G. E. HULSE.

REGULATOR FOR GAS LIGHTING SYSTEMS.

APPLICATION FILED AUG. 7, 1907.

959,745.

Patented May 31, 1910.

2 SHEETS—SHEET 1.

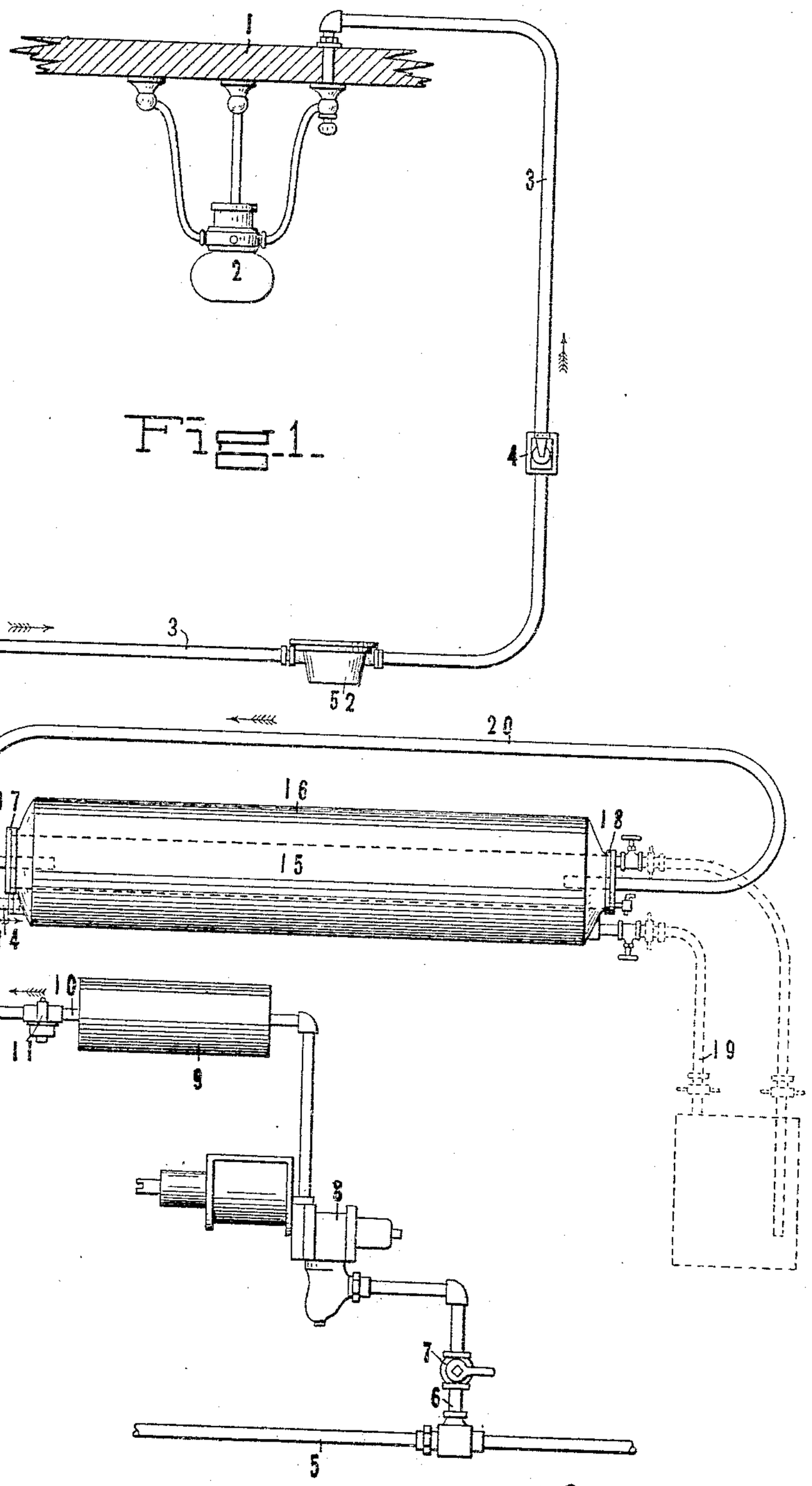

Fig. 1.

