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PORTABLE GAS TESTER FOR THE DETERMINATION OF GASOLINE CONTENT OF NATURAL GAS

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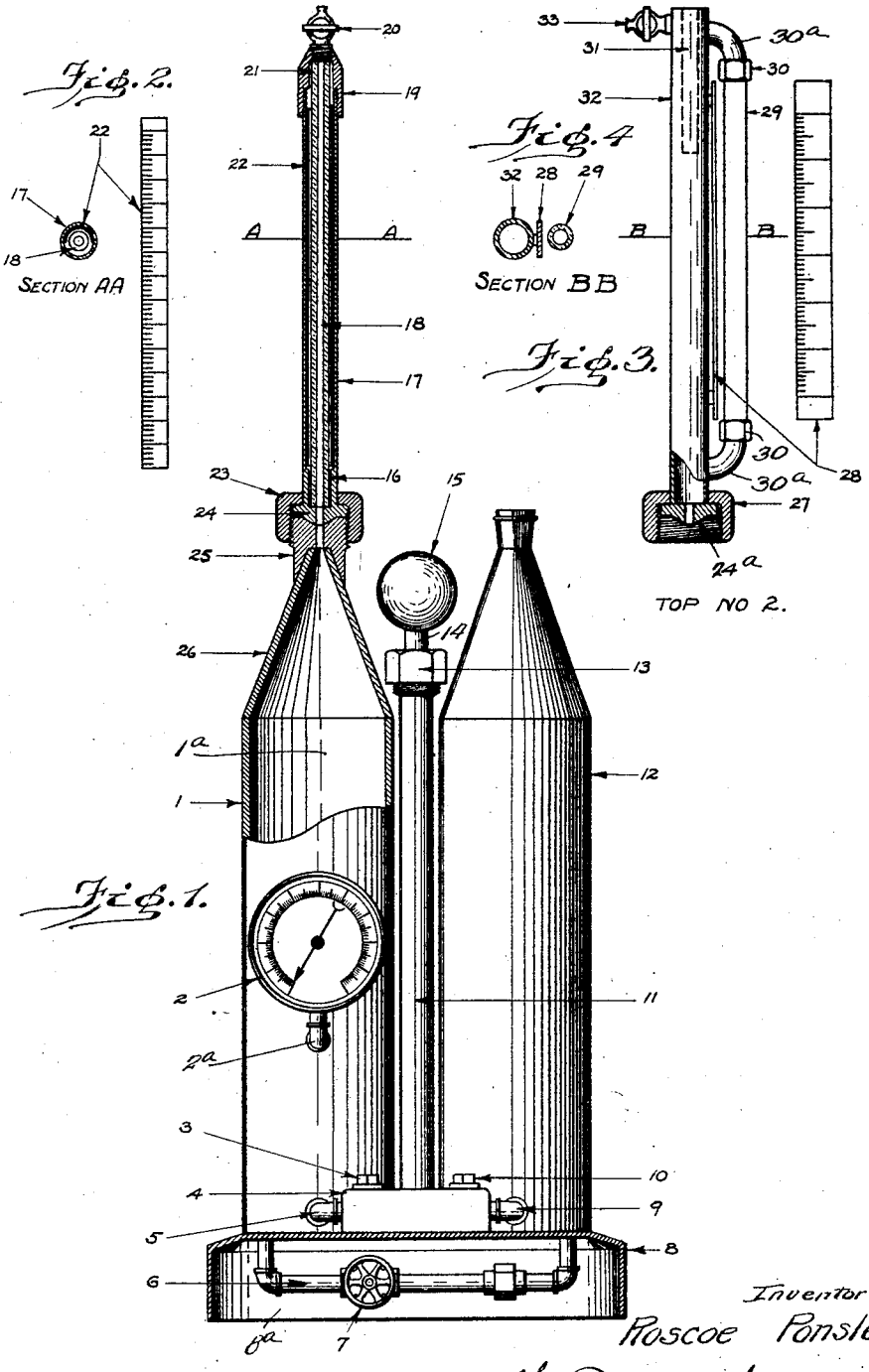

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PORTABLE GAS TESTER FOR THE DETERMINATION OF GASOLINE CONTENT OF NATURAL GAS.

