intervals, while at the

lower end of the working-table a bearing-roller L is journaled, and at the upper end a similar roller M is likewise supported, the latter being provided with pins or teeth M', adapted to engage conveying means secured to the edge of a pervious belt H', which is provided upon its surface with a series of riffles H, as will be more fully hereinafter described. Below the reticulated plate W a connection is made with any suitable source of air-supply—for instance, as illustrated herein, a depending frame is provided composed of side walls F and end walls F', to which flexible members J of a bellows are secured, while the opposite ends of the flexible members are closed by means of a bottom plate J', having an inwardly-opening valve J² and provided at its lower portion with a pocket K, adapted to receive and retain any gold or other mineral which may pass through the pervious belt into the bellows, from which pocket the mineral may be removed by means of a door or closure K'.

Any desired means may be used for intermittently moving the riffle-belt, imparting motion to the table, and operating the bellows; but as illustrating one desirable form a driving-shaft P is shown as supported upon suitable bearings in the frame C and provided with a cam P', adapted to contact with a pin or projection P², carried at one end of a pitman O, which is pivotally connected to its opposite end to a pin or projection O', extending from the working-table. The free end of this pitman O is provided with a bifurcated portion O², adapted to fit upon opposite sides of the shaft P, so as to bring the projection P² into the same vertical plane as the cam P' in order that the cam may strike the pin and force the table in one direction, thus placing the springs N and N² under tension to restore the table to its initial position. It will be noted that the pin P², which may carry a friction-roller, does not rest in contact with the cam when the parts are without motion, so that the reaction of the springs throws this pin or roller into contact with a face of the cam, thus producing a bumping blow in addition to the rocking action imparted to the table. For the purpose of operating the bellows a disk crank S is applied to the driving-shaft P and has eccentrically mounted thereon one end R' of a crank-rod R, which extends to the connecting-rod R² from the bottom of the bellows, so as to impart a reciprocatory motion thereto. In order to secure from this same driving-shaft and disk crank a proper intermittent feed for the riffle-belt, a connecting-rod Q is secured at its lower end Q' to the bellows-rod R² and at its upper end Q² connected to the free end of a lever G, which carries a spring-held pawl g', adapted to cooperate with a ratchet-wheel G², secured upon the journal or axis of the roll M, so that in the downward movement of the free end of the lever G a partial rotation is imparted to said roll in order to feed the belt

over the reticulated face of the bellows-box in the downward movement of the bellows and when no air is passed through the belt. 70

As illustrating a desired form of securing the riffle to the belt and of driving the belt a construction is shown in Fig. 3 in which a slot Y is provided at the sides of the working-table by any desired means—for instance, a framework Y', supported by the side board F of the bellows-box—which slot is in the same horizontal plane as the upper face of the reticulated cover-plate W. The riffle-holder V in this form of the invention is placed beneath the pervious belt H', while the riffle H is adapted to seat upon the holder V, thus securing the riffle to the belt and permitting its removal when desired. The outer end of the riffle-holder V is passed between the doubled or folded belt R³ and secured to the lower member thereof, while each of these belts is provided with an aperture S' at regular intervals, adapted to mesh with pins or teeth in the roll M, as shown in Fig. 1, which serve to keep the opposite edges of the pervious belt in exact alinement with each other. It will be seen that in assembling the belt or changing the cloth thereof in case of a tear or other injury the riffles H may be removed and the cloth belt laid over the riffle-holders V and placed between the double belts R³, after which the riffles are replaced, which holds the cloth securely in position. This construction of double belt prevents the air from escaping through the slot Y around the edges of the cloth, as would otherwise occur. A guard-strip X of leather or other suitable material is placed at the side of the table to prevent the ore from leaving the table and working into the slot Y. 80 85 90 95 100 105

In Fig. 4 a further modification is shown embodying the same construction practically, with the exception that the reticulated cover W is placed in a lower horizontal plane than the slot Y, while the riffle-holder V' is provided with an upturned or angular end portion V², by which it is secured to the double belt R³ in the manner hereinbefore described. In the present form of the invention a link Z, provided with a securing-lip Z', is shown as disposed within the slot Y and secured to the upper layer of the double belt in order to form a means for moving the pervious belt intermittently. 110 115 120

