B&W

INSTRUCTION MANUAL

Model 600

Dip Meter

Serial No.

BARKER & WILLIAMSON, Inc.

237 Fairfield Avenue • Upper Darby, Penna.

B&W

MODEL 600

Dip Meter

SPECIFICATIONS

Frequency Range	1.75 to 260 MC with 5 overlapping color coded plug-in coils
Dimensions	Approximately 3" x 3" x 7"
Weight	Approximately 2 lbs.
Power Supply	115 volts AC. 60 cycles
Tube	955 Acorn type
Meter	0-500 microamperes
Finish	Hammeroid gray

Coil Set No. 600-A

Coil No.	Frequency Range	Color Code
600–A–1	1.75 to 5.2 mc	Green
600–A–2	5 to 14 mc	White
600–A–3	14 to 36 mc	Yellow
600–A–4	36 to 95 mc	Blue
600–A–5	95 to 260 mc	Red

INTRODUCTION

The B & W Model 600 Dip Meter is a sensitive, accurate and versatile electronic instrument. Few devices will prove so handy in so many ways in the laboratory, ham shack, and radio-TV service shop.

The Model 600 consists of a compact, highly sensitive oscillator circuit utilizing a type 955 acorn tube powered from a 115 volt 60 cycle AC. line through the medium of a transformer and metallic rectifier.

A rust proof chassis and sturdy aluminum case contribute in making this unit rugged, light in weight and virtually impervious to the effects of normal climatic conditions.

Five sturdily constructed color coded plug-in coils are furnished with each instrument. Colored vinyl bands on the coils serve as a means of identifying each coil, and further match the colored ranges of the instrument dial.

The panel plate is of richly reverse etched aluminum, designed to withstand the wear of hard service.

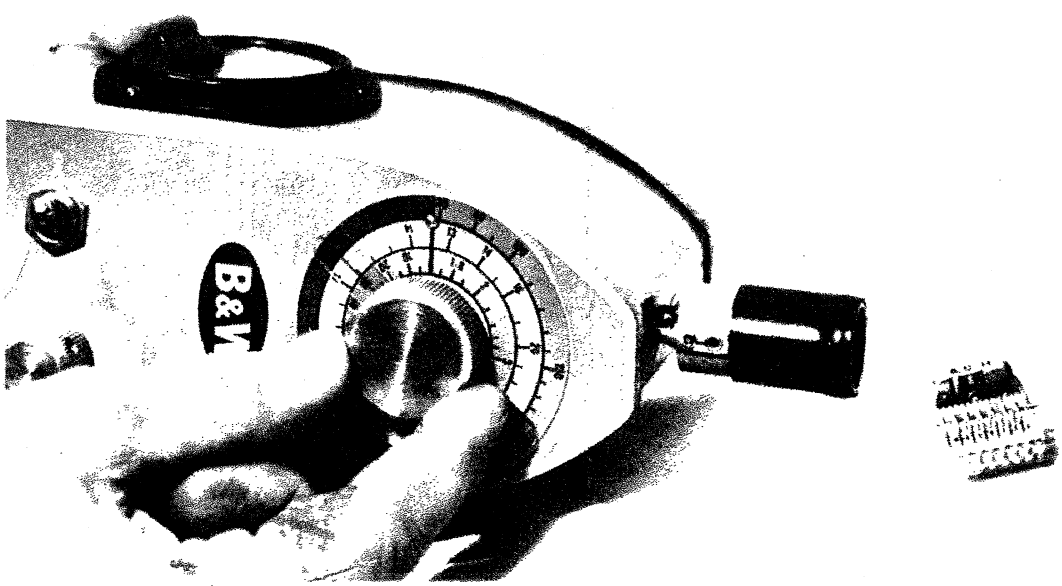
An adjustable sensitivity control permits adjustment of the meter to a suitable scale reading.

This simple, accurate and indispensable instrument is capable of saving the engineer, ham operator and service man much valuable time.

