

March 25 , 1924.

1,487,845

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GAS PRODUCER APPARATUS

Filed July 15, 1918.

Fig.1.

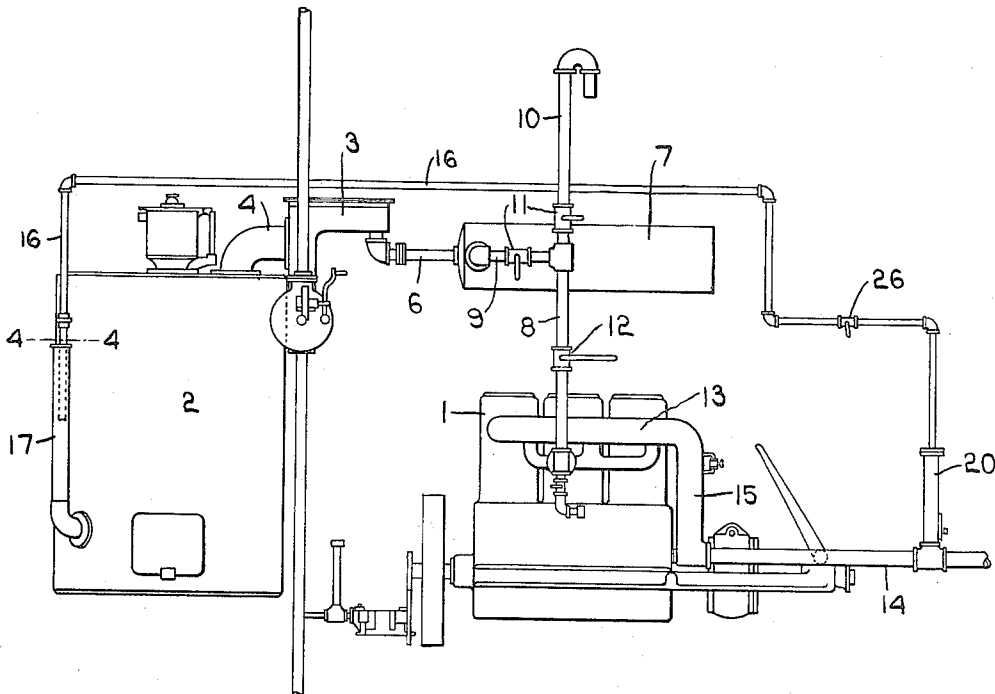


Fig. 2.

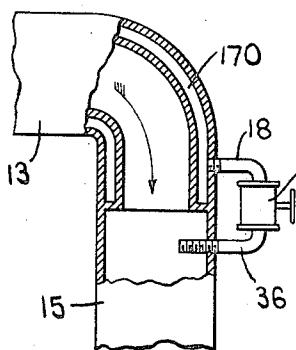


Fig. 5.

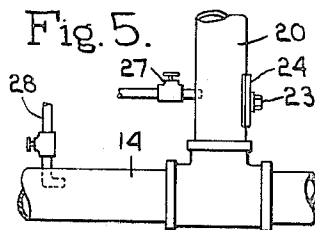


Fig.3.

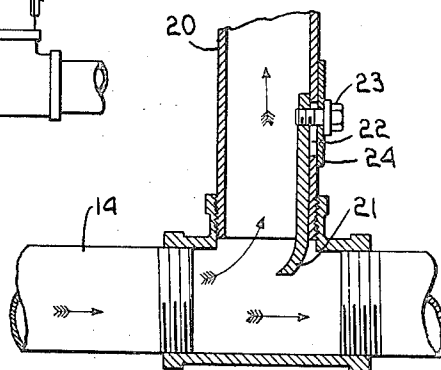
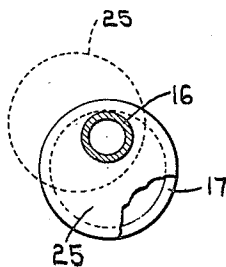


Fig.4.



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GAS-PRODUCER APPARATUS.