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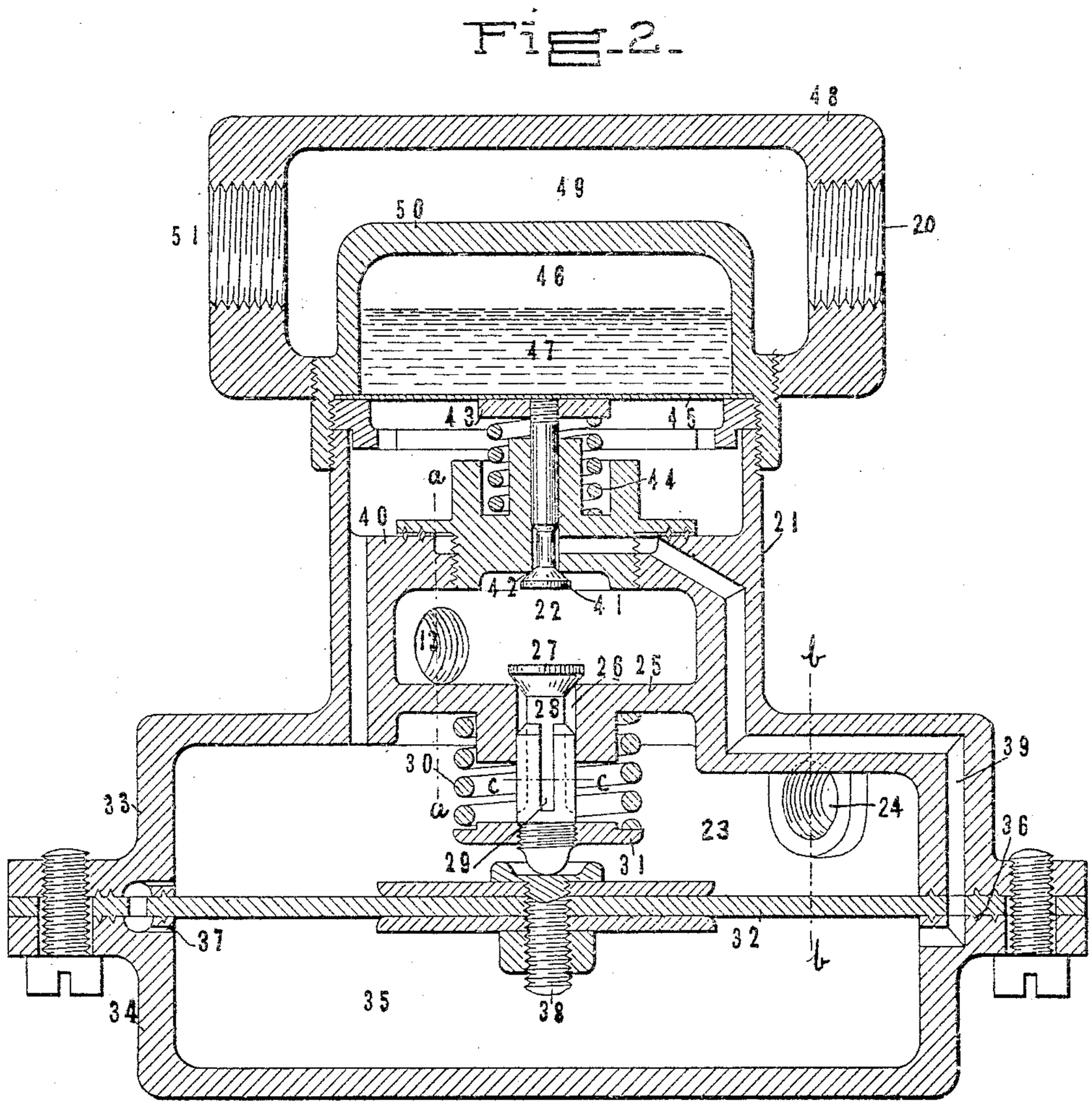
2 SHEETS—SHEET 2.

Fig. 2.



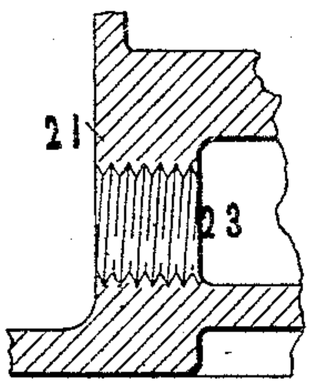


Fig. 3.

Fig. 5.

