United States Patent [19]

David

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[45] **May 14, 1974**

[54] **MINING MACHINE DUST COLLECTOR**

[76] Inventor: **Joseph S. David,** 320 Pinavak Dr., Franklin, Pa. 16323

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[21] Appl. No.: **289,833**

[52] **U.S. Cl.** **299/64,** 299/12, 299/18

[51] **Int. Cl.** **E21c 35/22**

[58] **Field of Search** 299/12, 18, 64–68, 299/56, 57; 175/206

[56] **References Cited**

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Primary Examiner—Ernest R. Purser

Attorney, Agent, or Firm—E. Wallace Breisch

[57] **ABSTRACT**

A mining machine having a boom enclosed dust collector assembly for use in a coal mining operation wherein the dusty air from a mining operation is gathered directly from said operation, collected in the mining machine boom, selectively wetted and separated by centrifugal processing into a coal slurry for disposal and clean air for exhaust.

10 Claims, 11 Drawing Figures

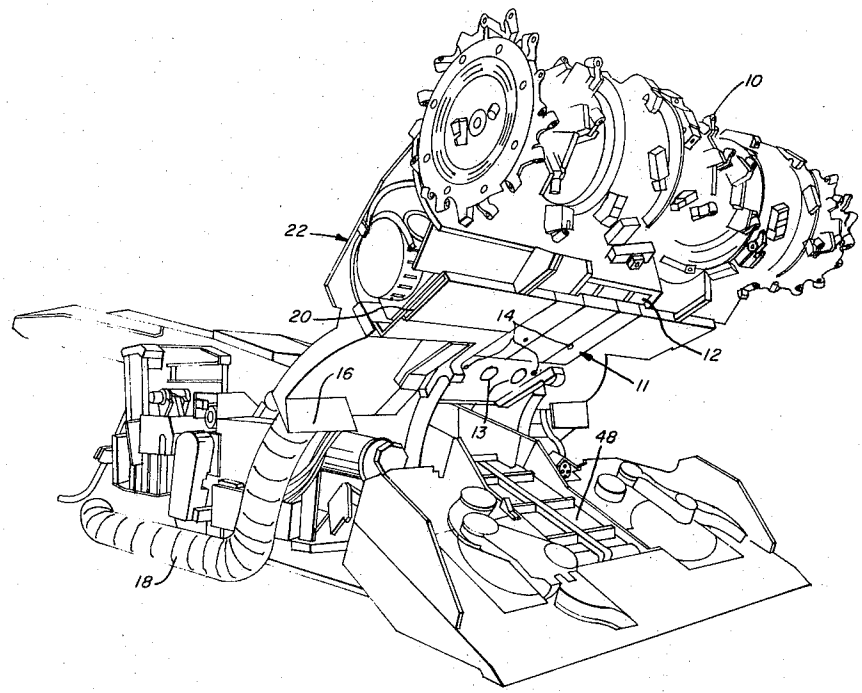
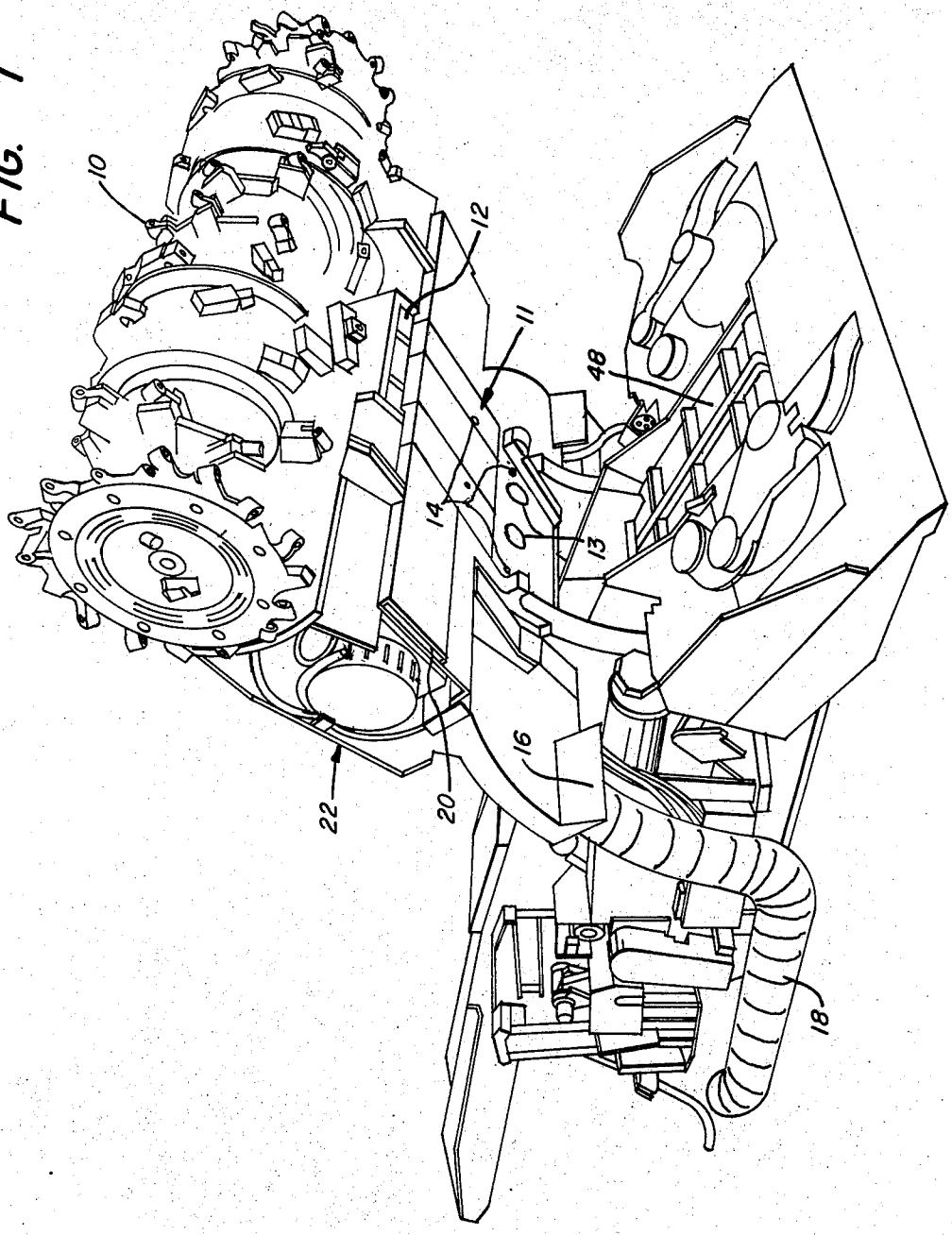


