J. L. BEADLE.

VENTILATION OF MINES.

No. 47,694. Patented May 16, 1865.

Fig: 4.

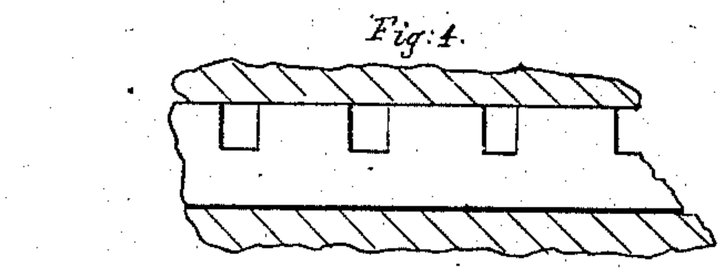
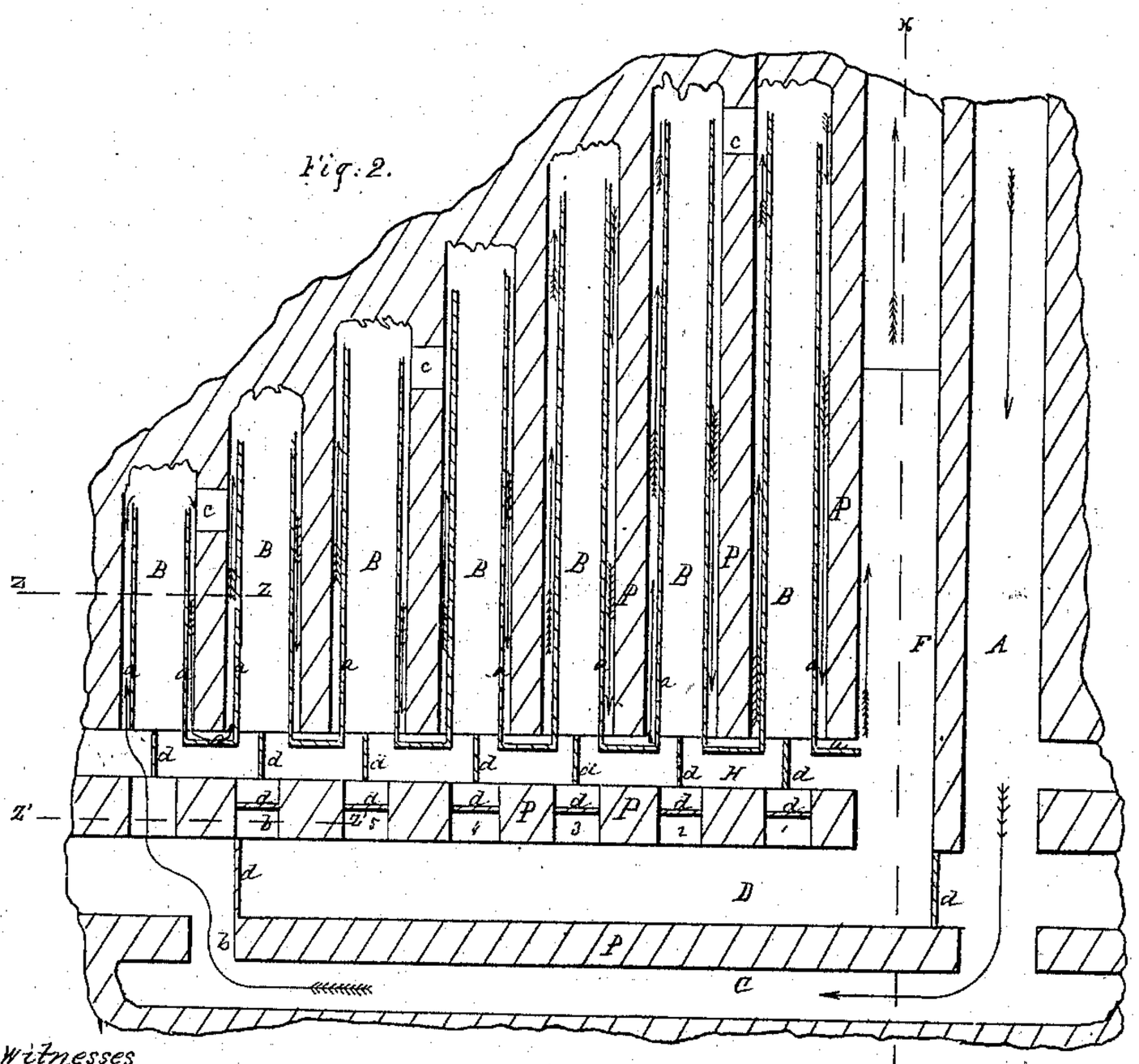


