April 11, 1939. E. O'TOOLE, JR., ET AL 2,154,180

DRY COAL CLEANING APPARATUS

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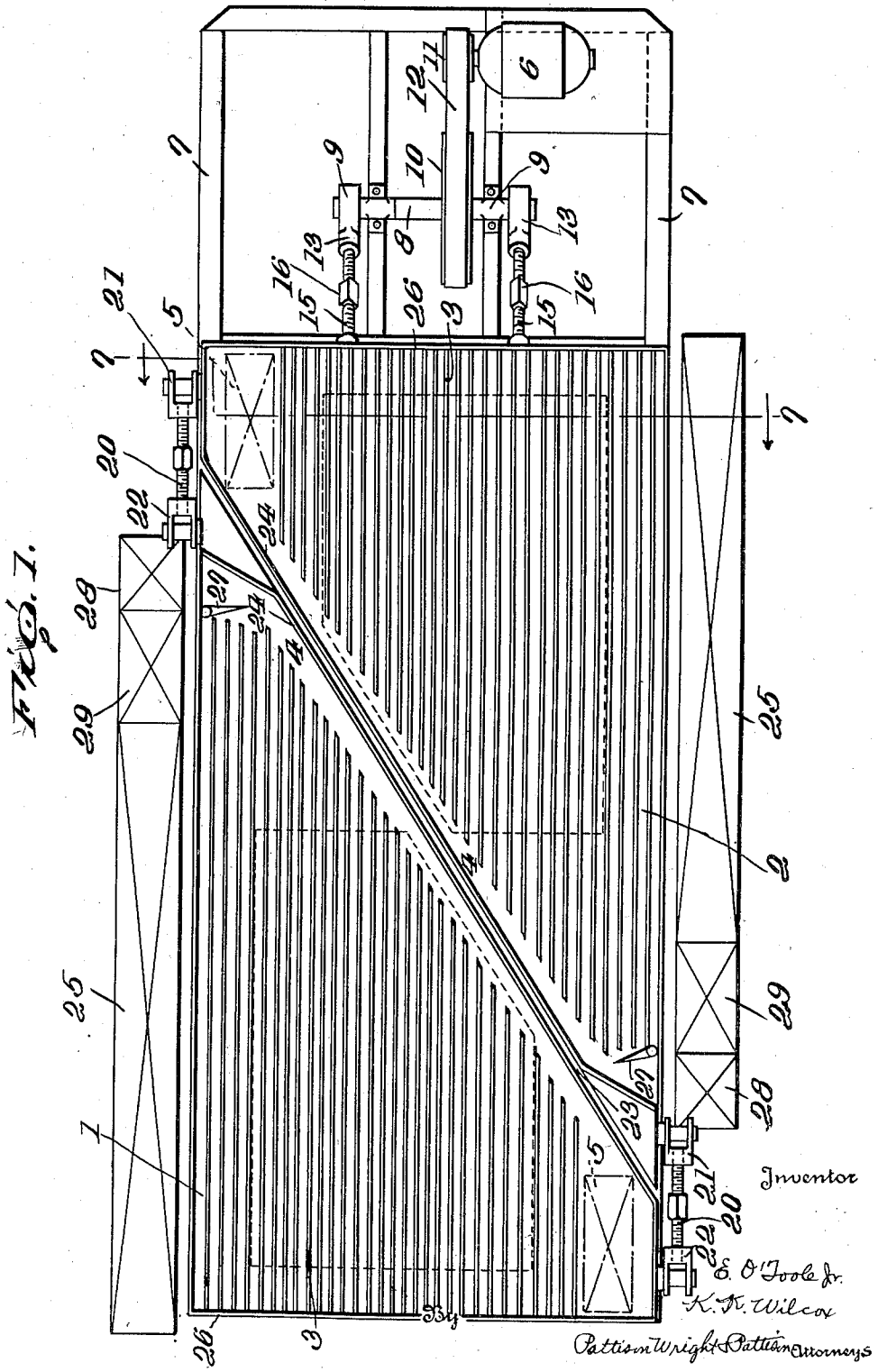


Fig. 1.

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DRY COAL CLEANING APPARATUS

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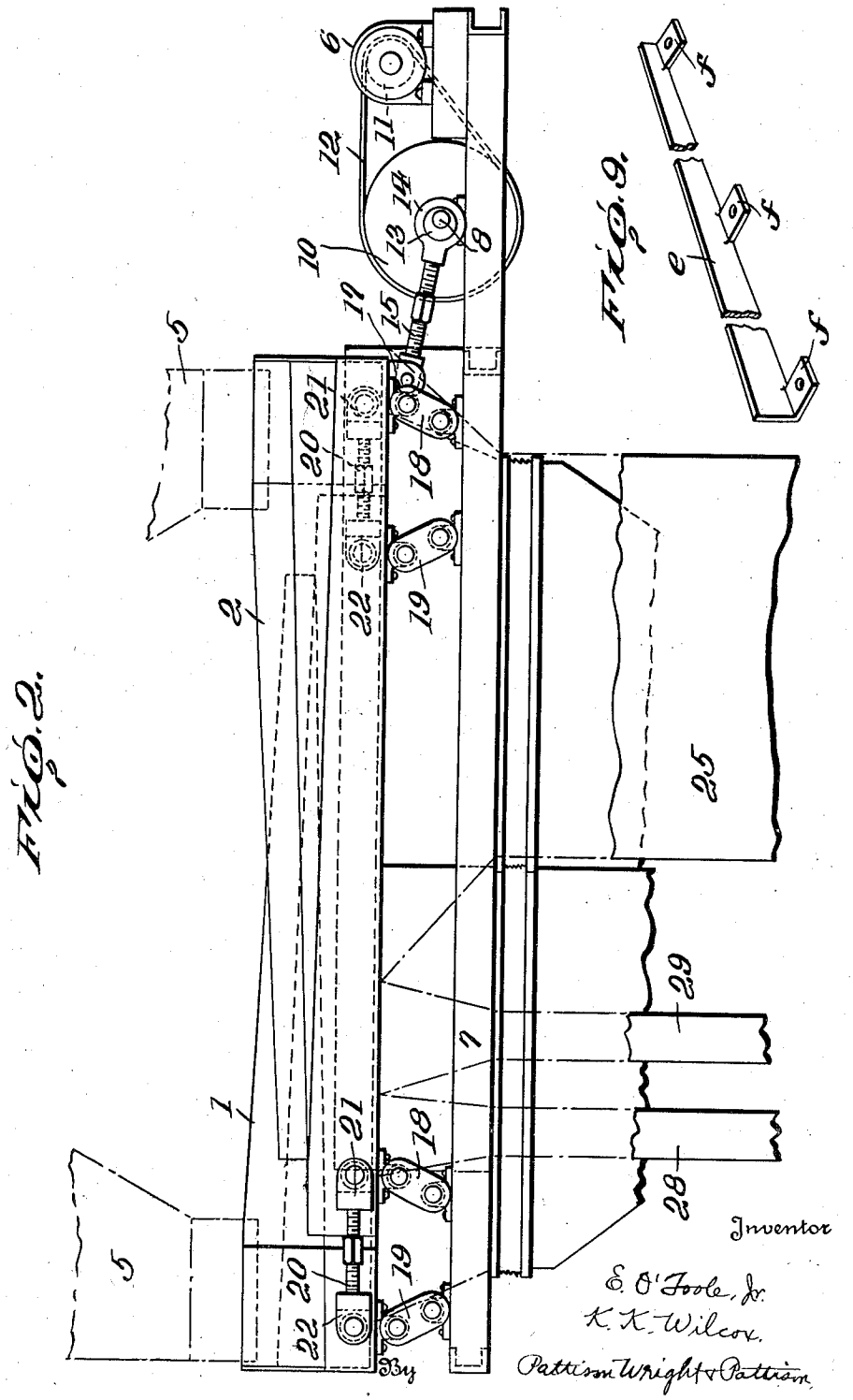


