Dec. 15, 1959 N. ANTON 2,917,632

RADIATION DETECTOR AND INDICATOR

Filed May 4, 1953 10 Sheets-Sheet 1

Fig. 1.

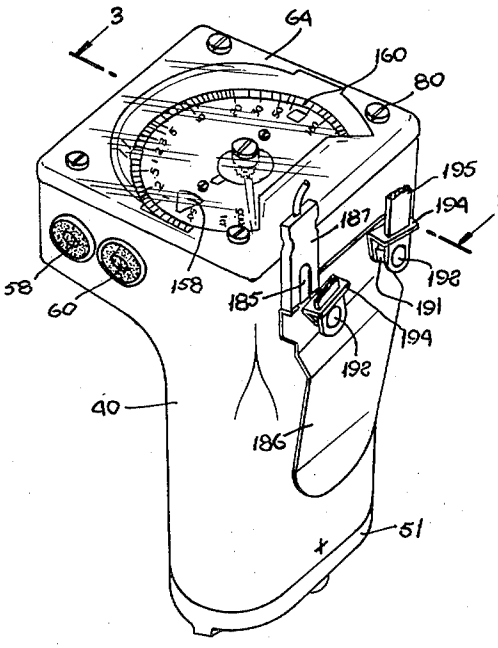


Fig. 2.

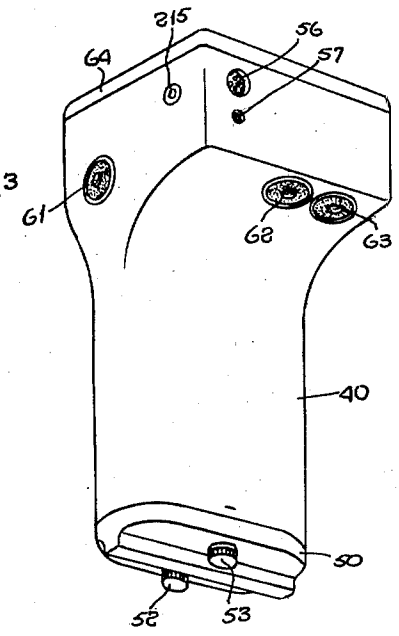


Fig. 9.

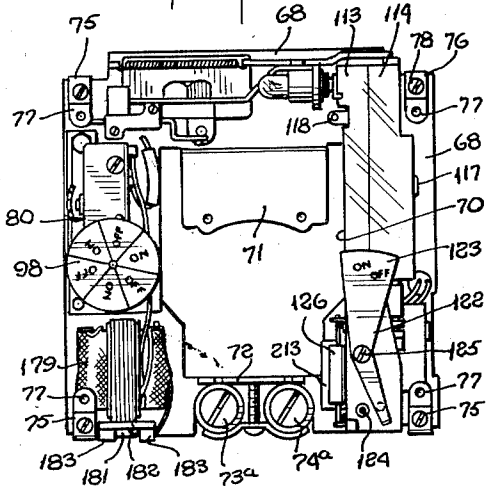
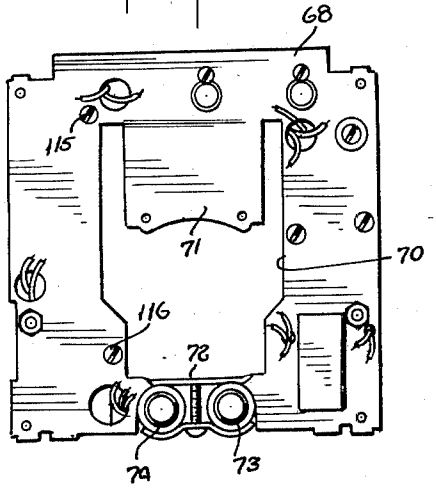


Fig. 10.



