(No Model.)

G. WESTINGHOUSE, Jr.

SYSTEM FOR CONVEYING AND UTILIZING GAS UNDER PRESSURE.

No. 301,191. Patented July 1, 1884.

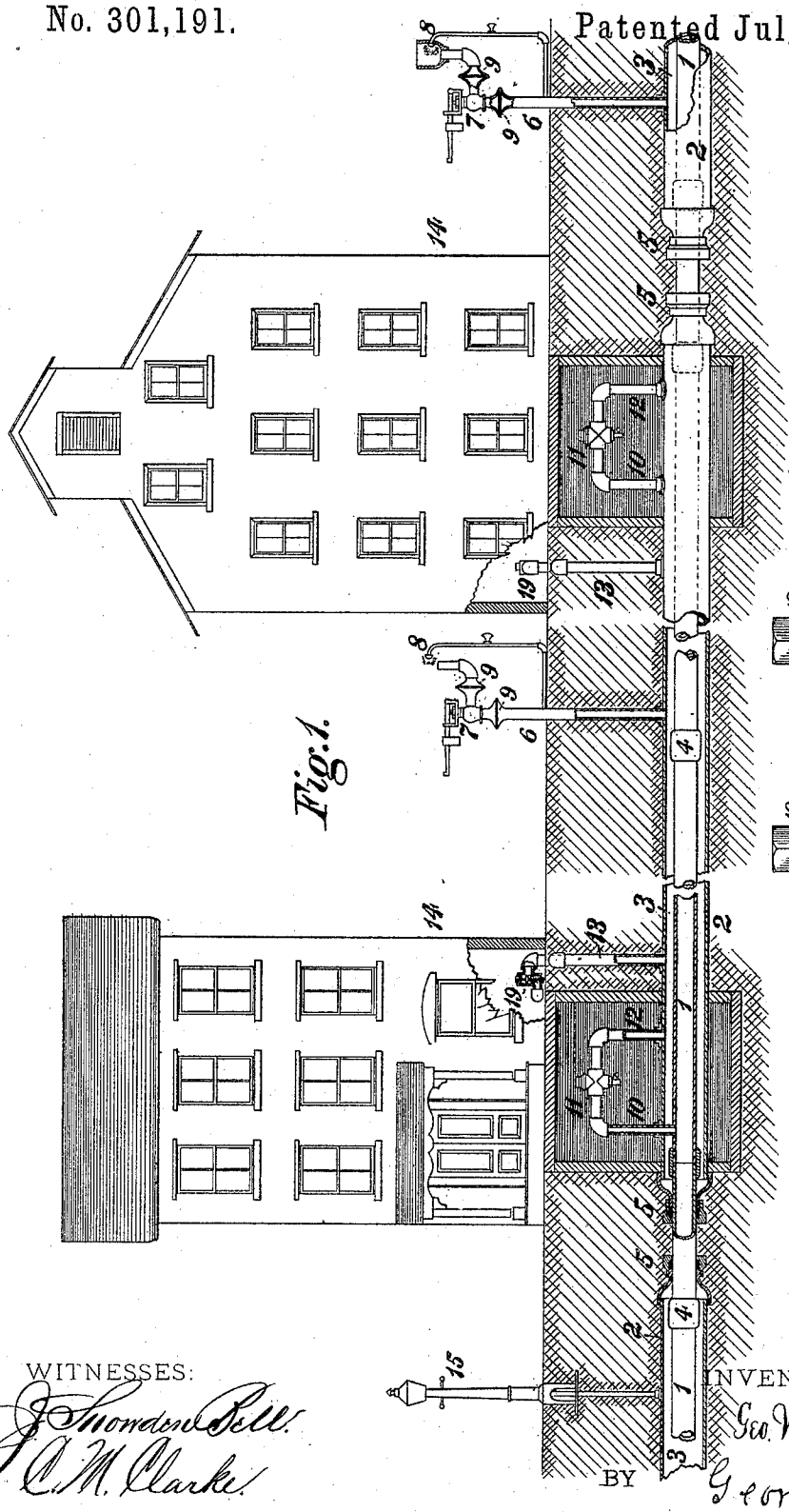

Fig. 1.

