Feb. 26, 1957 A. L. MENDENHALL, JR 2,783,390

SMOKE DETECTING DEVICE

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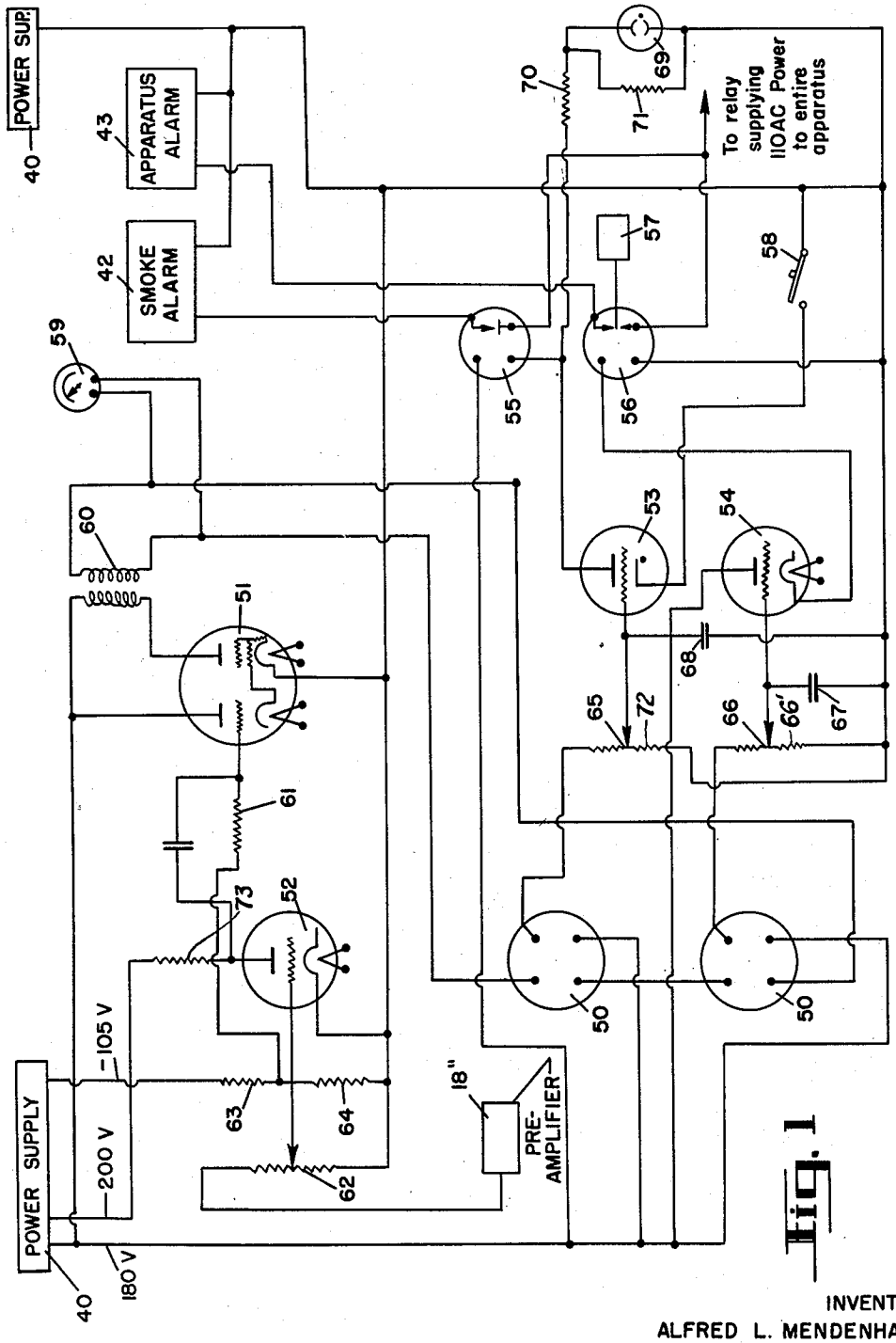


