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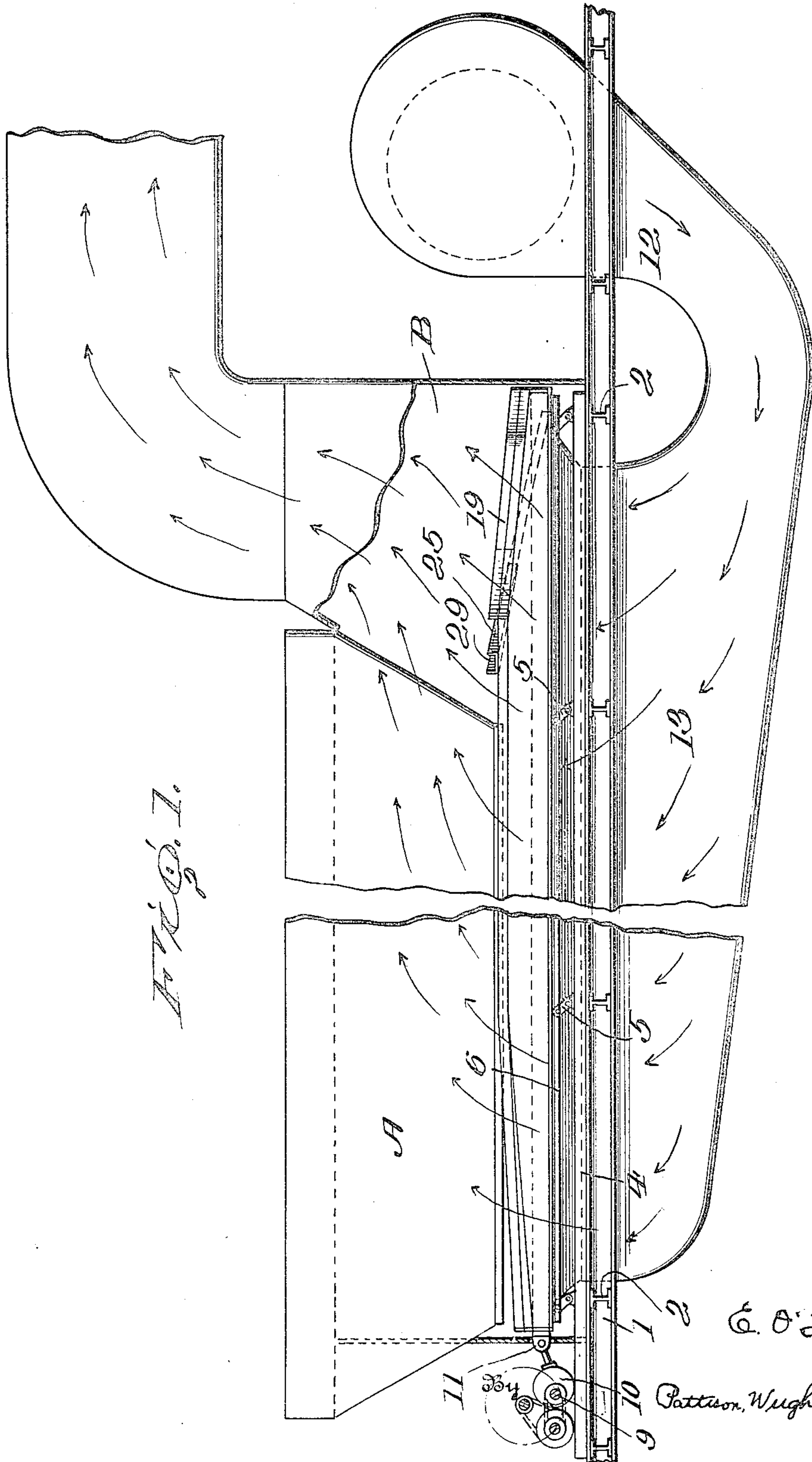
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APPARATUS FOR DRY CLEANING OF COAL

