J. L. HILLER.

COAL BREAKER AND CLEANER.

APPLICATION FILED NOV. 13, 1915.

1,322,567.

Patented Nov. 25, 1919.

3 SHEETS—SHEET 1.

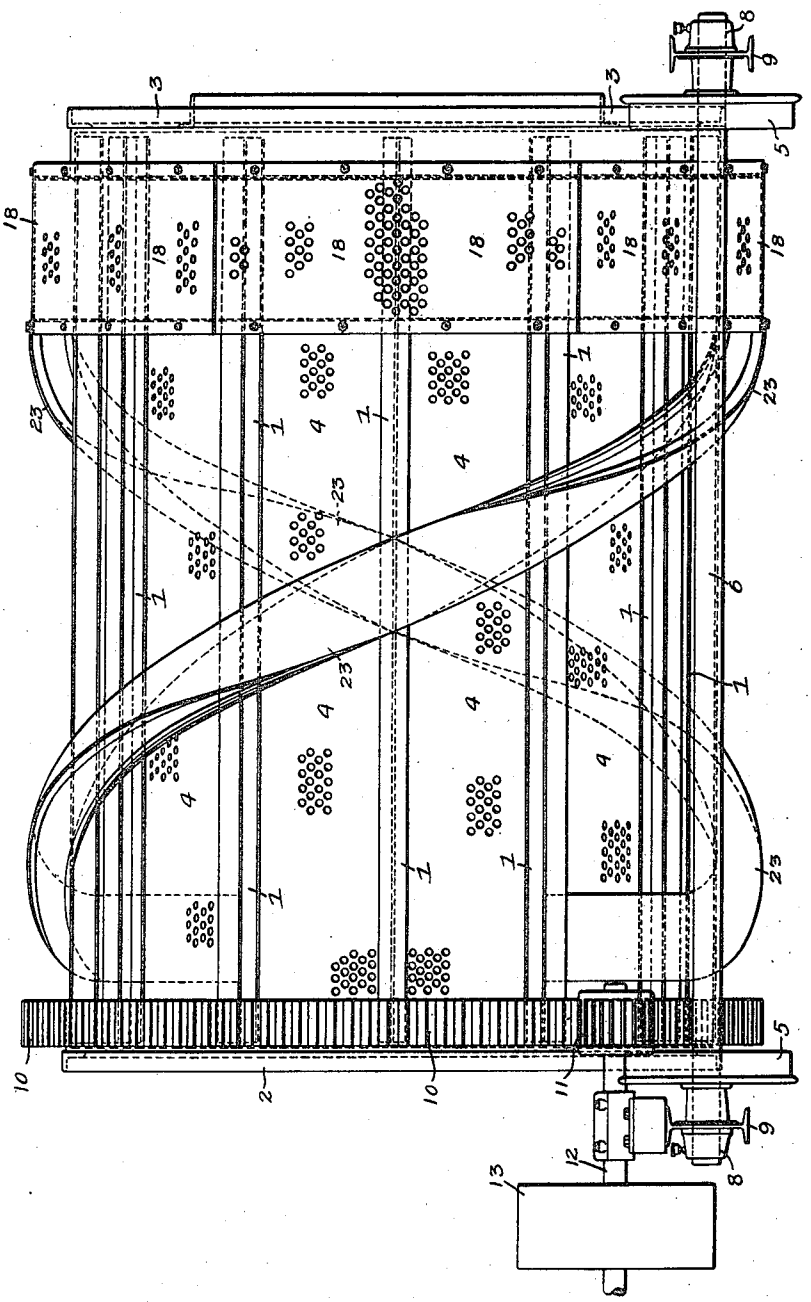


