Dec. 28, 1965 N. W. DENSMORE 3,225,678

MINE VENTILATION SCHEME

Original Filed May 22, 1962 3 Sheets-Sheet 1

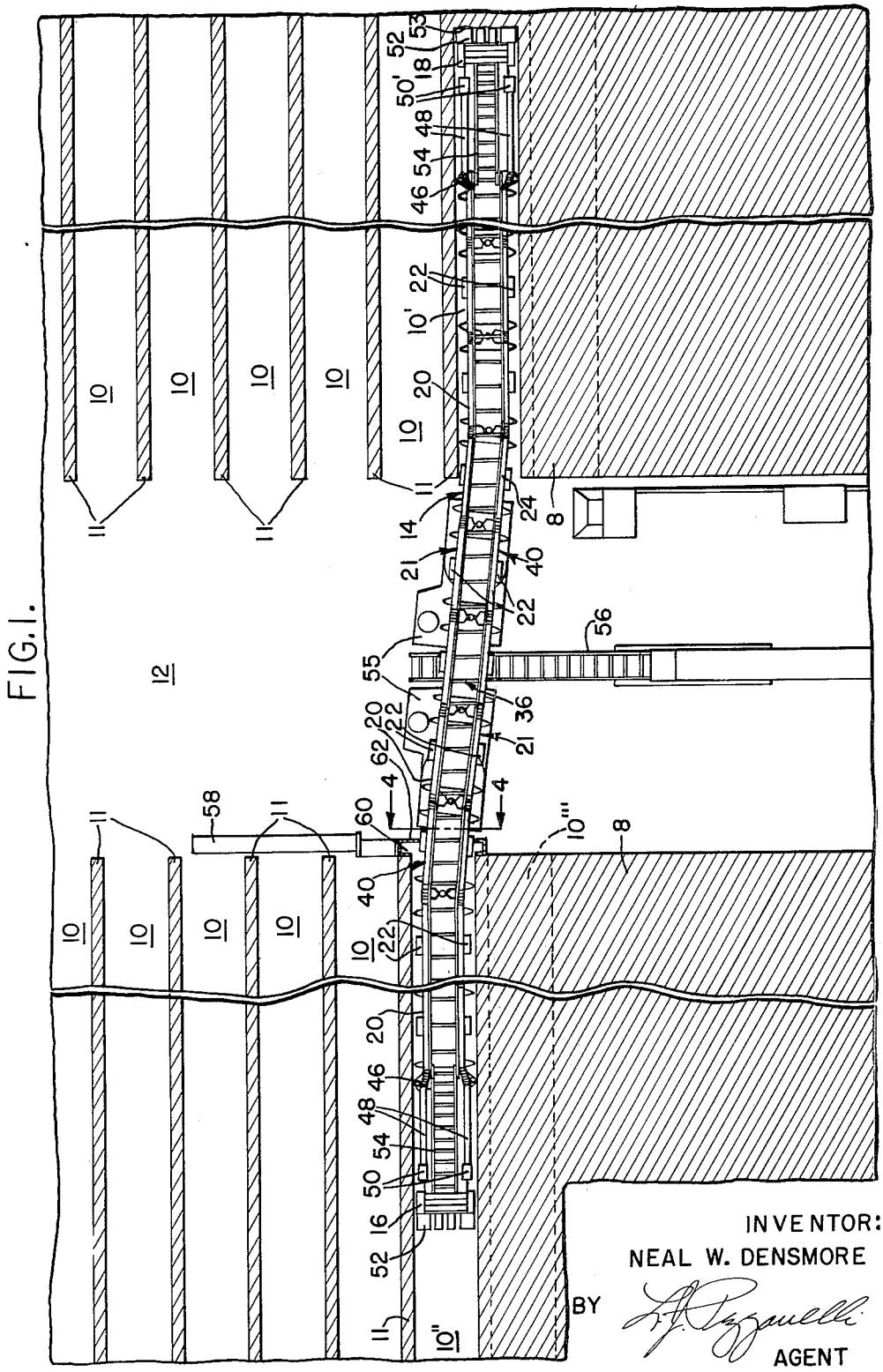


