

Nov. 26, 1935.

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2,022,588

METHOD OF AND APPARATUS FOR CLEANING COAL

Filed Sept. 1, 1933

2 Sheets-Sheet 1

Fig. 1.

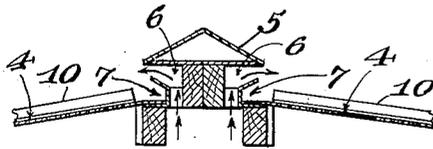


Fig. 2.

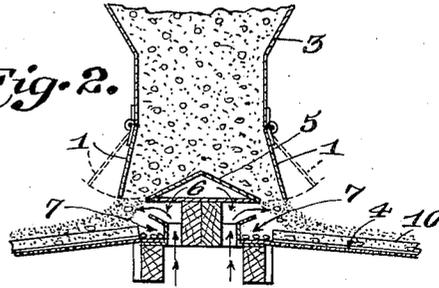


Fig. 3.

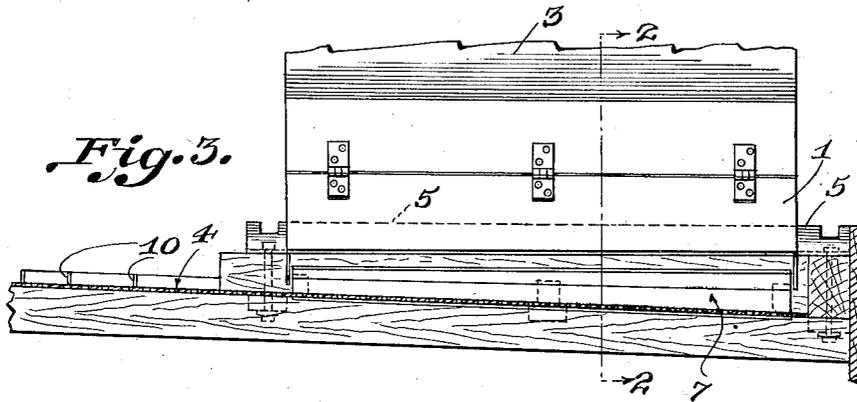
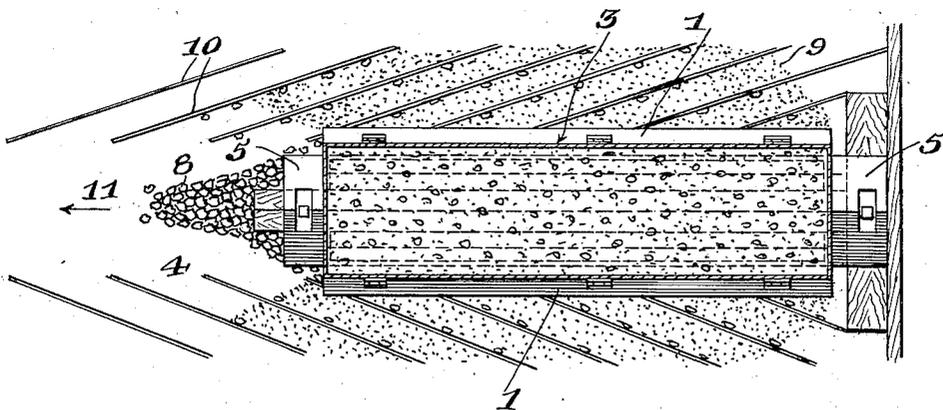


Fig. 4.