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2

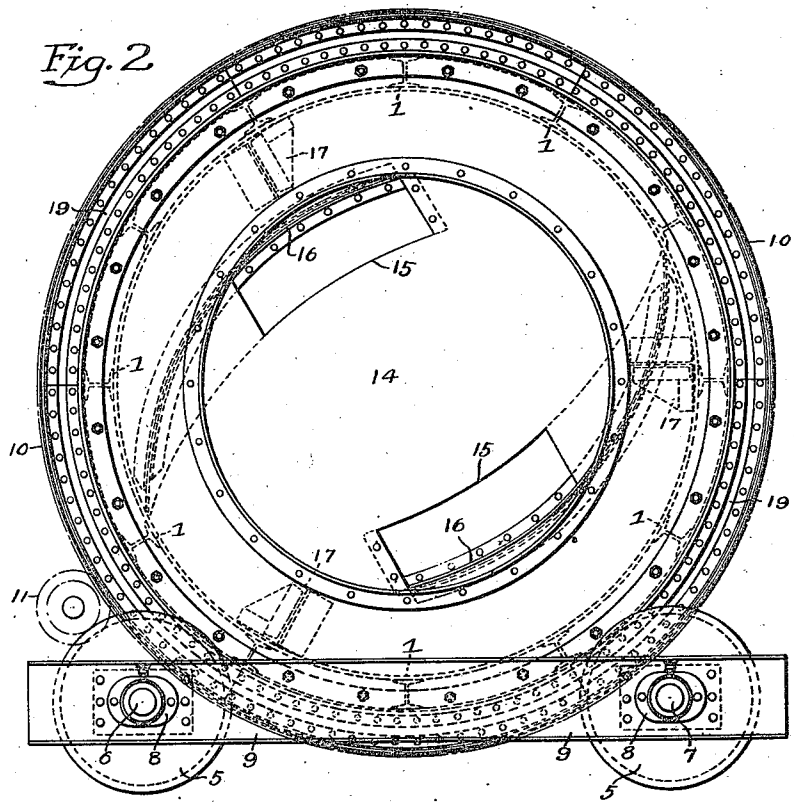
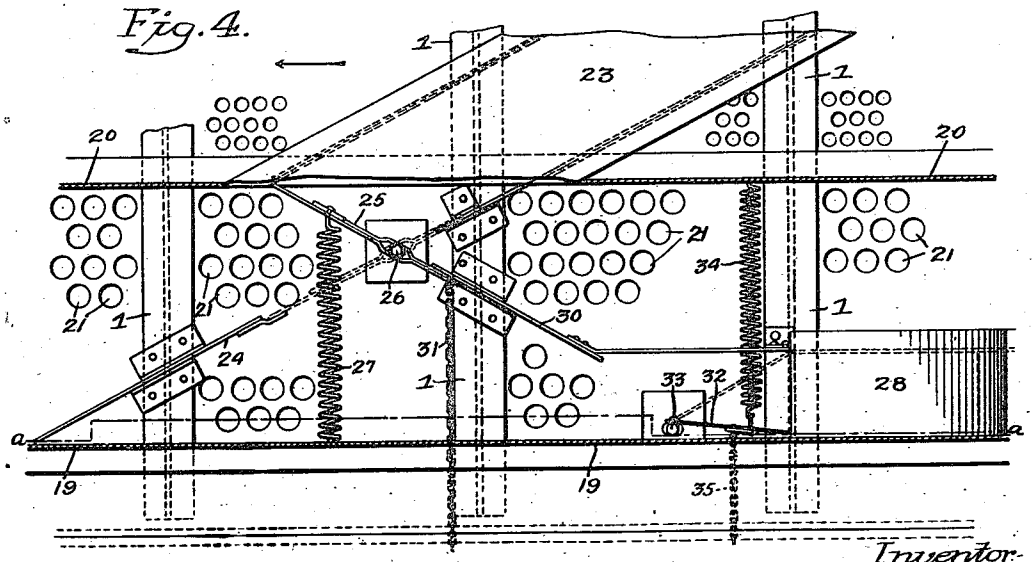


Fig. 4.