Filed March 19, 1931

3 Sheets-Sheet 1



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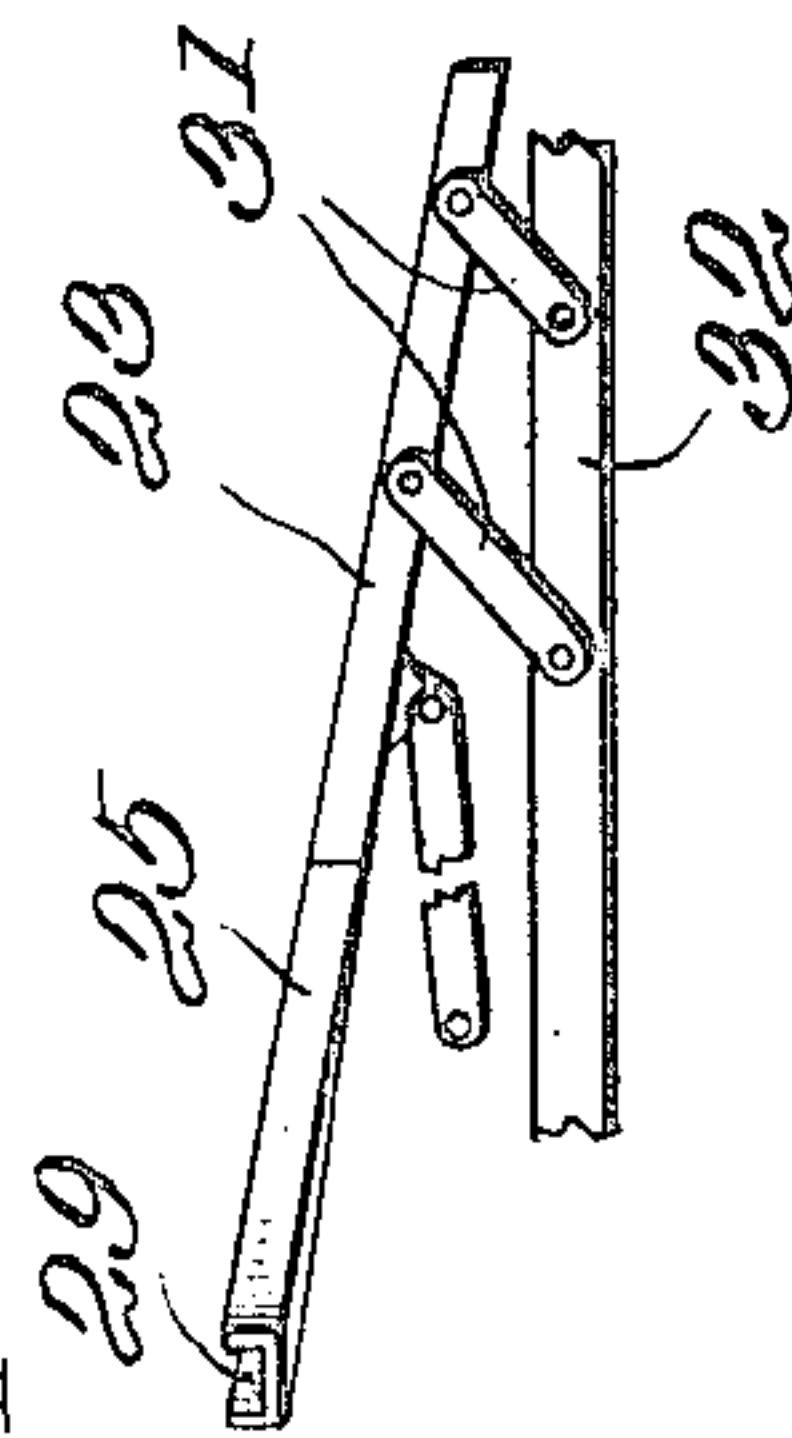
