United States Patent [19]

Nash et al.

[11] **3,843,199**

[45] **Oct. 22, 1974**

[54] **APPARATUS FOR VENTILATING AND PROVIDING DUST SUPPRESSION FLUID TO CUTTER-HEADS OF MINERAL MINING MACHINES**

[75] Inventors: **Harold Llewellyn Nash; John Ewards; Charles Morgan Jones,** all of Glamorgan, South Wales, England

[73] Assignee: **Coal Industry (Patents) Limited,** London, England

[22] Filed: **Apr. 23, 1973**

[21] Appl. No.: **353,438**

[30] **Foreign Application Priority Data**

May 19, 1972 Great Britain 23621/72

[52] **U.S. Cl.** **299/81**

[51] **Int. Cl.** **E21c 25/10**

[58] **Field of Search** 299/81

[56] **References Cited**

UNITED STATES PATENTS

3,747,982 7/1973 Agnew et al. 299/81

3,767,265 10/1973 French et al. 299/81

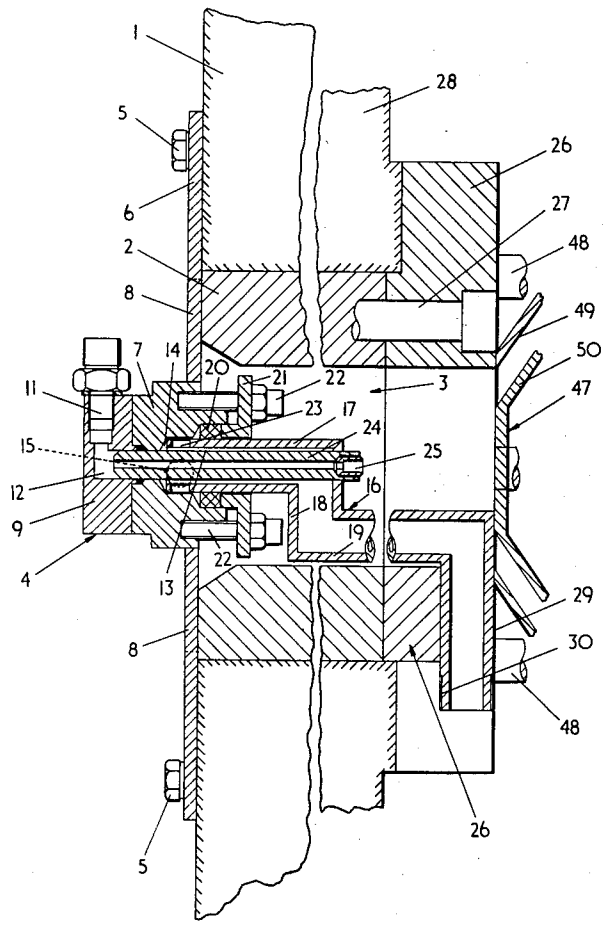
Primary Examiner—Ernest R. Purser

Attorney, Agent, or Firm—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

Apparatus for ventilating cutter heads on mineral mining machines having an axially bored driven shaft, includes a fixed adaptor which is secured to the body of the machine and which is arranged to feed relatively low pressure dust suppression fluid along a tube extending along the bore of the driven shaft towards the cutter head and to feed relative high pressure fluid to a nozzle positioned within the bore of the driven shaft so that fluid discharged from the nozzle induces an air flow along the bore of the driven shaft. Thus, the apparatus permits ventilation of the cutter head by an induced air flow and feeding of dust suppression fluid by the cutter head.

