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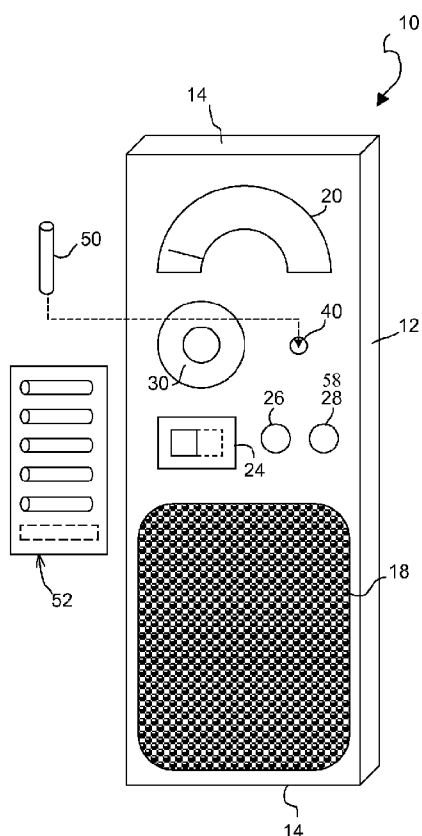


Fig. 1

(57) Abstract: A handheld device (10) for determining a degree of degradation of an oil sample comprises a sample well (30) for receiving the oil sample, an analyzer for measuring a desired property of the same sample when the sample is in the sample well, and a selectable device (50, 60) for providing a benchmark value for the desired property. The selectable device may comprise a calibration sample that can be placed in communication with the measuring means or a lookup table. The selectable device may be provided as one of a plurality of selectable devices.



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DEVICE FOR ASSESSING OIL VITALITY
WITHOUT REQUIRING A CLEAN OIL SAMPLE

Related Cases

Not applicable.

Field of the Invention

5 **[0001]** The invention relates to devices for assessing the vitality or degree of degradation of an engine oil. More particularly, the present invention relates to devices for measuring a desired property of a variety of engine oils without requiring calibration of the device.

10 Background of the Invention

[0002] Internal combustion engines commonly include a lubrication system that includes a reservoir of oil and a mechanism for applying the oil to various surfaces within the engine as it operates. Various factors, including temperature, dirt, shear, and moisture, can contribute to degradation and loss of efficacy of the oil.

15 Eventually, it is necessary to remove the old oil and replace it with new oil in order to maintain operation of the engine.

[0003] Because the rate of degradation is not entirely predictable, it is not possible to accurately estimate when an oil replacement is needed. In addition, visible characteristics of the oil are not particularly good indicators of the degree of degradation of the oil. For these reasons, it may be desirable to quantitatively measure one or more properties of a used oil, in order to determine whether it should be replaced. It is further desirable to provide a measuring device that can be easily and quickly operated to assess the oil in a vehicle while the vehicle is in a service station.

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Summary of the Invention

[0004] Preferred embodiments of the invention provide a device for quantitatively measuring one or more properties of a used oil, in order to determine whether it should be replaced.

[0005] In certain embodiments, the present device includes a sample well for receiving the oil sample, an analyzer for measuring a desired property of the same sample when the sample is in the sample well, and a selectable device for providing a benchmark for the desired property. The selectable device may be one that can be placed in communication with the analyzer.

[0006] The selectable device may comprise an entry in a lookup table or a calibration sample that can be placed in communication with the measuring means. The device may include a plurality of calibration samples, or may be stored in a memory cache. There may be provided a plurality of selectable devices corresponding to a plurality of oil types.

[0007] The device may include a display indicative of the measured value of the property.

Brief Description of the Drawings

[0008] For a more detailed understanding of the invention, reference is made to the accompanying Figures wherein:

Figure 1 is a simplified plan view of a device constructed in accordance with a first embodiment of the invention; and

Figure 2 is a simplified plan view of a device constructed in accordance with a second embodiment of the invention.

Detailed Description of the Preferred Embodiments

[0009] Referring initially to Figure 1, a handheld device 10 for assessing oil quality in accordance with one preferred embodiment comprises a body 12 having a grip end 14 and a display end 16. Body 12 may be any desired size and configuration and is preferably sized and configured to be held comfortably in the hand of an operator.

[0010] Grip end 14 of body 12 is preferably provided with a surface layer 18 of a material that enhances the ability of the operator to grip the device or enhances the comfort of the operator, such as a rubber or synthetic foam layer. Such materials are well known in the art.

[0011] Display end 16 of body 12 preferably includes a display 20 for displaying an output. Display 20 may comprise a moveable indicator, a color-changing

indicator, an LED or LCD display, or any other suitable display means such as are known in the art. While display 20 is shown and sometimes referred to herein as a visual display, it will be understood that other types of output or display, such as audible, tactile, or printed outputs, are equally suitable for use with the present invention and are intended to be encompassed with the scope of the term “display” or “display means.”