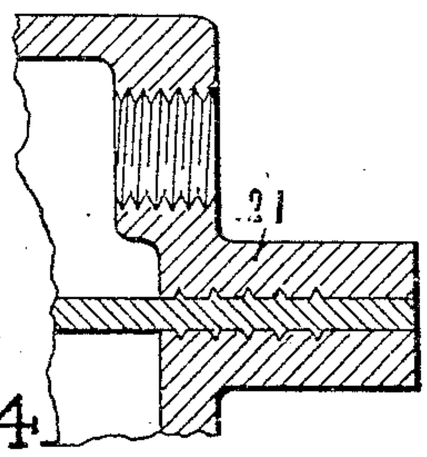


Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE E. HULSE, OF NEWARK, NEW JERSEY, ASSIGNOR TO SAFETY CAR HEATING & LIGHTING COMPANY, A CORPORATION OF NEW JERSEY.

REGULATOR FOR GAS-LIGHTING SYSTEMS.

959,745. Specification of Letters Patent. Patented May 31, 1910.

Application filed August 7, 1907. Serial No. 387,451.

To all whom it may concern:

Be it known that I, GEORGE E. HULSE, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Regulators for Gas-Lighting Systems, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to lighting systems generally, but is more particularly directed to means for lighting railway cars or like structures.

One of the objects thereof is to provide means whereby lamps or other gas utilizing devices may be supplied with gas of even quality or richness.

Another object of the invention is to provide regulating means adapted for use in conjunction with the carbureters employed in hydro-carbon gas supplying systems for rendering their action uniform.

Another object of the invention is to provide means whereby hydro-carbon gas of predetermined quality or richness may be delivered from the carbureter employed in a hydro-carbon gas lighting system, irrespective of the temperature to which the exterior of the apparatus is exposed.

Another object hereof is to provide means whereby the temperature of the hydro-carbon gas delivered from a carbureter may be utilized to regulate the air pressure within the carbureter.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings wherein is illustrated one of the various possible embodiments of my invention, Figure 1 is a diagrammatic view of the same; Fig. 2 is a central sectional elevation taken through the regulator for the carbureter; Fig. 3 is a sectional view taken substantially on line *a*—*a*, Fig. 2; Fig. 4 is a similar view taken on line *b*—*b*, Fig. 2; and Fig. 5 is a similar view taken on line *c*—*c*, Fig. 2.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, there is shown diagrammatically in Fig. 1 a hydro-carbon gas supply system adapted for use in railway cars, a portion of the roof of which is shown in section at 1. In the present instance I have shown a gas lamp 2 suspended from the roof which receives its supply of hydro-carbon gas by means of a conduit 3 provided with a controlling cock 4. Leading from the air brake supply pipe 5 is a pipe 6 the passage through which is controlled as by the cock 7. This conduit leads through the brake cylinder 8 to the air reservoir 9 connected with the opposite end of which is a pipe 10. In this latter pipe is positioned a check valve 11 adapted to permit the passage of fluid only in the direction indicated by the arrow. From this check valve the conduit leads to a T connection 12 one arm 13 of which leads to regulating apparatus hereinafter to be described in detail, and the other arm 14 leads to the carbureting apparatus.

The carbureter comprises an inner cylinder 15 (shown in dotted lines) and an outer cylinder 16 spaced in spaced relation therewith as by heads 17 and 18, the inner chamber constituting a receptacle for the carbureting material and the outer chamber comprising an air chamber. The inner chamber 15 is connected with a reservoir which supplies a liquid hydro-carbon to the carbureter, said liquid being forced therein by means of air pressure conducted from chamber 16 to the upper portion of the reservoir by means of conduit 19. From the carbureter leads a conduit 20 which supplies the lamps with the combustible mixture. At this point it may be noted that the particular construction of the above described apparatus forms no part of my present invention, the same being shown, described and claimed in application covering a joint invention of myself and Robert M. Dixon, Serial Number 339,983, filed October 15, 1906. My invention, however, comprehends a new and improved form of regulating apparatus adapted for use in conjunction with the above described apparatus, the construction and operation of which I will now proceed to describe in detail. This latter apparatus is best shown in Figs. 2 to 5 of the drawings. At this point it may be noted that the aim of the regulat-