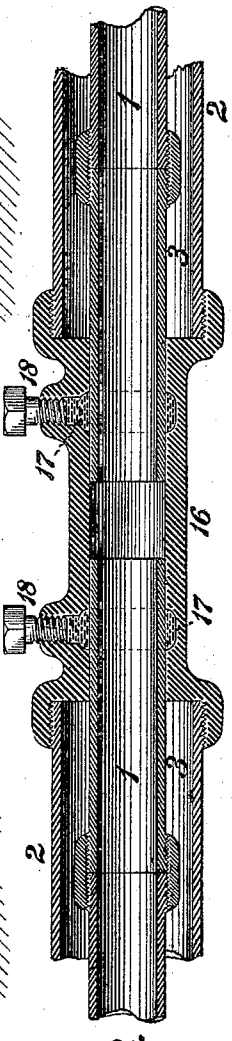

Fig. 2.

WITNESSES:

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SYSTEM FOR CONVEYING AND UTILIZING GAS UNDER PRESSURE.

SPECIFICATION forming part of Letters Patent No. 301,191, dated July 1, 1884.

Application filed June 6, 1884. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered certain new and useful Improvements in Systems of Conveying and Utilizing Gas under Pressure, of which improvements the following is a specification.

In the accompanying drawings, which make part of this specification, Figure 1 is a longitudinal section through portion of a gas-pipe line, illustrating the application of my invention; and Fig. 2, a similar section showing a modification in the means for connecting the sections of the casing and conduit.

The objects of my invention are to afford protection against accidents due to leakage of gas at high pressure from the conduit or main conducting-pipe in which it is transported from the source of production or generation to the locations at which it is to be delivered for consumption or storage, to effect the retention and utilization of gas that may leak from said conduit in passing through the same, and to provide for the delivery of gas at desired points in the line and at determined pressures below that of the gas in the main conducting-pipe.

The improvements claimed are hereinafter fully set forth.

My invention, while designed more particularly for use in the conveyance and distribution of what is termed "natural gas"—that is to say, gas which issues from wells or cavities in the earth—is equally and similarly applicable in dealing with any other gas of high pressure, and of such character as to render its escape dangerous or objectionable. In the conveyance of natural gas through pipes great difficulty has been experienced in preventing its leakage therefrom, owing to its high pressure and the facility with which, when under such pressure, it makes its way through comparitively-tight joints, and through pores, cracks, or other minute openings in the material by which it is inclosed. The gas being extremely subtle, and usually destitute both of color and of odor, its leakage or escape is difficult of detection, and being, when mixed with atmospheric air, highly explosive, such leakage, in addition to the waste which it entails, subjects life and property in the vicinity of the line of conveyance of the gas to the risk of accidents of a serious and disastrous character, against which it is of the highest importance, particularly within city limits, to provide an efficient safeguard. Further, in the utilization of the gas for household and light manufacturing purposes, its employment is practicable and desirable only at pressures practically constant and materially lower than that which is exerted in the main line of the conducting-pipe, or which may be required for its consumption upon a larger scale, or for its conveyance through a long line and storage or consumption at the termination thereof. My invention enables the requirements above stated to be satisfactorily complied with, and involves neither complication nor undue expense in application, nor liability to failure or derangement in the operation of the system in which it is employed.

