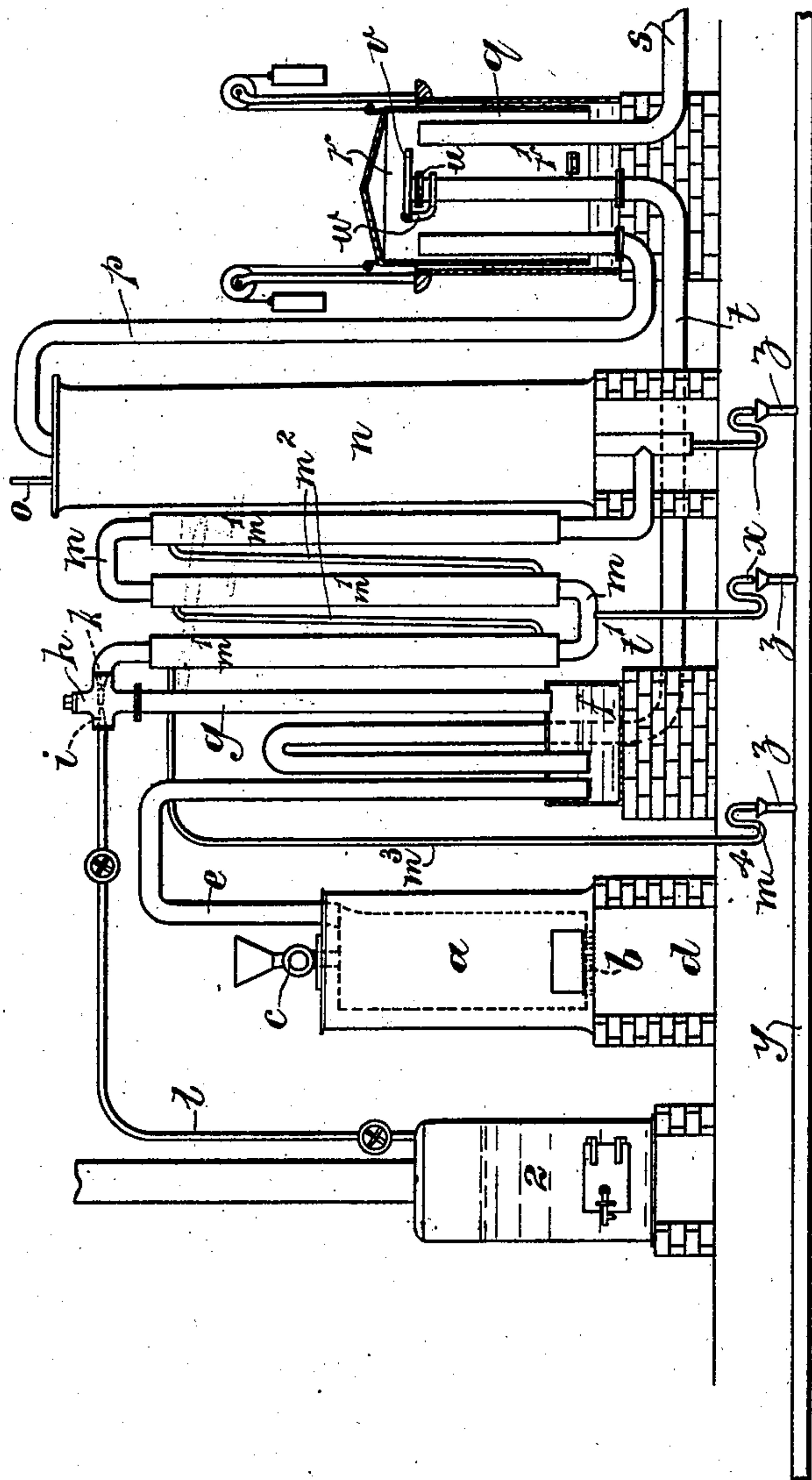


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C. WHITFIELD.  
GAS GENERATING SYSTEM.  
APPLICATION FILED DEC. 5, 1901.

NO MODEL.



Witnesses:

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# UNITED STATES PATENT OFFICE.

CHARLES WHITFIELD, OF KETTERING, ENGLAND.