Application filed July 15, 1918. Serial No. 244,898.

To all whom it may concern:

Be it known that I, ALBERT L. GALUSHA, a citizen of the United States, residing at Sharon, county of Norfolk, State of Massachusetts, have invented an Improvement in Gas-Producer Apparatus, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to apparatus of that type which includes a gas producer adapted to produce gas from coal, coke, charcoal and other solid fuel or from suitable liquid fuel, and a gas-consuming element, such, for instance, as an internal combustion engine, in which the gas is consumed, and said invention relates particularly to apparatus in which the production of gas in the gas producer necessitates the admission thereto of the required quantities of steam and air. In the production of gas in such gas producers the oxygen in the air enters into partial combustion with the carbon contained in the fuel thereby liberating heat, and this heat has the effect of decomposing the steam. The oxygen thus liberated from the steam assists in carrying on combustion and the hydrogen which is liberated passes off with and forms a desirable constituent of the gas produced.

In order that the apparatus may work satisfactorily to produce gas of the proper quality it is highly important that the air and the steam should at all times be introduced into the gas producer in proper proportions, for if an excess of air is used, the result will be a generation of excessive heat in the gas producer, while if excessive steam is used, the temperature in the gas producer will be unduly lowered and gas of inferior quality will be produced.

It is one of the objects of my present invention to provide an apparatus of the above-mentioned type having novel means for regulating automatically the supply of steam to the gas producer so that the quantity of steam thus delivered will vary as the amount of gas consumed varies, and also to provide novel means for generating the steam which is thus admitted to the gas producer. In order to thus regulate the quantity of steam supplied, I have provided means whereby the amount of gas which is

consumed in the gas-consuming element controls automatically the amount of steam delivered to the gas producer and thus when conditions require an increased consumption of gas, an increased amount of steam will be automatically delivered to the gas producer, while if conditions require a decreased consumption of gas, a correspondingly decreased amount of steam will be delivered to the gas producer whereby the proper gas-producing conditions will be always maintained automatically in the gas producer. I also propose to generate the necessary steam by bringing water into direct contact with the products of combustion delivered from the gas consuming element, the heat from such products of combustion vaporizing the water and producing the necessary steam. The apparatus will preferably be so arranged that the quantity of steam produced is in excess of the requirements, and means are provided for withdrawing from the commingled steam and products of combustion a sufficient amount of steam to maintain proper gas-producing conditions in the gas producer, such withdrawing or separation of the steam being accomplished in such a way that the amount of steam supplied to the gas producer is properly proportioned to the amount of gas being consumed.

In order to give an understanding of my invention I have illustrated in the drawings a selected embodiment thereof which will now be described, after which the novel features will be pointed out in the appended claims.

Fig. 1 is a general view in elevation showing an apparatus embodying my invention;

Fig. 2 is a detail view showing partly in side elevation and partly in vertical section the manner of introducing the water into direct contact with the products of combustion;

Fig. 3 is a view partly in side elevation and partly in vertical section showing the manner of separating the steam from the products of combustion;

Fig. 4 is an enlarged section on the line 4-4, Fig. 1;

Fig. 5 is a view similar to Fig. 3 showing a modified form of the invention.

In Fig. 1 the gas producer is indicated generally at 2 and the gas-consuming element is indicated at 1, the latter being shown

as an internal combustion engine. The gas producer may be of any suitable or usual type, it having associated therewith a scrubber 3 into which the gases are delivered through the pipe 4 and in which the gases are cleansed and purified. From the scrubber the gases pass by means of a pipe 6 to a pressure-equalizing chamber 7, from which they are taken to the gas engine or other gas-consuming elements. I have herein shown the intake pipe 8 of the engine as connected to the tank 7 through a valve connection 9, said intake pipe also being connected to a pipe 10 which leads to the atmosphere so that when the engine is operating both air and gas will be delivered through the pipe 8. The pipes 9 and 10 are regulated by suitable valves 11, and a throttle or power control valve 12 is also provided in the intake pipe 8.