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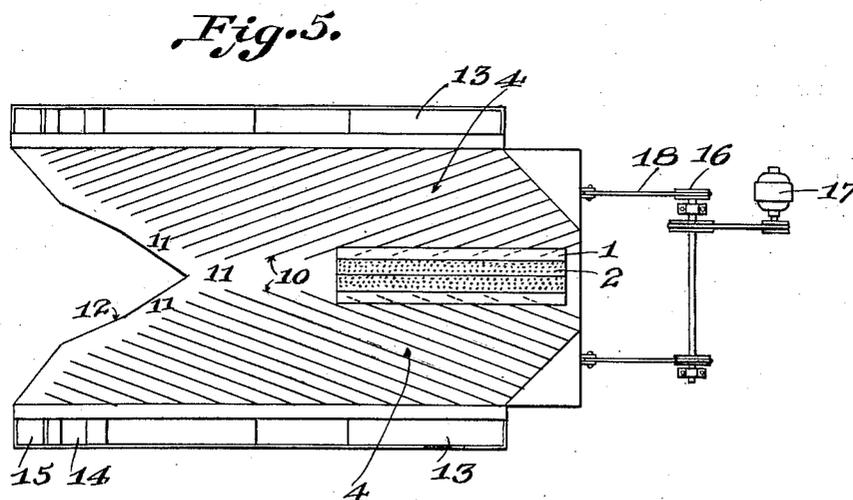
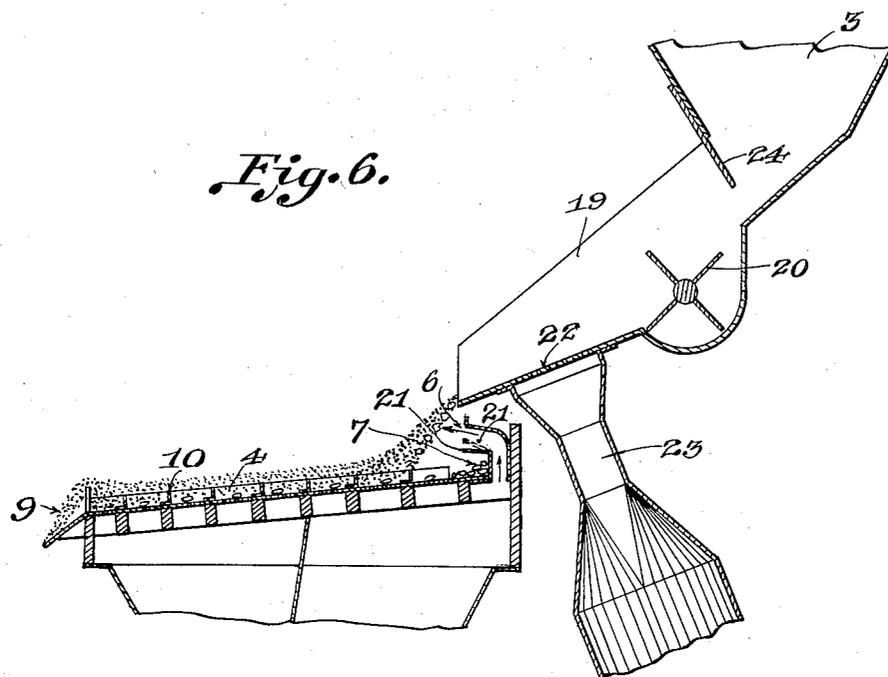
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METHOD OF AND APPARATUS FOR CLEANING COAL

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR CLEANING COAL

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Application September 1, 1933, Serial No. 687,770

4 Claims. (Cl. 209—467)

Method of and apparatus for cleaning coal

This invention relates to improvements in pneumatic separators, used to remove refuse from coal or other material. It refers to a type of cleaner having a pervious riffled deck with a rocking reciprocating motion, together with a current of air passing through it upwards, causing the coal to spread out and pass to the lower side of the table, while heavier gravity material is trapped and propelled forward along the riffles to a stream of refuse discharging ahead.

One object of this invention is an improved feed arrangement in which a current of air is passed thru a thin stream of raw coal below the feeder, and some of the heavier gravity material is separated from the coal before it touches the deck.

A further object is to provide a free passageway for refuse along the deck below the feeder, and avoid all interference from the raw coal.

Another object of the current of air is to give the coal better preparation for cleaning by loosening up the coal, separating pieces held together by clay or moisture, and raising most of the dust at one point to facilitate dust collection.

The invention in one of its forms relates to a pneumatic separator having a pervious diagonally riffled forwardly moving reciprocating deck, means to feed a thin longitudinal stream of raw material downwardly to the upper side of said deck, means to provide a current of air upwardly through the perforated deck, means to provide a stream of air to intercept said stream of raw material from behind before it touches the deck, and a passageway below the feed means and behind the stream of raw material for the free forward movement of the heavy gravity material as it passes across the feed stream directed by the diagonal riffles and movement of the deck, while the lighter material passes over the riffles to the lower side of the deck causing a separation. In a more specific aspect of the invention, control gates are provided extending longitudinally of the deck, said gates being separated from the deck and a feed plate is positioned adjacent to the gates, these elements cooperating to deliver the feeding materials in a thin longitudinal stream substantially parallel to the forward movement of the deck, while preventing any substantial grinding of the coal between the deck and the feeding elements.