FIG. 2.

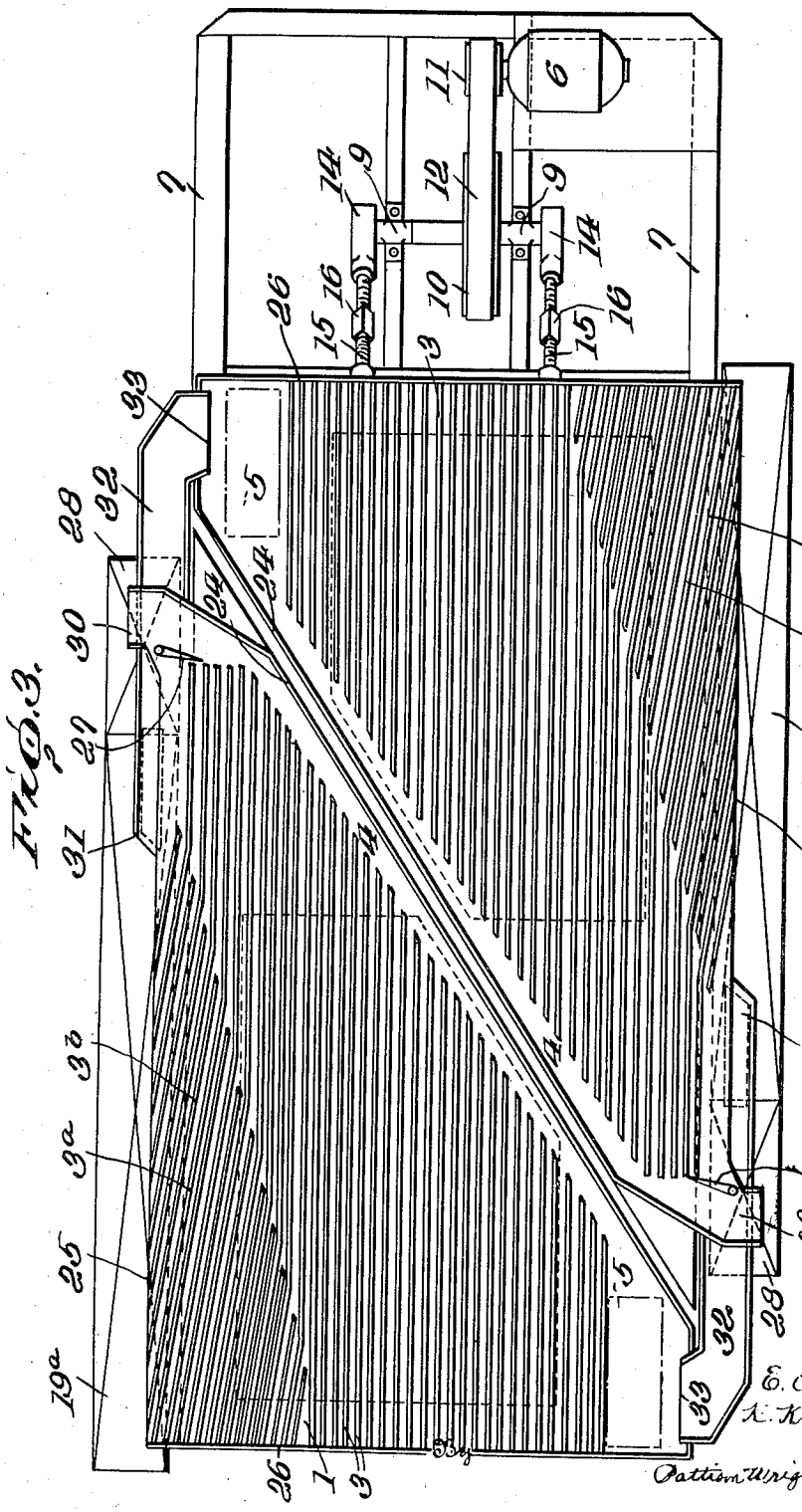
FIG. 9.

