

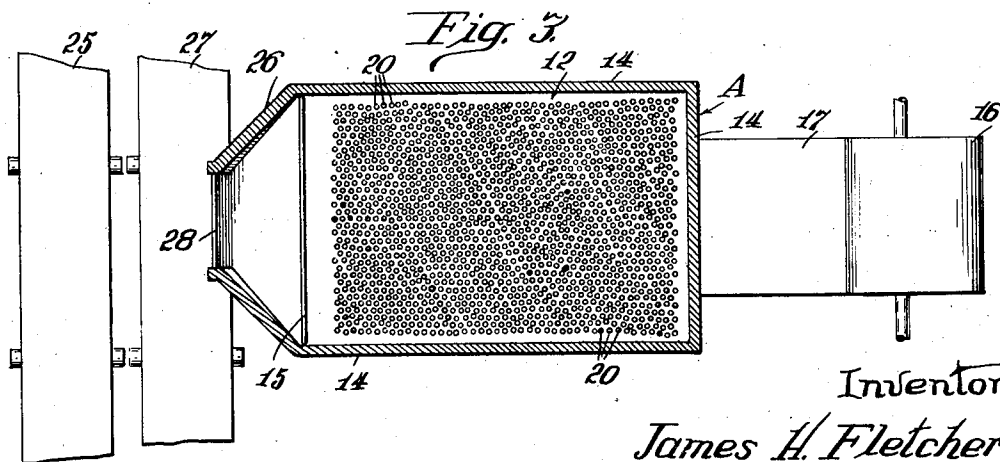
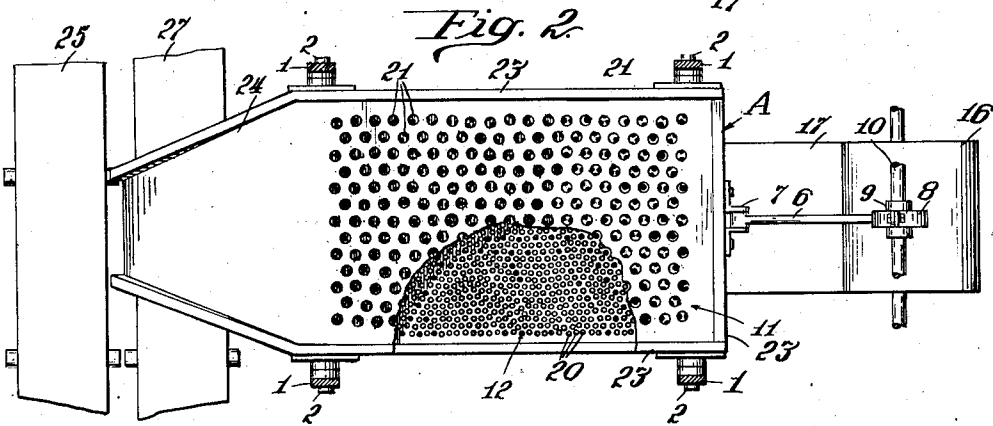
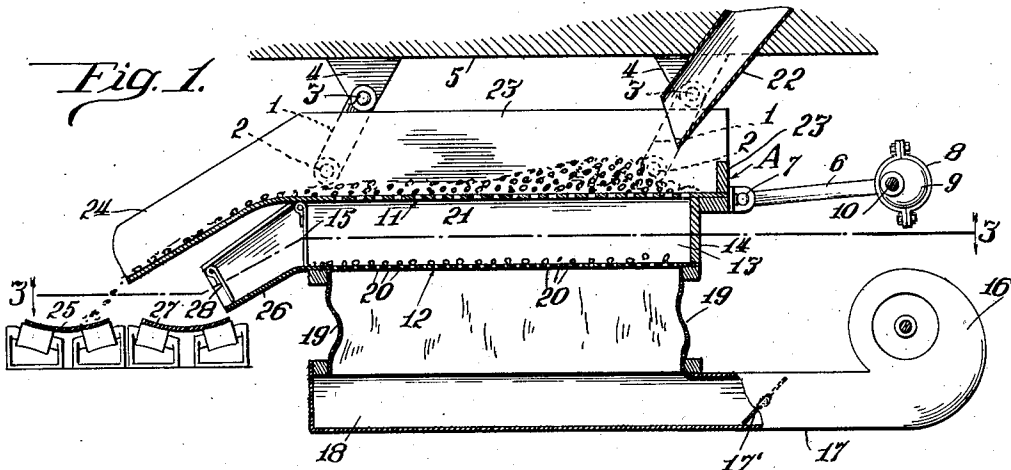
Sept. 10, 1935.

