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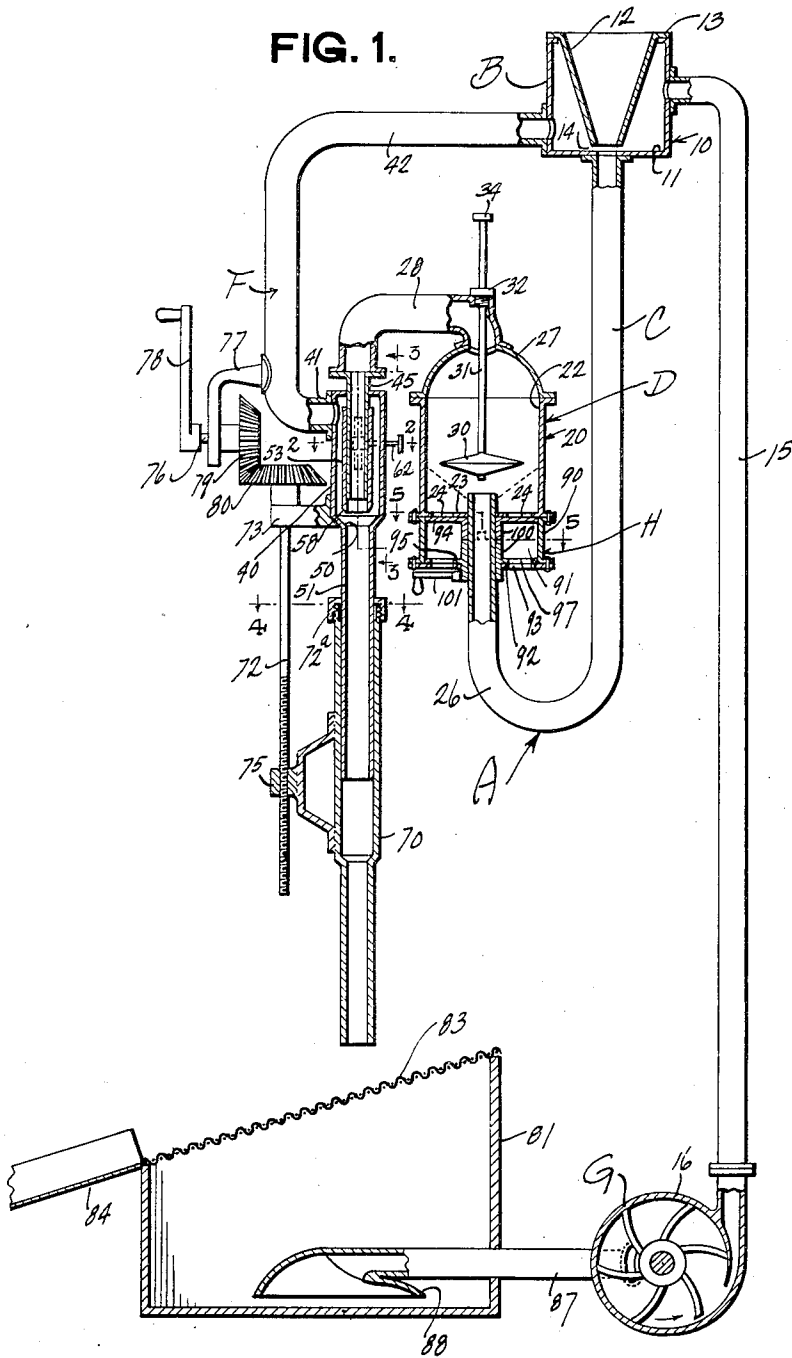
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1,948,140

SIPHON GRAVITY SEPARATOR

Filed June 1, 1931

2 Sheets-Sheet 1



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FIG. 2.

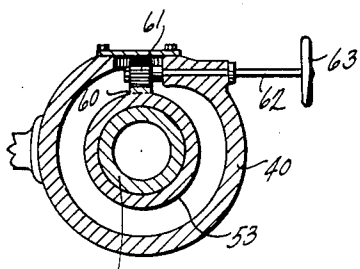


FIG. 3.