8 Claims, 6 Drawing Figures



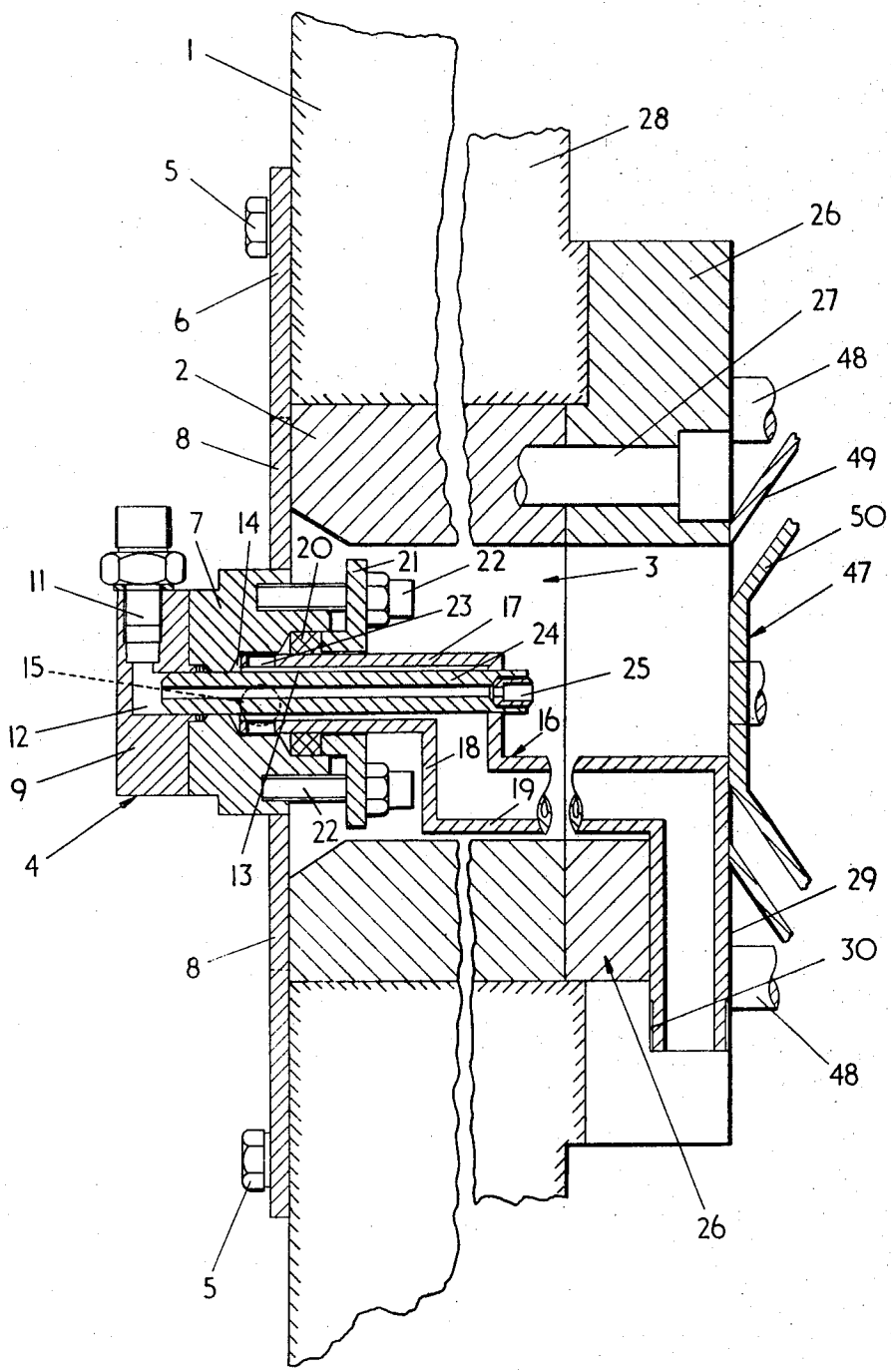

1
28
5
26
6
27
48
2
8
49
7
14
20
21
22
50
3
11
47
23
17
24
15
25
16
12
18
9
19
22
4
13
29
8
30
48
26
5

FIG. 1.

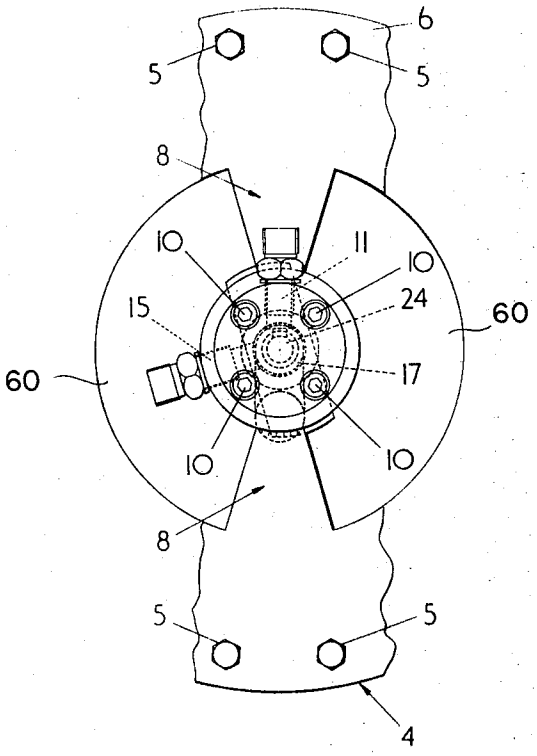

6
5
5
8
10
11
10
24
60
15
17
60
10
10
8
5
5
4

FIG .2.