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2,014,249

METHOD AND APPARATUS FOR SEPARATING REFUSE FROM COAL

Original Filed Nov. 21, 1930 2 Sheets-Sheet 1



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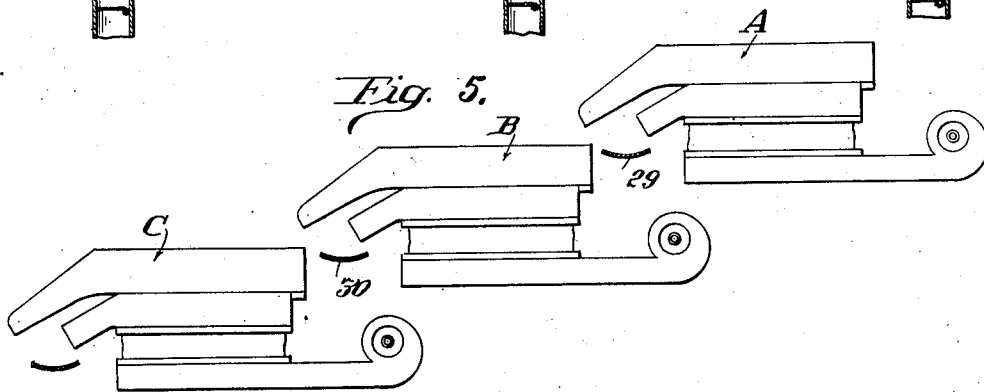
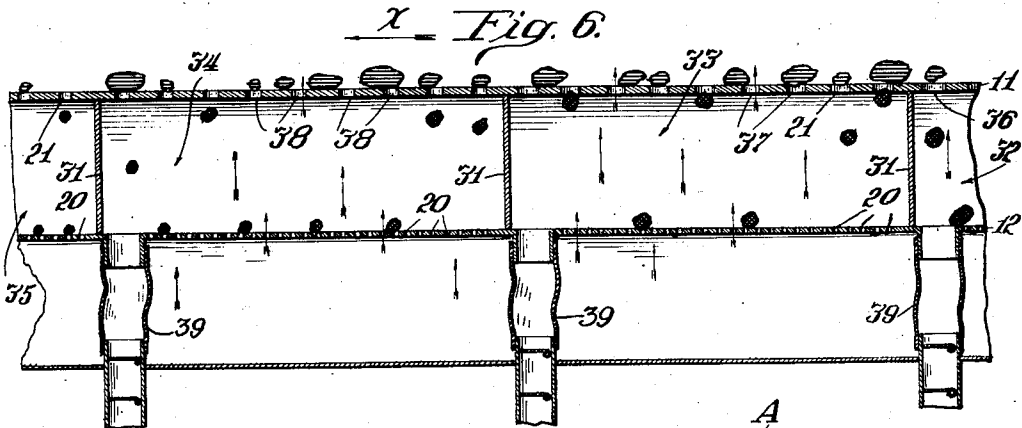
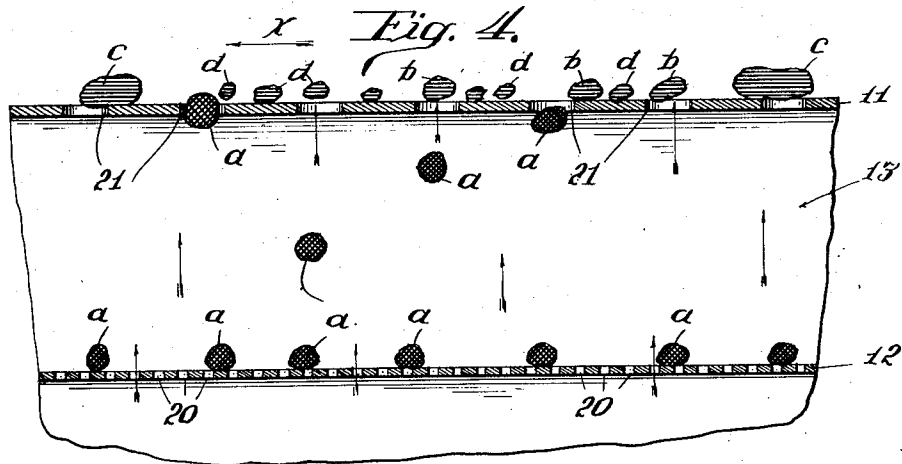
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METHOD AND APPARATUS FOR SEPARATING REFUSE FROM COAL