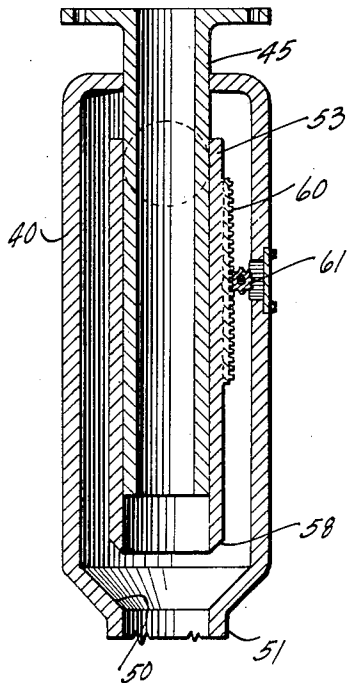


FIG. 4.

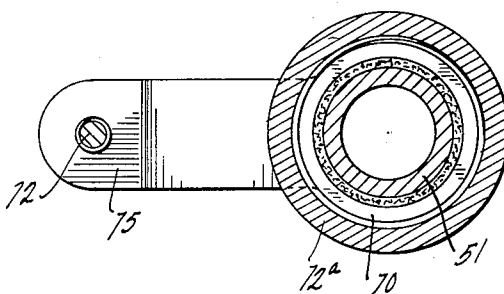
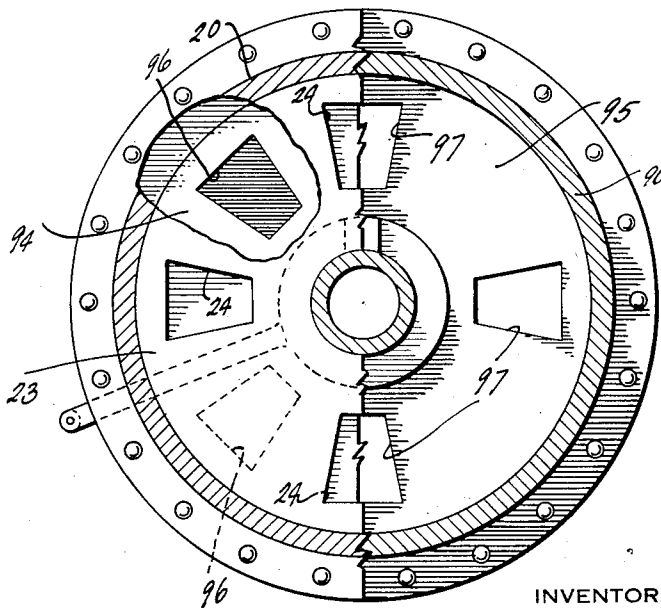


FIG. 5.



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SIPHON GRAVITY SEPARATOR

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Application June 1, 1931. Serial No. 541,430

9 Claims. (Cl. 209—155)

This invention relates to improvements in apparatus for the separation of valuable mineral or other materials from worthless constituents such as dirt, silt, slate, rock and the like.

5 The primary object of the invention is the provision of improved apparatus particularly well adapted for the separation of coal from worthless constituents such as slate and rock; the improved apparatus embodying means which
10 will admit of the economical cleaning of large amounts of coal, and in such manner that the capacity of the machine may be varied to suit the requirements of the mineral being cleaned.

15 A further object of this invention is the provision of an improved siphon-gravity type of cleaning apparatus for the separation of valuable solids from the worthless constituents with which they have become associated.

20 Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts
25 throughout the several views,

Figure 1 is a partly diagrammatic and sectional view of the improved apparatus.

30 Figures 2, 3, 4 and 5 are sectional views taken substantially on their respective lines in Figure 1 of the drawings.

In the drawings, wherein for the purpose of illustration is shown only a preferred embodiment of the invention, the letter A may generally designate the cleaning apparatus, which is preferably adapted for the cleaning of anthracite coal, but which may be utilized for the cleaning of any other mineral or material for which it may be adapted. Generally, the apparatus A
35 includes a hopper construction B communicated by a conduit C with a cleaning device or receptacle D. Siphon and gravity control means F is provided in cooperative connection with the hopper B and cleaning casing D. Means G is provided for receiving and recycling the cleansing
40 fluid, such as water.

