Feb. 6, 1968 G. F. EVESON 3,367,501

DRY-CLEANING OF LARGE OR SMALL COAL OR OTHER PARTICULATE MATERIALS CONTAINING COMPONENTS OF DIFFERENT SPECIFIC GRAVITIES

Filed April 14, 1965 4 Sheets-Sheet 1

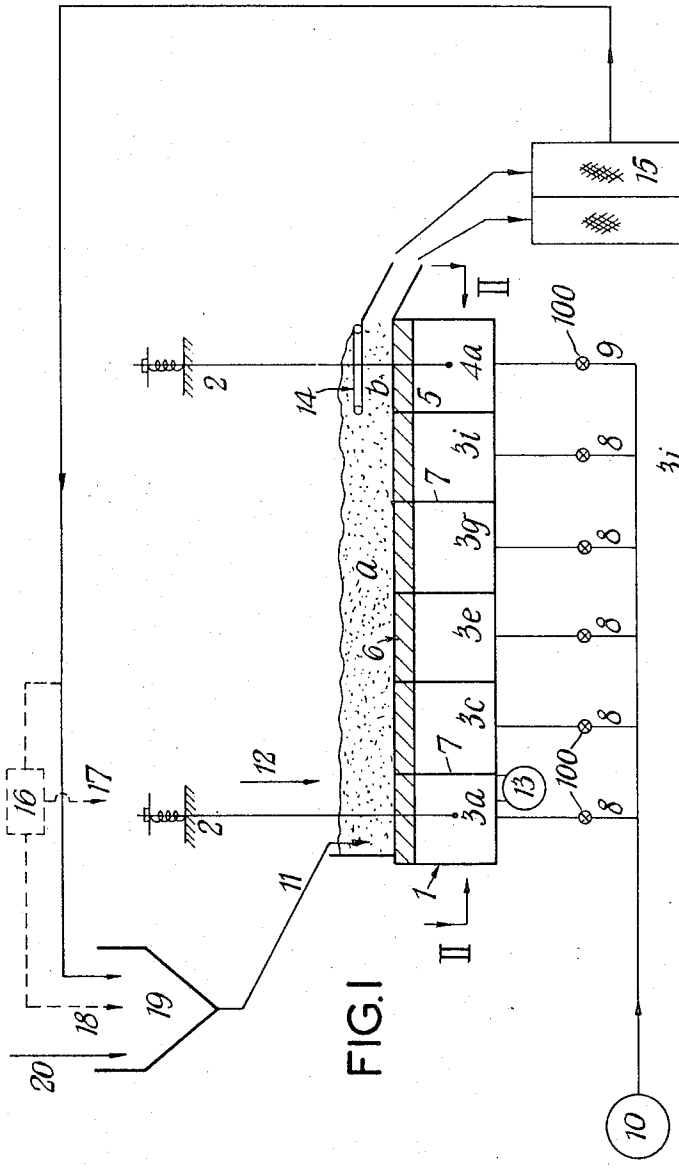

FIG. 1

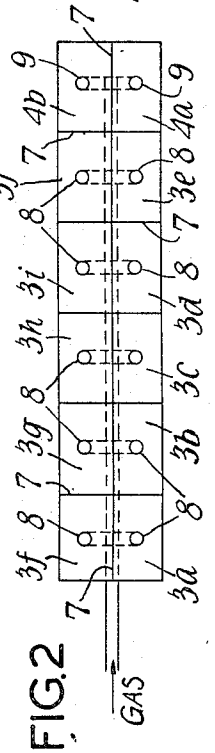

FIG. 2

Inventor
Geoffrey F. Eveson
by Sommers & Young
Attorneys

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Filed April 14, 1965 4 Sheets-Sheet 2