13 indicates the exhaust manifold of the engine which leads into the exhaust pipe. This exhaust pipe comprises the vertically-disposed portion or pipe section 15 which leads into the horizontal pipe section 14.

16 indicates a steam pipe by which steam is admitted to the ash-pit of the producer 2. This steam pipe leads into the upper end of an air inlet pipe 17 which is larger than the steam pipe and the force of steam issuing from the pipe 6 acts to draw air in the upper end of the air pipe 17 and the commingled steam and air are then delivered to the producer 2.

In accordance with my invention I have provided novel means for generating the necessary steam by bringing water into direct contact with the hot products of combustion issuing from the gas-consuming element. The steam thus generated is then withdrawn from the products of combustion and delivered to the gas producer in sufficient volume to provide proper gas-producing conditions in the gas producer.

In the illustrated embodiment of the invention the water is brought into direct contact with the hot products of combustion by introducing it into the exhaust pipe of the engine, and preferably into the vertical portion 15 of said exhaust pipe. This can be done by tapping a water pipe 36 into said vertical portion 15, as shown in Fig. 2. The water may be taken from any suitable source. One convenient arrangement is that by which the water may be taken from the water jacket of the engine, or in case the exhaust manifold 13 is water-jacketed, then from the water jacket of a manifold. It is the latter construction which I have herein shown, and in Fig. 2 I have illustrated the manifold 13 as provided with a water jacket 170. The pipe 36 leads into this water jacket, as shown at 18, and is provided with a suitable regulating valve 19 by which the flow of water can be con-

trolled. When the valve 19 is properly adjusted the correct amount of water will flow into the exhaust pipe and thus be brought into direct contact with the hot products of combustion, the heat of which will convert some or all of the water into steam. The steam thus generated, any excess water that has not been vaporized, any salts or other solids which may be contained in the water, and the products of combustion will pass into the horizontal section 14 of the pipe, and since the specific gravity of steam is less than that of the products of combustion and other substances carried along thereby there will be a tendency for the steam to rise to the upper side of the horizontal pipe section 14 and for the heavier substances, such as excess water, salts, dirt, and other impurities that may be contained in the water, and the products of combustion, to settle to the bottom of the pipe section 14. Hence the gas mixture at the upper side of the pipe section 14 will be much richer in steam than the gas mixture at the lower side of the pipe section 14. I have provided herein means for trapping or withdrawing from the exhaust pipe the portion of the gas mixture traveling along the upper side of the pipe section 14, and which is largely steam but may also contain a certain percentage of carbon dioxide, and delivering such portion to the gas producer through the pipe 16.

The exhaust pipe 14 has a steam dome 20 communicating with the upper side thereof and depending from this dome is a deflector 21, the lower end of which extends into the pipe 14 and forms an obstruction across the upper portion thereof. The lower end of this deflector is preferably curved forwardly, as best seen in Fig. 3, and its function is two-fold. It serves not only to divert into the dome a portion of the gaseous mixture which is passing at relatively high velocity through the exhaust pipe, thus creating a substantial pressure in the dome, but owing to its position in the top of the exhaust pipe it acts to deflect into the dome 20 the gaseous mixture at the upper part of the pipe which is rich in steam. The gaseous mixture passing along the lower part of the pipe which has comparatively little steam and which also contains any unvaporized water, salts, dirt, or other solid impurities, will pass beneath the deflector 21 and be exhausted from the exhaust pipe in usual manner.

The deflector 21 is preferably made adjustable so that a greater or less proportion of the gases passing along the pipe may be deflected into the steam dome 20, thus determining or regulating the pressure of the steam in the steam dome as well as the richness or relative purity of the steam. This is herein accomplished by providing the de-

deflector 21 with a clamping screw 23 which extends through a vertical slot 22 formed in the steam dome, a cap plate 24 being employed to close the slot. By loosening the screw 23 the deflector may be adjusted vertically and when the screw is tightened it will be longitudinally held in its adjusted position. The cover plate 24 will keep the slot 22 closed in all positions of the deflector.