The hopper construction B preferably includes a tank 10 having a water receiving chamber 11 therein. The conduit C is connected centrally with the bottom of the tank 10. A funnel-shaped
45 hopper 12 is supported at 13 on the top of the tank and depends into the tank and at its lower end is spaced at 14 from the inner surface of the bottom of the tank 10, centrally over the opening through the conduit C. The hopper 12 is
50 adapted to receive the uncleaned mineral, such

as anthracite coal, and it guides the same into the conduit C. The tank 10 receives water from a conduit 15 connected to the centrifugal pump 16. The water is pumped into the chamber 11 and passes through the space 14 into the conduit C together with the uncleaned mineral.

The cleaning device D includes a tank proper 20, which has a chamber 22 therein of substantially the same capacity as the hopper B. The bottom wall 23 of this tank 20 is provided with
65 openings 24 thru which the refuse material drops into a valve controlled receiving device H which is provided to periodically remove the precipitated worthless constituent from the mineral. The cleaning device D is located at a level below
70 the hopper construction B and the conduit C extends downwardly, preferably vertically below the hopper tank 10 and is then upturned in a J-shaped relation at 26 and enters through the central part of the bottom wall 23 of the tank
75 20, so that the uncleaned coal and water mixed therewith will fall from the hopper construction B and enter the chamber 22.

The top wall 27 of the tank 20 is dome-shaped and has a central outlet conduit 28 extending
80 upwardly and laterally. It is part of the siphon construction F to be subsequently described. A double cone type of deflector 30 is centrally supported in the chamber 22 above the inlet of the conduit C to said chamber. It is supported up-
85 on a slidable rod 31 which is mounted for sliding in a suitable gland 32 so that the upper end of the rod 31 extends exteriorly of the tank D. This exterior portion of the rod 31 may have a
90 hand engaging portion 34 thereon. The deflector in facing relation with the opening of the conduit C to the chamber 22 is downwardly convergent to a point axially of the inlet of the conduit to the chamber 22 and the upper face
95 of the baffle is upwardly convergent to its connection with the rod 31.

The coal, foreign solids, and water enter the chamber 22 and are laterally deflected by the baffle 30. The heavier constituents, such as slate and rock, will fall upon the bottom wall 23, and
100 will pile up thereon to approximately the dotted line position shown in Figure 1 of the drawings. As the refuse piles upwardly in the chamber 20, the baffle 30 will of course be forced upwardly, and the operator from time to time may lower
105 the baffle 30 to engage the pile of refuse within the chamber 22, to determine its depth, and the desirability of discharging the same from the chamber. Of course the water or cleansing fluid and the lighter weight valuable mineral constit-
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uents, such as coal, pass upwardly into the siphon conduit 28.

Referring to the siphon control means F, it should be noted that the cleaning tank 20 is located at a level below the hopper construction. At about the same level as the tank 20 there is provided a valve casing 40 of upright cylindrical formation, which in the upper portion thereof has connection at 41 with a conduit section 42 which extends upwardly for connection with a side of the hopper tank 10 above the bottom thereof. Thus the water from the tank 11 enters the upper part of the valve casing 40. It should be remembered that the space 14 between the bottom of the hopper proper 12 and the bottom of the tank 10 is only sufficient to permit the water to enter the conduit C and not permit the coal and refuse to pass from the hopper into the tank 10. The water enters the conduit section 42 and the upper part of the valve casing 40. The conduit 28 which connects with the top of the tank 20 extends laterally and downwardly to a point above the valve casing 40 and there it is provided with a reduced conduit 45 which extends downwardly through the valve casing 40. The latter at its lower end is provided with a downwardly sloping convergent seat 50 from whence a vertical conduit section 51 depends. The lower end of the conduit 45 terminates above the seat 50.