[0012] Still referring to Figure 1, preferred embodiments of the device include various additional components on the front of the device between the display and the grip end. The additional components may include a power switch 24, an optional calibration switch 26, a test switch 28, a sample well 30, and an optional calibration opening 40.

[0013] Power switch 24 is preferably a manually operated switch that closes a circuit between a power source (not shown) located within body 12 and the operating components of the device, as described below. When power switch 24 is in the “off” position, no power flows to the components of the device.

[0014] Calibration switch 26 causes power to flow through the calibration circuit of the device. The calibration circuit (not shown) includes the power source, a benchmarking device, at least one sensing device, and display 22.

[0015] Similarly, test switch 28 causes power to flow through the test circuit of the device. The test circuit (not shown) includes the power source, sample well 30, a sensing device (not shown), and display 22. Both the test and calibration circuits can be constructed in any suitable manner, using known techniques and materials.

[0016] Sample well 30 is preferably an indentation in the front surface of body 12. Sample well 30 may be frustoconical, hemispherical, cylindrical, rectangular, or any other desired shape. Sample well 30 is preferably sized such that its volume is sufficient to receive a fluid sample of sufficient size to allow the desired properties of the fluid to be measured as described below. In many instances the volume of sample well 30 may be between about 0.5 and 5 ml, and more preferably between 1 and 2 ml.

[0017] The calibration and test circuits may share a common sensing device or may have separate sensing devices. The sensing device or devices used in the present invention may be any device suitable for measuring a desired property of the sample, such as are known in the art. By way of example only, the sensing device

may measure dielectric constant, electrical resistance or conductivity, or an acoustic property. By way of further example, if the sample to be assessed comprises oil that has been used in an internal combustion engine, it may be desirable to measure water contamination of the oil. Engine oil has a dielectric constant of from about 1.5 to about 3, depending on brand and age, while the dielectric constant of water is about 87 and that of typical coolants is about 35. Thus, measurement of the dielectric constant of the oil is one way to assess the amount of water in an oil.

[0018] Each sensing device may be coupled to a display so that the property measured by the sensing device is qualitatively or quantitatively displayed thereby.

To continue with the above example, if the dielectric constant is measured, the display may either display a value for the measured dielectric constant or merely indicate whether the measured value is above a predetermined threshold or within a predetermined range.

[0019] Because engine oils and other industrial fluids exhibit a range of properties, including dielectric constant, even when in a new condition, the value of a measured property of the fluid sample may not give meaningful information about the degree of degradation or contamination of the fluid in the sample. In order to differentiate between different oil types and be able to detect degradation in each the present device needs to be calibratable. According to certain embodiments, the present device can be calibrated in several ways.

[0020] According to the embodiment shown in Figure 1, one method for calibrating device 10 is to provide a calibration opening 40 into which a corresponding calibration member 50 can be inserted so as to provide the device with a value of the measured property against which the sample is to be compared. Calibration member 50 preferably includes an amount of a material for which the value of the measured property, such as impedance or dielectric constant, is the same as or close to the value of the same property for fresh oil of the same type that will be tested. For example, calibration member 50 may comprise a small sample vial of oil or other substance having a dielectric constant approximately equal to that of a known clean oil. In some embodiments, calibration member 50 may be provided as part of a set 52 comprising multiple different calibration members, so that the device can be calibrated for a variety of different clean oils. When calibration member 50 is inserted in calibration opening 40, it is in sensing contact with the sensing device in

the calibration circuit. Actuating calibration switch 26 causes the calibration circuit to measure the desired property in the sample so as to produce a calibration value.

[0021] Once a calibration value or benchmark has been obtained, the test circuit is used to obtain a measured value for a sample of oil in sample well 30, which may contain used or new oil. Test switch 28 is actuated so as to cause the sensing device to measure the desired property for the sample in well 30. The measured value is then compared to the calibration value and the result is used to generate an output that is indicative of the quality of the oil in well 30.

[0022] Referring briefly to Figure 2, in another embodiment, device 10 can be provided with a memory cache of selectable values that can be used for calibration. By way of example, the memory could include data regarding a dielectric constant for each of several types of fresh oil. The desired oil type may be selected using a manual selection device 60. In some embodiments, manual selection device 60 may include an indexed slider 56 that is slidable as indicated by arrow 58 between a plurality of positions. At least one of the positions is identified with a value in the memory cache or lookup table. In this case, selection of an oil type by the operator using the slider would cause the device to use the stored dielectric constant corresponding to that oil type as a benchmark or calibration value for comparison to an oil sample. The positions for slider 56 may be labelled to facilitate selection by the operator.

