

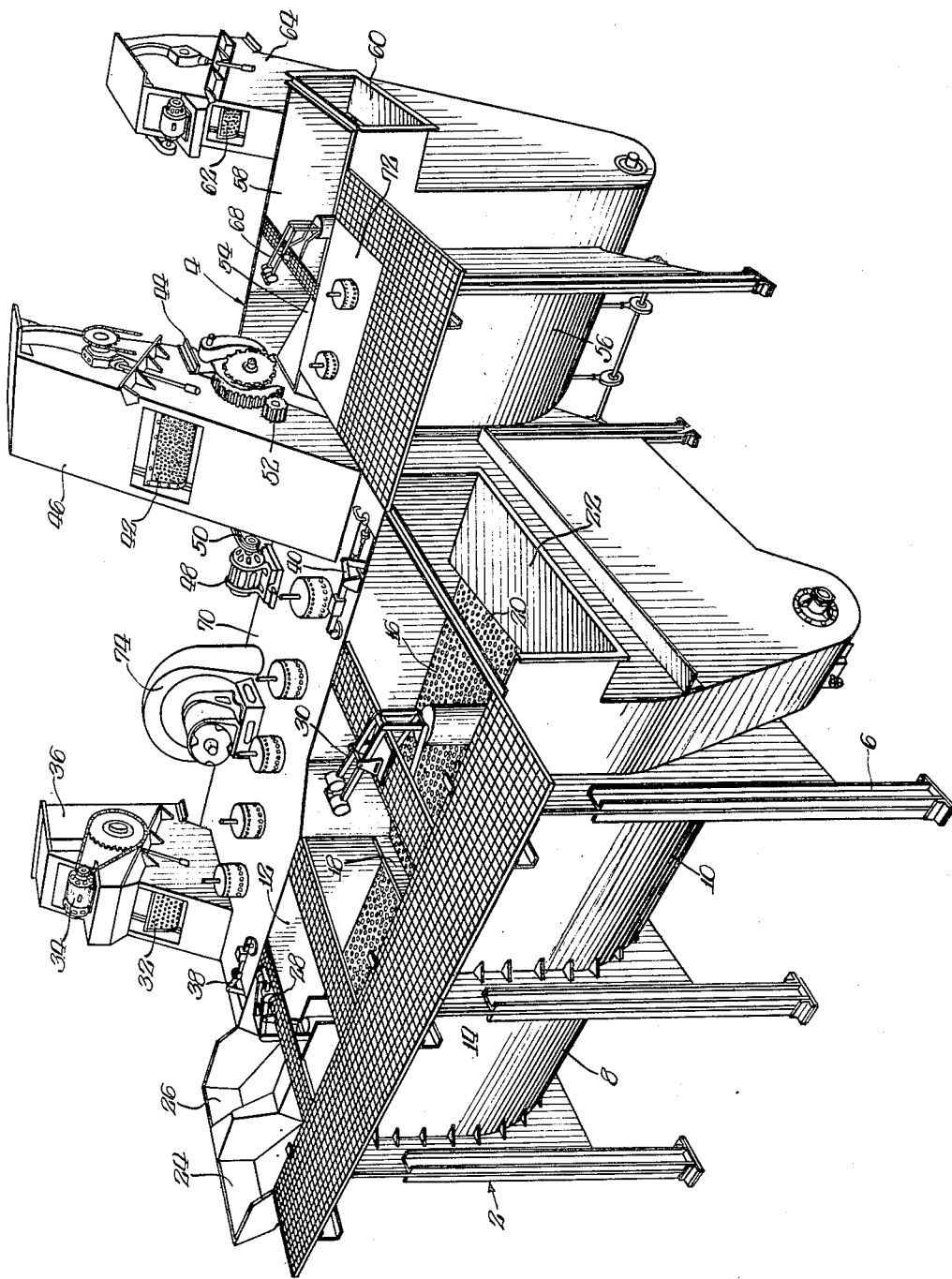
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COAL WASHING MACHINE

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COAL WASHING MACHINE

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The present invention relates to devices for separating and segregating commingled materials of different specific gravity, and more in particular to coal washing devices adapted to segregate coal of a desired specific gravity from other materials interspersed therewith when newly mined and commonly referred to as refuse or undesirable constituents.

The art of washing raw coal, as now practiced, contemplates the use of a washing device having one or more washing chambers, but preferably at least two, the treatment of said coal consisting of an initial washing thereof in the first compartment to separate and segregate the heavier and pure impurities, after which the body of coal is progressively moved to one or more additional compartments to be treated therein. The treatment of the coal in said additional compartments constitutes a repetition of the preceding process in that the body of partially treated coal is subjected to the further step of separation and segregation whereby laminated pieces of material, consisting of strata of coal and impurities bound together in pieces, are separated from the main body of coal.

