Aug. 9, 1932. W. G. CHURCHILL 1,870,710

PLACER MINING MACHINE

Original Filed May 1, 1928 2 Sheets-Sheet 1

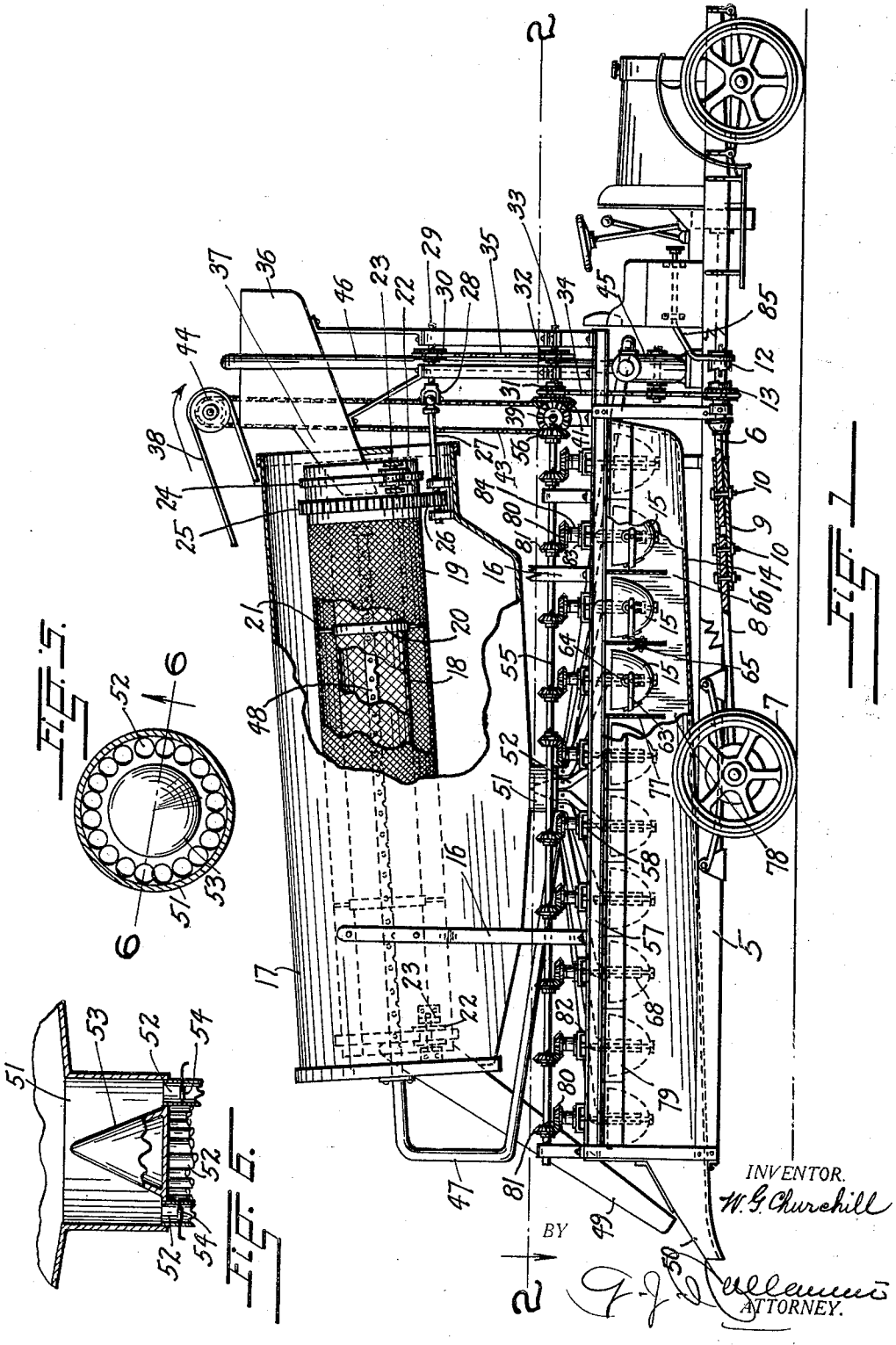


Fig. 7

Fig. 5

Fig. 6

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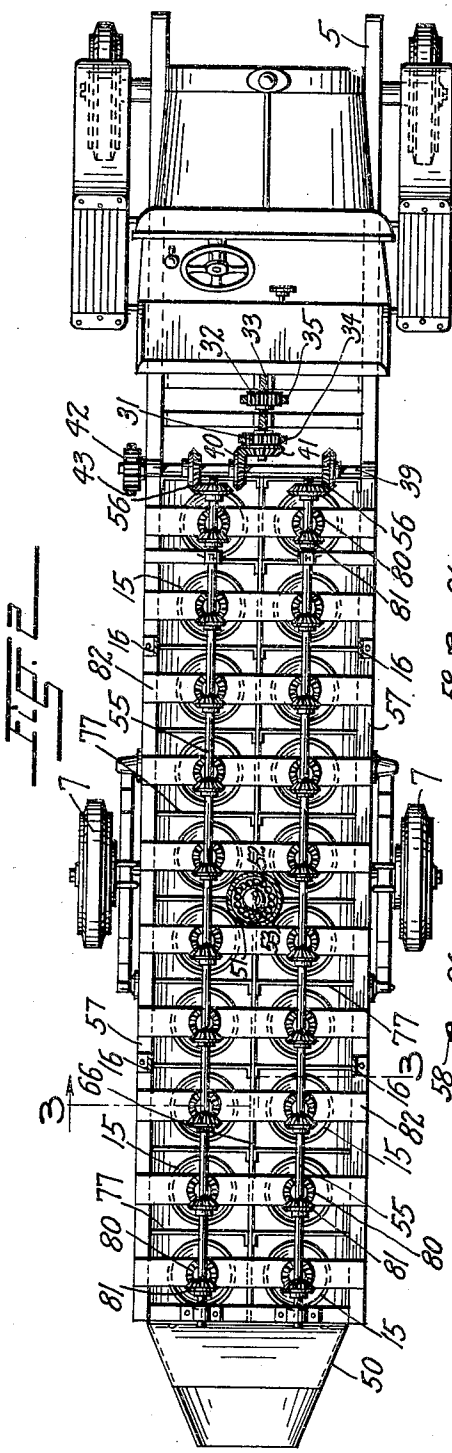