The invention is also directed to a method of separating raw materials of different specific gravities, such as coal and refuse, although it is

obvious that the method may be applied to other materials, a mixture of coal and refuse merely serving to illustrate a preferred material to which the process may be applied. The material is fed in a thin freely-flowing stream upon a reciprocating support and a partial separation in the stream is effected by directing a current of air to the stream to cause the coal to be directed out of the feed stream and upon the support while some of the heavier impurities fall on the support behind the stream. Thereafter, the partially purified coal is stratified upon the support or deck by the combined action of the reciprocating motion or its equivalent and upwardly directed air currents or its equivalent. Of course, the stratification is facilitated by combining with the above elements a rocking motion. Impurities settling on a portion of the support cross under the feed stream to join the impurities previously separated from the feed stream and then are directed forwardly without further interference with the feed stream forming a refuse stream receiving impurities directed to it from other parts of the support.

Other objects improving the efficiency of the cleaner will be apparent from the following description.

The above objects are attained by mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a cross section showing one form of the improved feed parts.

Figure 2 shows these parts as installed on a type cleaner now used.

Figure 3 shows a side elevation, and Figure 4 a plan of improved feeder parts as installed on an existing separator.

Figure 5 is a comprehensive plan of a type deck to which the improved feed arrangement may be added.

Figure 6 shows a cross section of a deck sloping to one side with a current of air intercepting the flow of coal from an improved feed chute and rotary feeder.

Similar numerals refer to similar parts throughout the several views.—

Longitudinal feed control gates 1 nearly touch the deck 4 before they are shortened for the improved feed device, and before the old perforated feed plate 2 is removed. Surge bin 3 usually has a capacity of five tons or more. Feed plate 5 is solid and may be made with a ridge top as shown or have it rounded. A current of air 6 flows thru the opening below the feed plate to intercept the thin stream of raw coal passing to the deck. A

lane or passageway 7 below the feed plate 5 and current of air 6 permits the free passage of refuse forward to the slate channel 11. Refuse 8 is indicated by the coarser and clean coal 9 by the finer material, but this is for illustration and does not show relative size, as coal may be as large as the slate. Riffles 10 are partitions which retard the movement of material by gravity and trap the slate. The refuse banks against the banking bar 12. The product hoppers 13, 14, and 15 are for clean coal, middlings and refuse respectively. Eccentrics 16, motor 17, and connecting rods 18 are parts for one form of drive. A wide chute 19 and rotary feeder 20 show a type of feed independent of the deck motion. Plate 21 may be bent to direct or regulate the flow of air current 6. A perforated plate or screen 22 is placed in bottom of chute 19 for a flow of air from pipe 23. Depth of coal in chute 19 is controlled by the gate 24 and the feeder 20, but any form of feeder and gate may be used.

As shown in Fig. 5, the deck is provided with a perforated feed plate 2. The present invention is directed to improvements on such prior art feed plates. Instead of using the feed plate such as shown in Fig. 5, in the present invention, there is provided a feed plate 5 which cooperates with the gates 1 to deliver a thin stream of material downwardly to the deck.

Method of operation, and further explanation of functions

With the type feeder having wide gates coming close to the deck to regulate the flow of coal between their lower edges and the deck, and a perforated feed plate on the deck between the gates, the weight of coal above the feeder causes such pressure on the bottom of the deck and against the gates that very little air can work up into the coal. Refuse collected along the riffles and guided into the coal coming out from beneath the gates under pressure is thrown back into the coal and can not get into the slate channel until it has passed the forward part of the feeder gates. If there is much refuse in the coal there is a bad congestion of refuse ahead of the gates, and a blocking of the air so the efficiency of the machine is rapidly reduced as the quantity of refuse increased. Much of the deck area is of little value, and there is a considerable degradation of coal between the gates and the deck due to pressure and crushing.

With the substitution of the improved feed plate attached rigidly above the deck, and the gates shortened to substantially the same level as the lower part of the feed plate, the raw coal is still fed to the deck by its own action and the capacity is regulated by the adjustment of gates inwardly or outwardly as shown in Fig. 2. There is very little degradation as the coal is not ground between the deck and the gates. The coal leaves the feed plate in a thin stream and a current of air passes thru it floating the lighter material a little forwardly, and some of the refuse is dropped before it reaches the deck. This refuse is carried along the slate lanes 7 until the end of the feed surge bin 3 is passed. Then the slate streams unite in the main slate channel 11. The riffles 10 trap the slate and material too heavy to be lifted over them by the deck action and the air current, guiding it forward into the refuse lanes 7. In this way slate and other refuse is removed along the side of the feeder 5, without being thrown back into the coal, congestion ahead of the gates is

stopped, and the efficiency of the whole deck is increased.