A sleeve valve 53 is telescopically disposed exteriorly upon the conduit portion 45, entirely within the valve casing 40. This sleeve valve fits snugly upon the conduit portion 45 and is open at its lower end. Its lower edge 53 is tapered for valve seating cooperation upon the seat 50. As the sleeve valve 53 is moved upwardly or downwardly it opens or closes the valve clearance between the lower end of the sleeve valve 53 and the seat 50. Inasmuch as the sleeve valve 53 is exteriorly spaced from the inner walls of the casing 40, and since the water from the conduit section 42 enters the upper part of the valve casing it can readily be seen that this valve clearance between the lower end of the sleeve valve and the seat 50 controls the quantity and rate of flow of water through the conduit section 42 into the conduit section 51 of the siphon conduit.

The manner of controlling and regulating the sleeve valve 53 will be apparent from Figures 2 and 3 of the drawings. The said sleeve valve is provided externally thereon with a vertical rack 60. An operating pinion 61 meshes with this rack; the said pinion being rotatably supported upon a shaft or rod 62 which extends tangentially through the valve casing 40 to a point externally thereof where it is provided with a handle 63 for regulating the sleeve valve in a manner which is perfectly apparent.

Additional means is provided to increase the lift power of the siphon. This includes an elongated conduit section 70 telescopically slidable upon the conduit section 51; a gland 72^a being provided on the upper end of the conduit section 70 through which the conduit section 51 extends. The conduit section 70 of course extends considerably below the lower end of the conduit section 51 and its level may be regulated at will. The means to accomplish this regulation includes a screw threaded rod 72 rotatably supported in a bracket 73 mounted upon the valve casing 40. The external screw threaded end of the rod 72 is threaded in a suitable nut 75 which is rigid with the conduit section 70. An operating shaft 76 is rotatably supported upon a bracket 77 which

is rigidly connected with the conduit section 42. A crank 78 is provided to rotate this shaft 76. Bevel gears 79 and 80 are keyed respectively upon the shafts 76 and 72. They are in meshing relation so that upon rotation of the shaft 76 the rod 72 will be rotated for feeding the conduit upwardly or downwardly.

A sump tank 81 is located below the discharge end of the conduit section 70. It is adapted to receive the water which drops from the conduit section 70. A de-watering and coal receiving screen 83 is disposed on the top of the sump tank 81. It preferably slopes and has a discharge trough 84 connected therewith into which the valuable mineral, such as the cleansed coal, passes. Suitable scrapers or cleaners may be provided upon the screen 83 if desired.

The centrifugal pump 16 has an inlet conduit 87 which extends into the sump tank 81 and is provided with a downwardly facing funnel-shaped inlet mouth 88 which has a relatively large area compared with the cross section of the passage-way in the conduit 87, and into which the water from the sump tank passes to the centrifugal pump 16. This specific inlet mouth 88 prevents gulping as an incident of operation of the centrifugal pump.

Referring to the valve construction H for discharge of the worthless constituent, the same includes an annular trap tank 90 connected with the tank 20 and therebelow. It has a trap chamber 91 therein and it has a bottom wall 92 which is apertured at 93 for discharging the refuse. The valve construction which is provided for discharging the slate and stone or other worthless materials includes valve plates 94 and 95, operating below and above the bottom walls 23 and 92 respectively. These plates 94 and 95 are provided with apertures 96 and 97 therethrough. The said valve plates 94 and 95 are operatively connected by means of sleeve portions 100 through which the conduit C extends. These sleeve portions have lug and notch connections to insure the simultaneous rotation of the valve plates 94 and 95. The lower end of the sleeve 100 below the bottom wall 92 is provided with an operating crank 101, as shown in Figure 1 of the drawings. It is quite apparent that turning of the crank 101 will simultaneously rotate on the said valve plates. The plate ports are so related to the ports of the walls 23 and 92 that when the ports of the valve plate 94 align with the ports 24 of the bottom wall 23, the ports of the valve plate 95 and the adjacent bottom wall 92 will be out of alignment, and vice versa. Thus, as seen in Figure 1 of the drawings the worthless slate and rock collects in the bottom part of the tank 20 at a level above the discharge end of the conduit C in the tank chamber 22, and the ports 24 are closed off by the valve plate 94. To dump the worthless rock and slate, or other worthless constituents if the mineral being cleaned is not coal, it is merely necessary to throw the crank handle 101 for a slight angular turn, to align the ports 24 and 96 of the bottom wall 23 and valve plate 94 respectively. This operation permits the worthless material to drop from the cleansing chamber 22 into the valve chamber. In this position the ports of the bottom wall 92 and valve plate 95 will be out of alignment. Upon throwing the valve plate back to close off the ports 24, the ports of the plate 95 and the bottom wall 92 will be aligned and permit the refuse previously deposited in the valve casing 90 to drop therefrom to any desired location. Thus the dumping of