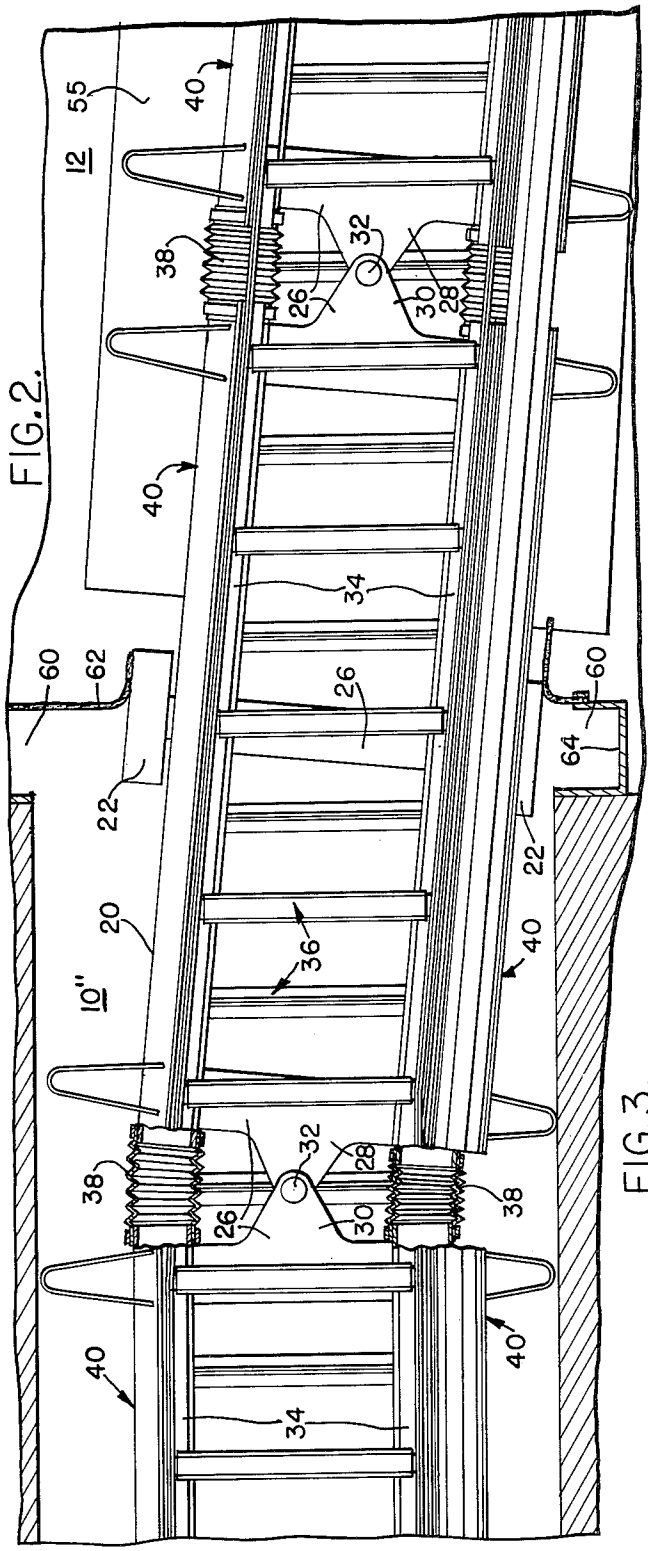
FIG. 1.

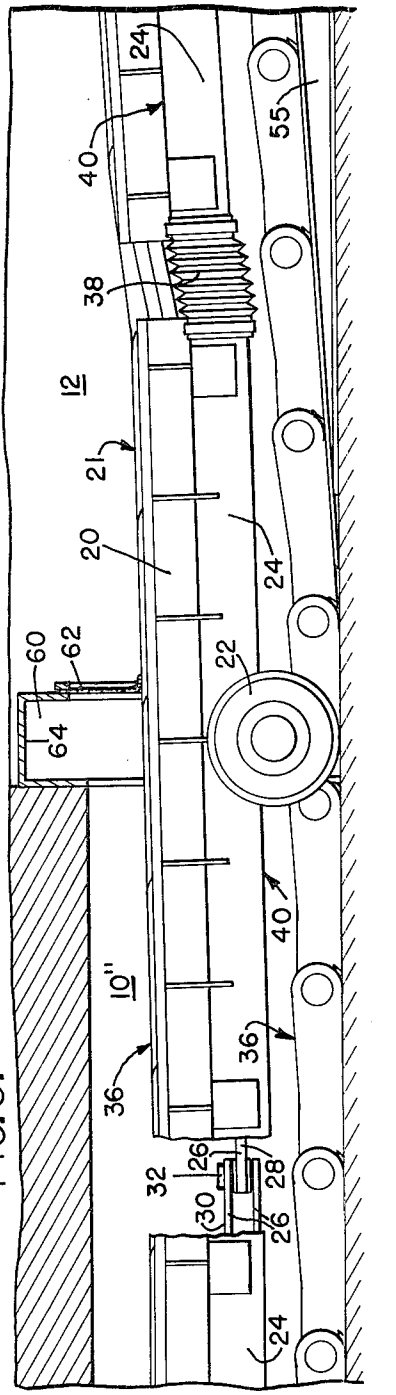
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MINE VENTILATION SCHEME