In Fig. 5 another modification is shown in which the side boards, riffles, and adjacent parts are adapted to be constructed entirely of metal, the riffles being of the general construction shown in Fig. 10. In this form of the invention the side plate Y² is connected with an angle-plate Y³ to form a slot Y⁴, while the upper projection X' of this plate Y³ is adapted to receive a guard-strip X². In this form of the invention the reticulated plate W is adapted to be secured in position by means of the flange W', bolted to the plate Y², while the riffle-plate V' is provided with the angular portion V², as shown in Fig. 6, which is 125 130

bolted directly to the lug Z' , carried by the link Z . This link coöperates with a link-plate adapted to pass over the teeth or pins upon the roll M and between the riffle-holding members of the belt. Links Z^2 are provided having at one side an open slotted portion Z^3 , adapted to receive the edges of the cloth belt between the riffles, and thus carry the belt to prevent sagging thereof.

In Fig. 8 a form of riffle is shown at H^2 which is adapted to be secured to the riffle-holder V^3 , having the curved upper face, by means of a securing screw or bolt W^2 . This riffle has opposite inclined faces and is adapted to be reversed, while the attachment to the holder V^3 is such as to avoid all sharp edges or corners for the belt to travel over or around, thus preventing injury to the belt.

In Fig. 9 a form of riffle is shown at H^3 having an angular seat adapted to rest upon the holder V^4 and to be secured thereto by a securing means W^3 , passed through the holder in the under side of the belt.

In Fig. 10 a form of metallic riffle is shown at H^4 adapted to be secured to a holding-plate V^5 by means of a fastening device W^4 , so as to accomplish the objects of the invention. In this form of the invention a screen-surface W^5 is shown, which is regarded as the equivalent of the reticulated surface W shown in other figures of the drawings.

By reference to the foregoing description it will be seen that in the operation of the machine a rocking and bumping movement is imparted to the table, while a pneumatic action is obtained upon the pervious belt, by means of which the machine is automatically self-cleaning and capable of two independent concentrates in which the fine flour metal which may pass through the pervious belt and the larger values and gravel which are carried over the roll M are deposited, through the hopper I , into any desired receptacle. In securing this action the disposition of the feed-hopper is an important element, as by securing the feed of the larger material at a point below the longitudinal center of the riffle-belt a better separation and concentration is secured. It will be observed that the larger gravel and ore will be discharged from the lower end of the chute or grizzly B , while the smaller particles will pass through the slats of the grizzly and reach the pervious belt at a point nearer its upper end. The smaller values thus reach the table first and are caught in the riffles, while the larger gravel falling upon the table at the lower end of the grizzly reaches the riffles already partially filled with material which has passed down the table and is consequently more easily forced over the same in the rocking and bumping action of the table until it is deposited at the lower end of the table with the least possible work and in the shortest time, as such gravel usually contains only large nuggets, which can easily force their way downward to the riffle. The portion of the table above the feed-hopper is

subjected to the air-blast and vibratory motion, which has a tendency to remove from the riffles the surplus gravel as the pervious belt travels upward, so that by the time the top of the table is reached the riffles have been practically cleaned of all excepting the values and a small portion of the gravel. The air-blast passing through the belt, which is of porous or pervious material, causes a certain amount of friction between the larger particles and gravel by which the fine metal adhering to such particles is removed therefrom and falls upon the belt, through which it passes in the downward or suction movement of the bellows, thus falling to the bottom thereof and finally collecting in the pocket K , from which it can be removed. At each opening or downward movement of the bellows an upward movement of the belt is imparted through the rod Q and lever G to present a clean riffle at the bottom of the belt simultaneously with the discharge of a riffle at the upper end of the belt. It will be observed that the belt does not move through the upward stroke of the bellows, so that the action of the air upon the ore is not distributed, as the intermittent action only occurs in the opening or suction movement of the bellows. The rocking or bumping action upon the table causes the metal or values which are heavier than the gangue to reach the table first, where they are securely held in the riffles and settled therein by the blow or bump from the cam, after which the gentle rocking of the table by the springs upon which it is supported further tends to settle the metal in the riffles and even the layers of ore upon the table and also to shake the top layers downward toward the lower end of the table, where they are discharged into a suitable receptacle or conveyer. It will be noted that the intake J^2 in the bottom of the bellows is held under tension by means of springs, as shown in Fig. 1, in order to secure the desired suction through the belt in the downward movement of the bellows, although it is desirable that some air should be admitted through this intake in order to permit the free feed movement of the belt through the downward movement of the bellows.