ing apparatus is, as has been suggested, to render uniform under all conditions the quality or richness of the gas fed to the lamps. This regulation is of peculiar value in an apparatus of this nature, inasmuch as it is highly desirable to avoid the necessity for any adjustment of the apparatus in order to provide for a uniform pressure and richness of gas to insure a uniform action of the lamps. The quality of gas supplied to the lamps is dependent obviously upon the amount of hydro-carbon vaporized per unit of air supply and depends therefore upon a substantially constant rate of evaporation of the volatile hydro-carbon fluid. The rate of evaporation, in accordance with the well-known laws of physics, varies, other factors being equal, inversely with the surface pressure and directly with the temperature. Both of these factors necessarily vary widely in apparatus employed for the purposes set forth, the air braking pressure being far from constant and the temperature extending over a wide range dependent upon climatic conditions. The aim of this invention is to cause these variables exactly to neutralize one another by an increase or decrease in the surface pressure upon the hydro-carbon and I have found that this object can be most efficiently attained by regulating the air supply to the carbureter by means of the temperature of the hydro-carbon gas or combustible mixture delivered therefrom.

My preferred form of regulating apparatus comprises a casing 21 having a chamber 22 connected by means of the conduit 13 with the source of air supply and a chamber 23 from which leads a conduit 24 to the carbureter. These chambers are separated as by means of a partition 25 provided with a connecting passage-way 26. Interposed in passage-way 26 is a valve 27, which coöperates with a seat formed upon the inner end of the passage-way, the stem 28 of said valve stem being preferably grooved as at 29 to provide channels through which the air may readily pass from one chamber to another. Valve 27 is constantly urged toward its seat by means of a coil spring 30 interposed between partition 25 and a collar 31 threaded upon the lower end of stem 28. A flexible diaphragm 32 forms the lower wall of chamber 23, said diaphragm being clamped securely between sections 33 and 34 of casing 21 the lower section of which forms a chamber 35 beneath the diaphragm. The diaphragm and clamping sections of casing 21 are scored as at 36 to provide against the leakage of gas and, in the present instance, a small equalizing by-pass 37 extends between chambers 23 and 35 through the diaphragm. Valve stem 28 rests upon the central portion of diaphragm 32 which in the present instance is provided with an adjusting screw 38 engaging the lower end of the valve stem.

From the above construction it will be seen that an upward movement of the diaphragm will tend through stem 28 to lift valve 27 from its seat against the tension of spring 30 and that the proper adjustment between the diaphragm and the valve can be obtained by means of adjusting screw 38. It will also be seen that when the diaphragm is lifted and valve 27 carried from its seat the air from the source of supply will flow from chamber 22 to chamber 23 and thence through conduit 24 to the carbureter. The upward movement of the diaphragm to lift valve 27 is accomplished by means of air pressure from the source of air supply by means of a by-pass 39 which leads upwardly through a partition 40 which forms the upper wall of chamber 22 and then extends downwardly through the wall of casing 21 to a position beneath the diaphragm. Interposed in by-pass 39 is a valve 41 which rests against a seat formed at the mouth of the by-pass, the stem 42 of said valve extending upwardly through partition 40 and at its outer end is provided with a collar 43. Interposed between collar 43 and partition 40 is a coil spring 44 which exerts a pressure upon the collar, urging the same and stem 42 in an upward direction and holding the valve resiliently against its seat. Collar 43 is secured to the lower surface of a flexible diaphragm or wall 45 of a chamber 46 containing a suitable expansible fluid 47. This chamber and its contents constitute what is ordinarily known as an "aneroid chamber" the expansible liquid therein being adapted upon a rise in temperature to produce a pressure within the chamber which causes the flexible wall to become expanded or distended, thereby moving the stem in a downward direction and opening the valve at its lower end. Conduit 20 which leads from the carbureter is threaded into the wall 48 of a chamber 49 surrounding the outer wall 50 of the aneroid chamber and conduit 3 which supplies the lamps with the combustible mixture leads, in the present instance, from an opening 51 provided on the opposite side of the wall of chamber 49. It will thus be seen that the hydro-carbon gas or combustible mixture delivered from the carbureter passing in intimate contact with the aneroid chamber causes the contents thereof to volatilize or condense in accordance with the temperature of the combustible mixture.

Interposed in conduit 3 which extends from chamber 49 to the lamps is a regulator 52 adapted to reduce the gas pressure to the lamps to the desired degree.

