ACCESSORIES

GALVANOMETER
Spot reflecting Type G.1 as illustrated. Resistance 10 ohms, sensitivity 220 mm. per microamp. Or portable galvanometer 36 ohms, 190 mm. per microamp. according to application.

STANDARD CELL
Saturated acid Type S.C.2 consisting of two cells in a metal case suitable for oil filling.

ACCUMULATOR
2 volt Type V.80.

VOLT RATIO BOX—Type V.R.2
Having input voltages of 15, 30, 75, 150, 300 and 600 volts to give 1·5 volts at the Potentiometer terminals. Accuracy ± 0·02% (See leaflet No. 70).

RESISTANCE STANDARDS—Type R.S.1 and R.S.2
Resistance values of from 0·01 to 10,000 ohms., having an absolute accuracy of 0·03% with a certificate specifying the resistance to ±0·005% (See leaflet No. 70).

AC-DC THERMAL TRANSFER STANDARD—Type AC-DC 1
A transfer instrument to facilitate the measurement of RMS voltage and current.
Range: 3-300 volts 9 mA to 5 amps.
Frequency: 25 cps. to 10 kcs. (See leaflet No. 61).

THERMOCOUPLE SELECTOR SWITCHES—Type S.P.2
Constructed entirely from copper with 10% gold-silver alloy contacts. Any number of positions and poles up to 102 position, 4 pole (See leaflet No. 64/A).



Galvanometer movement and scale stand assembly for use at 2 metres distance.

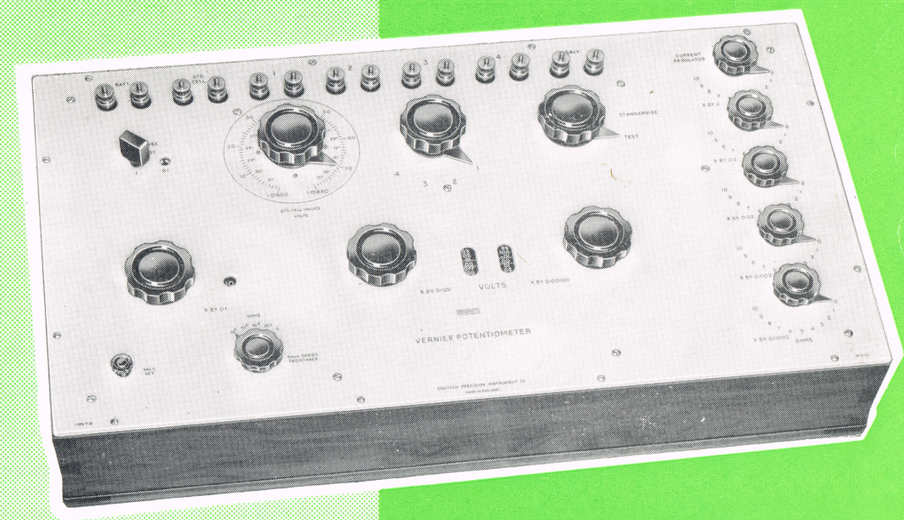
Resistance 10 ohms.
Sensitivity 220 mm/μA

Double Standard Cell
Saturated Acid Type S.C.2.
1·01859 volts at 20°C.