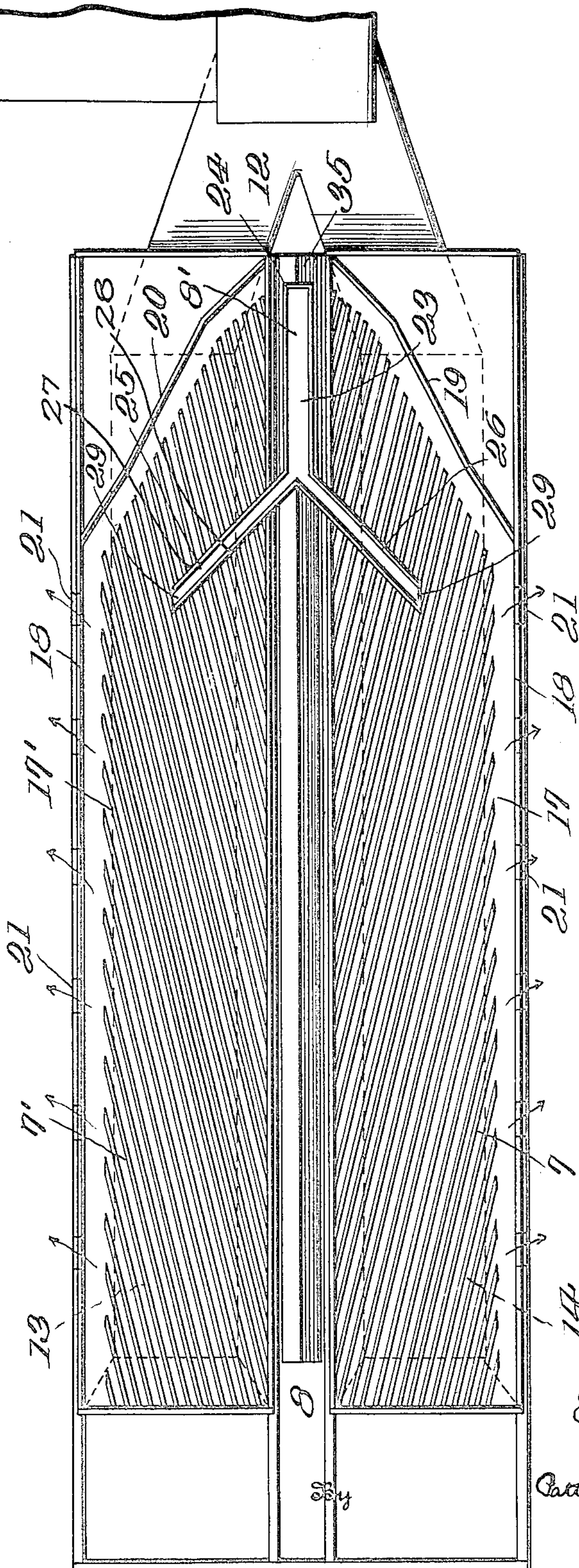
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3 Sheets-Sheet 2

