

W. E. WINNIE & J. E. SEELEY.

DRY ORE CONCENTRATOR.

APPLICATION FILED OCT. 30, 1911. RENEWED JUNE 3, 1913.

1,083,172.

Patented Dec. 30, 1913.

3 SHEETS—SHEET 1.

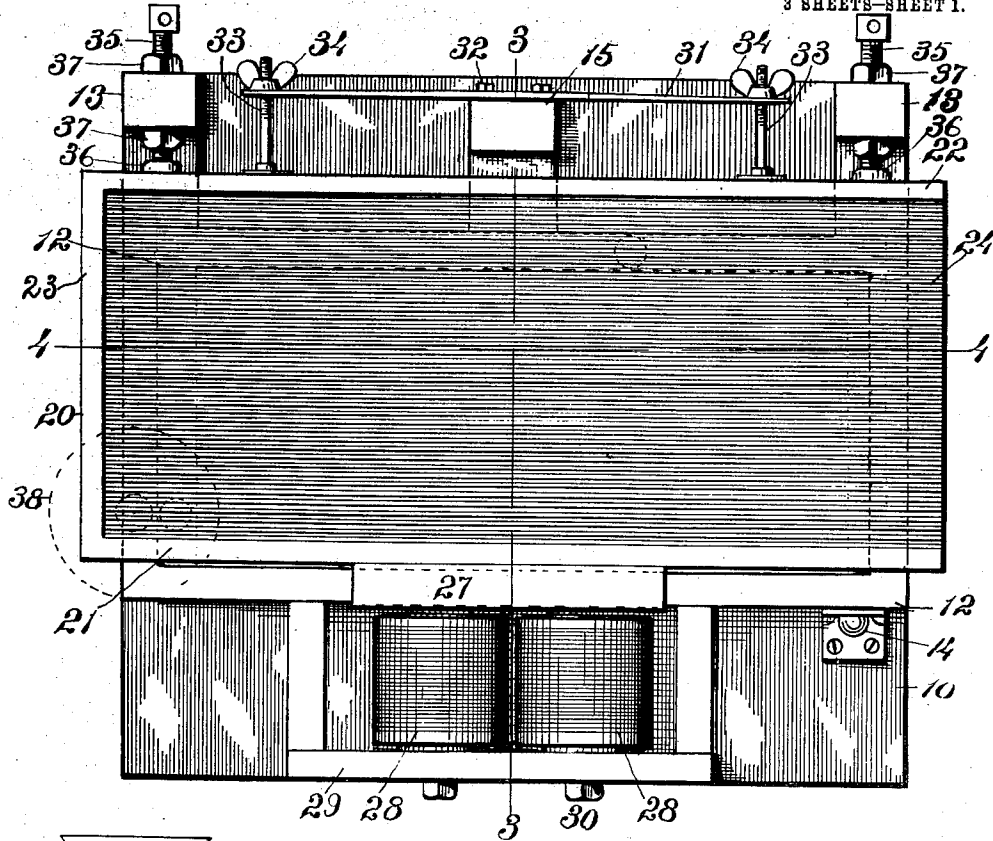


Fig. 1.

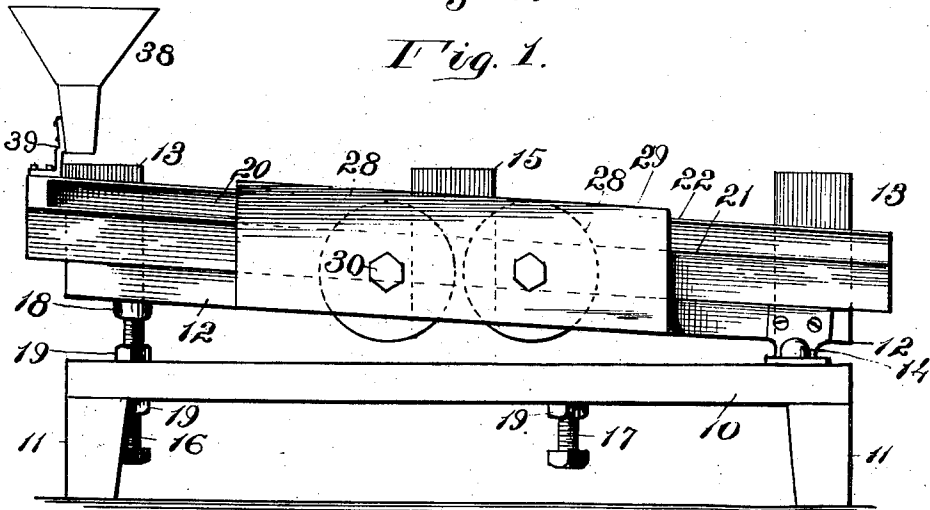


Fig. 2.