FIG. 2

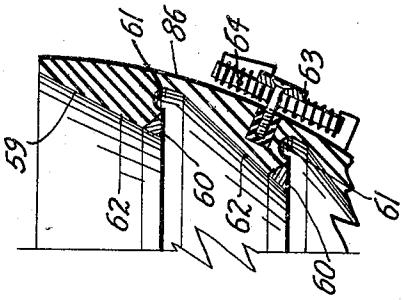


FIG. 4

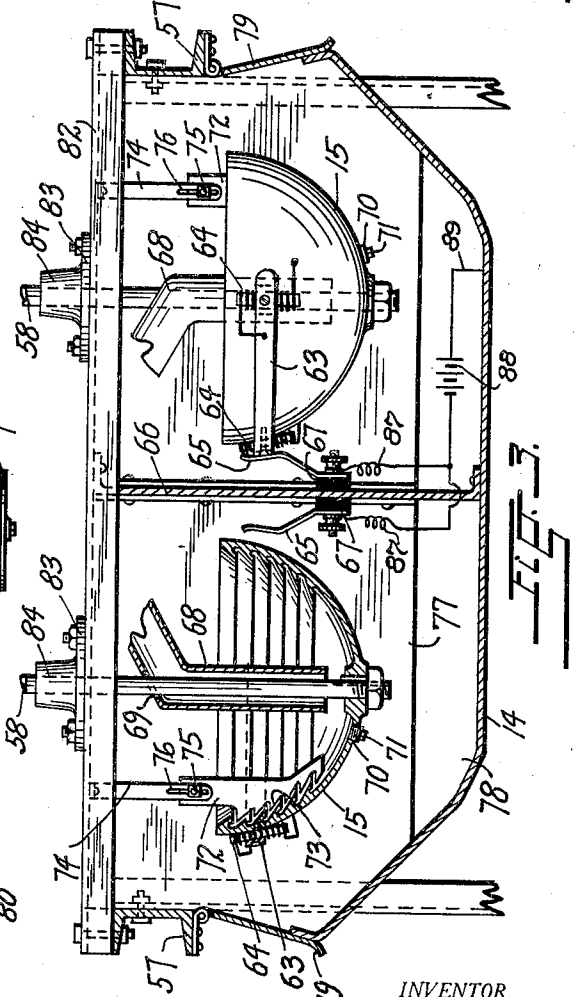


FIG. 3

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PLACER-MINING MACHINE

Application filed May 1, 1928, Serial No. 274,225. Renewed December 3, 1931.

