United States Patent

Markey

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[54] **FLUID VAPORIZATION TESTER WITH HOT AIR PURGE AND METHOD**

[72] Inventor: **Francis J. Markey,** Lewisburg, Ohio

[73] Assignee: **General Motors Corporation,** Detroit, Mich.

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[52] **U.S. Cl.** ..... **73/17 A**

[51] **Int. Cl.** **G01n 25/02**

[58] **Field of Search** 73/15, 17

[56] **References Cited**

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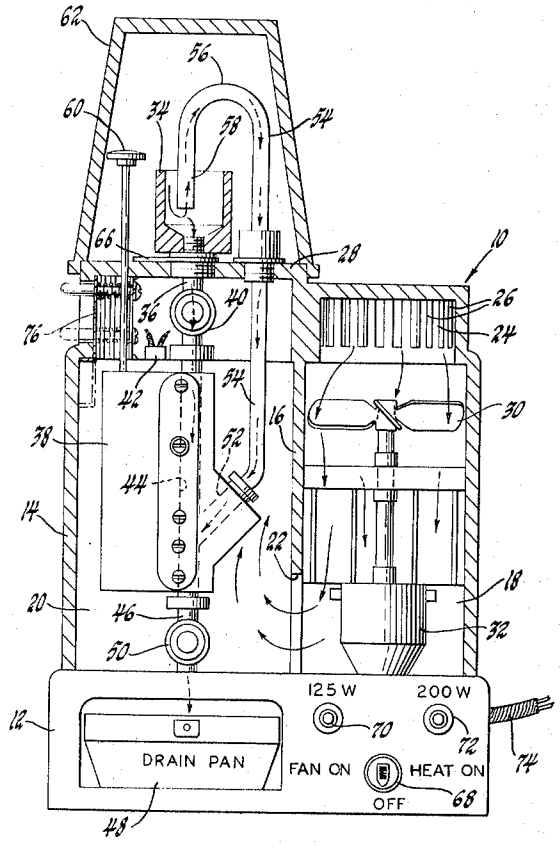
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Primary Examiner—Richard C. Queisser
Assistant Examiner—Herbert Goldstein
Attorney—W. E. Finken and D. D. McGraw

[57] **ABSTRACT**

A visual fluid vaporization indicator in which a sample of the test fluid is placed in a boiler, heated to cause a percolating action until a fluid column surges through the visual indicator tube at the vaporization temperature of the fluid, this temperature being measured and considered to be the boiling point of the fluid sample. After the test is completed, a drain valve is opened to drain the fluid sample from the boiler, and a cooling fan is energized to blow air to cool the boiler, hot air having passed over the boiler being directed through the boiler and the visual indicator tube and out the drain valve to purge the system of the remains of the fluid which was tested, as well as cooling the boiler, prior to inserting another fluid sample.