PUTTING THE INSTRUMENT INTO SERVICE

The instrument when shipped from the factory is complete with five color coded plug-in coils in a separate container box, a 955 acorn type tube which is already in place within the instrument, and an instruction book. The instrument when taken from its packing carton is ready for service.

To place the instrument in operation, insert the line cord plug into an AC. outlet delivering 115 volts 60 cycles single phase power, and turn the sensitivity control knob clockwise to turn power on. With the diode switch in the off position and a coil in place, a reading on the meter scale adjusted by the sensitivity control will indicate that the instrument is functioning and ready for service.



A MINIDUCTOR TRAP

The Model 600 is shown during the process of tuning a small trap circuit utilizing a B & W Miniductor coil and a compression type trimmer capacitor.

It may be similarily used for finding the resonant frequency of chokes and filters.

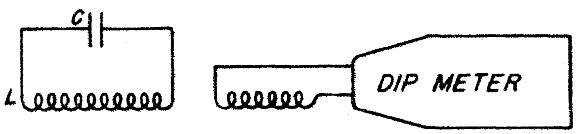


FIGURE 1

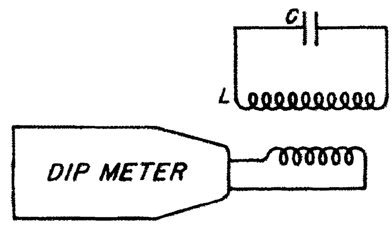


FIGURE 2

APPLICATIONS

DIP METER (Diode Switch "Off")

L C Circuits

The main function of the instrument, when used as a dip meter, is to indicate the resonant frequency of a tuned circuit. This is done by placing the coil of the instrument in close inductive relation to the coil of the circuit being measured, and rotating the tuning knob until a sharp dip is noted in the meter. See figures (1) and (2). The sensitivity control is used to keep the meter reading approximately in mid scale. When the position of the meter dip is ascertained, the coil distance is increased until the dip is barely discernible. The frequency of the circuit being measured is then read from the appropriate scale.

The above procedure is used in finding the resonant frequency of:

1. Traps and chokes
2. Tank circuits
3. I. F. circuits
4. R. F. circuits
5. Filters (high, low and band-pass) etc.

After the resonant frequency of a tuned circuit has been determined, the inductance or capacity may be found if one or the other is known. The nomograph (see Fig. 8) relating inductance, capacity and frequency has been prepared to facilitate this procedure. Known values of capacity can be purchased for use as standards, or established by the use of known values of inductance. An inexpensive source of inductance that can be easily trimmed and adjusted is the B&W Miniductor series. They are made in a number of inductance values as shown in the Miniductor inductance chart on Pages 8 and 9.

Note that the approximate "Q" or quality of resonant circuits may be compared by observing the sharpness of the meter dip as the condenser is rotated through resonance. A sharp dip indicates a circuit of higher "Q" than one with a broad dip.

When using the instrument at the extreme end of the highest frequency range, near 260 megacycles a spurious dip may be noticed that should not be confused with a resonance of the circuit under test.

Antennas and Transmission Lines

Antennas and transmission lines differ from ordinary lumped LC circuits in that the inductance and capacity is distributed. It is important to remember that more than one resonant frequency is present which must be taken into consideration. It is advantageous to determine in advance the approximate frequencies of interest and sketch the antenna and transmission line set-up in terms of current distribution.

Generally, the resonant frequency of an antenna is measured by coupling the coil of the instrument to the part of the antenna with a current maximum. Although points of voltage maximum may be used, they are best avoided due to the increased possibility of spurious dips. See figures (3),