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DRY COAL CLEANING APPARATUS

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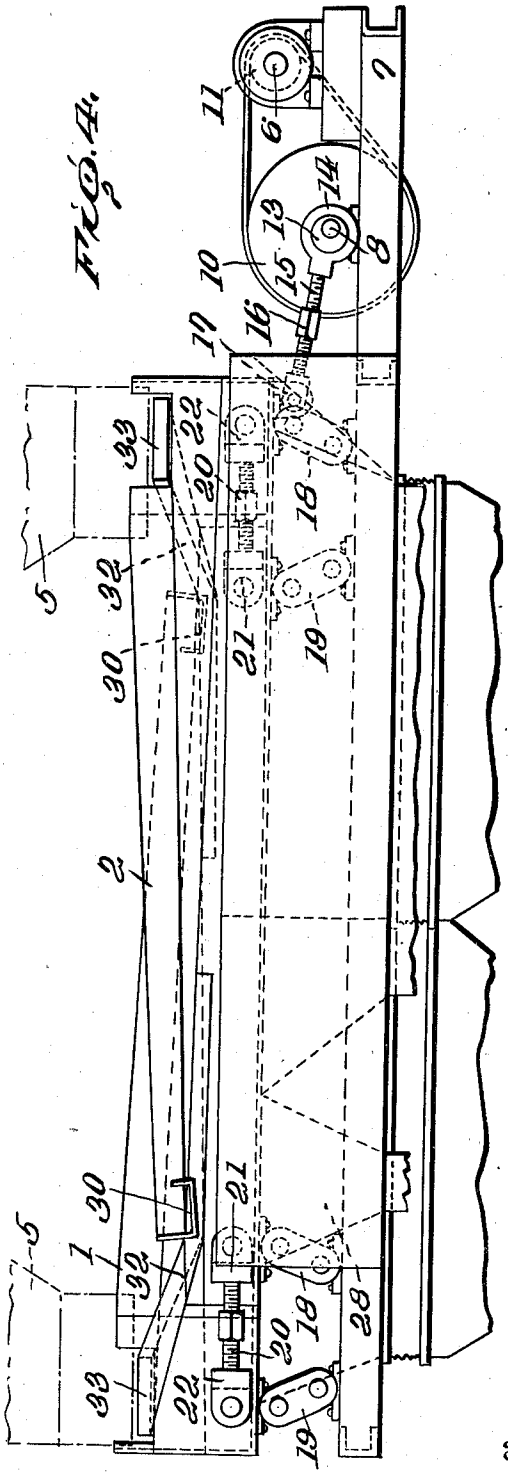
FIG. 3.

