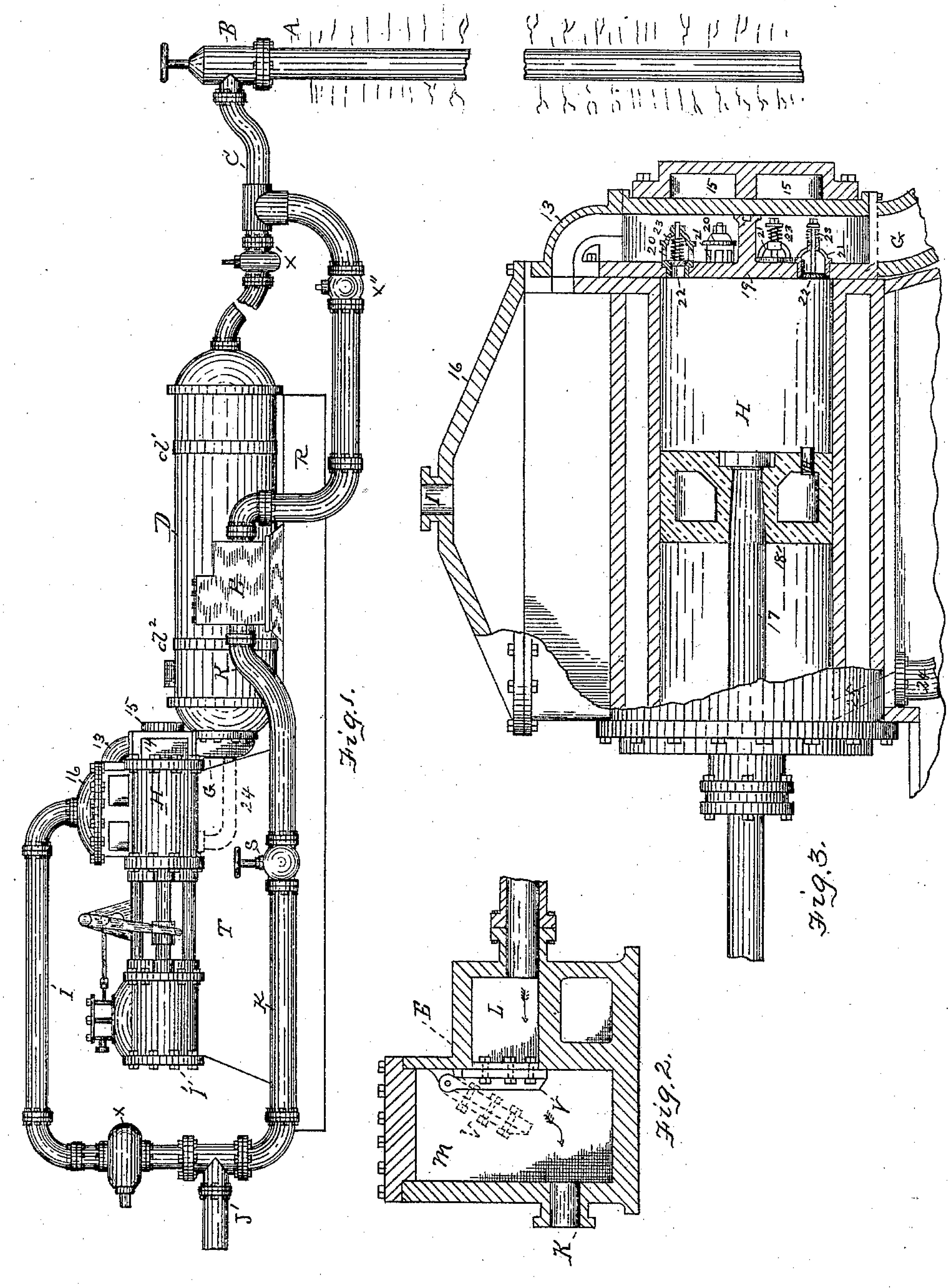
(No Model.)

J. N. PEW.

SYSTEM FOR PUMPING NATURAL GAS.

No. 448,670. Patented Mar. 24, 1891.



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SYSTEM FOR PUMPING NATURAL GAS.

SPECIFICATION forming part of Letters Patent No. 448,670, dated March 24, 1891.

Application filed February 25, 1889. Serial No. 301,056. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH N. PEW, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered a certain new and useful Improvement in Natural-Gas-Pumping Devices, (the system being claimed in application, Serial No. 278,365, already filed by me,) of which the following is a specification.