In the use of stationary riffles the same constantly become clogged, for no matter how many times the ore is screened nor how carefully there is always a certain amount of fine gold which adheres to the larger particles and is brushed off on the table by the friction of the particles against each other. This fine mineral ordinarily remains on the table and eventually packs in the riffles, causing a loss of the gold, while in the present invention the table or belt carrying the riffles is moved so as to present clean riffles at the bottom and to deposit the values of fine gold at the top. The structure herein presented completely prevents the clogging of the riffles, which constantly occurs in all types of dry concentrators having stationary riffles.

It is obvious that changes may be made in the details of construction and configuration of the several parts without departing from the spirit of the invention as defined by the appended claims.

Having described the invention, what is claimed is—

1. In a dry ore-concentrator, a framework, a working-table thereon, an inclined pervious belt movably mounted on said table to discharge by gravity at its lower end, an air-chamber beneath the belt having an inclined bottom thereto, a receptacle within said chamber at the lower end thereof to collect and retain by gravity metal falling in said chamber, means for producing an intermittent blast and suction action upon a face of said belt, and means for moving said belt during the suction action; substantially as specified.

2. In a dry ore-concentrator, a framework, a working-table thereon, an inclined pervious belt movably mounted on said table to discharge by gravity at its lower end, an air-chamber beneath the belt having an inclined bottom thereto, a receptacle within said chamber at the lower end thereof to collect and retain by gravity metal falling in said chamber, means for producing an intermittent blast and suction action upon a face of said belt, means for moving said belt during the suction action, a reticulated surface in supporting contact with said belt, and means for mounting said table to permit a reciprocation thereof in a downward plane at an angle to the base; substantially as specified.

3. In a dry ore-concentrator, a framework, a working-table therein, an inclined pervious belt to permit the passage of fine ore there-through and movably mounted upon said table to discharge by gravity at its lower end, riffles secured to said belt, a discharge at one end of said belt from said riffles, means for longitudinally vibrating said table and belt, a receptacle beneath said belt comprising an inclined bellows having at its lower end a pocket to retain metal passing therethrough, means for actuating said bellows to produce an intermittent blast and suction action upon a face of said belt, and means for intermittently moving said belt; substantially as specified.

4. In a dry ore-concentrator, a framework, a working-table therein, an inclined pervious belt to permit the passage of fine ore there-through and movably mounted upon said table to discharge by gravity at its lower end, riffles secured to said belt, a discharge at one end of said belt from said riffles, a receptacle beneath the lower end of said belt to retain metal passing therethrough, a bellows comprising part of said receptacle for producing an intermittent blast and suction action upon a face of said belt, means for intermittently moving said belt, and means for longitudinally vibrating said table and belt; substantially as specified.

5. In a dry ore-concentrator, a framework,

a working-table therein, an inclined pervious belt to permit the passage of fine ore there-through and movably mounted upon said table to discharge by gravity at its lower end, riffles secured to said belt, a discharge at one end of said belt from said riffles, a reticulated surface upon which the upper layer of said belt travels, a receptacle beneath said belt comprising a bellows having a pocket at its lower end to retain metal passing there-through, means for operating said bellows to produce an intermittent blast and suction action upon a face of said belt, means for intermittently moving said belt, means for longitudinally vibrating said table and belt, and a feed-chute extending longitudinally of said belt having a slatted bottom; substantially as specified.

6. In a dry ore-concentrator, a framework, a working-table therein, an endless pervious belt to permit the passage of fine ore there-through and movably mounted upon said table, riffles secured to said belt, a receptacle beneath said belt to retain metal passing therethrough, means for producing an intermittent blast and suction action upon the face of said belt next said receptacle, means for intermittently moving said belt, and a reticulated surface in supporting contact with said belt and above said blast and suction device; substantially as specified.

7. In a dry ore-concentrator, the combination with a framework, of a working-table supported therein for vibration, an inclined bellows secured to the under face of said table, a reticulated surface at the upper face of said table, an endless pervious belt in supporting contact with said surface and provided with riffles adapted to pass over said reticulated surface, a discharge from the riffles of said belt at one end thereof, an ore-collecting pocket at the lower end of said bellows, and means for vibrating said working-table; substantially as specified.