In the practice of my invention I inclose the conduit or conducting-pipe through which the high-pressure gas is conveyed within a protecting-casing, forming compartments which are continuously charged with gas at low pressure, and which receive and retain any leakage from said conducting-pipe, the compartments being provided with vent-pipes governed by safety-valves, to relieve any excess of internal pressure. Each compartment communicates, through a pressure-regulating valve adapted and adjusted to maintain the desired delivery-pressure in the compartment, with the main conducting-line, the leakage, if any, into the compartment being utilized as a part of the supply thereof, and correspondingly reducing the amount delivered thereto through the pressure-regulating valve, and the gas is taken off for consumption at low pressure at points along the line through service-pipes leading from the compartments to the points at which the gas may be required.

Referring to the drawings, the main conduit 1, through which the gas is conveyed from the well or other source of production or generation to the point or points of consumption or storage, is inclosed within a tight casing, 2, which, not being required to resist as high pressure as the main conducting-pipes, need

not be made of as great strength as the latter. The casing 2, which is of larger diameter than the main conducting-pipe 1, so as to form around the same a chamber or receptacle, 3, designed to be continuously charged with gas at low pressure, is by preference made in separate sections, as shown, of any desired and convenient length, thereby forming a series of independent chambers, each inclosing a series of the connected lengths of main conducting-pipe 1 and their couplings 4, and being interposed between the joints of said pipe and the outer air or earth, according as the line of pipe extends above or below ground. The joints of the ends of the casings 2 with the pipes 1 are packed in any suitable manner, as by glands 5, and packing compressed therein, so as to prevent the escape of gas thereat, as well as to admit of relative longitudinal movement as between the casing and main line of pipe, in accordance with expansion and contraction of the metal under variations of temperature.

Fig. 2 illustrates a construction in which expansion and contraction are provided for and tight joints insured between the conduit and casing by means of tubular couplings or connections 16, to the ends of which the casing-sections 2 are tightly secured, so that the couplings form the heads or end boundaries of said sections, and which are bored out truly to admit the correspondingly-turned ends of two adjacent sections of the conduit 1, which fit tightly within the coupling 16, with the capacity of longitudinal movement relatively thereto. Packing 17, of lead or other suitable material, is inserted in internal recesses in the coupling surrounding the conduit-sections 1, and may be tightened, as required, by clamping-screws 18, so as to prevent communication between the conduit and the compartments of the casing. Said construction does not, however, constitute, *per se*, part of my present invention, and it is not therefore herein claimed, but, with modifications providing for the expansion of both the conduit and the casing, will be set forth in a separate application for Letters Patent by me to be filed in due time. Each of the chambers or compartments 3, included between the casing 2 and the conduit 1, is provided with a vent or escape pipe, 6, leading from said compartment to a point at which gas may be discharged, without injury or inconvenience, into the atmosphere, said vent-pipe being closed by a safety-valve, 7, which is loaded, so as to open upon any increase of pressure within the compartment 3 above a determined point within the capacity of safe resistance to outward pressure of the casing 2. A small burner or gas-jet, 8, may be located adjacent to the discharge opening of the vent-pipe 6, in order to ignite and consume any gas that may escape therefrom, and to guard against liability to ignition of the gas in the compartment a screen or diaphragm, 9, of finely-perforated sheet metal, as in a Davy safety-lamp, may be fitted across the vent-pipe on either or both sides of the safety-valve. The jet or burner should also be inclosed in a suitable casing to prevent its extinguishment by accident or unauthorized interference. The vent-pipes may be arranged to serve for street-lighting purposes by providing for the issue of a properly-limited and constant supply of gas therefrom during such period as light is required. A supply of gas at such pressure as may be desired for domestic or other service along the line is afforded to and insured in each compartment 3 of the casing by a supply-pipe, 10, leading from the conduit 1 to the chest or case of a pressure-regulating valve, 11, of any suitable and preferred construction, located on the outside of the casing 2, the regulating-valve chest communicating by a delivery-pipe, 12, opening into said casing, with the compartment 3 thereof. Service-pipes 13, connected to the casing 2 at suitable points, convey low-pressure gas therefrom to the several localities of utilization, as buildings 14, street-lamps 15, &c., at which its delivery may be desired, and said service-pipes are provided with valves 19, adapted to close outwardly under any sudden increase of pressure in the compartment 3, and thereby prevent access thereof to the delivery or discharge openings of the service-pipes. The regulating-valve is inclosed in a box or casing, so as to be readily accessible when required, and may be either an ordinary cock or valve adjusted by hand, or an automatically-acting valve governed by a weight or spring, and adapted to be adjusted to required pressures, as is well known in regulators of such character employed in gas, steam, and water pipes. Intercepting diaphragms of finely-perforated sheet metal may be fitted in the service-pipes to prevent the access of fire through said pipes to the gas in the compartments 3.