For a deck discharging on one side only the same arrangement may be used with feed plate sloping in one direction. An alternate plan is to feed it on from a gravity chute or mechanical feeder so that it goes to the deck in a thin stream thru which a current of air is passed and refuse is collected in a lane under the feed plate as previously described. The discharge of raw coal may be along the top side or ridge of feed plate as shown in Figure 1 so the latter will become a distributor. Another arrangement is to provide a wide chute 19 with a rotary feeder 20, a gate 24 above the feeder to control the depth of coal, and a short chute below the feeder as shown in Fig. 6.

Where the separator has one or more cleaning areas it may be fed by a rotary feeder with an aerating chute as just described. The deck will have a reciprocating or vibrating motion which will propel refuse forward along the riffles to the slate lanes and channels, hence to the point of refuse discharge. The diagonal type of riffles is used to spread the coal out over a longer deck. The motion of the deck and the air bring the lighter material or coal to the top and over the riffles, while the slate sinks to the bottom where it is trapped by the riffles and guided by them at an angle to the flow of the coal. For a single deck sloping to one side the lighter material or coal having passed over the riffles to the edge of the deck drops into product hoppers.

Certain subject matter originally present in the case, as filed, is now claimed in copending applications, Serial No. 18,029, filed April 24, 1935, entitled "Method and apparatus for separating composite material into its components", and application Serial No. 38,105, filed August 27, 1935.

Having described my invention, what is claimed is:

1. In a pneumatic separator for separating a material comprising coal and heavier gravity components, the combination of a pervious diagonally riffled reciprocating deck, feed control gates extending longitudinally of the deck and separated from the deck, a feed plate positioned adjacent to said gates, said gates and feed plate delivering feeding material in a thin longitudinal stream substantially parallel to the forward movement of the deck while preventing any grinding of coal between the deck and feeding elements, means for feeding air in a direction substantially transverse to said feed stream to intercept said feed stream before the feed material touches the deck of the separator, whereby the coal is moved forward and some of the heavier gravity material is forced downwardly behind the forwardly moving stream, and a passageway below and behind said longitudinal stream of material adapted to receive the heavier gravity components which are directed thereto, and reciprocating means for moving the heavier gravity material along the table and the coal transverse thereto.

2. In a pneumatic separator for separating material comprising a light gravity component and a heavier gravity component, the combination of a pervious diagonally riffled reciprocating deck having cleaning sections sloping respectively from the center of the table, a feeder separated from the table deck and discharging centrally and longitudinally of the deck to each side of the deck thin streams of raw material, means for applying a current of air to each longitudinally thin stream to intercept the material fed to the deck

before the material touches the deck whereby the lighter material is positioned to be moved transverse of the latter under the influence of the reciprocating table and the air issuing through the pervious deck, and some of the heavier gravity component dropped down behind the forwardly moving stream, and a passageway below and behind each of said longitudinal streams of material, said passageway being adapted to receive the heavier gravity components which are directed thereto.

3. In a pneumatic separator, the combination of a pervious diagonally riffled forwardly moving reciprocating deck, means to feed a thin longitudinal stream of raw material downwardly to the upper side of said deck, means to provide a current of air upwardly through said perforated deck, means to provide a stream of air to intercept said stream of raw material from behind before it touches the deck, a passageway below said feed means and behind said stream of raw material for the free forward movement of the heavier gravity material after it passes under the

feed stream directed by the diagonal riffles and movement of the deck, while the lighter material passes over the riffles to the lower side of said deck causing a separation.

4. The method of separating raw materials of different specific gravities such as raw coal comprising feeding the material in a thin freely flowing stream upon a reciprocating support, effecting a partial separation in the stream by directing a current of air to the stream to cause the coal to be directed out of the feed stream and upon the support while some of the heavier impurities fall on the support behind the stream, stratifying the partially purified coal upon the support by reciprocating motion and upwardly directed air currents, and directing the impurities settling on a part of the support to cross under said feed stream to join the impurities previously separated from the feed stream and then forward without further interference with the feed stream forming a refuse stream receiving impurities directed to it from other parts of the support.

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