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR SEPARATING REFUSE FROM COAL

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2 Claims. (Cl. 209—321)

This invention relates to certain new and useful improvements in a method and apparatus for separating refuse from coal or similar material, and more particularly to an improved process which combines the use of mechanical means and air under pressure for effecting the separation.

Briefly described, an apparatus is used comprising an upper deck on which the material to be separated is deposited, and a lower deck for receiving the refuse, the space between the decks being confined so that a superatmospheric air pressure may be maintained between the decks. Means is provided for reciprocating or moving the table so that the material on the upper deck will be agitated and urged along the table from the receiving to the discharge end thereof. The upper deck is perforated or provided with a plurality of openings of a determined size, and the air pressure between the decks is maintained just sufficiently high so that the air jets flowing upwardly through the openings or perforations will be just sufficient to support coal particles of a size capable of passing through these openings, but insufficient to support the heavier refuse particles of similar size. Suitable means is provided for discharging the refuse from the lower deck without excessive loss of air pressure from the space between the decks.

The principal object of this invention is to provide an improved method and apparatus for separating refuse from coal or similar material, such as briefly described hereinabove and disclosed more in detail in the specifications which follow.

Another object is to provide an improved apparatus for air-cleaning coal or similar material.

Another object is to provide an improved apparatus comprising a series of similar separating tables, each adapted to separate out refuse particles of a substantially predetermined size.

Another object is to provide an improved air separation table adapted to successively but separately withdraw refuse particles of substantially predetermined sizes from the mass of mixed materials.

Other objects and advantages of this invention will be more apparent from the following detailed description of certain approved form of apparatus adapted to carry out the improved process herein disclosed.

In the accompanying drawings:

Fig. 1 is a longitudinal vertical section through a simple form of the apparatus.

Fig. 2 is a plan view, partially broken away, of the apparatus shown in Fig. 1.

Fig. 3 is a horizontal section of the apparatus taken substantially on the line 3—3 of Fig. 1.

Fig. 4 is an enlarged vertical section through a fragment of the separating table illustrating the separating process.

Fig. 5 is a diagrammatic side elevation illustrating a series or battery of separators of the type shown in Fig. 1.

Fig. 6 is a partial vertical section through a separating table embodying a plurality of separating zones, each adapted to divide out a different size of refuse particles.

Referring first to the simplified example of the apparatus as illustrated in Figs. 1, 2 and 3, the separating table indicated as an entirety at A is suspended by a plurality of links 1 which are pivoted at their lower ends 2 to the table, and which are pivotally supported at their upper ends 3 from brackets 4 carried by an overhead supporting structure 5. A pitman 6 pivoted to one end of table A at 7, has a collar 8 at its other end surrounding an eccentric 9 keyed on shaft 10, which is rotated in any suitable manner. It will be apparent that as the shaft 10 is rotated the eccentric will cause pitman 6 to reciprocate the table A and simultaneously give a small up and down movement to the table, due to the oscillation of the supporting links 1.