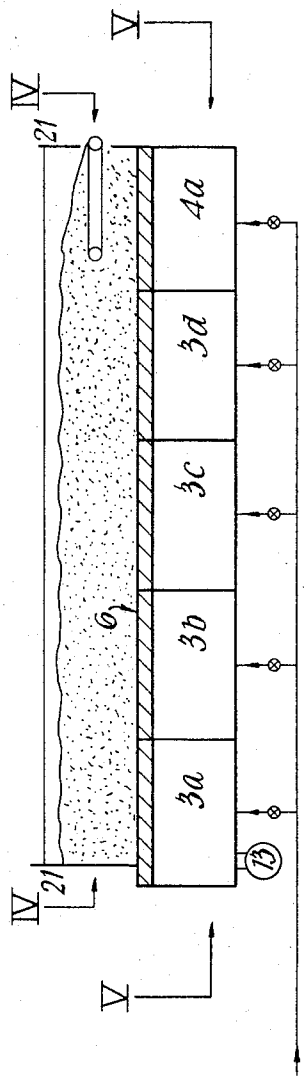

FIG.3

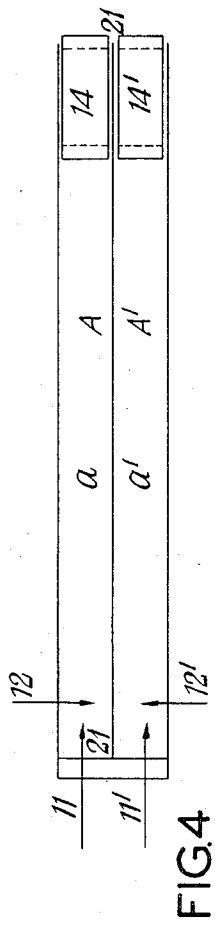

FIG.4

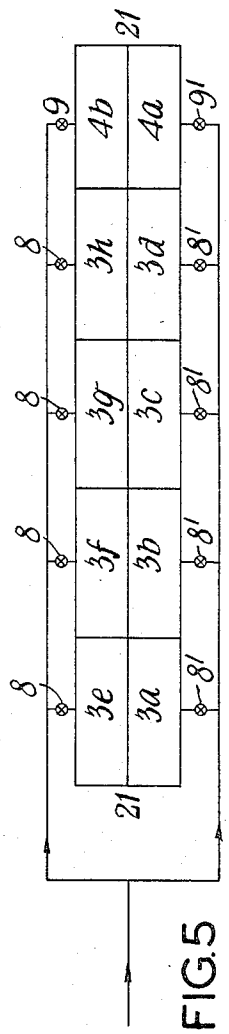

FIG.5

Inventor
Geoffrey F. Eveson
by Sommers & Young
Attorneys

Feb. 6, 1968 G. F. EVESON 3,367,501
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Filed April 14, 1965 4 Sheets-Sheet 3

