United States Patent [19]

Gundlach et al.

[11] **3,792,568**

[45] **Feb. 19, 1974**

[54] **AIR SCRUBBER**

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[22] Filed: **Aug. 15, 1972**

[21] Appl. No.: **280,799**

Related U.S. Application Data

[63] Continuation of Ser. No. 52,631, July 6, 1970, abandoned.

[52] **U.S. Cl.** **55/223**, 55/231, 55/240, 55/257, 55/385, 55/423, 55/442, 98/50, 261/89, 299/12, 299/64

[51] **Int. Cl.** **B01d 47/06**

[58] **Field of Search** 299/12, 64; 98/50; 55/182, 55/199, 202–203, 207, 223, 230–231, 240, 400–403, 406–409, 423–424, 385, 442; 261/89; 417/67, 68

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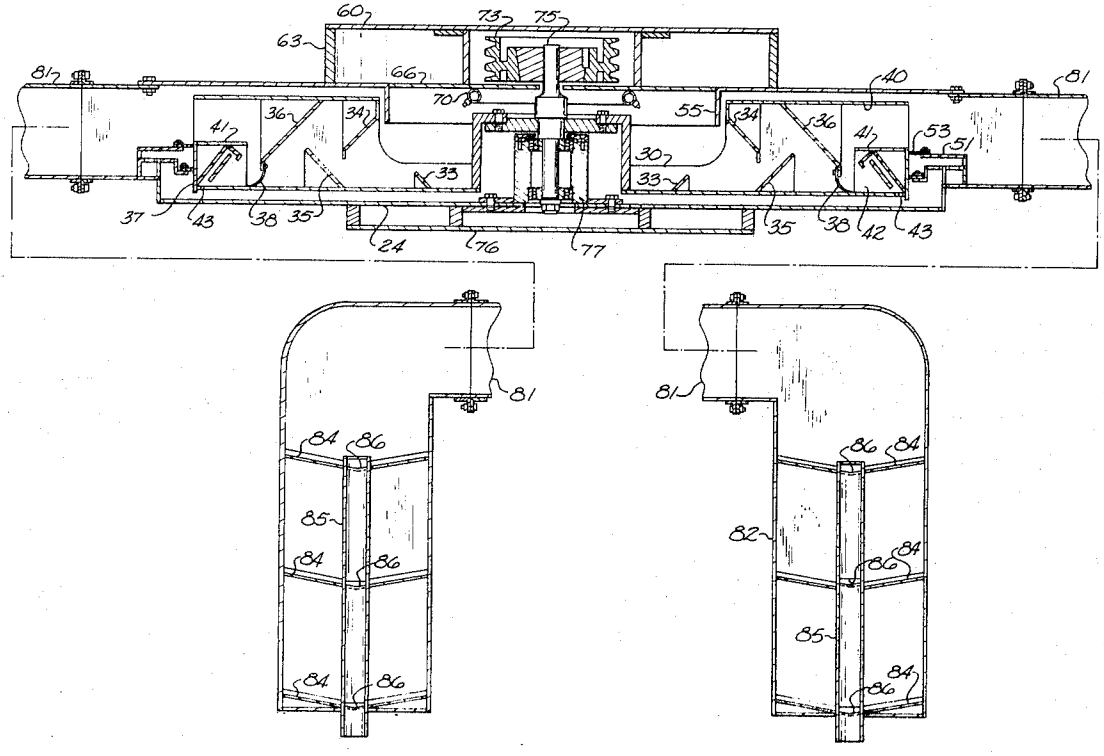
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[57] **ABSTRACT**

A mining machine including a mechanism for removing material from a mine face, and an air scrubber for removing polluted air including gases from the mine face and for removing the pollutants from such air. The air scrubber includes a duct located adjacent the mine face for removing the polluted air at the face, a pollutant-removal mechanism operatively connected to the duct for separating the pollutants from the air moving through the duct, and a second duct operatively connected to the pollutant-removing mechanism for directing the resultant clean air back toward the mine face.

The air scrubber has a revolving rotor mounted in a rotor housing, the rotor including a bottom plate, a top plate spaced from the bottom plate to provide a radial passage therebeween, an entrance communicating with the rotor passage, a plurality of substantially radially extending fan blades, a plurality of baffles extending into the rotor passage against which the pollutant-laden liquid impinges, the rotor passage being open peripherally of the rotor for the discharge of clean air, and means for permitting discharge of the pollutant-laden liquid through the bottom rotor plate. A spray means sprays the polluted air upon entry into the rotor or at any point in the rotor passage.

