(No Model.) 2 Sheets—Sheet 1.

T. SHAW.

SIGNALING APPARATUS.

No. 384,792. Patented June 19, 1888.

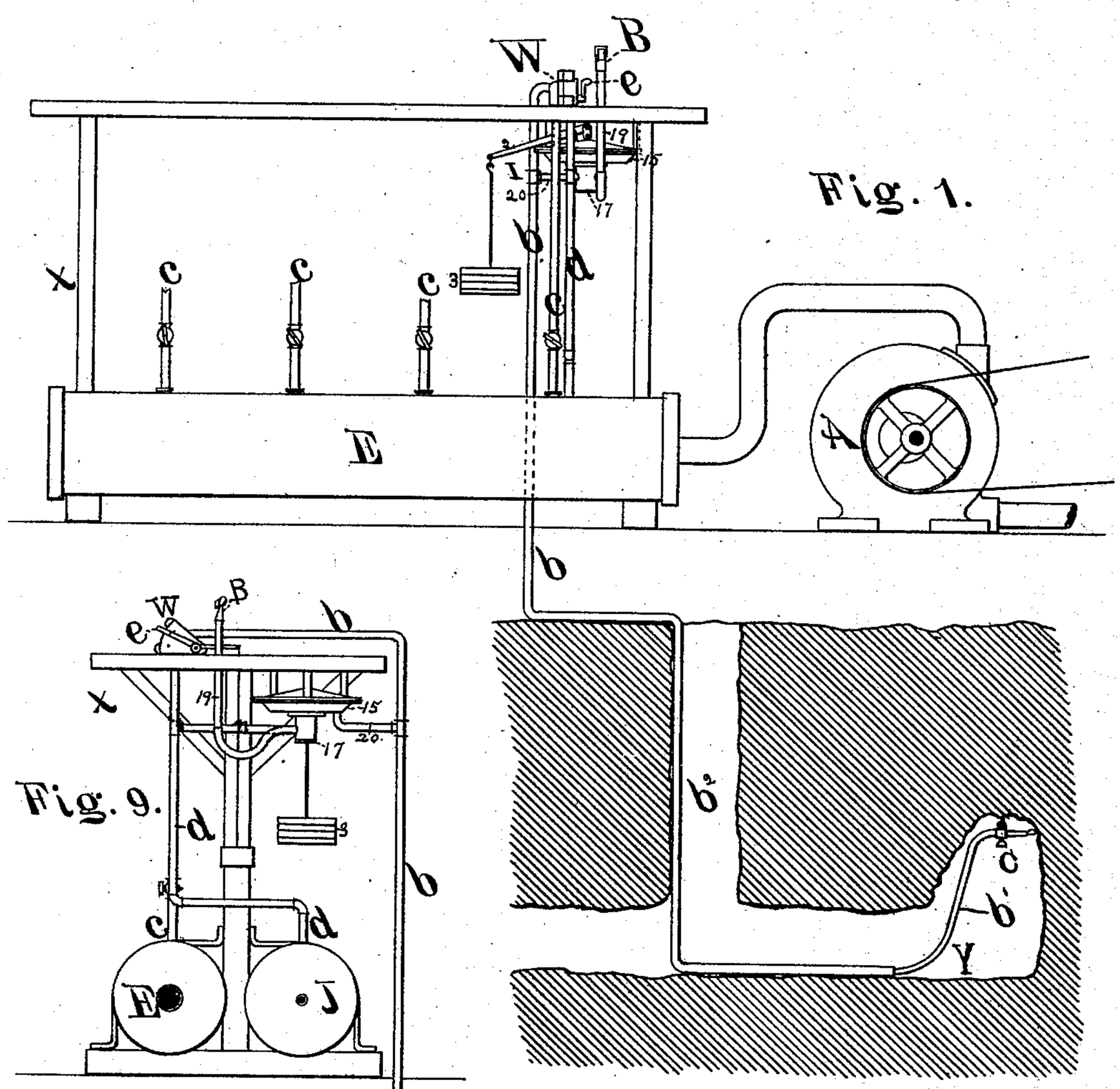

Fig. 1.