CROPICO

CROYDON PRECISION INSTRUMENT COMPANY

PRECISION D.C. POTENTIOMETER TYPE P10



CROPICO

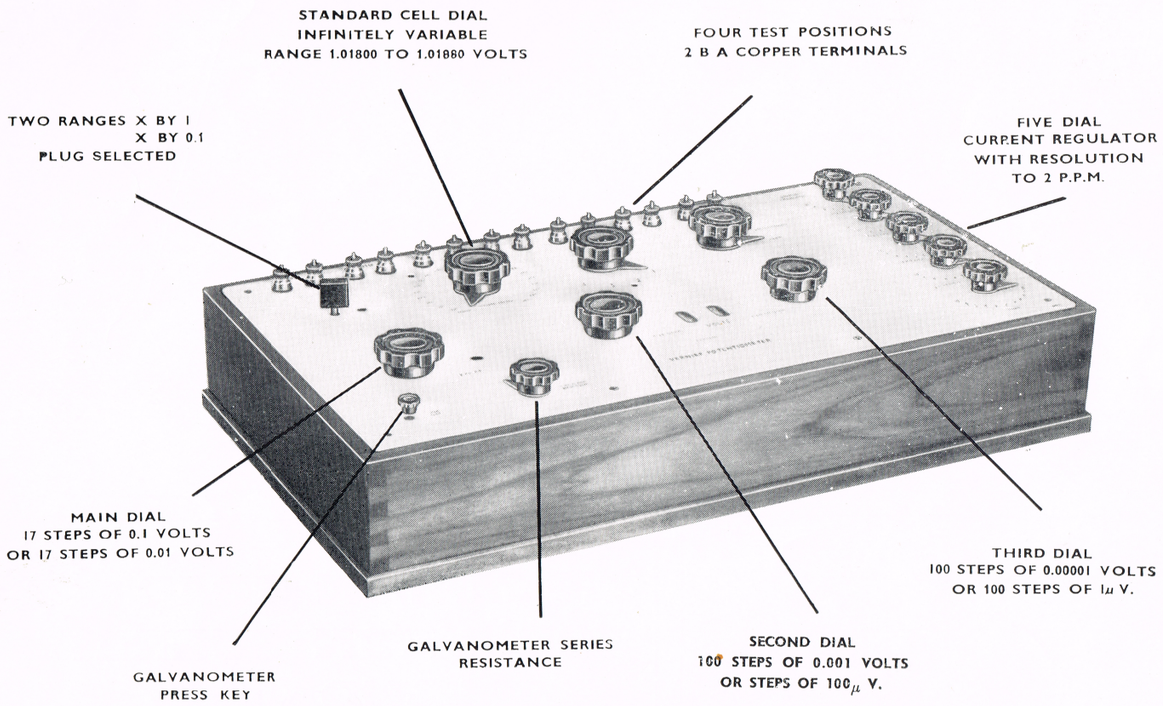
HAMPTON ROAD
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INTRODUCTION

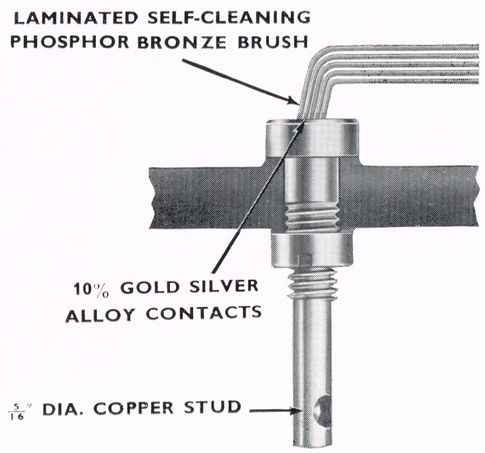
The precision potentiometer Type P.10 has been manufactured for many years, during which time it has been the subject of continuous development resulting in this latest model, so that it is now without any doubt the optimum as regards stability and accuracy. All the materials used in the instrument are carefully selected; the coils are aged for a minimum period of one year and the general construction is extremely rugged.

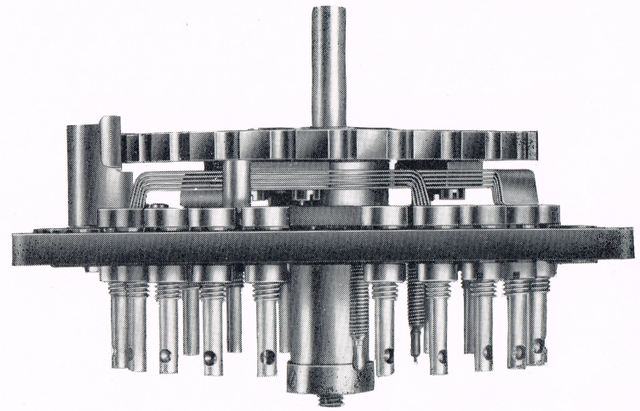
Many of these potentiometers have been supplied to Universities, Technical Colleges and leading Industrial concerns throughout the World for the standardisation of instruments and the calibration of thermocouples etc. Also, with the available accessories it is possible with this instrument to measure alternating current and voltage.



