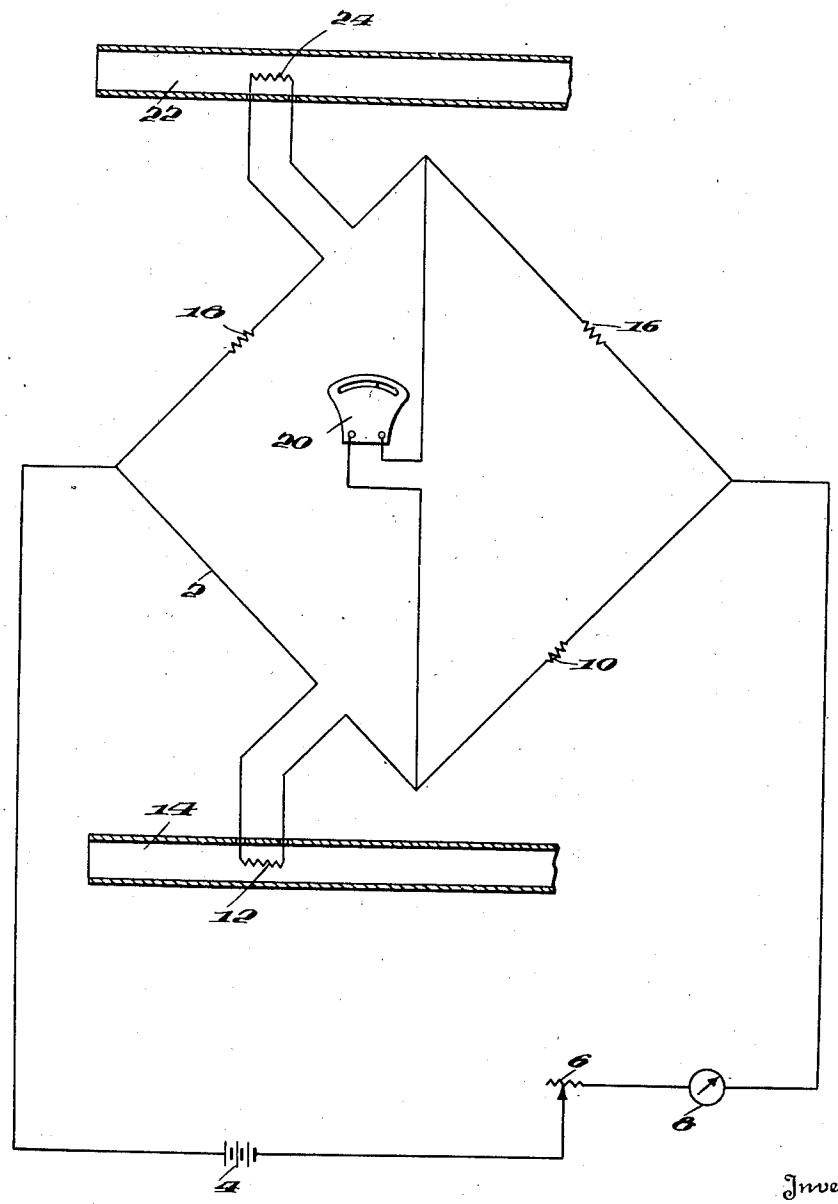
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MEASURING AIR-FUEL RATIO

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MEASURING AIR-FUEL RATIO

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2 Claims. (Cl. 73—51)

This invention is directed to a process for determining the air-fuel ratio of a fuel mixture supplied to an internal combustion engine. Particularly, the invention is directed to the determination of the air-fuel ratio by analyzing both the intake and exhaust gases of an internal combustion engine.

It is well known that the air-fuel ratio in the fuel mixture supplied to an internal combustion engine can be determined by analyzing the heat conductivity of the exhaust gases discharged from the engine. The total heat conductivity of the exhaust gases is, of course, dependent upon the specific heat conductivities of the individual constituents of the gas. One of the constituents is hydrogen, which has a heat conductivity about seven times greater than that of any of the other normal constituents in the exhaust gases, namely N_2, CO, and CO_2. Furthermore, the quantity of hydrogen in the exhaust gas is a measure of the quantity of fuel in the air-fuel mixture.