[0023] In embodiments such as shown in Figure 2, in which calibration is provided through a lookup table, the calibration circuit, calibration opening 40, and calibration switch 26 may be omitted from the device. Alternatively, the calibration circuit and switch can be provided in conjunction with the lookup table, so as to offer a choice of calibration techniques in a single device.

[0024] In still other embodiments (not shown), the device may be hardwired with a single, pre-set benchmark value. The benchmarked property is selected to correspond to the property that will be measured in the test circuit and its value may be selected on the basis of an expected value for the market or region in which the device will be used. Alternatively, the pre-set benchmarked value can be provided by a separate benchmarking device that is selected based on region or market and then permanently or semi-permanently mounted in device 10.

[0025] Typically, operation of device 10 begins when power switch 24 is turned on, so that power is available to the device circuits. When it is desired to assess the quality of an oil sample, the sample is placed in the sample well. Calibration can be performed before or after the sample is placed in the well. If necessary, the device is calibrated, such as by selecting and inserting a calibration member 50 that corresponds to the type of oil that comprises the sample, or by selecting the oil type on selector 56 so that the desired data is accessed in the device memory. If the device is hardwired with a benchmark value, no calibration may be necessary, but if the device is provided with a hardwired benchmarking device 50, it may be necessary to use the calibration circuit to obtain a benchmark value from the benchmarking device.

[0026] Once the benchmark value has been established, the test circuit may be used to measure the desired property of the oil sample and obtain a measured value. By comparing the measured value to the benchmark value, device 10 can provide an output that is indicative of the degree of degradation or contamination of the oil sample. That output is displayed on display 20. If the output indicates that the oil quality is below a desired level, the oil can be replaced.

CLAIMS

1. A handheld device (10) for determining a degree of degradation of an oil sample, comprising:
 - 5 a sample well (30) for receiving the oil sample;
 - an analyzer for measuring a desired property of the same sample when the sample is in the sample well, said analyzer generating a measured value for the oil sample;
 - a selectable device (50, 60) for providing a benchmark value for the desired property; and
 - 10 a display (20) for displaying an output, said output corresponding to a comparison between said measured value to said benchmark value.
2. The device according to claim 1, further including a plurality of selectable devices corresponding to a plurality of oil types.
 - 15
3. The device according to claim 2 wherein the selectable devices comprises at least one calibration sample (50) that can be placed in communication with the analyzer.
4. The device according to claim 3, further including a plurality of calibration samples
20 (50) housed in the device.
5. The device according to claim 4, further including a manually operated selector for selecting one of said calibration samples.
- 25 6. The device according to claim 1 wherein the selectable device comprises a lookup table.
7. The device according to claim 6 wherein the lookup table is stored in a memory cache.
 - 30
8. The device according to claim 1 wherein the analyzer is selected from the group consisting of analyzers that measure dielectric constant, electrical resistance or conductivity, acoustic properties, and combinations thereof.

9. The device according to claim 1 wherein the analyzer is selected from the group consisting of analyzers that measure water contamination of the oil.
- 5 10. The device according to claim 1 wherein the volume of sample well (30) is between 0.5 and 5 ml.

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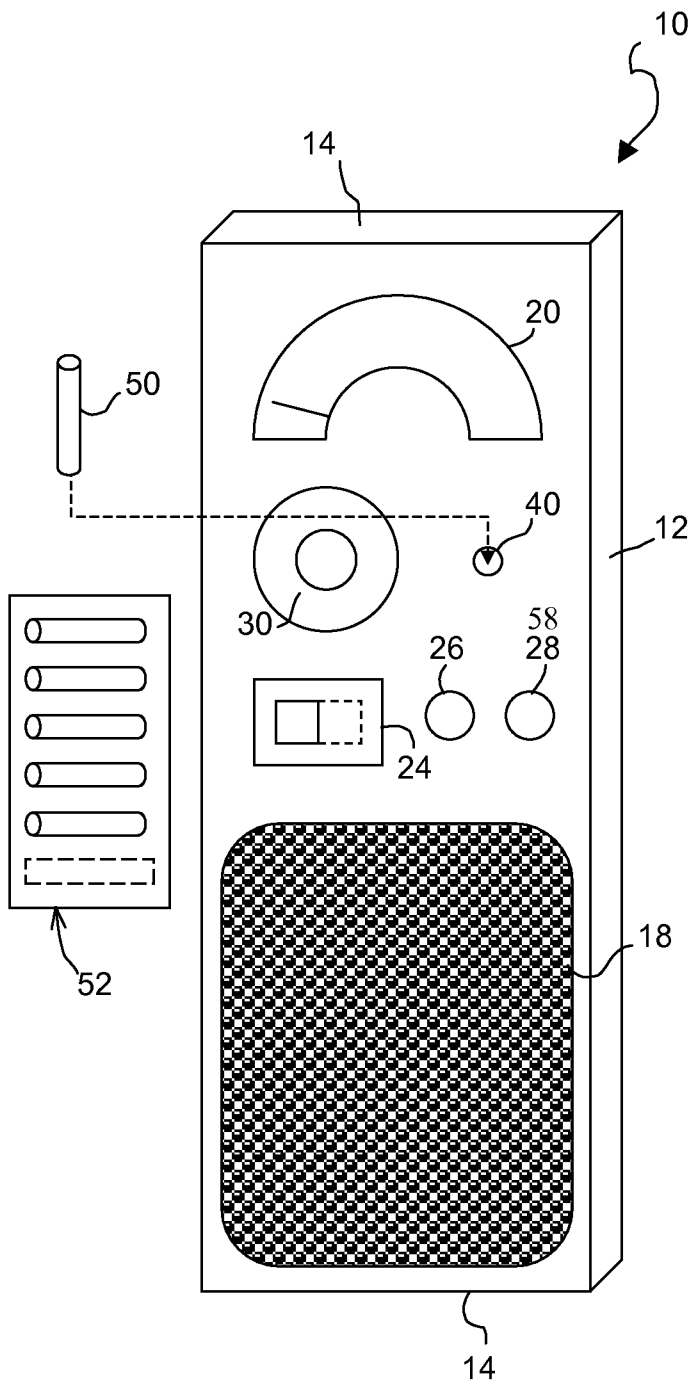