## GAS-GENERATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 724,357, dated March 31, 1903.

Application filed December 5, 1901. Serial No. 84,754. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES WHITFIELD, a subject of the King of Great Britain and Ireland, residing at Kettering, in the county of Northampton, England, have invented Improvements in Apparatus for the Generation, Purification, and Storage of Combustible Gas, of which the following is a specification.

This invention has for object to provide gas generating, purifying, and storing apparatus which shall be nearly automatic in its action, so as to require little or no attention, except that of charging the gas-producer with fuel from time to time and also, it may be, charging the furnace of a steam-boiler with fuel, and which is specially suitable for use in places where the consumption of combustible gas is comparatively small in amount and intermittent in character. For this purpose in apparatus according to this invention the gas-producer is connected to a pipe (hereinafter called for distinction the "suction-pipe") that is provided with means, such as steam-jet apparatus, that will set up a partial vacuum therein and is connected on the delivery side through suitable gas washing or scrubbing apparatus with a gas-holder provided with a vertically-movable gas-bell and with a pipe (hereinafter called the "circulating-pipe") one end of which terminates within the upper part of the gas-holder and is provided with a valve adapted to be operated by the gas-bell and the other end of which is in communication with the suction-pipe. The arrangement is such that while combustible gas is being withdrawn from the gas-holder for consumption air will be drawn into the gas-producer, and the resulting gas will be drawn through the gas-outlet pipe by the suction-producing device and delivered into the washing or scrubbing apparatus, wherein it will be cleaned or purified, and thence delivered into the gas-holder, and when the withdrawal of gas from the holder for external consumption ceases and the gas-bell rises to a predetermined height the said bell will open the gas-valve and place the interior of the gas-holder in communication with the suction-pipe through the circulating-pipe, with the result that gas will then be continuously drawn through the circulating-pipe from the gas-holder by the suction-producing device and caused to again

pass through the washing or scrubbing apparatus back to the gas-holder, little or no air being then drawn through the gas-producer, which at this time will be practically out of operation, although maintained in a condition to again come into action when sufficient gas has been withdrawn from the gas-holder for external consumption to allow the gas-bell to fall and close the gas-valve.

The invention also consists in various combinations and arrangements of parts, as hereinafter described, and fully pointed out in the claims.

The accompanying illustrative drawing shows, partly in side elevation and partly in longitudinal vertical section, apparatus for generating, purifying, and storing combustible gas according to this invention.

*a* is a gas-producer of any suitable kind—such, for example, as one having a fire-grate *b* at the bottom and a fuel-charging device *c* at the top and designed to burn, preferably, non-bituminous coal, such as anthracite, the fire-grate being centrally arranged, so that air drawn into the bottom of the producer will enter the central portion of the mass of fuel therein.

The gas-producer is mounted above an ash-pit *d*, open to the atmosphere, and is provided at its upper part with a bent gas-outlet pipe *e*, that extends downward and dips into water within a hydraulic box *f*. From the top of this box extends a suction-pipe *g*, the upper end of which is provided with steam-jet apparatus comprising in the example a casing *h*, that is provided with a steam-nozzle *i* and a cone *k* and is connected by a bent pipe *m*, forming a tubular condenser, to the bottom of a washing or scrubbing chamber or tower *n*, that is charged with porous material, such as coke, and through which water is allowed to trickle from a pipe *o*, the top of the said chamber or tower being connected by a bent pipe *p* to the bottom of a gas-holder *q*, provided with a vertically-movable gas-bell *r*. The vertical portions of the bent tube *m* may for the purpose of cooling them and the gas flowing therethrough be provided with water-jackets *m'*, connected together by pipes *m''* and delivering into a discharge-pipe *m'''*, provided with a trap *m''''*.

*s* is a gas supply or delivery pipe extend-



ing from the upper part of the gas-holder to any desired place for the consumption of the gas.

Within the gas-holder *q* and terminating within its upper part is a vertical pipe *t*, the top of which is provided with a valve *u*, that normally closes the pipe and is arranged to be opened by the rising of the gas-bell. In the example the valve *u* is carried by a lever-arm *v*, pivoted to a fixed support *w* and arranged in the path of a projection *r'*, fixed to the gas-bell *r*. The bottom of the said pipe *t* is connected to a return or circulating pipe *t'*, that extends backward to the hydraulic box *f* and dips below the water therein, the arrangement being such that when the steam-jet apparatus is in action and the gas-valve *u* is open gas will be drawn from the gas-holder *q* through the return or circulating pipe *t'* into the hydraulic box *f*, through the water therein, and thence into the suction-pipe *g*, whence it will be delivered, as before, by the steam-jet apparatus through the bent pipe or condenser *m* and the washing or scrubbing chamber or tower *n* back to the gas-holder *q*.