Fig. 1

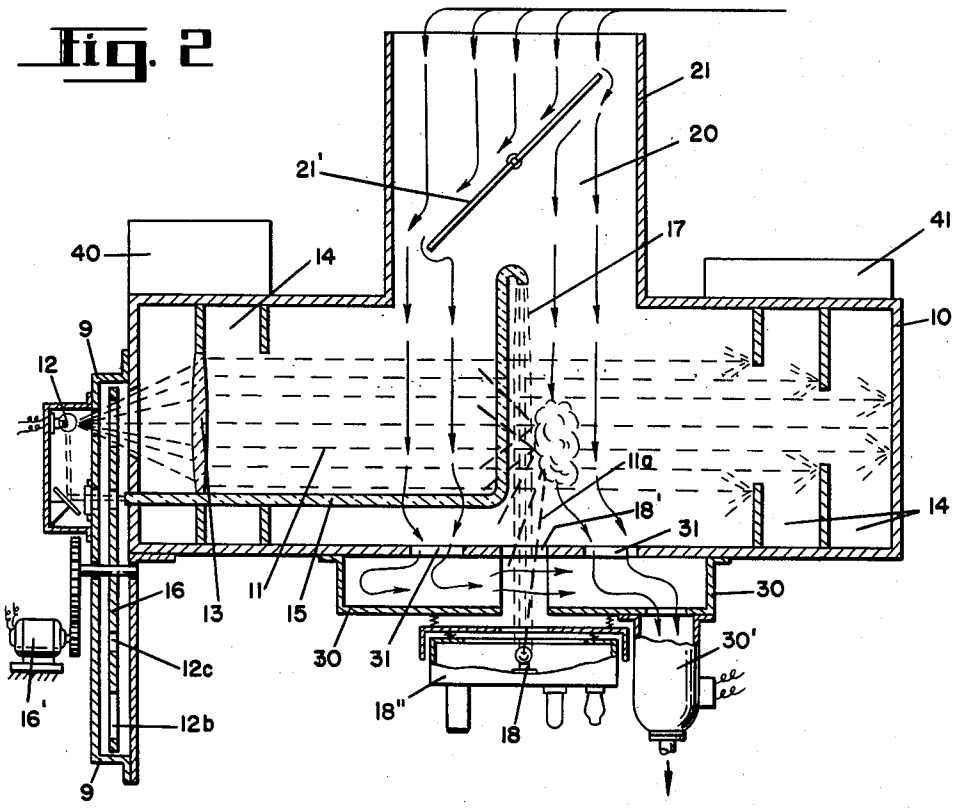
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Fig. 2



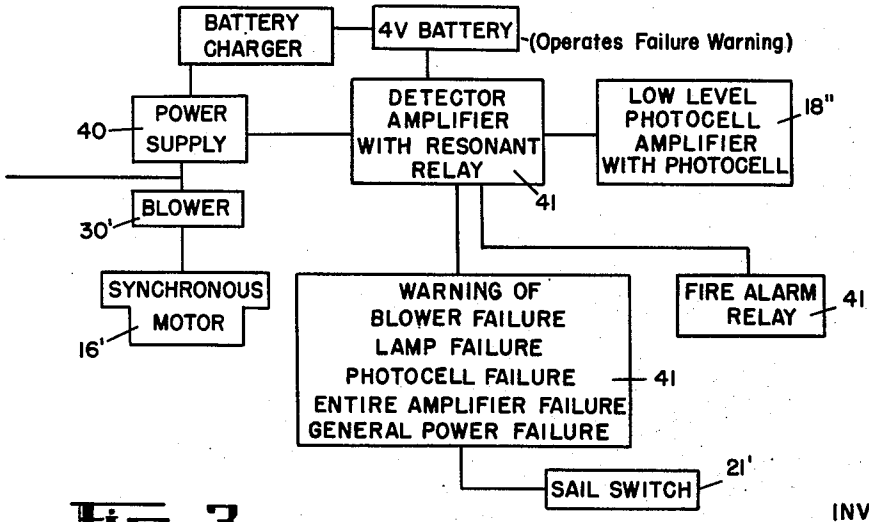


Fig. 3

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SMOKE DETECTING DEVICE

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8 Claims. (Cl. 250—218)

My invention relates to a device for the detection of smoke by utilizing electrical circuits with an associated photocell, apparatus for sounding alarms, and a modulated light source generator.

