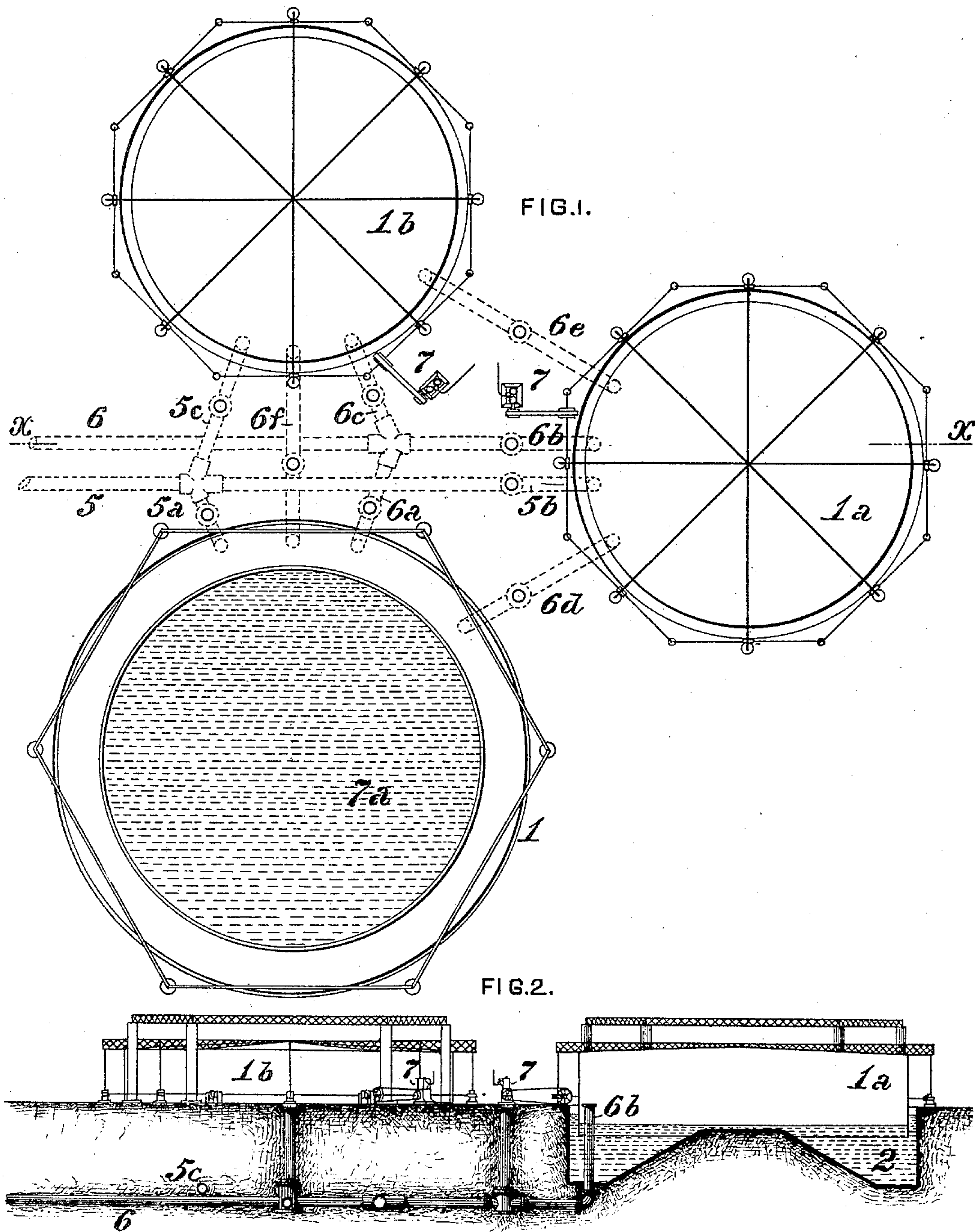


(No Model.)

F. MOORE.
SYSTEM OF GAS STORAGE AND DELIVERY.

No. 442,325.

Patented Dec. 9, 1890.



WITNESSES:

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UNITED STATES PATENT OFFICE.

FRANK MOORE, OF PITTSBURG, PENNSYLVANIA.

SYSTEM OF GAS STORAGE AND DELIVERY.

SPECIFICATION forming part of Letters Patent No. 442,325, dated December 9, 1890.

Application filed January 6, 1890. Serial No. 335,993. (No model.)

To all whom it may concern:

Be it known that I, FRANK MOORE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Systems of Gas Storage and Delivery, of which improvement the following is a specification.

The object of my invention is to provide for the storage and continuous delivery to distributing-mains of gas at a delivery pressure of higher degree than that at which it is received from the source of generation or primary supply; to which end my invention, generally stated, consists in the combination of two or more gas-holders, each working in a hydraulic seal-tank, means for mechanically elevating and depressing the gas-holders in their respective tanks, and valved pipes connecting the gas-holders one with the other and with inlet and outlet pipes.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a plan or top view of an apparatus for storing and delivering gas embodying my invention, and Fig. 2 a vertical section at the line *x x* of Fig. 1.