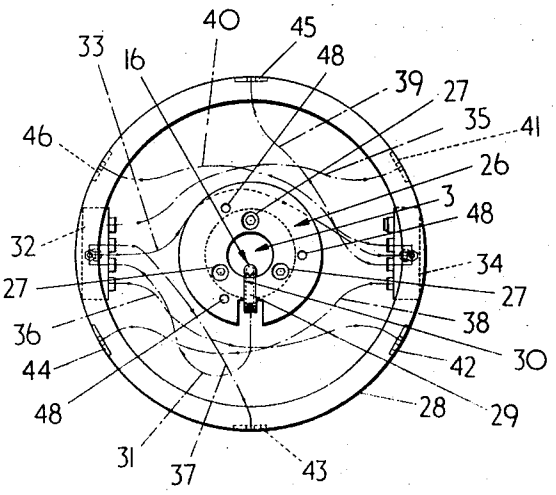

40
45
33
16
48
39
27
35
41
46
26
3
48
32
34
27
27
38
36
30
44
42
48
28
29
31
37
43

FIG.3.

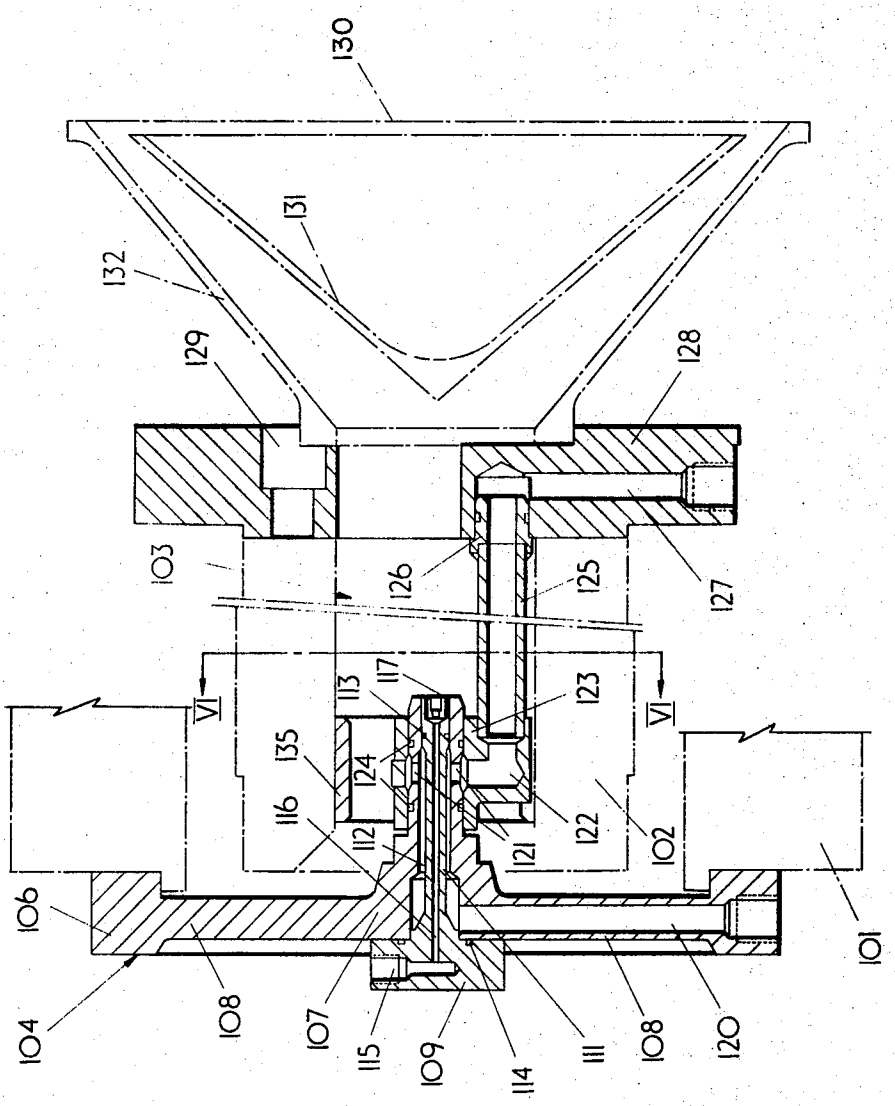

130
131
132
129
128
103
126
125
127
VI
VI
113
117
123
135
124
116
112
122
102
121
106
101
104
108
107
115
109
114
111
108
120

FIG. 4.

