Aug. 4, 1942. E. STUMP 2,291,661

APPARATUS FOR DEDUSTING AND CLEANING COAL AND THE LIKE

Filed April 27, 1939 2 Sheets-Sheet 1

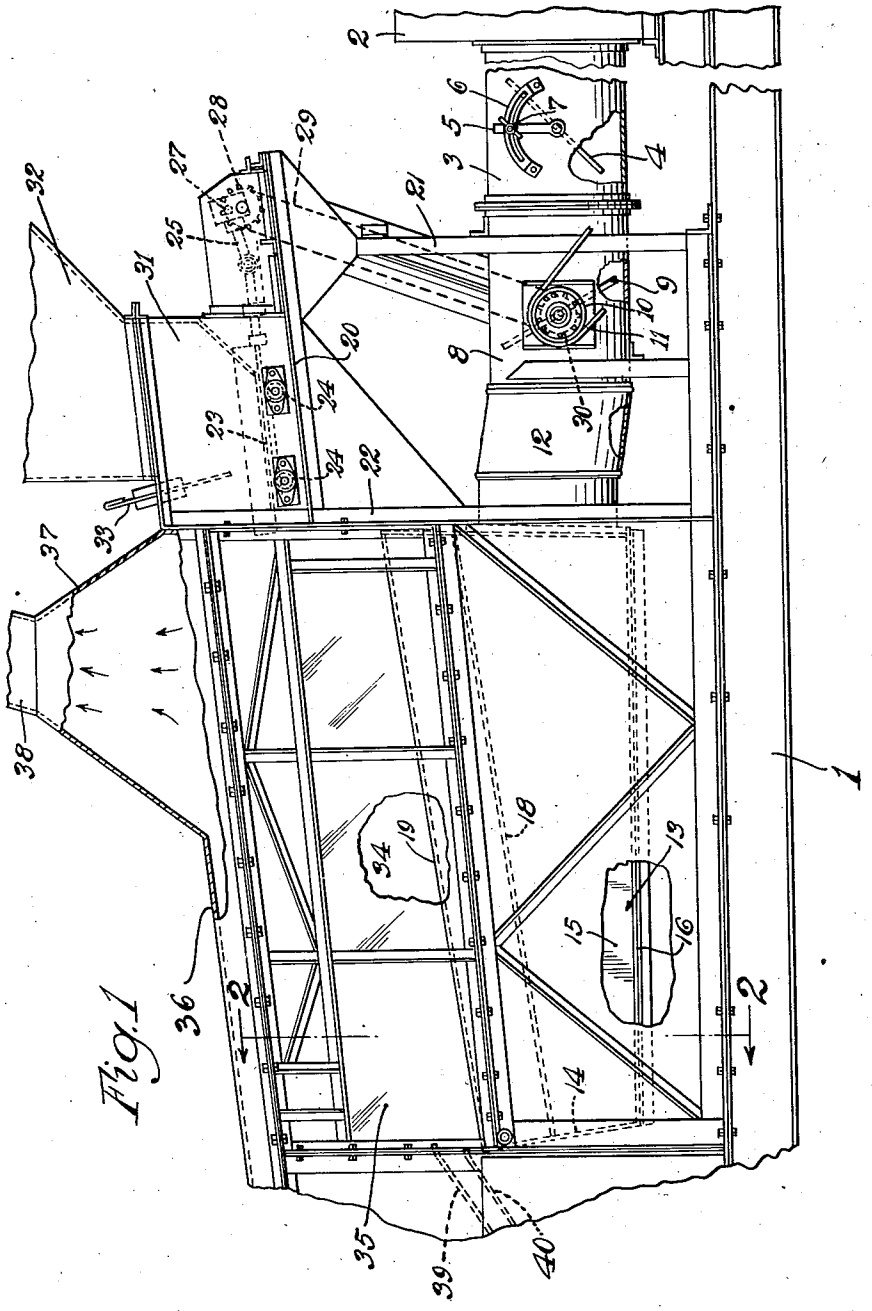


Fig. 1