While I have herein shown the casing as composed of separate sections forming independent and detached compartments, such construction being desirable, particularly in point of facility of application, renewal and repair, and facility of access to and repair of leaks or defects in the conduit, I do not limit myself to the employment of a casing of such character, as corresponding functions may be equivalently performed in the system by a continuous casing. Further, the casing may be made of sufficient strength to serve upon occasion for the conveyance of the current of high-pressure gas, if desired; and to this end, when in separate sections, as above described, the several compartments may be connected by pipes governed by suitable valves or gates.

It will be seen that the results attained by my improvements are threefold—to wit: (*a*) the prevention of leakage of gas from the conducting-pipe into the earth or atmosphere, (*b*) the retention and utilization as a portion of the supply to points along the line of such gas

as may leak from the conducting-pipe, and (c) the delivery of gas at determined pressure below that existing in the conducting-pipe to desired points of utilization. The apparatus required is simple and inexpensive, and is of ready application under any of the conditions and requirements of the conveyance and distribution of gas, whether manufactured from carbonaceous material or evolved from the earth.

I claim herein as my invention—

1. The improvement in the method of conveying high-pressure gas and supplying the same for use, which consists in storing the leakage from the main conduit, combining the same with a direct supply at reduced pressure from said conduit, and delivering the supply derived from leakage and normal issue, as either may predominate, to the desired point or points of utilization, substantially as set forth.

2. The combination of a high-pressure-gas conduit, a chamber or compartment surrounding said conduit, and a pipe leading into said compartment and serving to supply and maintain a continuous charge of low-pressure gas therein, substantially as set forth.

3. The combination of a gas-conduit, a closed casing forming a chamber or compartment surrounding said conduit, pipes establishing communication between said conduit and said compartment, a pressure-regulating valve governing said communicating pipes, and a service-pipe leading from said compartment to a desired point of gas-delivery, substantially as set forth.

4. The combination of a gas-conduit, a chamber or compartment surrounding said conduit, a vent-pipe leading out of said compartment, a safety-valve governing said vent-pipe, and a gas-jet or burner located adjacent to the discharge-opening of the vent-pipe, substantially as set forth.

5. The combination of a gas-conduit, a chamber or compartment surrounding said conduit, a pipe leading out of said compartment and serving to convey gas therefrom, and a flame-intercepting partition or diaphragm fitted in said pipe, substantially as set forth.

6. The combination of a gas-conduit, a chamber or compartment surrounding said conduit, a pipe for supplying gas to said compartment at a lower pressure than that existing in the conduit, a service-pipe leading from said compartment to a point of delivery for utilization of the gas, and a valve governing said service-pipe and fitted to close outwardly therein upon a sudden increase of pressure in the compartment, substantially as set forth.

7. The combination of a gas-conduit, a closed casing forming a chamber or compartment surrounding said conduit, a pipe leading from said conduit to said compartment, a pressure-regulating valve governing said pipe, a vent-pipe leading from said compartment to a suitable point of discharge, a safety-valve governing said vent-pipe, and a service-pipe leading from said compartment to a point of delivery for utilization of the gas, substantially as set forth.

In testimony whereof I have hereunto set my hand.

GEORGE WESTINGHOUSE, JR.

Witnesses:

J. SNOWDEN BELL,

R. H. WHITTLESEY.