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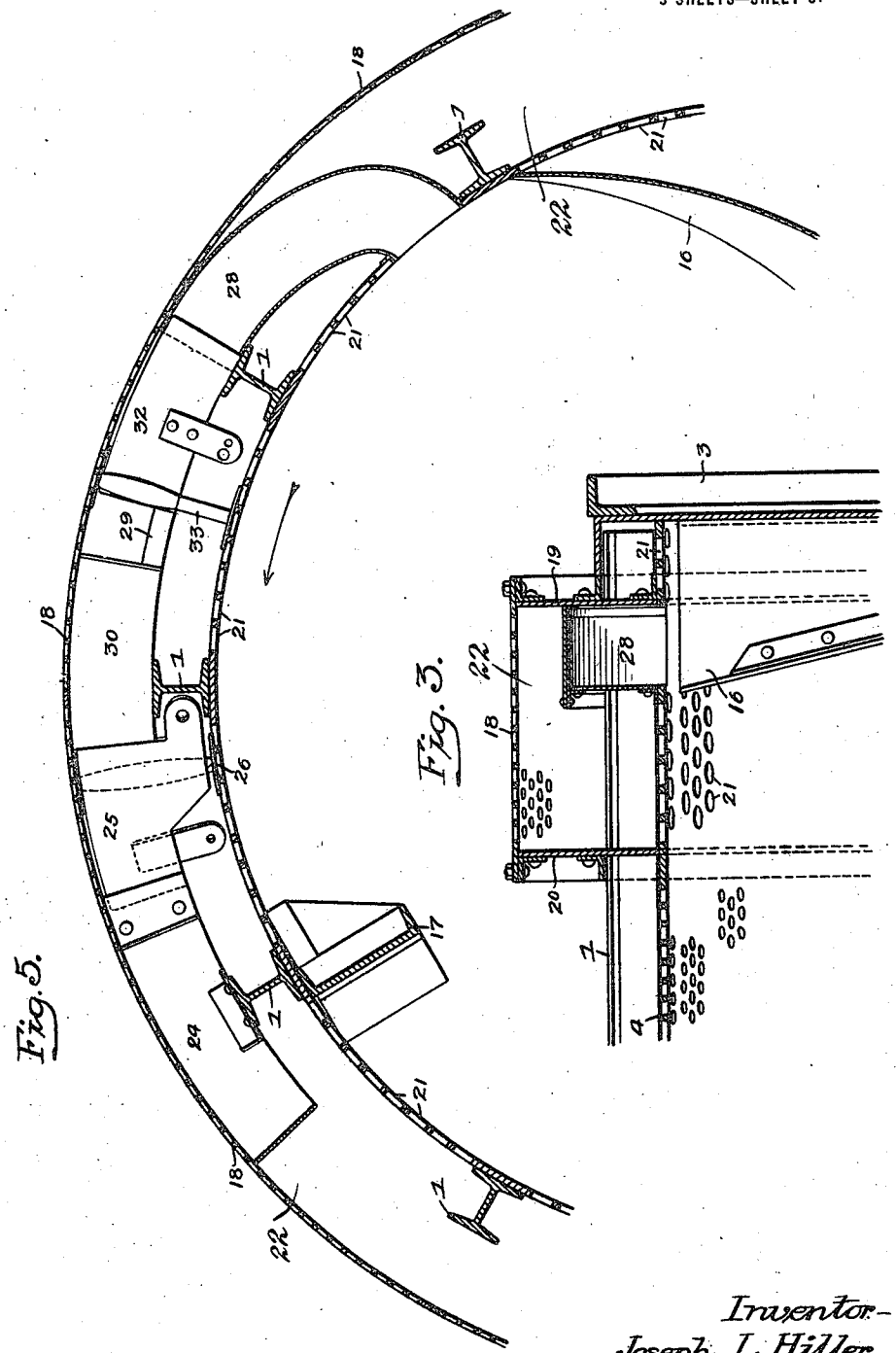


Fig. 5.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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COAL BREAKER AND CLEANER.

1,322,567. Specification of Letters Patent. Patented Nov. 25, 1919.

Application filed November 13, 1915. Serial No. 61,301.

To all whom it may concern:

Be it known that I, JOSEPH L. HILLER, a citizen of the United States, residing in Mattapoisett, Plymouth county, State of Massachusetts, have invented Coal Breakers and Cleaners, of which the following is a specification.

One object of my invention is to provide a machine for reducing and cleaning coal of widely varying sizes so that all of its particles are of a diameter less than a predetermined amount, and at the same time removing from the coal foreign bodies such as pieces of metal, stone, sulfur balls, etc.,—the construction of the apparatus being such that the diameter of the screen drum is less than has heretofore been required for a machine of a given capacity.