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To all whom it may concern:

Be it known that I, ROSCOE PONSLER, a citizen of the United States of America, and a resident of Tulsa, in the county of Tulsa and State of Oklahoma, have invented certain new and useful Improvements in Portable Gas Testers for the Determinations of Gasoline Content of Natural Gas, of which the following is a specification.

This invention relates to a portable instrument of light weight for the speedy and accurate determination of gasoline content of natural gas.

The object in view in aiming to perfect and develop this gas tester is to furnish a much needed portable instrument, which, by reason of its simplicity in construction and operation, can be readily, or easily, manipulated by the average layman, so as to obtain speedy and accurate determinations of the gasoline content of natural gas.

Another object in producing this instrument is to make it of such compact construction and light weight as to render it able to be readily handled and carried by hand from place to place.

My invention comprises a pair of vessels, one vessel providing a chamber for containing water, and the other vessel providing a compression chamber for the gas or fluid to be tested, a hollow main base upon which the vessels are supported, a pump having a pump base also supported on the hollow main base, and provided with a pump discharge valve and a pump suction valve, a pump discharge pipe connecting the pump base with the compression chamber, a pump suction pipe connecting the water chamber with the pump base, a bypass connection located in the hollow main base having a valve, and connecting the said compression chamber and the said water chamber beneath the pump base, a pressure gage connected with the compression vessel and an indicator mounted on the compression vessel all as hereinafter described and claimed.

In order that my invention may be fully understood, I will proceed to describe it with reference to the accompanying drawing, in which:

Fig. 1 is an elevation of my improved gas tester partly in section.

Fig. 2 is a horizontal section of the indicator on the line A—A, Fig. 1 and showing a detail of the graduated scale.

Fig. 3 is an elevation of a modified form of indicator partly in section.

Fig. 4 is a horizontal section of the modified form of indicator on the line B—B of Fig. 3, and showing a detail of the scale.

Referring to Figs. 1 and 2 of the drawing:

My gas tester comprises a pair of vessels 1 and 12. 1 is a compression vessel having a chamber 1^a to which the natural gas is introduced, compressed and tested, while 12 is a water vessel having a chamber providing a water reservoir. These two vessels 1 and 12, are mounted on a hollow main base 8 which provides a substantial support for the instrument wherever the tester is placed, 2 is a pressure gage supported on the compression vessel 1 and is connected with the interior of the compression chamber 1^a by a pipe 2^a.

Also mounted on the hollow main base 8 is a pump base 4 having a pump discharge valve 3 and a pump suction valve 10. 5 is a discharge pipe connecting the chamber of the pump base 4 with the compression chamber 1^a of the compression vessel 1. Connecting the chamber of the water vessel 12 with the chamber of the pump base 4 is a section pipe 9. 11 is the pump cylinder within which the pump plunger 14 is operated by a pump handle 15, 13 is the pump packing nut. Within the chamber 8^a of the hollow main base is located a bypass connection 6, having a controlling valve 7, and connected at one end through the top of the hollow main base 8 with the chamber 1^a of the compression vessel 1 and at the other end through the top of the hollow main base 8 with the chamber of the water vessel 12. Supported on the compression vessel 1, is the main form of indicator comprising a top body 17, within which is an indicating glass tube 18, set in packing 16 at its lower end surmounted, together with the top body 17 by a detachable top stuffing box 19 receiving the upper end of indicating glass tube 18, surrounded by a packing 21. The upper end of the indicator is fitted with a pressure relieving valve 20. The compression vessel 1 is also constructed with a cone 26 at the top and fitted to and seated upon this cone 26, is a cone tip 25, surmounted by

a ground joint union 24, in which is positioned the packing 16, and indicating glass tube 18 and upon which the top body 17 is supported and between the said indicating glass tube 18 and the said top body 17 is located the graduated scale 22 shown more clearly in Fig. 2. 23 is a union nut whereby the cone tip 25 and ground joint union 24 are detachably secured together.