14 Claims, 8 Drawing Figures



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SHEET 1 OF 4

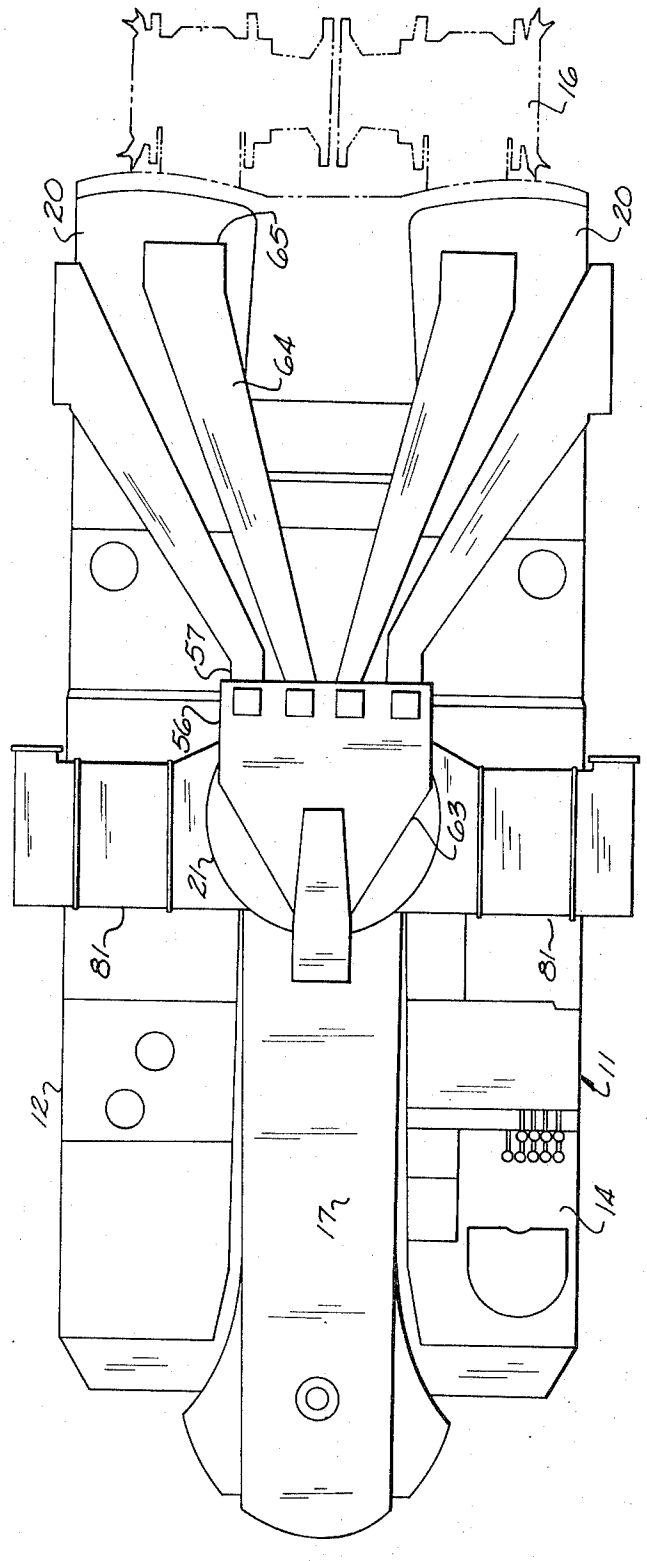


Fig 2

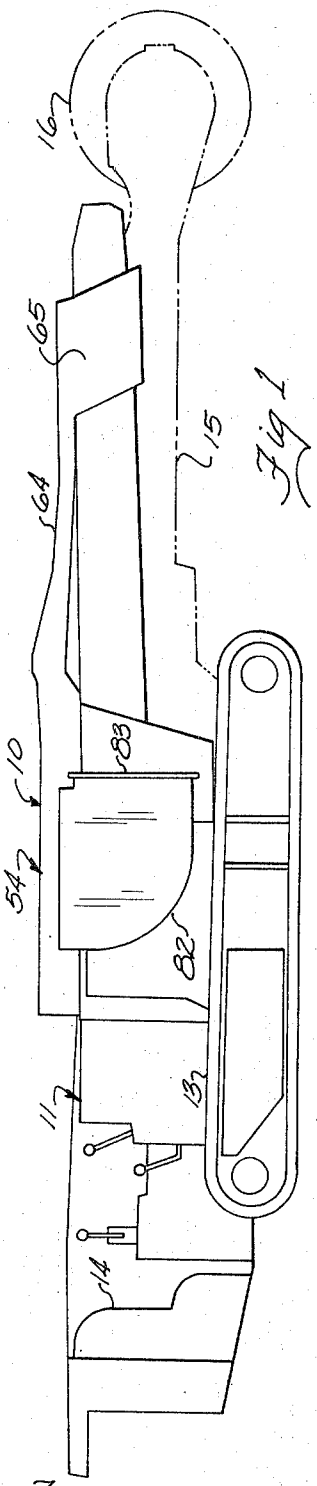


Fig 1

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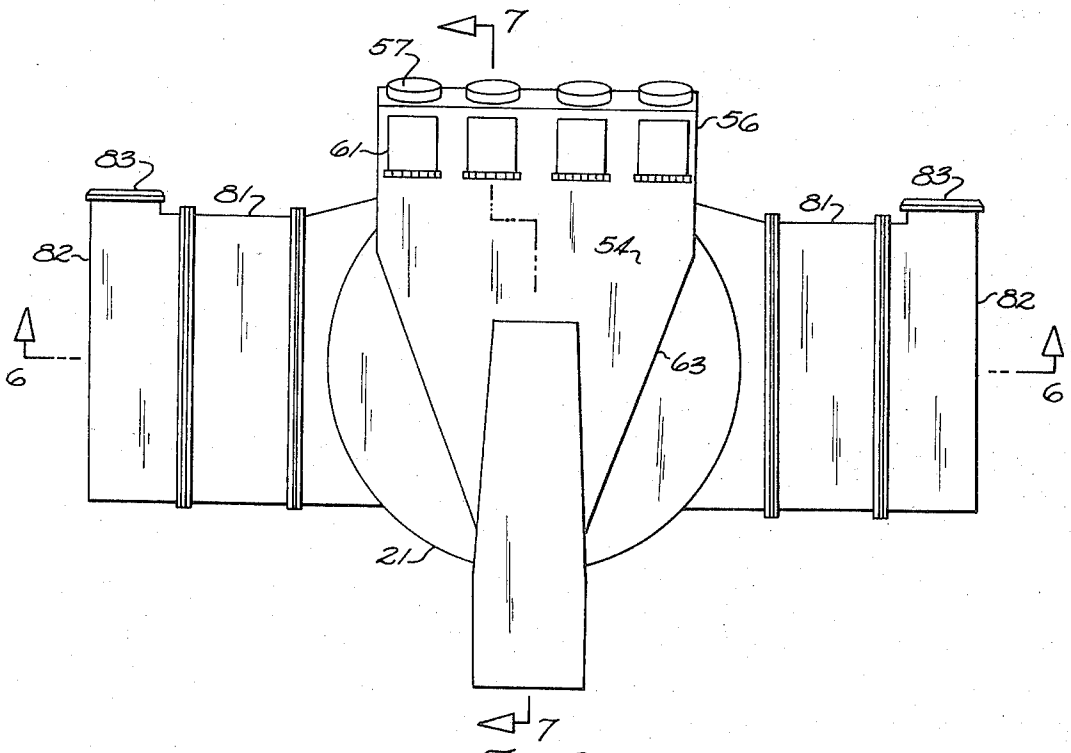