A further object of the invention is to provide a coal breaker and cleaner whose parts are so arranged and constructed that certain of the coal after having once passed through it, shall be returned to its receiving end and repeatedly circulated until it has been broken to the required diameter or is discharged.

I also desire to provide a machine of the class noted which shall be available for operating on two different grades of coal, the design of said machine being such that a soft low-volatile coal for example, may be passed through it, and while the greater part of said coal is broken to the desired size and separated out by one passage through the drum, the unbroken lumps of material, whether coal or foreign bodies, will be directly discharged by the plows. The machine is also adjustable so that when required to act upon a harder high-volatile coal, the unbroken lumps thereof will be circulated until they are reduced to the desired sizes.

These objects and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which,

Figures 1 and 2 are respectively a side and a rear elevation of a coal breaker and cleaner constructed according to my invention;

Fig. 3 is a fragmentary longitudinal section of the machine shown in Fig. 1;

Fig. 4 is a developed plan partly in section, showing the outside screen of the annular chamber removed; and

Fig. 5 is a section on the line *a*—*a*, Fig. 4.

In the above drawings, 1 represents a series of parallel frame members connected at their ends to a pair of heads 2 and 3 so as to define a cylindrical structure which has mounted upon said members a series of plates arranged to form a cylindrical screen drum 4 having perforations all of the same size, for example three-quarters of an inch. While this drum may be rotatably supported in any desired manner, I have illustrated it in the present instance as provided at its opposite ends with a pair of bearing rings placed to rest upon flanged supporting wheels or rollers 5 mounted on a pair of parallel shafts 6 and 7 carried in bearings 8 supported in a pair of parallel arms 9. At one end said drum has mounted upon it an annular rack 10 whose teeth are engaged by a pinion 11 fixed to a shaft 12 which is driven from any suitable source of power; in the present instance through a pulley wheel 13.

The head 2 of the rotary drum is preferably open so that the material to be treated may be delivered thereto in any desired manner, while the discharge end in the present instance is closed by a plate 14 having two or any suitable number of discharge openings 15 through which material is delivered from the interior of the drum by a pair of discharge plows 16. These latter, as shown in Fig. 3, each have one end formed with its edge parallel and in contact with the cylindrical surface of the screen 4 adjacent the plate 14, from which said plow extends inwardly in the form of a warped scoop to the adjacent discharge opening 15.

Extending longitudinally within the screen drum and projecting inwardly from its surface is a series of shelves or lifting elements 17 whereby the material operated on is carried up as the drum is rotated and is thereafter permitted to drop. Obviously any of the devices common to this art but constituting no part of the present invention, may be employed to agitate or accelerate the longitudinal movement of material through the drum.

Adjacent the discharge end of the screen drum I provide an annular auxiliary screen chamber 22 formed of a cylindrically curved plate or screen 18 having perforations the same size as those of the screen 4 and provided with annular sides 19 and 20 whereby

it is supported concentrically with the main screen. It is particularly to be noted that the annular portion of said main screen lying directly under the auxiliary screen 18 has perforations 21 materially larger in diameter than those in the body thereof, and for example, if the perforations of the main part of the screen 4 and of the screen 18 are three-fourths of an inch in diameter, then the perforations 21 might be about one and one-half inches; it being understood that the sizes of the perforations or screen openings are dependent on the material operated on.

Leading from openings in the side 20 of the auxiliary screen casing 22 are two or any other desired number of conduits 23 extending around the main screen drum in approximately helical lines and opening into said drum adjacent its forward end, these conduits being carried on and fixed to the frame work in any suitable manner.

Adjacent the open end of each of these conduits I mount in the chamber 22 a valve structure whereby the coal moving therein may be deflected into said conduits. As shown in Figs. 4 and 5, this device preferably consists of a fixed partition 24 extending diagonally about half way across said chamber and designed to coöperate with a pivotally mounted valve plate 25 supported on a pin or spindle 26 and so acted on by a spring 27 that it tends to lie in the position shown in dotted lines, between the partition 24 and the adjacent side of the conduit 23.