Heretofore these laminated particles, designated generally as "middlings," have been crushed to separate the pure coal from the impurities forming the same, after which the crushed material is mixed with the raw coal in the first compartment and subsequently treated in accordance with the above indicated process, or such middlings, after crushing, have been treated in a separate washing device whereby the pure coal was recovered.

Where the art of washing coal, including the step of returning such middlings to the raw coal for re-treatment, has been practiced, certain undesirable and objectionable operating characteristics of the device have been experienced, leading to intricate control problems which cannot be satisfactorily solved to obtain a desirable treated body of coal discharged from the said device. Principally, the objectionable feature of following such a process is that the return of these crushed middlings to the raw coal effects a progressive building up of a body of material in the washing device wherein the constituents thereof consist of particles of material of substantially the same gravity, which makes separation and segregation of particles difficult in the second wash compartment. As a further objectionable characteristic of this process of returning the crushed middlings to the raw coal being treated by the device, it has been found

that unless the crushed middlings are screened to remove the smaller sizes before crushing, a condition will exist in the coal treating device upon return of said middlings to the raw coal which comprises a build-up in the device due to a "closed circuit."

The return of screened and crushed middlings to the coal washing device as now practiced therefore has unsurmountable difficulties which make it impractical, if not impossible, to properly operate the device for securing washed coal of a particular specific gravity. In the ordinary installation, the use of a separate washing device for said middlings is out of the question because of the investment involved and the cost of operating such separate devices after the same have once been installed. As a further objection to this layout, including a separate device for washing middlings, it has been experienced that the additional power costs, the costs of transporting middlings from the first device to the second device, and other considerations, make it highly uneconomical to treat said middlings, and as a result the average plant does not treat such middlings but considers the same as waste not worthy of further treatment to separate and segregate the component constituents thereof.

The present invention has, as one of the principal objects, the idea of constructing a unitary coal washing device having primary washing means and a secondary washing means whereby middlings from the first washing means are successfully treated in the second washing means.

As still another desiderata of the invention, the same comprehends the idea of building a coal washing device as a compact and economically arranged unit consisting of a primary washer and a secondary washer for treating middlings discharged by said primary washer so as to recover the merchantable coal particles from said middlings.

The invention further comprehends the idea of building a unit as hereinbefore described wherein the said middlings as discharged from the primary washer are conveyed to a crusher between the primary and secondary washers and are discharged immediately and directly from the crusher to the secondary washer. As a more particularly desirable feature of this construction, the invention contemplates providing a single power drive for the said conveyor and crusher.

As a further object within the purview of the present invention in order to conform to the desirability of arranging the washing units com-

pactly and to provide a device which is economical as an investment and to operate and maintain, the contemplated device is provided with a common air duct and source of air for the

5 primary and secondary washers.

Other objects, features, capabilities and advantages are comprehended by the invention, as will later appear and as are inherently possessed thereby.

10 Referring to the drawing:

The figure is a view in perspective of a coal washer of unitary construction made in accordance with the present invention.

Referring now more in detail to the drawing, 15 the embodiment selected to illustrate the present invention is shown as being of unitary and compact construction including a primary washer 2 and a secondary washer 4, the same being supported in any convenient manner, as for example, by the legs 6. Although the details of construction of the said primary and secondary coal washers alone form no part of the present invention, nevertheless a somewhat detailed consideration of their operation will be given for the 20 purpose of illustrating the present contribution in the art.

The primary washer 2 consists, in the illustrative embodiment, of two washing compartments 8 and 10, both being formed with a communicating coal receiving channel, represented generally as 12, the same consisting of oppositely disposed walls and lower grating or screen members 14 and 16 for the said compartments 8 and 10, respectively. Interposed between screens 14 35 and 16 is a baffle 18 for a purpose to be hereinafter more fully described, and at the end of screen 16 is a baffle or abutment 20 at the top of which is a discharge plate 22. Raw coal is introduced into the primary washer through troughs 24 and 26 leading into the channel 12 40 whereby the coal initially is treated within compartment 8. Certain of the particles of said body of coal are discharged from the compartment 8 over baffle 18 into that part of channel 12 within compartment 10 whereupon the same 45 as a body resting upon screen 16 are further subjected to treatment. After being treated in compartment 10, certain of the particles forming the body of coal disposed above the screen 16 are discharged from the device over the discharge 50 plate 22. It is to be understood that during operation of the device a body of material of substantial depth is disposed at all times in conduit 12.