Fig. 9.

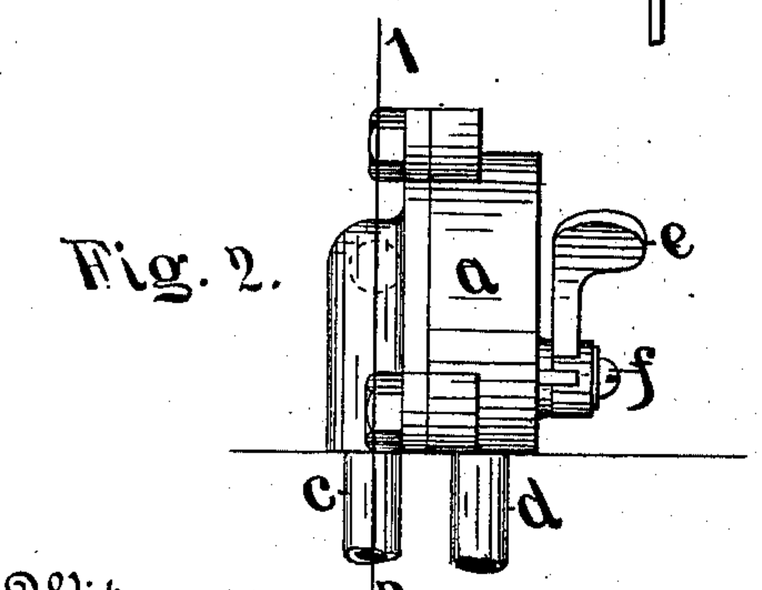

Fig. 2.

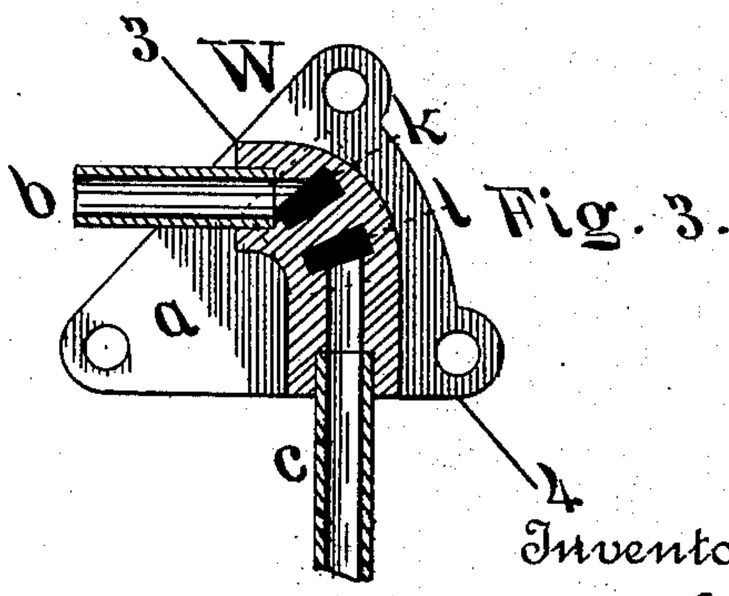

Fig. 3.

Witnesses.
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(No Model.) 2 Sheets—Sheet 2.

T. SHAW.

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Fig. 4.

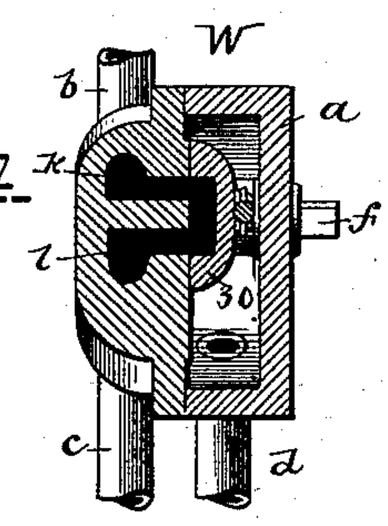


Fig. 5.