Fig 3

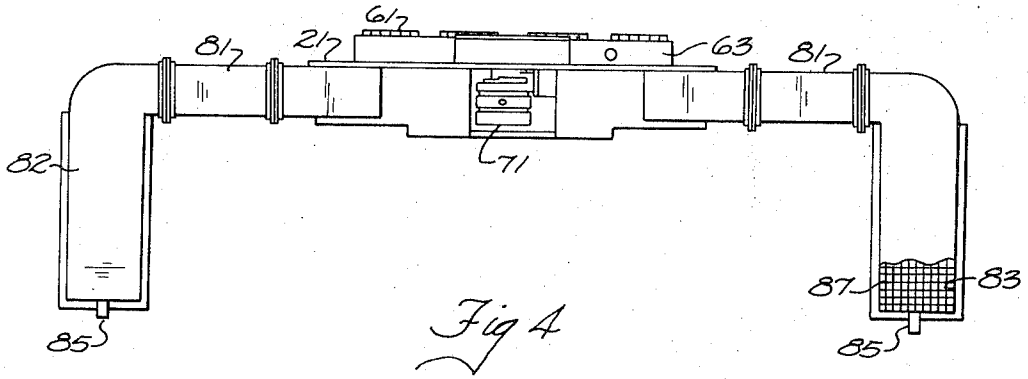


Fig 4

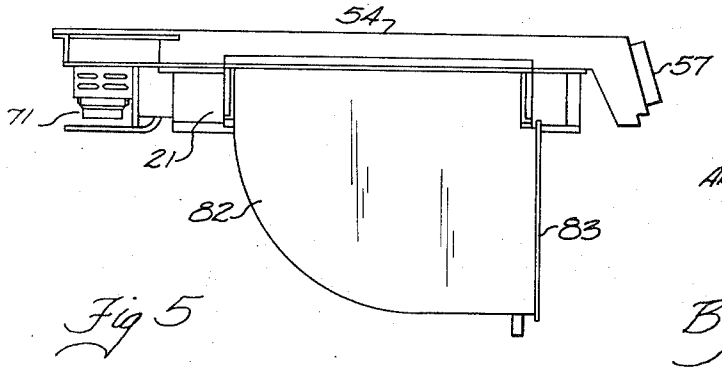


Fig 5

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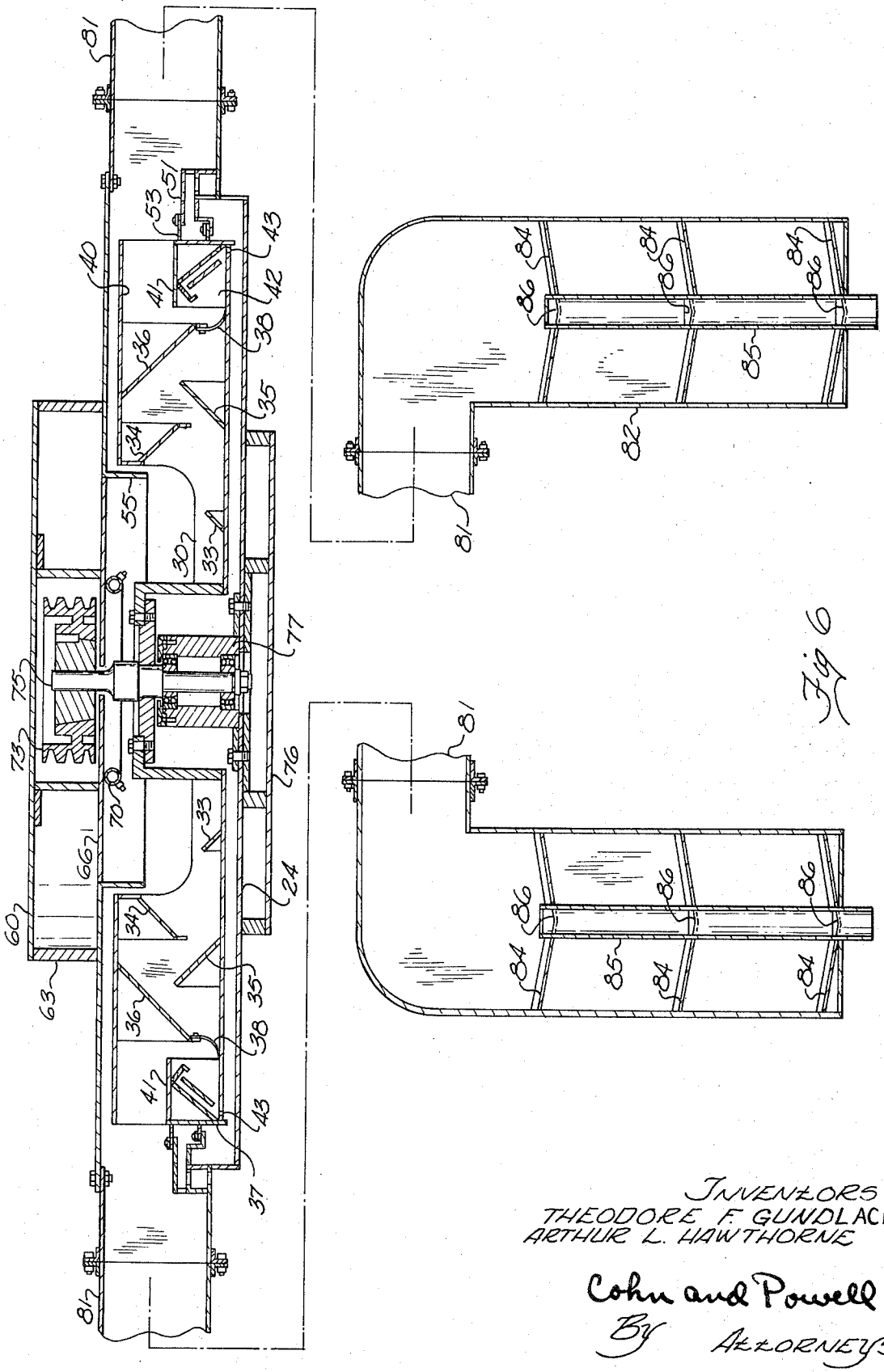


Fig 6

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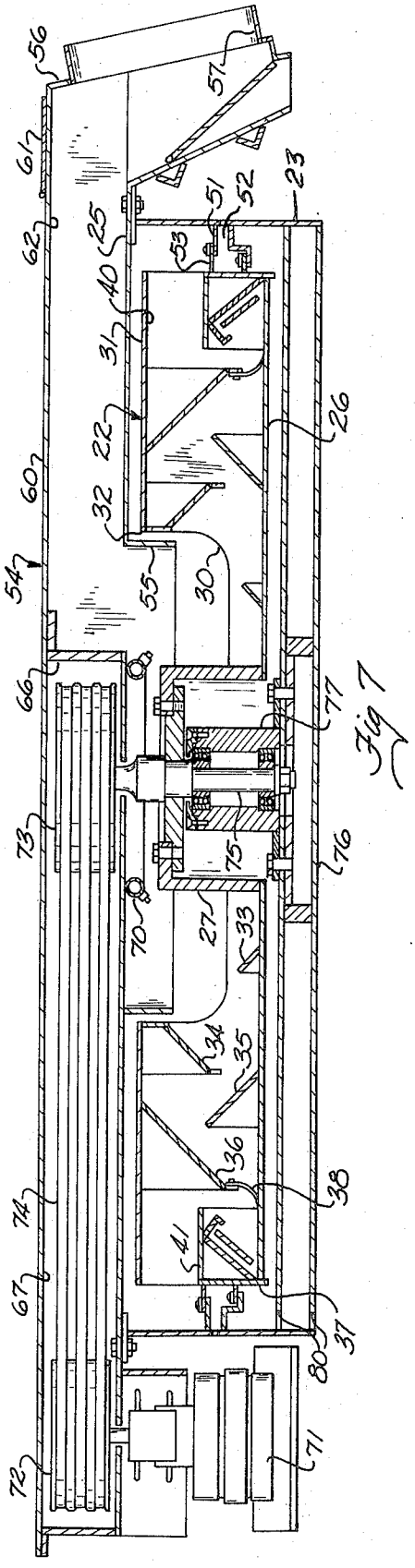


Fig 7

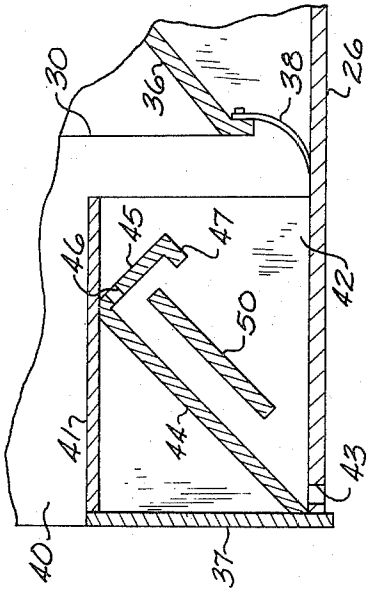


Fig 8

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AIR SCRUBBER

This is a continuation, of aqplication Ser. No. 052,631 July 6, 1970 now abandoned.

BACKGROUND OF THE INVENTION

This invention relates generally to improvements in an air scrubber, and more particularly to a device of this type that can be used in combination with a continuous mining machine for the removal of pollutants including gases from adjacent the mine face.

The basic function of an air scrubber (wet dust collector) is, of course, to clean dust and/or contaminated air, and is accomplished in three basic steps. The first step is to convey the dirty air into the scrubber by an air-moving device which is usually a fan that is any one of many different types, as for example, propeller, radial, squirrel-cage and the like or any one of various types of positive displacement air movers. The only requirement is that the air mover be capable of moving the quantity of air desired and at the same time be capable of moving this air against whatever static air pressure is required by the type of scrubbing device used. Heretofore, the air moving device and the scrubbing device have generally been separate functions.

