Dec. 12, 1933. T. W. KENT ET AL 1,939,121

COAL CLEANER

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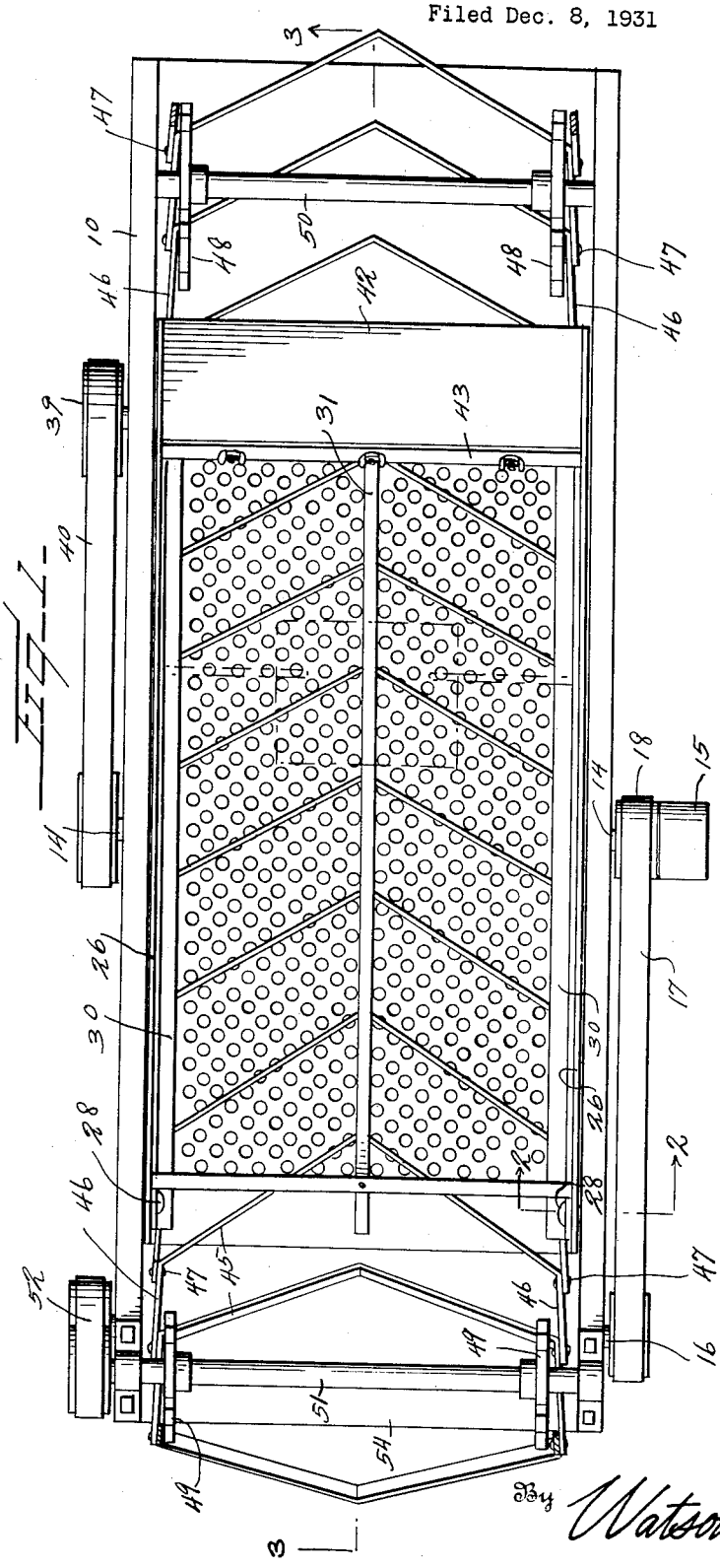