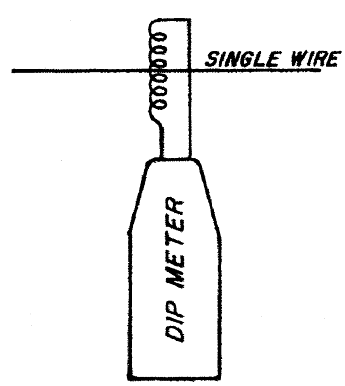


FIGURE 3

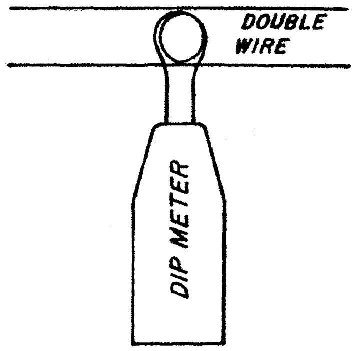


FIGURE 4

(4), (5) and (6). The adjustment of the instrument is then the same as for LC circuits. For example, the half wave antenna has a current maximum at the center. The driven element in a beam antenna is ordinarily a half wave. When its frequency is to be determined, it is necessary to disconnect all feeders and short out all breaks so introduced.

An antenna may also be operated on any multiple of its fundamental frequency. When this operation is desired, it is clarifying to sketch the current variation along the length of the antenna and make the frequency determination at one of the points of current maximum. For this frequency determination, it is also necessary to disconnect all transmission lines and short out any breaks.

The resonant frequency of a transmission line may be measured by considering it as similar to the folded section of an antenna. The instrument is coupled to a shorted end of the transmission line and measurement made as for an LC circuit. A sketch of the probable current distribution is helpful in determining the harmonic mode of operation. See figure (7). For instance, a one quarter wave transmission line with the far end open is similar to a half wave antenna and resonances will be found approximately at odd multiples of the fundamental frequency. When a transmission line is shorted at the far end, it may be considered as two quarter wave transmission lines placed back to back. The resonant frequency is then approximately twice that found with the far end open.

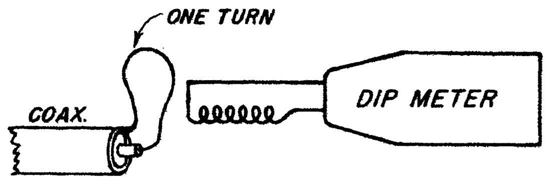
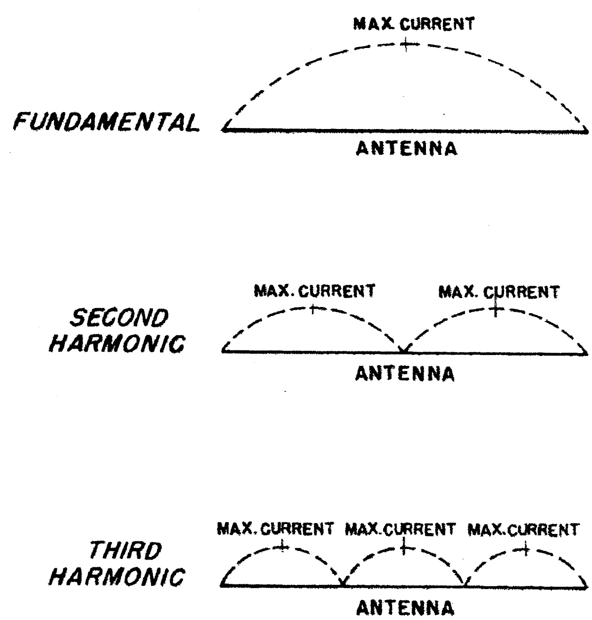


FIGURE 5

When the transmission line is terminated in a pure resistance equal to its characteristic impedance, it will be found that the resonances will disappear. Any other load will cause resonances to reappear except at those frequencies at which the load on the transmission line is equal to its characteristic impedance. These facts can be used to load a transmission line to a high degree of accuracy.