Referring now to the Figs. 3 and 4 of the drawing showing a modified form of indicator, 24^a is a ground joint union formed with a top body 32 having a thermometer well 31, and a ground joint union nut 27 which connects the indicator with the cone tip 25 shown in Fig. 1. In this instance the glass tube 29 is supported on the exterior of the top body 32 and connected by packing nuts 30 and elbow pipe joints 30^a with the chamber of the top body 32; the graduated scale 28 being in this instance supported on the top body 32 between the latter and the glass tube 29. This top body 32 is provided with a pressure relieving valve 33. This modified form of indicator is also furnished with the instrument to replace the main form of indicator in certain tests of lean gases and its action will be described in subsequent description.

In testing a sample of gas the operation of the instrument is as follows:

The chamber of the water vessel 12 is filled with cold water, the pressure relieving valve 20 of the top body 17 is opened and the water is pumped from the water chamber of the water vessel 12 to the chamber 1^a of the compression vessel 1 until the water overflows the top body 17. Connection is then made from the source of supply of gas under pressure to the indicator, by means of a small rubber tube (not shown). The bypass valve 7, in the bypass connection 6, is next opened, thus allowing the gas under pressure to force the water from the chamber 1^a of the compression vessel 1, through the bypass connection 6, into the water chamber of the water vessel 12 until the gas begins to bubble up through the water. The bypass valve 7, of the bypass connection 6, and pressure relieving valve 20 are closed. The instrument is now charged with the gas sample and is ready for the test. Water is now pumped from the water chamber of the water vessel 12 back into the chamber 1^a of the compression vessel 1 which encloses the gas sample. Sufficient water is pumped into the chamber 1^a of the compression vessel 1 to compress the gas to 250 pounds pressure per square inch or to any other desired test pressure. The gas sample, which is now under 250 pounds pressure and in contact with the cold water, deposits the condensable portion in the form of liquid gasoline on the surface of the water. The pressure relieving valve 20 is next opened sufficiently to allow the pressure to escape gradually. More water is next pumped into the chamber 1^a of the compression vessel 1, expelling the dry, or residue, gas past the pressure relieving valve 20 and bringing the water level up to the bottom of the indicator which will be shown by the water appearing in the glass tube 18. Between the glass tube 18 and the inner surface of the top body 17 is a glass tube shield having a graduated or printed scale 22, as shown by the section line A—A of the top body 7 in Fig. 2. The zero 0 of this graduated scale 22 is near the bottom of the glass tube 18 and is graduated to read in gallons of gasoline per 100 cubic feet, of gas corrected to standard conditions of temperature and pressure. The water level is stopped opposite the zero 0 marked on the graduated scale 22. The gasoline, being much lighter than the water, appears in the glass tube 18 above the surface of the water. The graduated scale 22 is so divided that the depth of the gasoline above the surface of the water indicates the gasoline content of the gas in gallons of gasoline per 100 cubic feet of gas.

If it is desired to test the specific gravity of the gasoline condensed, two or three tests are run on samples of the same gas, collecting the gasoline from each test until enough is obtained to immerse a small hydrometer (not shown) furnished with the instrument. This will not be necessary in the majority of cases since the actual recovery in gallons per 100 cubic feet is the object sought.

There will be cases where the gas tested is very lean and it will be more convenient to use a second type of top body 32 for the instrument which will prove more satisfactory. This second top body 32 as shown in Figs. 3 and 4, is constructed so as to be interchangeable with the first described top body 17 by unscrewing the union nut 23 and replacing with the union nut 27.