The second step is to mix the contaminants in the dirty air with a liquid by any one of various means including: 1) bubbling the dirty air through a pool of liquid, which is very inefficient. 2) Mechanically atomizing the liquid through spray nozzles or other means and dispersing these liquid particles throughout the dirty air, usually in an enclosed compartment, thereby depending on numerous small particles of liquid to mix with or "wet" the particulate matter in the dirty air. This method, in order to obtain any worthwhile mixing efficiency, requires a relatively large mixing chamber. 3) Injecting the liquid and dirty air into a cylindrical chamber of a cyclone in such a way that the mixture spins around the cylinder so that the heavy particulate matter and liquid tend to spin to the outside, mix together and run downwardly to the bottom of the cyclone where it is drained out of the bottom, the lighter air or gas being allowed to escape from the center of the chamber where the centrifugal force has been largely dissipated. Both wet and dry cyclone dust collectors have been used for various purposes, the wet type being referred to previously. Naturally, the higher the velocity of the dirty air entering the cyclone, as well as the smaller diameter of the cyclone tends to increase the collection efficiency of the cyclone. 4) Mixing the liquid and the particulate contaminant that is in a gas by so-called "wet plate impingement." In this method, a high velocity of dirty air is directed against a wetted surface, and air is diverted from such surface. The inertia and mass of the heavier solid particulate matter tends to make it strike or impinge on the wetted surface and hence be trapped by the liquid. Of course, the smaller and lighter the particulate, the harder such particulate has to be forced into contact with a wet plate and thus be mixed with the liquid. Wet plate impingement can be accomplished in two different ways. The first method is, as mentioned, with stationary plates and utilizing high velocity air movement to provide the necessary inertia force for the particulate. The second method is to move the wet plates at high speed through relatively clam dirty air. Both methods serve the same basic purpose, that is to mix the solid particulate matter (wetting action) with the scrubbing liquid.

The third step necessary in this type of air scrubber is that the dirty mixture of solid particulate matter and liquid must now be removed from the main air stream, and thereby provide relatively clean air.

Many devices heretofore utilized in mines in an attempt to clean up the foul air are of relatively large size and are of awkward shapes and configurations that preclude advantageous location of such devices near the mine face. Such devices are placed in the mine tunnel at a relatively remote location from the mine face behind the continuous mining machine. The heretofore conventional devices do not direct the clean air back toward the mine face, but rather, because of their structure and configuration, serve to direct the clean air rearwardly from the mine face. Moreover, such devices are not adapted to be carried by the continuous mining machine because such is prohibited by the bulk and shape of such devices. There is no provision on the device for permitting such functional and structural cooperation. As a result, such devices fail to cooperate with the mining machine in an effor to save the useful coal dust that is removed from the polluted air and remove such dust with the mined material to a remote location.

SUMMARY OF THE INVENTION

The present air scrubber is of a relatively flat, horizontal shape and of compact size so that it can be utilized with the continuous mining machine without increasing the height of the machine beyond the capability of the pivoted and rotatable cutting heads. Of course, the scrubber could be vertical or in any other plane if desired. As a result, the inlets to the air scrubber can be placed right at the mine face where the concentration of the polluted air is the greatest and where the need for treatment is most desirable. Moreover, the present air scrubber can and does direct the treated clean air back toward the mine face for most beneficial results.

The air scrubber is provided with a single rotor that causes the flow of air to the scrubber and also, because of its unique construction, removes the undesirable pollutants from the air. Such pollutants including valuable fines of the material being mined are deposited with the mined material so that all such material is removed together to a remote location.

The combination of the mining machine and air scrubber includes a means on the mining machine for removing material from a mine face, while the air scrubber on the mining machine, removes polluted air including gaes created during the mining operation from the mine face and removes the pollutants from such air. The duct means of the air scrubber are located adjacent the mine face and the pollutant-removal means is operatively connected to the duct means for separating the pollutants from the air moving through the duct means. A second duct means of the air scrubber is operatively connected to the pollutant-removal means for directing the resultant clean air back towards the mine face. The mining machine includes means for collecting the material as it is removed from the mine face and for delivering it to a remote location. The pollutant-removal means deposits the separated pollutants to the collecting means for transporting such pollutants with the mined material to such remote location. Spe-

cifically, the collecting means in a continuous mining machine is a conveyor extending substantially from the material-removing means to the remote location, while the pollutant-removal means of the scrubber is located over the conveyor and deposits the separated material on the conveyor. The scrubber could be located remotely from the conveyor and the polluted liquid pumped to the conveyor.

The air scrubber includes a revolving rotor mounted in the housing, and a duct means communicating with the housing for delivering polluted air into the rotor. A liquid spray means in the housing sprays the polluted air upon entry into the rotor, the rotor bearing the pollutant-laden liquid out of the air. A pollutant-discharge passage communicates with the housing and receives the pollutant-laden liquid as it passes from the rotor, and a clean air passage communicates with the housing and receives the clean air as it passes from the rotor.

The revolving rotor mounted in the housing is of unique and important construction. The rotor includes a plurality of substantially radial blades, constituting a radial fan, for moving the dirty air into and through the rotor. A plurality of baffles extend into the flow passage circumferentially about the rotor and between the fan blades, the baffles providing an interrupted flow path for the moving air and liquid. The baffles can be inclined, squared, or curved relative to the radial flow passage. The baffles force the moving air flow as it moves radially through the rotor into reversing transverse directions so that the moving air and liquid will impinge directly on the baffles, the particulate contaminants striking the wet baffles and mixing with the liquid so as to be held in suspension.

The scrubber housing is of relatively smaller thickness than width, and the rotor is mounted for rotation in the housing on a substantially transverse axis. The duct means communicates with the housing at one side of the rotor while the pollutant-discharge passage communicates with the housing at the opposite side. The clean air passage communicates with the housing at the rotor periphery. A partition of the rotor is disposed between the clean air passage and the pollutant-duscharge passage. A seal is provided between the rotor partition and the housing. Means is provided in the rotor for delivering the pollutant-laden liquid to the pollutant-discharge passage.

The seal between the rotor partition and the housing includes a pair of spaced seals with an air pressure equalizing chamber therebetween which prevents any unbalanced pressure on opposite sides of the double-spaced seal from causing liquid discharged from the rotor to re-mix with the clean air as it is discharged from the rotor.

The rotor includes a rotor passage that is open peripherally of the rotor for the discharge of clean air into the clean air passage, and means for permitting discharge of the pollutant-laden liquid from the rotor into the pollutant-discharge passage.

The present rotor provides an integral air mover, a water impingement means for mixing the pollutants with the water, and a de-watering device for slurry removal and separation from the clean air, such integral construction resulting in a compact unit.

In one embodiment, the top rotor plate is provided with an opening at the rotor axis entering into the rotor passage. Of course, the opening could be located at the side or the bottom if desired. The duct means leads to and communicates with the rotor passage through the plate opening. The spray means is located substantially at the top plate opening. Although it will be understood that water can be sprayed into the air at any place in the flow passage through the rotor. For example, nozzles could be used to wet the baffles directly. The baffles extend from the rotor plates into the rotor passage to deflect the pollutants and air into radial, yet transversely irregular flow paths, the pollutants striking the wet baffles and mixing with the liquid and thereby being removed from the air.