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RADIATION DETECTOR AND INDICATOR

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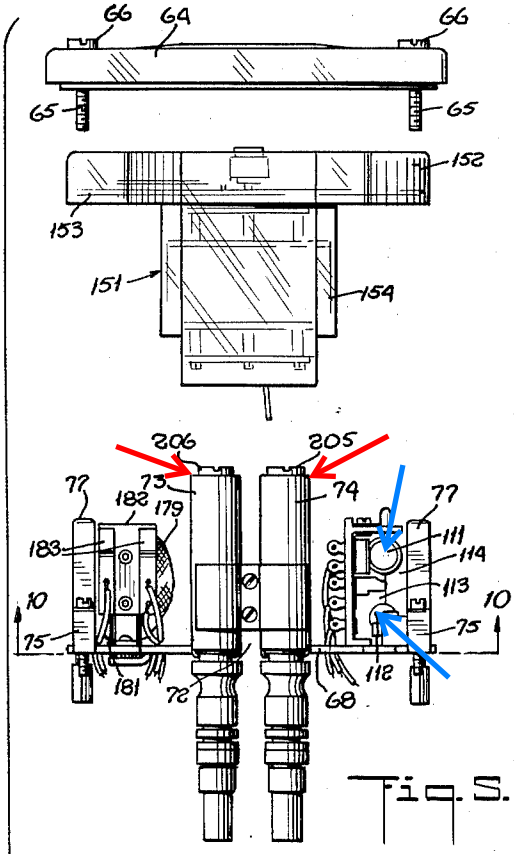


Fig. 5.

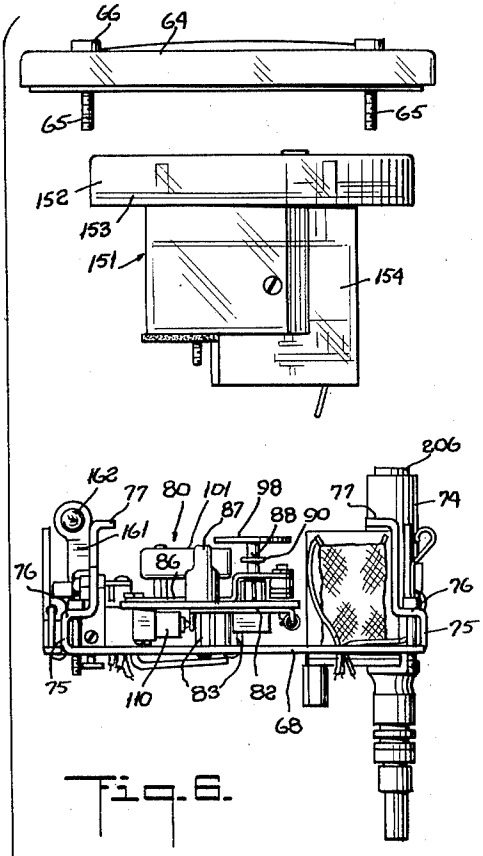
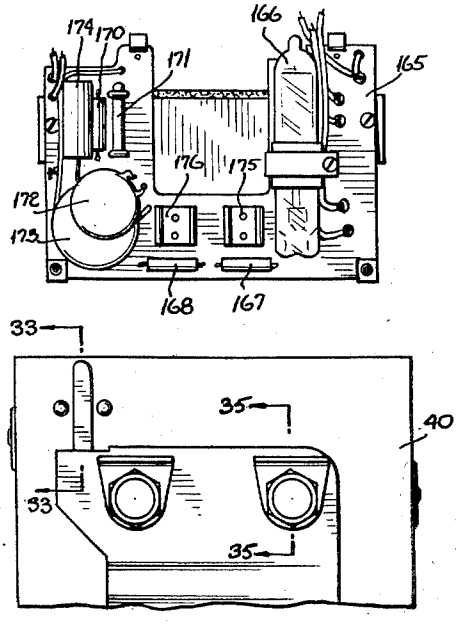
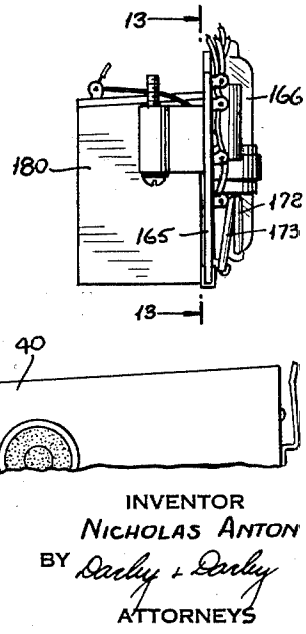


Fig. 6.