EXAMPLES OF RESONANT ANTENNA CURRENT DISTRIBUTIONS

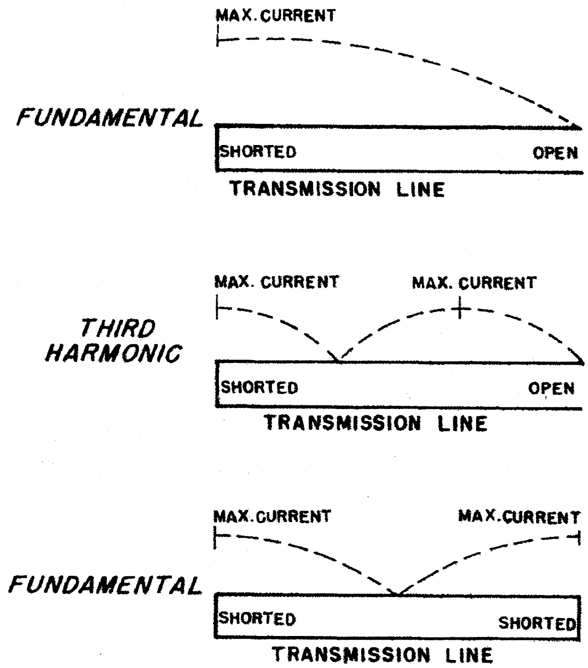
FIGURE 6

Signal Generator

The instrument can be used as a source of signal in the preliminary alignment of receivers. The amount of pickup by the receiver is varied by adjusting the position or distance of the instrument. The output signal is unmodulated, so that an R.F. type of signal tracer is necessary for indicating the proper alignment of the tuned circuits. The "S" meter, in some receivers, may be used as an indicating device for alignment.

The instrument is a convenient source of marker signals in the approximate adjustment of television circuits when using a sweep generator. In this case also, the intensity of the marker may be varied by adjusting the position or distance of the instrument from the circuit under test.

For isolation, markers and test signals may be fed to various circuits by means of a transmission line. The input end of the transmission line should be shorted with a loop that is lightly coupled to the coil of the instrument. The output of the transmission line is then fed into the equipment under investigation by any convenient means.



EXAMPLES OF RESONANT TRANSMISSION LINE CURRENT DISTRIBUTIONS

FIGURE 7

SIGNAL INTENSITY METER AND MONITOR

(Diode Switch "On")

In this case, the instrument functions as an R.F. pickup device where the meter deflection is proportional to the signal picked up by the coil. The sensitivity may be increased by coupling the coil of the dip meter to an antenna.

As a signal intensity meter, the instrument is useful in:

1. Relative field strength measurements
2. Neutralization
3. Harmonic and parasitic analysis
4. Investigation of standing waves on open transmission lines.

Inserting a phone plug into the "phone" jack disconnects the meter and enables the modulation on the signal to be monitored. The instrument may then be used for the determination of:

1. Hum and noise
2. Distortion
3. Quality

When using crystal head phones, place a 10,000 ohm resistor in parallel with them so that a DC path is provided to ground.