The table A comprises an upper deck 11 and a lower deck 12 which are spaced apart to provide an intervening chamber 13 which is closed on three sides by the vertical walls 14, and which is closed at the discharge end by a movable gate 15.

A fan or other suitable air pumping mechanism 16 discharges air under pressure through conduit 17 provided with pressure-regulating valve 17' into a chamber 18 having flexible side walls 19, the upper side of chamber 18 being closed by the lower deck 12 of the table A. This lower deck is formed with a multiplicity of small perforations 20 whereby the air under pressure will be discharged from chamber 18 through lower deck 12 into the chamber 13 between the upper and lower decks of the separating table. The upper deck 11 is formed with a plurality of holes or perforations 21, the size or diameter of which is determined by the size of the refuse particles or lumps that are to be discharged therethrough by gravity. The air pressure built up in chamber 13 by fan 16 will be regulated in accordance with the size of the openings 21 in the upper deck so that the force of the air jets passing upwardly through openings 21 will be just sufficient to support particles of lumps of coal capable of passing through

the openings, but of insufficient force to support the heavier refuse particles of similar size.

The broken mass consisting of mixed coal and refuse is discharged onto upper deck 11 from a chute 22 and is confined on this deck by the upright walls 23 surrounding three sides of the table. A chute 24 at the delivery end of the table serves to discharge the cleaned coal from the table onto a conveyor 25 or any other suitable receiving means. A chute 26 projects from the lower deck 12 of the table for discharging refuse from the lower deck onto a conveyor 27 or into any other suitable receiving means. This chute 26 is provided with a discharge gate 28 in addition to the gate 15, already mentioned. The purpose of the two gates 15 and 28 is to permit the discharge of solid material from the lower deck 12 without an excessive loss of air pressure in the space between the decks. The gate 28 will be closed and the gate 15 opened until a sufficient quantity of refuse has collected in the chute 26, then the gate 15 will be closed and the gate 28 opened to discharge this refuse onto the conveyor 27. Any other suitable forms of gates or valves could be used for this purpose, the mechanism hereinabove described being merely a diagrammatic example of apparatus suitable for this purpose.

Referring now more particularly to Fig. 4, the principle of operation of this improved apparatus and separating process will be more definitely described. The separating table will be reciprocated so that the mass of mixed material supported on the upper deck 11 will be continually agitated and urged along the table in one direction, for example, in the direction of the arrow indicated at *x*. Air under pressure is forced through the openings 20 in the lower deck 12 in sufficient quantities to build up a super-atmospheric pressure in the chamber 13 between the two decks so that air jets will be directed upwardly through the several openings 21 in the upper table 11, all as indicated by the small arrows in the drawings. In this figure the lumps or particles of refuse are heavily shaded, whereas the particles of coal are indicated by lighter shading. The force of these air jets will be just sufficient to support lumps or particles of coal, such as indicated at *b*, which are small enough to pass through one of the openings 21. However, this air pressure is not sufficient to support particles of refuse of similar size, as indicated at *a*, and these pieces of refuse will drop through the openings 21 against the force of the air streams and be caught by the lower deck 12. It is desirable that the openings 20 in the lower deck may be made as small as practicable so as to prevent the passage of refuse material therethrough, but these openings should be in sufficient numbers to permit a free flow of air upwardly through the lower deck so as to keep up the air pressure within the chamber 13. It will be apparent that larger lumps of coal, such as indicated at *c*, would not be supported by the air pressure, but these pieces are too large to pass through the openings 21 and will be mechanically supported upon the upper deck 11. Also smaller sizes of coal, such as indicated at *d*, will either be supported by the air pressure over the openings 21 or will be supported mechanically upon the upper deck 11, according to their position on the table. As a result, all of the coal will be maintained upon or above the upper deck 11, whereas refuse of a predetermined size will be permitted to pass through the openings in the upper deck under the influence of gravity and will be collected upon the

lower deck 12 and subsequently discharged therefrom, as already described. Some of the smaller sizes of refuse may be supported by the air streams above the upper deck, but it is contemplated that these smaller sizes will be subsequently removed by means of additional separating tables in which smaller openings are provided in the upper deck and the air pressure is decreased.