In the practice of my invention I provide a series of two or more gas-holders, in this instance three holders 1, 1^a, and 1^b being shown, which are of the ordinary cylindrical type and are fitted to move vertically in tanks of water 2, to which their lower ends are open and by which they are sealed in the usual manner. An inlet-pipe 5, leading from the source of generation or supply, communicates with pipes 5^a, 5^b, and 5^c, which are controlled by valves and extend upwardly into the gas-holders 1, 1^a, and 1^b, respectively, their upper ends being open and located above the highest level of the water in the several tanks. Discharge-pipes 6^a, 6^b, and 6^c, controlled by valves and similarly extending into the gas-holders 1, 1^a, and 1^b, communicate with an outlet or delivery pipe 6 and pipes 6^d, 6^e, and 6^f, which are likewise governed by valves and extend each into two gas-holders—that is, the pipe 6^d into the holders 1 and 1^a, the pipe 6^e into the holders 1^a and 1^b, and the pipe 6^f into the holders 1^b and 1—and admit of communication being established between

one holder and another as from time to time required in the operation of the apparatus.

When two gas-holders only are employed, each of said holders is adapted to be mechanically elevated and depressed in its tank in order to effect the compression of the gas in the holders, and also its exhaustion from the inlet-pipe into the holders when the conditions of supply are such as to require such exhaustion. To this end each of the two holders is provided with a steam-engine or other motor 7, which, through suitable gearing and connections, elevates and depresses the holder as required. Such construction does not in and of itself constitute part of the invention herein claimed, and being, moreover, exemplified in an application for Letters Patent, filed by me January 2, 1890, Serial No. 335,621, will not be herein at length set forth.

In the case of the employment of three or more gas-holders, one of the same, as in this instance the holder 1, which is used as the final or delivery holder, is made of considerably greater capacity than the others, and may be loaded with a weight, as a tank of water 7^a, fixed upon its top, to maintain the desired delivery pressure, instead of being provided with a direct power-actuated motor for depressing it, as in the preceding case, its elevation being effected by the inflow of the gas under pressure. The remaining gas-holders of the series are provided with motors and gearing for applying power therefrom to the holders, as before specified.

In operation, assuming first that two gas-holders are employed, one of said holders, as 1^a, is first filled with gas at the supply-pressure from the inlet-pipe 5, and the holder is then depressed and the gas compressed therein to final-delivery pressure. The valve of the pipe 5^b is then closed and that of the pipe 5^c is opened, and the holder 1^b is filled with gas at supply-pressure and the gas similarly compressed by the depression of said holder. During the filling of the holder 1^b and the compression of the gas therein the valve of the discharge-pipe 6^b is opened, and the gas at higher pressure in the holder 1^a is discharged to the outlet-pipe 6 and delivery-main. When the compression of the gas in the holder 1^b is completed, the valve of the pipe 5^c is closed and that of the pipe 6^c is

opened, and the compressed gas from the holder 1^b is discharged to the outlet-pipe and delivery-main, the operation of refilling and compression of the gas in the holder 1^a being
5 meanwhile again effected. A continuous storage and delivery of gas at a pressure greater than that of the supply is thus maintained, and the holders are enabled to serve as exhausters where the employment of the
10 same is necessary or desirable, one of the holders being moved upward while the other is moved downward.

In the case of the employment of a series of more than two gas-holders, one of said
15 holders, as 1, is preferably made of comparatively large capacity relatively to the others and is used as the delivery-holder, being either weighted, as shown, by a tank of water 7^a or other weight fixed upon it, to effect the
20 maintenance of the desired delivery pressure, or being provided with a motor and gearing for depressing it by the application of power. The remaining holders of the series are provided with actuating-motors and valved pipe-
25 connections, as before described.

In operation the holder 1^a is first filled with gas at supply pressure, which is then compressed to delivery pressure by the depression of the holder 1^a, during which the holder
30 1^a forces the gas at such pressure into the delivery-holder 1. While the gas is being compressed in the holder 1^a the holder 1^b is receiving gas at supply pressure, the charge of gas being then compressed by the depression
35 of the holder 1^b. When the holder 1^b has been filled, the holder 1^a has completed its discharge into the holder 1, and the holder 1^b then commences to compress and discharge at delivery pressure into the holder 1, during
40 which compression the holder 1^a is being again charged at supply pressure for subsequent compression and delivery.

Two comparatively small holders, which can be constructed at inconsiderable cost and
45 readily and economically operated, may under this construction be employed to charge a comparatively large delivery-holder, thus insuring a continuous delivery and giving an ample capacity for storage during periods in
50 which gas is not being supplied.

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

1. The combination of two gas-holders, each working in a hydraulic seal-tank, depressing mechanism connected to each of said holders
55 for the compression of the contained gas by the positive application of power, valved inlet and outlet pipes leading into each of said holders, and a valved pipe leading from one holder into the other, substantially as set
60 forth.

2. The combination of two or more compressing gas-holders, each working in a hydraulic seal-tank, motors connected with each of said holders and adapted to effect the ele-
65 vation and depression thereof in their tanks, valved inlet and outlet pipes leading into each of said holders, an independent delivery gas-holder, valved pipes leading from the delivery-holder into each of the compressing-
70 holders and from each compressing-holder into another compressing-holder, and a valved pipe leading from the delivery-holder into the outlet-pipe, substantially as set forth.

3. The combination of two or more com-
75 pressing gas-holders of relatively small capacity, each working in a hydraulic seal-tank, motors connected with each of said holders and adapted to effect the elevation and depression thereof in their tanks, valved inlet
80 and outlet pipes leading into each of said holders, an independent delivery gas-holder of comparatively large capacity relatively to the compressing-holders, a weight fixed to said holder to maintain required delivery-
85 pressure therein, valved pipes leading from the delivery-holder into each of the compressing-holders and from each compressing-holder into another compressing-holder, and a valved pipe leading from the delivery-holder into the
90 outlet-pipe, substantially as set forth.

In testimony whereof I have hereunto set my hand.

FRANK MOORE.

Witnesses:

J. SNOWDEN BELL,
R. H. WHITTLESEY.