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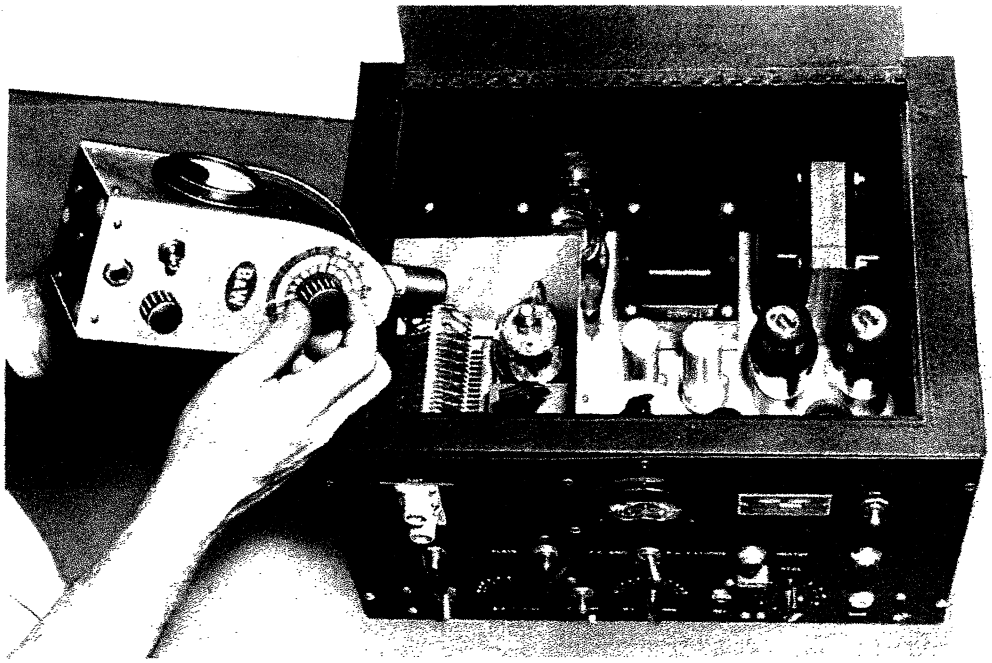
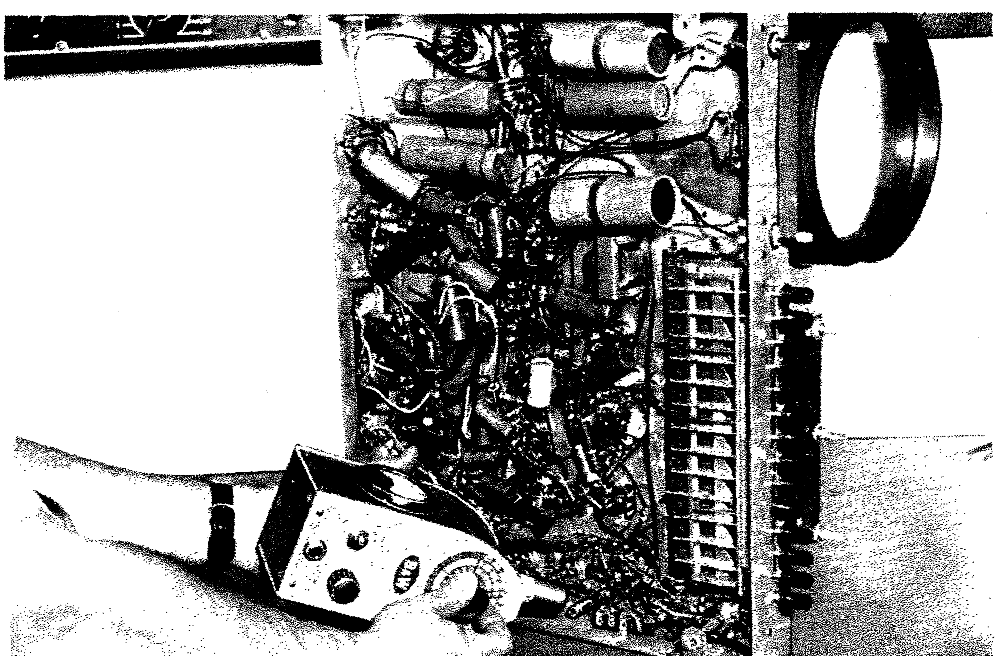


HAM TRANSMITTER

Here the Model 600 is shown performing one of its many and useful services in the ham shack. It may be further used to neutralize the transmitter, locate spurious oscillations and their frequencies, pretune all stages and as a field strength meter.

As a monitor it is indispensable for audible observation of hum level, noise, quality and general characteristics of the signal.