the worthless constituents from the cleansing chamber may be accomplished without stopping the continuity of operation of the apparatus.

The operation of the apparatus will be apparent from the foregoing description. The force of fall of the uncleaned mineral and water through the conduit C will cause the same to enter the tank and strike the deflector. At this point the action of the siphon further continues the cleansing operation. By adjustment of the sleeve valve 53 the lift power of the siphon may be regulated. Of course it will be understood that the greater the lift force of the siphon the greater will be the capacity of the machine for cleansing the desired mineral. This sleeve valve may be utilized to start the action of a siphon, as will be readily apparent. The lengthening and shortening of the conduit arrangement below the valve casing 40 may be utilized for increasing or decreasing the lift power of the siphon, as will be quite apparent, since the variation in length of this part of the conduit increases or decreases the column of water passing through the conduit. Thus the regulating system of siphon control is of a dual nature.

Various changes in the shape, size, and arrangement of parts may be made to the form of invention without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In apparatus for cleaning coal and other minerals the combination of a cleansing chamber, means for forcing upwardly into the lower part of said chamber the impure mineral and a cleansing fluid in mixture, combined means for baffling the upward flow entrance of the said impure mineral and cleansing fluid to the cleansing chamber for deflecting by gravity the impurities from the valuable constituent of the mineral and means for vertically moving the baffle means for determining the depth of settled deflected impurities within said chamber, and means for withdrawing from the upper portion of the chamber the cleansing fluid and lighter weight constituent of the mineral.

2. In apparatus for cleaning the heavier worthless constituents from the valuable lighter weight constituents of minerals the combination of a cleansing chamber, means for discharging into the cleansing chamber the impure mineral admixed with a cleansing liquid, means for withdrawing from the upper portion of the chamber the cleansing fluid and the lighter weight constituent, said means including a siphon column extending from connection with the upper portion of said chamber to a location below the cleansing chamber, and sleeve valve means interposed in said siphon column in a level with said cleansing chamber and said valve means adapted for the uninterrupted passage of said constituent and for regulating the efficiency of lift force of the siphon.

3. In cleansing apparatus of the class described the combination of a cleansing tank, a hopper tank mounted at a location above said cleansing tank, means connecting the hopper tank with the lower portion of the cleansing tank, means associated with the hopper tank for transmitting therefrom through said last mentioned means an impure mineral together with a cleansing fluid into the lower portion of the cleansing tank, a conduit extending from the hopper tank to a location below the cleansing tank, a conduit connected with the cleansing tank and entering the last mentioned conduit, valve means at the jun-

ture of said conduits for regulating the siphonic flow of cleansing liquid from the hopper through said first mentioned conduit for creating a siphonic lift suction through the second mentioned conduit for withdrawing the cleansing liquid from the cleansing tank together with the lighter mineral constituent of the mineral being cleansed in said tank.

4. In cleansing apparatus of the class described the combination of a cleansing tank, a hopper tank mounted at a location above said cleansing tank, means connecting the hopper tank with the lower portion of the cleansing tank, means associated with the hopper tank for transmitting therefrom through said last mentioned means an impure mineral together with a cleansing fluid into the lower portion of the cleansing tank, a conduit extending from the hopper tank to a location below the cleansing tank, a conduit connected with the cleansing tank and entering the last mentioned conduit, valve means at the juncture of said conduits for regulating the siphonic flow of cleansing liquid from the hopper through said first mentioned conduit for creating a siphonic lift suction through the second mentioned conduit for withdrawing the cleansing liquid from the cleansing tank together with the lighter mineral constituent of the mineral being cleaned in said tank, and means for discharging the heavier constituent from said cleansing tank.

