(No Model.) 2 Sheets—Sheet 1.

T. SHAW.

APPARATUS FOR TESTING MINE GASES.

No. 394,214. Patented Dec. 11, 1888.

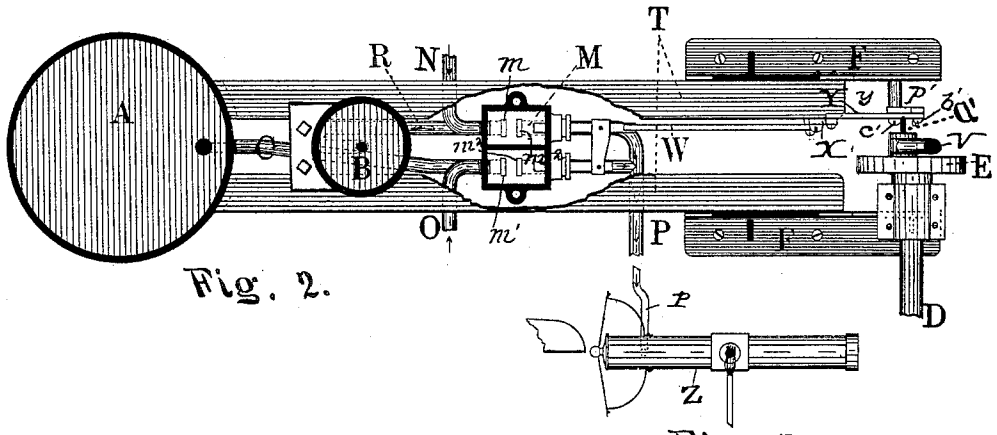


Fig. 2.

Fig. 3.

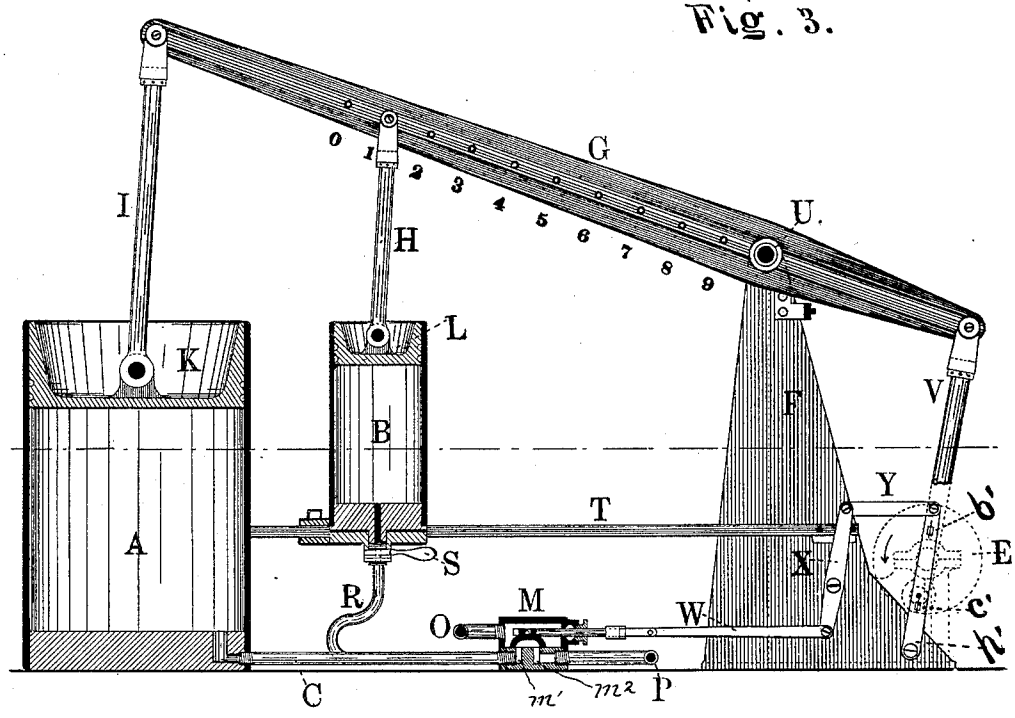


Fig. 1.