RED: Voltage Reg.

BLUE: GM Tube

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RADIATION DETECTOR AND INDICATOR

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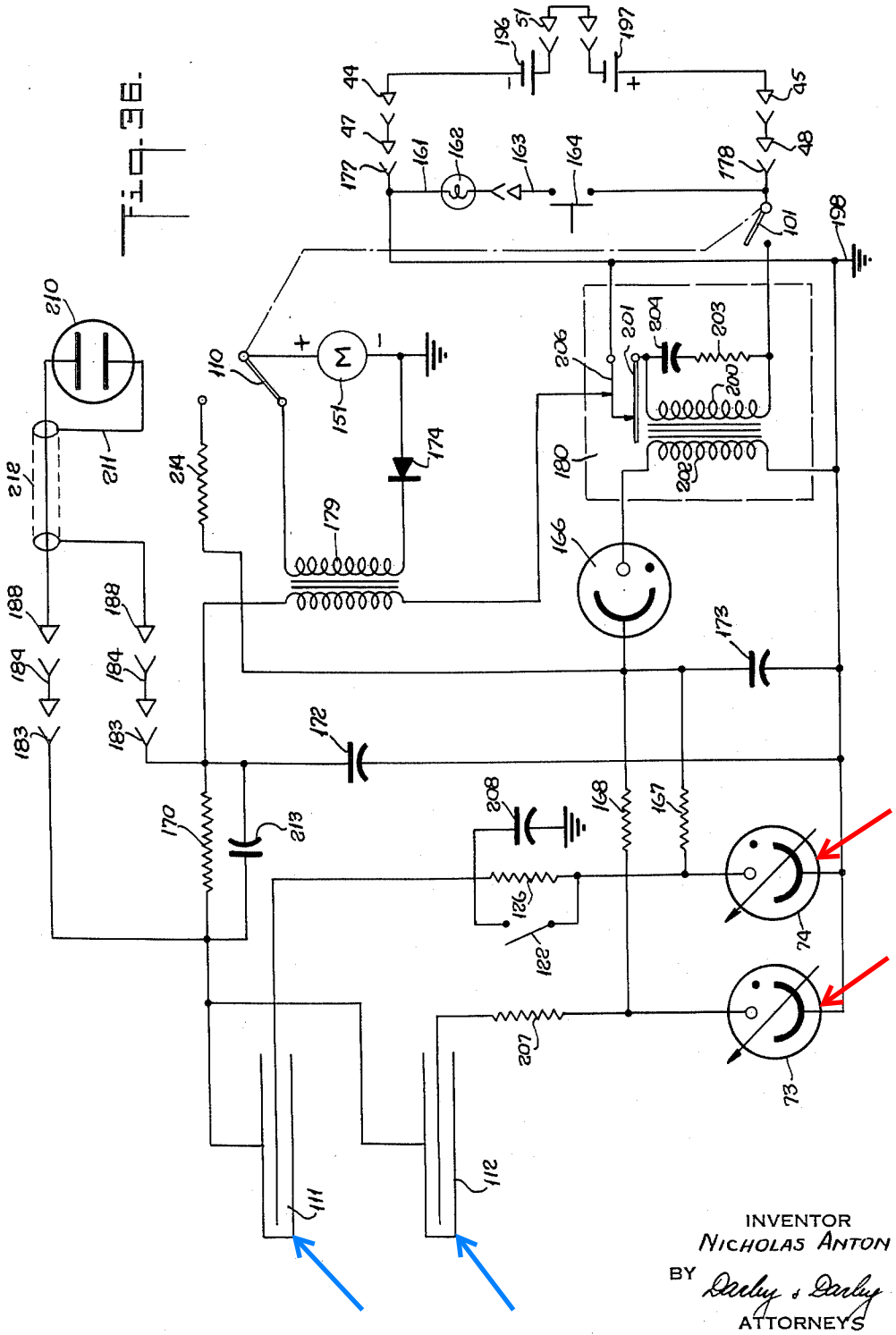
Fig. 3E.