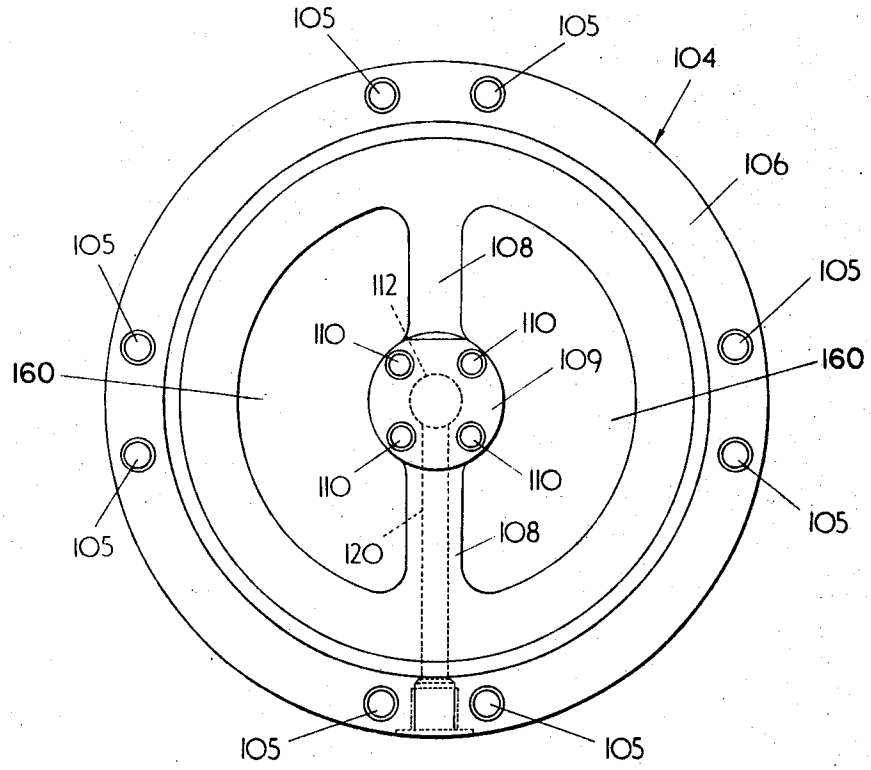

105
105
104
106
105
105
160
160
105
105
105
105
108
112
110
110
109
110
110
120
108

FIG. 5.

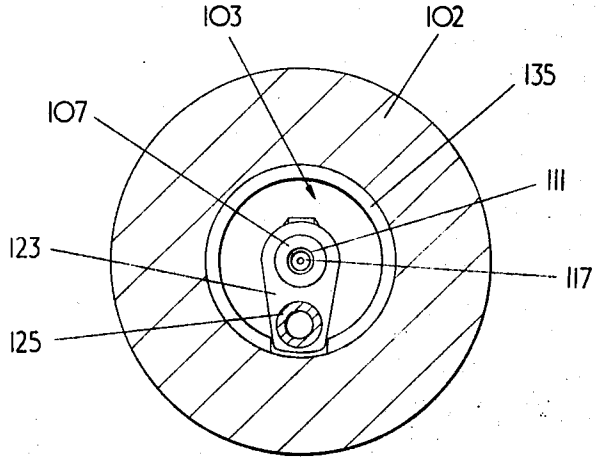

103
102
135
107
111
123
117
125

FIG. 6.

APPARATUS FOR VENTILATING AND PROVIDING DUST SUPPRESSION FLUID TO CUTTER-HEADS OF MINERAL MINING MACHINES

This invention relates to apparatus for ventilating cutter heads on mineral mining machines and has particular application to a mining machine of the kind comprising a rotary cutter head mounted on a hollow or axially bored driven shaft and provided with at least one outlet nozzle for dust suppression fluid.