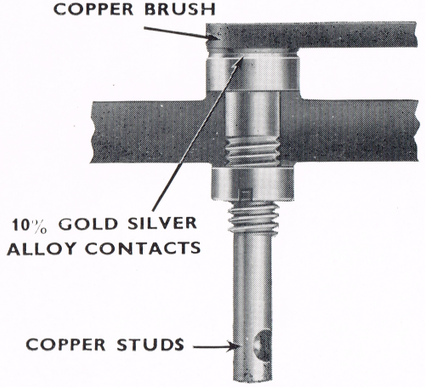
CROPICO

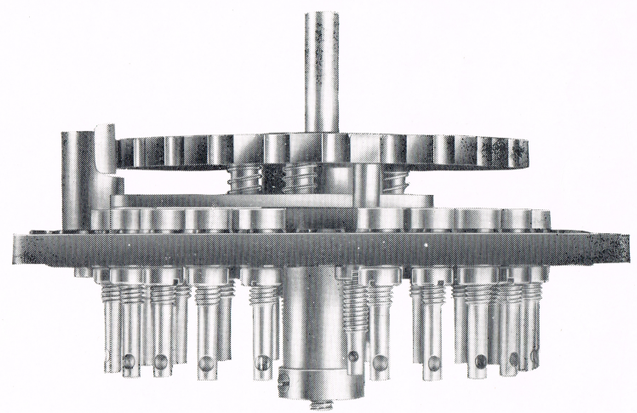
MAIN DIAL SWITCH





2nd AND 3rd DIAL SWITCHES
(102 POSITION)





ALL CONTACTS FACED WITH A 10% GOLD SILVER ALLOY 0·01" THICK.

Illustrations shewing general switch arrangement

NOTE:— Centre Spindle Bearing 1" in length with $\frac{5}{8}$" diameter thrust faces.

These switches have a low and invariable contact resistance and thermal E.M.F.'s are negligible.

CROPICO

MAIN DIAL AND RATIO COILS

These are the most important coils in the potentiometer and a special form of construction is used—see fig. 2.

These coils are wound on large brass tubes 20″ long by 1·7″ diameter. The reason for this is that brass has a similar temperature co-efficient to " Manganin " and the large diameter ensures that winding strains are reduced to a minimum, which results in extremely high stability after the ageing and adjustment process.