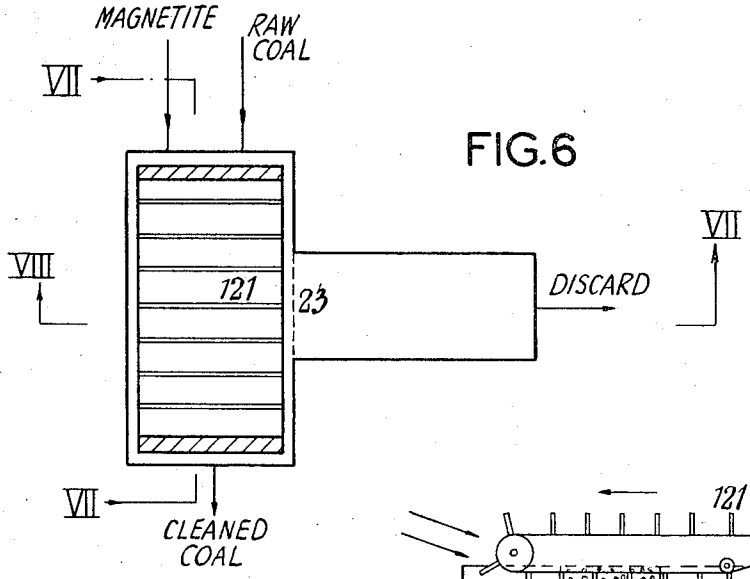


FIG.6

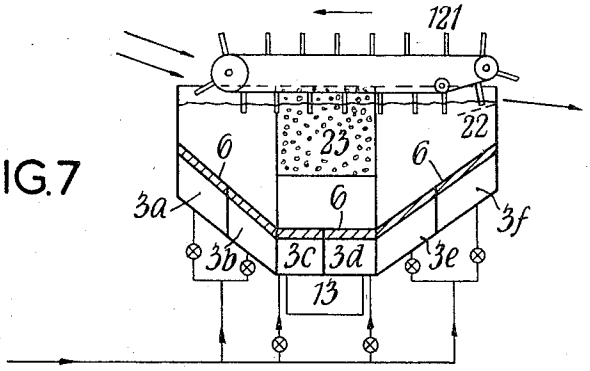


FIG.7

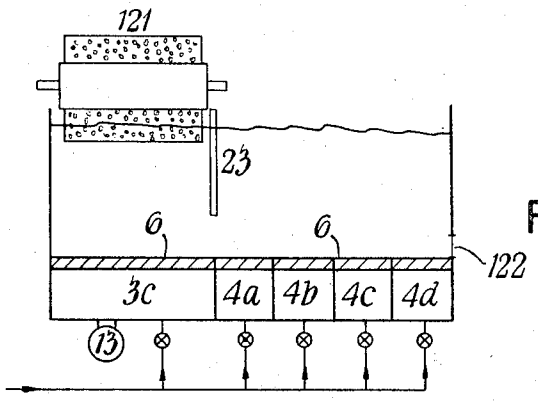
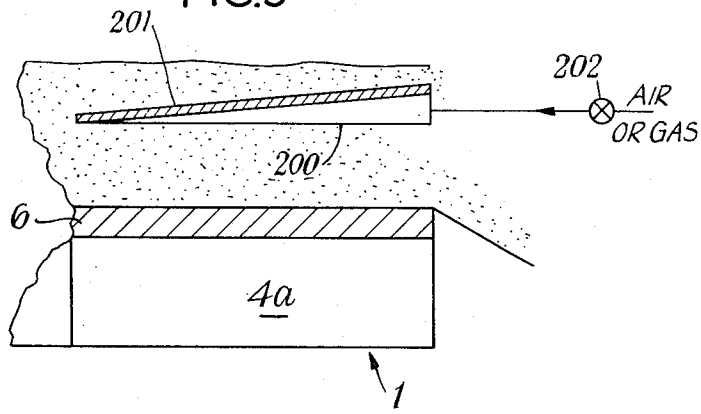


FIG.8

Inventor
Geoffrey F. Eveson
by Sommers & Young
Attorneys

Feb. 6, 1968 G. F. EVESON 3,367,501
DRY-CLEANING OF LARGE OR SMALL COAL OR OTHER PARTICULATE MATERIALS CONTAINING COMPONENTS OF DIFFERENT SPECIFIC GRAVITIES
Filed April 14, 1965 4 Sheets-Sheet 4

FIG.9



Inventor
Geoffrey F. Eveson
by Sommers & Young
Attorneys

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DRY-CLEANING OF LARGE OR SMALL COAL OR OTHER PARTICULATE MATERIALS CONTAINING COMPONENTS OF DIFFERENT SPECIFIC GRAVITIES

Geoffrey Frank Eveson, Ecclesall, England, assignor to Head, Wrightson & Company Limited, Thornaby-on-Tees, England, a corporation of Great Britain

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12 Claims. (Cl. 209—467)

ABSTRACT OF THE DISCLOSURE

Apparatus for cleaning coal or other particulate material by use of a fluidised bed or particles maintained at an effective density to cause the lighter fraction of the particulate material to float on the bed and the heavier fraction to sink through the bed, the apparatus comprising an elongated vibratory trough with a cleaning zone and a discharge zone, the fluidity of the bed in the discharge zone being controllable separately from the cleaning zone to control the rate of discharge of the heavier fraction from the bed.

This invention concerns improvements relating to the dry-cleaning of large or small coal, or other particulate materials containing components of different densities.

Competition from oil as a fuel has reawakened an interest in the dry cleaning of raw small coal for the preparation of a product which is easily-handleable, free-flowing and of uniform ash content. Some of the advantages accruing from the dry cleaning of raw small and fine coal will be lost if the necessary dry cleaning equipment is associated with a conventional wet cleaning process for treating the raw large coal.

An object of the present invention, therefore, is to provide a process of, and apparatus for, dry cleaning large or small coal. However, it will be evident to those skilled in the art that the features of the present improvements are applicable in appropriate instances to the treatment of a limited range of ores and other particulate materials.

The process on which is based the invention comprises delivering the said coal or other particulate material (both hereinafter referred to simply as "material") into a fluidised bed or beds of discrete solid particles, maintaining the bed or beds in a fluidised condition by a gaseous medium applied thereto in such a manner as to give, and retain in, the bed or beds an effective density to cause a separation of the said material into at least first and second fractions of less dense and denser components respectively.

By way of example, considering the said material to be composed of three categories of components (i.e. one of relatively low density, one of relatively high density and one of intermediate density), the process may be operated to separate in appropriately dry condition the component of relatively low density from the remainder, to separate the component of relatively high density from the remainder or to separate the material into the three above-mentioned categories.

One aspect of the invention resides in an apparatus comprising a vibratory fluidising vessel in the form of an elongated trough-sectioned member, a gas-pervious support mounted in the trough-sectioned member for carrying a fluidised bed, supply means for supplying particulate material to be cleaned and said particles for forming said fluidised bed on to said support at an end of said trough-sectioned member at a controlled rate, vibrating means for imparting to said trough-sectioned member a component of vibration in a direction to cause at least said second fraction of said particulate material to be moved

along said trough-sectioned member towards a discharge outlet located at a termination of said trough-sectioned member, extractor means for removing said first fraction from the surface of said fluidised bed, at least two gas chambers beneath said support for the supply of gaseous medium to beneath said support, a first of said gas chambers being located beneath a cleaning zone in which cleaning of said particulate material is effected and the other chamber being located beneath a discharge zone for said second fraction adjacent said discharge outlet, and control means for adjusting the supply of air to said other chamber whereby to control the degree of fluidity of said fluidised bed in said discharge zone so that the rate of discharge of said denser fraction is dependent upon the vibration of said trough-sectioned member and the degree of fluidity in said discharge zone.