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APPARATUS FOR DEDUSTING AND CLEANING COAL AND THE LIKE

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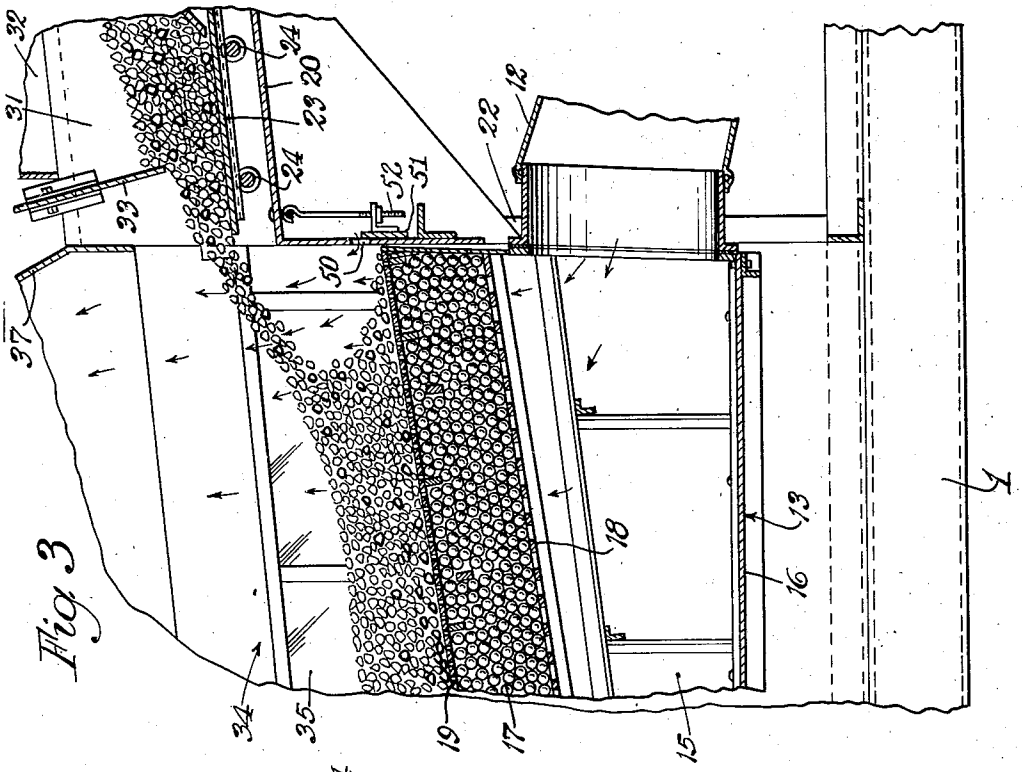