Witnesses.
C. A. Shaw
Wm Garwood.

T. Shaw Inventor.

N. PETERS. Photo-Lithographer, Washington, D. C.

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Fig. 4.

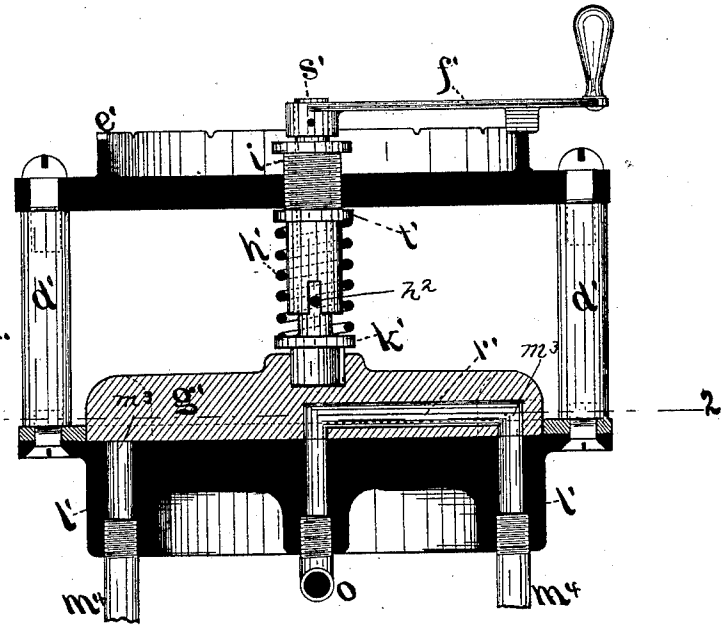
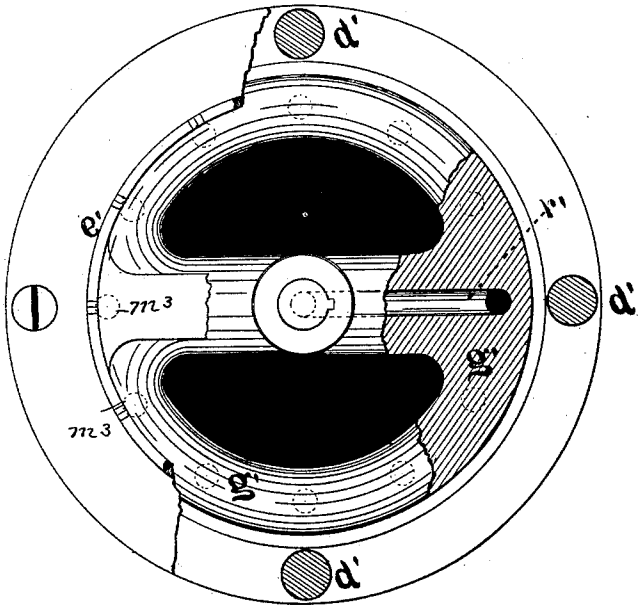


Fig. 5.



Witnesses.
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UNITED STATES PATENT OFFICE.

THOMAS SHAW, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR TESTING MINE-GASES.

SPECIFICATION forming part of Letters Patent No. 394,214, dated December 11, 1888.

Application filed October 21, 1887. Serial No. 252,959. (No model.)

To all whom it may concern:

Be it known that I, THOMAS SHAW, of the city and county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improved Apparatus for Testing Gases, of which the following is a specification.

My invention relates, generally, to the apparatus for testing gases, substantially as set forth in my prior patent, No. 359,102; and it has for its object to provide means which may be used in connection with the apparatus set forth in said patent, whereby a positive fire-test may be obtained from the fire-damp or other gases of mines, which in themselves have a very low per cent. of inflammable gas or are non-ignitible; and my invention consists in providing apparatus, substantially as hereinafter set forth, which may be used in connection with the apparatus set forth in my aforesaid patent, No. 359,102, whereby the low or non-ignitible mixtures of gases coming from the chambers, gangways, shafts, &c., of the mines may be mixed or commingled with any standard gas in such a manner that the mixture will become inflammable, and, further, in arranging the apparatus so that any desired per cent. of the gases from the mines may be mixed with a certain per cent. of the standard gas, and the explosive qualities of the mixture ascertained quickly and without the use of skilled labor, whereby the dangerous qualities of the gases in the mines may be accurately determined.