By utilizing the principle of a modulated light wave being viewed by a photocell only under smoke-present conditions whereby some portion of the modulated light is diverted and actuates a photocell, connected amplifier, resonant circuits and alarm system apparatus, I achieve a new and novel means of detecting smoke for alarm purposes, usually before combustion is complete resulting in a fire.

Therefore one of the objects is to provide a device to detect smoke in an atmosphere by means of a diverted or scattered modulated light beam. A further object is to provide in a smoke detecting device a continuously monitored electrical circuit and means to signal a failure of the same.

The apparatus, and electrical circuits embodying my invention are described herein and partially shown in the accompanying drawings which form a part of this application and in which:

Fig. 1 shows a detector circuit used in my invention.

Fig. 2 is a partial schematic and cross sectional view of one embodiment of my invention illustrating the elements used.

Fig. 3 a block diagram of my invention illustrates the combination of elements of my invention.

It will be noticed that Fig. 2 shows a portion of my invention to be contained within a T-shaped smoke-box housing, **10**, within which is transmitted the essential 210 cycle modulated light beams **11**, from light source **12**, perforated disc **16**, lens **13**, and into black body light traps, **14**. The Lucite rod **15**, conducts a modulated light **17** from light source **12**, modulating disc **16** and directs modulated light beam **17** of 153 cycles towards photocell **18**, as a continuous monitoring system to assure operator device is operating.

Air sample **20** is brought into throat **21** past sail switch **21'** of housing **10** and passes through light beams **11** and out through apertures **31** and chamber **30** by suction fan apparatus **30'**. In Figs. 1, 2 and 3, numeral **40** represents the power supply. **42** is the smoke alarm, **43** is apparatus warning alarms, **18"** is the low level photocell amplifier with photocell. It will be noted that when sail switch **21'** is not pressured by air **20** it functions to sound alarms that apparatus is inoperative. Fig. 1 shows a detector circuit used in my invention and in Fig. 3 **41** shows the location of the detector circuit. Disclosed in Fig. 1 is a typical detector circuit which illustrates my method of producing circuit currents to operate auxiliary apparatus as shown. It is obvious that a recording mechanism could also be placed in the circuit to show the time of any failure of the apparatus. **50** shows resonant relays, **51** shows a 6N6G duo-triode tube, **52** shows a 6AC5GT triode tube, **53** shows an 0A4G gas triode, **54** shows a 6C5 triode, **55** shows a SPDT relay, **56** shows a SPDT relay, **57** shows a 4 volt battery, **58** shows the

smoke alarm cut off switch, **59** shows an A. C. volt meter which reads the signal to the resonant relays, **60** shows a coupling transformer, **61** is a grid bias resistor 2.2 megohm, **62** shows a potentiometer 2.5 megohm, **63** shows a 10 megohm resistor, **64** shows a 1 megohm resistor, **65** shows a ¼ megohm resistor, **66** shows a 5 megohm resistor, **66'** shows a 22 megohm resistor, **67** shows a .1 mfd. capacitor, **68** shows a .2 mfd. capacitor, **69** shows a voltage regulating tube VR150 which prevents a high voltage surge from appearing on the plate of the 0A4G tube, **70** shows a 17,500 ohm resistor, **71** shows a 50,000 ohm resistor, **72** shows a 500,000 ohm resistor, and **73** shows a 160,000 ohm resistor. **40** is the power supply, **42** shows the smoke alarm relay, **43** is the warning alarm relay, and **18"** is the low level photocell amplifier with photocell.

I choose to use a pulsed light wave signal, beam **17**, as mentioned above, with characteristics of 153 cycles per second secured from disc **16**, as interrupter revolving at 19.1 revolutions per second, having 8 hole system **12***c* which provides the supervisory testing light wave frequency.

As for the smoke warning system, on one end of housing **10** is located a light generator **9** or interrupter, rotatable disc **16**, driven by a synchronous speed 1800 revolutions per minute electric motor **16'**. Disc **16** has two sets of perforations, viz; hole system **12***b* near the periphery and **12***c* near the center of the disc **16**. **9** represents the housing for the light source and disc **16**.

Hole system **12***b* interrupts light **11** from source **12**, so as to produce 210 cycles per second modulated light **11***a* which is directed in a parallel manner from lens **13**, towards light traps **14**, as shown in Fig. 4.