55 The principle of operation of the coal washer is well known, the same depending upon a separation of the constituent components of the body of coal by the action of gravity wherein the refuse or undesirable particles of the body of coal are 60 settled out on the screens 14 and 16 for removal from the device, the resulting treated coal being of the desired specific gravity containing a controlled amount of undesirable constituents. The separation and segregation of the constituents of 65 the body of coal are effected by means of pulsating movements of bodies of water contained within compartments 8 and 10 and beneath grills or screens 14 and 16 which are caused by introducing at proper intervals air under pressure into 70 said compartments. The introduction of such air under pressure into compartments 8 and 10 causes the water therein to rise through the screens 14 and 16 up into the body of coal passing through the channel or passageway 12 to momentarily and 75 intermittently rearrange the particles composing

the same in accordance with their specific gravities. Inasmuch as the undesirable constituents of the body of coal have specific gravities greater than the coal particles themselves, this movement of water results in segregating the undesirable constituents of greater specific gravity on 5 the screens 14 and 16 at the lower part of the bed of material in the channel 12. The degree of segregation of the particles within compartments 8 and 10 is accomplished by the control devices 10 28 and 30, respectively, which may be adjusted as desired for varying the quantity of undesirable constituents contained in the body of coal discharged from this primary washer.

The refuse segregated out on the screen 14 is 15 discharged through a gate (not disclosed) disposed adjacent and below the intake troughs 24 and 26 whereby such refuse particles are received by the conveyor 32 and discharged from the washing device, said conveyor 32 being driven by a 20 motor 34 mounted upon a housing 36, as clearly shown in the drawing. Control of the discharge gate for the refuse material is effected through mechanism 38 which in turn is controlled by the control device 28. 25

The body of coal passing over baffle 18 and received on screen 16 is further subjected to the movement of water within compartment 10 30 wherein additional undesirable constituents of the body of coal are separated and segregated upon the screen 16, the treated coal being discharged over baffle 20 onto plate 22, from which it may be transported to any point desired. The refuse on the screen 16 is discharged through a gate (not 35 disclosed) controlled by mechanism 40 which, in turn, is controlled by the control means 30, such refuse being discharged onto a conveyor 42 for removal from the compartment 10. Additional means in the form of screw conveyors (not disclosed) are disposed adjacent the bottom of compartments 8 and 10 and are driven by operating 40 mechanisms for elevators 32 and 42, respectively, for transferring smaller refuse particles which have been dropped through screens 14 and 16 to the said respective elevators for removal from the 45 primary washer device.

The material discharged onto the conveyor 42 50 constitutes those undesirable particles segregated within the chamber 10 on the screen 16, and each of which particles consists of strata of coal and impurities bound together. Because of such impurities, these particles have a greater specific gravity than the desirable coal particles discharged over the plate 22. Such material is generally referred to in the trade as "middlings" and 55 if properly treated the coal contained therein can be recovered at a profit. It is one of the principal objects of the present invention to so reclaim such coal at a low cost that the same may be sold at a profit, either alone as second-grade 60 coal or mixed in certain proportions with the coal treated by the primary washer.

Therefore the device herein contemplated comprises unitary structure wherein the middlings removed from compartment 10 by the conveyor 42 65 are lifted laterally upwardly and away from the primary washer 2 and are dumped into a crusher mechanism, generally represented as 44, and disposed within the conveyor housing 46. The crusher 44 is operated by an electric motor 48 70 through a belt 50, and said crusher in turn through suitable mechanism, generally represented as 52, drives the conveyor 42 hereinbefore referred to. The crushed middlings are then discharged onto the receiving launder of the wash- 75

ing device 4 and the same progressively move as a body through channel 58 disposed above washing chamber 56 of the secondary washer 4, the body of middlings being supported upon a screen 54 forming the bottom of channel 58 and being substantially the equivalent of screens 14 and 16. Segregation of the particles of coal from the refuse and undesirable constituents of these middlings is effected by movement of water contained within chamber 56, all in accordance with the process followed in operating washer 2 as hereinabove described. The refuse, because of its greater specific gravity, is separated from the coal particles of less specific gravity and is segregated upon the screen 54. The coal particles are discharged through discharge opening 60 of the trough or chute and the refuse particles are discharged through a gate (not disclosed) onto a conveyor mechanism, generally referred to as 62, disposed within housing 64 and operated by means of the motor 66, the refuse gate being controlled by control mechanism 68 which corresponds to similar mechanisms 28 and 30 of the primary washer.

As a further important feature of the unitary structure for a coal washer as exemplified in the drawing, the invention comprehends providing an air duct or chamber common to both the primary and secondary washers, said duct being formed in part as at 70 in the primary washer, and in part as at 72 in the secondary washer 2. Air within said air duct or chamber is maintained under pressure as by means of a blower 74 and said air, through the medium of suitable control valves and mechanism, is introduced into the compartments 8, 10 and 56 at desired intervals to cause the pulsations of the water therein which are instrumental in the re-arranging of the particles forming the body of coal in the devices 2 and 4 to separate and segregate out the undesirable constituents as hereinbefore described.