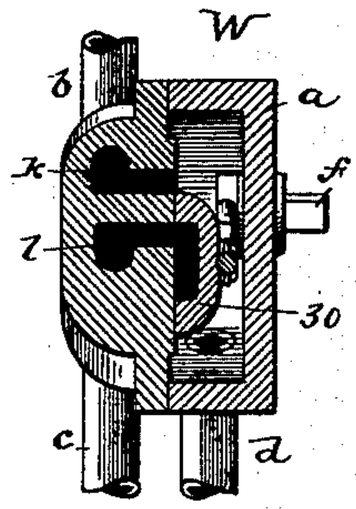


Fig. 6.

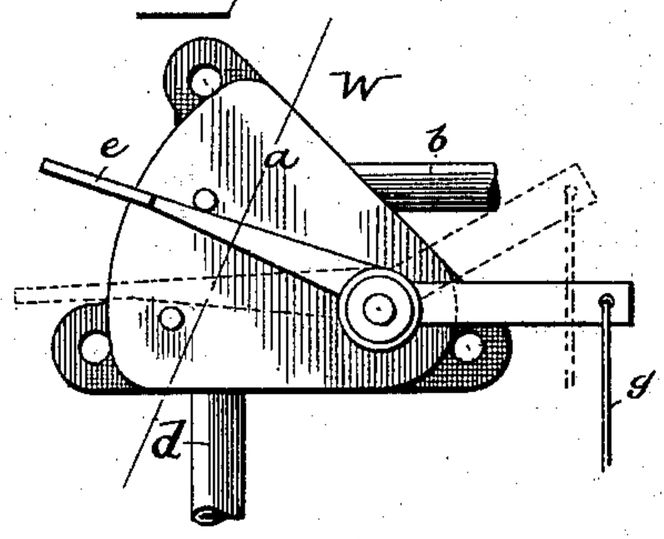


Fig. 7.

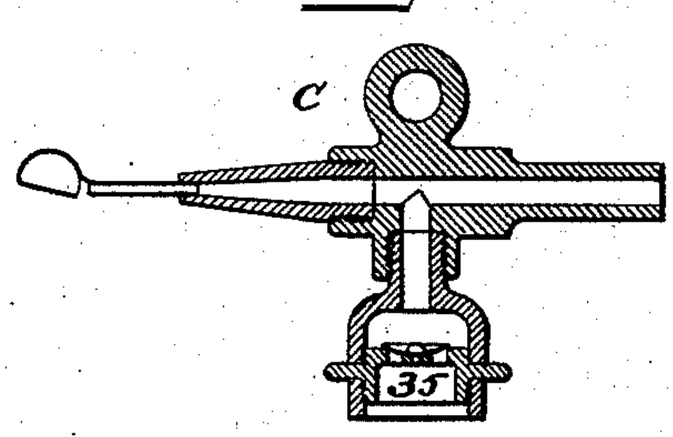
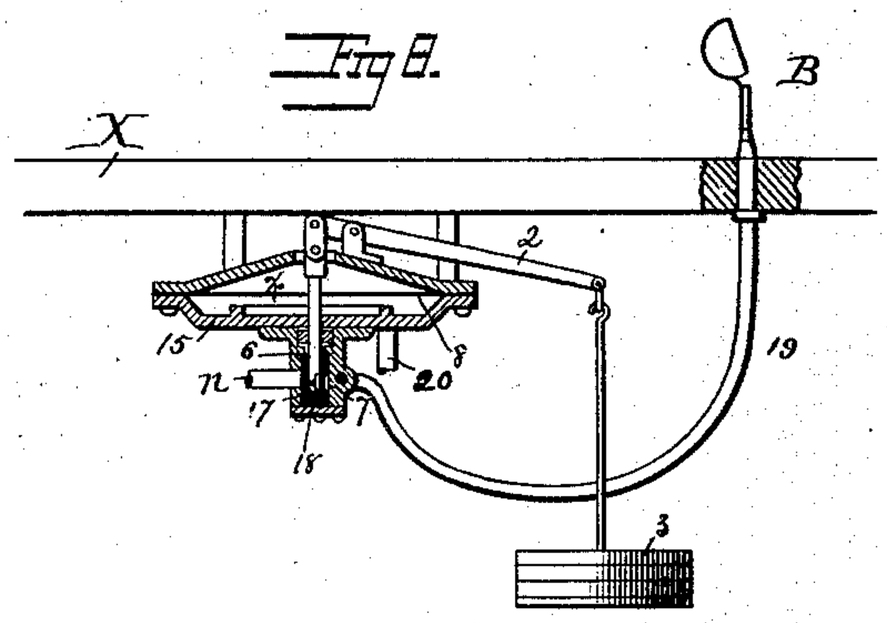