Original Filed May 22, 1962 3 Sheets-Sheet 2





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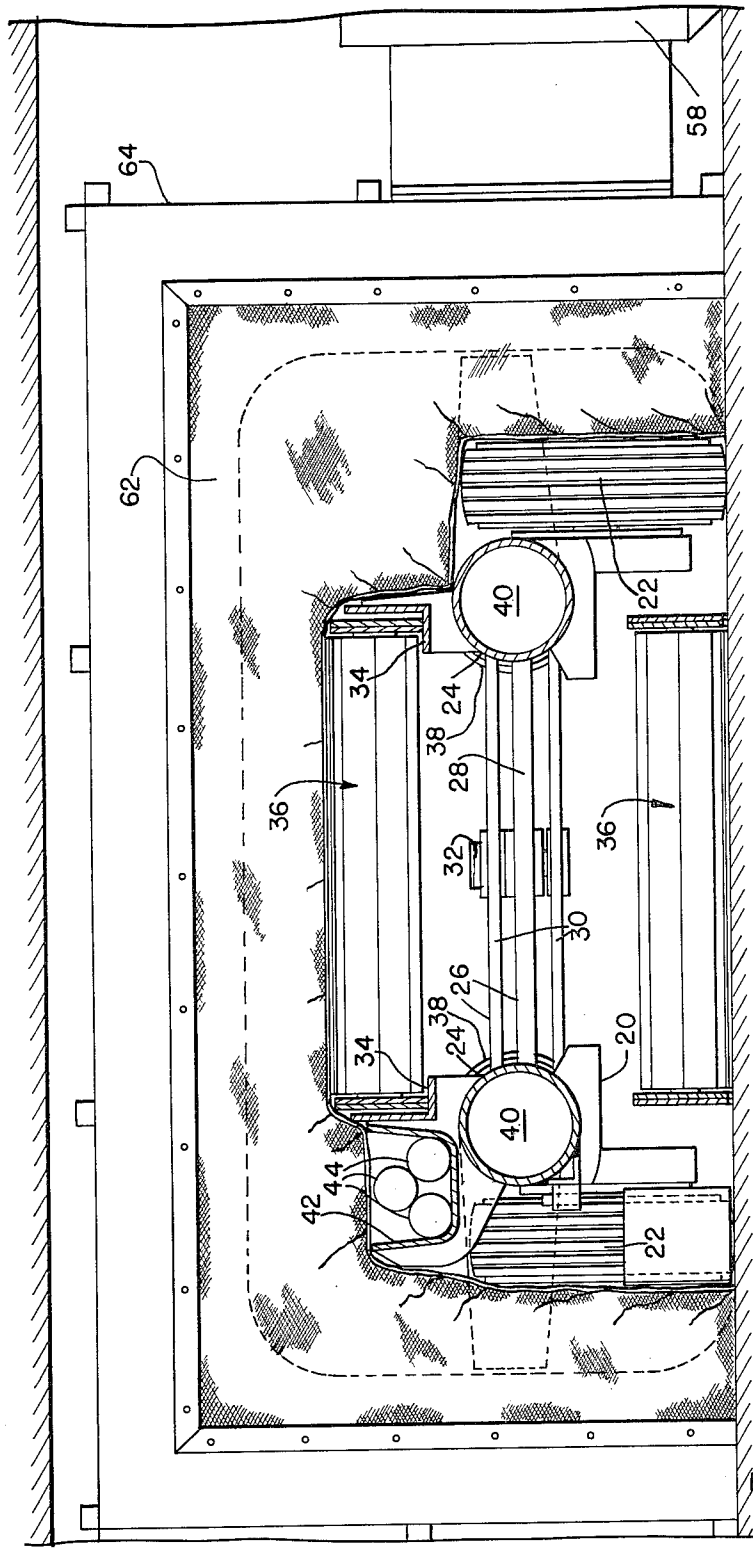
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MINE VENTILATION SCHEME

Original Filed May 22, 1962 3 Sheets-Sheet 3

FIG. 4.