In the operation of the device I propose to so adjust the valve 19 that the amount of water delivered to the exhaust pipe will produce an excess of steam over that necessary to provide proper gas-producing conditions in the gas producer. The pressure of the gases in the exhaust pipe maintains the proper pressure in the steam dome 20 to force the steam from the steam dome through the pipe 16 into the gas producer. Said pipe 16 is provided with a regulating valve 26 by which the amount of steam delivered may be properly regulated. The steam dome 20 is of sufficient size so that the gases passing therein have a relatively slow motion upwardly therethrough. Hence any water, salts or other heavy substances which may become trapped with the steam will have an opportunity to gravitate out of the steam dome into the exhaust pipe before the steam is delivered to the pipe 16. The amount of steam which is delivered to this gas producer depends upon the pressure in the steam dome 20, and this in turn depends upon the pressure in the exhaust pipe which varies with the amount of gas consumed. An increased consumption of gas due to an increased load on the engine will produce an increased pressure in the exhaust pipe, thus increasing the pressure in the dome 20 and causing a larger volume of steam to be delivered to the producer. A decreased consumption of gas with a consequent decreased pressure in the exhaust pipe will have the reverse effect. Hence the amount of steam which is delivered to the gas producer varies automatically as the gas consumption varies, and as a result, the proper gas-producing conditions are maintained in the gas producer, regardless of fluctuations in the gas consumption. The valve 26 will be set to admit the necessary steam to the gas producer for average load conditions on the engine and any variation in the gas consumption due to variations in load conditions will be automatically taken care of as above described.

I have stated above that the steam issuing from the delivery end of the pipe 16 operates to draw air into the open upper end of the pipe 17 so that a mixture of air and steam is delivered to the gas producer. For controlling the amount of air that is drawn into the pipe 17 I provide an air valve 25 which is in the form of a plate pivotally mounted on the steam pipe 16 and adapted to swing

across the end of the pipe 17. This valve may be positioned so as to close the open end of the pipe 17 more or less, depending on the amount of air which it is desired to admit and the relative pressure desired inside the producer 2. I will preferably so adjust the valves 26 and 25 that the pressure in the upper portion of the gas producer 2 is substantially the same as atmospheric pressure. The advantage of this is that there will be no tendency for the gas to leak out around the openings in the top of the gas producer as would be the case if the pressure inside the producer were greater than atmospheric pressure.

Further, with my gas producer it is possible to open the ash-pit doors to clean out ashes without effecting any change in the character or quality of the gas being produced. My improved apparatus is capable of giving the same high quality of gas as a so-called pressure producer, but without the disadvantages of the pressure producer type.

Another advantage which results from my invention is that it is possible to generate the necessary steam from salt water or water having salts or other mineral substances therein because the manner of withdrawing the steam from the commingled products of combustion permits the salts and other impurities to be largely separated from the steam before it is delivered to the gas producer and these impurities will be carried away through the exhaust pipe 14 by any excess water which may be delivered through the pipe 36.

In Figs. 1 and 3 I have shown a construction wherein the steam used is generated from water delivered into direct contact with the products of combustion. In Fig. 5 I have illustrated a slightly different embodiment of the invention wherein the steam dome 20 has a steam pipe 27 leading therein so that steam from any source may be delivered directly to the steam dome. With this arrangement I propose to deliver to the steam dome steam in excess of that required and then to rely upon the pressure of the exhaust gases in the exhaust pipe to maintain the necessary varying pressure in the steam dome to force the requisite quantity of steam into the gas producer as the gas consumption varies. I may also provide a steam pipe 28 leading into the exhaust pipe and which takes its steam from any suitable source. This arrangement will have the same automatic regulation of the delivery of steam to the gas producer as is present in the construction shown in Figs. 1 and 3 because as the gas consumption increases and the pressure in the exhaust pipe correspondingly increases the pressure in the steam dome will also be increased and thus more steam will be forced in the gas

producer, while a reduction in the consumption of gas will produce a corresponding reduction of pressure in the steam dome which results in a corresponding reduction in the amount of steam delivered to the gas producer.