Having thus described the construction of this embodiment of my invention, the operation thereof is substantially as follows:

Assuming the carbureting apparatus to be in operative position and having air

therein sufficient to volatilize the liquid hydro-carbon, a constant flow of hydro-carbon gas will take place through conduit 20 which leads through the regulator to the lamps. In the event, however, of a rise in the temperature within the carbureter, the pressure remaining constant, a proportionately greater amount of the hydro-carbon constituent will be volatilized and a richer gas flow from the carbureter to the lamps. This gas flowing through chamber 49 and in contact with aneroid chamber 46 therefore being higher in temperature will effect a volatilization of the expansible fluid within the aneroid chamber causing diaphragm 45 to be distended and valve 41 opened. This latter operation will allow air from the source of supply to pass through by-pass 39 into the chamber 35 beneath diaphragm 32 thereby distending the same, opening valve 27 and allowing air from the source of supply to pass directly from chamber 22 through passage-way 26 to chamber 23 and thence to the carbureter, causing an increase of the pressure therein and a consequent diminution of the amount of the liquid hydro-carbon volatilized within the carbureter. Thus the requisite amount of air pressure to produce the proper amount of volatilization of the hydro-carbon within the carbureter is at all times automatically effected and, at this point it may be noted that such adjustment of the parts can be effected as will operate to maintain the proper pressure within the carbureter whereby a gas of uniform richness will be given off thereby under wide variations of climatic conditions.

It will thus be seen that I have provided an apparatus adapted to attain among others all the objects and advantages above enumerated and an apparatus which will operate with an exceedingly high degree of effectiveness.

The entire system is of simple construction and being entirely automatic in action, may be operated with a minimum amount of care and attention.

While I have shown my invention as applied to railway cars or similar structures, it is obvious that the same may be employed with great facility in other relations, although the same is particularly well adapted for use in the relation shown.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which as a matter of language, might be said to fall therebetween.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In apparatus of the class described, in combination with utilizing devices, a carbureter connected to supply said utilizing devices, a source of hydro-carbon supply connected with said carbureter, means for supplying air under pressure to the carbureter, and means operated by the temperature of the hydro-carbon gas delivered from the carbureter for regulating the pressure of air delivered thereto.

2. In apparatus of the class described, in combination with utilizing devices, a carbureter connected with said utilizing devices and with a source of liquid hydro-carbon supply, means for supplying air to said carbureter, and thermostatic means operated by the temperature of the hydro-carbon gas delivered from the carbureter for regulating the amount of air to be delivered to the carbureter.

3. In apparatus of the class described, in combination with utilizing devices, a carbureter connected with said utilizing devices and also connected with a source of liquid hydro-carbon supply, a source of air supply connected with the carbureter, and means in operative contact with the combustible mixture delivered from the carbureter for automatically regulating the amount of air delivered thereto in accordance with the temperature of said combustible mixture.

4. In apparatus of the class described, in combination with utilizing devices, a carbureter connected therewith, a source of liquid hydro-carbon supply connected with the carbureter, a source of air supply connected with the carbureter, and means interposed in the path of flow of air from said source of supply to the carbureter adapted to regulate the flow of air to the carbureter in accordance with the temperature of the combustible mixture delivered therefrom.

5. In apparatus of the class described, in combination with utilizing devices, a carbureter connected therewith, a source of liquid hydro-carbon supply connected to supply said carbureter, a source of air-supply connected with the carbureter, and automatically operating means for increasing the air pressure within the carbureter when the combustible mixture delivered therefrom increases in temperature.

6. In apparatus of the class described, in combination with hydro-carbon gas utilizing devices, a carbureter connected therewith and also connected with a source of liquid hydro-carbon supply, a source of air supply connected with the carbureter, and a

thermostatic device adapted to be operated in accordance with the temperature of the combustible mixture delivered from the carbureter to regulate the fluid pressure within the same.

7. In apparatus of the class described, in combination with hydro-carbon gas utilizing devices, a carbureter connected therewith and adapted to supply the same with a combustible mixture, a source of liquid hydro-carbon supply connected with the carbureter, a source of air supply also connected with the carbureter, and means adapted to increase the fluid pressure within the carbureter upon the rise in the temperature of the combustible mixture delivered therefrom.