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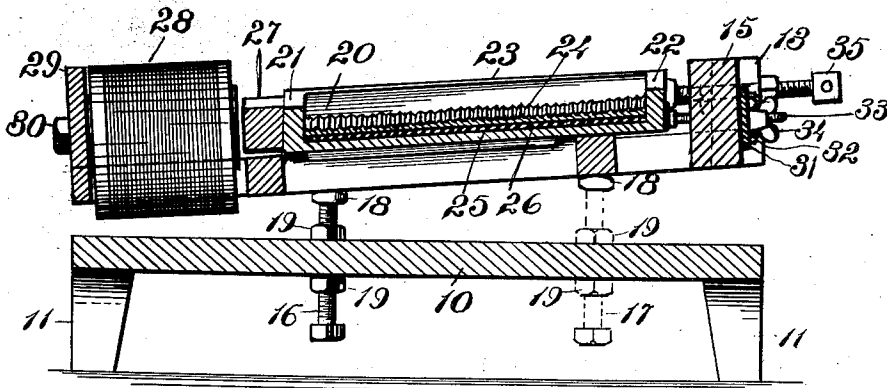


Fig. 3.

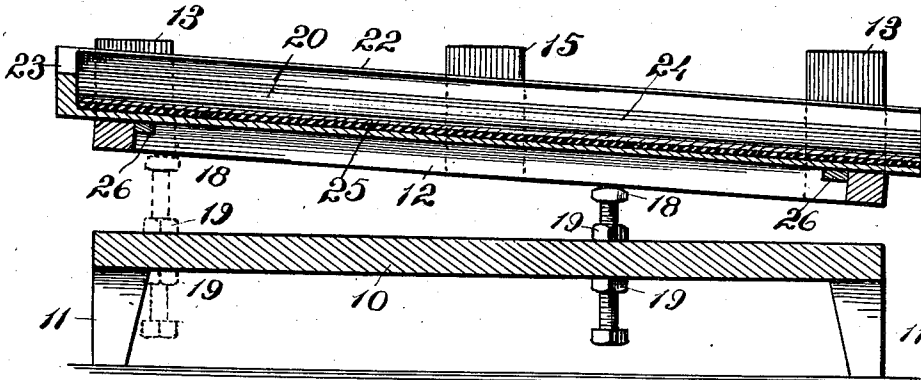


Fig. 4.

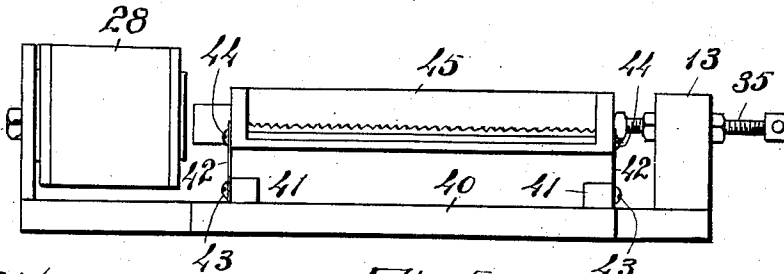


Fig. 5.

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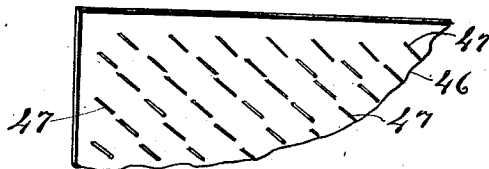


Fig. 7.

