July 16, 1935. W. SMITH 2,008,295

METHOD OF AND APPARATUS FOR DIAGNOSTIC ANALYSIS

Filed Dec. 7, 1933

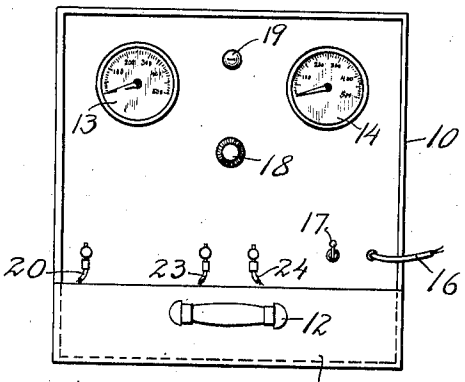

Fig. 1.

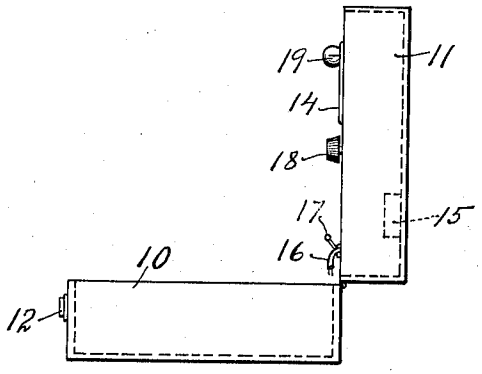

Fig. 2.

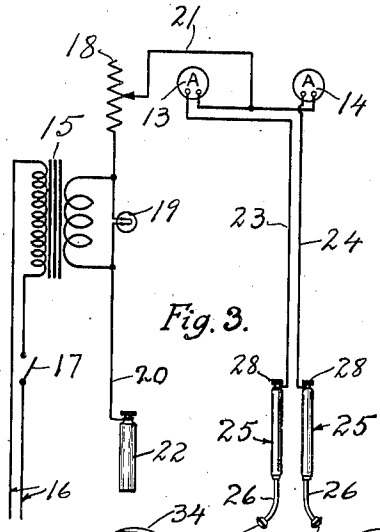

Fig. 3.

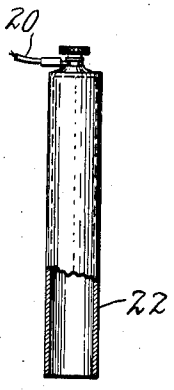

Fig. 4.

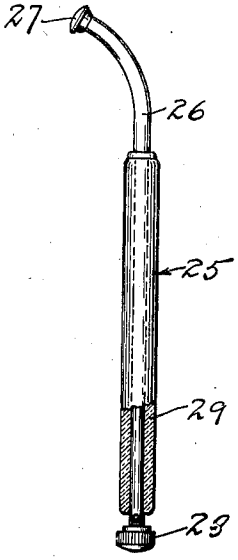

Fig. 5.

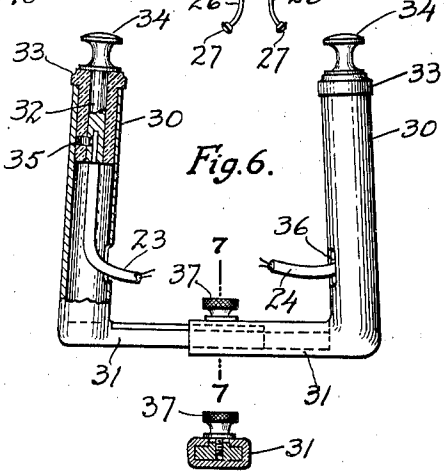

Fig. 6.

Fig. 7.

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METHOD OF AND APPARATUS FOR DIAGNOSTIC ANALYSIS

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Application December 7, 1933, Serial No. 701,324

2 Claims. (Cl. 174—177)

This invention relates to a new and useful method of and apparatus for measuring the resistance of the human body to a current of electricity.

An object of the invention is to locate abnormal conditions in the body.

Another object is to provide an apparatus embodying a plurality of electrodes adapted to contact spaced areas upon the surface of the body with means for measuring the resistance offered by the contacted areas to a flow of electric current, whereby the observer may locate local differences in such resistance.

In carrying out my invention, I take into consideration the fact that the human body is a conductor of electrical current and that healthy muscles and nerves offer a resistance to a flow of electric current different from that of unhealthy muscles and nerves.

I also take into consideration the fact that the body on both sides of the median line, i. e. an imaginary line drawn through the middle of the body from the top of the head to the middle of the floor between the feet, when the body is in so-called anatomical position, is substantially structurally alike, and that the muscular system and nervous system on both sides of said median line are substantially the same.

I provide a portable apparatus for passing a voltage of electricity through the human body and comparing the current as it comes out of the body at separated areas on opposite sides of the median line to determine what resistance is offered by the tissue at said areas.

In the drawing, Figure 1 is a front elevation of the improved apparatus.

Figure 2 is a side view of the same.

Figure 3 is a diagram of the wiring arrangement.

Figure 4 is a front view partly in section of the hand contact used with my improved device.

Figure 5 is a front view partly in section of one form of applicator used with my device.

Figure 6 is a front view of a pair of applicators of another form, one of the applicators being shown in section.

Figure 7 is a sectional view taken on the line 7—7 of Figure 6.

Referring to the various views of the drawing, my improved apparatus may be mounted in a portable casing 10 which is provided with a hinge cover 11 and handle 12 for convenience in carrying.