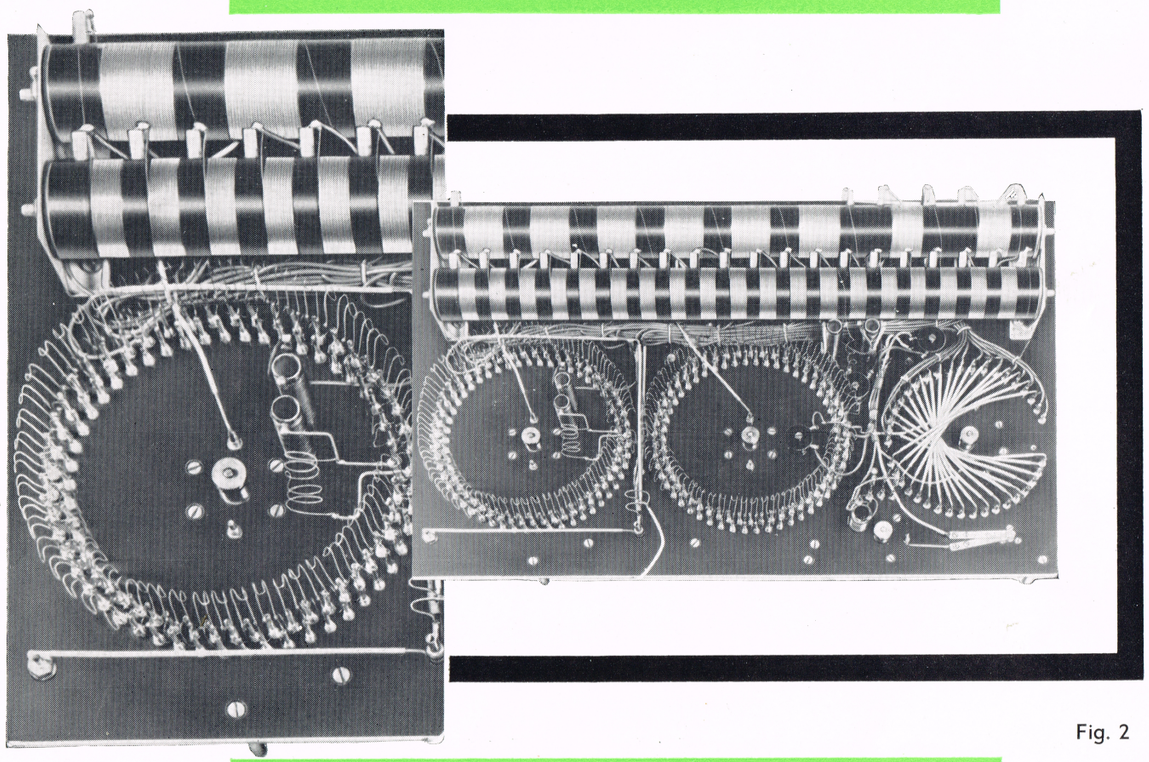


Fig. 2

2nd. DIAL

100 steps of 0·001 volts or 0·0001 volts according to range plug position.

3rd. DIAL

100 steps of 10 microvolts and a negative setting of 10 microvolts. 100 steps of 1 microvolt and a negative setting of 1 microvolt according to range plug position.

The switch type S.P.2 which is used for the 2nd and 3rd dials is constructed from copper, and all the contact surfaces are faced with a 10% gold silver alloy, having a thickness of at least 0·01 inches. This ensures a long life and with rapid rotation of these switches it is not possible to generate more than $\frac{1}{5}$th of one microvolt.

COILS 2nd. and 3rd. DIALS

The coils used in dials 2 and 3 are constructed from a continuous length of " Manganin " wire which is jig formed with copper connection leads, hard soldered at the appropriate intervals—see fig. 2.

This wire is from the same batch as used for the main dial and ratio. Consequently the potentiometer has an extremely good temperature co-efficient, as any changes of resistance in the wire due to temperature will all be in the same direction and the ratio of resistance between coils and dials will remain constant.

CURRENT REGULATOR *(BATTERY CIRCUIT)*

For the potentiometer supply a 2 volt accumulator is used and the current is regulated by five decade dials which give an extremely fine adjustment, 1 stud on the last dial giving a resolution of 2 parts in a million.

The effect of switch contact resistance variation is negligible due to the use of our switch Type S.P.1. and the Waidner-Wolff type decades, whereby individual decade positions have a high resistance compared with the switch, each dial being shunted to produce the correct resistance value.

A factor of 0·9 is chosen for x in the formulae below which gives convenient resistance values. The total resistance of this 5—dial decade is 22·222 ohms in steps of 0·0002 ohm.