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MINE VENTILATION SCHEME

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Continuation of application Ser. No. 196,706, May 22, 1962. This application July 10, 1964, Ser. No. 382,442
3 Claims. (Cl. 98—50)

This is a continuation of application Serial No. 196,706, now abandoned.

This invention relates to a ventilation scheme and more particularly to a method and apparatus for providing fresh air to, and removing dust and gases from, a mine face of a mineral vein being continuously attacked and disintegrated by a mining machine of the type characterized by continuous forward progress during its mining activities.

Ventilation of mine faces has been accomplished by forced air systems using various methods of supplying air to the face and removing air therefrom. Brattice formed passageways have been used with stationary fans and flexible tubing has been used with fans mounted on the mining machine, to provide ventilation for a mining operation. These methods have been useful but not entirely satisfactory because the forward progress of the mining machine was necessarily interrupted when sections of brattice or additional lengths of flexible tubing were added to keep pace with the forward progress of the machine.

The method of the present invention provides uninterrupted ventilation of a mine face being mined by a continuous miner without interruption in the forward progress of such mining machine.

It is therefore an object of this invention to provide a new and improved ventilation scheme for a mining operation.

It is another object of the invention to provide a new and improved ventilation apparatus for a remote controlled underground mining operation.

It is a further object of the present invention to provide a new and improved ventilation scheme having means whereby fresh air is continuously furnished to, and dust and gases are continuously removed from, a mining face being continuously attacked and disintegrated by a continuous mining machine.

It is a specific object of this invention to provide a new and improved ventilation apparatus for a remotely controlled underground mining operation which provides means for continuously removing a mixture of air, dust and gases from a mine face, conduit means for transporting such mixture to a mined out portion of the mine operation, and a dust collector for removing the mixture of air, dust and gases from the mined out portion to remove the dust from the mixture and disperse the gases in large volumes of air so as to constitute no further problem.

It is another specific object of this invention to provide a new and improved ventilation scheme for continuous ventilation of a mining face being produced by a continuous miner which method provides means for extracting air from a mined out portion of the mining operation at one end of the mining machine, transporting it to the other end of the mining machine actively engaged in the mining operation where such air will mix with the dust and gases being produced in the mining operation and by pressure differences force such dust and gases out of the portion of the mine adjacent to the mining face from whence it can be picked up by an air cleaner connected by brattice passages to the portion of the mine where active mining is taking place.

These and other objects and advantages of this invention will become more fully apparent upon consideration of the following description and drawings wherein:

FIG. 1 is a top plan view of a remotely controlled, underground, continuous mining machine together with a sectional plan view of a mining area being actively mined by such mining machine and provided with a ventilation scheme operating according to the principles of this invention;

FIG. 2 is an enlarged, fragmentary, top plan view of a portion of a conveyor train which is part of the continuous miner of FIG. 1;

FIG. 3 is a side elevational view of the apparatus of FIG. 2;

FIG. 4 is an enlarged sectional view taken substantially on the line 4—4 of FIG. 1.

In FIG. 1 there is shown a portion of a mineral vein in horizontal section comprising large unmined portions 8, to the left and right, respectively (as viewed in FIG. 1), a plurality of elongated, parallel, completed bore holes 10 extending left and right, respectively, and one incomplete bore hole 10′ (shown extending to the right), separated by elongated narrow unmined rib portions 11. Centrally located between the large unmined portions 8 and also between the ends of the left hand and right hand bore holes 10, respectively, is a large mined out portion or gallery 12. In FIG. 1 there is also shown a self propelled, double ended, remotely controlled, underground mining and conveying apparatus 14. The mining-machine 14 comprises two full face, boring type, continuous miners or material disintegrating mechanisms, the one at the left, in the most recently completed bore hole 10″, being indicated as 16 and the one at the right, in the incomplete bore hole 10′, being indicated as 18. The continuous miners 16 and 18 are connected together by a plurality of flexibly connected conveyor cars 20 extending therebetween.

