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PROJECTING INDICATING MEANS

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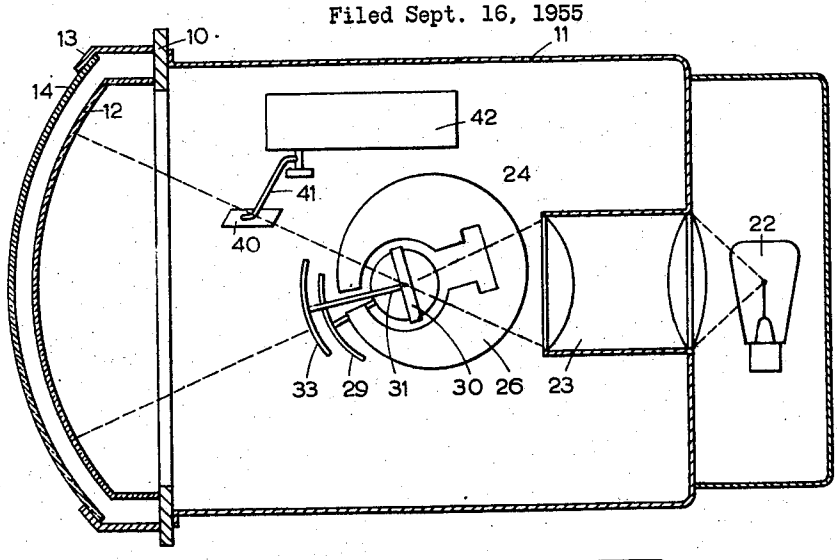


FIG. 1.

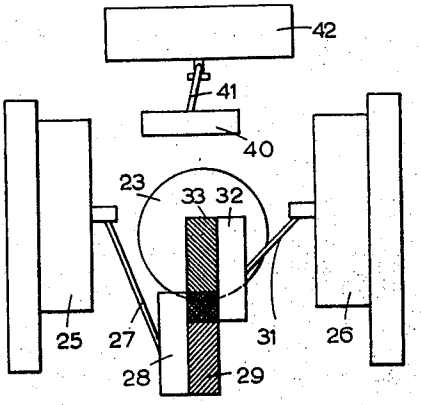


FIG. 2.

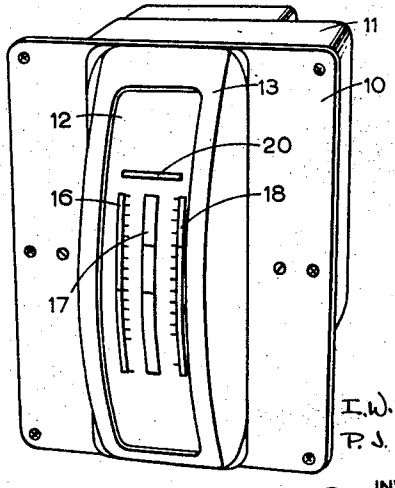


FIG. 3.

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PROJECTING INDICATING MEANS

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This invention relates to indicating means of the type in which the values of two different variables are indicated.

This is generally effected by two separate pointers and scales.

In some cases, for reasons of safety or efficiency one of the variables must not exceed a specified value which may be a function of the value of the other variable and it may then be possible to arrange the scales so that for the stated maximum permissible values the two pointers would be parallel to one another. The existence of an undesirable condition would be indicated when the pointer indicating the variable which must not exceed a stated maximum, was ahead of the second pointer. However, confusion can arise in distinguishing between the two pointers.

It is the object of this invention to provide improved indicating means of the type specified to provide a clear indication of the existence of an undesirable condition.

According to the invention, the indicating means comprises vanes made of light transmissible material, means for moving said vanes independently of each other in accordance with different variables, and illuminating means for throwing shadows of the vanes on to a screen. Preferably the vanes are made of light transmissible material of different colours and the paths of the shadows preferably overlap each other on the screen. The vanes may be semi-transparent and the scale means may be translucent.

The invention will now be described by way of example with reference to the accompanying diagrammatic drawings wherein:

Figure 1 is a side view of the main parts of an indicating means made in accordance with the invention for use as a furnace heat loss meter;

Figure 2 is a front view thereof of certain parts; and

Figure 3 is a perspective view of the meter.

In boiler furnaces and the like, heat losses are caused by the heat carried up the chimney in hot gases. For any given heat output from the boiler the volume of gases will vary inversely with the percentage of their oxygen content which has been converted into carbon dioxide so that theoretically the volume would be at its minimum under the conditions when all of the oxygen content in the through going gases has been converted to carbon dioxide, because in this condition no excess of air is passing through the combustion space to carry away heat. In practice, however, this condition can never be achieved, and it is always necessary for additional air to pass through the combustion space. For these reasons boiler flues are often fitted with continuously operated gas analysis equipment in order to assist in the maintenance of the correct fuel/air ratio. However in order to make a calculation to obtain the actual heat loss via the chimney expressed as a percentage of the heat generated, both the temperature of the gas and the percentage of carbon dioxide have to be taken into account. It is common practice to install in the boiler house either separate indicators showing the temperature rise of the gases and the percentage of carbon dioxide or a combined instrument showing these two variables by two separate pointeds.

According to a further part of the present invention, we provide a combined instrument preferably with scales disposed in the same vertical plane and consisting of a temperature scale and a percentage carbon dioxide scale which are so arranged that for any given point on the temperature scale the corresponding point on the carbon dioxide scale, on an equal physical level represents a constant predetermined percentage of heat loss.