*FIG. 2.*



*FIG. 4.*

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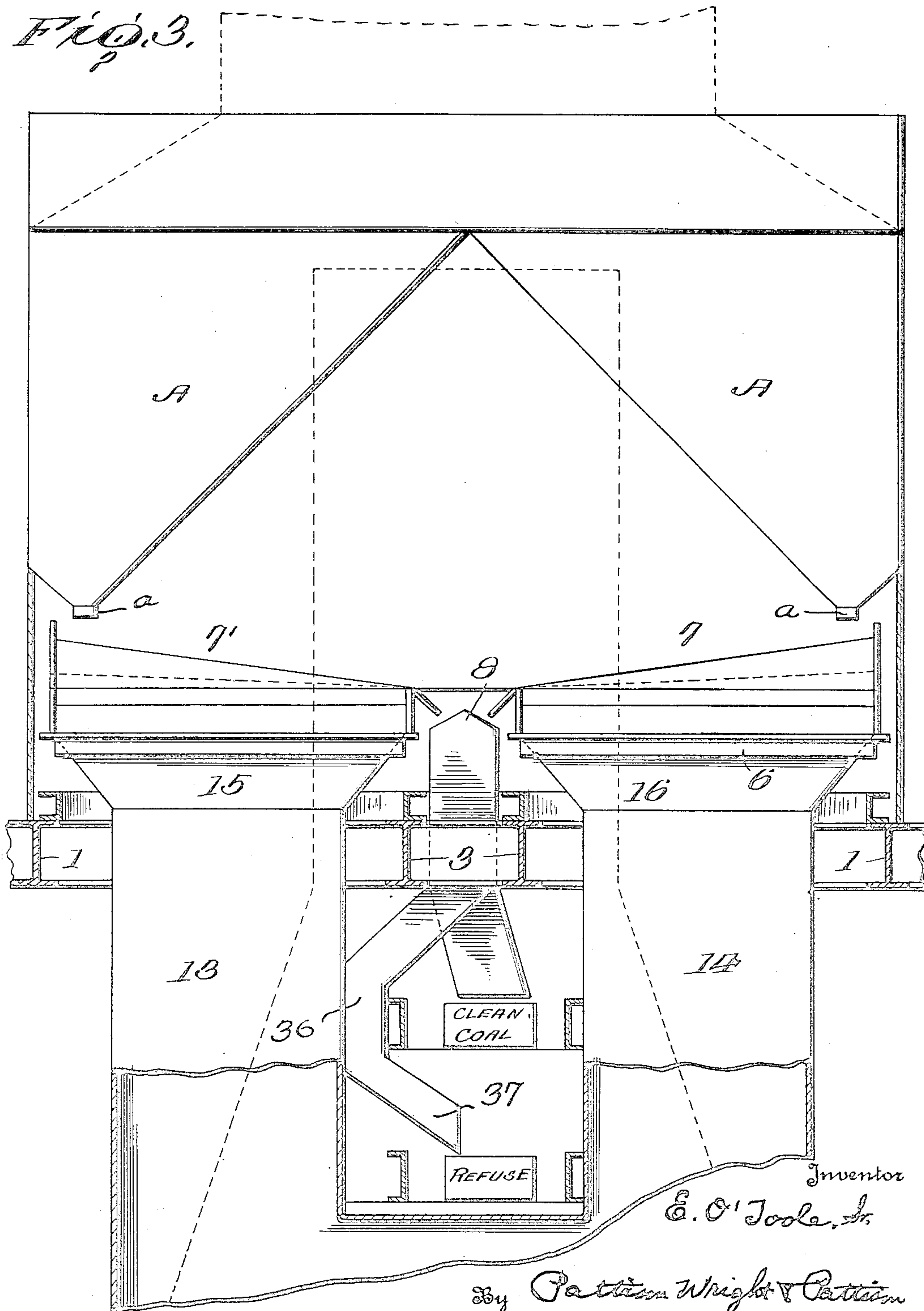
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APPARATUS FOR DRY CLEANING OF COAL

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3 Sheets-Sheet 3

*FIG. 3.*



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# UNITED STATES PATENT OFFICE

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## APPARATUS FOR DRY CLEANING OF COAL

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7 Claims. (Cl. 209—467)

This invention relates to improvements in apparatus for dry cleaning of coal and other granular material, and it is especially intended for cleaning bituminous coal of its refuse material such for instance as slate and the like which are non-combustible.

The objects of the invention may be stated to consist essentially of making an apparatus capable of accomplishing the following objects:

10 The primary object of the present invention is to so arrange and construct an elongated table that is capable of greater capacity by constructing the table with two outwardly and forwardly extending pluralities of riffles having their outer ends stopping before reaching the outer sides of the deck, and providing an opening between the inner edges of the said riffles into which opening the cleaned coal flows.

20 Another object of the present invention is to provide an elongated table constructed as above stated with hoppers having openings located at opposite sides of the deck, said openings beginning substantially at the feed end and extending approximate the delivery end whereby two elongated streams of coal to be cleaned are provided causing the cleaned coal being operated upon to be separated throughout the length of the elongated openings of the hopper and at once after being separated flows in a long sheet to the above-mentioned central elongated opening, thus greatly increasing the efficiency and capacity of the deck.

30 Another object of the present invention is to provide a chute located near the delivery end of the deck, the same being constructed to receive the middlings from the two pluralities of riffles and deliver the middlings backward on the deck to be reworked.

40 Another object is to eliminate multiplicity of units.

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

45 Other objects of the invention will be understood from the following description and drawings.

In the accompanying drawings:

Figure 1 is a side elevation partly in section of a deck which embodies the present invention.