The particles used for forming the fluidised bed may be of magnetite, ferro-silicon or other suitable inert magnetic material but when it is required to separate the raw feed into, say, two components at a relatively low density (e.g. below 1.7) it may be advantageous to use sand or other similar inert materials of comparatively low density to prepare the fluidised bed. Also, in certain circumstances it may be advantageous to use a mixture, in controlled proportions, of two or more inert materials.

For convenience, the material of the discrete solid particles hereinafter referred to will be magnetite except in special instances but it will be appreciated that the other types will be used in a substantially identical manner. It will be understood, however, that wherever, in the following description, magnetic separators are employed in carrying out the process of the invention, the discrete solid particles which are used for the fluidised bed or beds in which the separation of the materials under treatment takes place, must be of a magnetic nature. It would, of course, be inappropriate to use magnetic separators in the process when employing sand or similar inert material instead of a magnetic material for the above purpose and accordingly other means would be adopted for recovering the sand or similar inert material from the cleaned particulate material, as hereinafter indicated by way of example.

In order to enable the invention to be readily understood reference is directed to the accompanying schematic drawings showing three examples of apparatus in accordance with the invention. In the drawings:

FIGURE 1 shows a longitudinal section of a first form of apparatus,

FIGURE 2 is a sectional plan view on the line II—II of FIGURE 1,

FIGURE 3 is a longitudinal section of a second form of apparatus,

FIGURE 4 is a sectional plan view on the line IV—IV of FIGURE 3,

FIGURE 5 is a sectional plan view on the line V—V of FIGURE 3,

FIGURE 6 is a plan view of a third form of apparatus,

FIGURE 7 is a sectional view on the line VII—VII of FIGURE 6,

FIGURE 8 is a sectional view on the line VIII—VIII of FIGURE 6, and

FIGURE 9 is a fragmentary view of a modification.

Referring to FIGURES 1 and 2, the apparatus shown comprises an elongated fluidising vessel, in the form of a trough **1**, supported by hangers **2**. The trough **1** contains two main gas chambers **3** and **4**, separated by a transverse partition **5**, and above which is a fixed porous support **6**. The gas chambers may be subdivided into a number of smaller chambers; in the sketch, chamber **3** is shown as being divided into ten smaller chambers **3***a* . . . *j* and chamber **4** into two smaller chambers **4***a*

and 4*b* by vertically extending transverse and longitudinal metal partitions **7**. It is preferable, but not essential, for the vertical metal partitions **7** to be arranged so that the porous support **6** can be made up of a number of tiles, each cemented into the top of a chamber with the top of the partitioning members **7**, flush with the top of the porous support **6**. In this manner, a number of contiguous, gas-tight compartments is created and the upper surface of the porous support is smooth, with only a very small proportion of the area being composed of metal. Gaseous medium under pressure passes from a blower **10**, through inlets **8** and **9** into the chambers **3** and **4** respectively beneath the porous support **6**. To aid precise control of the process, it is desirable, but not essential, that the supply of gas to each of the small chambers be controllable by means of a valve **100**; all of these valves **100** are not shown in the sketch.

Provision is made for magnetite, sized for instance 100 B.S. mesh–300 B.S. mesh, to be fed, as at **11**, continuously and at a rate which can be controlled within pre-set limits into the trough **1**, above the porous support **6**. The gaseous medium is applied so that after passing upwards through the porous support **6** it forms the magnetite into fluidised bed *a* constituting a cleaning zone above gas chamber **3**, and bed *b*, constituting a discharge zone above gas chamber **4**. Since it is possible to control the mass flow rate of gas to each of the small compartments, the effective density of the fluidised bed *a* may be made uniform over the whole area of the cleaning zone above the chamber **3**, or (as may be advantageous in certain cases) it can be arranged that the effective density decreases from the feed end to the discharge end over the length of chamber **3**. Provision is made, indicated at **12**, for the raw coal, sized for instance —3 in. +½", to be fed continuously at a controllable rate into the fluidised bed *a* the effective density of which will be such that the less dense components of the raw coal will float and the denser components will sink to rest upon the porous support **6**; these two fractions will hereinafter be termed "cleaned coal" and "discard" respectively.