5. In cleansing apparatus of the class described the combination of a cleansing tank, a hopper tank mounted at a location above said cleansing tank, means connecting the hopper tank with the lower portion of the cleansing tank, means associated with the hopper tank for transmitting therefrom through said last mentioned means an impure mineral together with a cleansing fluid into the lower portion of the cleansing tank, a conduit extending from the hopper tank to a location below the cleansing tank, a conduit connected with the cleansing tank and entering the last mentioned conduit, valve means at the juncture of said conduits for regulating the siphonic flow of cleansing liquid from the hopper through said first mentioned conduit for creating a siphonic lift suction through the second mentioned conduit for withdrawing the cleansing liquid from the cleansing tank together with the lighter mineral constituent of the mineral being cleaned in said tank, means for discharging the heavier constituent from said cleansing tank, and means for baffling the entrance flow of cleansing liquid and mineral to said cleansing tank for deflecting the heavier mineral constituent from the lighter mineral constituent.

6. In cleansing apparatus of the class described the combination of a cleansing tank, a hopper tank mounted at a location above said cleansing tank, means connecting the hopper tank with the lower portion of the cleansing tank, means associated with the hopper tank for transmitting therefrom through said last mentioned means an impure mineral together with a cleansing fluid into the lower portion of the cleansing tank, a conduit extending from the hopper tank to a location below the cleansing tank, a conduit connected with the cleansing tank and entering the last mentioned conduit, valve means at the juncture of said conduits for regulating the siphonic flow of cleansing liquid from the hopper through said first mentioned conduit for creating a siphonic lift suction through the second mentioned conduit for withdrawing the cleansing liquid from the cleansing tank together with the

- lighter mineral constituent of the mineral being cleaned in said tank, means for discharging the heavier constituent from said cleansing tank, means for baffling the entrance flow of cleansing liquid and mineral to said cleansing tank for deflecting the heavier mineral constituent from the lighter mineral constituent, and means for increasing or decreasing the effective height of the siphonic column within said conduits above mentioned.
7. In cleansing apparatus for cleansing coal or other minerals of heavier worthless constituents the combination of a cleansing tank, means for passing a cleansing fluid and the impure mineral into the lower portion of the chamber of said cleansing tank, means for siphoning from the upper portion of the tank the cleansing liquid and the lighter valuable mineral constituent, and a baffle movably supported in the cleansing tank above the entrance location to the tank.
8. In cleansing apparatus for cleaning coal or other minerals of heavier worthless constituents the combination of a cleansing tank, means for passing a cleansing fluid and the impure mineral into the lower portion of the chamber of said cleansing tank, means for siphoning from the upper portion of the tank the cleansing liquid and the lighter valuable mineral constituent, a baffle movably supported in the cleansing tank above the entrance location to the tank, said baffle means having a rod connected therewith extending upwardly through the tank to an exterior location for gauging the position of the baffle means in the tank.
9. In apparatus for separating undesirable constituents from the valuable constituents of minerals such as coal, the combination of a cleansing chamber, means for directing into the chamber a mixture of uncleaned mineral and a cleansing fluid and means to start and regulate a siphonic flow of said material and fluid thru said apparatus including a siphonic conduit having a conduit section with its inlet above said chamber, a second conduit section into which said first named conduit section empties, a central outlet conduit connected with the upper portion of said chamber and extending therefrom into the second named conduit section and extending downwardly there-thru for a predetermined distance in spaced relation therein and opening at its lower end in said second named conduit section, the siphon conduit below the open end of the central outlet conduit having a valve seating surface, a sleeve valve slidable on the central outlet conduit and within said second named conduit section, said sleeve valve being disposed in spaced annular relation therewith, means to move the sleeve valve along the central outlet conduit, upon which said sleeve valve is slidable, towards and from said valve seat for regulating the flow passageway between the end of the sleeve valve and said valve seat.
- HARRISON A. STROHL.

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