FIG. 1

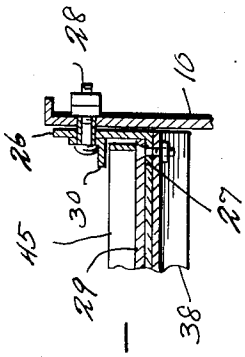


FIG. 2

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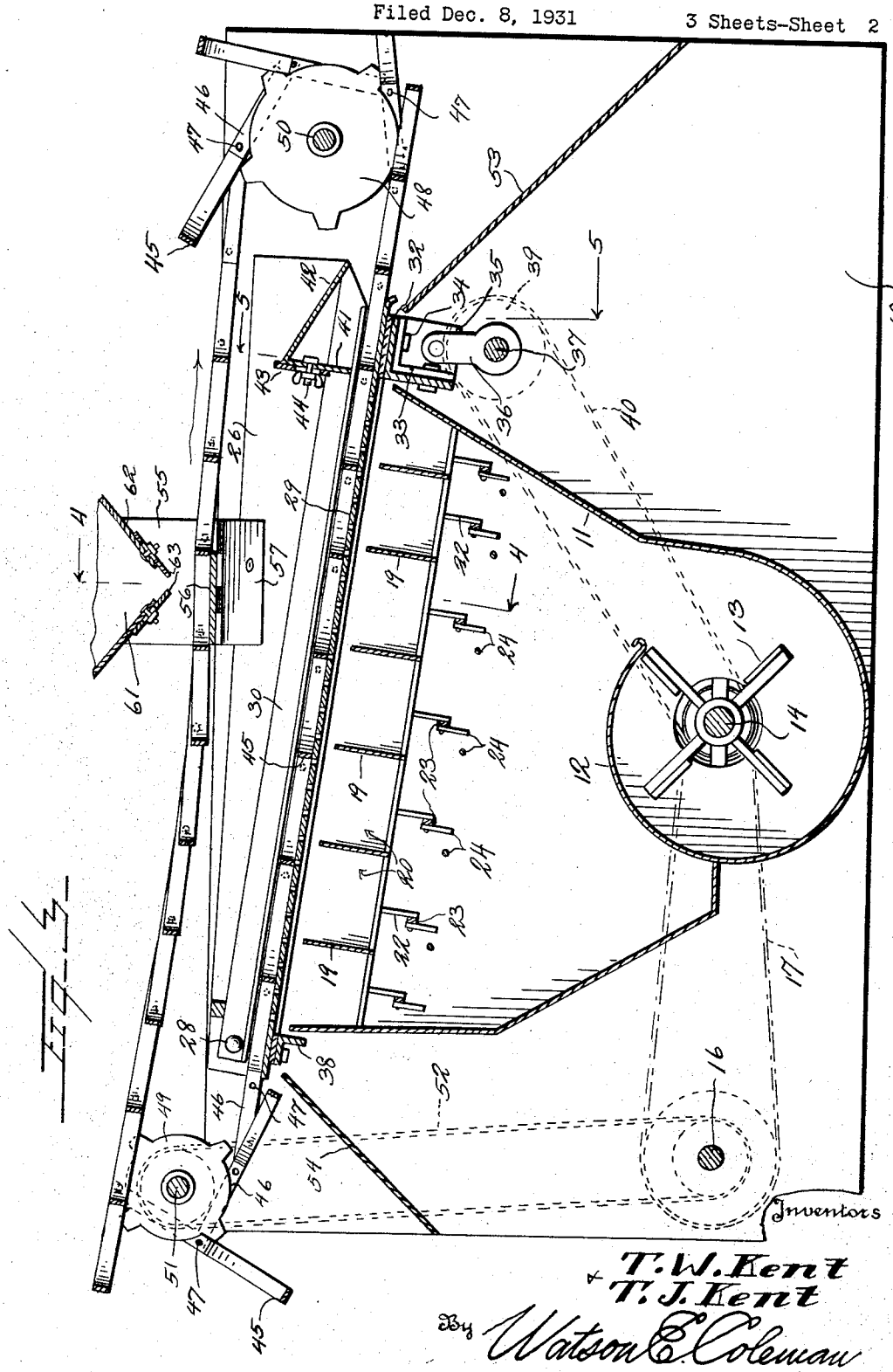


Fig. 2.