Movement of the dischard within the trough **1** is obtained by imparting to said vessel an asymmetric reciprocating or vibrating motion; the amplitude and, if necessary the frequency of this motion may be made controllable within pre-set limits. The motion may be produced by any of the known devices; e.g. an electromagnetic vibrator; a crank and connecting rod. In FIGURE 1 is shown a motor **13** with out-of-balance weights secured to the ends of the shaft; such a device may be mounted on the base of, on the sides of, or above the trough **1** with the line of action of the motion suitably arranged to impose a conveying action on the particles of the discard resting on the porous support. The vibratory motion of the trough **1** has a much less pronounced conveying action on the cleaned coal floating on, or near, the surface of the fluidised bed *a*. Cleaned coal is caused to move by the combined conveying action of the current of fluidised magnetite moving longitudinally along the vessel from inlet to discharge point and the displacement arising from incoming raw feed; movement may be assisted by the use of paddles, or comb-type scraper, suitably disposed above the vessel.

Within the fluidised bed *b* is arranged a device **14** for effecting a division between the upper stratum of cleaned coal and the lower stratum of dischard. This device shown is in the form of an endless conveyor but it may take the form of a stationary splitter plate; in either case, the device **14** occupies the whole of the area of discharge zone above the gas chamber **4**. The vertical separation between the underside of the device **14** and the upper surface of the porous support **6** must be adequate to permit free passage of the largest particle of discard. If the device **14** is in the form of an endless conveyor, the diameters of the head and tail drums should be made as small as is practicable in order that the precision with which the strata of cleaned coal and discard are separated approaches that which can be achieved by a stationary, thin splitter plate. One important advantage accrues from the use of a conveyor, operated so that its upper surface moves towards the discharge end of the trough **1**. The stratified, cleaned coal, together with some magnetite, is transported out of the trough **1** more rapidly than it would move over a stationary splitter plate; the rate at which raw coal can be treated in the trough **1** is, therefore, increased. The magnetite above the device **14** is not fluidised. This magnetite, together with the cleaned coal, passes to a sizing device **15**, which may be a stationary or a vibrating screen.

The mass flow rate of gas entering chamber **4**, and thence passing through the porous support to become instrumental in forming the fluidised bed *b*, is appreciably less than the mass flow rate entering chamber **3**. The separation of the raw coal into two products is completed within the cleaning zone constituted by the fluidised bed *a*. The function of the fluidised bed *b* is to provide a means of controlling the rate at which the discard product and its associated magnetite is discharged from the trough **1**. One extreme is the case where no gas is admitted to the chamber **4**. The magnetite above chamber **4** is then not fluidised and the motion imparted to the trough **1** by the drive unit **13** is the predominant agency influencing the rate at which the discard fraction is discharged. As the mass flow rate of gas entering chamber **4** is increased up to the point at which the effective densities of fluidised beds *a* and *b* are equal, the rate at which the discard fraction is removed is increased. Therefore, automatic or manual control of the mass flow rate of gas to chamber **4** provides a simple but effective method of controlling the rate of removal of discard from the trough **1**. The process is operated so that discard is removed at a rate equal to, or greater than, that at which it enters in the raw coal feed. Provided that the rate of addition of magnetite to the trough **1**, at point **11**, is sufficient always to ensure that the depth of the fluidised bed *a* above the plane of the device **14** is adequate to ensure that the cleaned coal fraction passes onto, and not under, the device **14**, the only possible disadvantage of removing discard at a rate greater than is absolutely necessary is to increase the rate of re-circulation of magnetite above the necessary minimum value. Discard and associated magnetite leaving the trough **1** will pass either to screening device **15**, which will be divided longitudinally in order that the cleaned coal and discard products will not mix one with the other, or to a separate screening device (not shown) if the capacity of screening device **15** is not great enough to allow of the simultaneous handling of both products.

The oversize products from the screening device, or devices, **15** will pass forward for disposal by conventional means as cleaned coal and discard. The undersize products from said device, or devices **15**, which will consist of magnetite and finely-divided coal and discard, (said coal and discard being mainly the products of the size degradation which will inevitably take place in any apparatus designed for handling raw coal) will be mixed together and re-circulated to the trough **1** at **11**. Provision will be made, however, where necessary, for a portion of said re-circulated material to pass to a dry, magnetic separator, **16**. The non-magnetic fraction from said separator will be joined with either the cleaned coal or discard products, or leave the process as a separate dry-fines product, as at **17**. The magnetic fraction from said separator is returned to the process, as at **18**.

Provision is made for a magnetite bunker **19**, to be placed in the process between the screening device, or devices **15** and the trough **1** into which all magnetite will pass, including magnetite fed in at **20** to make good losses of magnetite with the products, before being fed to the trough **1**. Obviously, the minimum capacity of the bunker **19** will be equal to the volume of magnetite re-

quired to fill trough 1 to its operating level plus the volume of magnetite contained in the whole of the sizing and recirculation system.