Referring to the accompanying drawings, which form part of this specification, Figure 1 is a vertical section of one form of apparatus embodying my invention. Fig. 2 is a top plan of the same, partly in section. Fig. 3 is a side view of the gas-testing gun, substantially such as is described in my patent, No. 359,102. Fig. 4 is a vertical section of a valve device which is adapted to be used in connection with my invention; and Fig. 5 is a top plan view of the same, partly in section.

A pump-cylinder, A, is mounted on a suitable base and provided with an ordinary piston, K, which is connected by a pitman, I, to a walking-beam, G, suitably mounted and pivoted upon the standards F, attached to the base-piece. This pump-cylinder A is suitably connected, as by a pipe, C, to a valve device, M, which is connected to a pipe, O, leading directly to that part of the mine from which flows the gas to be tested, or when the apparatus is provided with the valve device (shown more particularly in Figs. 4 and 5,) the pipe O leads directly to said valve, which is provided with suitable connections leading to the different portions of the mine, in a manner hereinafter set forth, so that the gas from any one or more portions may be readily tested.

Adjustably mounted upon suitable supports or ways, as the rails T, is a pump-cylinder, B, the piston L of which is connected by a pitman to the walking-beam G, and means are provided whereby the pitman may be readily attached to different points on the walking-beam, as indicated in Fig. 1, and the pump-cylinder may be adjusted on the rails or ways T to correspond therewith. This pump-cylinder is provided with a connecting-pipe, R, leading to the valve device M, and from there a pipe, N, leads to the gasometer or other receptacle of the standard gas which is to be used in making the tests.

In this connection I would remark that I preferably make use of pure hydrogen gas, although it is evident that any other gas which, when mixed with the gases from the mine, will form an explosive or ignitible mixture may be used as a standard.

The valve device M is duplex, and, as shown in the drawings, consists of a case having two chambers, each with a bottom plate having an ordinary ground face constituting a valve-seat covered by an ordinary D-valve, there being two ports to each valve, as clearly illustrated in the drawings, one of which ports, m, is interposed between the pipe or connection R and the pipe N, leading to the standard-gas reservoir, and the other of which, m', is interposed in the pipe C, leading from the cylinder A to the valve device in the pipe O, leading to the mine or the different portions thereof, as hereinafter set forth. The outlet-ports m^2 of both these valve-chambers are connected with the pipe P, leading to the testing apparatus, as the gun Z of Fig. 3. The two slide-valves of the duplex valve device are also preferably connected to a single valve-rod, W, so that they are operated in unison, and this valve-rod is provided with suitable connec-

tions to be operated in unison with the movements of the walking-beam, so that the properly-mixed gases will be expelled and forced into the testing apparatus at the proper periods of time with relation to the movements of the pistons connected with the walking-beam.

While various means may be used for thus operating the valve, I have shown in the drawings an arrangement whereby I effect this result, in which the valve-rod W is connected at one end to a lever, X, to the other end of which is attached a connecting link-rod, Y, which is also connected to the vibrating lever p'. This vibrating lever p' is provided with two projecting spring-arms, b' c', which extend into the path of a projecting pin or crank-arm, a', which is secured to or rotates with the disk E, fixed upon the revolving shaft D, which is connected to or operated by any suitable motive power. The arrangement of these elastic arms or projections b' c' is such that the crank-pin a' will impinge upon each of them once at each rotation of the disk, and the result is that the vibrating lever p' will be forced to the right or the left, as the case may be, so as to shift the valves at the proper time and in relation to the movements of the walking-beam. The walking-beam is connected by a pitman or crank-arm, V, to the disk E, so that it is reciprocated at each revolution of said disk, in a manner well understood.