The purpose of my invention is to devise practical and cheap apparatus for pumping natural gas. Under certain circumstances it becomes highly desirable to increase and reenforce the "well-pressure" of natural gas by the use of pumps. This necessity for pumping may be occasioned either by some unusual demand for gas due to the severity of the weather or by a decline of the field-pressure, which becomes too light to force the gas through miles of pipe to the point of consumption. It is not, however, profitable to pump natural gas at atmospheric pressure for the following reasons: First, the gas is so volatile, rare, and bulky at atmospheric pressure that to deliver any commercial quantity by pumps would require a very large and expensive pump; second, the engine required to drive such a pump would be correspondingly costly; third, when gas is delivered for fuel purposes to mills and dwellings, the first and second reasons are still more apparent; fourth, as natural gas is so thin and volatile at atmospheric pressure, the leakage at the packing of the pump-piston is very great.

I have invented apparatus by which the gas may be received, pumped, and delivered under a high pressure.

The benefits I obtain by pumping under a high pressure are, first, that by reason of the high pressure the density of the gas is greatly increased, so that a greater quantity will occupy any given space, and therefore a much smaller pump will do the required work; second, for the same reasons a smaller engine will furnish sufficient power; third, as the gas is more dense, the leakage at the packing of the pump-piston will be materially diminished and a greater quantity of gas delivered.

The pressure required to condense the gas for pumping I derive primarily from the gas-field. My method of utilizing this natural force is more fully and specifically described below.

In the accompanying drawings, which make part of this specification, Figure 1 is a side elevation of my system. Fig. 2 is a central longitudinal section of a check-valve E. Fig. 3 is a like view of the pump-cylinder.

A shows a gas-well suitably cased. The well is turned on and off by the valve E. A main C runs from the well A to a receiving-tank D, which is secured to the timbers R R by iron straps d' d^2. The receiving-tank D is connected to a steam-pump H by the pipe G. The pump is worked by the usual engine, of which the cylinder I is shown in the drawings. A main I' extends from the pump to the delivery-main J. K K is a by-pass or "cut-around" connecting the delivery-main J with the field-main C.

X, X', X'', and S are valve-gates used as hereinafter described.

E is the ordinary check-valve, with a flap V and the usual chambers L and M before and behind said flap.

It is a well-known fact that nearly any gas-field will give a natural pressure of at least one hundred and fifty pounds when the well is shut in. Without any difficulty, then, the gas can be put under a pressure of ten atmospheres. By a well-known law of gases it is apparent that such a pressure will reduce the volume of gas to one-tenth of its atmospheric volume and increase its density tenfold. We start, then, with these important advantages: first, an accumulated pressure of one hundred and fifty pounds, and, second, a resulting density of ten times that given by atmospheric pressure alone. This natural pressure and increased density are carefully maintained and utilized. The valve E is opened and the gas at a pressure of one hundred and fifty pounds enters the main C, passes through the open valve-gate X' into the receiving-tank D, which is of proper size to act as a constant and adequate reservoir of gas to supply the pump H. From the receiving-tank D the gas passes through a large connection G to the pump H. A desirable form of this pump H is shown in Fig. 3 in longitudinal section. The gas is admitted through the ports 21 of the valves 22 in the lower half of the cylinder-head 19, which is separated from the upper half by a diaphragm 12. These valves in the lower half of the head are arranged to open inwardly and are seated by springs 23.

20 is the valve-guide. The valves work in the space 14. When the piston 18 moves forward on its rod 17, the valves on the lower half of the cylinder-head close and the valves on the upper side of the diaphragm, which are set to open outwardly, discharge the gas through the exit 13 into the dome 15 of the pump and out into the main I′. To equalize the gaseous pressure on both sides of the piston, gas is delivered also into the rear of the cylinder through a large pipe 24 and the inlet-opening 25, pipe 24 being supplied from the main C, as shown in Fig. 1. The entire pump-cylinder is surrounded by a water-jacket 15 15 to absorb and receive the heat generated by working the pump. The pump-piston therefore moves equally balanced in a gaseous atmosphere of one hundred and fifty pounds pressure (less any loss due to leakage and friction) before any steam is applied. Now, assuming that an additional steam-pressure of one hundred and fifty pounds is applied, the gas will be forced out of the pipe I′ at a pressure of three hundred pounds—the sum of the natural and the artificial pressure. The density of the gas at three hundred pounds pressure will of course be twenty times that of its density at atmospheric pressure and its volume one-twentieth of its atmospheric volume. On the back-stroke of the piston the gas behind the piston is forced back into the pipe 24. It follows, then, that a comparatively small pump and an equally small engine will pump a gas of such density and secure the same results with a large pump and a large engine pumping the rare gas at atmospheric pressure. For example, it can be computed that a pump-cylinder containing only three cubic feet will pump daily more than four million cubic feet of gas at atmospheric pressure.