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Fig. 4.

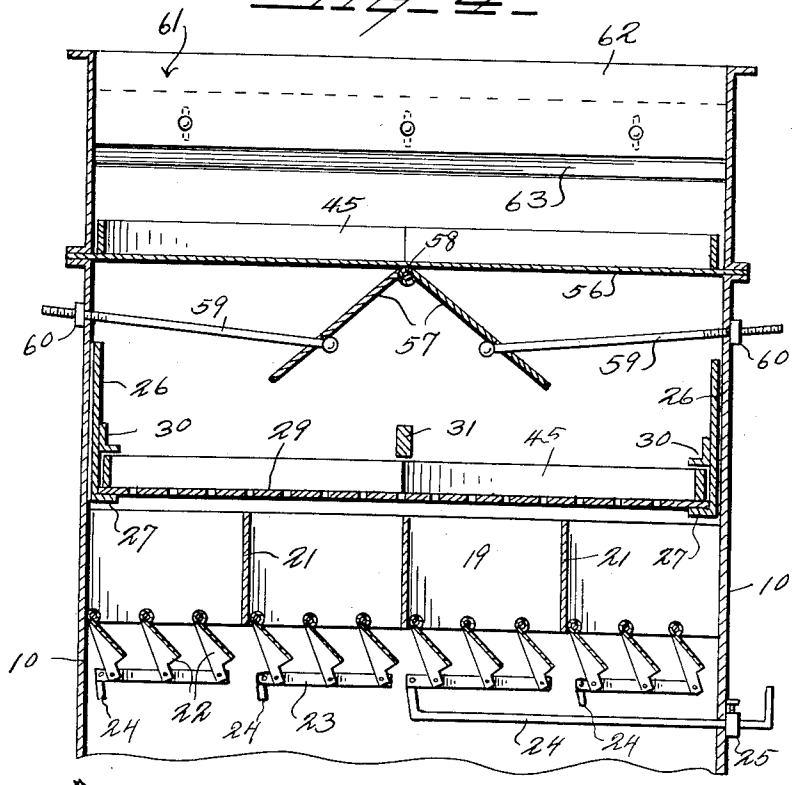
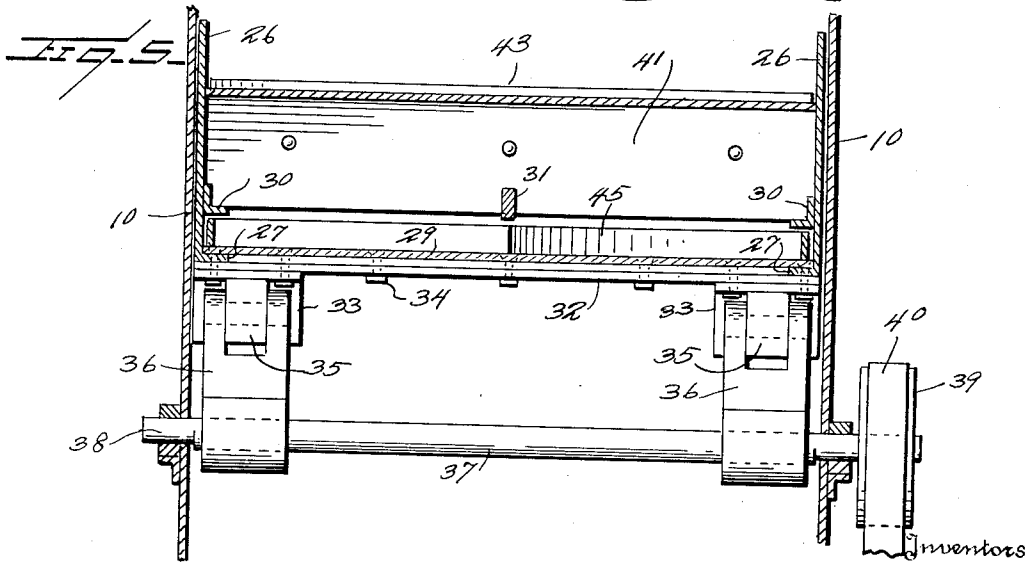


Fig. 5.