8. In apparatus of the class described, in combination with hydro-carbon gas utilizing devices, a carbureter connected therewith and adapted to supply the same with a combustible mixture, a source of liquid hydro-carbon supply connected with the carbureter, and means adapted upon a rise in the temperature of the combustible mixture delivered from the carbureter to cause a proportional increase of the air pressure within the carbureter.

9. In apparatus of the class described, in combination with a carbureter connected with a source of liquid hydro-carbon supply, means of supplying air under pressure to said carbureter, and means the operation of which is determined by the temperature of the combustible mixture flowing from the carbureter adapted to regulate the flow of air thereto.

10. In apparatus of the class described, in combination, a carbureter adapted to supply a combustible mixture and connected with a source of air supply, and means operated in accordance with the temperature of the combustible mixture delivered by the carbureter adapted automatically to regulate the air pressure within the carbureter.

11. In apparatus of the class described, in combination, a carbureter adapted to supply a combustible mixture and connected with a source of air supply, and means for regulating the air pressure within the carbureter, comprising a thermostatic device in operative contact with the combustible mixture and adapted to be operated in accordance with the temperature thereof.

12. In apparatus of the class described, in combination, a carbureter adapted to supply a combustible mixture and connected with a source of air supply, and means operated automatically by the temperature of the combustible mixture for regulating the supply of air to the carbureter.

13. A pressure regulator for carbureters of hydro-carbon gas utilizing systems, comprising a thermostatic device adapted to be operated by the temperature of hydro-carbon gas delivered from the carbureter, and a valve interposed in the avenue of flow of air to the carbureter operated thereby.

14. In apparatus of the class described, the combination with the carbureter, and its source of liquid hydro-carbon supply and air supplying means, of means for controlling the delivery of air to the carbureter, comprising a chamber interposed in the flow of the combustible mixture from the carbureter, an aneroid chamber arranged adjacent said first-named chamber and having a depressible wall, a valve interposed in the avenue of flow of air from the supplying means to the carbureter adapted to be operated in accordance with the operation of the first-mentioned valve to regulate the flow of air to the carbureter.

15. In apparatus of the class described, in combination a carbureter, a source of compressed air supply, and means interposed between said carbureter and said source of supply adapted to regulate the air supply to the carbureter in accordance with the changes in the temperature of the combustible mixture delivered therefrom.

16. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a conduit adapted to lead air from said source of supply to the carbureter, a valve interposed in said conduit and means controlled in accordance with the temperature of the combustible mixture delivered from the carbureter, adapted to determine the operation of said valve.

17. In apparatus of the class described, in combination a carbureter, a source of compressed air supply, a conduit leading from said source of supply to said carbureter, a valve interposed in said conduit, and means controlled in accordance with the temperature of the combustible mixture delivered from the carbureter adapted to open said valve upon a rise in temperature of said combustible mixture.

18. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a conduit leading from said source of supply to said carbureter, a valve interposed in said conduit, a diaphragm operatively connected to said valve and adapted to be exposed upon one side to the pressure of the air supply, and means for admitting air to that side of the diaphragm comprising a valve and a thermostatic device adapted to actuate the same in accordance with the temperature of the combustible mixture delivered from the carbureter.

19. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a conduit leading from said source of supply to the carbureter, a

valve interposed in said conduit, and means exposed to the combustible mixture delivered from the carbureter adapted to actuate said valve in accordance with the temperature of the combustible mixture.

20. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a conduit leading from said source of supply to said carbureter, a valve interposed in said conduit, a diaphragm operatively connected with said valve, and means through which said air supply may be led beneath said diaphragm thereby to open said valve, comprising a passage-way, a valve interposed in said passage-way, and a thermostatic device operatively connected with said valve and exposed to the combustible mixture delivered from the carbureter.

21. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a conduit leading from said source of supply to said carbureter, a valve interposed in said conduit, a diaphragm operatively connected with said valve, and means whereby the air pressure may be exposed to said diaphragm to open said valve, comprising a valved passage-way through which the air supply is admitted in accordance with the temperature of the combustible mixture delivered from the carbureter.

22. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a casing provided with a plurality of chambers, a conduit leading from the source of compressed air supply to one of said chambers, a conduit leading from another of said chambers to said carbureter, a passage-way connecting said chambers, a valve adapted to control the passage of air through said passage-way, a diaphragm operatively connected with said valve, and means for admitting air pressure to one side of said diaphragm to operate said valve, comprising a valved passage-way communicating with the source of air supply and that side of the diaphragm, and a thermostatic device for controlling the passage of air through said last mentioned passage-way in accordance with the temperature of the combustible mixture delivered from the carbureter.

23. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a casing provided with a plurality of chambers, an inlet provided in one of said chambers and connecting with the source of air supply, an outlet provided in another of said chambers through which the air supply passes to the carbureter, a partition separating said chambers and having a connecting passage-way, a valve located in said passage-way, a diaphragm operatively connected with said valve, and means for exposing said diaphragm to air pressure, comprising a passage-way connecting said diaphragm with the source of air supply, a valve interposed in said passage-way, an aneroid chamber having a flexible wall connected with said valve, said aneroid chamber being exposed to the combustible mixture delivered from the carbureter, and adapted to operate said valve in accordance with the temperature thereof.

24. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a casing having a plurality of chambers, a conduit connecting one of said chambers with a source of air supply, a conduit connecting another of said chambers with the carbureter, a partition interposed between said chambers having a passage-way connecting the same, a valve normally spring-pressed toward its seat for controlling the flow of air through said passage-way, a diaphragm operatively connected with said valve and adapted to open said valve, and means for distending said diaphragm, comprising a passage-way leading to a position beneath said diaphragm and connected with the source of air supply, a valve interposed in said passage-way, an aneroid chamber having a flexible wall operatively connected with said valve, a casing surrounding said aneroid chamber and a conduit for connecting said casing with said carbureter whereby said aneroid chamber will be exposed to the combustible mixture delivered from the carbureter and caused to operate said valve in accordance with the temperature of the combustible mixture.

25. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a chamber through which air is admitted from said source of supply, a second chamber, a passage-way connecting said chambers, a valve interposed in said passage-way, a diaphragm forming a portion of said second chamber and operatively connected with said valve, and means for distending said diaphragm to open said valve, comprising a by-pass leading from said air supply to one side of said diaphragm, a valve interposed in said by-pass, and a thermostatic device, the operation of which is determined by the temperature of the combustible mixture delivered from the carbureter, adapted to operate said valve.

26. In apparatus of the class described, in combination, a carbureter, a source of compressed air supply, a chamber connected with the source of air supply, a second chamber, a passage-way connecting said chambers, a valve interposed in said passage-way and spring-pressed toward its seat, a diaphragm forming a portion of said second chamber, a third chamber formed upon the opposite side of said diaphragm,

and means for admitting air into said third chamber to expand said diaphragm comprising a by-pass connected with the source of air supply and leading thereinto, a valve interposed in said by-pass and normally urged toward its seat, and a thermostatic device exposed to the combustible mixture delivered from the carbureter adapted to actuate the same and its valve in accordance with the temperature of the combustible mixture.

27. In apparatus of the class described in combination with a car having mounted thereon an air braking system, a gas lighting system, a carbureter connected with a source of gaseous fuel, a connection between said air braking system and said carbureter adapted to supply air under pressure thereto, and means interposed in said supply connection adapted to regulate the amount of air supplied thereto in accordance with the temperature of the gaseous mixture flowing from the carbureter.

28. In apparatus of the class described, in combination, a car having mounted thereon an air braking system, a gas lighting system, and a carbureter, a connection between said carbureter, and said gas lighting system, a connection between said air braking system and said carbureter, and a thermostatic device interposed between said air braking system and said carbureter and also interposed between said carbureter and the gas lighting system adapted to control the quantity of air admitted to the carbureter.

29. In apparatus of the class described, in combination, a car having mounted thereon an air braking system, a gas lighting system and a carbureter, a gas supply connection between the carbureter and the gas lighting system, an air supply connection between the air braking system and the carbureter, and means interposed in said air supply connection and in said gas supply connection adapted automatically to regulate the air pressure within the carbureter.

30. In apparatus of the class described, in combination, a car having mounted thereon a source of air supply, a gas lighting system, and a carbureter, a conduit connecting said carbureter with said lighting system, a conduit connecting said source of air supply with said carbureter, and a thermostatic regulator for said air supply conduit interposed therein, and connected with the conduit extending from the carbureter to the gas lighting system.

In testimony whereof I affix my signature, in the presence of two witnesses.

GEORGE E. HULSE.

Witnesses:
G. R. JEWETT,
E. E. ALLBEE.