Fig: 1.

Fig: 2.



Witnesses

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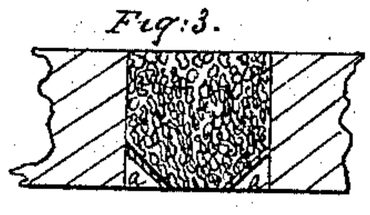
Fig: 3.



Inventor

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UNITED STATES PATENT OFFICE.

J. LOWDEN BEADLE, OF ASHLAND, PENNSYLVANIA.

IMPROVEMENT IN VENTILATION OF MINES.

Specification forming part of Letters Patent No. **47,694**, dated May 16, 1865.

To all whom it may concern:

Be it known that I, J. LOWDEN BEADLE, of Ashland, in the county of Schuylkill and State of Pennsylvania, have invented a new and useful Improvement in Ventilating Mines; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to fully understand and make use of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical section through the upcast shaft of a coal-mine, showing a gangway and air-courses which communicate with it, the line of section being seen at *x*, Fig. 2. Fig. 2 shows a horizontal section of the mine on the bent line *y* of Fig. 1. Fig. 3 is a cross-section of one of the breasts B on the line *z*. Fig. 4 shows the relative position of the chutes and gangway when the chutes are above the air-courses.

The invention consists in a new mode of ventilation to be applied to mines of coal, iron, or other subterranean workings, in which an exhausting-fan, or equivalent apparatus, is to be used in connection with a system of air-courses and air cut-offs for the purpose of freeing them from noxious and dangerous airs and gases and supplying fresh atmospheric air to the breasts and other parts of the mines.

In all extensive mines, and particularly in those which are excavated far beneath the surface, a large amount of heavy air and noxious vapors accumulates from several sources, among which are the condensations of the surface air, the accumulations of carbonic-acid gas and other heavy vapors from the burning of lamps, the explosions of powder, and from the respirations of numerous operatives, and the gases which escape from the seams of coal in numberless minute jets. From these and similar causes the mines become filled with vapor heavier than the common atmosphere, which cannot be removed by means of natural currents—that is, by those which may be induced by atmospheric pressure—since the columns of air in the upcast and downcast shafts are usually in equilibrium. Therefore, some adequate artificial means must be used to create a sufficient current in the galleries and workings in order to remove the noxious airs and gases and to supply their places with wholesome air, and which must be in sufficient quantity not only to sustain life, but also effectually to displace the noxious gases, and among them such as are dangerous because of their liability to cause explosions.

In deep and gaseous mines an enormous excess of pure air is required, beyond the mere wants of the operatives for respiration, in order to remove the danger of explosions. The gases which are liberated by the progress of the workings, and which are also delivered in all parts of the mine from innumerable minute jets from the beds of coal become explosive and liable to burn when they are mixed with certain equivalents of oxygen or atmospheric air. Therefore a feeble ventilation, or such as one would suppose to be enough for the wants of the miners, will only expose them to more certain destruction by producing a highly-explosive compound; and I am not aware of any system of ventilation hitherto tried or suggested, excepting the one herein set forth, which completely removes this source of danger.