On one side of the casing is a microampmeter or milli-ammeter 13 and on the other side is another milliammeter 14, both of said milli-ammeters being of ordinary construction and capable of measuring electric current and being mounted on the front of the panel of the casing.

The milli-ammeter 13 is connected to one side of the secondary winding of a step-down transformer 15, the primary winding of which is connected to a source of electrical supply, indicated at 16, such as the house supply of 110 volts.

A switch 17 is placed in the main or house supply line to control the same, and a rheostat 18 may be placed in the secondary supply line to control the voltage as will be understood.

A pilot lamp 19 may also be placed in the secondary circuit to indicate that the apparatus is properly functioning and to prevent surging.

Connected to the opposite side of the secondary winding of the transformer 15 is a flexible conductor 20 and connected to the other side is a conductor or line 21 to which the variable resistance or rheostat 18 is connected. This conductor 21 leads to the milli-ammeters 13 and 14. Removably attached to the conductor 20 is a metal hand piece 22. Leading from the milli-ammeter 13 is a conductor 23 and leading from the milli-ammeter 14 is a conductor 24. Attached to the conductors 23 and 24 are applicators 25.

The form of applicator shown in Figures 3 and 5 comprises an elongated metal spindle 26 having a rounded knob 27 at one end and a removable screw nut 28 at the other end for removably attaching the conductors. A hand piece 29 formed of insulating material encloses the greater part of the spindle 26.

The form of applicator shown in Figure 6 comprises a metal tubular member or casing 30 having an open top and an angled foot portion 31, the foot portion of one of the applicators being solid and slotted and the other being formed with a slotted socket portion to receive the solid portion of the other. An insulating sleeve 32 is mounted in the open end of each applicator, said sleeve having a shoulder 33 adapted to seat on the edge of the open top. A metal contact 34 is positioned in and extends out from the end of the insulating sleeve. The conductors 23 and 24 are fastened to the metal contacts 34 by screws 35 or by any suitable means, and they enter the casing 30 through openings 36. A set screw 37, extending through the slots in the socket portion of one applicator and into the slot in the solid portion of the other applicator, holds the applicators in adjusted position.

The operation is as follows: the switch 17 is closed and the rheostat 18 adjusted to regulate

the flow of current desired. The patient is given member **22** to hold in his hand. The operator then takes the two applicators, for instance the applicators **25** shown in Figures 3 and 5, and with one of them (say the one connected to milli-ammeter **13**) touches a muscle or motor nerve of the body on one side of the median line, for example, the right forearm. With the other applicator (say the one connected to milli-ammeter **14**) he with a uniform pressure simultaneously touches a similar muscle or motor nerve on the opposite side of the median line, that is, the left forearm. Immediately upon touching the body with these applicators, two circuits are completed as follows: main line **16**, transformer **15**, conductor **20**, hand piece **22**, the body of the patient, spindle **26**, conductor **23**, milli-ammeter **13**, conductor **21** to transformer, comprising the circuit through milli-ammeter **13**; main line **16**, transformer **15**, conductor **20**, hand piece **22**, body of patient, spindle **26**, conductor **24**, milli-ammeter **14**, conductor **21** to transformer, comprising the circuit through milli-ammeter **14**.

Both separated areas of the body touched by the applicators, the right and left forearms, being constructed substantially alike and being covered by the same construction and arrangement of fleshy tissue, the resistance to the flow of current passing through each area should be the same and therefore the resistance recorded on milli-ammeters **13** and **14** should be the same. If however, either of the areas touched, either the right or left forearm, is diseased or inflammed or the tissue structure is abnormal for one reason or another, such diseased area will offer a lesser resistance to the flow of electricity therethrough and such lesser resistance will be recorded on the particular milli-ammeter connected to the circuit in which said area is located. For instance, in the example give above, if the forearm is diseased at the area touched the lesser resistance offered thereby will be indicated on milli-ammeter **13**; and if the left forearm is diseased milli-ammeter **14** will show it.

By reason of this method, a positive way of detecting diseased areas of the body and thus localizing trouble is afforded. This detection is accomplished instantly by a mere glance at the milli-ammeters and requires no skill nor complicated technique.

The applicators shown in Figure 6 are of particular value in diagnosing the condition of the spinal column nerves. The applicators are adjusted to and from each other and can be made to fit the particular size of spine under observation and due to their slanting position they readily adapt themselves to rest on the spinal column so that the resistance offered by both sides of the spine may be readily detected.

The microampmeters or milli-ammeters **13** and **14** may of course be calibrated in micro-amperes or milli-amperes as may be desired.

It will be understood that changes might be made in details without departing from the principle of the invention.

I claim:

1. In an apparatus for locating abnormal conditions along the spinal column, in combination with a source of electric motive power, a step down transformer connected to said source, a hand contact flexibly connected to one side of said transformer, a pair of milli-ammeters connected to the other side of said transformer, a rheostat in said latter connection, a rigid applicator flexibly connected to each of said milli-ammeters, a rigid connection between said applicators and means for adjusting the length of said connection, said applicators being positioned in inclined relation towards each other to conform to the structure of the spine.

2. In an electrical apparatus for measuring the resistance of the human body, a pair of rigid body applicators rigidly connected together, each applicator comprising a tubular member having an open end, a solid angular portion at the other end having a slot therein, an insulating sleeve in the open end of the tubular member, a metal contact member for connection to a conductor in said sleeve and a screw for insertion in the slots, said tubular members being inclined towards each other.

WILLIAM SMITH.