

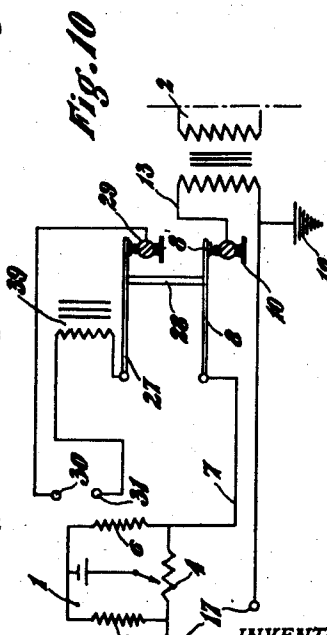
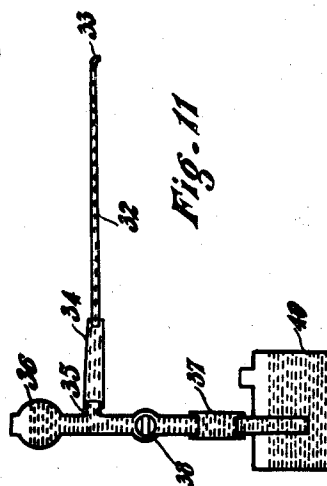
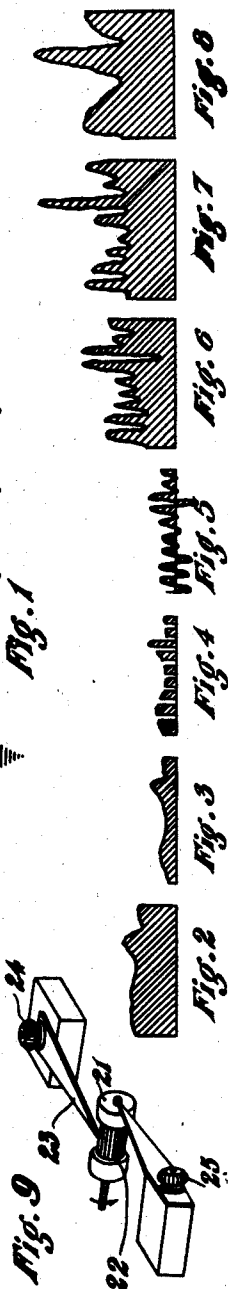
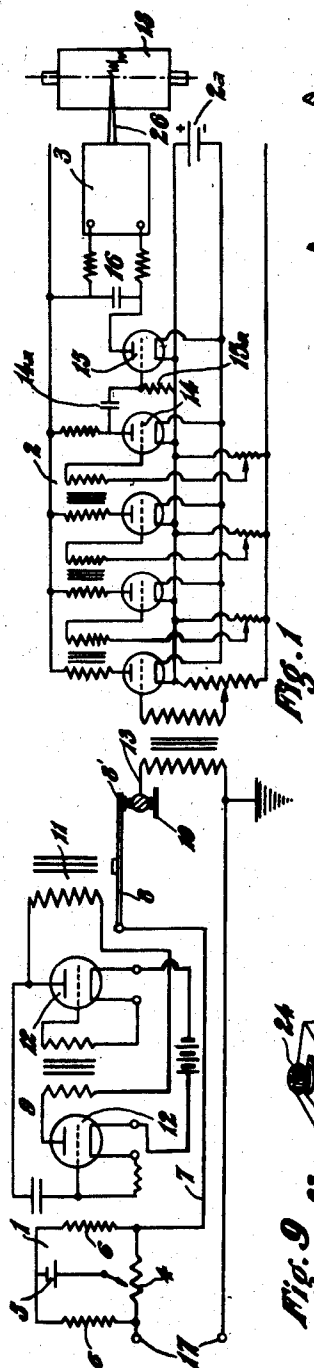
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APPARATUS FOR RECORDING ELECTRIC CURRENTS PRODUCED BY LIVING ORGANISMS

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APPARATUS FOR RECORDING ELECTRIC CURRENTS PRODUCED BY LIVING ORGANISMS

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This invention relates to an apparatus for recording electric currents produced by living organisms and has as its object to provide such an apparatus which is particularly adapted to be used as an electrocardiograph for recording electric currents which are produced by the heart.

The invention consists in an apparatus comprising a polarizer having terminals which are connected with electrodes adapted to come in contact with the subject of which the currents are to be recorded, a ticker, an amplifier having triode lamps, a rectifying device, and an oscillograph by means of which the currents are recorded.

In the drawings,

Figure 1 is a general diagrammatic view of the recording apparatus.

Figures 2 to 8 show diagrams of the successive variations of the electric current passing through the apparatus.

Figures 9 and 10 show two modifications of a ticker.

Figure 11 shows an inking device of a recorder.

The apparatus comprises a polarizer 1 adapted to compensate a constant part of the current, in order to permit the amplifier 2 and the oscillograph 3 to function with maximum sensibility with the variable remainder of the current. The polarizer comprises a potentiometer 4 with continuous variation, a cell 5 and two resistances 6. This whole device is enclosed in a common casing which is grounded.