The systems of ventilation commonly employed are, "natural ventilation," caused by free currents of air passing through the mine by the ordinary galleries and shafts, without resorting to any artificial compelling forces; "furnace-ventilation," caused by the erection of furnaces at the base of the upcast shaft in order to rarefy the air and produce an active upward current therein; "steam-ventilation," caused by introducing steam-jets into the upcast shaft, and "fan-ventilation," caused by exhausting the air from the upcast shaft and so inducing a current down the downcast shaft. The system of natural ventilation is the best where it can be availed of, but its application is limited to shallow mines and to such as are above water-level, where the currents of air can be made to move from natural causes; but this mode is not available in deep and extensive mines, and in such furnace-ventilation is now most generally resorted to. This mode is effective where "fire-damp" or coal-gas does not exist in appreciable quantities; but where it is abundant—as in "fiery" mines—this mode becomes highly dangerous, since when gas, in an explosive condition, is forced back upon ventilating-furnaces, as will occasionally happen from the falling in of some of the workings, and like accidents be-

yond the foresight and control of the most intelligent management, disastrous explosions will follow, resulting in loss of life and in great damage to the mine. The expedients hitherto devised to prevent these gases from reaching the furnaces have not been successful, and therefore the system of furnace-ventilation is defective and dangerous.

I have here illustrated my invention by showing its application to a coal-mine where the bed of coal is supposed, for the sake of simplicity in the drawings, to be horizontal.

A is the downcast shaft, open to the atmospheric pressure, and through it fresh air descends to the mine.

F is the upcast shaft, which is connected near its top with an exhaust-fan, I, through which the shaft is continued until in emerges at the surface of the earth.

D is the gangway, with which all the gal leries or breasts, or whatever other names the workings go by, communicate, it being the main avenue for the loading of the coal upon cars or trucks running upon a railway (not here shown) leading to the shaft A, or other place where the coal is to be brought to be taken to the surface of the earth. The ends of the gangway D are closed by means of doors *d*, which are opened to permit the passage of the miners and of the cars to and fro.

C is an air-course, here shown as running parallel with the gangway D and entering it near its inner end by means of a channel, *b*. The upcast shaft F communicates with the gangway D near its outer end, the door *d* being so placed as to prevent communication between the shafts F and A while it is closed.

B are the workings of the mine, in the class of mine here represented, properly called "breasts," and which are carried forward as far as found convenient or profitable, according to circumstances, being sometimes connected to each other at their extreme ends or at any other points by cross-cuttings *c*, at a point above the air-courses *a*, the object of which is to provide a means of escape for the miners from sudden peril, their location being determined by the character of the rock through which the breast is pushed. The breasts B communicate with the gangway by means of chutes, (designated by the figures 1 2 3 4 5 6,) through which the coal taken from the breasts is delivered to the cars in the gangway, the latter, whenever the situation and character of the mine admit, being sunk below the level of the breasts and chutes, so that the coal may be run down into the cars directly from the chutes without handling.

The width of the gangway and of the breasts will be greater than the air-courses or chutes, and the height of the air-courses need be only sufficient for the volume of air required for a mine, differing according to the extent of different mines, and for necessary communication with different parts of the mine in any exigency which may arise. The chutes are closed likewise by doors *d*, which close all communication between the breasts B. These doors may be hung to the roofs of the chutes so as to be pendulous, closing by their own gravity when the cars are emptied and drawn back into the breasts, or when the coal to be delivered into the gangways has been run down so as to load the gangway cars.

A is a return air-course, cut parallel with the gangway, between it and the end of the breasts, and intersecting the latter at their places of beginning. It is here shown, as cut below, the chutes 1 2 3, &c., and doors *d* are placed across the said air-course opposite each pillar of coal P left between the breasts, so as to prevent the air going directly down the said air-course to the shaft F, as it will go when the said doors are all opened.

The breasts or "workings B" are of a height equal to the combined height of the return air-course H and the chutes 1 2 3, &c., and both the air course H and the chutes communicate with the breasts. This air-course and the chutes are in different elevations, so that in passing from one of the breasts to the chute which is opposite to it one must pass over the roof of the air-course. The doors *d* of the air course are distinguished from the doors of the chutes by their positions.

In the working of the mine the breasts get filled up with loose coal to the line of the air-course, so as to obstruct ventilation. Therefore it becomes necessary to provide the air-passages *a*, which are continued from breast to breast by constructing them also along the outer ends of the pillars which divide the breasts.