More particularly, one of the annular baffles extends from one rotor plate and another baffle extends from the other rotor plate. The bottom rotor plate includes an upturned peripheral flange closing the lower portion of the rotor periphery, the open upper portion of the rotor periphery providing the clean air discharge from the rotor into the clean air passage. The bottom rotor plate is provided with holes adjacent the upturned peripheral flange through which the pollutant-laden liquid is discharged from the rotor into the pollutant-discharge passage. A plurality of spaced, curved whiskers are secured to the free end of one of the baffle blades extending from the top rotor plate and extend toward the bottom plate to direct the pollutant-laden liquid onto the bottom plate and towards the holes adjacent the upturned peripheral flange and yet enable the free passage of air outwardly of the rotor. In addition, the bottom rotor plate includes an inturned peripheral flange extending inwardly of the rotor passage from the upturned peripheral flange to provide an internal chamber into which the pollutant-laden liquid and air is directed by the baffles. The pollutant-laden liquid is removed from the air in this chamber, while the clean air reverses its direction to flow out of the chamber and into a clean air discharge passage. The discharge holes for the pollutant-laden liquid are located below the inturned peripheral flange.

When the clean air is discharged from the scrubber, it is directed through air discharge outlets toward the mine face in a diffused manner so as to provide a "wall" of air to help prevent contaminated air from the mine face from traveling backwards to the operator of the machine.

DETAILED DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a side elevational view of the air scrubber mounted on a continuous mining machine;

FIG. 2 is a top plan view of the combined scrubber and mining machine shown in FIG. 1;

FIG. 3 is a top plan view of the air scrubber;

FIG. 4 is a rear elevational view thereof;

FIG. 5 is a side elevational view thereof;

FIG. 6 is a cross sectional view taken on line 6—6 of FIG. 3;

FIG. 7 is a cross sectional view taken on line 7—7 of FIG. 3, and

FIG. 8 is a fragmentary, enlarged cross sectional view of the rotor periphery.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now by characters of reference to the drawings, and first to FIGS. 1 and 2, it will be understood that the air scrubber, generally indicated by 10, can be utilized with, but not limited to, a continuous mining machine referred to by 11. The air scrubber 10

in FIGS. 1 and 2 is mounted on the continuous mining machine 11. Of course, it will be understood that the scrubber can be built into the mining machine as original equipment. This combination of scrubber 10 and mining machine 11 are structurally related and functionally cooperate to remove material at the mine face and convey such material to a remote location, while at the same time removing the polluted air at the mine face to a location where the pollutants are removed and deposited with the material being mined for deliverance to the remote location, and the clean air is directed back toward the mine face.

The continuous mining machine illustrated in FIGS. 1 and 2 is conventional and is in widespread usage. The machine 11 includes a frame 12 mounted upon caterpillar treads 13. An operator's station 14 is located on the frame 12 near the rear end of the machine, the operator's station 14 providing a well in which the operator sits. The operator's head does not necessarily extend above the height of the combined scrubber 10 and mining machine 11, thus giving protection when the machine cuts a tunnel into which the machine 11 moves, the roof height of such tunnel providing minimum clearance.

The mining machine 11 includes a pair of arms 15 pivotally mounted onto the sides of the machine frame 12, the arms 15 rotatively mounting a cutting head 16. As is usual, a drive means is provided for rotating the cutting head 16, and a mechanism is provided for raising and lowering the arms 15 so that the head 16 can cut the mine face from the floor up to a predetermined height. Carried by the machine frame 12 and extending centrally of such machine along the longitudinal axis is a conveyor 17. The conveyor 17 extends from substantially a point just rearwardly of the cutting head 16 to a location rearwardly of the mining machine 11. Also mounted at the sides of the front end of the mining machine 11 is a pair of material-gathering members 20 which move in unison toward and away from each other to gather material mined by the cutting head 16 and to place it onto the front end of conveyor 17.

In using the continuous mining machine, the operator sitting in the operator's station 14, manipulates the position of the cutting head 16 while such heads 16 are rotating to cut material from a mine face. The machine 11 moves forwardly on its tread 13 as the head 16 cuts the mine face. The arms 15 are raised and lowered to to provide a full height cut. The material mined is gathered by the members 20 rearwardly of the cutting head 16 and placed onto the conveyor 17, the conveyor 17 transporting the material rearwardly to a remote location where the material is placed in cars and subsequently transported out of the mine.

The air scrubber 10 includes a circular housing 21 of relatively small height in which a rotor 22 is mounted on a vertical axis. The rotor housing 21 includes a circular peripheral wall 23, a bottom wall 24 and a top wall 25. The remaining portions of the housing construction will be described upon further detailed description of the rotor construction. The rotor 22 includes a circular bottom plate 26 having a raised center hub 27. A plurality of angularly spaced, radially extending fan blades 30 are attached to the bottom plate 26 and extend outwardly from the plate hub 27 to a location spaced just inwardly of the plate periphery. Also, a top plate 31 is attached to the fan blades 30 and disposed above the bottom plate 26, the bottom plate 26 and top plate 31 being maintained in space relation by the fan blades 30 to provide a radial flow passage therebetween. The rotor top plate 31 is provided with a circular, center opening 32 at the rotative axis of the rotor 22, the center opening 32 constituting an entrance to the radial flow passage of the rotor 22.

Disposed and retained by the rotor 22 inside of the rotor flow passage, are a plurality of inclined, annular baffles 33, 34, 35 and 36. These baffles can be inclined as shown or be perpendicular to the rotor plates or be curved. These baffles 33-36 are retained and positioned by the radial fan blades 30, such baffles being located in slots formed in the fan blades 30. The annular baffle 33 extends from the bottom rotor plate 26 and is located directly opposite the center entrance opening 32, the baffle 33 being upwardly and outwardly inclined. The annular baffle 34 is located just radially outward from the baffle 33 and adjacent the entrance opening 32, the baffle 34 extending downwardly and outwardly from the top rotor plate 31. The baffle 35 extends upwardly and outwardly from the rotor plate 26. The baffle 36 is radially spaced outwardly from the baffle 35 and extends downwardly and outwardly from the top rotor plate 31. These baffles 33–36 serve to deflect the liquid, pollutants and air into transversely reversing flow paths as they move radially outward through the flow passage between the fan blades, and serve to mix the pollutants with the liquid as will be described later.

A plurality of annularly spaced whiskers 38 are secured to the free end of the baffle 36 and contact the inner surface of the bottom rotor plate 26. Because of the tendency of a liquid to adhere to and follow along any solid surface, these whiskers 38 help to direct the pollutant-laden liquid onto the bottom rotor plate 26 in its movement radially outward toward the periphery of the rotor 22, and further provide wetted surfaces against which pollutants impinge to cause mixing of the pollutants with the liquid. Yet, these whiskers do not impair the free flow of air radially outwardly through the rotor.

The rotor 22 with its substantially radially fan blades 30 and the baffles 33-36 provide a unit that moves the pollutant-laden air and liquid substantially radially through the flow passage between the rotor plates 26 and 31 and between the fan blades 30, while at the same time causing the pollutant-laden air to move transversely in reversing directions to cause impingement of the pollutants with the wetted baffles 33–36 to cause effective mixing of the pollutants with the liquid. If desired, this clean air and the slurry consisting of pollutant-laden liquid can then be discharged from the rotor into a housing whereby the slurry would be collected and the clean air simply dissipated into the atmosphere. This rotor construction is very important in realizing this feature of the invention.

The present rotor 22 is provided with an integral dewatering device that includes an upturned, peripheral flange 37 attached to the bottom rotor plate 26. The flange 37 is spaced from the top rotor plate 31 to provide a clean air discharge 40. Another inturned peripheral flange 41 extends from the upturned peripheral flange 37 to define an internal chamber 42 that is adapted to receive the pollutant-laden liquid and air as it moves under centrifugal force radially outward from under the annular baffle 36 and through the whiskers 38. It will be understood that the inturned peripheral

flange 41 is spaced above the lower end of the baffle 36 to preclude this pollutant-laden liquid from passing into the clean air discharge 40.