When the top body 32 is used the principle of the machine is based on the thermodynamic law that for a perfect gas the product of the absolute temperature times the absolute pressure times the volume is constant. ($P_1V_1T_1=P_2V_2T_2=C$). The top body 32, consists essentially of a tube in which water levels may be read, either by making the tube itself of glass or by making the tube of metal, and attaching a water gauge glass 29 on the side, an opening at the top for introducing a sample of gas, a thermometer well 31, a graduated scale 28 for indicating the levels of the water in the tube and a union nut 27 at the base for connecting the tube to the cone-tip 25 of the tester. The top may be furnished also with a water jacket and insulating material, but for purposes of describing the operation of the instrument these are not shown or considered. Suitable means are also provided in

the form of a screw adjustment for raising or lowering the graduated scale 28 with reference to the top body 32, this action being a compensation for pressure and temperature of the gas sample correcting it to standard conditions.

The operation of obtaining and compressing a gas sample and condensing the gasoline vapor is the same as has been heretofore described and need not be mentioned again. It is here noted that the top body 32 is so designed as to size that a sample of dry gas which completely fills the instrument compression chamber of the compression vessel 1 and top body 32 when at 60 degrees Fahrenheit temperature and atmospheric pressure will be entirely contained in top body 32 above the point marker zero (0) on the graduated scale 28 when the sample is compressed to 250 pounds pressure and the temperature is maintained at 60 degrees Fahrenheit temperature. This zero (0) point is found by compressing a sample of air.

Since a sample of natural gas which carries condensable gasoline vapors will deposit these vapors as liquid gasoline when subjected to the high pressure and when in contact with the cold water in the instrument, it is obvious that the space in the tube occupied by the uncondensable vapors or portion of the gas called the residue gas, will be less than if none of the gas condensed. This means that the liquid level will raise higher than the zero 0 of the graduated scale 28 in order to maintain the residue of the sample at 250 pounds pressure. This distance above zero (0) to which the liquid level rises is a measure of the gasoline vapor condensed. The scale 28 is graduated to read this distance in percentage of the original sample of gas. It has been found that for each per cent of vapor condensed the recovery of gasoline is 1 pint per 1000 cubic feet of gas, which very closely corresponds to the actual manufacturing plant recovery.

It may be desired at times to test the gas at various higher or lower pressures than 250 pounds, in which case the active volume of the top is designed to be changed by inserting thermometer walls 31 of different size tubing which will occupy the desired space.

Various minor changes may be made on the design of the instrument from time to time in order to improve it as occasions arise without in any manner departing from the principle of the invention.

My improved gas tester furnishes a device having the following advantageous construction:

An instrument for determining the gasoline content of natural gas, using water or other suitable fluid as the compressing agent, by forcing it into a closed chamber containing a known quantity of gas to be tested and utilizing the water as a cooling agent as well as the means of collecting the gasoline into a suitable tube for measuring it.

An instrument of light weight which when enclosed in its carrying case will be very compact and readily portable when moved from place to place.

An instrument with which reliable results can be obtained by the average layman as well as by the technically trained man.

In certain cases it may be found that the gas supply from which the gas sample is taken is at such a low pressure that it will not force itself through the instrument against the head of water in the water reservoir. Provision is therefore made in these cases for the gas to escape through a valve controlled opening at the base of the compression chamber.

Since in many cases gas is sold and purchased under certain specific pressure bases, provision is made in this instrument for collecting the sample of gas to be tested, at the pressure specified by simply varying the depth of water in the water reservoir against which head the gas must force itself when the sample is being collected.

While not essential to the operation and reading of the instrument mention is hereby made of intention of using a colored water in the instrument. This is obtained by using an indicator such as phenophthalein in an alkaline water solution. This will not discolor the gasoline but will make the line between the water and the gasoline much plainer as it appears in the glass tube.

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

1. A gas tester comprising a water vessel, a compression vessel, a pump having a pump base provided with suction and discharge valves and suction and discharge pipes connecting the pump base with the vessels and a bypass connection having a valve and connecting the vessels.

2. A gas tester comprising a hollow main base, a water vessel and a compression vessel supported upon the hollow main base, a pump having a pump base, supported upon the hollow main base, and provided with suction and discharge valves and suction and discharge pipes connecting the pump base with the vessels, a pump cylinder supported upon the pump base having an operating plunger and a bypass connection having a valve and connecting the vessels.

ROSCOE PONSLER.