3 Claims, 2 Drawing Figures



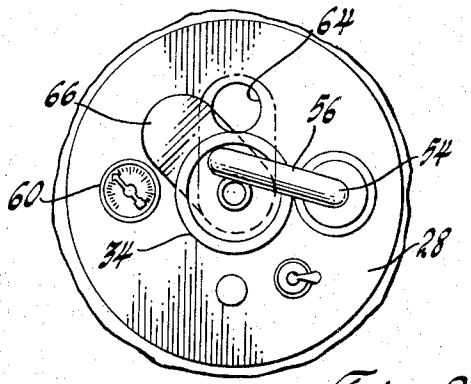


Fig. 2

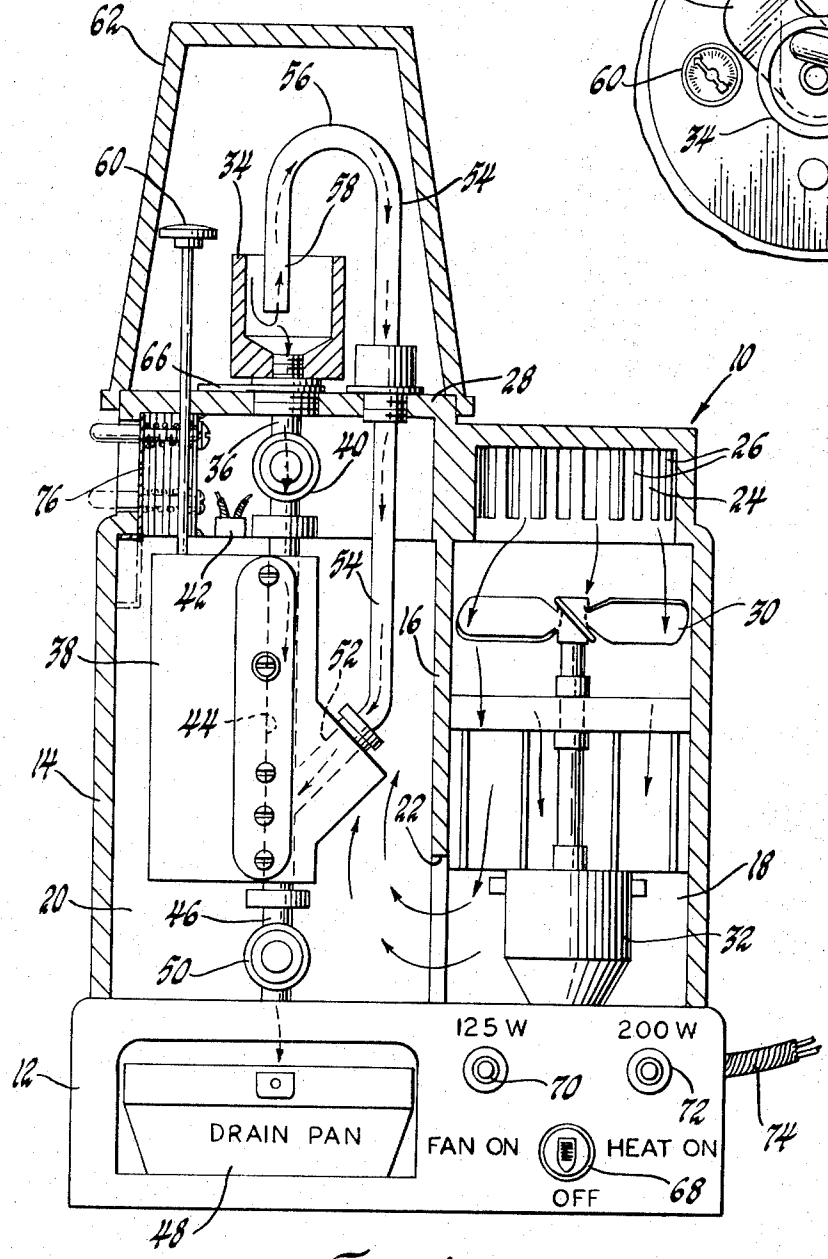


Fig. 1

INVENTOR.
Francis J. Markey
BY
D. D. McGraw
ATTORNEY

FLUID VAPORIZATION TESTER WITH HOT AIR PURGE AND METHOD

The invention relates to a fluid vaporization testing mechanism and a method of testing and preparing the mechanism for further testing, and more particularly to mechanism and method in which a sample of fluid is heated, percolated to determine the fluid vaporization temperature, the mechanism then being purged by hot air, as well as being cooled by air to prepare the mechanism for the next test sample.

The invention is an improvement over that disclosed and claimed in U.S. Pat. application Ser. No. 838,514 entitled "Fluid Vaporization Tester and Method" and filed July 2, 1969 by the applicants now U.S. Pat. No. 3,621,706.

Liquids with a wide variety of properties are used for heat transfer systems, fuel systems, hydraulic actuating systems, lubrication systems, etc. In many systems a safe and reliable operation depends on the liquids remaining in their liquid state and not changing to solids or to gases. Oxidation and low temperatures are common causes of liquids becoming solids while high temperature is a common cause for liquids changing into gases. The temperature at which a liquid begins to generate bubbles of vapor is called the boiling point.