FIG. 1



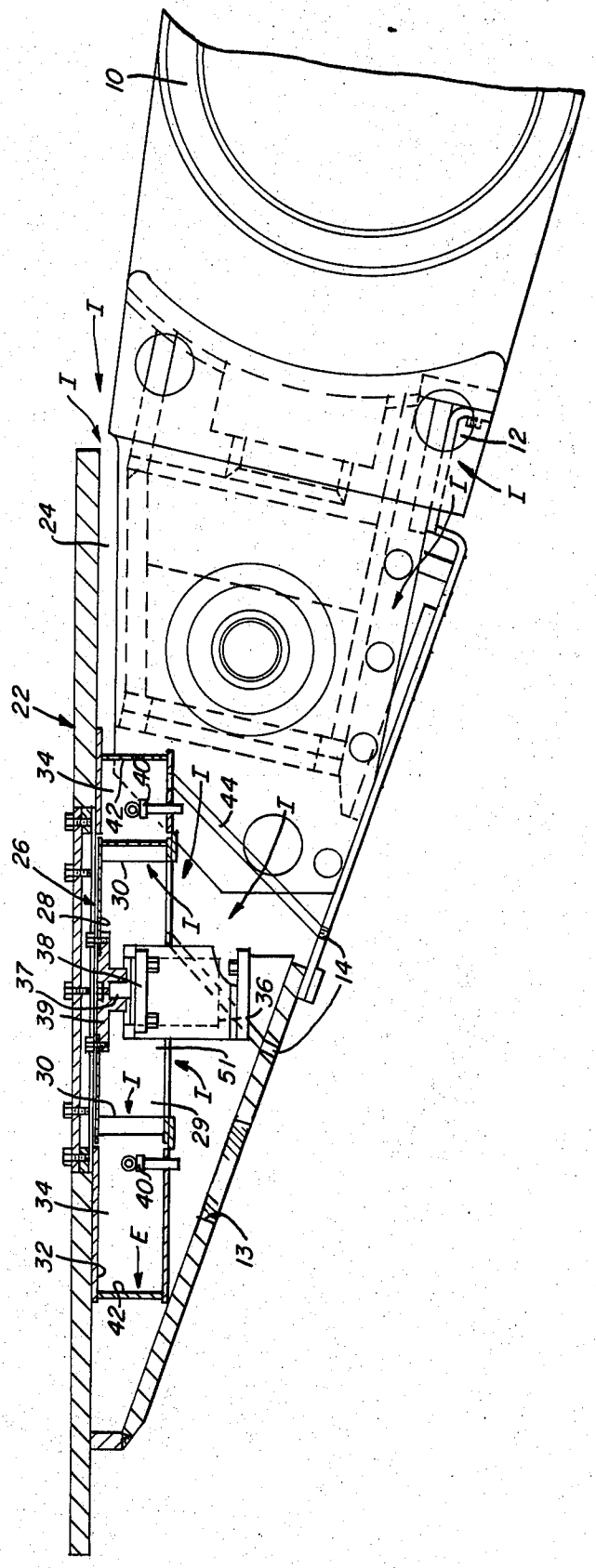

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FIG. 2

FIG. 3

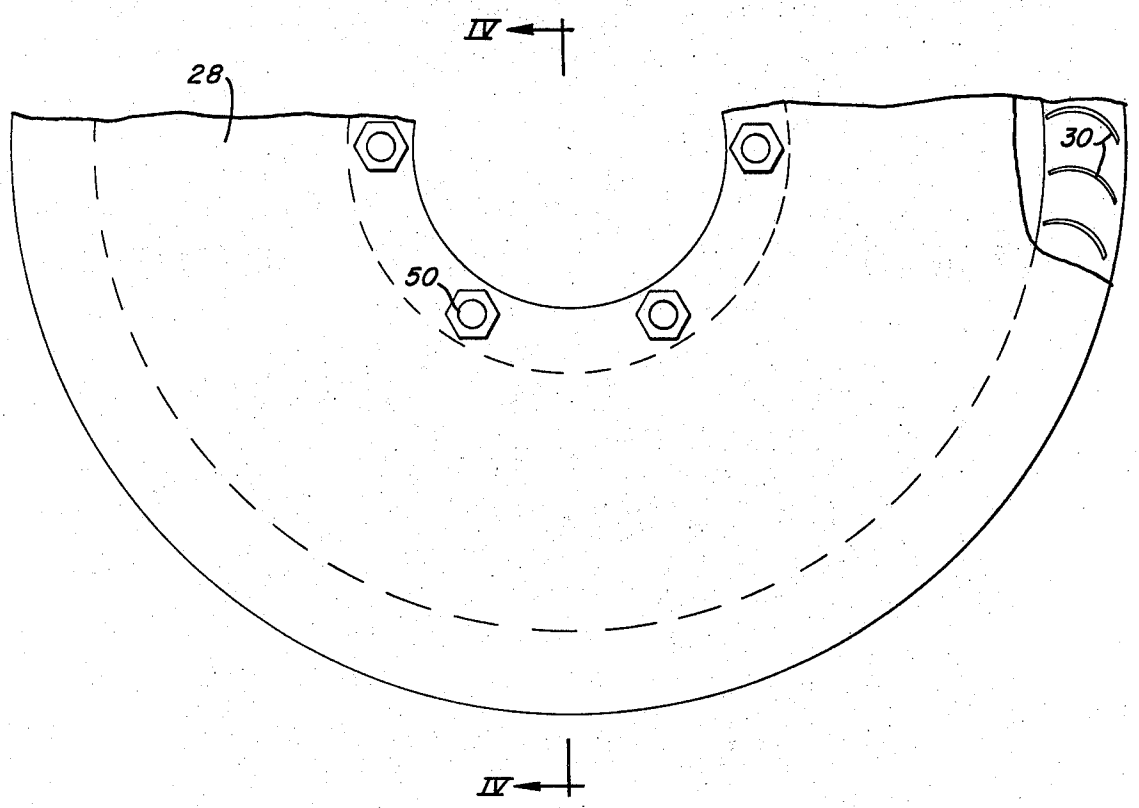