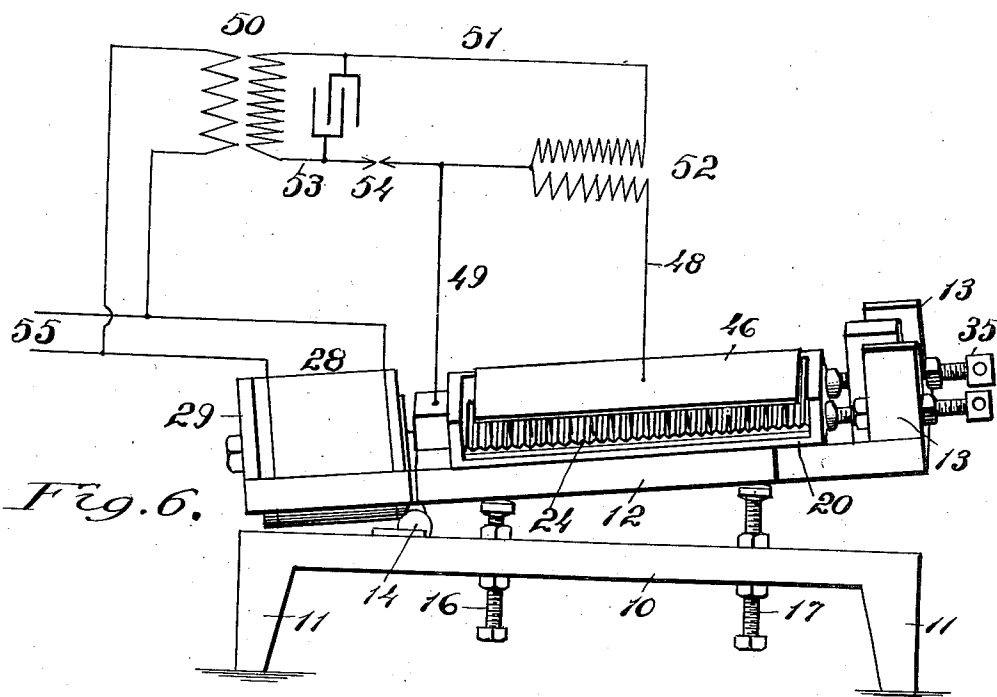


Fig. 6.

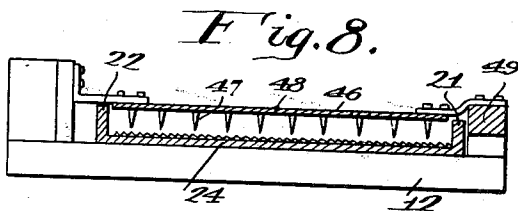


Fig. 8.

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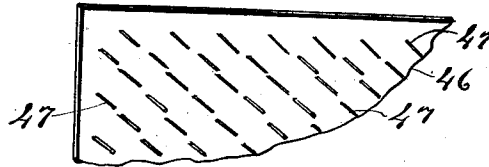


Fig. 7.

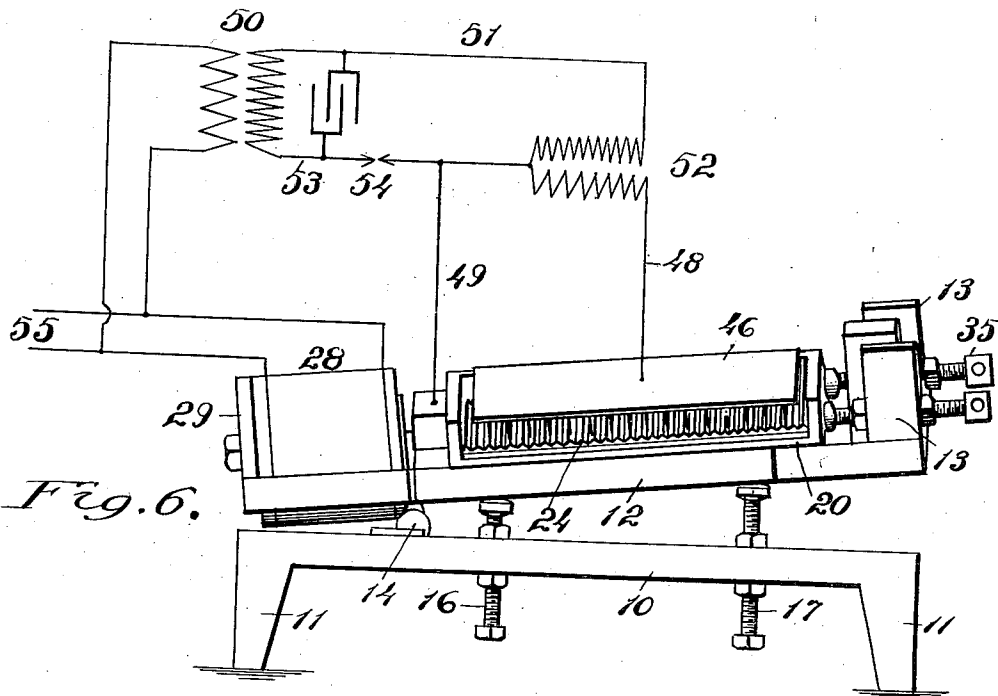


Fig. 6.