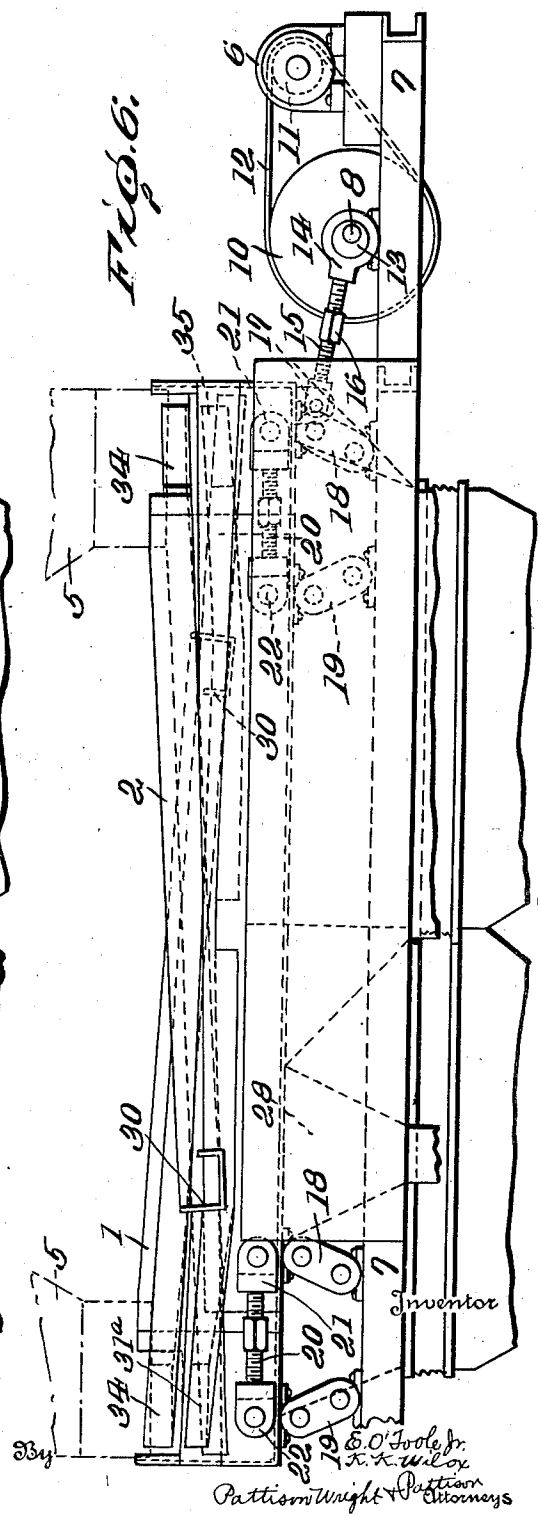


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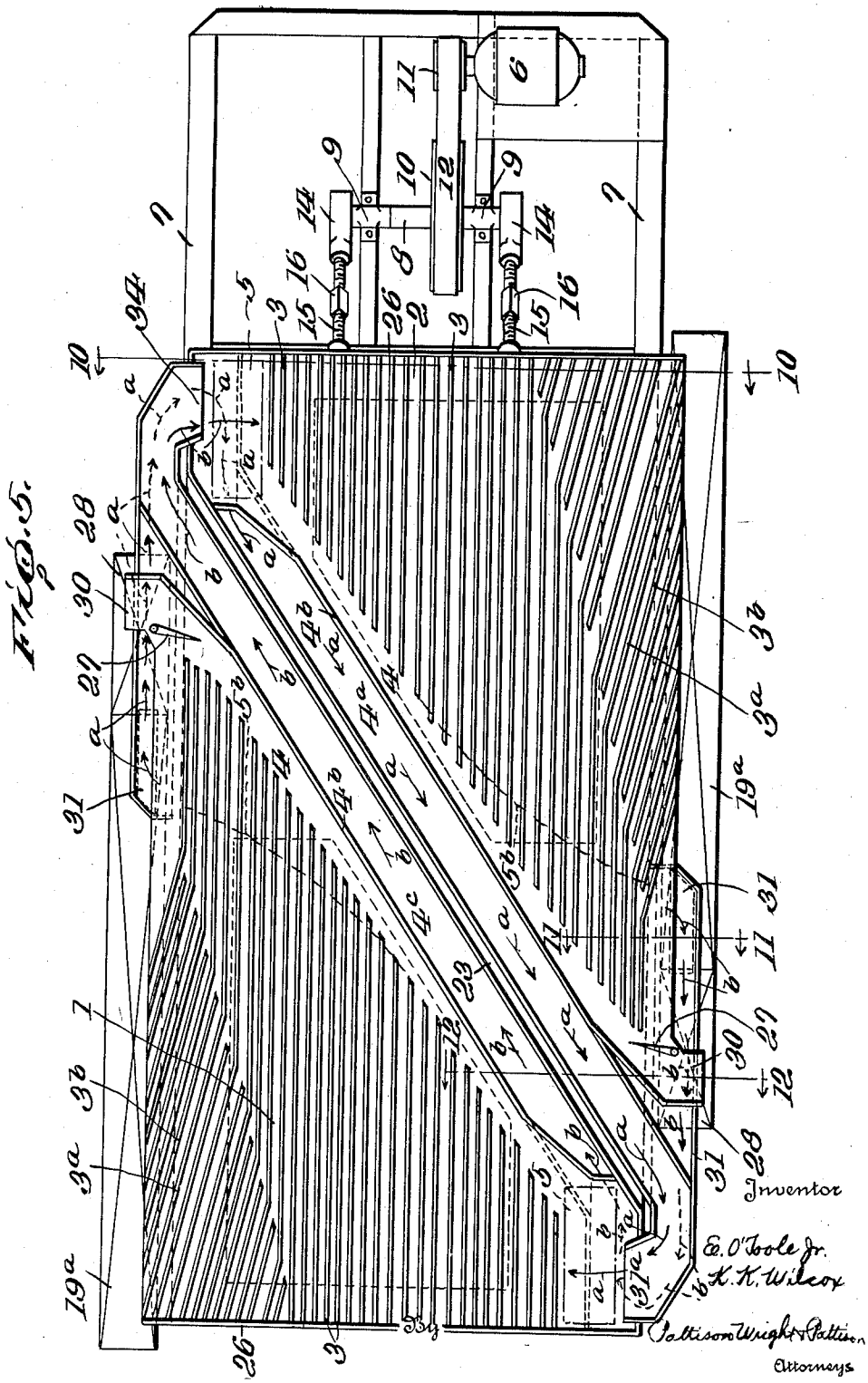


Fig. 5.

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FIG. 7.

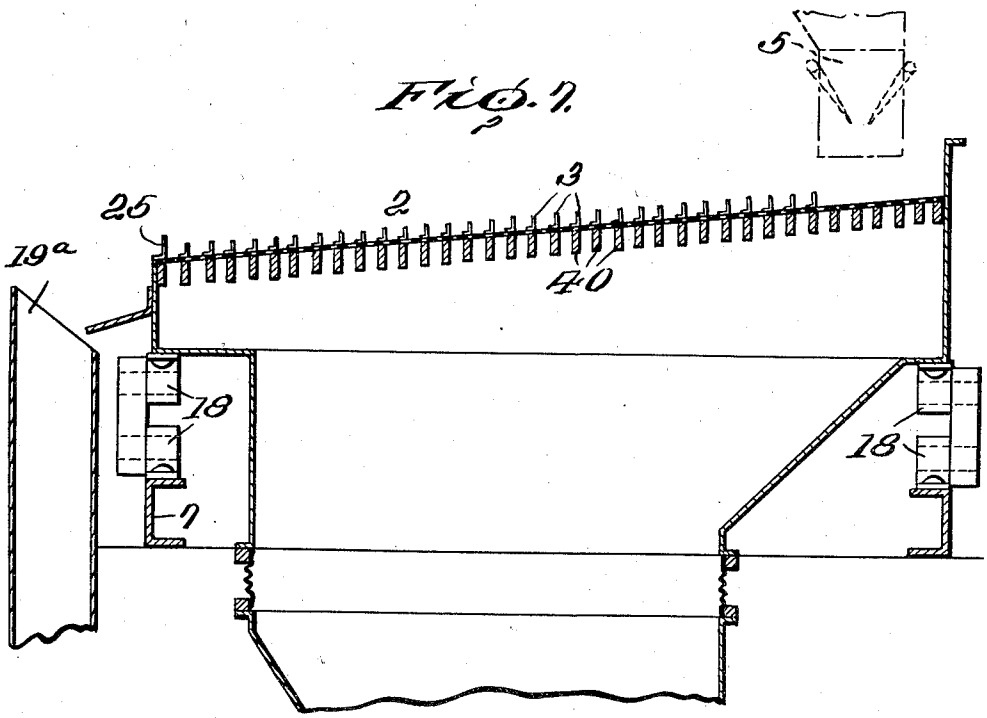
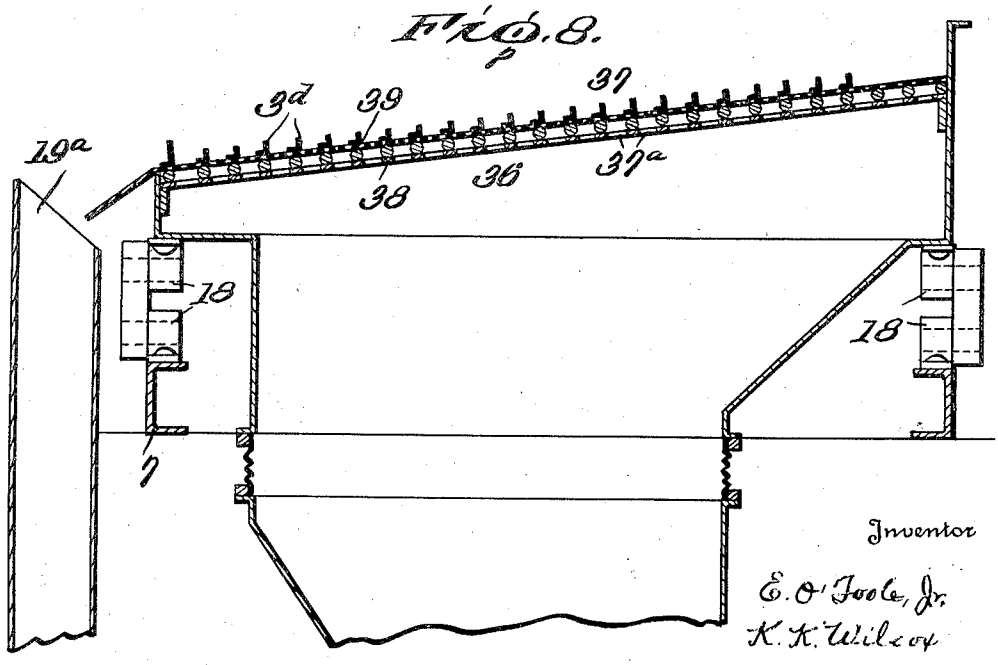