50 Fig. 2 is a top plan view showing the deck, and which omits the hopper for the purpose of disclosing parts which would otherwise be hidden by said hopper.

Fig. 3 is a cross sectional view in part.

55 Figure 4 is an elevational detail view illustrating the device for returning the middlings.

Referring now to the drawings a suitable supporting framework 1 is provided, the same being preferably made from suitable metal I beams which support the whole mechanism. The longitudinal I-beams 1 which form this support has a number of cross beams 2 which also form a part of the supporting framework. By reference to Figure 3 which is a cross section the I-beams 3 also extend parallel to the I-beams 1 and form a part of the said framework. Located on top of the I-beams 1 and 2 is a suitable framework 4 which preferably is made channel in cross section and it forms a part of the supporting framework for the mechanism. Attached to this member 4 are a number of toggles or links 5 which have their upper ends pivotally connected with the frame 6 to which is suitably attached a pervious deck which will be presently described.

This apparatus is intended for the dry separation of coal. The present invention utilizes the well known method of dry separation of coal, the said method involving the vibration of the deck and also involving the forcing upward through the pervious deck air under suitable pressure to properly lift the mass carried thereon so that the mass, as is well known, is stratified. By this is meant the heavier particles are caused to settle downward substantially on the deck and the lighter particles to be lifted from the deck.

The present improvement involves a deck that is inclined downward towards its center and it is provided in its center with a discharge opening so that the clean coal which has been separated flows by gravity down the inclined sides of the deck to the center passageway through which it passes.

Referring now particularly to my improved deck it consists in attaching the deck 7 and 7' upon a deck supporting member 6 whereby the deck 7, 7' are moved or vibrated together and this construction forms in the deck a passageway 8 that is centrally located in respect to the parts 7 and 7'. This passageway 8 extends preferably throughout the entire length of the deck 7, 7'.

This deck member 6 and its parts 7 and 7' are vibrated back and forward by any suitable means, for instance by a mechanism 9 that involves an eccentric 10 which is connected with one end of a portion 11 that is attached in any manner with the deck 7 and 7' whereby the deck is given reciprocation. It is also well known in this art that generally these decks are elevated from the feed end to the discharge end so that the refuse and to some extent the coal is projected by the vibration uphill. This uphill movement is caused by the



links 5 which are normally inclined in the direction shown so that an end movement first moves the deck up and then when it moves back it falls away from the mass and in this way the coal, refuse and middlings are moved step by step from the feed end A to the discharge end B, or to such place as the separated coal is fed from the deck. By this it is meant that a part of the coal by this vibration and the lifting action of the air is substantially separated from the mass shortly after it reaches the deck and it is at once conveyed by gravity to the longitudinal passageway 8 so that some of the coal reaches the said passageway very shortly, and in some instances substantially at the time it reaches the table, while other particles of coal farther away from the central opening are somewhat longer in reaching the said passageway.

The air is supplied from a suitable fan (not shown) to the passageways 13 and 14 the upper ends 15 and 16 being of a size to embrace the said decks thus feeding air substantially throughout the pervious decks. The splitting of this air chamber into the parts 13 and 14 is for the purpose of supplying equal amounts of air to each section 7 and 7' of the deck.

In the plan view Figure 2 it will be seen that this deck 7, 7' is provided with a plurality of parallel riffles 17 and 17' and that these riffles extend at an angle from the passageway 8 forward towards the wall 18 and the banking bars 19 and 20, a space being left at the end of the riffles to permit concentration of refuse between end of riffles and wall 18 and banking bars. The function of the banking bars is also well known to those skilled in this art as they provide means for obstructing the flow of the heavy particles of the mass which are pocketed between the riffles. In a table of the type here shown it adds to the efficiency of the table to remove from time to time these heavy slate particles from the deck and this is accomplished by providing the decks 7 and 7' with suitable openings 21 through which these heavy particles may escape. It is also well known in this art that these openings may be provided with gates so that the openings and the flow of the heavy particles from the deck can be controlled.