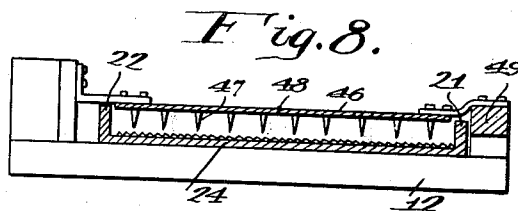


Fig. 8.

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UNITED STATES PATENT OFFICE.

WILLIAM E. WINNIE AND JAMES E. SEELEY, OF LOS ANGELES, CALIFORNIA.

DRY ORE-CONCENTRATOR.

1,083,172.

Specification of Letters Patent.

Patented Dec. 30, 1913.

Application filed October 30, 1911, Serial No. 657,561. Renewed June 3, 1913. Serial No. 771,531.

To all whom it may concern:

Be it known that we, WILLIAM E. WINNIE and JAMES E. SEELEY, citizens of the United States, and residents of the city and county of Los Angeles, State of California, have invented certain new and useful Improvements in Dry Ore-Concentrators, of which the following is a specification.

Our invention pertains to mechanism for separating metal from crushed ore or rock, and it has special reference to dry ore concentration, in which the metal bearing rock is finely ground, and the valuable metal therein is separated from the rock while in a dry state by a combination of mechanical and electrical means.

The metallic particles in a ground product have a greater mass than the non-metallic particles, hence when in movement, have a greater momentum than the non-metallic particles. Advantage is taken of this physical condition of the particles, in this invention. It is also well known in the art to which this appertains, that a high tension high frequency electric current causes the coherence of metallic particles and one of the great difficulties attending the concentration of metallic particles in a mass of finely divided or crushed metal bearing rock, is to so move and distribute the mass as to make concentration possible in a commercial way. We accomplish this by the combination of two agencies coöperating with each other, each agency being in itself capable of producing the concentration more or less efficiently.

A crushed or ground mass of metal bearing rock is difficult to handle in any form of mechanism heretofore devised, for the reason that the cohesion between the particles is very great and the tendency is to move *en masse* along a table or receptacle on or in which it may be treated, and the first essential is to secure absolute separation between the particles making up the mass, and this separation can be effected by imparting a high rate of vibration to the table or receptacle, and while the cohesion between the particles is thus neutralized the electrical action becomes effective and efficient.

One of the objects of the invention is to provide a table or vibration body so constructed and arranged that the metal-

lic portion, or the concentrates, will to a great extent be separated from the lighter or non-metallic particles. To accomplish this we provide a table with shallow longitudinal riffles, which is so mounted that it is inclined longitudinally and transversely, the lower or discharge margin of the table having an open end, so that the crushed rock and concentrates may be freely discharged therefrom; and further, in so locating the supply funnel at the lower side of the upper end of the table that the mass of the crushed rock and ore is compelled to travel up the incline and across the riffles while at the same time moving downwardly toward the discharge end of the table. The impulses which are imparted to the transversely vibrating table, are brought about, preferably, by an electromagnet, located at the lowest side of the table, and the elevated side of the table has a pair of adjustable springs, or other retractile means, to normally keep the armature, which is attached to the table normally separated from the electro-magnets, and in so arranging a pair of the springs that at each release of the magnetic impulse the springs, will draw the table forcibly against abutments in order to effect the separation.

A further object is to provide the elementary components of a high tension high frequency electric circuit which, by its action on the crushed mass, is such that the metallic particles are carried over to one side and separated from the non-metallic portions. In accomplishing this we make the concentrating table one of the electric terminals and also provide a terminal substantially the same size as the table, which constitutes a terminal plate, provided with discharge points, so that the crushed mass, in its movement over the table is under the influence of the discharge terminals in order to bring about the complete concentration of the metallic particles, all of which will now be set forth in detail.