Fig. 1

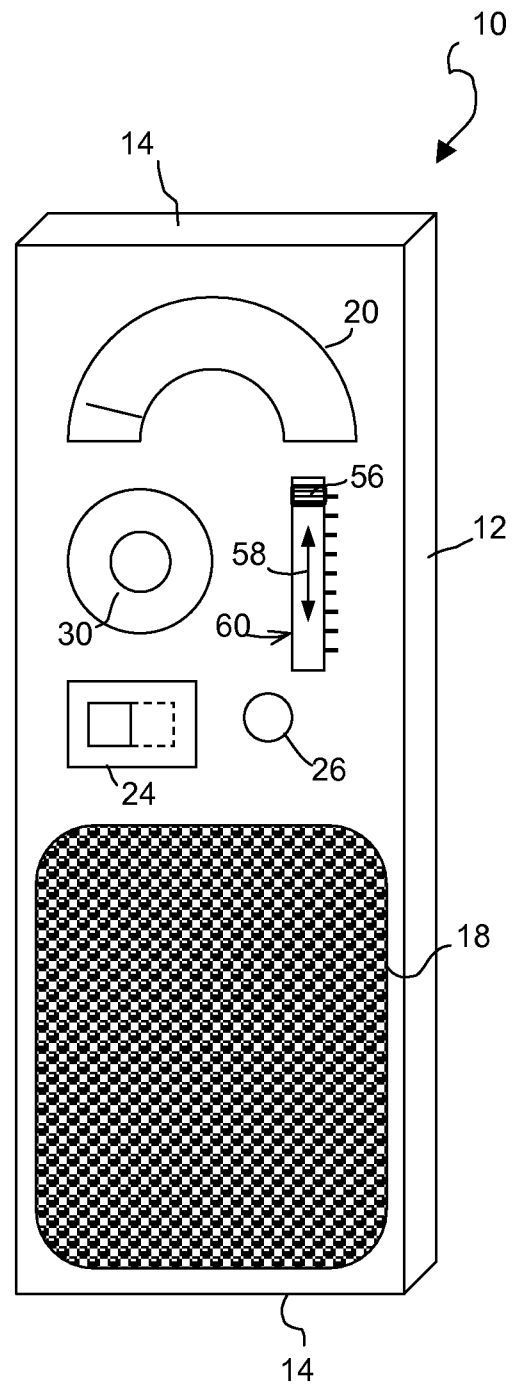


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER
INV. G01N33/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 5 194 910 A (KIRKPATRICK JR JAMES F [US] ET AL) 16 March 1993 (1993-03-16) column 15, line 9 - line 19 figure 7 -----	1-10
X	US 4 064 455 A (HOPKINS EVAN LLOYD ET AL) 20 December 1977 (1977-12-20) column 5, line 31 - line 37 column 6, line 19 - line 42 figures 2-4 ----- -/--	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

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Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 889 736 A (BORG EDWARD M) 9 June 1959 (1959-06-09) column 4, line 20 - line 43 figures 2,3 -----	1-10
A	US 5 644 239 A (HUANG JOSEPH Y [US] ET AL) 1 July 1997 (1997-07-01) the whole document -----	1-10
A	US 2 082 252 A (MCDILL REX D) 1 June 1937 (1937-06-01) the whole document -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2008/079909

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