One known cutter head has a series of water outlet sprays arranged around its periphery which are supplied with relatively low pressure water from a flexible hose connecting the machine to a pressure supply, the water flowing from the hose through a tube arranged within the bore of the driven shaft to a distributor mounted centrally within the cutter head. Water is sprayed from the outlet sprays towards the cutting zone of the cutter head to suppress dust generated during cutting. It has also been proposed to ventilate such a cutter head i.e., to direct air flow to zones adjacent to remote portions of the cutter head, by using a water powered device mounted above the body of the machine remote from the cutter head, the devices including an outlet nozzle for relatively high pressure water positioned within a hollow cylindrical housing member and directed towards the remote portions of the cutter head. As the rapidly moving jet of water passes through the hollow housing member it induces an air flow through the device. Unfortunately, the device is remote from the cutter head and cannot easily direct an air flow into the remote portions of the cutter head.

It is also known to mount a rotary cutter head on a hollow or axially bored driven shaft and to direct a jet of relatively high pressure water along the shaft towards the cutter head so that an air flow is induced along the bore of the hollow shaft to ventilate the remote portions of the cutter head. With such a ventilated cutter head it has been necessary to mount the outlet sprays for the relatively low pressure dust suppression fluid on the body of the machine remote from the cutter head where they tend to become damaged and from where they cannot always efficiently direct water flow into the cutting zone of the cutter head.

With both the above mentioned arrangements it is not always possible to obtain maximum benefit from both the ventilating apparatus and the dust suppression apparatus. In addition the apparatus which is mounted on the body of the machine remote from the cutter head tends to become damaged in use and frequently has a relatively short operational life.

An object of the present invention is to provide apparatus for a cutter head which enables improved ventilation and dust suppression to be achieved.

According to the present invention apparatus for ventilating a mineral mining machine cutter head of the kind adapted to be drivably mounted on a hollow or axially bored driven shaft and provided with at least one outlet nozzle for dust suppression fluid, comprises a fixed component for fixed attachment to the machine adjacent to the end of the driven shaft remote from the cutter head, the fixed component having fluid inlet means and first and second fluid outlets, a nozzle interconnected to the first fluid outlet for delivering an air flow-inducitng jet of fluid along the bore of the driven shaft, and a hollow elongated member connected to the second fluid outlet for feeding dust suppression fluid along the bore of the driven shaft towards the cutter head.

Preferably, the hollow elongated member is sealably and rotatably mounted on the fixed component.

Preferably, the elongated member feeds the dust suppression fluid to distributing means adapted to be mounted within the cutter head for interconnection with the outlet spray.

Preferably, the fixed component's fluid inlet means comprises first and second fluid inlets interconnected to the first and second fluid outlets, respectively.

Advantageously, the nozzle and the elongated member constitute an assembly rotatable with respect to the fixed component.

Preferably, the assembly comprises a tube interconnecting the nozzle to the first fluid outlet of the component and passing through the second fluid outlet, and a passage at least a portion of which extends transverse to the axis of the hollow elongated member and which interconnects the hollow elongated member to the second fluid outlet of the component.

Preferably, the apparatus comprises conical diffuser means for mounting in the cutter head to diffuse the induced air flow along the driven shaft.

Advantageously, the hollow elongated member has a radially extending portion adjacent to its end remote from the fixed component. The radially extending portion may be provided with means for retaining it in position within the cutter head.

According to another aspect, the present invention provides apparatus for ventilating a mineral mining machine in combination with a cutter head.

According to a further aspect, the present invention provides apparatus for ventilating a mineral mining machine in combination with the mineral mining machine.

By way of example only, two embodiments of the present invention will be described with reference to the accompanying drawings in which:

FIG. 1 is an incomplete sectional view through a first embodiment of apparatus constructed in accordance with the present invention and shown in an operational position;

FIG. 2 is an incomplete end view of the apparatus of FIG. 1;

FIG. 3 is a diagrammatic end view in the opposite direction to FIG. 2 and indicating distribution means for dust suppression fluid within the cutter head, the drawing being on a smaller scale than FIGS. 1 and 2,

FIG. 4 is an incomplete sectional view through a second embodiment of apparatus constructed in accordance with the present invention and shown in an operational position;

FIG. 5 is an incomplete end view of the apparatus of FIG. 4; and

FIG. 6 is a sectional view taken along the line VI—VI of FIG. 4.

Referring to FIGS. 1 to 3 of the drawings, the first embodiment of apparatus for ventilating a rotary cutter head of a shearer type mining machine is shown attached to the side of the machine body 1 remote from the cutter head (only a part of which is shown in FIG. 1 and which is not shown in FIG. 2) mounted on a hollow or axially bored driven shaft 2 drivably connected to a motor (not shown) housed within the body 1 of the machine.