Suitably-arranged water-traps *x* are provided for the escape of water from the bent tube *m* and from the lower part of the washing or scrubbing tower *n*.

*y* is a drain-pipe provided with upwardly-extending pipes *z*, with funnels into which the traps *m*<sup>4</sup> and *x* discharge.

The steam-nozzle *i* is connected by a pipe 1 to a steam-boiler 2, that may be fired with coal or gas and is preferably provided with automatic water-feeding apparatus.

In apparatus of the kind referred to it is of importance that no air shall become mixed with the producer-gas after it has been formed, and so produce a dilute and explosive gas. By placing the steam-blower between the gas-producer *a* and the condensing and washing apparatus *m n* and gas-holder *q* it will be seen that the whole of the apparatus between the steam-blower and the gas-holder will be under pressure, thus reducing any liability of air entering such portion of the apparatus to a minimum, while the suction produced in the portion of the apparatus between the steam-blower and the gas-producer will be very small, thus reducing liability of air entering the gas-producer except through the proper air-opening at the bottom thereof. Also by placing the steam-blower at the point described sufficient pressure can be produced to force the gas through the purifying portion of the apparatus into the gas-holder, while at the same time producing only such a small amount of suction as is necessary to cause air to flow through the gas-generator. Furthermore, by the use of a steam-blower *h* and gas-return pipe *t'*, arranged as described, if the fuel be of a bituminous nature or contains tar the arrangement renders it practicable to extract the greater portion of the tar from the gas by passing more steam through the steam-

blower, which can be done without increasing the total volume of the gas passing through the whole apparatus. Thus if the pressure of the steam supplied to the steam-blower is sufficient to draw gas from the gas-producer at the rate at which gas is being consumed it will be obvious that by increasing the pressure of the steam more gas than is being consumed will be delivered into the gas-holder until the latter rises sufficiently to open the valve *v* of the gas-return pipe *t'*, whereupon gas will be caused to circulate from the gas-holder through the return-pipe *t'* to the condensing and washing portions *m* and *n* of the apparatus back to the gas-holder *q*, and so on, and in this way become subjected to the purifying action of the apparatus several times before passing away for consumption, the rate of production of the gas at the same time automatically falling to the rate at which gas is being withdrawn from the gas-holder for consumption.

It will be evident that various changes can be made in the details of construction of my apparatus without departing from the spirit and scope of the invention, so long as the mode of operation described in the specification or the relative arrangement of parts shown in the drawing is preserved.

What I claim is—

1. Gas-producing plant, comprising a gas-producer, a gas-holder, means for causing gas to flow from the gas-delivery pipe of said producer to said gas-holder, a normally closed gas-circulating pipe connecting said gas-holder to said gas-delivery pipe, and means for automatically opening said gas-circulating pipe upon said gas-holder being charged with gas to a predetermined amount.

2. Gas-producing plant comprising a gas-producer, gas-purifying apparatus in connection with the gas-outlet of said gas-producer, a gas-holder in connection with said gas-purifying apparatus, means located between and adapted to cause gas to flow from said gas-producer to said gas-purifying apparatus and gas-holder, a normally closed gas-circulating pipe extending from said gas-holder to the gas-delivery pipe between said gas-producer and purifying apparatus, and means for automatically opening said gas-circulating pipe upon said gas-holder being charged with gas to a predetermined amount.

3. In a gas-producing plant, the combination of a gas-producer, gas-purifying apparatus, a suction-pipe between the outlet of said gas-producer and the inlet of said purifying apparatus, a gas-holder in connection with the outlet of said purifying apparatus, means for drawing gas from said producer through said suction-pipe and forcing it through said purifying apparatus, a gas-circulating pipe located between said gas-holder and suction-pipe and provided with a normally closed valve, and means for automatically opening said valve upon said gas-holder being charged with a predetermined amount of gas.