As particularly shown in FIG. 2, each conveyor car 20 comprises a pair of ground engaging wheels 22 pivotably mounted on suitable spindles (not shown) which are rigidly secured to, and support a pair of laterally spaced, horizontally disposed, elongated, rigid tubular members 24 (see FIGS. 2 and 3) extending substantially the full length of each conveyor car 20. The tubular members 24 are rigidly secured in parallel relationship by a plurality of horizontal cross members 26 extending transversely of the conveyor car 20 (see FIGS. 2 and 4). Referring to FIGS. 2 and 3 it will be seen that the end cross members 26 of each conveyor car 20 are provided with a tongue element 28 and fork element 30, respectively, pivotably secured together by a vertical pin 32 through the mating parts of the conveyor cars 20 so that the total number of conveyor cars form a flexible articulated conveyor train 21. The tubes 24 also support, by suitable brackets, a pair of inwardly facing, transversely spaced, elongated, parallel, angle elements 34 which in turn support and guide an upper return run of an endless, orbital, drag conveyor 36 which extends continuously from one conveyor car 20 to another along the whole length of the conveyor train. The return run of the conveyor 36 is carried and guided by the respective cars while a lower or conveying run of the conveyor 36 rests upon and slides along the bottom of the bore hole 10′ being produced by one of the continuous miners 16 and 18. The conveyor 36 is driven by power means (not shown) installed in certain power cars (also not shown) of the conveyor train 21. The tubular members 24 of longitudinally adjacent conveyor cars 20 are respectively joined together and communicate with each other through extensible, flexible, fluid conducting, tubular elements 38 so that the tubular elements 24 of all the cars in the

conveyor train 21 form a pair of continuous conduits generally indicated at 40. Each one of the conduits 40 extends the full length of the conveyor train from one continuous miner to the other for the purpose of conducting a stream of air therethrough. Each conveyor car 20 is also provided with an elongated, horizontally disposed, trough member 42 (see FIG. 4) to support and carry a plurality of power supply cables 44 to conduct electric energy to the drive cars of the conveyor train 21 and to the continuous miners 16 and 18. Certain of the cables 44 are also used for control functions and for transmitting the information necessary to the proper control of the cutting action of the continuous miners 16 and 18.

Referring again to FIG. 1, it will be seen that the continuous miner 16 is connected to the conveyor train 21 by a pair of laterally spaced articulated arms 46 flexibly connecting an end conveyor car 20 to the continuous miner 16 which also has laterally spaced, longitudinally extended, parallel, conduit tubular members 48 connected to and communicating with the conduits 40 through a pair of flexible tubular elements 38, respectively. The tubular members 48 extend longitudinally of the continuous miner 16 from the rearward end, connected to a conveyor car 20, to a forward portion of the continuous miner 16 where the tubular members 48 terminate in a pair of motor driven fan elements 50, respectively. The continuous miner 18 is entirely similar to the continuous miner 16 just described excepting only that it is connected to the other end of the conveyor train 21, faces in the opposite direction and has fan elements 50' which operate in tandem with the fans 50. The continuous miners 16 and 18 are also provided with cutting mechanisms 52 of any suitable type for attacking and disintegrating the mineral vein and are provided in the usual manner with longitudinally extended, centrally located, conveyors 54 to transport coal or other mineral removed from the mineral vein by the cutter action of the cutters 52 and carry it back to the conveyor train 21. When the mineral discharged by the conveyor 54 reaches the conveyor train 21 its transportation is taken over by the drag type conveyor 36 which drags the mineral along the floor portion of the unfinished bore hole 10' to the gallery 12. The conveyor train 21 extends across the gallery 12 and into a finished bore hole 10'' on the opposite side of the gallery as may be seen in FIG. 1. An intermediate portion of the conveyor train 21 is supported upon a pair of generally flat, nearly horizontal launching platforms 55 suitably positioned to support the conveyor train 21 in its intermediate portion and to elevate the intermediate portion of the conveyor train 21 so that it passes over an end portion of a gathering conveyor 56 centrally located in the gallery 12 and extending therealong. The conveyor 56 transports mineral deposited upon it by the drag conveyor chain 36 and delivers such mineral to the general transport system of the mine (not shown).