Provided in the bottom rotor plate 26 closely adjacent its periphery and closely adjacent the upturned peripheral flange 37, are a plurality of relatively small holes 43 through which the pollutant-laden liquid is discharged from the rotor 22. To assist in directing this liquid to the holes 43, and to preclude such liquid from moving back out of the internal chamber 42 and into the clean air discharge 40, and to provide additional wetted surfaces against which particulate pollutants impinge and mix with the liquid, there are provided additional baffle plates. For example, an annular baffle plate 44 is inclined downwardly and outwardly from the inturned peripheral flange 41 substantially to the juncture of the upturned peripheral flange 37 and the bottom rotor plate 26, the baffle plate 44 directing the pollutant-laden liquid to the holes 43. A second baffle plate 45 is inclined inwardly and downwardly from the first baffle plate 44, yet spaced above the bottom rotor plate 26. The second baffle plate 45 is provided with small holes 46 for the passage of air out of the internal chamber 42 and into the clean air discharge 40. The second baffle plate 45 is provided with a reversed, downturned lip 47 to assist in the prevention of reverse liquid flow out of the chamber 42. A third baffle plate 50 is located inside of and substantially parallel to and spaced from the first baffle plate 44, and is spaced endwise from the second baffle plate 45 and the bottom rotor plate 26, the third baffle plate 50 also assisting in the prevention of reverse liquid flow out of the chamber 42 and assisting in directing liquid flow to the holes 43. The small holes 46 in the second baffle plate 45 are located between the first and third baffle plates 44 and 50 so that such baffle plates 44 and 50 assist in directing the air through the holes 46.

The air reverses its flow direction and moves back out of the chamber 42 and moves into the clean air discharge 40.

A pair of spaced annular flanges 51 extend inwardly from the peripheral side wall 23 of housing 21. A pair of spaced, cooperating flexible sealing means 53 provide a double stage seal that precludes passage of liquid and air while the rotor 22 revolves. These flexible seals are attached to the flanges 51 and extend inwardly to a close fit to rotor flange 37. This seal prevents the intermingling of the clean air and the pollutant-laden liquid after discharge from the rotor 22.

A plurality of small holes 52 are provided in the peripheral side wall 23 of the housing 21 which communicate with the space between the sealing means 51—53 in order to provide equalization of the air pressure on opposite sides of the double stage seal. It will be understood that some air will be discharged, together with the pollutant-laden, through the holes 43 and cause a pressure build-up under the lowermost sealing means 53. As a result, a pressure differential could exist at opposite sides of the double stage seal which would cause liquid to seep through the seals and enter the clean air discharge 40. This undesirable possibility is eliminated by the provision of the pressure equalizing chamber between the double stage seal.

An upper housing referred to by 54 is attached and mounted to the top of the rotor housing 21. This duct housing 54 includes the top rotor plate 25 which is common to both housings 21 and 54. The top rotor plate 25 is provided with a depending circular flange 55 that fits into the rotor entrance opening 32 and is positioned relatively close to the top rotor plate 31. The upper housing 54 extends forwardly beyond the rotor housing 21 to provide a substantially rectangular flat portion 56 is which a plurality of duct inlets 57 are provided. Mounted on the top wall 60 of the upper housing 54 and adjacent the duct inlets 57 are a plurality of service panels 61 which cover openings through which access can be had to the duct passage 62. The side walls 63 of the upper housing 54 converge rearwardly toward the circular depending flange 55, and serve to direct the flow of polluted air moving through the duct passage 62 through the entrance opening 32 and into the rotor passage.

Attached to the front housing portion 56 and communicating with the duct inlets 57 are a plurality of duct extensions 64. As will appear, the inlets 65 to the duct extension 64 are located close to the mine face.

The upper housing 54 includes an internal partition 66 that forms a separate compartment 67 for the drive mechanism, the partition 66 partially overlying the raised hub portion 27 of the rotor 22. Carried by the underside of the partition 66 is a spray means 70 consisting of a circular tube and a plurality of nozzles. This spray means 70 sprays the polluted air as it moves through the entrance opening 32 and into the rotor passage. The liquid used is preferably water. The liquid saturates at least some of the particulate pollutants in the air and places such pollutants in suspension with such liquid. The liquid can be sprayed into the air at any place in the rotor, not just at the entrance opening 32. For example, nozzles could be used to wet the baffles 33—36 directly. In moving through the rotor passage, the wetted baffles 33–36 engage the air and pollutants and mix the particulate pollutants in the liquid so that the clean air and the pollutant-laden liquid can be discharged from the rotor.

A hydraulic motor 71 is carried by the underside of the upper housing 54 rearwardly of the rotor housing 21. The motor 71 rotates a pulley 72 and drives another pulley 73 through interconnecting belts, the pulleys 72 and 73 and the belts 74 being located in the housing compartment 67. The pulley 73 is operatively connected to a drive shaft 75 which is operatively connected to the rotor 22. The rotor drive shaft 75 extends through the partition 66 and is mounted in bearing 77 carried by the bottom housing wall 24. Specifically, the rotor drive shaft 75 is attached to the center hub 27 of the lower rotor plate 26.

As will appear from FIGS. 6 and 7, the rotor housing 21 is provided with a subjacent bottom wall 76 that is spaced from the other bottom wall 24. Both the bottom walls 24 and 76 are provided with arcuate slots 80 adjacent the rear side of the rotor housing 21.

The pollutant-laden liquid passing from the rotor through the holes 43, also passes through the aligned slots 80 for discharge from the air scrubber.

Attached to each side the rotor housing 21 is a clean air duct 81 that communicates with the interior of the housing and more particularly with the clean air discharge 40 at the periphery of rotor 22. These ducts 81 extend radially outwardly from the rotor housing in a substantially horizontal plane. Attached to the outer end of each air duct 81 is a depending, substantially vertical air duct 82, the air duct 82 providing a downwardly and forwardly extending air passage having an

air duct outlet 83 facing forwardly of the air scrubber substantially in the same direction as the inlet 57. As is best illustrated in FIG. 6, each duct outlet 83 is provided with a plurality of substantially V-shaped plates 84, and a vertical pipe 85 extending through the apexes of such plates 84. A plurality of slots 86 are provided in the pipe 85 immediately above th plates 84. As the clean air passes through the air ducts 81 and 82 and is discharged through the duct outlets 83, any remaining liquid transported with the clean air will collect on the plates 84 and will be discharged through the pipe 85. As is usual, the duct outlet 83 is covered by a screen and air-directional louvers 87.

As the clean air passes through the duct outlet 83, the air is diffused laterally outwardly by the screen and air-directional louvers 87 to provide a "wall" of air that moves toward the mine face and helps prevent contaminated air at the mine face from traveling rearwardly to the operator of the mining machine.

The air scrubber 10 is mounted on the continuous mining machine 11 as is shown in FIGS. 1 and 2. It will be understood that the scrubber 10 is positioned across the machine frame 12 so that the duct inlets 57 face forwardly. When positioned, the rotor housing 21 is located directly over the conveyor 17, the air ducts 81 extend transversely across the machine frame 12, and the vertical air ducts 82 extend downwardly along the opposite sides of such machine with the duct outlets 83 facing forwardly. The duct extensions 64 are carried forwardly over the top of the machine frame 12 with the inlets 65 located substantially adjacent the mine face, and preferably just behind the cutting head 16. Because the rotor housing 21 fits down into the longitudinal channel provided by the machine frame 12 directly over the conveyor 17, and because of the relatively flat and horizontal configuration of the air ducts 81 and the duct housing 54, it is obvious that the air scrubber 10 does not increase the overall height of the machine 11 to any great extent, certainly not to any degree as would hinder the movement of the combined scrubber 10 and machine 11 into a tunnel cut by the cutting head 16 during normal operation.