4. Gas-producing plant, comprising a gas-producer, a gas-holder, a conduit between said gas producer and holder, means for drawing gas from said gas-producer and forcing it into  
5 said gas-holder through said conduit, and means for automatically placing said gas-holder in connection with said conduit, at a part thereof behind the place where the means for causing the gas to flow, are located, when  
10 said gas-holder is charged with a predetermined amount of gas.

5. Gas-producing plant, comprising a gas-producer, a suction-pipe in connection with the outlet thereof, a gas-holder in connection  
15 with said suction-pipe, steam-jet apparatus connected to said suction-pipe and adapted to cause gas to flow therethrough to said gas-holder, a gas-circulating pipe arranged between said suction-pipe and gas-holder and  
20 provided with a normally closed valve, and means for automatically opening said valve when said gas-holder is charged with a predetermined amount of gas.

6. Gas-producing plant, comprising a gas-producer, a suction-pipe in connection with the outlet thereof, gas-purifying apparatus in connection with said suction-pipe, steam-jet apparatus located between said suction-pipe and gas-purifying apparatus, a gas-  
25 holder in connection with the outlet of said gas-purifying apparatus, a gas-circulating pipe arranged between said suction-pipe and gas-holder and provided with a normally closed valve, and means for automatically  
30 opening said valve when said gas-holder is charged with a predetermined amount of gas.

7. Gas-producing plant, comprising a gas-producer, a hydraulic box into which the gas-outlet pipe of said gas-producer extends so  
40 as to dip below the level of liquid therein, a suction-pipe extending from the upper part of said hydraulic box, gas-purifying apparatus, a gas-holder in connection with said gas-purifying apparatus, a steam-jet apparatus  
45 in connection with said suction-pipe and with said gas-purifying apparatus, a normally closed gas-circulating pipe connecting said gas-holder to said suction-pipe, and means for automatically opening said pipe when said  
50 gas-holder is charged with a predetermined amount of gas.

8. Gas-producing plant, comprising a gas-producer, a hydraulic box, a condenser, a gas-outlet pipe extending from said gas-producer  
55 into said hydraulic box and terminating below the level of liquid therein, a suction-pipe extending from the upper part of said hy-

draulic box, steam-jet apparatus connected to said suction-pipe and to said condenser, a gas-holder, gas washing or scrubbing appa- 60  
ratus having its gas-inlet connected to said condenser, and its outlet connected to said gas-holder, a normally closed gas-circulating pipe connecting said gas-holder to said suction-pipe, and means for automatically open- 65  
ing said pipe when said gas-holder is charged with a predetermined amount of gas.

9. Gas-producing plant, comprising a gas-producer, a hydraulic box, a condenser, a gas washing or scrubbing tower connected to said 70  
condenser, a gas-holder connected to said tower and having a movable bell, a gas-outlet pipe extending from said gas-producer to said hydraulic box and terminating below the level of the liquid therein, a suction-pipe ex- 75  
tending from said hydraulic box, steam-jet apparatus connected to said suction-pipe and condenser, a gas-circulating pipe having one end terminating within said gas-holder and its other end terminating below the liquid in 80  
said hydraulic box, a valve normally closing the end of said circulating-pipe within said gas-holder, and means carried by said movable bell and adapted to open said valve when said bell rises to a predetermined height. 85

10. Gas-producing plant, comprising a gas-producer, a hydraulic box, a gas-outlet pipe leading from said gas-producer and terminating below the level of the liquid in said hydraulic box, a suction-pipe extending upward 90  
from said hydraulic box, a steam-jet apparatus connected to said suction-pipe, a bent condensing-pipe connected to said steam-jet apparatus and provided with a cooling-jacket, a gas washing or scrubbing tower connected 95  
to said bent pipe, a gas-holder connected to said tower and having a vertically-movable bell, a gas-circulating pipe having one end portion extending upward into the gas-space within said holder and bell and its other end 100  
portion bent and arranged to dip into the liquid in said hydraulic box, a valve adapted to normally close the end of said pipe within said gas-holder, and means located within and carried by said bell and adapted to open 105  
said valve when said bell rises to a predetermined height, substantially as described for the purpose specified.

Signed at Manchester, county of Lancaster, England, this 18th day of November, 1901. 110  
CHARLES WHITFIELD.

Witnesses:

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ARTHUR VERNON BATHO.