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UNITED STATES PATENT OFFICE

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COAL CLEANER

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6 Claims. (Cl. 209—467)

This invention relates to coal cleaners for separating small coal from slate and other refuse matter and particularly to mechanism of this character where the lighter matter i. e. coal is held supported on a blast of air, the slate and other heavier material sinking to the bottom of the suspended bed of coal and being carried away in one direction while the coal flows freely and continuously in another direction and is discharged.

Another object of the present invention is to provide for the positive rejection or carrying away of the slate and other refuse from the coal and provide means in this connection which will act to wedge the lighter material or coal laterally outward and up into the bed of clean coal, thus securing a purer refuse with no middlings.

A further object is to provide for a continuous oscillation of the coal bed toward and from the perforated plate over which the slate is passing and through which the air passes to thus cause the faster settling of the slate and secure a more efficient separation.

Other objects will appear in the course of the following description.

Our invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a top plan view of a coal cleaner constructed in accordance with our invention.

Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a vertical longitudinal section of the coal cleaner;

Figure 4 is a section on the line 4—4 of Figure 3;

Figure 5 is a section on the line 5—5 of Figure 3.

Referring to these drawings, 10 designates the side walls of a casing or housing within which the movable parts of the coal cleaner operate. Mounted upon this housing is the blower trunk 11 which is formed with a scroll 12 within which is disposed the fan 13. This fan may be of any suitable type and causes a blast of air to be driven from the scroll into the enlarged body of the housing 11 and upward through the upper part of this housing or body.

The fan housing 11 is mounted upon the walls 10 in any suitable manner and the fan is mounted upon the shaft 14 driven from any suitable source of power. As illustrated in Figure 1, the shaft 14 is provided with a pulley 15 whereby power may be applied. Through one end of the casing 10 there is disposed the shaft 16 over which a belt 17 passes from a pulley 18 on the shaft 14. By this means the shaft 16 is driven. The upper portion of the fan housing 11 is provided with a plurality of transverse partitions 19 defining cells 20 through which the air passes.

A plurality of longitudinal partitions 21 are provided intersecting the partitions 19. To the partitions 19 are hinged a plurality of dampers 22, there being three dampers shown to each cell. The dampers of each cell are pivotally connected to a rod 23, each of these rods 23 being connected to an operating handle 24 extending out through the side wall of the machine and held in adjusted position by an adjustable stop 25, as shown in Figure 4. By this means, any of the series of dampers beneath any one cell 20 may be adjusted to either entirely close, entirely open or partly close the said cell. Thus the air may be readily controlled and directed through any desired portion of the coal bed as will hereafter appear.

Disposed between the walls 10 are the two side plates 26 of a shoe or screen frame as shown best in Figure 4. These side plates are inwardly flanged at their lower ends as at 27 and the plates are pivoted to the side walls by means of the bolt 28 shown in Figure 2.

Disposed upon the flanges 27 is a perforated air distributing plate 29 and on the inside faces of the plates 26 and in spaced relation to the plate 29 are the longitudinally extending angle irons 30, the pivot bolts 28 passing through the forward ends of these angle irons. The angle irons 30 overhang the perforated plate 29 and extend down the middle of the structure formed by the side plates 26 and perforated plate 29 and disposed in spaced relation to this perforated plate is a rail 31. Across the ends of irons 30 and rails 31 is a transverse angle iron 31*a* connected to the side walls 26 of the shoe or screen frame.