I claim:

1. In an apparatus of the class described the combination with a gas producer of an internal combustion engine provided with an exhaust pipe having an outlet to the open air, a steam connection opening at one end into the exhaust pipe between the engine and the outlet and connected at the other end to the producer for conducting steam to the producer, devices controlled independently of the engine for supplying steam to the steam connection, and means in the exhaust pipe for regulating the pressure in the steam connection, whereby the amount of steam delivered to the producer will be varied in accordance with variations in the pressure of the exhaust.

2. In an apparatus of the class described the combination with a gas producer of an internal combustion engine provided with an exhaust pipe having an outlet to the open air, a steam connection opening at one end into the exhaust pipe between the engine and the outlet and connected at the other end to the producer for conducting steam to the producer, devices controlled independently of the engine for supplying water to the exhaust pipe between the engine and the steam connection, and means in the exhaust pipe for regulating the pressure in the steam connection, whereby the amount of steam delivered to the producer will be varied in accordance with the variations in the pressure of the exhaust.

3. In an apparatus of the class described the combination with a gas producer of an internal combustion engine provided with an exhaust pipe having an outlet to the open air, a steam connection opening at one end into the exhaust pipe between the engine and the outlet and connected at the other end to the producer for conducting steam to the producer, devices controlled independently of the engine for supplying steam to the steam connection, and an adjustable deflector in the exhaust pipe adjacent the steam connection for deflecting to a greater or less extent into the steam connection the gases passing through the exhaust pipe, thereby to regulate the pressure of the steam in the steam connection.

4. In an apparatus of the class described, the combination with a gas producer of an internal combustion engine having an exhaust pipe, a steam pipe connecting the exhaust pipe and the producer, means to introduce water into the exhaust pipe between the engine and the steam pipe thereby to generate steam, and means in the exhaust

pipe acting to divert steam thus generated from the exhaust pipe and to deliver said steam to the gas producer.

5. In an apparatus of the class described, the combination with a gas producer of an internal combustion engine provided with an exhaust pipe, means to commingle water with the products of combustion of said engine thereby to generate steam, means to effect by gravity at least a partial separation of the steam and products of combustion, a steam connection between the exhaust pipe and the producer for conducting steam to the producer, and devices in the exhaust pipe to divert the steam thus separated and deliver it to the steam pipe.

6. In an apparatus of the class described, the combination with a gas producer of an internal combustion engine having an exhaust pipe provided with a horizontal portion, means to introduce water into said exhaust pipe thereby to generate steam, said commingled steam and products of combustion becoming separated partially at least by gravity as they pass along said horizontal portion of the pipe, a steam dome mounted directly upon the exhaust pipe and communicating with the exhaust pipe by an opening of substantially the same size as the cross sectional area of the dome, and means to deliver from the steam dome to the gas producer the steam thus separated from the products of combustion.

7. In an apparatus of the class described, the combination with a gas producer of an internal combustion engine having an exhaust pipe, means to introduce water into said exhaust pipe thereby to generate steam, a reservoir chamber connected to said pipe, and a pipe connecting said reservoir to the gas producer, said reservoir and its connection with the pipe being of sufficient cross sectional area to permit the steam to move slowly therethrough whereby condensed steam and heavy substances held in suspension will become separated from the steam by gravity and will return to the exhaust pipe.

8. In an apparatus of the class described, the combination with a gas producer and an internal combustion engine having an exhaust pipe provided with a horizontal portion, of a steam dome connected to said horizontal portion of the pipe, a deflector depending from said dome and extending partly across said pipe, means to introduce water into the exhaust pipe, and a connection between the dome and the gas producer.

9. In an apparatus of the class described, the combination with a gas producer and an internal combustion engine having an exhaust pipe provided with a horizontal portion, of a steam dome connected to said horizontal portion of the pipe, an adjust-

able deflector depending from said dome and extending partly across said pipe, means to introduce water into the exhaust pipe, and a connection between the dome and the gas producer.