An elongated table of the type here shown it is found gives the best efficiency if the table is made substantially thirty-six feet long and six feet wide and in the present instance twelve feet wide, the parts 7 and 7' constituting the complete width of the deck. However I wish it understood that it may be made of any desired length consistent with mechanical possibilities.

The wall 18 located at opposite sides of the deck is made sufficiently high to retain the heavy particles contained between the riffles 17, and the object of providing this wall with outlet openings 21 is to permit the escape through the wall at different points to prevent an accumulation of the slate and other refuse along the said wall. The amount of slate and other refuse that is retained by the wall 18 depends entirely upon the character of the coal being cleaned, as it is well known that this varies in different coals. The slate and refuse which escapes through the openings 21 preferably is conveyed to a suitable refuse receptacle spot or place and it is conveyed to said place or places in a suitable trough (not shown) located to receive it. Such conveying troughs being well known it forms no part of the present improvement as its construction may be varied. In fact so far as the operation of the present in-

vention is concerned the slate may be permitted to pass through the openings and fall to the floor and be removed, though such operation is not preferred.

The cleaned coal flows through the opening 8 into a suitable chute or receptacle 23 and it may be conveyed in this chute to any desired point by means of any well known conveying mechanism.

The present improvement also includes means for receiving the middlings and then conveying it backward and depositing it on the deck where it is again subjected to retreatment for removing such good coal as is retained therein. This is for the purpose of saving, instead of wasting, the small amount of coal contained in said middlings.

The device here shown for returning the middlings for retreatment is illustrated in plan in Figure 2 and in elevation in Figure 4 and it consists of a Y-shaped device. This device consists of a stem-like portion 23 that in part is depressed below the deck and this stem is provided with flanges 24 making it a trough. The middlings therefore pass from the deck through the opening at substantially 8' and it falls in the said trough 23. For the purpose of delivering the middlings to the deck this device for returning it to the deck has its inner end consisting of two divergent trough-like members 25 and 26 which extend rearward at an angle so that these arms and the stem 23 constitute a Y-shaped member for receiving the middlings and returning them to the deck. The rear edges of the arms 25 are also provided with upwardly projecting flanges 27 and the inner sides of the arms are also provided with upwardly projecting flanges 28. This constitutes a Y-shaped trough and the middlings pass through the inner ends 29 and they fall on the deck so that the middlings are returned to the deck and subjected to a recleaning treatment.

In order to have the stem 23 depressed below the deck so that the middlings fall into it the stem, as stated, is depressed as shown at 30 and the arms 25 and 26 are elevated above the deck. The middlings received are conveyed backward or in a direction opposite to that which they were traveling when they were deposited on the arm 23 and it is also necessary that they be conveyed uphill in order to deposit them on the deck. To accomplish this result the device is supported upon suitable links 31 and these links are inclined in a direction opposite to the inclination of the links 5 that permit the vibration of the deck 7, 7'. In order to thus convey the middlings this device when moving towards the rear end of the deck is first lifted and then on returning it falls away from the middlings contained on it. This propels the middlings back on the deck where they are deposited. The means for vibrating this member as here shown is connected by a suitable link to the deck so that it is vibrated back and forth in unison with the deck. However I wish it understood that the device may be vibrated by any separate mechanism in any well known way, which it is unnecessary to illustrate or describe herein. The links 31 are so constructed as to hold the device in proper position in its movements and the lower ends of these links are suitably connected to a stationary member 32 that is suitably connected in any well known way to the stationary portion or frame previously described.

The cleaned coal passes from the deck through the opening 8 substantially throughout its length into a suitable chute 33 from which it flows into a receptacle or trough 34. It is then conveyed



from this trough to any suitable point by means of any desired mechanism such for instance as a conveyor. The slate and other refuse matter falls through an opening 35 into the upper end of a suitable conveying pipe 36 as here shown may be made to pass around the cleaned coal trough or receptacle and has its lower end 37 located above a refuse receiving trough or receptacle 38. The refuse is then conveyed from this trough or receiver by any suitable conveyor to any desired point. These conveyors form no part of the present invention. In fact so far as the operation of the present improvement is concerned the cleaned coal receiving trough may be simply a receptacle from which the cleaned coal is removed in any well known manner and also the refuse receptacle or trough 38 may likewise be simply a receptacle from which the refuse can be removed in any desired manner.

