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APPARATUS
USED IN
ELECTROTHERAPY
AND
ACTINOTHERAPY

NOTES ON CONSTRUCTION AND WORKING

Compiled and Published by

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D'ARSONVAL FIXED MAGNET MOVING COIL MILLIAMPERE METER.

CONSTRUCTION:

(i) *Permanent magnet*—horse-shoe or U-shaped, with pole-pieces hollowed out to fit round a spherical or cylindrical piece of soft iron placed between the poles. There is only a small air-space between the iron and the poles, the former serving to concentrate the magnetic field.

(ii) *Light frame*—of some non-magnetisable metal (*e.g.*, brass) pivoted on agate stones in the horizontal plane, round the piece of soft iron.
Round the frame are many turns of fine, insulated wire (= the solenoid).

(iii) *Two phosphor-bronze springs*—one wound clockwise, the other anti-clockwise. One spring is connected to one end of the solenoid, the other to the other end. The springs serve (1) to lead the current to and from the solenoid. (2) To restore the frame to the horizontal plane after it has been deflected.

(iv) *Pointer*—attached to the frame and moving with it.

(v) *Scale*—calibrated in milliamperes, over which moves the pointer. Zero may be in the centre or on the left-hand side, depending where the meter is placed in the circuit. The calibrations differ in different meters.

(vi) *Two terminals*—one connected to one spring (see above), the other to the other spring. They are insulated from the case.

(vii) *Shunt system*—consisting of:—(1) a number of wires of known resistance connected by one end to one terminal of the meter, by the other end to a stud. (2) A crank-handle by which different wires are brought into the circuit. It is connected to the other terminal. (3) An indicator showing which shunt is in use. The numbered studs over which the crank-handle moves may be on top of the meter and therefore visible, or there may be a window in which the number appears.

The simplest arrangement of the shunts is as follows:—

(*a*) a "1" shunt—a stud with no wire connected to it.
(*b*) a "10" shunt—a stud connected to a wire having a resistance of one-tenth the resistance of the solenoid.
(*c*) a "100" shunt—a stud connected to a wire having a resistance one-hundredth of that of the solenoid.
(*d*) a "0" shunt—a stud connected to a wire of very low but not specified resistance. This is not present in all meters.

(viii) *Case*—with a glass face, enclosing all the parts. In older types this is of metal, and the meter is mounted between two supports, and is removable. In later models the meter is set in, the face being flush with the top of the switchboard.

WIRING:

The meter is placed in series in the patient's circuit.

WORKING:

Principle:

The interaction between two magnetic fields set at right angles, one fixed and one free to move.

The fixed field is provided by the permanent magnet, the movable by the current flowing in the solenoid. These two interact, and the solenoid with the frame is deflected, the pointer moving over the scale. The degree of deflection is proportional to the strength of the current.

The direction of the deflection depends on the direction of the current in the solenoid. Suppose the current flows through the solenoid in the direction shown in *Fig. 1*; then the upper face becomes a N. pole, the lower a S. pole; the solenoid will

D'ARSONVAL FIXED MAGNET MOVING COIL MILLIAMPERE METER

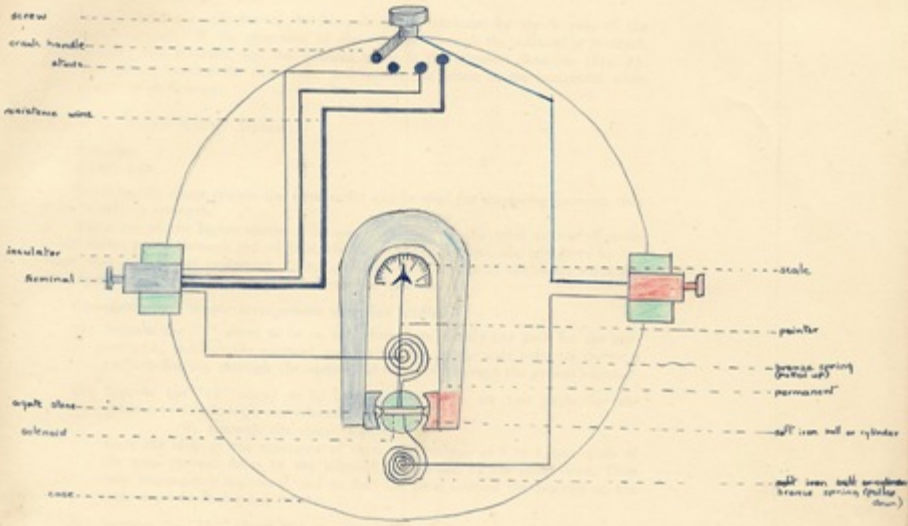


Fig. I.