Fig 8.



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Foster & Freeman
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UNITED STATES PATENT OFFICE.

THOMAS SHAW, OF PHILADELPHIA, PENNSYLVANIA.

SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 384,792, dated June 19, 1888.

Application filed September 2, 1887. Serial No. 248,627. (No model.) Patented in England March 8, 1887, No. 3,531; in France March 8, 1887, No. 182,057; in Germany March 8, 1887, No. 41,836; in Belgium March 9, 1887, No. 76,622, and in Canada December 22, 1887, No. 28,222.

To all whom it may concern:

Be it known that I, THOMAS SHAW, a citizen of the United States, residing at Philadelphia, Philadelphia county, State of Pennsylvania, have invented certain new and useful Improvements in Safety Apparatus for Mines, of which the following is a specification.

My invention consists in the certain means fully set forth hereinafter, and which are included in the following foreign patents: Great Britain, dated March 8, 1887, No. 3,531; Canada, dated December 22, 1887, No. 28,222; France, dated March 8, 1887, No. 182,057; Belgium, dated March 9, 1887, No. 76,622; Germany, dated March 8, 1887, No. 41,836, whereby to sound an alarm in a mine from a ground-station, or at the ground-station from within the mine, and for regulating said alarms according to any predetermined system, so as to send messages back and forth between the station and mine-chamber of any suitable character, and to supply fresh air direct to each miner's workings independent of the regular current of air used for ventilation.

The object of this invention is to establish a safe and efficient means of communication with the miner in his workings, and to quickly supply the miner with fresh air in cases of disaster, where the miner is liable to speedy death by white-damp, choke-damp, or excess of marsh-gas, that has heretofore sacrificed so many lives.

In order to enable others to use and practice my invention I will proceed to describe its construction and operation.

On reference to the accompanying drawings, which form part of the specification, Figure 1 is an elevation of the apparatus at the ground-station and diagrammatic view showing the connection with the mine-signal; Fig. 2, an external edge view of the hand-valve device for operating the mine-signal; Fig. 3, a section on line 1 2, Fig. 2; Figs. 4 and 5, sections on line 3 4, Fig. 3; Fig. 6, a side view of said hand-signal device; Fig. 7, a sectional enlarged view of the mine-whistle, with inlet-valve 35; Fig. 8, a sectional enlarged view of the shifting device for sounding the ground-signal; Fig. 9, an end view of the apparatus complete at the ground-station.

One form of apparatus for carrying out my improved system of signaling is illustrated in Figs. 1 and 9, in which X represents a suitable table or stand arranged at the station above ground, and supporting a reservoir, J, containing air under pressure, supplied by hand or power pump, and a tank, E, in which is maintained a partial vacuum by an exhausting-pump or device, A, and upon the table are a number of whistles, B, hand-valve devices W, and automatic valve-shifting devices I, with suitable pipes and connections with each mine-chamber, only one of each of said parts B W I being shown.

The valve device W communicates with the pipe *b*, extending into the mine, and to a chamber, Y, thereof, where it is provided with a terminal flexible section, *b'*, with a whistle, C, or other alarm device at the end constructed to sound upon the flow of air from the tube *b* toward the chamber Y.

The valve device W controls the flow of air through the pipe toward the whistle C.