FIG. 8.



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FIG. 10.

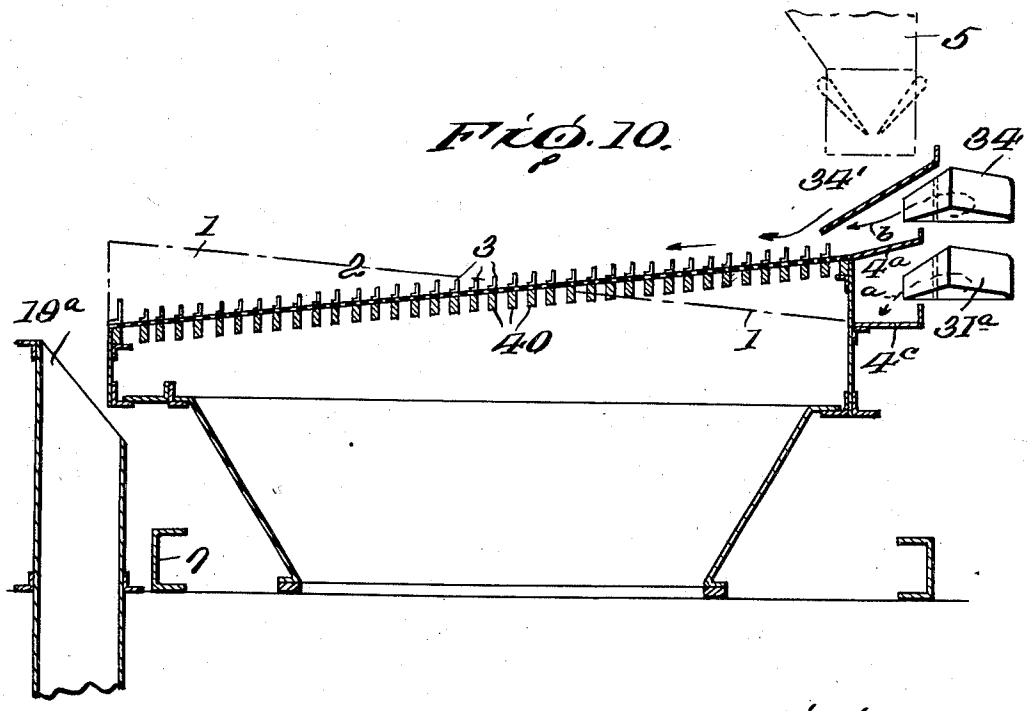
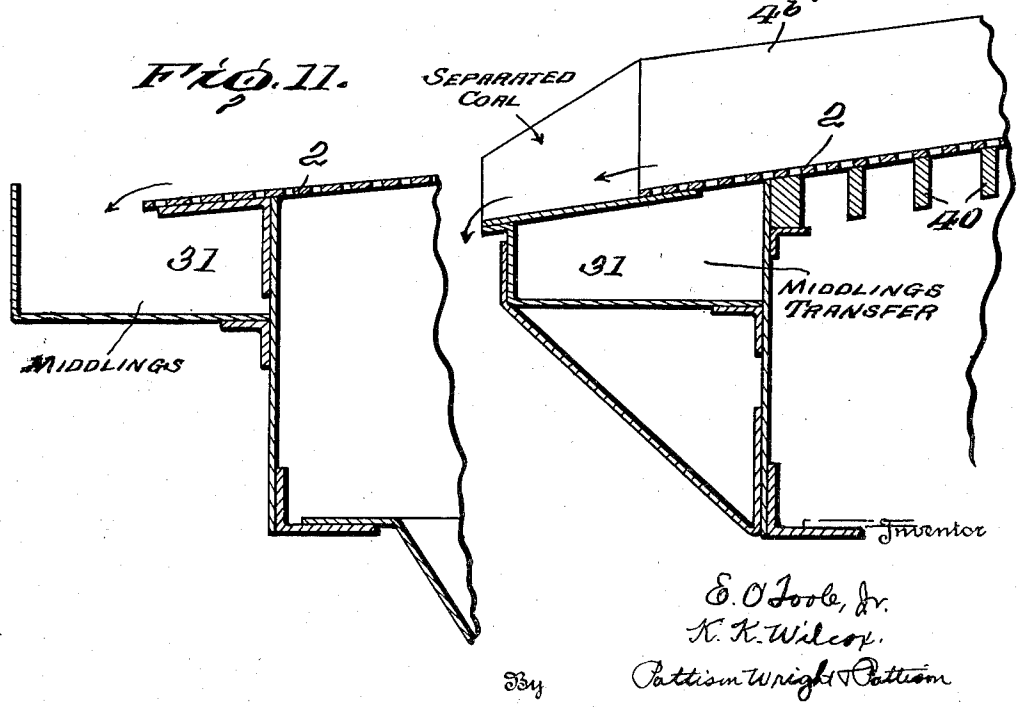


FIG. 12.

FIG. 11.