The banking bars 20 serve as an obstruction to the further travel of the refuse so that the refuse will follow these banking bars around until it is deposited at the point 35. I wish it also understood however that should it be desirable these banking bars 19 and 20 may have openings through which part of the refuse may pass without in any manner affecting the present improvement. The bin comprises two members A which extend substantially throughout the length of the deck as shown in Figure 1 and these bins are made angular in cross section so as to form a dust hood or space C and the two bins have their lower ends  $\alpha$  located adjacent the sides of the deck 7 and 7' and the opening  $\alpha$  extends substantially throughout the length of the bin. It will be understood from the above description that the dry coal flows through the openings  $\alpha$  in substantially a continuous longitudinally extending stream and that it falls in the unobstructed spaces 17 located at opposite sides of the said deck. This is very different from the usual type which usually feeds at the end of the deck. By feeding the mass of material directly to the unobstructed spaces and the deck being reciprocated and air flowing upward through it there is a substantially instant partial stratification of this material so that the heaviest particles are separated at these points and the smaller particles of the mass flow towards the center and the heavier particles of this mass sink into the spaces between the riffles 17' and they are projected forwardly and outwardly to the unobstructed space 17 and finally the separated coal flows into the longitudinal central space 8. The reciprocation of the deck and the air causes considerable dust that is retained within the dust hood C and communicating with the delivery end of this dust hood is a second hood B for the purpose of conveying the dust to the pipe shown from whence it will be carried to a suitable dust collector.

Attention is directed to the fact that the bins A, rest upon and are supported by the I-beams 1, as shown in Fig. 3. Therefore, the bins are stationary while the deck, as described, is movably supported by the links 5, whereby the deck is vibrated while the bins are stationary. It will be understood that the outlets  $\alpha$  of the bins A, as described, are adjacent the unobstructed portions of the deck and the coal flows in a longitudinal stream which stream is substantially continuous from the outlets  $\alpha$  to the surface of the deck. It will be further understood that the cause of this construction is that the vibration of the deck causes an efficient separation of the particles by a grinding action, due to the fact that the bins

are stationary while the deck is reciprocated. In order to insure substantially all the coal flowing from the outlets  $\alpha$  to the unobstructed portion of the deck, the outlets  $\alpha$  are placed near the unobstructed portion, whereby the stream is substantially continuous from the outlets  $\alpha$  to the unobstructed portion of the deck. It is believed to be new to have the outlets  $\alpha$  stationary and near the unobstructed portion, which causes the grinding separating action between the particles of the flowing stream. This loosening effect of the particles means that they respond to the stratifying effect and thereby adds to the efficiency of the mechanism.

The present improvement briefly stated consists in making a deck provided with forwardly and outwardly extending riffles and declined back from its outer edges to this central opening whereby the cleaned coal will flow by gravity to this opening where it is received and taken care of. It will be understood of course that this cleaned coal does not flow to the central opening in a direction at right angles to the deck because the reciprocation of the deck causes the coal to move slightly forward and in fact some of the coal moves forward all the time sliding by gravity to this center opening through the rear end of the table to the middlings point. The middlings are received by the device described and it is returned rearwardly and deposited on the deck where it is again subjected to a further cleaning action for the purpose of reclaiming whatever good coal it may contain. The table here shown has its front end inclined inwardly thus reducing its area. The object of this inclination or reduced end to the table is to cause the middlings and the refuse to be propelled towards the center of the deck where they are taken care of in the manner before explained.

By constructing the deck with the elongated unobstructed portions located at opposite edges thereof and providing the decks with a longitudinally extending central passageway for the clean coal, it will be observed that a single passageway performs a function for the two pluralities of riffles, viz., it receives the clean coal from each plurality of said riffles. This makes a very simplified construction and it serves to increase very much the efficiency of the said deck. Although the art of separating decks has been known for years, I believe myself to be the first to produce a composite deck having the two pluralities of forwardly and outwardly extending riffles, provided with an elongated opening at the inner ends of the riffles for the passage of the clean coal between the said riffles, whereby it serves for both, and to provide the elongated unobstructed portions on opposite sides of the deck and to furnish a bin or bins having elongated openings located over the unobstructed portions to feed the clean coal thereto.