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a minimum of 830 volts D.C. across the filter capacitor 173 which voltage is then supplied to two regulating circuits.

A separate variable regulated high voltage is required to supply each of the two integrator tubes **111** and **112**. The regulating circuit for integrator tube **111** consists of a resistor **167** in series with corona discharge type voltage regulating tube **74**. Tube **74** functions in a manner similar to the standard gaseous discharge voltage regulator tube except that it is adjustable over a minimum range, such as from 604 to 705 volts. This variation is made possible by the incorporation of a bellows-like section in the tube envelope which can be manipulated to vary the gas pressure within the tube by varying its volume. The volume variation mentioned is accomplished by means of an adjustment screw **205** located at the upper end of the tube (see Figures 7 through 10).

The regulating circuit for integrator tube **112** comprises a resistor **168** and in series with tube 73, which is identical with and functions in the same manner as the regulating tube **74** and its circuit. These regulating circuits produce regulated voltages across tubes **73**, **74**.

The two integrator tubes **111** and **112** are utilized as radiation detectors. Tube **111** is the more sensitive of the two and serves primarily to detect radiation dosages ranging from background level to 5 roentgens per hour. Tube **112** serves primarily to detect radiation dosages ranging from 5 roentgens per hour to 500 roentgens per hour.

As has been hereinabove indicated ionizing events cause current to be conducted through one or both of the integrator tubes. Current is drawn by tube **111** through the anode series resistor **126** while current is drawn by tube **112** through anode series resistor **207**. Both currents add together at the cathodes of the integrator tubes and pass through resistor **170** connected across the earphone terminals **183** (see Figure 5). The earphone **210** (preferably of the capacitance type) is thus connected across resistor **170** and is responsive to the current through the resistor. This current is the summation of many separate pulses, and especially for low levels, its varying or alternating component is indicative of radiation dosage, in regions where radiation levels may be too low to supply a readable indication on meter **151**. Capacitor **213** is coupled across resistor **170** and has a capacitance larger than that of earphone **210** to avoid any substantial variation in circuit constants when the earphone **210** is plugged in or removed from the circuit.

The meter circuit is designed to respond to the direct current component of the combined integrator tube outputs, which is indicative of radiation dosage. For this purpose the A.C. component of the combined tube output is by-passed by capacitor **172**, and the remaining D.C. component is supplied to the primary of transformer **179**.

According to one feature of the present invention, the meter circuit is provided with increased sensitivity, permitting direct use of a moving coil meter **151** without amplification. This is accomplished by the present circuit, in which the meter transformer **179** primary winding is connected to ground through contact **206** of vibrator **180**. As vibrator **180** operates, contact **206** grounds and ungrounds the meter transformer primary, and "chops" the D.C. input signal. This permits the meter transformer to step-up the input signal to high enough levels for direct indication. The meter **151** is connected across the transformer **179** secondary through rectifier **174**, preferably of the dry type such as a germanium crystal, which converts the stepped-up A.C. signal into D.C. to actuate the meter **151**, which gives a visual indication of the radiation dosage.

By closing the training range switch comprising the parts **122** through **125** (see Figure 9) the anode series resistor **126** is shorted out in order to produce full scale meter deflection at a radiation intensity of approximately 1 roentgen per hour, this being effected by causing a higher current to flow in integrator tube **111** at low radiation intensities. This permits use of the instrument at low levels which are not harmful to the user, thereby permitting the user to obtain actual operational experience with the present instrument, and serving as a training aid.