8. In a dry ore-concentrator, the combination with a framework, of a working-table supported therein upon spring-supports for longitudinal vibration, a bellows secured to the under face of said table, a reticulated surface at the upper face of said table, an endless pervious belt provided with riffles adapted to pass over said reticulated surface, a discharge from the riffles of said belt at one end thereof, a driving-shaft provided with a cam, a pitman connected to said table between its ends and having a bifurcated end adapted to embrace said driving-shaft, and a projection from said pitman end in the path of the cam and normally held out of contact with the shortest face of said cam by said spring-supports; substantially as specified.

9. In a dry ore-concentrator, the combination with a framework, of a working-table supported therein for vibration, a bellows secured to the under face of said table, a reticulated surface at the upper face of said table, an endless pervious belt in supporting

contact with said surface and provided with riffles adapted to pass over said reticulated surface, a discharge from the riffles of said belt at one end thereof, a driving-shaft provided with a cam, a pitman connected to said table between its ends and having a bifurcated end adapted to embrace said driving-shaft, a projection from said pitman normally held out of contact with the shortest face of said cam, a crank carried by said driving-shaft, and a rod extending from said crank to the lower portion of said bellows; substantially as specified.

10. In a dry ore-concentrator, the combination with a framework, of a working-table supported therein for vibration, a bellows secured to the under face of said table, a reticulated surface at the upper face of said table, an endless pervious belt in supporting contact with said surface and provided with riffles adapted to pass over said reticulated surface, a discharge from the riffles of said belt at one end thereof, a driving-shaft provided with a cam, a pitman connected to said table between its ends and having a bifurcated end adapted to embrace said driving-shaft, a projection from said pitman normally held out of contact with the shortest face of said cam, a crank carried by said driving-shaft, a rod extending from said crank to the lower portion of said bellows, a ratchet-lever for intermittently feeding a driving-roller for said belt, and a connecting-rod from the free end of said lever to the rod from said crank; substantially as specified.

11. In a dry ore-concentrator, the combination with a framework, of a working-table supported therein for vibration, a bellows secured to the under face of said table, a reticulated surface at the upper face of said table, an endless pervious belt provided with riffles adapted to pass over said reticulated surface, a discharge from the riffles of said belt at one end thereof, a driving-shaft provided with a cam, a pitman connected to said table and having a bifurcated end adapted to embrace said driving-shaft, a projection from said pitman spaced from the shortest face of said cam, a crank carried by said driving-shaft, a rod extending from said crank to the lower portion of said bellows, a ratchet-lever for intermittently feeding a driving-roller for said belt, a connecting-rod from the free end of said lever to the rod from said crank, and a feed-hopper having a discharge-chute at its lower portion with an apertured bottom to permit the feed of fine and larger material at different points upon said belt; substantially as specified.

12. In a dry ore-concentrator, the combination with an inclined work-table, a reticulated surface for the same, a pervious belt in supporting contact with said surface and provided with riffles upon its face, and a feeding-chute disposed below the mid-length of said belt and having a slotted bottom extending longitudinally of the belt to discharge dif-

ferent grades of material at different points upon said belt; substantially as specified.

13. In a dry ore-concentrator, the combination with a working-table, of a reticulated surface thereon, a traveling pervious belt upon said table in supporting contact with said surface, riffles secured to said belt, a bellows secured to the lower portion of said table, an ore-receptacle at one end of said bellows, means for operating said bellows, and means for moving said belt during the movement of the bellows in one direction; substantially as specified.

14. In a dry ore-concentrator, the combination with a working-table, of a reticulated surface thereon, a traveling pervious belt upon said table in supporting contact with said surface, riffles secured to said belt, a bellows secured to the lower portion of said table, means for operating said bellows to blast through the belt when at rest, means for moving said belt during the movement of the bellows to produce a suction through the belt, a pocket at the lower portion of said bellows, and an inlet to said bellows; substantially as specified.

15. In a dry ore-concentrator, a pervious belt, a slotted casing at the side of said belt, a conveying means for said belt adapted to receive and overlap the edge of said belt, a riffle-holder extending beneath said belt and secured at its outer end to said conveying means, and a riffle secured to said holder above said belt; substantially as specified.