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UNITED STATES PATENT OFFICE

2,154,180

DRY COAL CLEANING APPARATUS

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Application November 3, 1936, Serial No. 109,008

10 Claims. (Cl. 209—467)

This invention relates to improvements in dry coal cleaning apparatus and the objects thereof will be set forth hereinafter.

In dry coal cleaning plants which comprise several decks they are usually set up separately and each deck provided with separate operating means, and the decks here in question are triangular in horizontal shape.

One of the objects of the present invention embodies the idea of so arranging said triangular decks that two of them occupy substantially the same floor space that is usually occupied by a single deck.

The foregoing object we accomplish by arranging two of the triangular decks with the narrow or feed part of one deck in substantially a horizontal line with the wider or delivery end of the other deck, whereby a minimum floor space is occupied by the two decks.

A further object of the improvement is that the arrangement set forth in the preceding paragraphs enables greatly to increase the efficiency per square foot of floor space occupied by the decks.

These decks have a vibration in their separating operations and in the usual separated arrangement of said decks the vibration of the deck is conveyed to the building, which makes it necessary to go to the expense of so constructing said building that it will stand the vibration caused by the loaded deck. This vibration of the building is prevented in my improvement by so constructing and arranging said decks so that they each operate or reciprocate the load of coal in opposite alternate directions, that is to say, each of the twin decks lifts its load and reciprocates alternately in a direction opposite to the lifting and reciprocation of the other twin deck. Thus the vibrations of one deck neutralizes the vibration of the other twin deck so that the vibration of the decks is not conveyed to the building, and this is accomplished without the use of the ordinary shock absorbers or spring which are used for that purpose.

A further object of the present invention is so mounting and interlocking—so to speak—the two or twin decks that they are driven from a single driving mechanism.

A further improvement pertains to means for feeding or conveying the middlings—which is composed of mixed coal and refuse—from the discharge of one table to the feed end of the other table, when such operation is expedient or is desirable.

It will further be observed that in my twin arrangement of the decks places the feed side or end of one deck in substantially a horizontal line with the discharge side or end of the other deck which enables me to carry out several of the foregoing objects of the present improvement.

Other and additional objects of the invention will appear from the following description.

In the accompanying drawings:

Fig. 1 is a plan view of a deck embodying the broad idea of this improvement without the middlings reworking.

Fig. 2 is a side elevation of Fig. 1.

Fig. 3 is a plan view of my improved deck showing the same arrangement of decks that is shown in Fig. 1 the deck being provided with means for reworking or recleaning the middlings and the riffles located at the lower or discharge sides of the decks having their outer ends extending outwardly as shown.

Fig. 4 is a side elevation of Fig. 3.

Fig. 5 is a plan view of the decks arranged as shown in Fig. 3 and each deck having the riffles with their outer ends extending outwardly and the said decks provided with an additional partitioned-off section or trough for conveying the middlings to the feed ends of the decks to be reworked or recleaned.

Fig. 6 is a side elevation of Fig. 5.

Fig. 7 is a sectional view of the decks shown in Fig. 1 said section taken on the line 7—7 of Fig. 1 looking in the direction indicated by arrow.

Fig. 8 is a cross sectional view of a modified form of deck.

Fig. 9 is a sectional perspective view of a modified form of riffle for the decks.

Fig. 10 is a sectional view of the deck shown in Fig. 5 taken on dotted line 10—10 of said figure looking in the direction indicated by arrows.

Fig. 11 is a segmental sectional view taken on dotted line 11—11 of Fig. 5 looking in the direction indicated by arrows.

Fig. 12 is a segmental sectional view of Fig. 5 taken on dotted line 12—12 of said figure looking in the direction indicated by arrows.

It is well known to those skilled in the art of dry coal cleaning that several forms of decks and arrangements of the said decks have been suggested, and referring generally to the construction of said decks they all embody a riffled air-pervious deck and a bed of coal is on top of the deck. The deck is reciprocated, the objects of which are well known to those skilled in the art and therefore we will briefly refer to said old

parts and will particularly point out our present improvement.

Referring now particularly to Figs. 1 and 2, it will be observed that the decks 1 and 2 are triangular in plan view, which construction of itself is not new. Each deck is provided with a plurality of riffles 3 and the riffles are so arranged that they in plan view also form a triangular arrangement. These decks are provided with an unobstructed portion 4 the operation of which will be briefly referred to presently, and these decks are each provided with a feed or hopper member 5.

Means is here shown by which these two decks are vibrated horizontally and these two decks are so connected—as will be presently described—that when one deck is moved upwardly the other is moved downwardly and vice versa, and that when one of these decks is vibrated horizontally in one direction the other deck is vibrated in the opposite direction.

As here shown an electric motor 6 is mounted on a framework or supporting member 7, which member or members extend beyond the end of one of the decks as shown and a shaft 8 is mounted to rotate in suitable journals 9, and this shaft has intermediate its ends a wheel 10, and the said electric motor has a smaller wheel 11. A belt 12 passes around the wheels 10 and 11, as clearly shown in Fig. 2. The shaft 8 is provided with two eccentrics 13 around which eccentric straps 14 pass and in which the eccentrics 13 rotate. These members 14 are pivotally connected with the end of the deck 2 by rods 15 the said rods being capable of adjustment by a suitable member 16. The ends of these rods 15 are pivoted at 17 to the outer end of the deck 2. This deck 2 is mounted on links 18 and said links inclined in parallel directions. By reason of this arrangement when the deck 2 is reciprocated it is lifted vertically as well as being reciprocated horizontally, which also is well understood by those skilled in this art.

The deck 1 is pivotally supported by links 19 with the said supporting member 7 and these links 19 are normally inclined in a direction opposite to the inclination of the links 18 and by reason of this opposite link extension when one of these decks is moved vertically in one direction the other deck is moved vertically in the opposite direction, and when the two decks are reciprocated horizontally and the coal is moved thereon in opposite directions, and this movement is accomplished by pivotally connecting the two decks together. These pivotal connections consist of suitable rods 20 which have one end 21 pivoted to the deck 2 and the opposite end 22 pivoted to the deck 1. These pivotal connections are preferably located as shown on the outer side of the said decks 1 being at each side or end of the said decks. These decks are separated a suitable distance as indicated at 23 whereby space is provided for the said decks to be freely moved.