In FIG. 1 there is also shown a powered, fan equipped, air cleaner 58 communicating through a brattice formed passageway 60 with the mouth of the finished bore hole 10'', most nearly opposite the incomplete bore hole 10' into which one end of the conveyor train 21 extends. One side of the passageway 60 is formed by a screen 62 of flexible material such as canvas or the like, the other side of the passageway 60 being formed by the wall of the gallery 12. The screen 62 covers the end of the finished bore hole 10'', where it joins the gallery 12, except for a suitable opening in the screen 62 to allow for the conveyor train 21 passing through the mouth of the bore hole 10''. The screen 62 with a suitable opening surrounding a conveyor car 20 is best seen in FIG. 4, where it can be seen that the screen 62 is supported by a frame 64 surrounding the opening of the bore hole 10'' and rigidly secured to the wall of the gallery 12 in such position.

Referring again to FIG. 1 it will be seen that the cutting mechanism 52 of the continuous miner 18 at the right hand side of the picture is engaged with a mine face 53 which is that portion of the unmined mineral vein 8 being attacked and disintegrated by the mining machine 14 of this invention. It is to be appreciated that either end of the mining machine 14 can be used for attacking and disintegrating a mineral vein but for purposes of illustration the explanation will be directed to the situation as shown in FIG. 1 with the continuous miner 18 actively engaged in the mining operation while the continuous miner 16 is retracting from a mine face (not shown) already formed in the finished bore hole 10''. The forward direction will be defined for the operation herein described as from left to right in FIG. 1 it being understood that, after the bore hole 10' has been extended to a desired distance, the direction of motion of the mining machine 14 will be reversed and the continuous miner 16 will become the active mining element of the machine 14 engaged in producing a new bore hole 10''' (shown in dotted outline) parallel to, and laterally spaced from the bore hole 10''.

As is known, a continuous miner, actively engaged in cutting mineral such as coal, produces large quantities of finely divided particulate material, having a wide range of particle size such as coal dust and under certain circumstances liberates substantial quantities of gas, which dust and gas must be efficiently removed from the mining face 53 to prevent the development of explosive conditions. In operation of this machine the cutter mechanism 52 removes mineral from the mineral face 53 and the conveyor 54 delivers the mineral to the drag conveyor chain 36 by which it is carried out of the bore hole 10', laterally across the gallery 12 over one launching platform 55 and deposited upon the gathering conveyor 56 to be transported out of the mine in the usual manner. During the cutting operation on the mine face 53 quantities of dust and gases are mixed with the air in the unfinished bore hole 10' this mixture of dust, gases and air is picked up by the fans 50' on the continuous miner 18 which are operating in a suitable direction to apply fluid pressure to the tubular members 48 on the continuous miner 18. These tubular members 48 communicating with the conduits 40 on the conveyor train, force the mixture of air, dust and gases through the conduits 40 to the tubular members 48 on the continuous miner 16 at the left-hand end of the conveyor train as shown in FIG. 1. The fans 50 on the continuous miner 16 are operated in a direction suitable to remove air and gases from the tubular members 48 and the conduits 40 so that the mixture of dust, gases and air travels from the mine face 53 at the right of the illustration to the finished bore hole 10'' at the left of FIG. 1 where the air expands and loses velocity. Such reduction in velocity result in a separation of the large dust particles from the mixture and their deposition on the floor of the finished bore hole 10''. After such separation has occurred, the smaller particles, air and other gases progress toward the mouth of the bore hole 10'' where it joins the gallery 12 and communicates with the passageway 60. The air cleaner 58 being also equipped with fans is operating in a direction suitable to remove air from the passageway 60 and after subtracting the remaining dust from the mixture delivers the remaining air and gases to the atmosphere in a manner well known in the art. From the above description it will be seen that the air circulation system or ventilation scheme of this invention comprises three sets of fans 50, 50' and those in the air cleaner 58, acting in tandem to product a flow of air into the unfinished bore hole 10' from the gallery 12, up to the face 53 where it is mixed with dust and gases liberated from the mineral vein, picked up by the fans 50', conducted through the conduits 40, released into the finished bore hole 10'', removed from the bore hole 10'' by the air

cleaner **58**, and exhausted to the atmosphere in any suitable manner.

When the unfinished bore hole **10'** is completed the air cleaner **58** with its associated screen **62** and brattice formed passageway **60** is transferred across the gallery **12** to the opening of the bore hole **10'** which has become a finished bore hole **10''**. Operation of the drag conveyor **36** and of the fans **50** and **50'** is reversed and the operation restarted with the continuous miner **16** at the left-hand end of the machine **14** being the active mining component of the machine. In this manner provision is made for ventilation of the active mine face whether it is at the right-hand end of the machine as shown in FIG. 1 or at the left end of the machine as in the above description of the second half of the mining cycle.