The driven shaft 2 has an axial bore 3 extending the full length of the shaft.

The apparatus comprises a fixed component 4 bolted to the machine body side by bolts 5 and constituted by a generally annular plate 6, a central bush member 7 supported from the plate 6 by two arms 8 and a cap 9 bolted to the bush member 7 by bolts 10. The annular plate 6, the central bush member 7 and the arms 8 defining two openings 60 (see FIG. 2) in the fixed component 4. The cap 9 is provided with a radial fluid inlet bore 11 which interconnects with a blind axial bore 12 forming a fluid outlet. The bush member 7 has a stepped axial through bore 13, 14, the larger diameter portion 14 of which is interconnected to a radial fluid inlet 15 formed in the bush member and which constitutes an outlet for fluid from the inlet.

The apparatus also comprises a rotary assembly unit comprising a pipe 16 which has an axial portion 17 extending along the axis of the hollow driven shaft 2 and rotatably located within the outlet 14 in the bush member 7, a short radial portion 18 extending radially within the hollow driven shaft 2 and an elongated portion 19 extending along the wall of the bore 3.

The axial portion 17 is sealed within the outlet 14 by a seal 20 which is retained in position by a gland 21 secured to the bush member 7 by bolts 22. A series of cross holes 23 are formed adjacent to the end of the axial portion 17 to facilitate fluid flowing from the fluid inlet 15 into the bore of the pipe 16.

A tube 24 extends through the bore of the axial portion 17 of the pipe 16 and rotatably engages within the fluid outlet 12 in the cap 9. Leakage of fluid is prevented by a seal. The other end of the tube 24 passes through the pipe wall and is secured thereto by welding which extends around the tube wall so as to provide a seal. A nozzle 25 is located in the end of the tube 24.

The elongated portion 19 of the pipe 16 extends along the bore 3 of the hollow driven shaft 2 until it reaches a back plate assembly 26 secured by bolts 27 to the end of the shaft 2 upon which the cutter head 28 is mounted, the back plate assembly serving to retain the cutter head in position on the shaft. Upon reaching the back plate assembly 26 the pipe 16 is provided with a second radial portion 29 which extends along a radial slot 30 formed in the back plate assembly and the free end of which is threaded to accept a connecting nut (not shown) of a flexible hose indicated by line 31 of FIG. 3. The connecting nut abuts against the shoulder of the slot 30 so as to retain the pipe 16 in position adjacent the wall of bore 3 of the hollow driven shaft 2.

The hose 31 leads to a distribution block 32 which in turn is interconnected by a flexible hose 33 to a further distribution block 34, the distribution blocks 32, 34 are mounted radially remote from the hollow driven shaft 2 and are diametrically opposed so as to balance the rotating cutter head 28. Further flexible hoses 35, 36, 37, 38, 39 and 40 inter-connect the distribution blocks to fluid sprays 41, 42, 43, 44, 45, and 46, respectively, located around the periphery of the cutter head 28 and arranged to direct dust suppression fluid towards the cutting zone of the cutter head. The cutter head is provided with a plurality of cutting tools (not shown) arranged to cut rock mineral as the cutter head rotates.

Diffuser means 47 mounted on the back assembly plate 26 by bolts 48 comprise two spaced conical plates 49, 50. The diffuser means is arranged over the discharge end of the bore 3 of the hollow driven shaft 2 and in operation serves to diffuse and guide the induced airflow to around the rear zone of the cutter head 28.

In operation of the apparatus water is fed to both inlets 11 and 15 and then the cutter head 28 is rotated and the machine starts to traverse along the face. Relatively high pressure water e.g., 1,000 p.s.i. water pressure, is fed through the inlet 11 in the cap 9 and passes via the outlet 12 along the tube 24 to be discharged from the nozzle 25 as a jet of rapidly moving water which induces a flow of air through the opening 60 along the bore 3 of the rotating driven shaft 2. The end of the bore 3 adjacent to the fixed component 4 is tapered to assist air flowing into the bore. The induced air flow together with the jet of water impinges on the diffuser means 47 and is distributed around the periphery of the cutter head 28, the induced air and water being guided between the two spaced conical plates 49 and 50. Upon reaching the periphery of the cutter head 28, the induced air ventilates the zone and tends to prevent accumulations of methane forming in the zone and thereby reduces the chance of an explosive gaseous mixture forming in these zones. The water from the nozzle 25 is also guided to the periphery of the cutter head where it helps to suppress dust generated by the cutting tools on the head 28.