FIG. 4

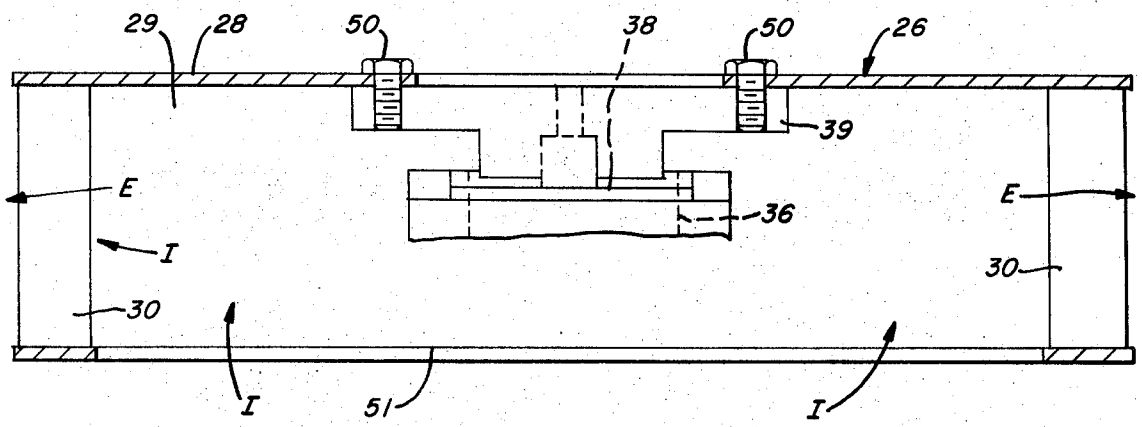

FIG. 5

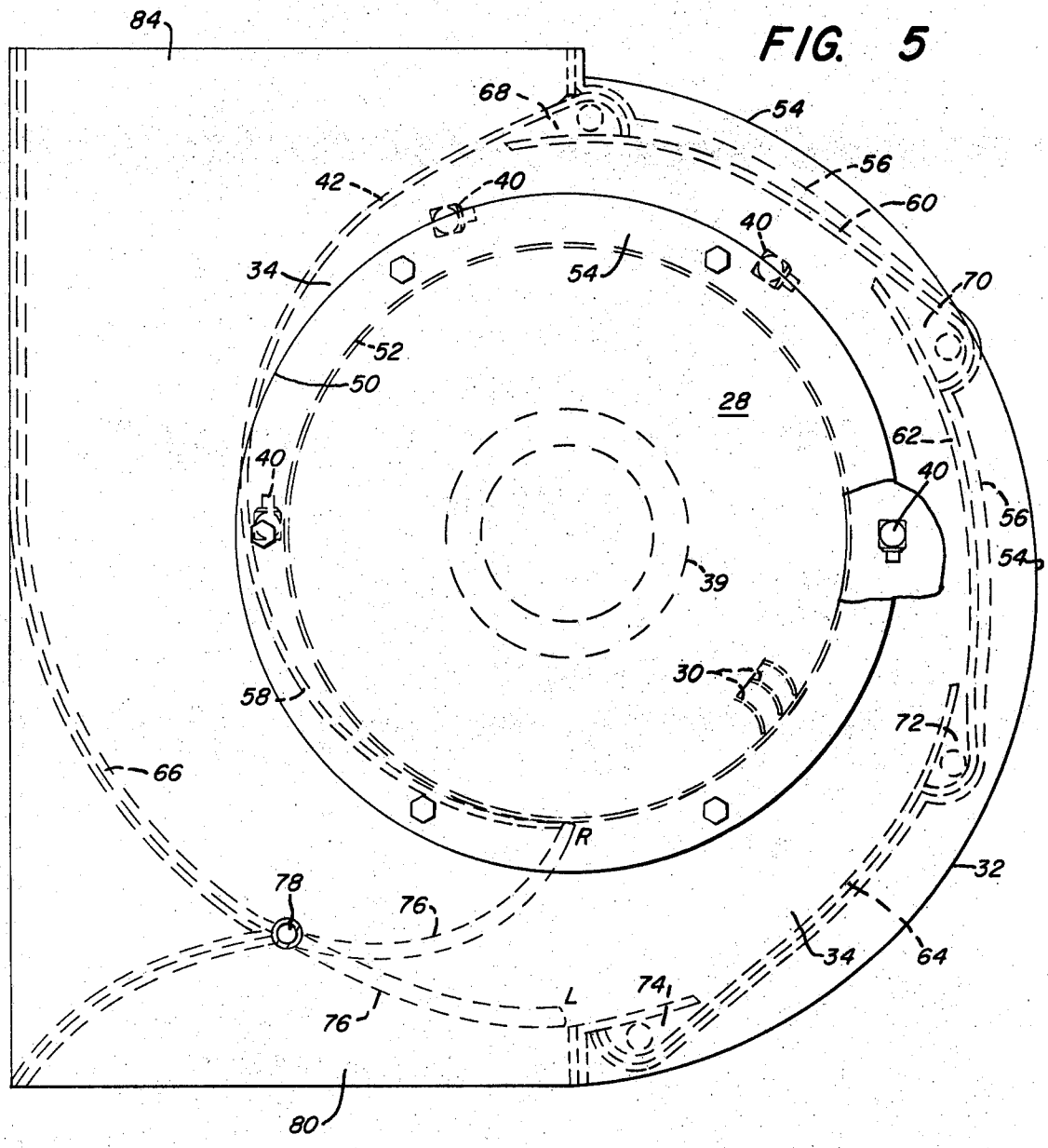
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FIG. 6