The devices herein shown and described are the preferred construction but I wish it understood that these may vary without departing from the present invention so long as such variations is within the scope of the appended claims.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. An apparatus for cleaning coal comprising a longitudinally reciprocated pervious deck declined from its outer portion inwardly and provided with a longitudinal escape portion located intermediate said outer portion, the upper surface of the deck provided with means adapted to receive the refuse that is projected by the reciprocation out-



- wardly and a feeding hopper having its upper portion embracing the whole deck and its outer marginal edges having feed passages communicating with said deck whereby the said hopper  
 5 performs a double function of supplying coal to be cleaned and a dust hood embracing the said table, said hood being connected with means for removing the said dust from the dust hood.
2. An apparatus for cleaning coal comprising  
 10 a longitudinally reciprocated pervious deck having a centrally arranged cleaned coal escape, the upper surface of the deck declined towards the escape opening and provided on its upper surface with means adapted to project the refuse out-  
 15 wardly from the said escape opening, a hopper located above and embracing said deck and separated from said deck to form a dust receiving receptacle, said hopper adapted to receive coal to be cleaned and deliver the same to the outer  
 20 portions of the deck the hopper having a depending flange portion separated from the deck and projecting downwardly, said dust receptacle having communication through which the dust is removed from the receptacle.
- 25 3. A coal cleaning apparatus comprising a deck portion adapted to receive the coal to be cleaned and to separate the refuse therefrom and deliver the coal at one point and the refuse at another point, and a hopper located above and  
 30 embracing the said deck, the hopper having a centrally arranged and upwardly extended bottom portion forming a dust receiving hood and the lower outer edges of the hopper bottom communicating with the outer sides of the said deck,  
 35 and means for removing the dust from the said hood.
4. An apparatus for cleaning coal comprising a deck having a longitudinal central escape opening for the cleaned coal and an escape opening  
 40 for the middlings located adjacent the discharge end of the table, of a Y-shaped device having its rear end located in the center of the table and under the said escape opening to receive the middlings, said device having its arms extend-  
 45 ing upward above and projecting in opposite directions over the two parts of said deck to deliver the middlings in opposite directions there-  
 to for retreatment.
5. A coal cleaning apparatus comprising a narrow elongated deck declined from its outer edges inward to its center, the outer edges provided with upwardly extending bed retaining walls, a plurality of parallel forwardly and outwardly ex-  
 80 tending riffles having their outer ends stopping before reaching said walls thereby forming elongated unobstructed passageways at the outer edges of said deck, said deck having an elongated centrally arranged passageway, said pas-  
 85 sageway separating the inner ends of the riffles, means for reciprocating said deck longitudinally the unobstructed passageways, and a hopper extending above, across and substantially throughout the length of the deck and having its outer  
 90 edges provided with outlet openings for feeding the coal to the unobstructed portions, said hopper thereby forming a dust hood above the deck.
6. A coal cleaning apparatus comprising a deck  
 95 having on its surface a plurality of riffles extending from the inner portion of the deck forwardly and outwardly thereby forming elongated unobstructed passageways at the outer edges of the deck, means for reciprocating said deck lon-  
 100 gitudinal said passageways, means for receiving and delivering the middlings to the table for reworking consisting of a Y-shaped member having its stem at the center and below the delivery of the deck to receive said middlings, and the arms  
 105 of the Y extending above and delivering said middlings rearward and outward in opposite directions to the deck to be reworked, the parts combined and operating for the purpose set forth.
7. An apparatus for the dry separation of coal,  
 110 comprising an elongated pervious deck, a bin extending longitudinally of the deck and located over it, said bin having a longitudinal feed opening communicating with the deck, flanges extending downward from the lower edges of said  
 115 bin and embracing the deck thereby forming a dust chamber below the bin, an extension in communication with the dust chamber also embracing another part of the deck and means for withdrawing the dust laden air from said  
 120 chamber.
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