Simultaneously, relatively low pressure water e.g., 150 p.s.i. water pressure, is fed via the inlet 15, outlet 14 and cross holes 23 along the pipe 16 to the flexible hose 31 and hence to the distribution blocks 32, 34 and is discharged through the sprays 41, 42, 43, 44, 46 into the cutting zone of the cutter head 28 where it suppresses dust generated during cutting.

Thus it can be seen from the above description that the present apparatus provides means for enabling a ventilated cutter head to be also provided with dust suppression sprays mounted on the cutter head.

The apparatus enables such a cutter head to be achieved simply and inexpensively.

In modification of the apparatus the bolts 22 retaining the gland 21 to the bush member 7 are arranged so that their heads are located on the side of the bush member remote from the hollow driven shaft 2 and thereby the seal 20 can be adjusted after assembly of the apparatus without requiring the removal of the apparatus on the rear side of the machine adjacent to the cutter head.

Referring now to FIGS. 4 and 6 of the drawing which show the second embodiment of apparatus for ventilating a rotary cutter head of a shearer type mining machine. As with the first described embodiment, the apparatus is shown attached to the side of the machine body 101 (only a part of which is shown) remote from the cutter head (only a part of which is shown) mounted on a hollow or axially bored driven shaft 102 drivably connected to a motor (not shown) housed within the body 101 of the machine.

The driven shaft 102 has an axial bore 103 extending the full length of the shaft.

The second embodiment of the apparatus comprises a fixed component 104 bolted to the machine body 101 by bolts 105 and constituted by a generally annular plate 106, a central bush member 107 supported from the plate 106 by two arms 108, and a cap 109 bolted to the bush member 107 by bolts 110. The annular

plate **106**, the central bush member **107** and the arms **108** defining two openings **160** (see FIG. **5**) in the fixed component **104**. The cap **109** has an elongated, stepped spigot **111** which is accommodated within an axial bore **112** formed in the bush member **107** and seals **113** and **114** are provided between the wall of the bore **112** and the spigot **111** and between the bush member **107** and the cap **109**, respectively. The cap **109** is provided with a radial fluid inlet bore **115** which interconnects with a blind, axial bore **116** extending along the elongated spigot **111** and forming a fluid outlet. A nozzle **117** is located in the end of the bore **116**.

The bush member **107** has a radial fluid inlet bore **120** which extends along one of the arms **108** and which connects via the outlet bore **112** with a plurality of radial passages **121** formed in the bush member **107** so as to communicate with an L-shaped passage **122** formed in a block **123** rotatably mounted around the bush member **107**. Seals **124** are provided between bush member **107** and the block **123**. The end of the L-shaped passage **122** remote from the passages **121** is connected to an elongated tube **125** which extends along the length of the bore **103** of the driven shaft **102** and which is connected to an adaptor **126** located within one end of an L-shaped passage **127** formed in a back plate assembly **128** secured to the end of the driven shaft **102** by bolts (not shown) located within the bolt holes **129** (only one of which can be seen). The end of the L-shaped passage **127** remote from the adaptor **126** is adapted for connection to a distribution means (not shown) which distribute the dust suppression fluid fed along the tube **125** to chambers (not shown) provided around the cutter head. The dust suppression fluid is then fed to dust suppression nozzles (not shown) located adjacent to the periphery of the cutter head.

Diffuser means **130** mounted on the back assembly plate **128** comprise two spaced conical plates **131** and **132**. The diffuser means is arranged over the discharge end of the bore **103** of the driven shaft **102** and in operation serves to diffuse and guide an air flow induced along the bore **103** by water discharging from the nozzle **117**.

A split drive ring **135** located adjacent to the mouth of the bore **103**, rotates with the driven shaft **102** and effectively forms a recess which accommodates the radially outer part of the block **123** which, thereby, is rotated with the driven shaft **102**.