It is to be noted that under certain operating conditions it is desirable that air circulation through the finished bore hole **10''** and the unfinished bore hole **10'** be reversed so that clean air is picked up from the finished bore hole **10''** by the fans **50** on the continuous miner **16**, conducted through the tubular elements **48** and the conduits **40** and delivered to the mine face **53** by the fans **50'**. The air delivered by the fans **50** to the mine face **53** mixes with the dust and gases being liberated at the mine face **53** from whence such mixture is removed by the air cleaner **58** now positioned at the opening formed by the confluence of the unfinished bore hole **10'** and the gallery **12**.

It is to be further noted that the use of a single tube in place of the paired conduit **40** with this or other types of conveyor and mining machine is within the scope of this invention.

The advantages of this invention reside in the continuous ventilation of the mining face by means of forced air motion with no interruption in the mining action for the purpose of extending the air supply means or otherwise readjusting the ventilation system during either half of the mining cycle. It is further to be appreciated that the shifting of the air cleaner **58** from one side of the gallery **12** to the other side is necessary only at such time as the mining action is necessarily interrupted by the completion of a bore hole with concomitant necessary readjustment of the launching platform and gathering conveyor before the second half of the mining cycle can be started. Under such consideration it can be seen that the necessary shifting of the air cleaner **58** and its associated screen **62** and screen frame **64** cannot be considered of itself to necessitate an interruption of the mining action. A further advantage of this invention resides in the fact that extensive installation of temporary brattice passageways or tubing is unnecessary with the ventilation scheme of this invention as the necessary fans, conduit means and tubular elements are permanently installed on the mining machine and are automatically relocated in operative positions as the mining machine progresses into an unfinished bore hole or is shifted to a new position at the start of another cycle of operation.

A still further advantage of this invention resides in a first stage cleaning action that takes place when the mixture of air, dust and gases exits from the conduit **40** through the fans **50** and expands into the finished bore hole **10''**. Such expansion of a mixture of dust and gases results in settling out of the larger suspended particles

and allows the air cleaner **58** to be designed for efficiently collecting the smaller particles as in the second stage of a two stage cleaning process.

A preferred embodiment of this invention having been described in accordance with the patent statutes, it is to be realized that modifications thereof may be made without departing from the broad spirit and scope of this invention. Accordingly, it is respectfully requested that the following claims be interpreted as broadly as possible and be limited only by the prior art.

I claim:

1. A process of ventilating an underground mining plan including a main gallery having oppositely extending bore holes formed in the lateral confronting sides thereof comprising, moving the atmosphere from a bore hole being formed to a formed bore hole on the opposite side of such gallery by fans mounted at spaced portions in a conduit, initially separating certain of the particles in such atmosphere by the deceleration of such atmosphere in the formed bore hole, exhausting and cleaning such atmosphere from the formed bore hole by means of an additional fan and a filter, respectively, located in such gallery.

2. A process of ventilating an underground mining plan including a main gallery having oppositely extending bore holes formed in the lateral confronting sides thereof comprising, moving the atmosphere from a bore hole being formed to a formed bore hole on the opposite side of such gallery by fans mounted at spaced portions in a conduit, moving such conduit and one of such fans in the bore hole being formed by mounting such conduit on a mining mechanism forming such bore hole, initially separating certain of the particles in such atmosphere by the deceleration of such atmosphere in the formed bore hole, exhausting and cleaning such atmosphere from the formed bore hole by means of an additional fan and a filter respectively located in such gallery.

3. A process of ventilating an underground mining plan having formed bore holes therein comprising, moving atmosphere from a bore hole being formed to a formed bore hole by fans mounted at spaced portions in a flexible conduit, moving such conduit and one of such fans in the bore hole being formed by mounting such conduit on a mining mechanism forming such bore hole, initially separating certain particles in such atmosphere by the deceleration of such atmosphere in the formed bore hole, further moving such atmosphere from said formed bore hole, removing the remaining particles from such atmosphere by a filter and exhausting such atmosphere by means of an additional fan.

References Cited by the Examiner

UNITED STATES PATENTS

899,509 9/1908 Byers ..... 98—50

OTHER REFERENCES

Coal Age, February 1959, pp. 96–100.

WILLIAM F. O'DEA, *Acting Primary Examiner.*

ROBERT A. O'LEARY, *Examiner.*