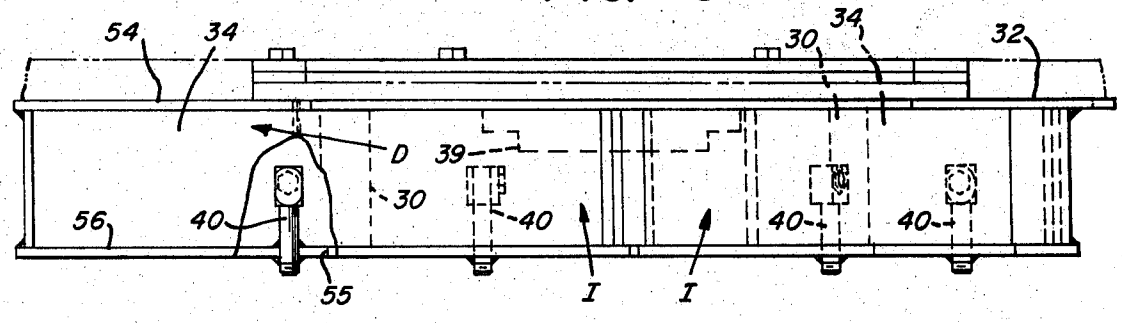
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FIG. 7

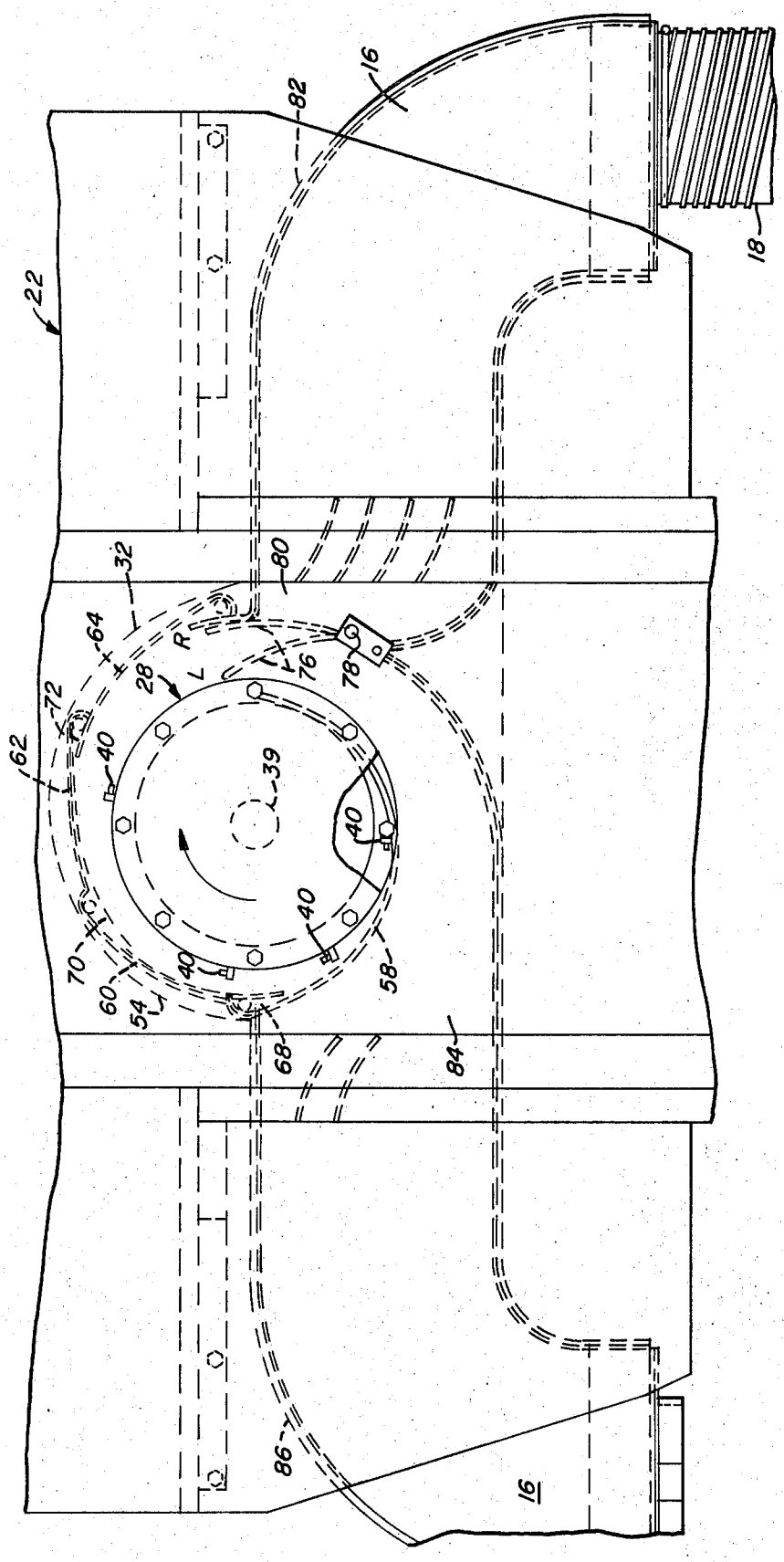


FIG. 8

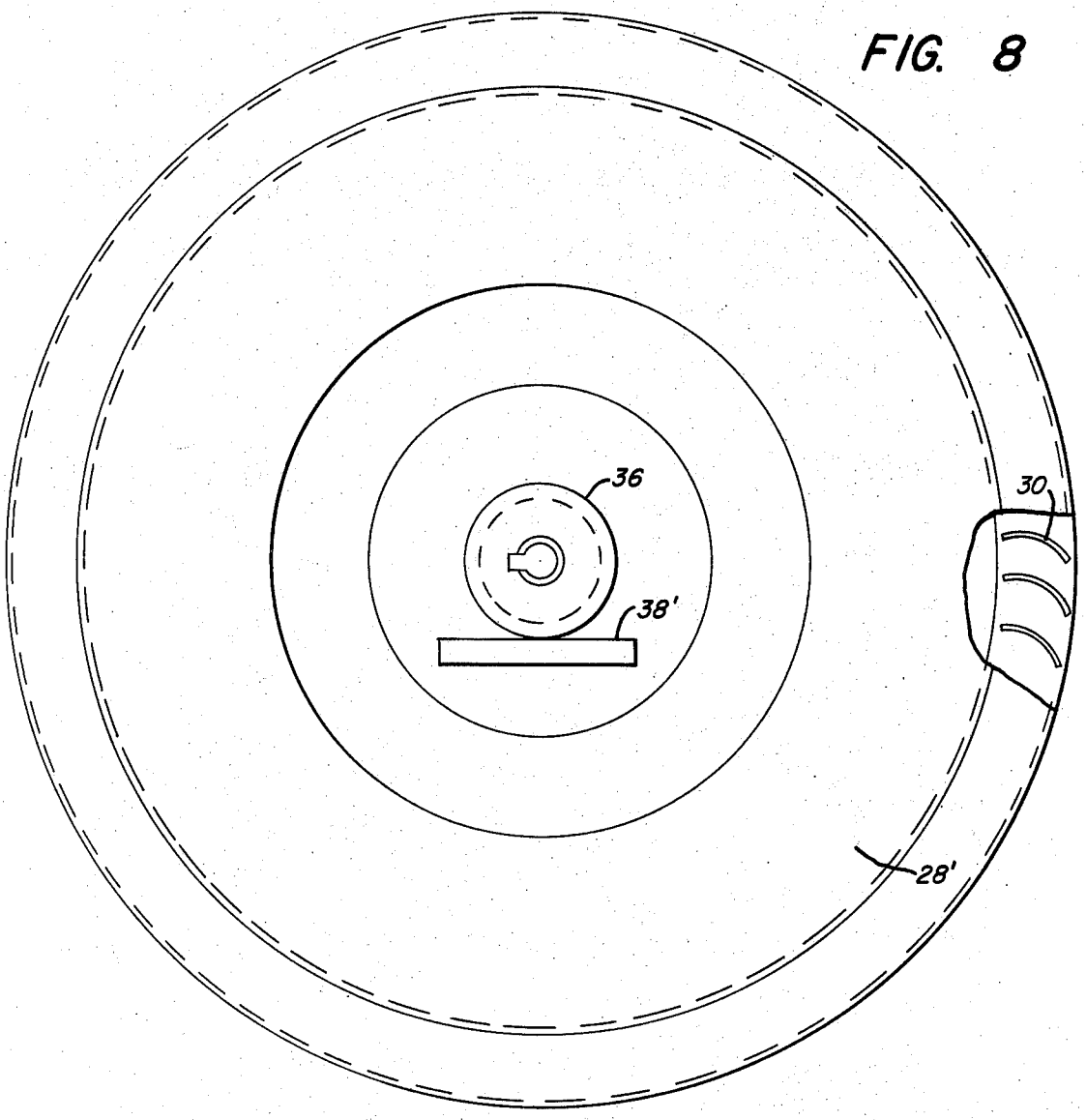


FIG. 9

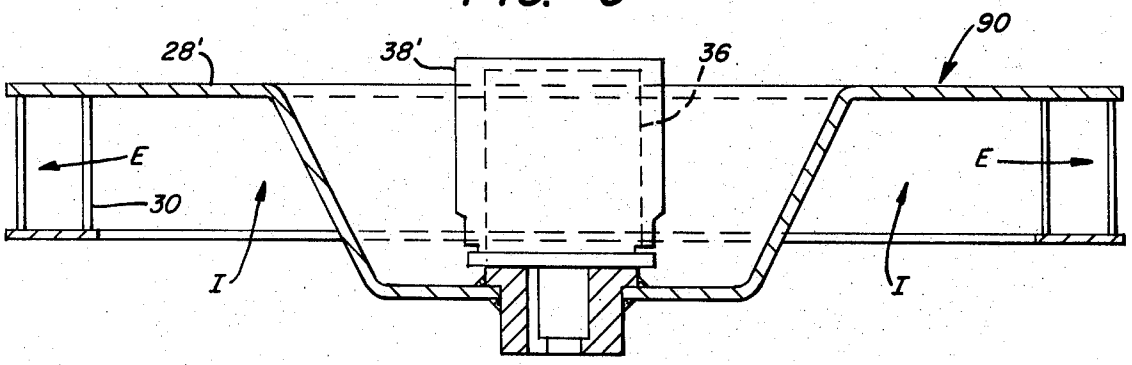


FIG. 10

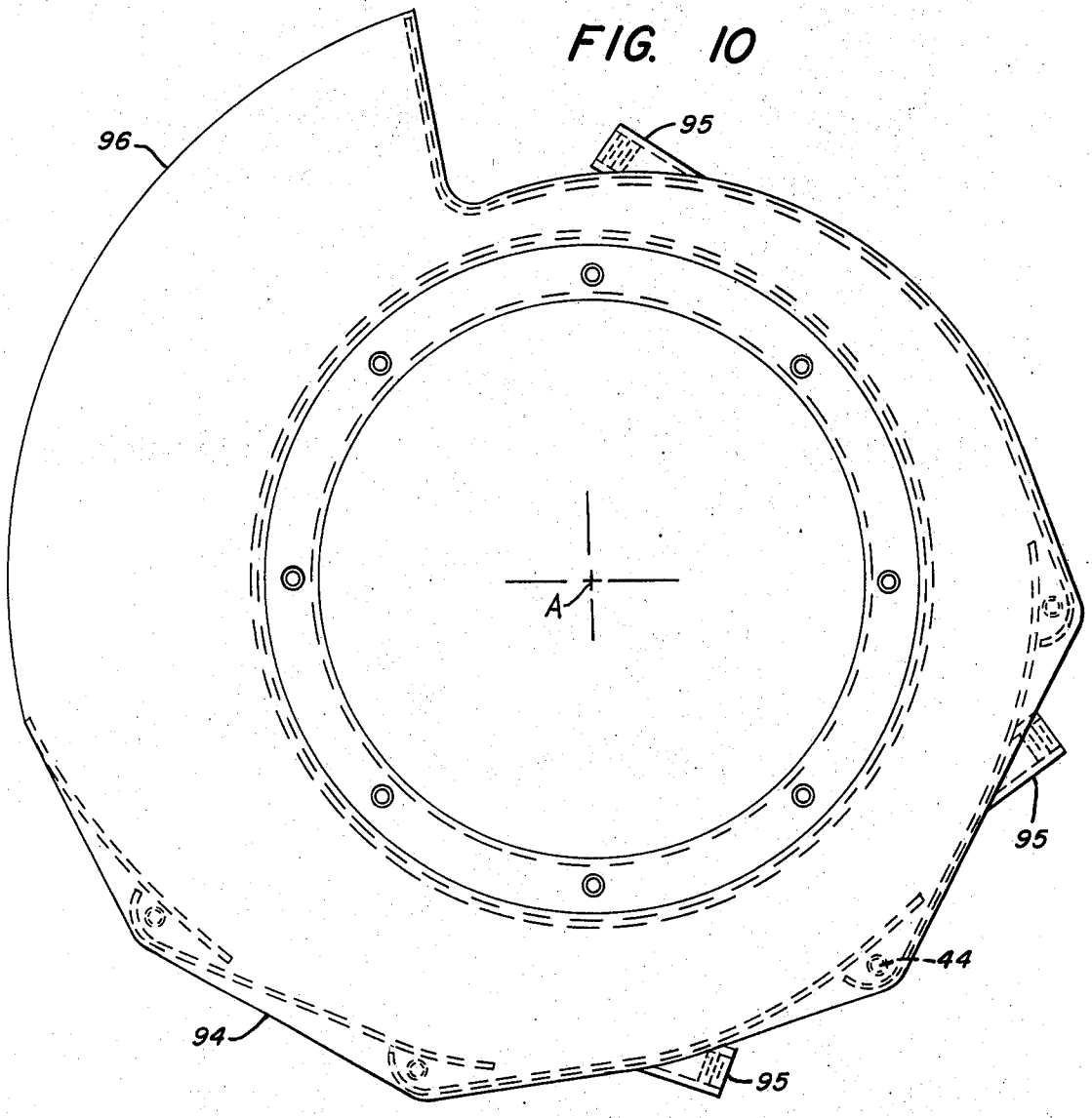
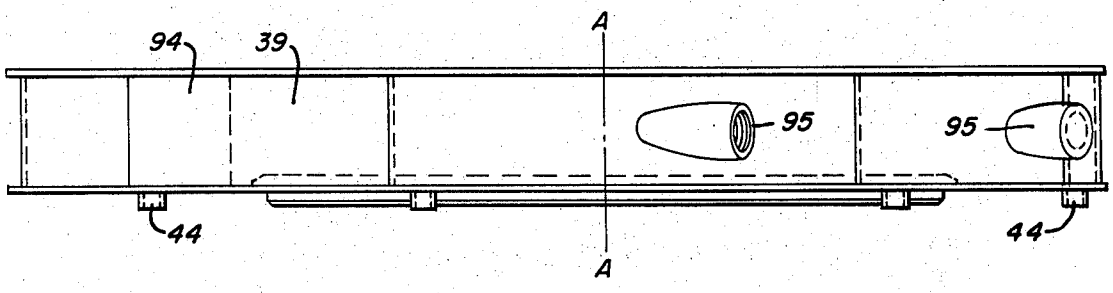


FIG. 11



MINING MACHINE DUST COLLECTOR

BACKGROUND OF THE INVENTION

Numerous methods have been suggested and employed to suppress or at least reduce the amount of coal dust in the air in the vicinity of a coal mining operation, the majority of which involve bulky and expensive elements such as brattices, tubing, intake fans, and exhaust fans separate from the machine. Presently employed dust removal means usually results in deposit of the collected dust at some secondary point where it may still be a problem. Other methods have involved dust collectors and removal means added on the sides or top of present machines or trailed behind thereby requiring additional space where space is limited.

SUMMARY OF THE INVENTION

According to the present invention there is provided a new and novel dust collector for use in a coal mining machine wherein a centrifugal air collector is located in a novel manner in a cutter boom frame to draw a mixture of coal dust and air from immediately behind the cutting elements, spray the dust with liquid, centrifugally separate the dust from air and deliver a coal slurry under air pressure to the mining machine discharge with the remaining substantially cleansed air being exhausted from the machine.