One example of an apparatus embodying a series or battery of these separating tables is illustrated diagrammatically in Fig. 5. Each of the units A, B and C may be of the type hereinabove described. The coal from the first separating table A, from which the larger particles of refuse have been removed, and discharged onto the conveyor 29, is discharged from the upper deck onto the upper deck of the second separating table B. In this second table, the openings 21 in the upper deck are reduced in size and a decreased air pressure is used, whereby refuse particles of a smaller size are permitted to gravitate out of the mass and are discharged from this second table onto the conveyor 30. The coal from the second table B is discharged onto the third table C where a smaller size of refuse is separated out, and so on throughout the series.

Another form of the invention is indicated in Fig. 6 of the drawings. In this form a single long separating table is used, the space between the upper and lower decks being separated by a plurality of transverse vertical partitions 31 into a series of separate zones, such as indicated at 32, 33, 34 and 35, respectively. The openings in the upper deck 11 are made successively smaller in the several zones throughout the series. For example, in the zones as shown in Fig. 6, the openings 36 in the first zone 32 will be larger than the openings 37 in the second zone 33, and the openings 38 in the third zone 34 will be smaller than the openings 37 in the second zone. The air pressures maintained in each of the separate zones will be correspondingly decreased, whereby refuse particles of successively decreasing size will be withdrawn from the mass as it is urged along the table in the direction of the arrow, indicated at *x*. The refuse deposited on the lower deck 12 in each zone will be removed through traps or valves 39, as hereinabove described, and the cleaned coal will be discharged from the delivery end of the table at the end of the series of zones.

While the expedient of providing the lower deck 12 with a multiplicity of small openings is desirable for maintaining a substantially uniform air pressure throughout the horizontal area of the table, or separating zone, the air could be forced into the chamber 13 through one or more conduits communicating with either the bottom or sides of the chamber so as to maintain the desired air pressure between the upper and lower decks. In such case, an imperforate, or a substantially imperforated lower deck 12 could be used.

This improved air-separation process is particularly adapted for removing the smaller sizes of refuse, which have not been efficiently handled by separation processes heretofore known. The efficiency of this improved method of separation depends upon a certain definite ratio being maintained between three factors, first, the number and size of the openings in the upper deck, second, the open area of the lower deck (which should have a multiplicity of very small holes), and third, the static air pressure maintained between the decks.

With these three factors properly balanced for the size of the refuse that is to be removed, any small size of the refuse, or other similar material, can be separated out by this process. It will be noted that this process could be used for selecting out particles of a desired size of any relatively heavier material, from a mixed mass containing this material.

It is to be understood that the simplified forms of apparatus herein disclosed are shown and described merely by way of example and that many other designs of apparatus could be adapted for performing this improved separation process, all of which are intended to come within the terms of the claims which follow.

I claim:

1. A process of purifying coal which comprises maintaining a bed of raw coal having a substantial variance in size of the pieces and particles, progressing said bed across a plurality of pervious zones having successively smaller apertures therein, passing air currents upwardly through the traveling bed and regulating said air currents so as to subject the zones with smaller apertures to lesser intensity of air action and by said air

regulation causing larger particles of refuse to fall through the coarsest apertures while floating the lighter material and the finer refuse particles by air pressure and thereafter causing said finer refuse particles to fall through the smaller apertures against the lesser air force while maintaining the lighter material above said apertures.

2. A process of purifying coal which comprises maintaining a bed of substantially continuous raw coal having a substantial variance in size of the pieces and particles, progressing said bed across a plurality of pervious zones having successively smaller apertures therein, passing air currents upwardly through substantially all parts of the traveling bed and regulating said air currents so as to subject the zones with smaller apertures to lesser intensity of air action and by said air regulation causing larger particles of refuse to fall through the coarsest apertures while floating the lighter material and the finer refuse particles by air pressure and thereafter causing said finer refuse particles to fall through the smaller apertures against the lesser air force while maintaining the lighter material above said apertures.

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