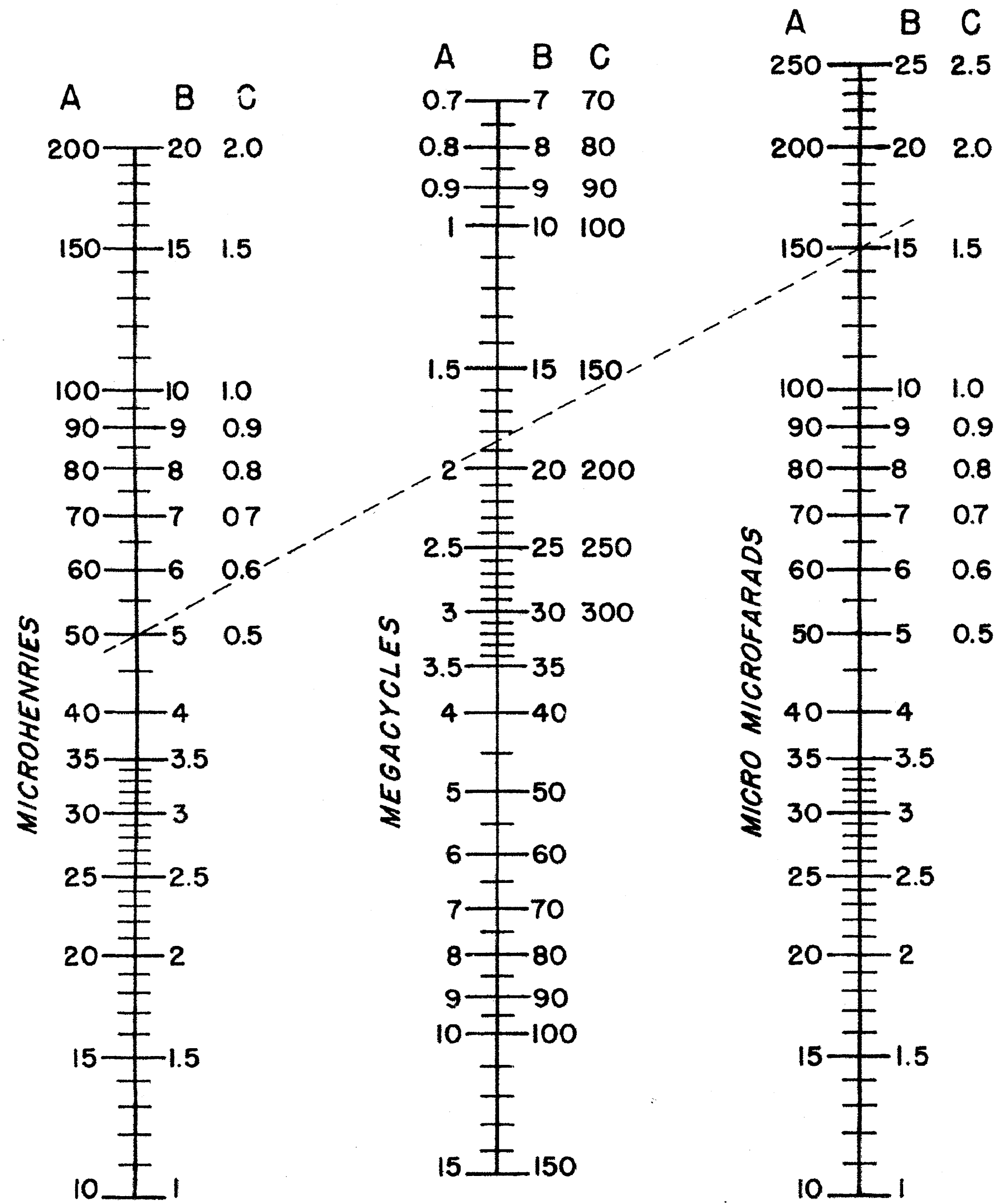


SERVICE SHOP

The preliminary alignment of the I.F. circuits in a TV receiver is shown in this photograph.

The Model 600 is also a valuable aid in the high frequency alignment of radio receivers of the all-band type. In service work it is useful in the alignment of R.F. and I.F. circuits, and as an auxiliary signal generator.