Other provisions of this invention will be more apparent when taken in conjunction with the following more detailed description with the accompanying drawings wherein:

FIG. 1 is a perspective view of one type of a continuous mining machine with the dust collector of this invention included in the boom structure;

FIG. 2 is a sectional view of a portion of the boom of a mining machine showing the location of the dust collector of FIG. 1;

FIG. 3 shows a fragmentary partially sectional plan view of one embodiment of an impeller assembly;

FIG. 4 is a median sectional view of the impeller of FIG. 3;

FIGS. 5 and 6 show respectively, a plan view and an elevational view of one type of impeller housing;

FIG. 7 is a plan view of a portion of a mining machine boom showing in phantom the location of the FIG. 5 type of the dust collector of this invention and a plurality of exhaust ducts;

FIGS. 8 and 9 show respectively a plan view and an elevational section view of a second embodiment of the impeller assembly;

FIGS. 10 and 11 show respectively, a plan view and an elevational view of one type of impeller housing constructed according to the principles of this invention.

Referring to FIG. 1 there is shown a mining machine in a high cutting position with a cutter support boom 22 raised so that intake and exhaust locations of the dust collector 11 of this invention can be seen. Immediately behind the cutter drum 10, not visible in FIG. 1 but indicated by the reference numeral 11, is the location of a gas and particulate matter separator which is a main part of the dust collector 11. Shown in FIG. 1 as part of the assembly of the dust collector 11 is a screened air intake 12 and intake ports 13 into which the dust accumulation created by the cutter drum 10 is drawn in by an intake fan (described hereinafter) to wash the dusty air and centrifugally separate it into a wet coal slurry to be discharged through ports 14, (see FIG. 2) and a remaining cleansed air flow which is discharged through exhaust duct work 16 and guide ducts 18. Only one guide duct 18 is shown in FIG. 1 but more than one is available as is indicated in the description of later figures. A pair of side intakes 20 (only one of which is shown) takes in any air borne dust that escapes the intakes 12 and 13 and travels to the sides of the machine. A top intake is also available as described in connection with latter description of FIG. 2.

Referring to FIG. 2, a series of directing arrows labeled with an "I" for intake and "E" for exhaust shows the air flow path of one embodiment of the dust collector as positioned in the cutter support boom 22 relative to the cutter drum 10 wherein the dust is drawn in at the bottom through the intake 12 and intake ports 13, at the sides of vents 20 (shown in FIG. 1) and at the top by an intake slot 24. A centrifugal impeller or fan 26 comprising a rotary plate 28 and impeller blades 30 completely around the periphery (only a few shown in the drawings, see FIG. 3) provide the negative pressure or suction to draw the dusty air into the fan rotor section 29 of the separator with impeller blades 30 driving the collected dust into a rotor housing 32 having a spiral duct 34 encircling the fan 26. Within the duct 34, the dusty air is washed and centrifugally separated into substantially clean air to be exhausted from the machine and liquid and solid particulates in the form of a wet coal slurry which is passed to the usual machine conveyor 48 (see FIG. 1) and discharged with the mined material in a manner described in detail hereinafter.

FIG. 2 also shows one embodiment of the positioning of the impeller motor 36 on a mounting bracket 38 wherein the motor 36 is connected by suitable driving means such as a keyed shaft 37 directly to the center hub 39 of the fan 26 to rapidly rotate the impeller blades 30 of the fan 26 within the housing 32. A plurality of water jet nozzles 40 (two of which are shown in FIG. 2) are located at spaced intervals around the housing duct 34 (see FIG. 5) to spray the incoming dust and wet the walls of a guide scroll arrangement 42 (described hereinafter) of the housing 32 with a high velocity water jet which is then drained off with a dust slurry via a plurality of drain tubes 44 (only one of which is shown in FIG. 2) to drain ports 14 to be discharged downward to a machine conveyor 48 (FIG. 1) as explained hereinafter.

Referring to FIGS. 3 and 4 there is shown one embodiment of the impeller or fan rotor section 29. The portion shown in FIG. 3 indicates the spacing of the impeller blades 30 spaced around the periphery of rotor section 29 and having a predetermined curvature so as to draw dust in a flow path indicated by arrows I and E in FIG. 4 when the fan 26 is rotated by the motor 36 shown in part in FIG. 4. The rotary plate 28 is secured by bolts 50 to the hub 39 to be rotated by the motor 36. In this embodiment (FIGS. 2, 4) the motor 36 is shown directly below the hub 39, however, space requirements may require different locations with separate drives as necessary.

The fan 26 is positioned within a rotor housing 32 shown in detail in FIGS. 5 and 6. The fan 26 comprises the top plate 28 with hub 39, and bottom plate 51 (FIGS. 2, 4, 5 and 6) with impeller blades 30 suitably rotatable within circular opening 52 in a housing top plate 54 and opening 55 in a bottom plate 56. The

guide scroll arrangement **42** includes a plurality of scroll plates **58, 60, 62, 64** and **66** arranged around the outside of the rotor section to form a duct **34** spirally increasing the volume from an initial point adjacent the path of the rotating impeller blades **30** so as to receive the dusty air drawn in by the fan **26** and discharged into the spiral duct **34.** The discharge of the air into the spiral duct **34** is at a rapid rate such that dirt and coal particles are inertially separated from the air and forced against the walls of the scroll plates **58, 60, 62, 64** where the spiral configuration causes the solid particles to be collected in a plurality of particulate matter traps or drain pockets **68, 70, 72** and **74.** In addition to the centrifugal action of the swirling dust, a plurality of water jet nozzles **40** are spaced within the spiral duct **34** to wet the swirling dust so as to assist in separating the solid particles from the air and also wet the walls of the guide scrolls **58–66** to collect particles thereon, to prevent bouncing or re-entrainment of dust particles and wash them to the entrapping drain pockets **68–74** to be drained off via tubes **44** (FIG. **2**) to the machine conveyor **48.**