As shown in the drawings a main plate **10** carries a casing **11** on one side, a scale plate **12** on the other side, and a metal frame **13** carrying a glass cover plate **14**. The scale plate **12** is formed with three vertically elongated windows **16**, **17**, **18** and a horizontally elongated window **20**, all provided with translucent covers forming screens. The scale plate carries scale markings of temperature alongside the window **16** and markings of CO_2 content alongside the window **18**.

In the rear part of the casing **11** is mounted an electric lamp **22** of the so-called "pre-focus" type the light from which passes through a lens assembly **23** which produces a beam having a focal point at **24** and which is able to illuminate all the windows.

On opposite sides of the casing are mounted two millivoltmeters **25**, **26** the former of which is operated according to the temperature of the gases by connection to a thermocouple located in the chimney, and the latter of which is operated in accordance with CO_2 content of the gases by connection to an electric gas analyser.

The moving coil of the millivoltmeter **25** carries an arm **27** on the end of which is a piece of sheet metal **28** doubled upon itself so as to hold a piece of celluloid or like synthetic plastic sheet material **29** which is light transmissible and coloured red. The moving coil (**30**, Figure 1) of the multivoltmeter **26** likewise carries an arm **31**, metal plate **32**, and a celluloid sheet **33** which is coloured green. The parts **28**, **29** and **32**, **33** constitute vanes which overlap transversely and vertically in the viewing direction and are adapted to interrupt the light beam so as to throw shadows on the screens, the shadows from the light transmissible parts **29**, **33** being coloured and appearing on the screen of window **17** whereas dark shadows are thrown by the opaque metal parts **28**, **32** on to the screens of windows **16**, **18** respectively. The vanes move in the direction of elongation of the windows **16**, **17**, **18** i. e., vertically. Thus the central translucent screen of the scale plate may either be shielded from the direct light by the red portion of the temperature indicating vane or the green portion of the carbon dioxide indicating vane, or it may be shielded by the coloured portions of both vanes, in which case since the red vane transmits only red light and the green vane only green light, the combination will cast a dark shadow on the central part of the scale plate. If the green vane is in a higher position in respect of the scale than the red one, then the dark shadow on the central part will have an illuminated green sector above it, but if the red vane is higher up the scale than the green one, then the dark shadow will have an illuminated red sector above it. Thus with the undesirable condition of high temperature and low carbon dioxide content, a clear warning is given of this condition by the presence of a red sector in the central portion of the translucent scale plate. Under normal working conditions (which may represent a calculated loss e. g., 15%, 20% or 25% loss) when the temperature and percentage carbon dioxide are indicated by shadows of equal height on their respective

scales, no colour appears in the central portion but if better than average conditions of combustion are achieved, as denoted by the presence of low temperature and high carbon dioxide content, then this condition is indicated not only by the indicating shadows on the respective scales but also by the appearance of a green sector in the central portion of the scale. The apparent length of the colour sector is a measure of the divergence of the actual conditions from the chosen condition from which the instrument scales are calibrated. Thus the combined indicator gives the boiler house operator immediate information as to the conditions of combustion in a very simple and obvious manner in addition to the usual information as to the temperature and percentage carbon dioxide of the flue gases.

An additional vane **40** may be made of metal or of light transmissible material of another colour e. g. amber and is carried by an arm **41** on the moving coil of a millivoltmeter **42** operated by connection to a gas analyser in accordance with proportion of unburnt gases (CO or H_2) showing a waste of fuel.

The principles of overlapping the coloured vanes may be used to indicate the comparative condition of many other pairs of inter-related variables. Alternative colours to red and green may be more suitable in certain applications.

We claim:

1. An indicating device comprising in combination, a plurality of separate movable vanes constructed of light transmissible sheet filter material of at least two different complementary colors, means for supporting and moving said vanes in overlapping relationship in related substantially uniformly spaced paths and independently of each other in accordance with moving means actuated by different variables in a projection light beam, a viewing screen means, and illuminating light source means in operative alignment with said screen means and said movable vanes for projecting shadow images of said moving vanes in overlapping relation to each other whereby color indications of each of the two moving vanes and the corresponding color indication of the difference of the two moving vanes are simultaneously projected on said screen.

2. The combination set forth in claim 1, said light transmissible material being made of selected colors respectively.

3. The combination set forth in claim 2, a window having a screen positioned on said device to receive said overlapping shadows of said vanes.

4. The combination set forth in claim 3, wherein at least one of the vanes has two parts of different light transmissibility throwing shadows on two such windows.

5. The combination set forth in claim 4, said device having three such windows elongated in the direction of movement of the vanes, said vanes throwing overlapping shadows on the center window and each throwing a shadow respectively on the other windows.

6. The combination set forth in claim 5, wherein one of said parts of said vane is a colored sheet of a synthetic plastic material carried by a metal support which constitutes the other of said parts.

7. The combination set forth in claim 6, wherein one said vane is provided with an actuating device for operation by a gas analyzer to show CO_2 content of furnace gases, and the other is provided with a similar actuating device for operation according to the temperature of said gases.

8. The combination set forth in claim 7, wherein a third vane carried by said support means throws a shadow on a fourth window to show the presence of unburnt gases.

9. The combination set forth in claim 8, said paths of said vanes being substantially concentric circles, said screen having a temperature scale and a percentage carbon dioxide scale marked thereon and so arranged that for any given point on the temperature scale the corresponding point on the carbon dioxide scale on an equal physical level represents a substantially constant predetermined percentage of heat loss.

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