The arms or projection b' c' are preferably made of elastic material, so that when the crank-pin a' comes in contact therewith they will yield to a certain extent to prevent shocks to the apparatus, and it will be readily understood that as the crank-pin rotates it will move the vibrating lever p' to operate the valves, when the crank-pin a' will slip by the spring projections b' c' and continue its rotation.

When it is desired to use the apparatus in connection with a number of gangways, shafts, chambers, or mines and to test the quality of the fire-damp or other gas in each one, I provide a cut-off valve substantially like that shown more particularly in Figs. 4 and 5, and interpose it between the mine-chambers and the pipe O. This valve, as shown, consists of a disk, l', provided with a ground surface upon its upper side for the support of the valve g', which valve is shown provided with a single port or passage, r', extending from the end of the central pipe, O, to near the periphery of the valve, so as to be set over one of the numerous ports m^3, the pipes m^4 of which lead to the various sections or portions of the mine. The valve g' is arranged to be rotated around its axis by a spring-crank, f', which is attached to the axle S', which axle is connected to the valve g' by means of a centrally-arranged hub or boss recessed to receive the lower end of the axle S', which is secured thereto by a key, as shown in Fig. 4. A spring, h', is arranged between a collar, k', on the axle S' and a collar, t', on a sleeve surrounding the axle, in order to insure frictional contact of the valve-face with the valve; and the stem S' is journaled in a collar, i, in the upper plate of the valve supported upon the pillars d'.

The valve g' is provided with a series of ports, m^3, around the periphery thereof, as indicated in dotted lines in Fig. 5, and each one of these ports may communicate with a different portion or section of the mine. Upon the top of the valve-case is arranged a notched rim, e', the notches of which correspond with the ports m in the valve, and as the spring-handle f' is rotated to move the valve g' it is evident that by placing the spring-handle f' in any particular notch in the rim the passage or port of the valve will be so arranged as to connect the corresponding port m with the central passage, O, of the valve.

Such being the preferred construction of my device, its operation will be apparent, and is as follows: The exhaust-ports m^3 being connected with the various sections of the mine, when the cut-off valve (shown in Figs. 4 and 5) is used and it is desired to test for fire-damp or other gases in any one of those sections, the handle f' is rotated until the port r' of the valve g' connects the particular exhaust-port m^3 with the pipe or passage O of the valve. The passage through the valve device M being now open, so as to connect the pipes O and N, respectively, with the pipes C and R, leading to the pump-chamber, the walking-beam is raised by hand or by rotating the shaft D, to which it is connected in the manner described, carrying with it the pistons K and L of the pumps A and B. This motion causes a quantity of the gas from the particular chamber of the mine connected through the valve to enter the chamber of the cylinder A, and at the same time a portion of the hydrogen or other gas is drawn from the reservoir into the pump B. As soon as the walking-beam reaches its elevated position, one of the spring fingers or projections b' c' is operated upon by the finger or crank-pin a' to shift the valves of the duplex valve device M, so that the connection with the pipes N and O is closed and the pipes C and R find a connection through the valves into the exhaust-pipe. At this moment, the pistons K and L being depressed, the gas and fire-damp are forced from the respective pumps B and A through the valve and become commingled or mixed in the pipe P, whence they pass into the testing-gun Z, Fig. 3, the operation of which has been fully described and illustrated in my prior patent before referred to.

The normal arrangement and proportions of the pumps are such that the amount of hydrogen or other gas drawn into the cylinder B is to the amount of fire-damp or other gas drawn from the mine into the pump A as one to ten, and of course when the gases are expelled from both these cylinders they become

commingled and mixed in that proportion and pass to the testing-pipe, where they are subjected to the fire or other test.

If it is desired to vary the proportions of hydrogen gas and the fire-damp or other gases from the mines, it is only necessary to adjust the pump B on the ways or rails T and connect the piston L to the walking-beam G in any one of the positions from 1 to 9, as indicated thereon, and then it will be seen that when the pumps are operated and connected as before described the proportions of hydrogen or other gas and the gases from the mines will bear such a relation to each other as is indicated on the scale of the walking-beam.