In the construction shown each valve device W communicates with the pipe *b*, and through a pipe, *c*, with the exhauster A through the tank E, and said valve device consists of a valve-casing, *a*, Figs. 3 to 6, with ports *k* and *l* covered by a common D-valve, 30. The port *k* connects with the tube *b*, and the port L with the tube *c*. The casing of said valve device is also connected through a pipe, *d*, with the reservoir J.

The valve 30 is connected with a shaft, *f*, actuated by a hand-lever, *e*. When the lever is depressed to the position shown in dotted lines, Fig. 6, it rotates the shaft *f* and shifts the valve from over the port *k* to the position shown in Fig. 5, and a weight or spring connected with a wire rod, *g*, Fig. 6, brings the valve back to the normal position shown in Fig. 4. When the valve is in the position, Fig. 4, the air exhausted by the air-pump A flows uninterruptedly from the mine-chamber through the pipe *b*, port *k*, valve 30, and port *l*, and pipe *c*, and tank E to the pump. The compressing of the flexible section *b'* of the

pipe *b* will serve to prevent the flow of air or gas from the mine, and thus cause an exhaust or partial vacuum. I make this the medium of varying the pressure and operating the shifting device I and cause the signal.

The valve-shifting device I may be a motor constructed in different ways to move the valve under the varying pressure within the mine-pipe. As shown, there is a metallic casing, 15, secured beneath the table X, with a chamber divided by a diaphragm, 8, of sheet-rubber secured between two disks, the outer edge of the diaphragm being clamped between the two parts composing the casing. In the center of said diaphragm is secured a valve stem, which passes through an ordinary packing-box, 6, to a valve-casing, 17, and there carries a common slide-valve, 18, covering a port, 7, which leads to a pipe 19, communicating with the whistle B. The diaphragm is connected by a link to a pivoted weighted lever, 2. A tube, *n*, leads to the casing 17 from one of the pipes *c*, communicating with the cylinder J, so that high-pressure air is always present in the valve-casing 17. A tube, 20, forms a communication between the chamber X below the diaphragm 8 and the tube *b* from the mine, so that when the air in said tube is being exhausted there is a tendency to a constant partial vacuum on the under side of the diaphragm 8, tending to draw it downward, which is counteracted by an excess of weight, 3, on the lever 2. When, therefore, the elastic tube *b'* is closed by pressure of the fingers, such a greater vacuum is produced as will draw said diaphragm downward and shift the valve 18, uncovering the port 7 and permitting the air to pass from the reservoir J and pipes *n* and *c* to the casing 17 and port 7, and then through the pipe 19 to the whistle B, which sounds until the compression of the tube *b'* ceases, when the vacuum will be relieved, the diaphragm and valve will rise, and the port 7 will be closed. Thus signals are sent from the mines to the station above, actuated by an exhaustor at the outer end, so that by alternately compressing and releasing the elastic pipe-section *b'* a series of signals may be made according to any predetermined system, which will enable the miners to send any desired information to the central station. When it is desired to reverse the current in the tube *b* for the purpose of signaling back to the mines, the valve 30 of the valve device W is placed in the position, Fig. 5, which closes the port *l* to the exhaust-pump and opens the port *k*, so that air from the reservoir J can pass through the pipe *d*, casing *a*, and through the pipe *b* to the whistle C in the mine, and there sound the signal or alarm, after which the valve, when the hand is removed, immediately recovers its normal position, Fig. 4, and the air passes to the exhausting-pump, as before.

By properly manipulating the lever *e* any desired succession of predetermined signals may be sounded into the mine-chamber.

Instead of the flexible tube-section *b'*, the tube *b* may be provided with a valve or cock for interrupting communication at will.

While I have referred to a whistle, any other suitable alarm device may be used.

While I have shown exhausting and valve-shifting devices of a certain character, I do not limit myself to the precise construction shown, as any skilled mechanic can vary them indefinitely without departing from the main feature of my invention.