In operation of the second embodiment of the apparatus water is fed to both fluid inlet bores **115, 120**, the cutter head is then rotated and the machine starts to traverse along the face. Relatively high pressure water e.g., 1,000 p.s.i. water pressure, is fed through the bore **115** in the cap **109** and passes via the outlet bore **116** to be discharged from the nozzle **117** as a jet of rapidly moving water which induces a flow of air through the opening **160** along the bore **103** of the rotating driven shaft **102**. The end of the bore **103** adjacent to the fixed component **104** is tapered outwardly to assist air flowing into the bore. The induced air flow together with water from the jet from the nozzle **117** impinges on the diffuser means **130** and is distributed around the periphery of the rotating cutter head, the induced air and water being guided by the passage between the two spaced conical plates **131** and **132**. It will be seen that with the second embodiment of the apparatus no relatively high pressure rotary seal is required.

Upon reaching the periphery of the rotating cutter head, the induced air ventilates the zone and tends to prevent accumulation of methane forming in the zone and, thereby, reduces the chance of an explosive gaseous mixture forming in the zone. The water from the nozzle **117** is also guided to the periphery of the cutter head where it helps to suppress dust generated by the cutting tools.

Simultaneously, relatively low pressure water, e.g., 150 p.s.i. water pressure, is fed via bores **120** and **112**, radial passages **121** and the L-shaped passage **122** along the tube **125** to the L-shaped passage **127** and then to the distribution means which distribute the water to the chambers provided around the cutter head. From the chamber the water is fed to the dust suppression nozzle located adjacent to the periphery of the cutter head, the water being discharged from the nozzles into the cutting zone of the cutter head where it suppresses dust generated during cutting.

In modifications of the apparatus the split drive ring **135** is dispensed with and a slot is provided in the mouth of the bore **103** to accommodate the radially outer part of the block **123**.

We claim:

1. Apparatus for ventilating a mineral mining machine cutter head of the kind adapted to be drivably mounted on an axially bored driven shaft and provided with at least one outlet nozzle for dust suppression fluid, comprising a fixed component for fixed attachment to the machine adjacent to the end of the driven shaft remote from the cutter head, the fixed component having fluid inlet means and first and second fluid outlet means, a nozzle interconnected to the first fluid outlet means for delivering an air flow-inducing jet of fluid along the bore of the driven shaft, and a hollow elongated member connected to the second fluid outlet means for feeding dust suppression fluid along the bore of the driven shaft towards the cutter head.

2. Apparatus as claimed in claim **1**, in which the hollow elongated member is slidably and rotatably mounted on the fixed component.

3. Apparatus as claimed in claim **1** in which the said fluid inlet means comprises first and second fluid inlet means interconnected to the said first and second fluid outlet means, respectively.

4. Apparatus for ventilating a mineral mining machine cutter head of the kind adapted to be drivably mounted on an axially bored driven shaft and provided with at least one outlet nozzle for dust suppression fluid, comprising a fixed component for fixed attachment to the machine adjacent to the end of the driven shaft remote from the cutter head, the fixed component having first and second fluid inlet means and first and second fluid outlet means interconnected to the said first and second fluid inlet means, respectively, a nozzle interconnected to the first fluid outlet means for delivering an air flow-inducting jet of fluid along the bore of the driven shaft, and a hollow elongated member which is connected to the second fluid outlet means for feeding dust suppression fluid along the bore of the driven shaft towards the cutter head and which constitutes an assembly rotatable with respect to the fixed component.

5. Apparatus as claimed in claim **4**, in which the said assembly comprises a tube interconnecting the nozzle

to the said first fluid outlet means and passing through the said second fluid outlet means, and a hollow member defining a passage at least a portion of which extends transverse to the axis of the elongated member and which interconnects the elongated member to the said second fluid outlet means.

6. Apparatus as claimed in claim **4,** in which the said assembly comprises a bored block adapted to be rotatably mounted around, a portion of the fixed component.

7. A mineral mining machine including an axially bored driven shaft, a cutter head drivably mounted on the driven shaft, at least one nozzle for dust suppression fluid, and apparatus for ventilating the cutter head, the apparatus comprising a fixed component for fixed attachment to the machine adjacent to the end of the driven shaft remote from the cutter head, the fixed component having fluid inlet means and first and second fluid outlet means, a nozzle interconnected to the first fluid outlet means for delivering an air flow-inducing jet of fluid along the bore of the driven shaft, and a hollow elongated member connected to the second fluid outlet means for feeding dust suppression fluid along the bore of the driven shaft towards the cutter head.

8. A mineral mining machine as claimed in claim **7,** comprising diffuser means mounted in the cutter head to diffuse the induced air flow along the driven shaft.

* * * * *