Fig. 3

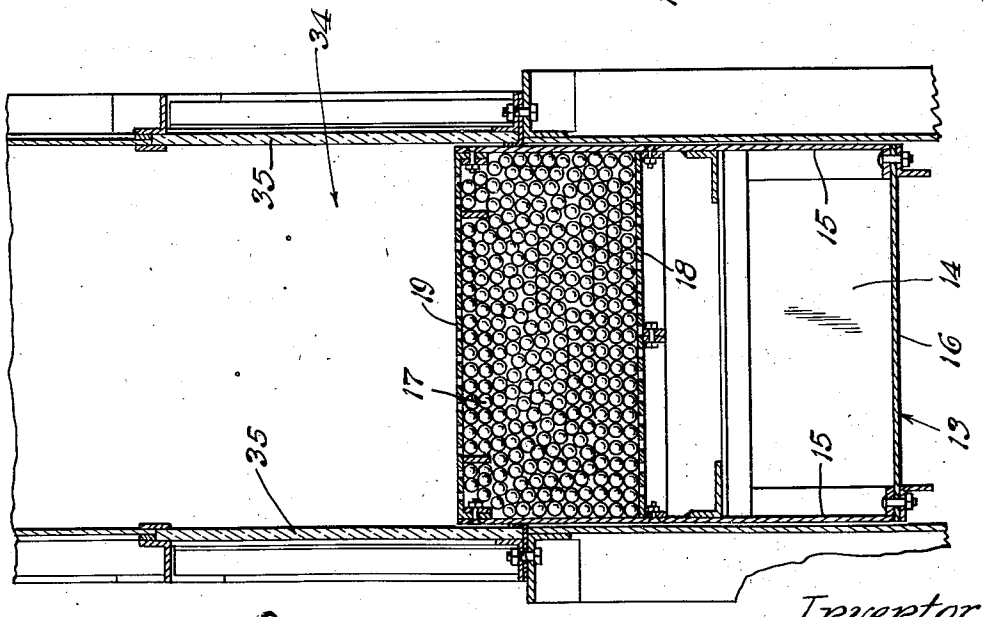


Fig. 2

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Patented Aug. 4, 1942 2,291,661

UNITED STATES PATENT OFFICE

2,291,661

APPARATUS FOR DEDUSTING AND CLEANING COAL AND THE LIKE

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Application April 27, 1939, Serial No. 270,391

7 Claims. (Cl. 209—475)

My invention relates to improvements in apparatus for dedusting and cleaning coal and the like, and has for one object to provide an apparatus and process whereby, in connection with apparatus such as that illustrated in United States Patent No. 2,245,942, dated June 17, 1941, the coal will be dedusted as a part of the gravitational separation or air washing process before the separation of coal and slate is commenced.

While I am concerning myself in the present invention more especially with the dry cleaning of coal, it will be understood that the separating and dedusting apparatus and process is applicable to any situation where it is desired to dedust or withdraw from any minerals or solids the dust which adheres to or is mixed with the larger particles.

This application is filed as a continuation in part of my prior application, Serial No. 165,129, filed September 22, 1937, which has become abandoned.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a side elevation of the apparatus in part section;

Figure 2 is a section along the line 2—2 of Figure 1; and

Figure 3 is a longitudinal part section of the device.

Like parts are indicated by like characters throughout the specification and claims.

A main supporting frame is indicated at 1. Numeral 2 indicates a blower which discharges air into a pipe 3, controlled by a butterfly valve 4, adapted for manual adjustment by means of lever 5, quadrant 6 and thumb screw 7. The flutter valve housing 8 is in alignment with the pipe 3 and contains a butterfly valve 9 mounted for rotation in the housing and driven by a pulley 10 and belt 11 from any suitable source of power. The flutter valve, when in its transverse position, may substantially close the pipe. When in its horizontal position, the pipe is open. The pipe 12 receives air from the flutter valve box and discharges it into an air box 13 which is closed at bottom, sides and forward end by plates 14, 15 and 16. At its top, this box is closed by a marble pack 17, constrained between perforate plates 18 and 19.

The auxiliary platform 20 is supported on the main frame 1 by columns such as 21 and 22. A reciprocating feeder plate 23 is adapted to travel on the rollers 24 and to be reciprocated by means of the connecting rod 25 and crank 27, which crank is driven by a pinion 28 and sprocket chain 29 from the gear 30 on the flutter valve drive shaft. The reciprocating plate 23 forms the bottom of a feed box 31 which receives coal or other material to be treated from a hopper 32. The manually adjusted valve 33 controls the thickness of the sheet of material fed forwardly and to the left in Fig. 1 by the reciprocating plate 23. The box 31 is open into the separating chamber 34, bounded at the bottom by the perforate plate 19, at the sides by plates 35, and at the top by a cover 36. This cover throughout the major part of its area is generally parallel with the perforate plate 19, but at the feed end the cover is associated with a dust and air funnel 37 which discharges into an air duct 38, above that part of the box into which the coal is first introduced.

The air duct 38 extends to an exhaust fan, and thence to a dust separator, both of which are known in the art and hence are not shown herein. The exhaust fan should be of sufficient capacity to maintain the pressure above the coal entering the separating chamber 34 below the atmospheric pressure outside the chamber.