Disposed beneath the flanges 27 at the lower or rear end of the perforated plate 29 is a cross bar 32 preferably formed of angle iron and disposed below the ends of this cross bar are the short angle iron sections 33. Bolts 34 bolt the plate 29, the flanges 27 and the cross bar 32 to each other as shown in Figure 5 and these bolts also engage the short angle irons 33. These short angle irons are formed with the intermediate ears 35 to which are pivoted the upper forked ends of eccentric links 36. A shaft 37 passes through the eyes of these links, this shaft at its ends being enlarged eccentrically as at 38 and thus as this shaft 37 revolves, the links 36 are reciprocated to a slight amount, thus slightly oscillating the structure which includes the plate 29, the side members 26, the angle irons 30 and the rail 31. At its upper end, the plate 29 is held to the side members 26 by means of the transverse angle iron 38 as shown in Figure 3. The shaft 37 is driven by means of a pulley 39 from which a blade 40 passes to a pulley on the shaft 14. Disposed at the lower end of the jig formed by the side walls 26 and plate 29 and resting upon the angle irons 30 as shown in Figure 5 is a baffle 41 which extends entirely across between the side walls 26, this baffle having a downwardly and rearwardly extending apron 42.

A plate 43 is mounted upon the face of the baffle for vertical adjustment by means of the bolts 44 so that this plate may be raised or lowered to thus increase or decrease the effective height of the baffle 41. Operating in the space between the angle irons 30 and the plate 29, and, therefore, below the rail 31 is the lower flight of an endless conveyor. This conveyor shown in Figure 1 has the rearwardly convergent blades 45. Each of these blades as shown at the left hand end of Figure 1 is forwardly extended at its ends as at 46, the forward ends of these forwardly extending portions 46 being pivoted by pins 47 to the blade in advance. Thus I have provided an endless flexible conveyor with rearwardly convergent blades and having a lower flight which passes immediately over the perforated plate 29 and is held down upon this plate by the angle irons 30 and 31. This conveyor passes around the supporting wheels 48 and 49 at the rear end and the forward end respectively of the conveyor. The wheels 48 are larger than the wheels 49 and are idler wheels rotating upon or with a shaft 50. The wheels 49 are mounted upon a shaft 51 driven by means of a belt 52 from the shaft 16 in the manner clearly shown in Figure 3. The upper flight of the conveyor moves downward and rearward as shown by the arrow in Figure 3 while the lower flight of the conveyor moves upward and forward over the perforated plate 29. Just below the rear end of the plate 29 is disposed a coal discharge chute or plate 53 and just below the forward and upper end of the plate 29 is disposed the slate discharge chute or plate 54. Mounted upon the side walls 10 are the end supports 55 of a feed hopper and carried upon these members 55 and resting upon the top of the side walls is a transverse plate 56 over which the upper flight of the conveyor passes. This plate 56 is less in width than the width of the supports 55. Upon the bottom of this plate are disposed two hinged deflecting wings 57 as shown in Figure 4, these wings being hinged at 58 and each wing being adjustable toward or from the other wing by means of the adjusting rods 59 which are screw-threaded and pass through the side walls 10 and are provided with the nuts 60. The hopper 61 includes the downwardly convergent plate 62 having adjustable sections 63 whereby the discharge aperture of a hopper may be widened or narrowed.

The hopper discharges upon the plate 56 and the upper flight of the conveyor moving in the direction of the arrow in Figure 3 drags the coal so discharged on this plate off the plate 56 and discharges it downward on to the bed of coal which is supported above the lower flight of the conveyor by the air passing upward through the apertured plate 29. By adjusting the deflector wings 57, the mixed coal and slate discharged from the hopper is discharged laterally as it passes off the plate 56 between the lateral portions of the lower flight of the conveyor and the lateral portions of the perforated plate 29.