NOMOGRAPH
FOR
INDUCTANCE — FREQUENCY — CAPACITY



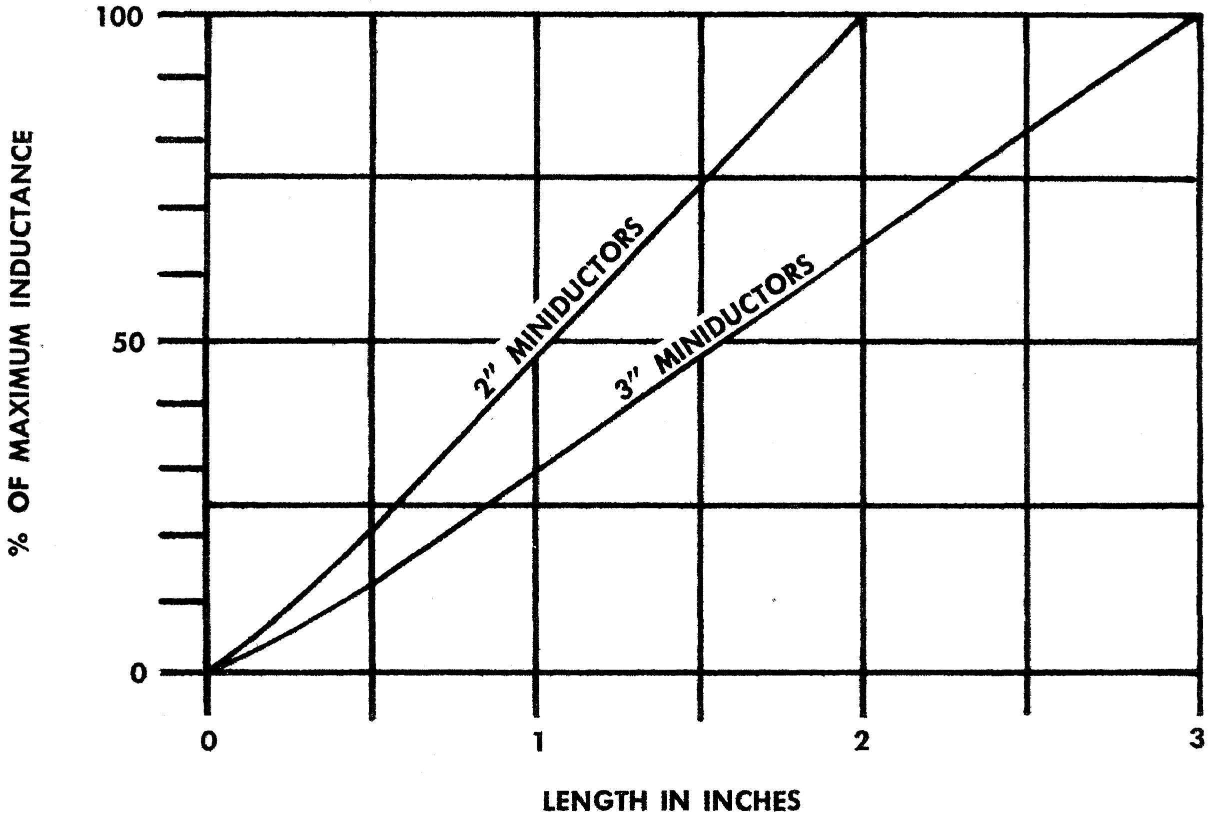
NOTE: *SCALES LETTERED "A" ARE USED TOGETHER, AS ARE SCALES "B" AND "C". IN USE, PLACE A STRAIGHT LINE BETWEEN ANY TWO KNOWN VALUES TO FIND THE THIRD.*

EXAMPLE: (NOTE DOTTED LINE) *USING SCALE "A"*

INDUCTANCE = 50 MICROHENRIES
FREQUENCY = 1.85 MEGACYCLES
CAPACITY = 150 MICRO MICROFARADS

FIGURE 8

PROPORTIONAL INDUCTANCE OF MINIDUCTORS VS. LENGTH



This reprint of a graph indicating proportion of inductance versus length of Miniductors will be useful for determining the approximate value of inductance remaining after a standard length has been cut.

Here is an example on how to use the graph for determining inductance versus length. These formulae apply to all Miniductors.

EXAMPLE:—Let us determine the approximate inductance value of a 1" section of Miniductor #3012 whose length is three inches and total inductance value is 24.0 Microhenries. By referring to the graph, we find that a one inch length of Miniductor coincides with the 3 inch curve at a point representing 27% of the total length. 27% of 24µh = 6.48µh.

Should the inductance value required for a given application be known, the reverse of the above procedure would apply.