10. In an apparatus of the class described, the combination with a gas producer and an internal combustion engine, of means operating automatically to deliver to the gas producer a quantity of commingled air and steam controlled in amount by the pressure of the exhaust of the engine and proportionate to the volume of gas consumed in the engine.

11. In an apparatus of the class described, the combination with a gas producer and an internal combustion engine having an exhaust pipe, of an air inlet pipe leading into the gas producer and having an open end, means to admit water into the exhaust pipe of said engine thereby to generate steam, means to separate from the exhaust gases the steam thus generated, and a steam pipe to deliver the steam to the gas producer, the delivery end of said steam pipe extending into the open end of the air inlet pipe whereby the steam acts to draw air through the inlet pipe.

12. In an apparatus of the class described, the combination with a gas producer and an internal combustion engine having an exhaust pipe, of an air inlet pipe leading into the gas producer, means to admit water into the exhaust pipe of said engine thereby to generate steam, means to separate from the exhaust gases the steam thus generated, a steam pipe to deliver the steam to the gas producer, the delivery end of said steam pipe extending into the open end of the air inlet pipe whereby the steam acts to draw air through the inlet pipe, and means to regulate the pressure of the steam and the amount of air so as to maintain approximately atmospheric pressure in the gas producer.

13. In an apparatus of the class described, the combination with a gas producer and an internal combustion engine, of a pipe leading to the ash-pit of said gas producer and having an air inlet open to the atmosphere, a steam dome in communication with said pipe, and means whereby the pressure in the steam dome varies as the consumption of the gas in the engine varies.

14. In an apparatus of the class described, the combination with a gas producer, of an air inlet pipe for the producer having an open end, a steam pipe, means for supplying steam through said pipe to the producer, the steam pipe being eccentrically arranged within the open end of the air inlet pipe, and an adjustable disc eccentrically mounted on the steam pipe for regulating the amount of air entering the air inlet pipe.

15. In an apparatus of the class described

the combination with a gas producer of an internal combustion engine provided with an exhaust pipe having an outlet to the open air, a steam connection opening at one end into the exhaust pipe between the engine and the outlet and connected at the other end to the producer for conducting steam to the producer, devices controlled independently of the engine for supplying steam to the steam connection, means in the exhaust pipe for regulating the pressure in the steam connection, and a valve in the steam connection for controlling the flow of steam to the producer, whereby steam will be delivered to the producer in automatically varied amounts to maintain a uniform quality of gas produced under varying rates of consumption by the engine.

16. In an apparatus of the class described, the combination with a gas producer of an internal combustion engine provided with an exhaust pipe having an outlet to the open air, an open ended air pipe for admitting air to the producer, a steam pipe with one end connected into the exhaust pipe and with the other end entering the open end of the air pipe for conducting steam to the air pipe, the steam drawing into the air pipe air in amount proportional to the amount of steam, and both steam and air being delivered to the producer, devices controlled independently of the engine for delivering steam to the steam pipe, and means in the exhaust pipe for regulating the pressure of steam in the steam pipe, whereby the amounts of steam and air delivered to the producer will be automatically varied in accordance with variations in the consumption of gas by the engine.

17. In an apparatus of the class described, the combination with a gas producer of an internal combustion engine provided with an exhaust pipe having an outlet to the open air, an open ended air pipe for admitting air to the producer, a steam dome mounted upon the exhaust pipe and communicating with the exhaust pipe by an opening of substantially the same size as the cross sectional area of the dome, a steam pipe with one end connected with the steam dome and with the other end entering the open end of the air pipe for conducting steam to the air pipe, an air valve for controlling the admission of air into the open end of the air pipe, a steam valve for controlling the flow of steam from the steam pipe, an adjustable deflector in the exhaust pipe adjacent the dome, and means controlled independently of the engine for supplying water to the exhaust pipe between the engine and the deflector.

In testimony whereof I have signed my name to this specification.

ALBERT L. GALUSHA.