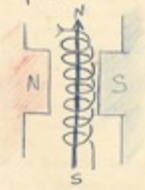
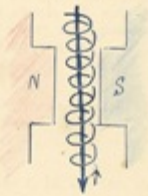
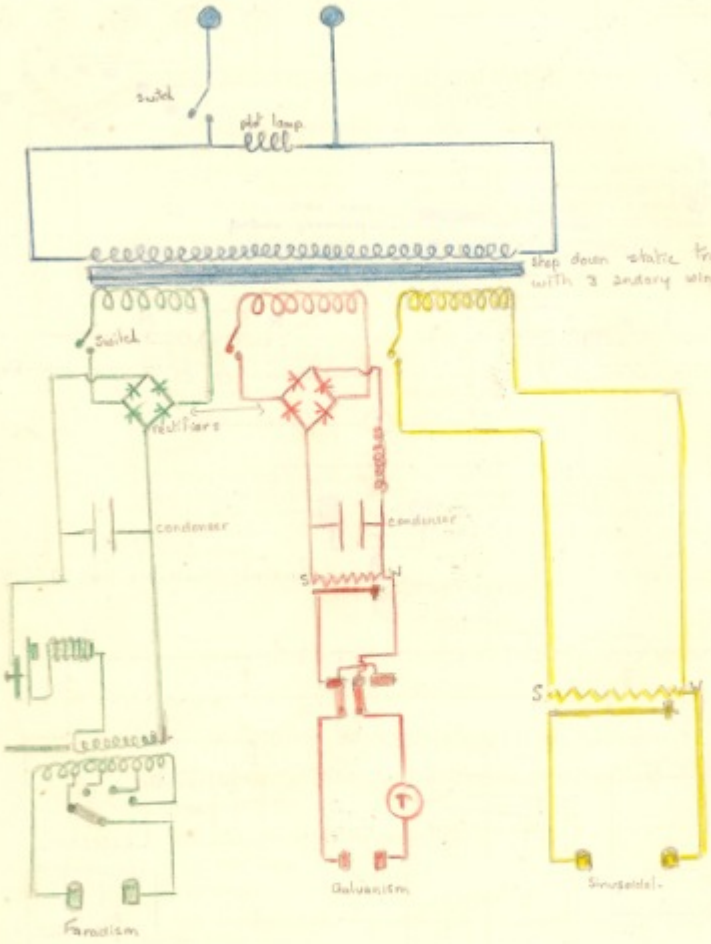


Fig. II.




switch
pilot lamp
step down static transformer with 3 sndary windings
switch
rectifiers
condenser
condenser
S
S
T
Galvanism
Sinusoidal
Faradism

(*d*) Switch.
(*e*) Potentiometer.
(*f*) Milliampere meter.
(*g*) Reversing switch.
(*h*) Patient's terminals.

(vi) *A.C. circuit*—consisting of:—

(*a*) Secondary winding of transformer.
(*b*) Switch.
(*c*) Potentiometer.
(*d*) Patient's terminals.

One potentiometer and one pair of terminals may be common to both circuits. In this case, a switch is provided for selecting the current required.

WIRING (*see diagram*).

(2) COMBINED SWITCH-TABLE WITH METRONOME AND SURGER.

This provides galvanic, sinusoidal and faradic currents; superimposed galvano-faradism and galvano-sinusoidal. All currents can be surged or interrupted. Three patients can be treated from this machine simultaneously.

CONSTRUCTION:

(i) *Plug*—for connection to supply.

(ii) *Pilot lamp.*

(iii) *Switch.*

(iv) *Step-down static transformer*—with three secondary windings.

(v) *D.C. circuit*—as in previous switchboard.

(vi) *A.C. circuit*—as in previous switchboard.

(vii) *Faradic circuit*—consisting of:—
(*a*) Secondary winding of transformer.
(*b*) Rectifiers.
(*c*) Condensers.
(*d*) Switch.
(*e*) Interrupting mechanism.
(*f*) Primary coil.
(*g*) Secondary coil.
(*h*) Tappings.
(*i*) Patient's terminals.

(viii) *Metronome and surger*—magnetic type.

(ix) *Terminals*—three pairs:—
(*a*) for superimposed currents.
(*b*) for metronome circuit.
(*c*) for surger circuit.

These are in addition to the terminals for the separate circuits.

(x) *Selective switch*—for selecting the required current when using the above terminals.

PREFACE

These notes have been printed to be used as a text-book for students training in Electrotherapy and Actinotherapy. It is felt that students, anxious to have adequate descriptions of the apparatus in writing for future reference, have concentrated too much on taking notes, and not enough on understanding the subjects under discussion.

In order to make sure that students do not play a purely passive part in the class, diagrams have not been included, but space has been left where these may be drawn as each piece of apparatus is considered in turn. In this way a text-book complete with diagrams can be built up.

The physical principles involved in the subsequent descriptions are named at the beginning of each section. Revision of these principles is advised before consideration of the corresponding section.

Explanation of the working of the more complicated pieces of apparatus has been kept as simple as possible, a general outline only being used in some cases. This seemed necessary because during the present training there is not time to go into details of the advanced physical principles involved in the working of some of the modern apparatus in use.

It is not claimed that every type of apparatus has been described, but those most commonly in use have been included.

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