To more particularly illustrate this feature, suppose the parts to be in the position shown in Fig. 1, and the proportions of the pistons being such that upon the upstroke of the walking-beam ten cubic inches of hydrogen gas will be introduced into the cylinder of pump B and one hundred cubic inches of fire-damp or other gas from the mines will be introduced into the cylinder of the pump A, it is evident that upon the reverse stroke of the walking-beam one hundred and ten cubic inches of gas will pass through the valves M M′ and become mixed or commingled in the pipe P, and will give what is known as a "ten-per-cent. mixture of gases," which is highly explosive and ignites with explosive effect, which would be observed at the test-gun, showing that the gas from the mine contained at least one per cent of carbureted hydrogen. The character of this fire-test is founded entirely upon the fact that only certain per cents. of gases mixed with air are ignitible and that certain definite per cents of mixture are explosive. The first commences at six per cent., while the second commences at ten per cent. The explosive gases are counted explosive when the speed of ignition is of high velocity, giving violent results.

By my arrangement of adjusting the pump B it will be readily seen that I can produce any proportionate mixture of fire-damp or other gases and hydrogen gas by simply adjusting said pump, and this can be accomplished by unskilled labor, as the figures on the walking-beam represent the per cent. of inflammable gas contained in the gases from the mine.

When it is desired to test the gas from any other channel or section of the mine, it is only necessary to move the spring-lever f', so as to bring the port or passage r' over the orifice or pipe m connected with the desired section, and repeat the operations above set forth.

It may be remarked, generally, that the object to be attained in testing mine-gases is to ascertain the fact as to whether the gases in the mine are inflammable or not, and, further, if they are inflammable, to what extent.

In my former patent I have described an apparatus for testing gases by ignition or non-ignition, and it will be evident from the above that the object of my invention is to provide means for carrying out that system when the gases to be tested are of such a low per cent. that they are not of themselves explosive, and this I accomplish by mixing with said gases a certain definite proportion of hydrogen or other gas and subjecting it to the fire-tests, as before set forth.

While I have shown the particular form of gas-tester illustrated in Fig. 3 and described in my aforesaid patent, it will be evident that my improvement may be used in connection with different kinds of testers.

It will also be evident that the pump A may be adjustable instead of the pump B, or that both may be capable of adjustment and that other means than those described may be employed for varying the pumping action—as, for instance, adjusting the crank-pins of a crank-shaft by the rotation of which the pistons of the pumps are actuated.

I do not limit myself to the particular form of pump shown and described, as any skilled mechanic could substitute pumps of a different character with the same effect.

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

1. The combination, with a gas-tester, of two pumps, one communicating with a chamber containing the gases to be tested and the other with a supply of standard gas, and means for varying the pumping action to vary the proportions of the gases forced to the tester, substantially as set forth.

2. The combination, with a gas-testing apparatus, of two supply-pumps connected therewith and with a mine-chamber and standard-gas supply, respectively, and adjustable devices for varying the action of one of the pumps, substantially as described.

3. The combination, with a gas-testing apparatus, of pumps communicating therewith, and one with a mine-chamber and the other with a standard-gas supply, both pistons connected to a single walking-beam and one of the pumps being adjustable in respect to said beam, substantially as set forth.

4. The combination of a gas-tester, two pumps communicating one with the standard-gas supply and the other with a mine-chamber, means for varying the pumping action, a communication between each pump and the tester, and a valve in said communication, substantially as set forth.

5. The combination, with a gas-tester, of two pumps communicating therewith and with a mine-chamber and a standard-gas supply, and a graduated walking-beam connected to operate the piston of each pump, one of the said pumps and its connections being adjustable in respect to said beam, substantially as set forth.

6. The combination of a gas-tester, a pump communicating therewith and with a supply of standard gas, another pump communicating with the tester and with a series of mine-chambers, and a valve whereby either of said

chambers may be put in communication with the latter pump, substantially as described.

7. The combination of the pumps A B, a walking-beam, G, provided with a series of connections for the rod of the pump B, a support upon which the latter pump is adjustable, a valve device controlling the flow of gases from the pumps connected with the walking-beam to be operated thereby, and a gas-tester, substantially as set forth.

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Witnesses:
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WM. GARWOOD.