The general operation of this mechanism is as follows:—The fan is, of course, constantly rotated driving a blast of air up through the perforated plate 29. The fan is of such a capacity as to cause a certain air pressure to be secured within the cells 20 and above the plate 29. This air pressure is sufficient to blow the light pieces of coal upward above the path of movement of the conveyor blades 45, but not sufficient to hold up the slate or other relatively heavy foreign matter, which foreign matter falls downward into the space traversed by the blades 45 and is positively carried off by these blades and discharged on to the discharge chute 54. The coal forms a bed above the path of movement of the blades and this coal by reason of the constant jar communicated to the shoe formed by the side plates 26 and the screen 29 is accordingly shifted over the top of the riffle 43 or end wall, slides down the apron 42, past the blades of the conveyor, and down on to the chute 53 where it is discharged. The amplitude of oscillation given by the eccentrics 38 is very small, not more than three-sixteenths of an inch to a half inch stroke.

This jigging motion given to the coal on the coal bed causes it to pass off over the top riffle 43 on to the discharge chute. Obviously the coal bed will get thinner and thinner toward the forward end of the machine where the slate is discharged.

Attention is particularly called to the effect secured by using converging blades 45 operating between the coal bed and the face of the screen 29. These blades constitute moving riffles and the angle of the perforated plate 29 to the horizontal is such that the outer ends of each angular blade 45 are higher on their lower edges than the upper edge of the middle of the blade. This acts to cause the heavy materials to tend to move toward the center of the blade or roll down toward this center and these heavy materials wedge the coal to the top. This forces in coal which may pass downward with the slate upward and out into the clean coal, thus securing the discharge of pure refuse at one end and pure coal at the other with no middlings. The fan is run at a speed to make approximately a pressure of two inches water gage or more if needed and air controlling dampers can be adjusted to let just enough air through the perforated plate as to secure an even flow of coal at the clean coal end. The oscillation of the jig which carries the bed of coal secures an up and down action of the coal which constitutes in a sense a bellows-like action which settles the slate faster and more efficiently than would otherwise be the case.

It will be seen that the conveyor acts as a drag line, dragging the slate from under the coal and positively moving the slate to the discharge chute. By adjusting the baffle plate 43, the depth of the bed may be increased or decreased and this keeps the coal from dragging on the machine. The upper flight of the conveyor coming back as it does beneath the feed opening in the hopper secures a positive feed of mixed coal and slate but discharges this mixture toward the sides of the machine, thus preventing the coal from mixing with the slate which has been concentrated at the middle of the machine.

The object of having the air passing through each of the cells 20 controlled by dampers 22 common to that cell is that during the operation of the machine, the slate goes to the middle of the machine because it is heavier than the coal and thus more air is required at the middle of the machine than at the sides. If all of the dampers were controlled by the same controlling device, then the heavy slate in the center would force the slate to the side walls 20 and the middle cells would not have the proper air pressure to support the coal above the slate.

It is to be understood that this machine is designed for the separation or cleaning of different sizes of coal. Thus the machine may be constructed to clean coal from zero to one-half inch or from one-half inch to one inch in diameter or

from one inch to two inches in diameter. This is secured by changing the size of the perforations in the plate 29, these plates being made with different sized holes to suit the different sizes of coal.

In the operation of this machine, the blast of air under the coal keeps it constantly flowing freely to the clean coal end, that is, toward the low end of the jig. The conveyor takes the slate from under the coal, keeping the perforated plate clean of slate. This allows more air to be used at the clean coal end so that the coal is never banked up much above the feed as indicated by the dotted lines in Figure 3.

It is to be particularly noted that in our construction the eccentric is located below the perforated plate and below the conveyor so that the perforated plate, the conveyor and the agitator or jig itself are oscillated. In our construction, we lift the coal bed up and down. Inasmuch as the eccentric or jig is disposed below the bottom of the perforated plate 29, there will be no chance of the coal being crushed and this construction furthermore permits the cleaning of relatively large sized coal. Inasmuch as the conveyor in our machine is formed of hinged or pivoted sections, there will be no danger of crystallization as there would be were there a screen or like element passing around band wheels in an endless path. In our construction, the conveyor continuously cleans the upper face of the plate 29 and continuously and positively carries off the slate. Furthermore, in our construction, the slate is worked toward the middle of the bed while the coal is worked toward the sides.