It is well known in the art that decks of this type are provided with banking bars 24 and that said banking bars are located a suitable distance from the inner ends of the riffles 3 to provide an unobstructed space 4 for the travel of the heavy particles of refuse. It is also well known to those skilled in this art that each of these decks is inclined in two directions, that is to say, the deck 2 is inclined towards its feeding hopper 5 which places the discharge side 25 at the opposite or lower end of the deck, and the deck 1 is inclined in the same direction. These decks also have another inclination, that is to say, the ends 26 are lower than the ends which contain the unobstructed portions 4. The object of this inclination is that the coal when being reciprocated and air passing through the coal bed the reciprocation and air causes separation and stratification of the particles containing different specific characteristics. The coal is gradually progressed up-hill towards the unobstructed portion 4 and the heavy or refuse particles sink between the riffles and these particles pass out into the unobstructed portion 4 and they then flow by gravity to the gate 27 into a hopper 28 and at the same time the coal which is lifted and accumulates above the said riffles flows by gravity towards the discharge end 25. The gate 27 is what is usually termed a cutting finger so that the amount of refuse that flows from the table can be regulated. The middlings which is composed of mostly refuse with some coal mixed, flows from the table into the hopper 29. These middlings make a product unsatisfactory to burn and several attempts have been made by inventors to rework these middlings. One method and construction is shown in the patent to Oppy, Number 1,888,933, dated November 22, 1932. This patent to Oppy shows means for regulating how much of the product will be taken off as middlings that is unfit for burning. It is well understood that coal differs in its characteristics. That is to say, some coal has a great deal of refuse which forms part of the middlings that must be disposed of, while other coal has a comparatively smaller amount of refuse, and the amount taken from the table is regulated in a manner substantially as shown, described and claimed in the said Oppy patent.

The foregoing is a description which shows the primary feature of the present improvement. We have also combined with the construction shown in Fig. 1 means whereby the middlings can be returned to the decks for reworking or recleaning and reclaiming the coal particles of the middlings while the refuse or slate particles of the coal pass out as refuse. It will be noted that in the arrangement shown in Fig. 1 and also in Figs. 3 and 5 the feed end is located adjacent that part of the table from which the middlings flow and that this arrangement of the decks with the said middlings reworking construction is a novel feature. Figs. 3 and 5 are identical with Fig. 1 except in those parts which will be now referred to.

Fig. 3 as stated, differs from Fig. 1 in two features, one, the provision of means to receive and deliver the middlings to the decks to be reworked, and two, extending the ends 3^a of the riffles 3 diagonally to the discharge edge 25 of said deck. The object of this is to utilize the extreme end of the deck which extends beyond the normal line of discharge and which also tends to cause the product to be progressed inwardly on the deck thus again working the product instead of having it flow immediately from the discharge edge or tailings riffle. In carrying out this second feature it will be noted that these diagonal riffles contain additional riffles 3^b which are located between the diagonal parts of riffles 3^a and the inner ends of these riffles 3^b stop where the diagonal riffles 3^a begin.

Reworking middlings

It has been stated that the middlings consists of a mixture composed of refuse and good coal and sometimes intermediate gravity material such as bone and ash, high ash coal, etc. Refer-

ring to Fig. 3 the refuse which is composed of the heavy particles flows down the unobstructed portions 4 of the two decks and they enter a trough 30 and they flow from this trough 30 into the hopper or other receptacle 28. The middlings however flow from the discharge edge 25 from the right hand side of the refuse cutting finger 27 to about the point 31 and the middlings fall into the trough 32 and they are propelled by the movement of the deck up the trough 32 to the outlet end 33 and they then fall into the feed end of the opposite deck of the table. The middlings pass over the table with the raw coal on the opposite deck and is again reworked and the coal in the middlings is recovered and reclaimed. The trough 32 inclines upwardly from about the point under the trough 30 and the trough at this point is located beneath the refuse trough 30.

Beginning at the point designated by 28, Fig. 3, the trough then extends upwardly at an inclination, as clearly shown in Fig. 4 and the middlings are propelled up this inclination due to the upward and forward movement of the deck and when it reaches the outlet 33 it falls onto the feed end of the other deck. It will be noted that this trough 32 is in a horizontal plane beneath the trough 30 so that the refuse flows out the trough 30 while the middlings flow into the trough 32 and they are conveyed beneath the trough 30 as previously stated. In this manner the middlings of one deck is conveyed to the feed part of the other deck and this distance is very short. In the Oppy patent hereinbefore referred to, the middlings are transferred in the opposite direction and throughout substantially the whole length of the deck before they are delivered to the feed end thereof. It will be noted that the hopper 28 is located in a horizontal plane below the refuse trough 30 and the middlings trough 32. The coal flows from the delivery edge or tailings riffle 25 throughout all that part of the table beginning at the inner end 31 of the trough 32 and extending outward throughout the length of the deck.

In Fig. 5 we show a table in which the middlings conveying construction is somewhat different from that described in Fig. 3 and it will be used when it is desired to rework a larger amount of the middlings. This is accomplished by providing the adjacent diagonal edges of the tables with the unobstructed portion 4 and an additional unobstructed portion 4^a. The function of these two parts is that the heaviest particles of the refuse flow down the unobstructed portion 4 against the banking bar 4^b while the intermediate gravity particles as well as the mixture of coal and refuse commonly referred to as middlings, rise above the riffles 3 of deck 2 and flow downward by gravity over said riffles in about the space lying between dotted line 5^b of deck 2 and the unobstructed space 4, to the trough 31 which lies under the trough 30 of deck 2, and thence it flows through the trough 31 as indicated by arrows marked *b* to and through trough 4^c on deck 1 as indicated by arrows *b* to the point 34 where they are delivered to deck 2 thus reworking the middlings on the deck 2 where they originated. The middlings originating on the other deck 1 in the space bounded by the dotted line 5^b of deck 1 flow to the trough 31 of said deck and pass under the outlet 34 around to trough 4^a as shown by arrow *b*, Fig. 10, and to the outlet 31^a of trough 4^a where the middlings mix with the raw coal feed 5 of deck 1 and travel over deck 1 with the raw coal as indicated by the arrows marked *a*. The amount of middlings flowing from decks 1 and 2 can be regulated in the manner explained in said patent to Oppy No. 1,888,933 and the adjustable cutting finger 27.