It is thought that the functional results of the air scrubber have become fully apparent from the foregoing detailed description of parts, but for completeness of disclosure, the operation will be briefly described.

The rotor 22 is revolved by energization of the motor 71 which drives the rotor shaft 75 through the belt and pulley drive connection 72–74. The revolving action of the rotor 22 creates a vacuum in the rotor housing 21 that draws the polluted air into the duct extensions 64 through their inlets 65, and thence through the duct inlets 57 and into the duct passage 62. As the polluted air moves through the duct passage 62 and into the central entrance opening 32 of the rotor 22 by way of the circular wall flange 55, the polluted air is sprayed by a liquid, preferably way, by the spray means 70. The liquid spray saturates at least some of the particulate pollutants in the air and places such pollutants into suspension in the liquid. The air and liquid then move radially through the rotor passage, impinging on the wet rotor baffles 33–36. It will be noted that the impingement of the air on the rotor baffles 33-36 causes the pollutants to mix with the liquid and causes effective separation of the pollutants from such air. The rotor baffles change the direction of the pollutant-laden air in transversely reversing flow paths during its flow radially through the rotor passage, the pollutant-laden liquid and air first engaging rotor baffle 33, then rotor baffles 34 and 35 and subsequently rotor baffle 36. As the pollutant-laden liquid and air leave the rotor baffle 36, it will move under such baffle 36 and move through the whiskers 38, where it is directed under centrifugal force into the internal chamber 42. The clean air moves through the whiskers 38, into the chamber 42 and then reverses its flow out of chamber 42, and flows into the clean air discharge 40 above the rotor flange 41. The pollutant-laden liquid is directed into and through the plurality of holes 43 by the inclined rotor baffle plates 44 and 50. The pollutant-laden liquid is precluded from moving back of the internal chamber 42 by the rotor baffle plate 50 and by the baffle plate 45 and its downturned lip 47. The remaining pollutants, if any, impinge on the wet baffle plates 45 and 50 and are mixed into suspension with the liquid. As the pollutant-laden liquid is discharged through the rotor holes 43, it is discharged through the aligned slots 80 formed in the rotor housing bottom walls 24 and 76 and is deposited directly on the material being mined as it passes rearwardly on the conveyor 17. The liquid settles the dust of the mined material, and at the same time, the ore dust that has been removed from the polluted air is preserved. The mined material and the particulate pollutants are then transported by the conveyor 17 to a remote location where it is loaded, as for example, into cars.

The clean air that has been moved into the internal chamber 42 flows back out of the chamber 42 through the rotor baffle plate holes 46 and around the inner lip of the inturned peripheral flange 41, and thence into the clean air discharge 40. The clean air moves from the clean air discharge 40 at the periphery of rotor 22 and into the clean air passage provided by ducts 81 and 82. Any remaining moisture contained in the clean air, before its discharge from the depending air ducts 82, is collected on the internal V-shaped plates 84 and is discharged through the drain pipes 85. The substantially dry clean air is then discharged through the duct outlets 83 in a direction back toward the mine face with the result that the removed polluted air is being constantly replaced by clean air. Furthermore, the louvers 87 diffuse or spread the discharged clean air divergently to provide a "wall" of air that moves toward the mine face and tends to prevent contaminated air at the mine face from travelling away from the face and toward the machine operator.

It will be understood that in this air scrubber, the same rotor that causes the movement of the air through the scrubber, also causes a mixing of the particulate pollutants into the liquid, and also directs the pollutant-laden liquid and clean air into separate discharge passages so that each can be independently handled.

We claim as our invention:

1. A rotor unit for an air scrubber, comprising:

a. a rotatable plate means having an open periphery spaced radially from its rotative axis, and providing a substantially radial flow passage to the open rotor periphery,

b. fan blades carried by the plate means and extending substantially radially of the rotor, the fan blades being circumferentially spaced, and being substantially non-reentrant to provide substantially unobstructed flow therebetween, the fan blades being provided with radially spaced slots

c. baffle means on the plate means, the baffle means being disposed in radially spaced relation in the fan blade slots and extending transversely into the flow passage to impinge all of the air with the baffle means and to divert all of the air into directions transverse to the radial flow passage upon impingement as the air moves substantially radially through the flow passage,

d. means directing pollutant ladened air into the flow passage at the center of the rotor,

e. spray means directing liquid into the flow passage at the center of the rotor, the substantially non-reentrant fan blades providing the motive force to throw both the pollutant ladened air and the liquid radially outwardly through the flow passage from the center of the rotor to the periphery under centrifugal force, the liquid wetting the baffle means and the pollutants impinging the wet baffle means under the centrifugal force provided by the fan blades to mix in the liquid,

f. the plate means include a pair of spaced plates that provide the flow passage,

g. an entrance opening is provided into the flow passage for the introduction of polluted air,

h. the baffle means includes a plurality of baffles, each baffle extending fromone or the other of the plates and is spaced from the opposite plate to provide a flow space therebetween, and

i. the baffles extend circumferentially of the rotor in the flow passage with the radially spaced baffles in overlapping relation both in a direction transverse to and circumferentially of the flow passage to eliminate any straight-through flow.

2. A rotor unit for an air scrubber as defined in claim **1**, in which:

j. the spray means directs the liquid into the flow passage between the plates, and

k. the plate means includes:

1. a structure extending inwardly in the flow passage from the plate that is spaced transversely from the radially outermost circumferential baffle, and extending in a direction against the flow to overlap the space transversely between said outermost baffle and the plate from which the structure extends and to overlap the said outermost baffle in a direction transverse to the radial flow passage to provide an internal chamber into which both the pollutant laden liquid and air is thrown under centrifugal force,

2. means communicating with the chamber adjacent the radially outward end of the structure through which the liquid is discharged from the rotor, and

3. the structure being spaced radially from the said outermost baffle to provide a clean air passage communicating with the entrance to the chamber adjacent the radially inward end of the structure to receive the clean air as it reverses its flow path and moves back around the structure and out of the chamber and to deliver the clean air through the open rotor periphery.

3. An air scrubber, comprising:

a. a housing,

b. a revolving rotor having an open periphery spaced radially from its rotative axis, and mounted in the housing, the rotor including a substantially radial flow passage to the open periphery, the rotor including fan blades extending substantially radially in the flow passage, the fan blades being circumferentially spaced, and being substantially non-reentrant to provide substantially unobstructed flow therebetween, the fan blades being provided with radially spaced slots

c. duct means communicating with the housing for delivering particulate polluted air into the flow passage at the center of the rotor,

d. a liquid spray means in the housing spraying liquid into the rotor flow passage at the center of the rotor, the substantially non-reentrant fan blades providing the sole motive force to throw both the particulate polluted air and the liquid radially outward through the flow passage from the center of the rotor to the periphery under centrifugal force,

e. baffle means disposed in radially spaced relation in the fan blade slots and extending transversely into the flow passage to impinge all of the air with the baffle means and to divert all of the air into directions transverse to the radial flow passage upon impingement as it moves substantially radially through the flow passage, the liquid wetting the baffle means, and the pollutants impinging on the wet baffle means under the centrifugal force to mix with the liquid,

f. a pollutant-discharge passage communicating with the housing and receiving pollutant-laden liquid as it passes from the rotor,

g. a clean air passage communicating with the housing and receiving the substantially clean air as it passes from the rotor,

h. the rotor includes:

1. a first plate,

2. a second plate spaced from the first plate to provide the substantially radial flow passage therebetween,

3. the baffle means having a plurality of radially spaced baffles extending into the rotor passage against which all of the polluted air impinges, the baffles being overlapping in the direction of flow both in a direction transverse to and circumferentially of the flow passage, the rotor flow passage being open peripherally of the rotor for the discharge of substantially clean air into the clean air passage, and

4. liquid-removing means carried by the rotor for permitting discharge of the pollutant-laden liquid from the rotor into the pollutant-discharge passage.