Also mounted within the chamber 22 just beyond each of the valves 25 is a chute or conduit 28 opening directly into the main screen drum immediately in front of a plow 16, and adjacent the entrance to this chute within the screen chamber 22 is a deflecting plate 30 which is inclined across said chamber so that when the valve 25 is turned on its pivot against the action of the spring 27, it will coöperate therewith to completely close the entrance to the adjacent helical return conduit 23 and form a deflector whereby material moving in the chamber 22 will be directed into the chute 28.

For turning the valve 25 on its pivot and holding it in a position to close the entrance to the conduit 23 against the action of the spring 27, I provide a chain 31 extending through the side 19 of the auxiliary chamber and provided with suitable means for maintaining said valve in a given position against the action of said spring. The entrance to each of the chutes or conduits 28 is controlled by a second valve 32 pivoted in the chamber 22 by a pin or spindle 33 and normally held by a spring 34 in a position to close the entrance to said chute. Also attached to this latter valve is an operating chain 35 extending through the side 19 of the auxiliary screen chamber whereby said valve may be moved to and held by suitable means in a position permitting material to pass into the chute 28.

Under conditions of operation, with the two valves 25 and 32 held in their normal positions by their respective springs, the drum is rotated at a suitable speed by power applied to the pulley 13. The material to be treated, such for example as a comparatively hard high-volatile coal, is then delivered into said drum through the opening in the head 2 and the larger particles of said coal are engaged and carried up by the shelves 17 from which they are dropped. Under this action the coal lumps are broken up and all pieces under three-fourths of an inch in diameter pass through the perforations in the main portion of the drum as the material moves through the same. As the unbroken lumps of coal and pieces of foreign material are gradually moved longitudinally through the drum, they finally reach that portion having the larger perforations 21, through which practically all of the unbroken bodies of coal pass into the auxiliary chamber 22, while the larger masses composed of metal, sulfur balls, etc., pass on and are delivered by the plows 16 through the discharge openings 15 or are discharged from the machine in any suitable manner.

The material in the auxiliary screen chamber 22, which cannot pass through the perforations thereof, shortly comes into engagement with the inclined valve plates 25, by which it is directed into the entrances of the adjacent helical return conduits 23, and as the rotation of the drum continues, this material is caused to pass through these conduits to the front or receiving end of the drum. Thereafter it is again repeatedly lifted and dropped as when first admitted and it is thus broken to the size necessary to permit it to pass through the small openings in the main screen. Obviously any fine material entering the auxiliary chamber 22 escapes through the small openings in the auxiliary screen 18 so that by the above treatment, any lumps of coal which would otherwise be discharged by the plows because of their inability to pass through the openings in the main portion of the screen, are collected and returned to the receiving end of said screen to be further treated;—it thus being possible to employ a screen drum of less diameter than would otherwise be permissible in a machine of a given capacity.

If, on the other hand, it should be desired to utilize the machine for the treatment of a relatively soft, low-volatile coal, the valves 25 and 32 would be adjusted and held by their respective chains in the positions shown in Fig. 4, so that any material passing through the large openings 21 into the auxiliary screen chamber would be directed

into the discharge chutes 28 and by them delivered into the main drum directly in front of the plows, which would discharge such material from the screen through the openings 15 in the discharge end thereof. As will be understood from the above description, I am enabled to employ a single machine for the treatment of two different grades of coal—thereby materially extending its field of usefulness.

The valves 25 and 32 are also adjusted and held in the positions shown in Fig. 4 when it is desired to discharge an accumulation of uncrushable material of a size small enough to pass through the screen openings 21 but not small enough to pass the openings in plates 4 or 18,—which material, if allowed to collect indefinitely, would tend to so choke the return conduits 23 as to interfere with their capacity in returning to the receiving end of the drum other material which if sufficiently circulated would be crushed or broken.

I claim;—

1. The combination of a rotary screen drum; with a conduit mounted thereon and connected to direct material from the delivery end thereof into the receiving end.

2. The combination of a rotary screen drum; with a helical conduit extending over the external surface thereof and connected to return material from the delivery end of the drum into its receiving end.