Some liquids, like water, will turn completely into vapor if the initial boiling point temperature is maintained. Other liquids, such as some mineral oils, will require an increasing temperature to continue the boiling action. Liquids of this type are commonly checked for initial boiling point by a distillation method in which a heated flask and a horizontal condenser are utilized to drain condensed vapor into a graduate. The temperature of the liquid being heated in the flask when the first drop over occurs is called the initial boiling point. Liquids which are a mixture of several ingredients, such as hydraulic brake fluids, have been checked for boiling point by a reflux boiling point test also used for radiator coolants, antifreeze solutions, etc. This type of test establishes a stabilized temperature obtained when a condenser is returning a prescribed number of drops per second of condensed vapor to the hot fluid test sample. The existence of a small quantity of light end or low boiling point ingredients which vaporize at lower temperatures does not seriously impair the effectiveness of coolants. However, hydraulic brake systems cannot tolerate very much compressible gas. Hydraulic brake fluid, as well as some fuels, have been found to vaporize under some conditions at temperatures below the reflux boiling point temperature because of lower boiling point fractions, chemical breakdown to produce more volatile fluids, and contamination by water, alcohol, etc. The percolating type of fluid vaporization tester disclosed in the above-mentioned application and also disclosed herein provides a simplified, fast operating, fluid vaporization indicator which will quickly and accurately perform the necessary testing on such liquids. A test sample is held in a boiler chamber which is heated by thermostatically controlled electric heaters. The test sample is connected to a visual indicator tube. As the test sample is heated, it will increase in volume by thermal expansion and this can be observed by the rise of the liquid level in the visual indicator tube. When the test sample begins to turn into vapor, the fluid column in the visual indicator tube will initially throb and the rate of rise in the tube will increase. When the fluid rises by a percolating action to the point of going over the loop of the tube the temperature at that time closely correlates with the temperature at which the fluid from which the test sample is taken will vaporize in actual use. A fan is utilized after the testing of the sample to cool the device and to provide a hot air blast for purging. By flowing the hot air which has absorbed heat from the boiler through the test chamber and the indicator tube the tested fluid sample is purged from the system so that no appreciable carry-over contamination is left to affect the test on the succeeding test sample. IN THE DRAWING:

FIG. 1 is a cross section view with parts broken away showing the mechanism embodying the invention.

FIG. 2 is a top view of the mechanism with the top cover removed.

The tester **10** has a base **12** to which is fastened a housing **14**. The housing is divided by a wall section **16** into a fan chamber **18** and a boiler chamber **20**. An opening **22** through wall section **16** connects the lower parts of the two chambers. The upper end **24** of chamber **18** is connected with cooling air inlets **26** formed through a portion of housing **14**. The upper end of chamber **20** is closed by the housing section **28**. Both chambers are closed by the base **12** at their bottom ends. A fan **30** with its motor **32** is mounted in chamber **18** so that, when the motor is operating, outside air is moved from the air inlets **26** through chamber **18** and opening **22** into the lower end of chamber **20**.

Above the housing section **28** a cup **34** is mounted on a fill pipe **36** which extends through section **28** and connects with the boiler **38** mounted in chamber **20**. A fill valve **40** in pipe **36** may be opened and closed at will by the person conducting the test. The boiler **38** includes two heating units **42** and a chamber **44** which receives the test sample. The lower end of the chamber is connected to a drain pipe **46** which extends through base **12** and terminates over a removable drain pan **48**. A drain valve **50** is positioned in pipe **46**, and it may also be opened and closed at will. Chamber **44** has a branch **52** extending upwardly and outwardly and connected to the indicator tube **54**. This tube extends upwardly through housing section **28** and has a U-shaped bend **56** with the tube end **58** positioned over the cup **34**.

Thermometer **60** extends through housing section **28** and into boiler **38** so that the temperature of the test sample can be determined and read. The cover **62** is provided to protect the portions of the tester above housing section **28** during storage and transport, as well as to guide the air during the purging operation. The cover is removed when tests are being run so that the appropriate observations may be made.

Aperture **64** in housing section **28** is positioned so that the cover plate **66** may be pivotably positioned to open and close the aperture as desired. When cover **62** is in place and purging the system with hot air, aperture **64** connects chamber **20** and the interior of cover **62**.

The mechanism is provided with a suitable control switch **68** which controls the heating units **42** and the fan **32**. Heating unit indicators **70** and **72**, also mounted on the base, may be provided as lights which indicate the amount of energy being transmitted to the heaters. A suitable electrical power supply line **74** is connected

through the control switch **68** to the fan motor and the heating units.

In order to initiate a test, the cover **62** is removed, fill valve **40** and drain valve **50** are closed, and the fluid test sample is placed in cup **34**. Fill valve **40** is then opened, allowing the fluid to move through pipe **36** and into chamber **44** and part of its branch **52**. Fill valve **40** is then closed and control switch **68** is actuated so as to energize the heating units **42**. This causes the test sample in the boiler to be heated.