At the end of the separating chamber which is beneath the box 31 there is provided an opening 50 for the admission of air. The size of this opening may be regulated by means of the adjustable gate or valve 51, which is suspended on a pair of hangers such as 52.

Two adjustable separating blades 39 and 40 are provided, which may be adjustable vertically to separate the sheet of material as it flows along the plate 19, coal going over the top of the blade 39, middlings moving between 39 and 40, and refuse being discharged below 40. The particular means for adjustment, support, and handling of the coal is not illustrated here because it has no connection with my present invention.

When the fan motor is started, and when the manually adjustable butterfly valve has been set for the desired operation, the motor which drives the flutter valve is also started, or the flutter valve may be driven by the same motor that drives the fan. This causes a continuous rotation of the flutter valve so as to open and close the air supply to permit the discharge into the air box of a pulsating current of air, which pulsating current of air passes up through the marble pack into the separating chamber above it and thence out through the funnel 37 and the discharge pipe 38. At the same time the feed plate is reciprocated and feeds the material to be separated forwardly toward the left into the

separating chamber. The velocity at which this plate feeds the material, for example coal is such that if there were no air current, the coal would rapidly drop down to the floor at the bottom of the separating chamber, though at the point where the coal leaves the plate, it has a definite mechanically imparted movement along a line generally horizontal.

When the exhaust fan is started up, it withdraws air from the cover or hood 36 at a high rate, sufficient to create a drop in pressure in the separating chamber, notwithstanding the air supplied through the marble pack, and a powerful upward air current is established at the upper end of the separating chamber where the coal is delivered from the feed plate. This air current is composed partly of air pulsations coming through the marble pack, greatly augmented, however, by air admitted through the opening 50, which is adjusted to admit the required amount of air depending on the condition of the coal and other factors. The upward air current thus created tends to support the sheet of coal or similar material discharged into the separating box and causes it to travel further toward the left, that is, further toward the discharge end than it otherwise would without the air support. This sheet of material traveling through the air on a path inclined to the vertical and supported as it is by the air blast is in an ideal condition for dedusting. The air blast at this point has a dual function. It supports the sheet of flowing material and as it passes up through that sheet of loosely suspended material in motion in space, it entrains the adhering and mixed dust and carries it upwardly away from the stream of coal. Depending upon the air velocity and the design of the parts, coarser or finer dust may be removed. The apparatus shown is ideally adapted to pick up minus 48 dust. That is, dust that is fine enough to pass through a screen having 48 meshes to the inch, which is the size of dust most desired to remove.

The coal, after the dedusting operation, falls to the floor of the separating chamber and then flows downwardly along the inclined floor, the floor and box being at rest, but the coal is agitated by the pulsating current of air which passes upwardly through it, the marble packing offering a resistance to the flow of air which is greater than the resistance of the coal by itself, so that the flow of air upwardly through the coal bed is properly controlled. The agitation caused by the pulsating air column as the coal stream flows downwardly causes stratification of the coal, heavy refuse at the bottom, lighter coal at the top, and some mixed coal and refuse or middlings in the center. Because the air stream at the upper end of the box has had a chance to work on the coal while it was suspended in the air and before it was supported by the floor of the box, the dust has been substantially removed, and so the gravitational separation is applied to coal and refuse only without interference from dust. The result is that a better separating effect is obtained and a clean, dustless product is discharged.

The air which passes up through the coal bed is guided by the cover or hood back along the top of the separating chamber, and there is mixed with the dust-laden air which has passed up through the sheet of coal and passes out through the contracting funnel or hood to the discharge pipe. A preferred situation is that the air velocity where it passes through the flowing suspended sheet of coal is in the neighborhood of 2000 feet per minute. It increases gradually upwardly along the contracting funnel until at the entrance to the discharge pipe, its velocity may be in the neighborhood of 3000 feet per minute. These velocities might be increased if larger dust particles were to be handled, or decreased if smaller dust particles were to be removed. Again, these velocities may be increased or decreased, depending upon the specific gravity of the dust material.