My invention relates to separators, and its primary object is to provide a mechanism of simple construction which in its operation separates metals from their gangues by magnetic influence and centrifugal force.

The invention is particularly adapted for the recovery of gold from black sand in placer mining, and it is in this connection that it will hereinafter be described.

The invention, however, is not limited to the separation of gold from black sand, since another object is to separate non-magnetic from magnetic matter.

A still further object is to combine the two fields of separation, to-wit, centrifugal force and magnetism.

Other objects reside principally in details of construction and in novel arrangements and combinations of parts.

In the drawings, in which like parts are similarly designated throughout the several views,

Figure 1 is an elevation, partly in section, of a machine embodying the present invention;

Figure 2 is a section taken on the line 2—2 of Figure 1;

Figure 3 is an enlarged section taken on the line 3—3, Figure 2;

Figure 4 is a still further enlarged sectional view of a portion of one of the separating bowls included in the present invention;

Figure 5 is an enlarged sectional view of a distributing chamber used in the present invention; and

Figure 6 is a section taken on the line 6—6 of Figure 5.

Referring more specifically to the drawings, the separator is mounted upon a truck chassis designated generally by the reference numeral 5. The details of the truck are not a part of the present invention, so shall not be minutely described.

The truck has a driving shaft which connects the motor of the truck with the driving wheels 7. The shaft is made in two sections 6 and 8 which are connected by a sleeve 9 and bolts 10. When the separator is to be operated, the motor of the truck is disconnected from the driving wheels by removing one of the bolts 10. The sleeve then becomes a bearing for the rotating section 6 connected with the motor.

The separator is operated from the driving shaft of the truck. A clutch 12 on said shaft provides a controllable connection between the separator and the driving shaft. One member of the clutch carries a sprocket wheel 13 for the operation of the separator.

Mounted on the truck is a supporting frame 57 carrying a tilted pan 14 for receiving waste matter from separating bowls 15 suspended in the pan, as will be more fully explained hereinafter.

Mounted on standards 16 on the frame 57 is a tilted screening unit comprising a housing 17 and concentric rotating screens 18 and 19 within the housing. The inner screen 18 is coarser than the outer one 19 and is held in spaced relation thereto by spiders 20.

Roller bearings 22 on the inner surface of the drum support the rotating screens 18 and 19 by means of tread rings 24 on the circumference of the outer screen 19. A circular rack 25 also on the outer screen engages with a driving pinion 26 on a shaft 27.

The shaft 27 is driven by an angularly arranged stub shaft 29 through the medium of a universal joint 28. The sprocket 13 on the driving shaft of the truck drives one of two sprockets 31 and 32 on a jack shaft 33 through the medium of a chain 34. The other sprocket 32 drives a sprocket 30 on the stub shaft 29 by a chain 35.

A hopper 36 has a spout 37 that feeds material into the coarse screen 18. An endless belt 38 is provided to feed the material into the hopper 36. Only the end of the belt adjacent the hopper is shown, the remainder being of conventional design.

A transverse shaft 39 is driven from the jack shaft 33 by bevel gears 40 and 41. The transverse shaft 39 carries a sprocket 42 that drives a chain 43 which in turn operates the endless belt 38 through the medium of a sprocket 44.

A pump 45 on the truck is operated by the chain 34. The pump feeds water to the hopper 36 by a pipe 46 and to the screens by a

pipe 47 having a perforated portion 48 within the inner screen 18.

A chute 49 receives coarse material from the interior of the screens and discharges it into a drain spout 50 on the pan 14.

The separating bowls 15 are arranged in two rows in the pan. The rows are separated by a lengthwise partition 66, and the bowls in each row are separated by transverse partitions 77. The transverse partitions are spaced from the bottom of the pan to provide passageways 78 for material to the spout 50 at the end of the pan.