As was indicated hereinabove an earphone is provided, designated **210** in Figure 36. This earphone is connected to the plug **187** (see Figure 34) by means of a coaxial cable comprising the two conductors **211** and **212**. Conductors **211** and **212** are connected across the earphone load resistor **170** when the plug **187** is held in position by the clip **185**, the circuit being extended through the terminals **188**, rivets **184** and spring contacts **183**.

A battery voltage test circuit is also provided and consists of the current limiting resistor **214** (see Figures 25 and 36) and the battery voltage switch **110**. The purpose of this switch is to permit checking the power supply performance in the field. Operation of the "on-off" push button **60** actuates the single-pole, double-throw, spring-return, microswitch **110** in addition to actuating the "on-off" microswitch **101**. The ungrounded terminal of indicating meter **151** is then connected through resistor **214** to the cathode of rectifier tube **166** thereby giving a meter indication of the output voltage of the rectifier. In this way, it can be determined whether the batteries may have deteriorated with age or use so as to be below the minimum effectiveness necessary for proper operation. It will be understood that so long as the battery voltage is sufficiently high, the regulator tubes will maintain a uniform output as needed for accurate indications, and the battery check circuits permits determination of this.

In use, each time the button **60** is held depressed, as when turning the instrument on, the battery condition is indicated, thereby showing at each use whether the instrument is accurate. Release of the button **60** then re-connects the meter to the secondary of transformer **179** to yield radiation dosage readings as hereinabove described.

Operation

The normal operation procedure which has been indicated in the foregoing comprises a number of steps which are set forth in detail below.

(1) The instrument is first tested by the following steps:

(*a*) The "on-off" button **60** is pressed to the "on" position and the meter reading checked while the button is held depressed. The meter reading at this time should be no less than is indicated by the minimum battery marking **159** on the meter dial **153**. The button **60** is then released and at this time the meter reading should fall to zero (in the absence of radiation being detected).

(*b*) The right hand calibration check button **62** is now actuated, resulting in the exposure of the low intensity integrator tube **111** to the internal radioactive test button **144**, this exposure resulting through operation of the lever **142** in the manner previously described. The meter reading at this time should be approximately that of the test point B as indicated by the adjustable tab **157**.

(*c*) The left hand calibration check button **63** is now depressed in order to check the high intensity integrator tube **112**. This exposes the high intensity tube **112** to the internal radioactive test button **144** due to the operation of the lever **142** in the opposite direction from that in which it moved in the preceding step. At this time the meter reading should be approximately that of the adjustable tab B on the meter dial **153**.

(*d*) If the head set or earphone **210** is to be utilized, the operation thereof is checked by listening for clicks when the calibration check button **62** or **63** is depressed.

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AN/PDR-32 GM Survey Meter (early 1950s)

A high range meter that employs two halogen quenched GM tubes connected in parallel. Normally a GM tube would not be used in a high-end instrument because it would be prone to saturation. However, this is

not a problem if the detector operates in the current mode (i.e, the circuit integrates the charge) rather than the more usual pulse mode. A vibrator type transformer (similar to an induction coil) is used to step up the high voltage. The meter employs a five-decade logarithmic scale from 5 mR/h to 500 R/h. It seems that this unit was based on the LeVine meter.

The AN/PDR-32 was identified as being obsolete in the 1975 version of the List of Radiacs in the Navy Program

Manufactured by Anton Electronic Laboratories, Inc., of Brooklyn New York (contract date: 1951).

Range: 0.005 to 500 R/h

Audio: No speaker, but employs hearing aid type of headset

Size: 3” x 3.25” x 6.5”

Weight: 1.5 pounds

Batteries: Two 1.5 volt

References

- Levine, H.D. and H.J. DiGiovanni, “An Inexpensive, Wide Range Gamma Ray Geiger Survey Meter, NYO-1538, January 1951.
- Morgan, K.Z., “Health Control and Nuclear Research,” unpublished manuscript, ca. 1951-1955.
- Naval Electronic Systems Command, List of Radiacs in the Navy Program P-9670-1, February 1975.
- Department of the Navy, Directory of Radiac Equipment, NAVSHIPS 94200.5, page date April 1958.

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