16. In a dry ore-concentrator, a pervious belt, a slotted casing at the side of said belt, a conveying means for said belt adapted to receive and overlap the edge of said belt, a riffle-holder extending beneath said belt and secured at its outer end to said conveying means, a riffle secured to said holder above said belt, and a guard-flap disposed between said slots and the center of the belt; substantially as specified.

17. In a dry ore-concentrator, a belt, a riffle-holder adapted to lie upon one side of said belt, and a riffle having opposite beveled faces secured to said holder at the opposite side of said belt; substantially as specified.

18. In a dry ore-concentrator, a traveling belt provided at its edges with conveying means to embrace the same, a riffle-holder extending transversely beneath said belt and secured to said conveying means, and a riffle secured to said holder above said belt; substantially as specified.

19. In a dry ore-concentrator, the combination with an inclined working-table, of a pervious belt to permit the passage of fine ore therethrough and adapted to travel thereover, riffles upon the surface of said belt adapted to discharge over the upper end thereof, and an inclined bellows-casing having a pocket at its lower portion to retain finer metal which may pass through said belt; substantially as specified.

20. In a dry ore-concentrator, the combina-

tion with an inclined working-table, of a reticulated surface thereto, a pervious belt to permit the passage of fine ore therethrough and adapted to travel thereover in contact with a reticulated surface, riffles upon the surface of said belt adapted to discharge over the upper portion thereof, a bellows beneath said belt provided with a pocket at one end to retain finer metal which may pass through said belt, and means for producing a blast of air through said belt, while at rest for agitating the material thereon; substantially as specified.

21. In a dry ore-concentrator, the combination with an inclined working-table, of a pervious belt to permit the passage of fine ore therethrough and adapted to travel thereover in contact with a reticulated surface, riffles upon the surface of said belt adapted to discharge over the upper portion thereof, a bellows beneath said belt provided with a pocket at one end to retain finer metal which may pass through said belt, means for producing a blast of air through said belt while at rest for agitating the material thereon, and means for producing a suction through said belt to remove therefrom particles of metal carried thereby; substantially as specified.

22. In a dry ore-concentrator, the combination with an inclined working-table, of a pervious belt to permit the passage of fine ore therethrough and adapted to travel thereover in contact with a reticulated surface, riffles upon the surface of said belt adapted to discharge over the upper portion thereof, a bellows beneath said belt provided with a pocket at one end to retain finer metal which may pass through said belt, means for producing a blast of air through said belt while at rest for agitating the material thereon, means for producing a suction through said belt to remove therefrom particles of metal carried thereby, and means for moving said belt simultaneously with said suction action; substantially as specified.

23. In a dry ore-concentrator, the combination with an inclined working-table, of a per-

vious belt to permit the passage of fine ore therethrough and adapted to travel thereover in contact with a reticulated surface, riffles upon the surface of said belt adapted to discharge over the upper portion thereof, a bellows beneath said belt provided with a pocket at one end to retain finer metal which may pass through said belt, means for producing a blast of air through said belt while at rest for agitating the material thereon, means for producing a suction through said belt to remove therefrom particles of metal carried thereby, means for moving said belt simultaneously with said suction action, and a feed device adapted to feed fine material at a higher point upon said belt than the coarser material; substantially as specified.

24. In a dry ore-concentrator, the combination with an inclined working-table, of a pervious belt to permit the passage of fine ore therethrough and adapted to travel thereover in contact with a reticulated surface, riffles upon the surface of said belt adapted to discharge over the upper portion thereof, a bellows beneath said belt provided with a pocket at one end to retain finer metal which may pass through said belt, means for producing a blast of air through said belt while at rest for agitating the material thereon, means for producing a suction through said belt to remove therefrom particles of metal carried thereby, means for moving said belt simultaneously with said suction action, a feed device adapted to feed fine material at a higher point upon said belt than the coarser material, and means for producing a rocking and bumping action of said table during the concentration of ore thereon; substantially as specified.

In testimony whereof we affix our signatures in presence of two witnesses.

HENRY M. SUTTON.
WALTER L. STEELE.
EDWIN G. STEELE.

Witnesses:

J. C. JOHNSON,
EDWIN J. CARONS.