4. An air scrubber as defined in claim **3**, in which:

i. one of the rotor plates includes an upturned peripheral flange closing a portion of the rotor periphery,

j. the remaining open portion of the rotor periphery provides the radial clean air discharge from the rotor flow passage into the clean air passage, and

k. the said one rotor plate is provided with holes adjacent the peripheral flange through which the pollutant-laden liquid is discharged from the rotor into the pollutant-discharge passage, the holes having their opening dimension substantially in a radial plane to preclude discharge radially therethrough.

5. An air scrubber as defined in claim **4**, in which:

l. an inturned peripheral flange extends radially inwardly of the rotor flow passage from the upturned peripheral flange to provide an internal chamber into which both the pollutant-laden liquid and air is thrown under centrifugal force, the space between the inturned peripheral flange and the other rotor plate defining the open portion of the rotor periphery for radial clean air discharge, and

m. the discharge holes for the pollutant-laden liquid are located below the inturned flange and communicate with the chamber.

6. An air scrubber as defined in claim **5**, in which:

n. the radially outermost baffle extends from the said other rotor plate and has a free end spaced from said one rotor plate, and

o. the inturned peripheral flange is spaced from and located above the free end of the adjacent radially outermost baffle so that the internal chamber overlaps the free end of the said radially outermost baffle so that the pollutant-laden liquid and air are both directed under the free end of such baffle into the annular internal chamber.

7. An air scrubber as defined in claim **6**, in which:

p. another baffle means is located in the internal chamber and wetted by the liquid, the last said wetted baffle means being impinged by any remaining particulate pollutant for mixture into the liquid.

8. An air scrubber as defined in claim **7**, in which:

q. the last said baffle means includes a first baffle plate inclined radially outward from the inturned peripheral flange substantially to the junction of the upturned peripheral flange and the said one rotor plate, and substantially to the pollutant-discharge holes to direct the pollutant-laden liquid to the pollutant-discharge holes.

9. An air scrubber as defined in claim **6**, in which:

p. the clean air passage provided by the space between the said one rotor plate and the inturned peripheral flange communicates with the entrance to the internal chamber adjacent the radially inward end of the inturned peripheral flange to receive the clean air as it reverses its flow path and moves back around the inturned peripheral flange and out of the chamber.

10. An air scrubber, comprising:

a. a housing,

b. a revolving rotor having an open periphery spaced radially from its rotative axis, and mounted in the housing, the rotor including a substantially radial flow passage to the open periphery, the rotor including fan blades extending substantially radially in the flow passage, the fan blades being circumferentially spaced, and being substantially non-reentrant to provide substantially unobstructed flow therebetween,

c. duct means communicating with the housing for delivering polluted air into the flow passage of the rotor,

d. a liquid spray means in the housing spraying liquid into the rotor flow passage,

e. baffle means disposed in radially spaced relation and extending transversely into the flow passage to impinge all of the air with the baffle means and to divert all of the air into directions transverse to the radial flow passage upon impingement as it moves substantially radially through the flow passage, the liquid wetting the baffle means, and the pollutants impinging on the wet baffle means under centrifugal force to mix with the liquid,

f. a pollutant-discharge passage communicating with the housing and receiving pollutant-laden liquid as it passes from the rotor,

g. a clean air passage communicating with the housing and receiving the substantially clean air as it passes from the rotor,

h. the rotor includes:

1. a first plate,

2. a second plate spaced from the first plate to provide the substantially radial flow passage therebetween,

3. the baffle means having a plurality of radially spaced baffles extending into the rotor passage against which all of the polluted air impinges, the baffles being overlapping in the direction of flow both in a direction transverse to and circumferentially of the flow passage, the rotor flow passage being open peripherally of the rotor for the discharge of substantially clean air into the clean air passage, and

4. liquid-removing means for permitting discharge of the pollutant-laden liquid from the rotor into the pollutant-discharge passage,

i. one of the rotor plates includes an upturned peripheral flange closing a portion of the rotor periphery,

j. the remaining open portion of the rotor periphery provides the radial clean air discharge from the rotor flow passage into the clean air passage,

k. the said one rotor plate is provided with holes adjacent the peripheral flange through which the pollutant-laden liquid is discharged from the rotor into the pollutant-discharge passage,

l. the said one rotor plate includes an inturned peripheral flange extending radially inwardly of the rotor flow passage from the upturned peripheral flange to provide an internal chamber into which the pollutant-laden liquid and air is thrown under centrifugal force, the inturned peripheral flange and the other rotor plate defining the open portion of the rotor periphery for radial clean air discharge,

m. the discharge holes for the pollutant-laden liquid are located below the inturned flange,

n. the radially outermost baffle extends from the said other rotor plate and has a free end spaced from said one rotor plate,

o. the inturned peripheral flange is spaced from and located above the free end of the adjacent radially outermost baffle so that the pollutant-laden liquid and air are directed under the free end of such baffle into the annular internal chamber,

p. another baffle means is located in the internal chamber and wetted by the liquid, the last said wetted baffle means being impinged by any remaining particulate pollutant for mixture into the liquid,

q. the last said baffle means includes a first baffle plate inclined radially outward from the inturned peripheral flange substantially to the junction of the upturned peripheral flange and the said one rotor plate to direct the pollutant-laden liquid to the pollutant-discharge holes, and

r. the last said baffle means including a second baffle plate inclined radially inwardly from the first baffle plate, yet spaced above the said one rotor plate and

above the free end of said radially outermost baffle, to preclude liquid from moving back out of the internal chamber and into the clean air discharge passage.

11. An air scrubber as defined in claim **10,** in which:

s. the second baffle plate is provided with small holes for the passage of air back out of the internal chamber and into the space between the said one rotor plate and inturned peripheral flange for radial discharge.

12. An air scrubber as defined in claim **10,** in which:

s. the second baffle plate is provided with a reversed downturned lip to assist in the prevention of reverse liquid flow inwardly along the first and second baffle plates and out of the chamber.

13. An air scrubber as defined in claim **10,** in which:

s. the last said baffle means includes a third baffle plate radially inward of and substantially parallel to and spaced from the first baffle plate, and spaced endwise from the second baffle plate and from the said one rotor plate, the third baffle plate assisting in the prevention of reverse liquid flow radially inward from the first baffle plate and out of the chamber and in directing liquid toward the pollutant-discharge holes.

14. An air scrubber as defined in claim **13,** in which:

t. the second baffle plate is provided with small holes located substantially between the first and third baffle plates for the passage of air out of the internal chamber and into the space between the said one rotor plate and inturned peripheral flange for radial discharge.

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