The air-course H and its doors *d* are seen in Fig. 2. It may be cut above the level of the chutes, instead of below it.

a are air courses temporarily made along each side of the breasts B, and around the ends of the several pillars, by means of plank and timber, rough or hewn, and disposed by the miners as they dig into a breast along the lower edges of the pillars P on either side, so that the timber or plank rest securely in an angular position, forming an air-course of an area, say, four feet wide at its base and six feet high, and which, if of different proportions and size, must be always large enough to admit the ingress and egress of the miners to and from the face of the breast, and to admit an air-current of sufficient volume for the ventilation of the working. I make the air-courses *a* of the dimensions above stated when the breast B is about thirty feet wide.

As the miners push the breast forward, they throw the coal behind them, covering the air-courses *a*, and filling the breast to its roof, as seen in Fig. 3. As they advance, they lay the temporary air-course *a*, in continuation, nearly up to the face of the breasts. The planks and timbers of which the air-courses *a* are built need not be accurately fitted or jointed together, because the masses of broken coal and coal-dust thrown over them, will seal them sufficiently tight for the object in view.

The course of the air through a mine supplied with air-courses and doors or cut-offs according to my invention is indicated by arrows, the air and gases taken from the mine being delivered into the up-cast from the air-course *a* of the nearest breast B, as seen in Fig. 2.

The air-courses *a* remain unobstructed and in good order until the coal is removed from the several breasts, which may be in a longer or shorter period, according to the demands of the market or the convenience of the owners, since the ventilation of the mine is not hindered by letting the coal remain in the breasts.

When a direct return air course is required for any purpose, it is had by opening some of the doors *d* in the air-course H, or all of them, as occasion demands.

The air which descends the shaft A enters the air-course C, and passes thence through its branch *b* into the gangway, where it has free access to and passes along the face where the workmen are engaged driving the main avenue D forward. It then enters the inside chute and passes into the adjoining run or breast B, traversing its air-courses *a* and those of the other breasts, until it reaches the upcast shaft F, and is carried by the fan I or other suitable mechanism out of the mine. The doors *d* prevent it from returning or deviating from its course. They are constantly kept closed, except those in the main avenue, which are opened temporarily to allow the laden cars to pass to the shaft A, through which they reach the mouth of the pit.

Pillars of coal (marked P) are left throughout the mine for its support and systematic working.

The doors in the return air course H tend to compel the air to pass up one side of the breasts to the face where the miners are at work.

The term "face" is the technical name given to the point where the miners are at work extending the excavations of the mine, whether in the gangways, air-courses, headings, or breasts.

The mine may be extended in all directions from the upcast and downcast shafts, and all the excavations be ventilated in the way above explained.

This system of ventilation is applicable to all modes of deep mining without any change in the principle or mode of operation.

The size of the fan I should be greater or less, according to the extent of the workings.

I have used in the Locust Dale Colliery, Pennsylvania, a fan of eight feet diameter by a width of thirty inches clear. The working-speed, or that which is sufficient to effect perfect ventilation throughout the mine, is ninety revolutions per minute, but it can be run with ease to three hundred, at which rate fully sixty thousand cubic feet of air per minute is discharged; but in this mine such a speed produces a perfect storm of wind along the air-courses, and of course is not required nor allowed.

The fan or other apparatus used for exhausting the noxious gases from the mine and keeping up a current of fresh air through it is to be placed in such a position as will be most advantageous for its efficient operation.

My invention is not confined to any peculiar form of mine, as distinguished by the terms "shaft," "slope," "tunnel," &c., but it is applicable wherever an artificial current is required through subterraneous excavations and intricate and numerous avenues, and it inaugurates a system of mining, ventilating, or operative air-courses which will facilitate the economical excavation and mining of coal, and secure the permanent working of the mine and its perfect ventilation.

I do not claim, broadly, the application to mines of the fan as a ventilator, nor do I claim the use of the fan for propelling or forcing a current of air, as hitherto used in mines generally; but

I claim as my invention and desire to secure by Letters Patent—

The use of the fan as an exhauster of the impurities of mines, or for the purpose of creating a partial vacuum in the working parts thereof, in combination with the system of air-courses herein represented and described.

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