In my specification and claims, where I refer to coal and the like, it will be understood that this reference is for convenience only, that this apparatus and process is applicable to a wide range of materials in the ore dressing or material treating field and it is understood that where this language is used in the specification and claims, it is intended to cover any type of material which may be dedusted.

While it is, of course, a fact that the major portion of the dedusting operation takes place while the bed of coal is on its way from the feed plate 23 to the point where it contacts the floor 19, nevertheless the dedusting operation may continue as long as any of the coal is passing through the machine. For instance, a small residue of dust may have remained in the coal and dust may perhaps, under some circumstances, even be generated as the coal travels along the floor. Such dust will be blown upwardly through the mass of coal and projected above such mass by the high velocity air currents in the interstices between the coal particles. Such dust particles, if fine enough, may be suspended in the air and carried back to the hood 37 by the lateral current of air travelling across the upper surface of the coal bed from the discharge end of the deck backward and upward toward the air discharge hood 37.

The invention having been described, that which is considered to be new and for which the protection of Letters Patent is desired will be pointed out in the appended claims.

I claim:

1. In a combined coal separator and deduster, a fixed inclined air-pervious deck having a resistance bed beneath it, a chute above the upper end of said deck for delivering raw coal thereto by gravity, means for forcing air up through said resistance bed and deck to cause the coal and refuse mixed therewith to flow down the inclined deck and separate into parallel strata, means including a suitable hood and an exhaust pipe connected thereto at a point above the upper end of the deck for withdrawing the air from above the coal, said exhaust pipe having a substantially greater capacity than is required to remove the air which comes through the deck, whereby a partial vacuum is established, and an opening communicating directly with the atmosphere outside of the separator for admitting air underneath the stream of coal as it flows from the chute to the deck, whereby a current of air is drawn through said stream of coal at high velocity to dedust the same before it reaches the deck.

2. A coal separator and deduster as claimed in claim 1, characterized by the provision of means for adjusting the size of the air opening to regulate the volume of air admitted and thereby control the dedusting operation.

3. A coal separator and deduster as claimed in claim 1, characterized by the peculiar shape

of the hood, which above the lower half of the deck is substantially parallel to the deck and above the upper half of the deck has sloping sides which terminate in the walls of the exhaust pipe.

4. In a combined separator and de-duster, a fixed inclined air-pervious deck having a resistance bed beneath it, a casing enclosing said deck and including an air chamber beneath the resistance bed and a hood above the deck, means for delivering a stream of mixed materials to the upper end of the deck by gravity, an opening in said casing above the deck and adjacent the stream of descending coal, means for delivering air under pressure to said chamber to force air currents through said bed and deck to cause the said materials to flow down the deck, and means for exhausting the air from said hood at such a rate that a stream of air is caused to flow through said opening from outside the casing and through the descending stream of materials to dedust the same.

5. In a combined separator and de-duster, a fixed inclined trough having an air-pervious bottom, means including a chute for delivering a stream of material to the upper end of said trough by gravity, means for supplying air at greater than atmospheric pressure to the bottom of said trough, means for supplying air at atmospheric pressure at a point between the upper end of the trough and said chute and beneath the descending stream of material, and means for maintaining the air above the material in the trough and said stream below atmospheric pressure to assist the flow of air through the trough and material therein and to create a current of air from said point through the descending stream of material to de-dust the same.

6. The structure and combination defined in claim 1, together with feeder means in said chute for delivering said raw coal to the deck, and means for actuating said feeder means to impart to the raw coal to be delivered to the deck a definite mechanical movement in a direction generally parallel to the plane of the deck.

7. The structure and combination defined in claim 4, wherein said means for delivering a stream of mixed materials includes a feeder device, and means for actuating said feeder device to impart to the stream of descending material a definite mechanical movement in a direction generally parallel to the plane of the deck.

EARL STUMP.