The invention is not restricted to the apparatus above particularly described and as illustrated, because a number of modifications of it are possible without departing from the scope of the present improvements. For example, in one case, the hangers 2 may be replaced by suitably designed floor mounted supports. As another modification, the hangers or supports may be so arranged that the longitudinal axis of the vessel 1 is inclined to the horizontal. The feed inlet end may be arranged to be higher than the outlet end, to bring about an increase in the rate of conveying or discard, or the outlet end may be arranged to be higher than the inlet end.

A further modification is shown in FIGURE 9, where a device whose purpose corresponds to that of device 14 of FIGURE 1 is a wedge-shaped construction formed from sheet metal 200 and a porous plate in the form of a tile 201. The device, as does the device 14, occupies the whole of the area of the discharge zone above the gas chamber 4. Air or other gas is admitted via valve 202 to the air chest defined by the sheet metal structure beneath the porous tile 201. The rate of gas admission is sufficient to fluidise the magnetite accompanying the cleaned coal and therefore promote removal of these materials from the fluidising vessel 1. The tile 201 may be inclined to the horizontal in the manner shown in the sketch, or it may be horizontal, or it may be inclined in the opposite direction to that shown in the sketch. In each case, a thin tile is desirable and the depth of the air chest must be kept small in order to achieve good separation of the stratified layers of cleaned coal and discard.

As a still further modification, the fluidising vessel may be designed as shown in FIGURES 3 to 5 where parts corresponding to parts shown in FIGURE 1 have been given the same reference numerals. The vessel again in the form of a trough 1 is divided longitudinally both above and below the support 6 by the partition 21 which therefore also divides the gas chambers 3 and 4 and together with transverse partitions forms separate compartments *3a . . . h* and *4a* and *4b*. The partition 21 in FIGURE 2 is shown as dividing the unit above the support into two equal sections, A and A', but the partition 21 is not necessarily located so that these sections are equal in width nor need the sections A and A' be equal in depth. The mass flow rate of gases to chambers *3a* to *3d* and *3e* to *3h* may be adjusted so that the effective densities of the fluidised beds *a* and *a'* in sections A and A' respectively are equal, or are different within the range of effective density which can be achieved when using any given bed medium (e.g. magnetite or a mixed medium of, say, magnetite and sand) from which to form these fluidised beds. Again the effective densities of fluidised beds *b* and *b'* may be made equal or different by adjusting the mass flow rate of gas to chambers *4a* and *4b*, depending upon the relative rates at which the discards from the two sections A and A' are to be discharged. This modification is of value, for example, in the following circumstances:

(a) where it is necessary separately to clean different size fractions of the same raw coal at the same, or nearly the same, effective density.
(b) where two coals of different rank have to be cleaned separately at the same, or nearly the same, effective density.

In such applications, a common re-circulation system for the magnetite may be employed if so desired but the sizing device, or devices 15 (FIGURE 1) must be arranged so that the products of the separation are kept separate. A further possible application of this design of fluidising vessel may be where it is necessary to prepare, from one raw coal, three products of different densities, e.g. clean coal, middlings and refuse. It may then be possible to admit the raw coal at 11 into section A and separate this raw coal into clean coal and a mixture of middlings and refuse, or into refuse and a mixture of clean coal and middlings. The mixed product (i.e. middlings plus refuse or clean coal plus middlings) is passed to a sizing device 15, to be freed from its associated magnetite and then returned at 11', to section A'. The effective density of the fluidised bed *a'* is adjusted to achieve the separation of middlings from refuse or of clean coal from middlings. This system is of practical value mainly when the effective densities of the fluidised beds *a* and *a'* are sufficiently close to enable them to be obtained, using the same bed material (e.g. magnetite), merely by adjustment of the mass flow rates of fluidising gas to the two sections, A and A', of the vessel. If the required effective densities of the fluidised beds *a* and *a'* cannot be achieved in this manner, but involve the use of different bed materials (e.g. magnetite and sand), it would probably be preferable to use separate fluidising vessels of the form shown in FIGURE 1 and a recirculation system for each separation.