However, prior to this invention, none of the known methods of measuring the air-fuel ratio by analyzing the exhaust gases took into account the moisture content of the air supplied to the air-fuel mixture, and the effect that this moisture content has on the composition of the exhaust gases which are analyzed. With increasing moisture in the air, the hydrogen content of the exhaust gases increases in ratio with the quantity of moisture in the air. The effect of a larger hydrogen content in the exhaust gases because of an increased moisture content of the air gives a faulty measurement of the air-fuel mixture ratio in the sense that an increase of fuel in the air-fuel mixture is indicated. The error is accentuated because of the relatively great thermal conductivity of the hydrogen.

An object of the instant invention is to produce a method by which the exhaust gas analysis is automatically corrected for changes in the moisture content of the air supplied to the air-fuel mixture.

Another object of the invention is to measure the air moisture content of the air supplied to the air-fuel mixture and correct the exhaust gas analysis by such a measurement so that an exhaust gas measuring instrument will always give the actual air-fuel mixture ratio.

Generally, the objects of this invention are accomplished by measuring, with a hydrometer, the moisture content of the air supplied to an air-fuel mixture, and using this measurement to correct the exhaust gas analysis. For example, when the Wheatstone bridge principle is employed in making the exhaust gas analysis, the hygrometer can be coupled in one of the legs of the bridge to correct automatically for any changes which may occur in the moisture content of the air.

A means by which the objects of this invention may be obtained is more fully shown in the accompanying drawing.

For purposes of demonstrating the novel process of this invention it is assumed that the air-fuel ratio is to be determined by employing an instrument using a Wheatstone bridge for analyzing the exhaust gases. Instruments of this sort are shown, for example, in United States Patents No. 2,154,862, April 18, 1939, to Olshevsky, and No. 2,025,121, December 24, 1935, to Minter.

The Wheatstone bridge **2** is provided with a source of current **4** through variable resistance **6** and milliammeter **8**. One leg of the bridge includes a first resistance **10** and a second resistance **12**. The resistance **12** is in communication with the exhaust gases coming from an internal combustion engine and passing through conduit **14**. Thus resistance **12** varies with the heat conductivity of the gases in conduit **14**.

In heretofore known measuring methods, this leg was balanced by a second leg including resistances **16** and **18**. A potentiometer **20** connected across the two legs is scaled to give the fuel-air ratio upon variations of resistance **12**.

According to the instant invention, further means are included in the measuring apparatus in order to correct for the changes in moisture content of the air in the air-fuel mixture.

In the intake manifold **22**, a hygrometer **24** is mounted which functions as a resistance varying with the changes in moisture content in the air supplied to the air-fuel mixture. This resistance is connected to the second leg including resistances **16** and **18**. Thus the opposed legs of the bridge are balanced against a change in the moisture content of the air in conduit **22** as reflected in the exhaust gases in conduit **14**. That is, if the moisture content of the gases in manifold **22** increases, that increasing will be reflected upon the Wheatstone bridge through hygrometer **24** to offest an increase in the hydrogen content of the gases in the exhaust manifold which affects resistance **12**. Therefore the meter **20** will give a true indication of the air-fuel ratio in the exhaust gases despite changes in the moisture content of the air.

The invention is applicable to any method of exhaust gas analysis, the Wheatstone bridge principle being given merely for purposes of illus-

tration. The process broadly relates to the determination of the correct air-fuel ratio by correcting the exhaust gas analysis with respect to the moisture content of the air.

Having now described a means by which the objects of this invention may be obtained, what I claim as new and desire to secure by Letters Patent is:

1. The process of measuring the air-fuel ratio of the fuel mixture supplied to an internal combustion engine comprising determining by a change of the resistance in a Wheatstone bridge the variation in the heat conductivity of the exhaust gases, and offsetting in said change in resistance such changes induced through changes in the moisture content of the air supplied to the fuel mixture.

2. The process of claim 1 in which said offsetting is obtained by measuring the moisture content of the air in the air-fuel mixture, and varying a resistance in said bridge according to the variations in said moisture content.

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