The bottom of the housing 17 slopes to a substantially central outlet 51. The outlet is connected with the separating bowls 15 by pipes 52 radiating from the outlet. A cone 53 in the outlet divides the material among the pipes.

A valve 54 in each pipe controls the flow of material to the bowls 15.

Parallel line shafts 55 mounted on the frame 57 are driven by the transverse shaft 39 through the intermediary of bevel gears 56. Cross bars 82 are provided between the side channels of the frame 57 for the suspension of shafts 58 that carry the separating bowls 15. The bowls are fastened to the shafts 58 and rotate therewith. Each of the shafts carries a bevel gear 80 at its upper end, which engages with bevel gears 81 on the line shafts 55. The cross bars 82 have bearings 84 for the suspension shafts.

The bowls 15 are of substantially hemispherical form and have at their inner surfaces, a series of circumferential riffles 59, each provided with a pointed end-portion 60 of different material. Rearward of said end-portions and beneath each riffle is an annular pocket provided with a recess 61 in its under side. The outer surfaces 62 of the riffles slope downward from the pockets of those immediately above the same with the exception of the uppermost riffle whose surface slopes from the rim of the bowl.

The body portions of the riffles are integral with the wall of the bowl which is composed of non-magnetic and preferably conductive material in contrast with the tips 60 of the riffles which are made of a magnetic substance. It will be understood, however, that a bowl composed of non-conducting material may be substituted without appreciable modification, and further without departing from the scope and spirit of the invention.

The bowl carries upon its outer surface a number of electromagnets 64 connected by a conductive rail or contact-strip 63 extending part of the way around the bowl, the entire structure being held in place by insulated bolts and so arranged as to effect a suitable balancing of the bowl during its rotation.

Bearing against the contact strip is a brush 65 in an electrical circuit. The brushes are supported by and insulated from the partition 66. A wire 87, leading from the brush 65, connects with a source of electric energy 88, which is grounded on the frame of the truck by a ground wire 89.

The pipes 52 discharge into the bowls preferably almost at the bottoms thereof. The pipes may be concentric with the shafts. If concentric, the shaft may extend through an opening 69 in the upper part of the pipe, as shown in Figure 3.

Each of the bowls has an outlet 70 normally closed by a screw plug 71. Scrapers 72 in the bowls prevent foreign matter from clogging the pockets. The scrapers have a serrated edge 73 conforming to the riffles on the interior of the bowl. The scrapers are suspended from the cross bars by rods 74, and may be made adjustable on the rods by a bolt 75 in an elongated eye 76 in the bar.

Doors 79 are provided on either side of the pan to make the bowls readily accessible from the exterior of the pan.

In operation, the material under treatment, preferably sand or gravel found in placer mining, is conveyed to the hopper 36 by the carrier belt 38. The pump 45 supplies water to the hopper to mix with the material.

The wet material is fed into the inner and coarser screen where it is subjected to a washing action by sprays of water from the perforated pipe 48. The water and rotation of the screens scour and wash the material to separate all fine material from the coarse and to wash gold-bearing black sand from the coarse material as much as possible.

The fine material passes through both screens and to the outlet 51 of the housing. The coarser material in both screens passes into the chute 49 and is carried away by the waste water through the spout 50.

The fine material finding its way to the outlet 51 is divided and fed through the pipes 52 to the bottoms of the rotary bowls 15.

During a part of each revolution of the bowls, the riffle points are magnetized by the electric current that passes through the electromagnets. The course of the current is as follows: Beginning in the source 88, the wire 87, the brush 65, the contact strap 63 connecting with one end of the coils of the electromagnets, as best shown in Figure 4, the electromagnets, the bowl 15, the shaft 58 and/or the material under treatment in the bowl, the vehicle frame constituting the ground and the conductor 89 connecting the ground with the source of electricity.

The solids in the aqueous mass in each bowl are moved by centrifugal force to engagement with the circumferential wall of the bowl. The magnetic black sand, attracted by the magnetized tips of the riffles, remains there while the non-magnetic matter is carried away.

The water, likewise moved by centrifugal

force, washes the non-magnetic gold from the black sand on the magnetized riffle-tips into the pockets 61.