In a further modification, the trough-sectioned fluidising vessel may be designed as in FIGURES 6 to 8. In plan view, the vessel is T-shaped. Raw coal is separated, into cleaned coal and discard, in a cleaning zone constituted by a fluidised bed established in the bar of the T. The cleaned coal is caused to move primarily by the action of the comb-type scraper 121, which preferably is equipped with perforated flights or vanes. The scraper 121 need not be fixed to the fluidising vessel, but may be separately mounted or suspended. An inclined perforated plate 22, acting as a beach, is fixed inside the fluidising vessel and the scraper moves the cleaned coal over this plate before discharging it together with some magnetite. The discard sinks through the fluidised bed to rest on the porous support 6. Part of this support is inclined, as shown, at such an angle to the horizontal that discard will move down the slope until it reaches the horizontal, or substantially horizontal, portion. The discard is caused to move along this portion, which constitutes a discharge zone extending at right angles to the flow of cleaned coal, by the motion imparted to the fluidising vessel by the drive unit 13. A vertical, perforated plate 23, permits magnetite to move, at all levels, in the direction of travel of the discard but prevents cleaned coal from moving out of the path of the scraper 21. The mass flow rates of gas to the various gas chamber compartments designated as *3a* to *3f* are adjusted so that a uniformly-fluidised bed is established throughout the cleaning zone in which raw coal is separated into cleaned coal and discard. The effective density of the fluidised bed above the gas chamber compartments designated *4a* to *4d* need not be uniform throughout, nor need it be the same as that in the cleaning zone. Conveniently, the gas mass flow rates may be adjusted so that the effective density of the fluidised bed increases from the plane of the perforated plate 23, to the discard discharge point. As before stated, the rate at which discard is removed from the fluidising vessel can be controlled by adjusting the mass flow rates of gas to the gas chambers, 4, and, in particular, to the gas chamber sited below the discharge point. The port 122 extends the whole width of the vessel and its depth must be adequate to ensure that the largest particle of discard can be discharged freely. In the modification shown in FIGURES 6 to 8, the width of the cleaning zone is determined by the rate at which raw coal has to be treated and by the proportion of cleaned coal in the feed. The width of the discharge zone of the fluidising vessel is fixed by the proportion of discard in the feed and by the rate of feed or raw coal. Since the majority of the magnetite fed into the fluidising vessel is discharged with the discard product, it will be seen that the rate of recirculation of magnetite may be minimised by careful selection of the

widths of the two limbs of the fluidising vessel. This modification will be of greatest value in cases where the raw feed contains a small proportion of discard material in which case the width of the discharge zone is advantageously narrower than that of the cleaning zone.

In carrying out a cleaning process using any of the apparatus shown in the drawings, the supply of gaseous medium to the chamber 3 may be entirely separate from the supply of gaseous medium to the chamber 4.

As another modification, the supply of gaseous medium to chambers 3*a*, etc., or to chambers 4*a* etc., or both, may be pulsed by allowing a controlled portion of said supply of gaseous medium to by-pass the vessel 1 in a cyclic manner, the frequency of said cycle during which gaseous medium is by-passed being controllable within pre-set limits.

In yet another modification, where it is desired to remove a small amount of surface moisture from the raw coal feed, the magnetite may be heated to a pre-determined extent by some suitable means before being fed at 11 to the vessel 1. Again, the gaseous medium can be supplied to the chambers 3, 4 in a pre-heated condition, either additionally to the use of heated magnetite or instead of said heated magnetite. The system will be such that particles of the raw feed are dried as they are separated into two products. There is evidence that it is necessary to ensure that finely-divided particles of magnetite are virtually free of surface moisture if a gas-fluidised medium of the requisite degree of homogeneity is to be prepared. Magnetite particles will absorb water present, in the form of free moisture, on the surfaces of particles of the raw feed. This modification will provide the magnetite in a suitably moisture-free form. It is possible to heat the magnetite in apparatus external to the fluidising vessel or, conceivably, in the first portion of said vessel. The heating may be direct (e.g. use of hot gases) or indirect (e.g. use of heating coils through which circulates steam or other hot gases).

In the treatment of ores, or particulate materials other than ores and raw coal, the apparatus employed may be substantially the same as above described or according to any of the stated modifications, with such variations, if any, as may be apparent having in mind the nature of the raw product treated. With certain feed materials, suitably-sized fine particles of one or more of the constituents of the feed may be used for forming the fluidised bed in place of the magnetite or other magnetic or non-magnetic inert material above mentioned.

It will be apparent to those skilled in the art that the present invention has many advantages. It may here be mentioned, for instance, that it permits in a simple and efficient manner the dry cleaning of raw large, or small, coal or other material of the nature aforesaid; the process and apparatus are suitable for the treatment of a wide range of particle size; said treatment can be effected within a range of specific gravity; the process and apparatus are suitable for the simultaneous drying and dry-cleaning of a wide range of materials, the products of separation being relatively dry and easily handleable; and, finally, the invention offers the possibility of effectively separating a raw feed into three products by dry-cleaning, even if the feed contains a relatively high proportion of middlings.