From the foregoing description it will be seen that Fig. 3 is a modification of Fig. 5 and that Fig. 1 is a modification of Fig. 3 in the respect which has been previously pointed out.

It will of course be understood that the reciprocations of all the tables and the means for reciprocating them are exactly alike although they are not illustrated in either Figures 3, 4, 5 or 6.

A further modification in the construction of the decks 1 and 2 is shown in Fig. 8 which consists in making the said deck with an under plate 36 and place the perforated deck 37 above it and separated from the under plate 36. This under plate has large openings 37^a on which are placed supporting rods 39 for the deck 37. The object of this construction is to do away with the wood supporting members 40 which are located under each of the riffles as shown in Figs. 7 and 8 and also by omitting these supporting members or ribs 40 the air is not impeded or obstructed in passing upward through the support 36. By omitting these ribs and substituting these wires we find that the efficiency and capacity of the cleaning deck per foot is greatly increased. When these wood ribs are utilized as supports for the deck they occupy from twenty to thirty-five percent of the cleaning and air restricting area. The deck 37 can be made without departing from this idea either by stepped or corrugated perforated metal. Riffles 3^d, Fig. 8 can be attached direct to decking with suitable metal screws or bolts which permits any desired spacing of riffles, in place of being limited to spacing of wood ribs as in former practice. The feet of riffles may be eliminated excepting ⅜ inch square attachment *f* as shown in Fig. 9, or foot space at predetermined distances apart. This greatly reduces the blockage of air caused by foot of riffles as in former practice which increases cleaning capacity and efficiency per square foot of cleaning area. It enables the complete elimination of foot of riffles. Riffles may be attached direct to decking by spot welding or soldering, thus entirely eliminating blockage of air caused by foot of riffles as in former practice with benefits as described above.

Where the following claims state that the decks are in substantially the same horizontal line, it is to be understood to be interpreted broad enough to include the positions shown in the drawings.

We claim:

1. A dry coal cleaning apparatus comprising two triangular decks, said decks arranged with the angular portions extending at an angle across said decks and parallel with each other, means for reciprocating said decks, said angular portion of each deck having a partitioned off portion extending parallel said angular portion and forming substantially an unobstructed race-way for the middlings, said middlings race of one deck receiving the middlings from the adjacent deck and conveying them to the feed end of the other adjacent deck, and means connecting said middlings race of one deck with the feed end of the other deck.

2. A dry coal cleaning apparatus comprising two decks, means for reciprocating said decks, the decks arranged so that the discharge end of one deck is along side of the feed end of the other deck, means whereby the major part of the coal is separated leaving middlings, means for feeding

the middlings of one deck to an adjacent passageway of the other deck, said passageway being connected with the feed end of the first said deck whereby the middlings are returned to the deck on which they originated.

3. A dry coal cleaning apparatus comprising two triangular shaped decks having their longest sides adjacent and parallel with each other, one of said decks having a middlings receiving passageway connected with a delivery passageway of the other deck, said delivery passageway connected with the feed end of the deck having the receiving passageway.

4. A dry coal cleaning and separating apparatus comprising two triangular shaped decks arranged with their longest sides parallel and adjacent each other, said side of one deck having a receiving passageway and the said side of the other deck having a delivery passageway, the separated middlings of one deck entering a passageway connected with the delivery passageway of the other deck, whereby the middlings originating on one deck passes through the delivery passageway of the other deck and is delivered to the receiving end of the deck having the receiving passageway whereby the middlings are fed with the raw coal at the feed end of the same deck on which they originated.

5. A dry coal cleaning and separating apparatus comprising two triangular shaped decks arranged with their longest sides opposite and parallel with each other, said sides provided with passageways throughout their lengths, one deck having a passageway at its delivery end receiving the separated middlings and delivering middlings to a receiving passageway of the other deck said receiving passageways delivering the said middlings to the feed end of the deck on which said middlings originated, whereby the middlings are fed to and mixed with the raw coal on the table on which they originated.

6. A dry coal cleaning and separating apparatus comprising two triangular decks arranged with the long sides of the triangle opposite and adjacent each other, said long sides having parallel passageways extending from end to end of said decks, each deck adapted to separate the middlings from the raw coal and deliver the said middlings at the delivery ends thereof, said middlings of one deck adapted to pass through the passageway of the other deck and be delivered to the feed end of the deck on which the middlings originated.

7. A dry coal cleaning apparatus comprising twin decks, each deck having a narrow feed and a final narrow delivery portion, said decks being triangular in plane view and arranged side by side with the long part of said triangles arranged side by side and with said decks substantially in the same horizontal plane and each having a parallel adjacent raceway for the separated heavier particles of the coal.

8. A dry coal cleaning apparatus comprising twin separating decks each deck having a narrow feed end and a final narrow delivery portion, said decks being triangular in plan view and arranged side by side with the long part of said triangles arranged side by side said decks having their adjacent edges provided with a raceway for the heavier particles of said coal, said decks located in substantially the same horizontal plane and said planes arranged slightly crosswise of each other, for the purpose set forth.

9. A dry coal cleaning apparatus comprising twin separating decks, each deck having a narrow feed end and a final narrow delivery portion, said decks being triangular in plan view and arranged side by side with the long part of said triangles side by side, said decks arranged substantially in the same horizontal plane with the narrow feed end of one deck at the final delivery portion of the other deck but slightly below the said delivery portions, for the purpose set forth.

10. A dry coal cleaning apparatus comprising two reciprocating triangular shaped decks arranged with the hypotenuse of the triangle of one deck parallel with and adjacent to the hypotenuse of the triangle of the other deck, said decks also arranged at slight angles in respect to each other, supporting toggles for said decks arranged to cause the respective decks to be so reciprocated that the coal on one deck moves in a direction opposite to the coal on the opposite deck.

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