The above operation takes place only while the electromagnets are in the circuit, and, when the contact strip disengages the respective brush, the black sand is released from the riffles and moves onto the next ones, where the above operation is repeated.

The material that is being fed into the bottom of the bowl washes the black sand up to the riffles above.

Each time the points attract the black sand, it will be held in a different position, so that all of the gold may be recovered from the material before it is washed over the top of the bowl by the waste water. The scrapers prevent the pockets from clogging with foreign matter.

The waste matter flows under the cross partitions through the passage-ways 78 and out through the spout 50, carrying the coarse matter from the screens.

At the end of the operation, the bowls are drained through the outlets by removing the screw plugs. The free flour gold, which has caked in the pockets by the centrifugal force, may then be removed.

The motor of the truck is used to operate the separator through the clutch 12 by disconnecting the motor shaft from the driving wheels by removing one of the bolts 10. When it is desired to continue the operation at a different location, the clutch is moved by the operating lever 85 to disconnect the separator from the drive shaft, and the bolt 10 is replaced.

What I claim:

1. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential magnectic riffles, and having back of the magnetic riffles pockets to receive values washed from material held on the riffles by magnetic force, and means for magnetization of the riffles during rotation of the bowl.

2. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential magnetic riffles and having back of the magnetic riffles pockets to receive values washed from material held on the riffles by magnetic force, and means for intermittent magnetization of the riffles during rotation of the bowl.

3. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential riffles terminating in magnetic tips, and having rearward of said tips, non-magnetic pockets to receive values washed from material held on the riffles by magnetic force, and means for magnetization of the riffles during rotation of the bowl.

4. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential downward sloping magnetic riffles and having back of the magnetic riffles, pockets to receive values washed from material held on the riffles by magnetic force, and means for magnetization of the riffles during rotation of the bowl.

5. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential magnetic riffles and having back of the magnetic riffles, pockets formed by recesses in the under surface of the riffles rearward of the tips, to receive values washed from material held on the riffles by magnetic force, and means for magnetization of the riffles during rotation of the bowl.

6. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential magnetic riffles and having back of the magnetic riffles, pockets to receive values washed from material held on the riffles by magnetic force, an electric circuit, a brush in the circuit, a magnet on the bowl for magnetizing the riffles, and a contact strip in electric connection with the magnets, the contact strip being disposed to engage the brush during a portion of the rotation of the bowl.

7. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential magnetic riffles and having back of the magnetic riffles, pockets to receive values washed from material held on the riffles by magnetic force, an electric circuit, a brush in the circuit, a magnet on the bowl for magnetizing the riffles, and a contact strip extending partially around the bowl and in electric connection with the magnets, the contact strip being disposed to engage the brush during a portion of the rotation of the bowl.

8. In a separator, a rotary, non-magnetic bowl having interiorly, circumferential magnetic riffles and having back of the magnetic riffles, pockets to receive values washed from material held on the riffles by magnetic force, means for magnetization of the riffles during rotation of the bowl, and a scraper in the bowl to prevent foreign matter from clogging the riffles.

9. A separator comprising a rotary container, riffles in the container having magnetic portions, means to magnetize the portions including an electro-magnet and a circuit for the magnet including means to close the circuit during a portion of the rotation of the container.

10. A separator comprising a rotary bowl for containing an aqueous mass of material under treatment and having a magnetizable element rotating therewith for the retention of magnetizable values of the material, mechanism for rotating the bowl, means for magnetizing the element during rotation of the bowl, and means within the bowl and adjacent the element for receiving non-magnetizable material impelled by centrifugal force.

11. A separator comprising a rotary bowl for containing an aqueous mass of material under treatment and having a magnetizable element rotating therewith for the retention

of magnetizable values in the material, the bowl having means therein adjacent said element to catch the non-magnetizable material impelled by centrifugal force.

12. A separator comprising a rotary bowl for containing an aqueous mass of material under treatment and having a magnetizable element rotating therewith for the retention of magnetizable values in the material, mechanism for rotating the bowl, means for magnetizing intermittently the element during rotation of the bowl, the bowl having means adjacent the element for catching the non-magnetizable material impelled by centrifugal force.

In testimony whereof I have affixed my signature.

WINSTON G. CHURCHILL.