I claim:

1. An apparatus for the cleaning of coal or other particulate material containing components of different densities by use of a fluidised bed of particles, said fluidised bed having an effective density to cause a first fraction of said particulate material comprising the less dense components of said particulate material to float on said fluidised bed and a second fraction comprising the denser components to sink through said fluidised bed, said apparatus comprising a vibratory fluidising vessel in the form of an elongated trough, a gas-pervious support mounted in the trough for carrying the fluidised bed, supply means for supplying particulate material to be cleaned and said particles for forming said fluidised bed on to said support at one end of said trough at a controlled rate, vibrating means for imparting to said trough a component of vibration in a direction to cause at least said second fraction of said particulate material to be moved along said trough from one end to a discharge outlet located at the opposite end of said trough, extractor means disposed beneath the surface of said fluidised bed and extending along said trough from said opposite end towards said one end to support said first fraction adjacent said opposite end and cause it to be conveyed out of said trough over said opposite end, at least two gas chambers beneath said support for the supply of gaseous medium to beneath said support, a first of said gas chambers being located beneath a cleaning zone extending from said one end up to said extractor means and in which cleaning of said particulate material is effected and the other chamber being located beneath a discharge zone for said second fraction which discharge zone lies immediately below said extractor means and up to said discharge outlet, and control means for adjusting the supply of air to said other chamber whereby to control the degree of fluidity of said fluidised bed in said discharge zone so that the rate of discharge of said second fraction is dependent upon the vibration of said trough and the degree of fluidity in said discharge zone.

2. An apparatus as claimed in claim 1, wherein said extractor means comprises an endless belt conveyor disposed with its upper surface below the surface of said fluidised bed to support said first fraction.

3. An apparatus as claimed in claim 1, wherein said extractor means are provided with an air chest for supplying gas to fluidise particulate material passing over the plate.

4. An apparatus as claimed in claim 1, wherein said trough is divided longitudinally to provide first and second independent cleaning zones side by side, first and second supply means for supplying particulate material to be cleaned and particulate bed material to said first and second cleaning zones respectively at said one end of said trough and first and second independent discharge zones side by side, and respective extractor means disposed over each discharge zone.

5. A process of cleaning coal or other particulate material using the apparatus as claimed in claim 4, wherein said particulate material is fed through said first supply means and is cleaned in said first cleaning zone to produce said first and second fractions and said second fraction discharged from said first discharge zone is fed through said second supply means to said second cleaning zone to produce further first and second fractions.

6. A process of cleaning coal or other particulate material using the apparatus as claimed in claim 4, wherein said particulate material is fed through said first supply means and is cleaned in said first cleaning zone to produce said first and second fractions, and said first fraction discharged from said first discharge zone is fed through said second supply means to said second zone to produce further first and second fractions.

7. An apparatus for the cleaning of coal or other particulate material containing components of different densities by use of a fluidised bed of particles, said fluidised bed having an effective density to cause a first fraction of said particulate material comprising the less dense components of said particulate material to float on said fluidised bed and a second fraction comprising the denser components to sink through said fluidised bed, said apparatus comprising a vibratory fluidising vessel having a first trough portion defining a cleaning zone and a second trough portion extending transversely from said first trough portion at a position intermediate the length of said first trough portion and defining a discharge zone for said second fraction, gas-pervious supports in said first and second trough portions for carrying the fluidised bed, the gas-pervious support in said first trough portion sloping

downwardly in the longitudinal direction thereof to said gas-pervious support in said second trough portion whereby to cause said second fraction to slide down said gas-pervious support in said first trough portion to the entrance of said second trough portion, supply means at one end of said first trough portion for supplying particulate material to be cleaned and said particles for forming said fluidised bed, extratcor means for removing said first fraction at the opposite end of said first trough portion, vibrating means for imparting to said fluidised vessel a component of vibration in the longitudinal direction of said second trough portion to cause said second fraction to be moved along said second trough portion in the direction away from its junction with the first trough portion, at least one gas chamber disposed beneath said gas-pervious support in said first trough portion, at least one gas chamber disposed beneath said gas-pervious support in said second trough portion, and control means for adjusting the supply of air to said last-mentioned gas chamber whereby to control the degree of fluidity of said fluidised bed in said second trough portion.

8. An apparatus as claimed in claim **7**, wherein a plate extends part way down into said bed at the entrance of said second trough portion in order to close said second trough portion to said first fraction.

9. An apparatus as claimed in claim **7**, wherein the widths of the first and second trough portions are different.

10. An apparatus as claimed in claim **7**, wherein mechanical means are provided for sweeping said first fraction along said first trough portion from the end adjacent which said supply means is located to the opposite end.

11. An apparatus as claimed in claim **10**, wherein said mechanical means also constitute said extractor means and are adapted to sweep said first fraction onto a beach at said opposite end of said first trough portion.

12. An apparatus as claimed in claim **11**, wherein said mechanical means comprises a comb-type scraper having perforated vanes.

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HARRY B. THORNTON, *Primary Examiner.*

TIM R. MILES, *Examiner.*