Hole system **12***c* interrupts light **11** at a rate of 153 times per second and thus produces a modulated light **11***b* of 153 cycles per second which is continuously directed by Lucite rod **15** into view of photocell **18** through window **18'**.

For an explanation of the essential feature of my invention it should be noticed that the 153 cycles per second light signal **11***b* is continuously beamed into photocell **18** for a circuit "test" or monitoring purpose, thereby assuring the continuous operable condition of the device, while the 210 cycles per second light **11** is never viewed by photocell **18** unless a quantity of smoke particles are sucked into throat **21** and in passing through light beams **210**, scatter a portion **11***a* of light **11** and reflects a portion **11***a* into photocell **18**, causing it to function and transmit the necessary alarms by means of electrical relays, amplifiers, and auxiliary apparatus not deemed necessary to fully set out in detail.

The power supply indicated in Figs. 1 and 2 by numeral **40**, and resonant relays and other auxiliary equipment are not of my invention and being common to the electronic art it is not believed necessary to fully show or explain the same.

Photocell **18** in Fig. 2 with associated electrical resonant circuits, is receptive to the two different light frequencies, namely 153 cycles per second for monitoring, and 210 cycles per second for sounding an alarm when smoke, indicating a fire hazard, is present in housing **10** and scatters some portion **11***a* of light **11** into view of photocell **18** as explained hereinbefore. Thus it will be understood that tuned resonant circuits associated with photocell **18** will function as auxiliary apparatus to operate selected alarms not deemed necessary herein to describe further.

Fig. 3 illustrates by way of a block diagram of my invention, the essential elements and their combination deemed to be a part of my invention.

The electrical circuit shown herein, Fig. 1, electrically very stable due to the combination of using A. C. amplifiers with modulated light frequencies, this has been dis-

covered to be of great importance to render the device sensitive and stable in operation.

Having explained and shown my invention, I claim:

1. In a device of the class described, the combination of a photocell responding to one light wave frequency for monitoring purposes and another light wave frequency for alarming purposes, a light source, means for casting light waves of differing frequency from said source, one upon said cell and another in by-passing accessible relation to said cell, and means for passing an air sample through the latter said light wave, relatively solid particles in said sample reflecting light from the said latter wave upon said cell.

2. In a device of the class described, the combination of photoelectric control apparatus including a photocell, a smoke box housing, the interior of which is exposed to said photocell, means for passing a light wave and an air sample through said housing in such intimate contacting relation that solids in said air sample reflect light from said light wave upon said photocell, and means for casting another light wave separately from the first said wave continuously on said photocell.

3. In a device of the class described, the combination of photoelectric control apparatus including a photocell, a smoke box housing, the interior of which is exposed to said photocell, means for passing an air sample through said housing, a light source, means for casting a first light wave from said source through said housing in transverse by-passing relation to said photocell, solid particles in said air sample reflecting light from said first light wave upon said photocell, and means for casting a second light wave directly from said source continuously upon said photocell.

4. A combination according to claim 3, characterized in that said last named means includes a light conducting rod receiving light from said source at its one end and extending into aligned relation with said photocell at its other end.

5. In a device of the class described, the combination of a smoke box housing, a photocell exposed to the interior of said housing, means for passing an air sample through said housing, a light source, a light conducting rod extending through said housing from said source to said photocell to cast a light wave continuously on said photocell, other means directing a second light wave from said source through said housing in intersecting relation to said air sample and in transverse by-passing relation to said photocell, and means for interrupting said light waves in different predetermined frequency.

6. A combination according to claim 5, characterized in that said last named means includes perforate disc means rotating in front of said light source and defining said separate light waves as well as the relative frequency thereof.

7. In a device of the class described, the combination of a smoke box housing, a photocell exposed to the interior of said housing, a light source beaming light into said housing, a light control means interposed in front of said light source and separating the light beamed into said housing into first and second waves, means for projecting said first wave in by-passing relation to said photocell, and means for projecting said second wave directly on said photocell, and means for passing an air sample through said first light wave, solids in said sample reflecting light from said first wave upon said photocell.

8. A combination according to claim 7, characterized in that said light control means includes a rotating disc having radially spaced apart series of perforations defining the said first and second light waves and different frequencies for said light waves.

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