We claim:—

1. In a coal cleaner, a supporting frame, a jig mounted in the frame for vertical oscillation and having an apertured bottom, the bottom being inclined downward toward its free end, means for oscillating the jig, a fan housing discharging air upward against the perforated bottom, a refuse conveyor comprising transversely extending blades operating over the upper face of the perforated bottom, and means for holding the conveyor blades against the perforated bottom, the blades being angular in plan view and converging downward and rearward toward the middle of the perforated bottom.

2. A coal cleaner comprising supporting frame, a jig mounted in the frame for vertical oscillation and having side walls and a perforated bottom, the bottom of the jig inclining downward toward its free end, a baffle wall disposed at the lower end of the jig in spaced relation to the perforated bottom, means for discharging air against the perforated bottom of the jig including a housing, and means for controlling the air passing through the housing, an endless refuse conveyor comprising transversely extending blades and connecting elements, the blades being angular in plan view and converging downward and inward toward the middle of the bottom, means for moving the endless conveyor with its lower flight over the upper face of said perforated bottom, means for holding the lower flight of the endless conveyor against the perforated bottom, means for operating the endless conveyor, and means for discharging coal through the upper flight of the endless conveyor.

3. A coal cleaner comprising a supporting frame, a jig mounted in the frame for vertical oscillation and having side walls and a perforated bottom, the bottom of the jig inclining downward toward its free end, a baffle wall disposed at the lower end of the jig in spaced relation to the perforated bottom, means for discharging air against the perforated bottom of the jig including a housing, means for controlling the air passing through the housing, an endless refuse conveyor comprising transversely extending blades and connecting elements, the blades being angular in plan view and converging downward and inward toward the middle of the bottom, means for moving the endless conveyor with its lower flight over the upper face of said perforated bottom, means for holding the lower flight of the endless conveyor against the perforated bottom, means for operating the endless conveyor, a hopper disposed above the upper flight of the endless conveyor, a plate disposed beneath the hopper and over which the upper flight of the endless conveyor passes, the endless conveyor acting to scrape the material from said plate and discharge it into said jig.

4. A coal cleaner comprising a supporting frame, a jig mounted in the frame for vertical oscillation and having a perforated bottom, the bottom inclining downward toward its free end, means for vertically oscillating the free end of the jig, a fan housing discharging upward against the perforated bottom, means for maintaining a coal bed within the jig, a hopper disposed above the jig, a plate disposed below the lower end of the hopper and to which the contents of the hopper discharges, downwardly and laterally extending deflecting wings mounted upon the under face of the plate, and a refuse conveyor having its lower flight operating over the upper face of said perforated bottom, the conveyor having transversely extending blades angular in plan view and converging downward and rearward toward the middle of the plate, the upper flight of said endless conveyor passing over the plate disposed immediately beneath the hopper and acting to drag material from said plate on to said deflecting wings.

5. In a coal cleaner, a supporting frame, a jig mounted in the frame for oscillation and having a perforated bottom, means for forcing air up through the perforated bottom, the bottom being disposed at an inclination, means for discharging culm into the jig, and means for conveying the culm upward over the perforated bottom while it is subjected to the action of the air forced therethrough and simultaneously guiding the culm downward and toward the middle of the perforated bottom to cause the heavier impurities contained within the culm to force the coal to the top.

6. In a coal cleaner of the character described, a jig having a perforated bottom inclined upward toward its discharge end, means for forcing air through the perforated bottom of the jig, means for discharging culm into the jig, and means for conveying culm coal upward over the perforated bottom and simultaneously subjecting the culm to pressure comprising an endless carrier having blades diverging outward and toward the discharge end of the perforated bottom and moving over the perforated bottom, the upwardly divergent blades causing the heavier materials to move toward the middle of the bottom to thereby cause the lighter coal to be squeezed upward out of the surface of the bed of refuse.

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