In the accompanying drawing Figure 1 is a top or plan view. Fig. 2 is a front elevation of the concentrator. Fig. 3 is a vertical cross section of the concentrator, on line 3 of Fig. 1. Fig. 4 is a vertical cross section of the concentrator, on line 4 of Fig. 1. Fig. 5 is an end view of the concentrating

table and the frame supporting it, showing a modified form of mounting the table. Fig. 6 is an end view of the concentrating mechanism, with a diagrammatic view of the high tension high frequency current connected up therewith. Fig. 7 is a perspective view of a portion of the plate terminal employed above the concentrating table. Fig. 8 is a cross section of a dielectric rifled bed and one of the terminal plates.

In constructing our invention we provide a base 10, preferably mounted on legs 11. On this base we mount a rectangular frame 12, one corner of the same being secured to what is herein designated as the discharge end of the machine, by means of a ball and socket joint or hinge 14, the corner so secured to the base being normally the lowest part of the frame, since the head or opposite end of the frame is adapted to be elevated, and permanently held by means of adjustable set bolts. A set bolt 16, at the end of the frame is placed at the same side of the table as carries the hinge 14, while the other set bolt 17 is located beneath the frame at the opposite side. The rear side of the frame has at each corner a short upwardly-projecting post 13, and a short intermediate post 15. Each of the bolts 16, 17, has a head 18, which rests against the under side of the frame, and they are screw threaded so they pass through the base 10, and are each provided with a jam nut 19, on each side of the base, so they may thus set the bolts firmly at any position after adjustment. In practice the frame 12 has a vertical motion only, as the hinge 14 and the set bolts 16, 17, prevent any lateral or longitudinal movement. We place a rectangular table 20 on this frame, which has side bars 21, 22, and a bar 23, at the head of the table. The receiving bed of the table, which is glass or other suitable dielectric material, has longitudinal grooves or riffles 24, extending from end to end, these grooves being small or shallow, and beneath this dielectric bed is a metal plate 25, provided the table itself is not made of metal. The table may or may not be mounted on anti-friction means on the frame 12, but in either case the table should be provided with cleats 26, or other suitable means, to keep the table from moving longitudinally while permitting a limited lateral play.

Secured to the side bar 21, or the table is an armature 27, and suitable electro-magnets 28 are secured by cap-screws 30, to a post 29, extending up from the frame. On the opposite margin of the table 20 is a flat spring 31 secured by cap-screws 32, midway between its ends, to the post 15, and through each end of the spring is a threaded stem 33, secured to the side bar 22 of the table. A thumb nut 34, on each stem 33, is adapted to press against the spring and thus nor-

mally hold the armature 27 away from the magnets.

Each of the corner posts 13 has an inwardly-projecting screw 35, the inner end of which has a head 36, normally resting against the side bar 22, of the table 20, and an adjusting nut 37 is placed on each side of the post, so that the vibration of the table will not cause the screws to change their position.

From the foregoing description it will be seen that the table has a slight lateral vibration, the line of the vibration being at right angles to the grooves of the table, and the supply hopper or funnel 38, is at the lowest point of the head of the table. It will further be observed that the highest point of the table is directly across from the funnel, so that the ground ore, after being discharged from the funnel to the vibrating table, is caused to travel diagonally across and down the table.

In action the electro-magnets at the lowest edge of the table draw over the table by magnetic means, against the pull of the retractile spring, and the abutments 36, being located in such a position that when the table is released from its magnetic pull, the return of the table is stopped by the abutments, whereby the inertia of the ground ore carries it up and over the riffles to the highest side or margin of the table. This action of the mechanism has the effect of causing a separation of the metallic and non-metallic particles, because it is obvious that the heavier or metallic particles, having a greater mass, will be impelled farther along in their course across the table, than the non-metallic particles, and therefore, the metallic particles will find their way to the highest margin of the table, and eventually be discharged as concentrates, while the non-metallic particles will find their way to the discharge end of the table along the lowest margin.

It is obvious that we may use any form of electrically-operated vibrating mechanism for actuating the table, or any suitable mechanical structure, and that a plurality of magnets may be employed; and further we may use electro-magnets on each side of the table thereby dispensing with the spring, but we find it essential to employ the abutments in either form of construction.

The riffles should be made of glass, or other material which will assure a smooth surface to prevent lodgment of the ground particles, and to assure a free movement of the mass, and the riffles should be shallow and evenly formed.

In practice the hopper or funnel should be attached to the table by a bracket 39, or otherwise, as thereby the ground ore will be constantly freed from the funnel and thus assure a positive and steady flow.