The air remaining in the spiral duct **34** after being washed and cleaned by the nozzles **40** and the inertial action described, is guided to a gating area in the duct **34** between scroll **64** and scroll **66** where a movable gate **76** is mounted on pivot pin **78.** The gate **76** has a tightening means (not shown) whereby the gate **76** can be placed and secured into one of several selected positions until a different position is desired under different operating conditions. In FIGS. **5** and **7** the gate **76** is shown in dotted outline in two different positions R and L. With the gate **76** in the R position, the cleansed air is directed to the right (as viewed in FIGS. **6** and **7**) out a right exhaust duct **80** which is connected to the duct work **16** and a guide conduit means such as a flexible guide duct **18** (FIG. **1**), to be directed where desired. With the gate **76** in the L position, the cleansed air is directed to the left (as viewed in FIG. **5**) out a left exhaust duct **84** which is connected by suitable duct work **16** to a flexible tube (not shown) similar to guide duct **18** of FIG. **1** to be directed where desired. If it is desired to exhaust the cleansed air out both the right exhaust duct **80** and the left exhaust duct **84,** the gate **76** is suitably positioned intermediate the L and R positions such that the cleansed air is divided and selectively proportioned to the two exhaust ducts according to the positioning of the gate **76.**

The relative location of the dust collector **11** in the machine boom **22** is shown in FIG. **7** with the duct work **16** including the two exhaust ducts **80** and **84.**

It should be noted that although the exhaust duct work **16** is shown in the drawings is directed toward the rear of the machine boom **22,** with guide ducts **18** (FIG. **1**) leading to the rear of the mining machine, it is not limited to such direction. The guide ducts **18** being flexible can be directed in any direction, and the duct work **16** can be constructed to direct the exhausting air in any direction desired. Accordingly, other embodiments of the present dust collector may be utilized wherein the duct work **16** may be directed in selected different directions.

Still another arrangement is shown in the fan and motor assembly **90** including the rotary element **28'** of FIGS. **8** and **9** and the rotor housing **94** of FIGS. **10** and **11.** In FIGS. **8** and **9** the rotary element **28'** is of different shape than that of FIGS. **3** and **4** with an upwardly open cup-shaped center portion such that the motor **36** may be mounted on a bracket **38'** above the rotary element **28'** to meet different space requirements.

FIGS. **11** and **12** show a variation of the rotor housing wherein mounting bosses **95** for the jet nozzles **40** are located on the sides of the scroll plates instead of in the spaces defined by the spiral duct **34** thereby providing different access thereto to meet different space requirements. For example, the housing **94** can be mounted in cutter support boom **22** to be rotatably adjustable therein and with suitable changes in the boom duct work and a housing outlet opening as at **96** matable with left hand exhaust duct **84** or right hand exhaust duct **80** (see FIG. **7**) asdesired by rotation of the housing **94** about point A on the vertical axis A—A of the fan **26** (see FIG. **11**). This rotation has the advantage of providing either right hand or left hand air flow without the use of a gate element such as gate **76** thus allowing more aerodynamically perfect air flow.

It is also intended to make the duct work **16** adaptable so that exhaust air could be directed forwardly into either or both corners of the mining face to provide diffusion air to more thoroughly clear out pockets of gas collecting in these corners.

When diffusing action is required the intake of air can be through openings in the top of the boom connected rearwardly of the miner by ducting to provide clean air for better diffusion by using the apparatus of this invention.

Summarizing the above description of the various figures of the drawings, it can be seen that the accumulated dust caused by the operating cutter drum is taken in the various intake passages and ducts by the fan **26.** The fan imparts an outward motion to the dust to cause inertial separation of dust particles and air while simultaneously washing the dust and collecting dirt particles to be separately discharged as a particle slurry and cleansed air as desired.

Although I have shown and secribed only a few embodiments of the present invention, different embodiments may be comprised of variations in the duct work locations, operation of the fan to act as a ventilation means, variations in the shapes and drives of the impeller means etc. without departing from the spirit and scope of the invention and it is intended that all matter contained in the foregoing description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A mining machine having a cutter supporting boom which includes a lower surface thereof overlying at least a forward portion of a gathering head conveyor comprising: a hollow within said boom; a centrifugal gas and particulate matter separator assembly mounted within said hollow; at least one gas inlet means communicating between said assembly and the exterior of said boom adjacent said surface; at least one gas exhaust means communicating between said assembly and the exterior of said boom; at least one particulate matter trap within said hollow; and at least one particulate outlet means communicating between said trap and the exterior of said boom adjacent said surface.

2. The mining machine as specified in claim **1** wherein said separator assembly comprises a housing mounted in said boom.

3. The mining machine as specified in claim **2** wherein said separator assembly further comprises a

centrifugal impeller rotatably mounted within said housing.

4. The mining machine as specified in claim 3 wherein said trap is a plurality of said traps spaced along an interior peripheral portion of said housing.

5. The mining machine as specified in claim 4 having a similarly communicating particulate outlet means for each of said traps.

6. The mining machine as specified in claim 5 having spray means mounted within said housing.

7. The mining machine as specified in claim 2 wherein said housing has at least one outlet means and said boom has at least two gas exhaust means with respective duct work.

8. The mining machine as specified in claim 7 wherein said housing is mounted for rotational adjustment within said boom to bring said housing outlet means into communication with a selected one of said exhaust openings.

9. The mining machine as specified in claim 2 wherein said gas exhaust means is directed forwardly with respect to said boom.

10. The minimg machine as specified in claim 6 wherein said particulate outlet means is a gravity drain for a slurry.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,810,677 Dated May 14, 1974

Inventor(s) Joseph S.David

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

1. A mining machine having a cutter supporting boom which includes a lower exterior surface thereof overlying at least a forward portion of a gathering head conveyor comprising: said boom having a compartment therewithin; a centrifugal gas and particulate matter separator assembly mounted within said compartment; at least one gas inlet means to said assembly extending through said surface; at least one gas exhaust means communicating between said assembly and the exterior of said boom; at least one particulate matter trap within said compartment; and at least one particulate outlet means to said trap extending through said surface.

Signed and sealed this 24th day of September 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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