It will be clearly appreciated from the above disclosure that the device, as illustrated, is compactly arranged and includes a separate washer for the middlings which can be treated with very little additional operating expense, it being noted that the crusher and conveyor for said middlings are operated by a common source of power, and that the air supplied to both the primary and secondary devices is from a common source under pressure. As an additional feature of importance, the present device can be manufactured at a cost only slightly above the cost of a single device; thus with an investment not greatly in excess of an investment in a single device middlings can be separately treated, thereby making it unnecessary, in order to salvage certain of the coal contained therein, to return them to a primary washer for re-treatment which, as above indicated, has very distinct disadvantages. In addition, the compactly arranged units lend themselves admirably to efficient procedure steps involving low elements of cost as compared to former installations, as for example, elimination of duplication of separate devices and appurtenances with attendant increased power costs, additional material transportation mechanism, and other instrumentalities necessary to such equipment. The unitary construction characterized as above described has the further advantage that the purity of the coal treated in the primary washer free from middlings can be controlled with greater ease and facility while the resulting product is more uniformly graded and of higher quality than would otherwise be ob-

tained were middlings re-treated in the said primary washer. As an adjunct to said last-named advantage, substantial profit is derived by reclamation of the coal in said middlings because of the operator's option of returning said coal particles to the body of coal from the primary washer without in any way affecting its grade or quality.

While I have herein described and upon the drawing shown an illustrative embodiment of the invention, it is to be understood that the invention is not limited thereto but comprehends other constructions, arrangements of parts, details and features without departing from the spirit of the invention.

I claim:

1. A coal washing machine comprising a unitary structure formed in part by a primary washing device and in part by a secondary washing device laterally spaced with respect to said primary washing device for separating and segregating bodies of coal and other material of varying specific gravity, an air duct interposed between said washing devices for introducing air into each of said devices, means for supplying air to said air duct, means for transferring segregated material from said primary washing device to said secondary washing device, and crushing means for conditioning said segregated material during its transfer to said secondary washer.

2. A coal washing machine comprising a unitary structure formed in part by a primary washing device and in part by a secondary washing device laterally spaced with respect to said primary washing device for separating and segregating bodies of coal and other material of varying specific gravity, an air duct interposed between said washing devices for introducing air into each of said devices, means for supplying air to said air duct, said primary device having its discharge end substantially disposed in laterally opposed relation to the receiving launder of said secondary washing device, conveyor means disposed adjacent the discharge end of said primary washing device for conveying segregated material from said primary washing device to said secondary washing device, and crushing means associated with said conveyor means for crushing said segregated material and discharging the same onto the launder of said secondary washing device.

3. A coal washing machine comprising a unitary structure formed in part by a primary washing device and in part by a secondary washing device disposed laterally in spaced relation with respect to said primary washing device for separating and segregating bodies of coal and other material of varying specific gravity, an air duct interposed between said washing devices for introducing air into each of said devices, means for supplying air to said air duct, said washing devices extending longitudinally in substantially parallel relation with their discharge ends disposed at one end of the machine and with the discharge end of said primary washing device in substantially opposed relation to the receiving launder of said secondary washing device, conveyor means disposed adjacent the discharge end of said primary washing device for conveying segregated material from said primary washing device to said secondary washing device, and crushing means associated with said conveyor means for crushing said segregated material and discharging the same onto the launder of said secondary washing device.

4. A coal washing machine comprising a unitary structure formed in part by a primary washing device and in part by a secondary washing device disposed laterally in spaced relation with
5 respect to said primary washing device for separating and segregating bodies of coal and other material of varying specific gravity, an air duct interposed between said washing devices for introducing air into each of said devices, means for
10 supplying air to said air duct, said washing devices extending longitudinally in substantially parallel relation with their discharge ends disposed at one end of the machine and with the discharge end of said primary washing device
15 in substantially opposed relation to the receiving launder of said secondary washing device, and means disposed between said washing devices at the discharge and receiving ends of said primary and secondary washing devices, respectively,
20 for transferring and conditioning segregated material discharged from said primary washing device and delivering said conditioned material to said secondary washing device.

25 5. A coal washing machine comprising a unitary structure formed in part by a primary wash-

ing device and in part by a secondary washing device disposed laterally in spaced relation with respect to said primary washing device for separating and segregating bodies of coal and other
5 material of varying specific gravity, an air duct interposed between said washing devices for introducing air into each of said devices, means for supplying air to said air duct, said washing devices extending longitudinally in substantially
10 parallel relation with their coal discharge means disposed at one end of the machine, said primary washer having discharge means for said other material of varying specific gravity disposed in substantially opposed relation to the receiving
15 launder of said secondary washing device, conveyor means disposed between said washing devices for receiving said other material of varying specific gravity from the discharge means therefor of said primary washer, and a crusher for
20 receiving said other material of varying specific gravity from said conveyor means to condition the same and to discharge the conditioned material onto the launder of said secondary washing device.

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