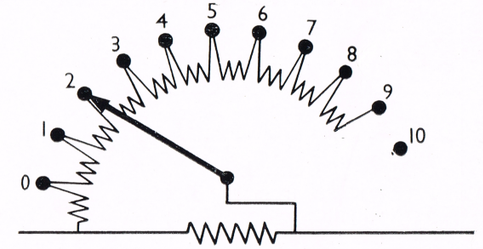
STANDARD CELL DIAL

Infinitely variable slidewire.
Range—1·01800 to 1·01880 volts, scale length approximately $10\frac{1}{4}$″, smallest sub-division 10 microvolts=$\frac{1}{8}$″ easily subdivided to 5 microvolts.
To special order this dial can be calibrated to suit all types of Standard Cells at any temperature, the range of adjustment being always 800 microvolts.
Blank scales can also be fitted when desired and the pointer is moveable so that the standard cell dial can be made to line up exactly with the potential divider, resulting in a zero standardisation error.

RANGE CHANGING

Is facilitated by means of a tapered brass plug which is located in a massive brass block, the plughole is carefully reamed to ensure a perfect fit of the plug resulting in negligible contact resistance.

CURRENT REGULATOR DETAILS
WAIDNER-WOLFF DECADE



$$\text{SERIES COIL} = x - \sqrt{x \times \frac{\text{TOTAL RESISTANCE}}{\text{CHANGE OF DIAL}}}$$

$$\text{SHUNT COIL} = \sqrt{x \times \frac{\text{TOTAL RESISTANCE}}{\text{CHANGE OF DIAL}}}$$

Resistance Joining Studs	8 to 9	$=\frac{5x}{1}$
,, ,, ,,	7 to 8	$=\frac{5x}{3}$
,, ,, ,,	6 to 7	$=\frac{5x}{6}$
,, ,, ,,	5 to 6	$=\frac{5x}{10}$
,, ,, ,,	4 to 5	$=\frac{5x}{15}$
,, ,, ,,	3 to 4	$=\frac{5x}{21}$
,, ,, ,,	2 to 3	$=\frac{5x}{28}$
,, ,, ,,	1 to 2	$=\frac{5x}{36}$
,, ,, ,,	0 to 1	$=\frac{5x}{45}$

EXTERNAL CIRCUIT SELECTION

Four external circuits can be selected by means of the Type S.P.2 Switch (all copper with 10% gold silver alloy contacts).

STANDARDISATION

Completely independent of range and dial setting.

GALVANOMETER SERIES RESISTANCE

This is for the protection of the galvanometer when measuring unknown voltages, and of the standard cell when initially standardising the potentiometer current.

Switch type S.P.2 all copper with 10% gold silver contacts.

Five positions— 0, 10^3, 10^4, 10^5, and 10^6 ohms.

GALVANOMETER PRESS KEY

This key has precious metal contacts and can be locked in the "ON" position by depressing and turning.

When the key is open circuited, it does not connect a resistance across the galvanometer terminals as this is not necessary with the recommended galvanometer, since the latter is electrically damped and has extremely good zero keeping qualities.

EXTERNAL CONNECTIONS

For the battery, standard cell, galvanometer and test circuits are all made to 2BA solid copper terminals.

COIL CONSTRUCTION

General. The resistors throughout the whole of the potentiometer are "Manganin" selected from the same batch and particular care is taken to ensure equal and minimum winding tensions: they are artificially aged by baking, and have a shelf life of at least 12 months prior to use.

POTENTIOMETER RESISTANCE

Measured at the battery terminals—77 to 100 ohms.
Measured at the test terminals—0·32 to 89 ohms.

GENERAL CONSTRUCTION

The instrument is contained in a polished teak box with a light alloy stove enamelled and engraved cover panel. A lid is also provided which is cut away at the back to enable it to be fitted when the potentiometer is connected to external circuits.

The Switches and coils are mounted on a high grade bakelite sub-panel and the insulation between switch studs measured at a pressure of 500 volts is in excess of 50,000 Megohms.

The adjacent illustrations show the type of Switch construction used for the various components of the potentiometer. Please note that all switches have a positive indexing mechanism working on the full switch diameter to ensure that wear on this important feature is negligible.