We prefer to mount the table on the frame in the manner shown in Fig. 5, in which case the frame 40, which carries the table, has a pair of longitudinal bars 41, on the outer side of each of which is a vertical metallic strip 42, the lower edge of each strip being secured to the bar 41 by screw 43, or otherwise, and the upper edge of each strip is secured by screws 44 to the edge of the concentrating table 45, so that these metallic strips serve not only as supports to hold the table, but also act as springs to permit the table to vibrate laterally a limited distance, and thus dispense with the spring 31 shown in Fig. 1.

It will, therefore, be understood that the mechanism thus far described provides for a mechanical separation of metallic particles, since more or less of the metallic particles will find their way to the highest margin of the table and be discharged at the lower end of the table apart from the non-metallic particles. To produce a complete concentration however, we provide a plate 46, substantially the same size as the riffled bed 24 of the table, this plate being located directly above the riffled bed and secured to the side bars of the table to vibrate therewith, or it may be stationary, and not vibratory. The lower side of this plate 46 has a plurality of metallic projecting pins 47, which approach close to the dielectric riffled bed 24. One terminal 48, of a high tension high frequency electric circuit is secured to this plate 46, while the metallic plate 25, below the riffled bed is connected by wire 49 with the other terminal of the circuit.

The high frequency high tension apparatus may be constructed in any suitable manner best adapted for the purpose, but in this case we show it as comprising the step up transformer 50, the circuit wire 51, from one side of the high tension coil which is connected with one terminal of the resonator 52, and the other circuit wire 53 which extends to a spark gap 54, thence to one terminal of the resonator 52. This high tension circuit receives its current supply from a main line 55, that also connects with the magnets 28 for vibrating the table.

As hereinbefore stated the magnets 28 impart a vibration to the table at a high rate, the effect of which is to cause the ground metal bearing rock to move across the table, and up the incline, while at the same time the downward inclination of the table causes the particles to move toward the discharge end, the vibration thus having the effect also of spreading the particles over the table. Under the circumstances as the table is thus one of the terminals of the high tension circuit the action of the discharge is to precipitate the heavier particles throughout the mass, whereby they are forced, so to say, into more immediate contact with the body of

the table, whereas the non-metallic particles being, as it were, repelled from the table, are still less subject to the mechanical action of the table, and thus not influenced so readily to be impelled across the riffles. On the other hand the metallic particles, being thus closely in contact with the riffles, are at each impulse of the vibrations moved over and across the riffles until they reach the side margin of the table, when they follow the margin down and are discharged. Meanwhile the non-metallic particles are discharged at the lower end of the table without having traveled entirely across.

What we claim as new, is:—

1. In mechanism of the character described, the combination of a high tension, high frequency electric apparatus, a fixed terminal and a vibratory terminal in close proximity to the fixed terminal, said vibratory terminal having riffles to receive and discharge comminuted particles, and means for imparting differential travel to the components of the material being separated.

2. In mechanism of the character described, the combination of a high tension, high frequency electric apparatus, a fixed and a vibratory terminal in close proximity to each other, the vibrating terminal being composed of dielectric material and having riffles thereon, and means for imparting differential travel to the components of the material being separated.

3. In mechanism of the character described, the combination of high tension, high frequency electric apparatus, a terminal of dielectric material with riffles thereon, and adapted to receive and discharge comminuted particles, means for imparting differential travel to the components of the material being separated on said terminal, and a fixed terminal in close proximity thereto.

4. In mechanism of the character described, high tension, high frequency electric apparatus, in combination with a dielectric body having an inclined surface with riffles thereon adapted to receive, and discharge comminuted particles comprising one of the terminals, means for imparting differential travel to the components of the material being separated on said terminal, and a fixed terminal in close proximity thereto.

5. In mechanism of the character described, a high tension, high frequency electric apparatus one of the terminals being a table with longitudinal riffles thereon, in combination with means at the sides of the table for vibrating said table at right angles to said riffles and imparting a differential travel to the components of the material being separated, an ore supply pipe at one side and end of the table, and the discharge end of the precious metal in the ore body

being diagonally across the opposite end of the table from the ore supply pipe, and the other terminal being fixed in close proximity to the vibrating table.