3. The combination of a rotary screen drum; a conduit mounted on the external surface thereof and having its ends respectively in communication with the two ends of the drum; with means for causing material at the discharge end of the drum to enter the conduit.

4. The combination of a rotary screen drum; with a conduit extending around its external surface and connected to its interior in position to cause material entering said conduit from one part of the drum to be delivered by it into another portion thereof.

5. The combination of a rotary screen drum having an auxiliary screen chamber adjacent its discharge end; and a conduit leading from said chamber to a delivery point adjacent the receiving end of the drum.

6. The combination of a rotary screen drum; an annular chamber surrounding a portion of the discharge end thereof; with a helical conduit connected to said chamber and discharging into the drum adjacent its receiving end.

7. The combination of a rotary screen drum having perforations of which those adjacent its discharge end are larger than the others; a perforated casing mounted on the drum in position to receive material discharged through said larger perforations; and a conduit for delivering to the receiving end of the drum certain of the material entering said casing.

8. The combination of a rotary screen drum; a casing mounted on the drum in position to receive certain of the material passing through the openings therein; with conduits carried by said drum and connecting said casing respectively with the discharge and receiving ends of the drum.

9. The combination of a rotary screen drum; a casing mounted on the drum in position to receive certain of the material passing through the openings therein; conduits connecting said casing respectively with the discharge and receiving ends of the drum; and valves for causing the material in the casing to pass at will into either of said conduits to the exclusion of the other.

10. The combination of a rotary screen drum having relatively large perforations adjacent its discharge end; a casing surrounding said drum in position to receive material passing through said perforations; a conduit leading from said casing to the receiving end of the drum; a second conduit leading from the casing to the discharge end of the drum; and means for causing material entering the casing to flow out through one or the other of the conduits at will.

11. The combination of a rotary screen drum having perforations of which those adjacent its discharge end are larger than the remainder; a discharge plow in the drum; an annular casing on the drum in position to receive material passing through said large openings; means for delivering material from the casing to the discharge end of the drum adjacent the discharge plow; and a conduit for delivering material from the casing to the receiving end of the drum.

12. The combination of a rotary screen drum having perforations of which those adjacent its discharge end are larger than the remainder; a discharge plow in the drum; an annular casing mounted on the drum in position to receive material passing through said large openings; means for delivering material from the casing to the discharge end of the drum adjacent the discharge plow; a conduit for delivering material from the casing to the receiving end of the drum; with two valves in the casing for directing the material therein either to the conduit or to the means for delivering it to the discharge end of the drum.

13. The combination of a rotary screen drum having perforations of increased size adjacent its discharge end; an annular screen casing surrounding the drum in position to receive material passing through said large openings; two conduits leading from the casing respectively to the discharge and

receiving ends of the drum; and a valve mounted to direct material into one or the other of said conduits at will.

14. The combination of a rotary screen drum; means for operating said drum to break coal and separate out the fine portions thereof; and means carried by said drum for separating larger bodies of coal adjacent the discharge end of the drum and returning them to the receiving end thereof.

15. The combination of a rotary screen drum; means for operating said drum to break coal and separate out the fine portions thereof; means carried by said drum for separating larger bodies of coal adjacent the discharge end of the drum and returning them to the receiving end thereof; with means at said discharging end for delivering from the drum any remaining large bodies of material.

16. The combination of a rotary screen drum; a casing mounted on said drum to receive certain material passing through the perforations thereof; and means adjustable either to discharge material entering said casing independently of that passing through the screen or to cause said material to be returned to the receiving end of the drum.

17. The combination with a rotary cylinder of a grinding mill, of a classifier rotating therewith and attached to an outlet thereof for the separation of outflowing material, and a conduit connecting the classifier with an opening adjacent the feed end of the cylinder and winding spirally around the circumferential surface of the same.

18. A grinding mill comprising a rotary cylinder having at its opposite ends an inlet and an outlet for material, and in its circumferential wall adjacent its feed-end, an opening for the attachment of a conduit, a classifier connected with the outlet of the cylinder and rotatable therewith for the separation of outflowing matter, and a conduit connecting the classifier with said opening, to discharge the oversize directly into the cylinder.

JOSEPH L. HILLER.