The polarizer 1 is connected to the vibrating blade 8 of an electric excitation ticker 9 by means of a conductor 7. The blade 8 is provided with a platinized contact 8' adapted to make contact with the end of a contact screw 10. The blade 8 is made to vibrate by means of an electromagnet 11 adapted to be traversed by an alternating current which is produced by two triode lamps 12 mounted to produce an oscillating circuit. This device is also enclosed in a casing.

The ticker 9 is used to split up the electric current which is to be amplified and is connected by means of a conductor 13 with the low frequency transformer containing am-

plifier 2 of a type which is employed in wireless installations. This amplifier can have three or four amplification stages, each stage being separately enclosed and the tension of polarization of the screen grid of the last lamp being given by a potentiometer.

The amplifier is followed by a detecting device for electrical rectifying and filtering, comprising a triode lamp 15 (several such lamps could be connected in parallel) connected by means of a condenser 14a to the last lamps 14 of the amplifier, the screen grid of the lamp 15 being connected by means of a resistance 15a to the positive terminal of a heating battery which is not represented.

The current which is furnished by the triode lamp 15 flows through a filter 16 before coming to the oscillograph 3. The filter may consist of a capacity in parallel and resistances in series and may be substituted by an interrupting device when the frequency of the current is high enough.

The oscillograph 3 of an electro-magnetic type, comprising a stylus 26, records the current, which is taken, up by the electrodes 17, on a paper surrounding the drum 18, the electrodes consisting as usual of damp bands. The recording can be made by means of an inking stylus on white paper or by a simple stylus tracing a line on blackened paper. The described installation is grounded as shown at 19.

The operation of the apparatus will now be described with reference to the diagrams shown in Figures 2 to 8. The diagrams of Figure 2 represents the weak biological current with slow variations which is to be recorded. After having passed the polarizer 1 the current will be reduced to near zero as shown in Figure 3. After leaving the ticker the current is as represented by Figure 4. Following the first transformer and in the entire amplifier 2 the current takes the shape as shown in Figures 5 or 6. The diagram of Figure 7 represents the current after leaving the detector 15 and the diagram of Figure 8 shows the current after having passed the filter 16.

Instead of employing an electric excitation

ticker as represented in Figure 1, there can be used a rotary ticker driven by a clock-work as shown in Figure 9. This ticker comprises a cylinder 21 of insulating material and provided with metallic bars 22 upon which a resilient blade 23 is adapted to rub. Terminals 24 and 25 are provided for connection of the ticker with the amplifier 2 and with the polarizer.

There could also be used a ticker as shown in Figure 10. This ticker comprises an electromagnet 39 acting upon an armature 27 which is formed by a flexible blade having the same period of oscillation as the vibrating blade 8 and being connected with this blade by means of an insulating piece 28 consisting for instance of an ebonite bar or an ordinary string. 29 is a contact which cooperates with the armature 27, and 30 and 31 indicate two terminals for connection with the poles of a source of direct current. When a current flows through the circuit of the electromagnet 39, the armature 27 starts to vibrate like the hammer of an electric bell and transmits its movement by means of the insulating piece 28 to the blade 8. The two blades 27 and 8 have to be placed at a certain distance from each other in order that the current flowing through the interrupter 8, 8', 10 is not subjected to magnetic influences arising from the electromagnet 39. Preferably the electro-magnet 39 and its armature 27 are enclosed in an iron casing while the vibrating blade 8 and the parts related therewith are enclosed in a zinc casing.

Figure 11 illustrates a recording device which can be used in place of the stylus 26 shown diagrammatically in Figure 1. This recording device comprises a glass tube 32 with a curved end 33. The opposite end is held in a rubber tube 34 which is attached to the connecting piece 35. An ink reservoir 36 can be filled by inserting its bottom end 37 into an ink bottle 40, opening the valve 38 and effecting a suction at the top of the reservoir 36. The tube 32 oscillates under the action of the current which is to be recorded. As long as the curved end 33 is not in contact with the paper, the ink does not flow out of the tube, but when the open end of the tube touches the paper, this latter sucks the ink and produces a regular flow in the tube 32. This ink recording device could also be replaced by an optical galvanometer permitting a photographic recording of the current.

I claim:—

1. An apparatus for recording electric currents produced by living organisms, comprising a polarizer provided with terminals, electrodes adapted to make contact with the organism of which the currents are to be recorded and to be connected with said terminals, an electromagnet, a ticker having a vibrating blade, a second vibrating blade having the same period of oscillation as said first

mentioned blade and adapted to be acted upon by said electromagnet and to control the circuit thereof, an insulating member connecting said two blades, an amplifier having triode lamps, a rectifying device, and an oscillograph adapted to record the currents produced by said organism.

2. An apparatus for recording electric currents produced by living organisms, comprising a polarizer provided with terminals, electrodes adapted to make contact with the organism of which the currents have to be recorded and to be connected with said terminals, a ticker adapted to transform the currents produced by the organism into high frequency alternating current, an amplifier for amplifying said high frequency currents, a rectifying device, and an oscillograph adapted to record the currents after leaving said rectifying device.

In testimony whereof I affix my signature.

PIERRE DUCHOSAL.