5 6. In mechanism of the character described, a high tension, high frequency electric apparatus, in combination with a terminal comprising a table with longitudinal
10 ruffles thereon, inclined or sloping both longitudinally and laterally, and means for vibrating said table laterally.

7. In mechanism of the character described, a high tension high frequency electric apparatus, in combination with terminals, one of said terminals comprising a
15 table with longitudinal ruffles, thereon, and inclined longitudinally and transversely, an ore supply pipe at the lowest side of the table and at its highest end, means for vibrating said table, and a fixed terminal in
20 close proximity to the vibrating terminal.

8. In apparatus of the character described, in combination, a high tension high frequency electric apparatus, a dielectric terminal connected therewith comprising a rif-
25 fled body, adapted to receive and discharge comminuted particles, means for imparting a rapid vibration thereto, a stop for arresting the movement of said body in one direction, and a fixed terminal in close proximity
30 to the vibrating terminal.

9. In mechanism of the character described, the elementary components of a high tension high frequency electric apparatus, one of the terminals comprising a rif-
35 fled body, means for supplying and discharging comminuted particles, means for imparting a rapid vibration thereto, a stop for arresting the lateral movement of the body in a direction at right angles to the ruffles on the
40 body, and a fixed metallic terminal in close proximity to the vibrating body.

10. In mechanism of the character described, in combination, a high tension, high
45 frequency electric apparatus, a terminal comprising a body with a sloping surface, means to supply and discharge comminuted particles, means for imparting a rapid vibration laterally to said body, a stop for ar-
50 resting the movement of said body in one direction, and a fixed terminal above and in close proximity to the vibratory body.

11. In mechanism of the character described, in combination, the elementary com-
55 ponents of a high tension, high frequency electric apparatus, one of the terminals comprising a table having an inclined surface with longitudinal ruffles thereon, adapted to receive and discharge comminuted particles, said table having at its lowest side margins
60 means for laterally vibrating the same, means at the highest margins of the table for arresting the movement of the table in one direction, the vibration of the table being
65 transversely to the ruffles, and the other

terminal being above the table and having a plurality of discharge points in close proximity to the vibratory table.

12. In mechanism of the character described, in combination, the elementary components of a high tension, high frequency
70 electric apparatus, one of the terminals comprising a table having thereon longitudinal ruffles, an upwardly-projecting flange at all margins except at the discharge end, means
75 for transversely vibrating said table and imparting differential travel to the components of the material being separated, a feed hopper at the head of the table at one of its side margins, and the other terminal being fixed
80 above the vibratory terminal and in close proximity thereto.

13. In mechanism of the character described, in combination, the elementary components of a high tension, high frequency
85 electric apparatus, one of the terminals comprising a dielectric table, having thereon longitudinal ruffles, an upwardly-projecting flange at all margins except at the discharge end, said table being inclined longitudinally
90 and transversely, a feed hopper at the lowest side margin at the head of the table, means for laterally vibrating said table, and the other terminal being fixed above and in close proximity to the vibratory terminal.
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14. A high tension high frequency electric apparatus, in combination with a dielectric body or receptacle, adapted to receive and discharge comminuted particles, and having longitudinal ruffles thereon, compris-
100 ing one of the discharge terminals, means for imparting a rapid vibration thereto and imparting differential travel to the components of the material being separated, and a fixed terminal having a plurality of discharge points in close proximity to the vibrating terminal.
105

15. A high tension, high frequency electric apparatus, in combination with a dielectric terminal, inclined longitudinally and transversely, provided with longitudinal ruffles thereon and adapted to receive and discharge comminuted particles, means for vibrating said terminal, a terminal having a
110 plurality of discharge points in close proximity to the aforesaid vibrating terminal and a hopper for supplying comminuted particles to said table at the lowest side margin thereof, said vibratory means being provided with a stop at the high margin of the
115 table whereby the comminuted particles will be forced transversely across the ruffles to the high margin of the table.

16. A high tension, high frequency electric apparatus in combination with a dielectric body having an inclined surface adapted to receive and discharge comminuted particles longitudinal ruffles on said table, means
120 for imparting a lateral vibration to the table at right angles to the ruffles and means for
130

imparting differential travel to the components of the material being separated, and a fixed terminal having a plurality of discharge points in close proximity to the vibratory table, and means for adjusting the longitudinal and lateral inclinations of the table.

Signed at the city and county of Los An-

geles, State of California, this 27th day of September, 1911, in the presence of witnesses. 10

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