While the pump or other air-pressure device and the exhaust-pump or other vacuum device may communicate directly with the mine-pipes, I prefer to use the vacuum-tank E, connected with the exhaust-pump A, which permits of a number of tubes, *c*, Fig. 1, leading from valve devices connected with the pipes of separate mine-chambers to be all connected with one vacuum-chamber and one exhaust-pump. The pipes *c* are provided with ordinary valves to regulate or limit the flow through each separate pipe, and I also prefer to use one pressure tank or reservoir, which may be put in communication with a series of signal devices.

Heretofore miners have not been provided with any means to ward off the deadly effects of the gases known as "choke-damp," (CO_2,) and "white-damp," (CO_1,) and where an excess of carbureted hydrogen cuts off the needful supply of oxygen and suffocation ensues. The statistics of mine disasters show lists of thousands of deaths from this cause, the major portion of which would have been prevented by the means herein set forth for supplying fresh air uncontaminated by mine-gases direct to the individual miner to sustain his life from that source until the regular ventilation has removed the dangerous gases, which can be done in thirty minutes, while at other times it may take many hours, as is evidenced in the history of this class of disaster. In emergencies of this kind the valve device W is operated to open the port *k*, which permits air under high pressure to flow down the tube *b* to the miner, and a casing, 35, containing a valve, Fig. 7, can be detached from the signal device by the miner, permitting air enough to flow down said pipe to supply a dozen men and sustain their lives against suffocating gases.

It will be evident that the exhaust-tubes leading to the mine-chambers may be used in connection with the pump or blower independently of the signaling devices.

Without limiting myself to the precise construction and arrangement of parts shown, I claim—

1. The combination of a mine, a tube leading from a chamber thereof to a terminal station, an air-exhauster and air-pressure device at such station, and a valve controlling the communication between said tube and the exhauster and pressure devices, substantially as described.

2. The combination, with a pipe leading to a mine-chamber and with an exhauster commu-

nicating therewith, of an alarm communicating with the inner end of said pipe, a second alarm near the outer end communicating with an air-tank through a pipe provided with a valve, and a valve-shifter connected with said valve and in line with the communication between the mine-pipe and exhauster, substantially as described.

3. The combination, with the mine-pipe *b*, alarms B C at the terminal station and in the mine, respectively, and air pressure and exhaust pumps, with connections with the pipe *b*, of a valve controlling the flow of air between the exhaust-pump and said pipe and between the pressure-pump and the alarm B, substantially as described.

4. The combination, with the mine-pipe *b*, alarms B C at the terminal station and in the mine, respectively, and air pressure and exhaust pumps, of reservoirs or tanks connected with said pumps, and a valve controlling the communication between the exhaust-tank and mine-pipe and between the pressure-tank and pipe and also with the alarm B, substantially as described.

5. The combination, with the mine pipe and pump connected therewith, and with the alarm at the station end of the pipe, of a chamber communicating with the pipe and provided with a diaphragm and connections between the diaphragm and the alarm whereby the latter is sounded on the movement of the diaphragm under the variation of pressure in the pipe, substantially as described.

6. The combination of a tube leading to a mine, exhaust-pump connected with said tube and with a chamber covered by a diaphragm, a whistle, a valve controlling the passage to the whistle from a reservoir of air under pressure, and a connection between the valve and the diaphragm, and means for interrupting the flow of air through the mine-tube, substantially as described.

7. The combination of the whistle above ground, a whistle in a mine-chamber, connecting-tubes and pump for controlling the flow of air through the mine-tube, a valve for controlling the flow of air to the whistle above ground, a diaphragm in a chamber communicating with the mine-tube and connected to said valve, and a hand-valve constructed to open and close the communication between the exhaust-pump and the mine-tube and also between the exhaust-pump and the chamber covered by the diaphragm, substantially as described.

8. The combination, with a tube leading from a mine-chamber to an outer station, and with a pump controlling the flow of air through said tube, of a valve at the inner end of the pipe, and a signal at the outer end, and a chamber communicating with the tube and having a movable diaphragm connected to operate said signal, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS SHAW.

Witnesses:
J. LOGAN FITTS,
W. J. MOODIE.