Weight: 56 lbs. (25·4 kgs.)
Size with lid: 29″ × 16″ × 6¾″ (73 × 40·6 × 17·6 cms.)

SPECIFICATION

OVERALL ACCURACY

Range Position	Measuring Range	Resolution	Accuracy
X 1	—10μV to + 1.801V	10μV	±0.001% or 10μV
X 0.1	— 1μV to + 0.1801V	1μV	±0.001% or 1μV

These accuracy figures are relative to the one volt setting and when instruments leave our test room the accuracy of potential sub-division is better than 5 parts in 10^6.

The history of potentiometers made in the last decade suggests that the above specification will be maintained for several years.

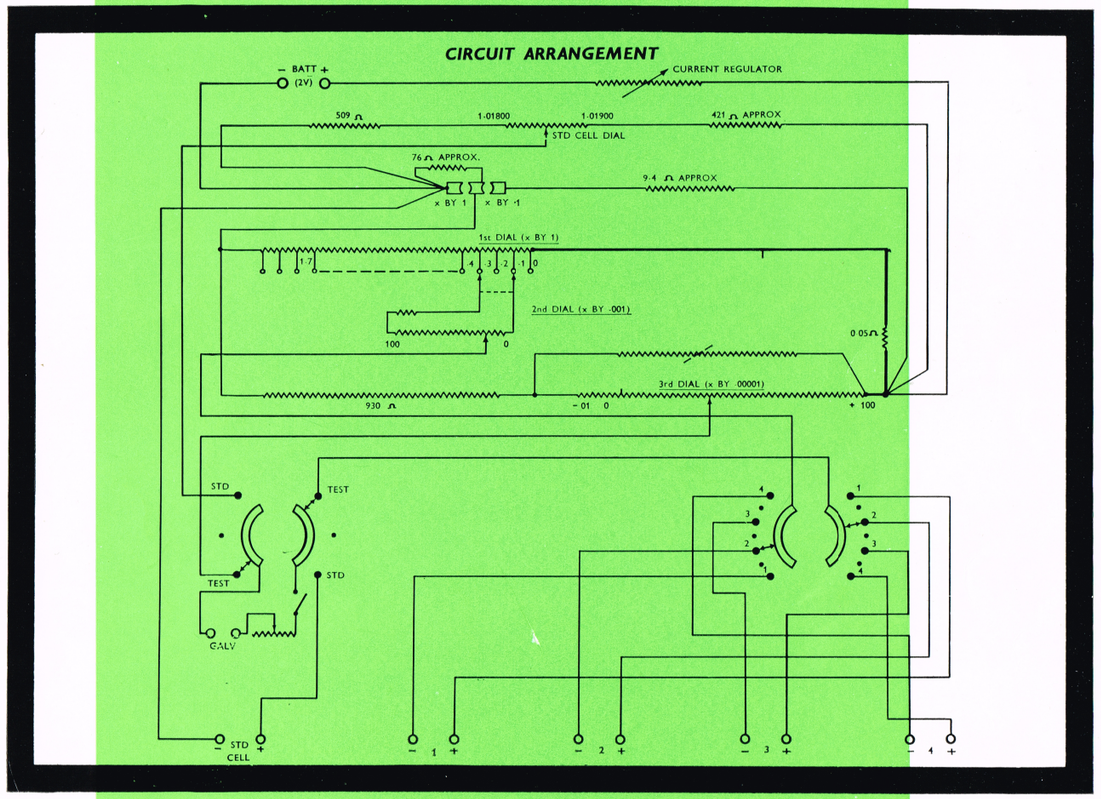


Fig. 2

POTENTIAL DIVIDER

MAIN DIAL

17 steps of 0·1 or 0·01 volts according to the range selected; incorporating a double pole switch which has $\frac{5}{16}$″ dia. copper studs faced with a 10% gold silver alloy, the multileaf phosphor bronze brushes are self cleaning.

This is the only current carrying switch in the potential divider, and the maximum possible contact resistance variation is 20 microhms.