The reduction in leakage around the packing of the pump-piston by pumping the gas under pressure has already been noted.

Should the natural pressure of the gas be sufficient under ordinary circumstances to supply the necessary quantity of gas, the receiving-tank D, the pump H, and engine I may all be cut out of the circuit by the gate-valves X′ X and the gas flow through the by-pass K K direct to the delivery-main J through the open check-valve E and the open gate-valve S′. The gate-valve S′ is desirable in my system should the check-valve E fail to properly work. The valve X″ is used to cut off the by-pass K K when desired. Should a still further pressure than that given by the wells and first pumping-station be desired, I propose to duplicate my system or its essential features at proper intervals between the field and the market. At each of these auxiliary or relay stations I take the same care and precautions to maintain and preserve the pressure in the main and introduce the gas at the highest possible pressure into the pump-cylinder and by the same arrangement of valves before noted, the reason for so doing being the same as those given in describing the original station.

At each station the pumps may be worked singly and in pairs, as circumstances dictate. While for the reasons before cited the receiving-tank D is beneficial, it is not absolutely essential to my system, for the gas may be piped immediately into the pump from the well. The by-pass K K, while highly useful when it is necessary to repair the pump or engine or cut them out of the circuit for any reason whatever, may be omitted. Should a break occur in the pump or engine and no by-pass be used, the gas must be shut off from the consumer.

It is apparent that a gas-engine, hot-air engine, or any other suitable motive power may be used to operate my pump. Should the field-pressure fall very low, I propose to use a series of pumps right at the field, the first of which shall receive the gas at the field-pressure, the second at the increased pressure at which the gas is delivered from the first pump, the third at the increased pressure at which the gas is delivered from the second pump, &c., until a sufficient pressure is obtained to turn the gas into the delivery-main.

My pump may readily be made so that the gas will be admitted into the cylinder on one side only of the piston. All the advantages of pumping gas under pressure will then be gained; but additional steam-power will be required, as the gas-pressure on the piston will be unbalanced and must be overcome.

The pump here shown is only illustrative, as many varieties of pumps would accomplish substantially the same results.

In pumping gas at high pressure there would probably be some leakage around the piston-head, so that the piston would not be entirely unbalanced, even if the gas were admitted on one side thereof only.

By the expression "natural pressure" I mean the pressure which the gas itself will be under before any steam or other generated pressure is applied thereto.

By "artificial pressure" I mean such pressure as is generated by the application of steam or other like power to the gas.

By the term "combined pressure" I mean a pressure which is the sum or result of both natural and artificial pressure.

By the term "pressure" I mean either artificial, natural, or combined pressure.

By "natural density" I mean the density which results from such natural pressure above defined.

By "artificial density" I mean the density which results from such artificial pressure.

Having fully described my invention, I claim—

1. In a system for pumping natural gas, the

combination of a receiving-tank connected with the field, a pump adapted to receive gas under pressure on both sides of the piston and connected with said receiving-tank, an engine working said pump, a delivery-main leading from said pump to the point of supply, and a by-pass connecting said delivery-main with the field-line, the whole system being provided with suitable valves, all substantially as and for the purposes set forth.

2. In a system for pumping natural gas, the combination of a receiving-tank connected with the field, a pump adapted to receive gas under pressure into the pump-cylinder and connected with said receiving-tank, an engine working said pump, a delivery-main leading from said pump to the point of supply, and a by-pass connecting said delivery-main with the field-line, the whole system being provided with suitable valves, all substantially as and for the purposes set forth.

3. In a system for pumping natural gas, the combination of a receiving-tank connected with the field, a pump adapted to receive gas under pressure on both sides of the piston and connected with said receiving-tank, an engine working said pump, and a delivery-main leading from said pump to the point of supply, the whole system being provided with suitable valves, all substantially as and for the purposes set forth.

4. In a system for pumping natural gas, the combination of a receiving-tank connected with the field, a pump adapted to receive gas under pressure into the pump-cylinder and connected with said receiving-tank, an engine working said pump, and a delivery-main leading from said pump to the point of supply, the whole system being provided with suitable valves, all substantially as and for the purposes set forth.

In testimony whereof I have hereunto set my hand.

JOSEPH N. PEW.

Witnesses:
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WM. L. PIERCE.