As the fluid is heated it increases in volume. This can be observed as the fluid level rises in the tube **54**. One of the heating units may have been set to be shut off by its thermostat at about 175° F. if hydraulic brake fluid is being tested, for example. A thermostat adjustment may be provided so that this cut-off point may be changed as desired. A second thermostat controls the other heating unit and the maximum temperature. The second heater thermostat is preferably set to de-energize the second heater at a limit such as 500° F, when hydraulic brake fluid is being tested, or at such other desirable limit which will give a sufficient testing range and not exceed the thermometer limit. The thermostat controlling the second heater may be set to hold the boiler temperature at any desired temperature. If, for example, it is set at the minimum vaporization temperature which is permitted, and no fluid is percolating over the loop **56** when this temperature is reached, the test sample has met the minimum vaporization temperature specification.

When the test mechanism is being operated to determine the vaporization point, it has been heated quickly by both heating elements until one has been cut off by its thermostat, and then more slowly by the remaining heating element. As the test fluid sample begins to vaporize, the initial throbbing action of the fluid in the indicator tube **54** will occur, the fluid will rise rapidly in the tube, and will be observed to go over the loop **56** and drop into the fill cup **34**. The temperature registered by thermometer **60** at this time is observed and recorded as the vaporization temperature for that test sample.

The heating units are turned off immediately after the percolating action occurs indicating that vaporization temperature has been reached. The shutter **76**, in the side of chamber **20** and controlling the air outlet, is then closed. The cover plate **66** is moved to open the hot air blast aperture **64**, the cover **62** is installed, valves **40** and **50** are opened, and the fan motor **32** is turned on. The test sample flows downwardly into the drain pan **48**, air is moved by fan **30** through opening **22** and into chamber **20**. As the air passes over boiler **38** to cool the boiler, the air is heated. The hot air passes through aperture **64** and into the cover **62**. As illustrated by the dashed arrows, air passing through tube **54** to branch **52** of the boiler chamber **44** also passes through fill cup **34**, pipe **36**, open valve **40** and the boiler chamber **44**. The air passes outwardly through pipe **46** and open valve **50**. It is desirable to allow the fluid and vapor being purged by the hot air to flow into the drain pan until the temperature registers a temperature of about 150° F. At this point the valves **40** and **50** may be closed, the shutter **76** open, the cover **62** removed, and the cover plate **66** moved to close aperture **64**. The fan may be turned off when the temperature reaches about 100° F. This purging operation should be followed if the test mechanism has not been recently used, or if a test has just been completed.

A fluid vaporization testing mechanism has been provided which permits a quick and thorough purging of the device to remove a tested sample before a new test sample is inserted. The entire operation can be accomplished in 3 or 4 minutes as compared to test operations of much larger duration when the reflux or distillation methods are used. The mechanism is sufficiently accurate to be utilized to spot check fluids on a production line basis shortly before they are inserted in an automobile, for example. It is also capable of being used effectively by service centers and vehicle inspection stations.

What is claimed is:

1. In a fluid vaporization tester having a housing defining a boiler chamber with a boiler including heating means for heating test fluid, a testing tube leading upwardly from said boiler and reverse-bent to extend downwardly to a boiler fill cup, valve and conduit means selectively connecting the cup with said boiler, drain means for selectively draining test fluid from said boiler, and a cover for the boiler fill cup and reverse-bent portion of the testing tube and when in place defining a second chamber adjacent said boiler chamber, the improvement comprising:

means for forcing cooling air into said boiler chamber,

first air valve means selectively opened and closed and positioned in said housing for venting said boiler chamber to atmosphere after air has passed around said boiler for cooling,

and second selectively opened and closed air valve means positioned in said housing fluidly intermediate said boiler chamber and said second chamber and when open with said first air valve means closed and said cover in place venting said boiler chamber through said second chamber and said testing tube and said boiler and said drain means to purge said testing tube and said boiler of test fluid after testing has been completed.

2. In a vaporization testing mechanism for measuring the vaporization temperature of a liquid sample by heating it in a boiler and measuring the temperature of the liquid at a predetermined condition, hot air purge means comprising:

a fan for forcing air over the boiler to cool the boiler and heat the air, and passage means directing the hot air through the boiler to purge the boiler of liquid which has been tested.

3. The method of testing a series of liquid samples for vaporization and purging the mechanism of tested liquid between each test, comprising the steps of:

a. heating the sample liquid to vaporize a portion thereof,

b. percolating a portion of the sample liquid through a visible inverted U-shaped indicator by gas pressure of the vaporized liquid,

c. measuring the temperature of the sample liquid at the time of the first percolating surge of sample liquid through and beyond the highest point of the visible inverted U-shaped indicator,

d. cooling the sample liquid heater by air and thereby heating the air,

e. and directing the air so heated through the liquid heater and the indicator to purge them of tested liquid.

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