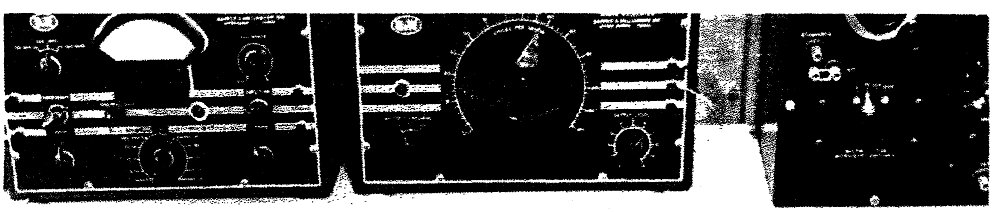
EXAMPLE:—A small coil having an inductance value of 6.48µh is required. Assuming that a #3012 Miniductor is at hand, whose total inductance value we know is approximately 24µh, we arrive at the length by first learning the percentage of 6.48µh to 24µh or 6.48 ÷ 24 = 27%.

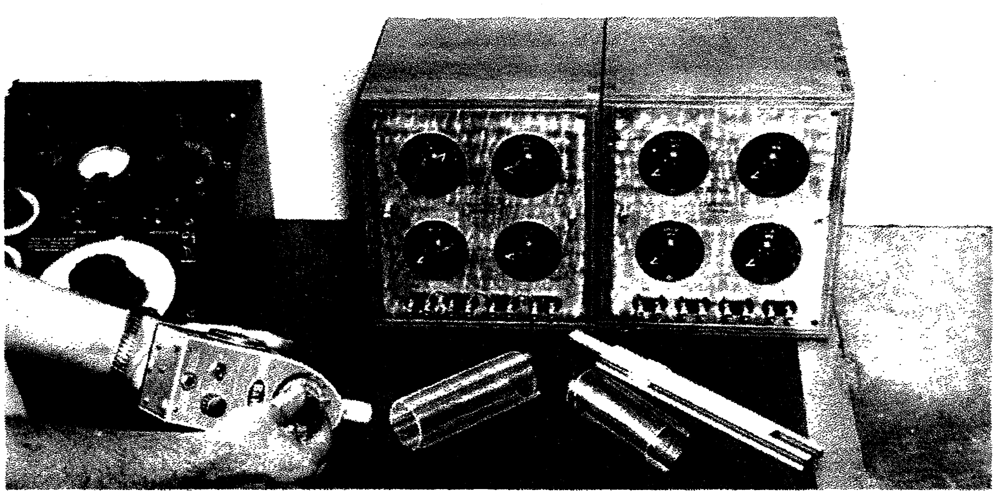
Due to possible inaccuracy in cutting, plus other variable factors beyond control, the resultant *value of inductance* remaining after a standard length of Miniductor has been trimmed, may be considered as approximate only.

CAUTION:—In trimming or cutting Miniductors, be sure to allow at least one extra turn on each end for lead lengths.

MINIDUCTOR SPECIFICATIONS

Catalog Number	Dia.	Turns Per Inch	Length	Approx. Inductance μh
3001	½″	4	2″	0.19
3002	½″	8	2″	0.75
3003	½″	16	2″	3.0
3004	½″	32	2″	12.0
3005	⅝″	4	2″	.28
3006	⅝″	8	2″	1.1
3007	⅝″	16	2″	4.5
3008	⅝″	32	2″	18.0
3009	¾″	4	3″	.37
3010	¾″	8	3″	1.5
3011	¾″	16	3″	6.0
3012	¾″	32	3″	24.0
3013	1″	4	3″	1.0
3014	1″	8	3″	4.0
3015	1″	16	3″	16.0
3016	1″	32	3″	64.0





LABORATORY EXPERIMENTS

In the laboratory, the Model 600 is a versatile and indispensable piece of test equipment. It can save the engineer many valuable hours during the course of experiments and general electronic work.

Here it is shown being used in an investigation of the self resonant frequency of solenoid coils.

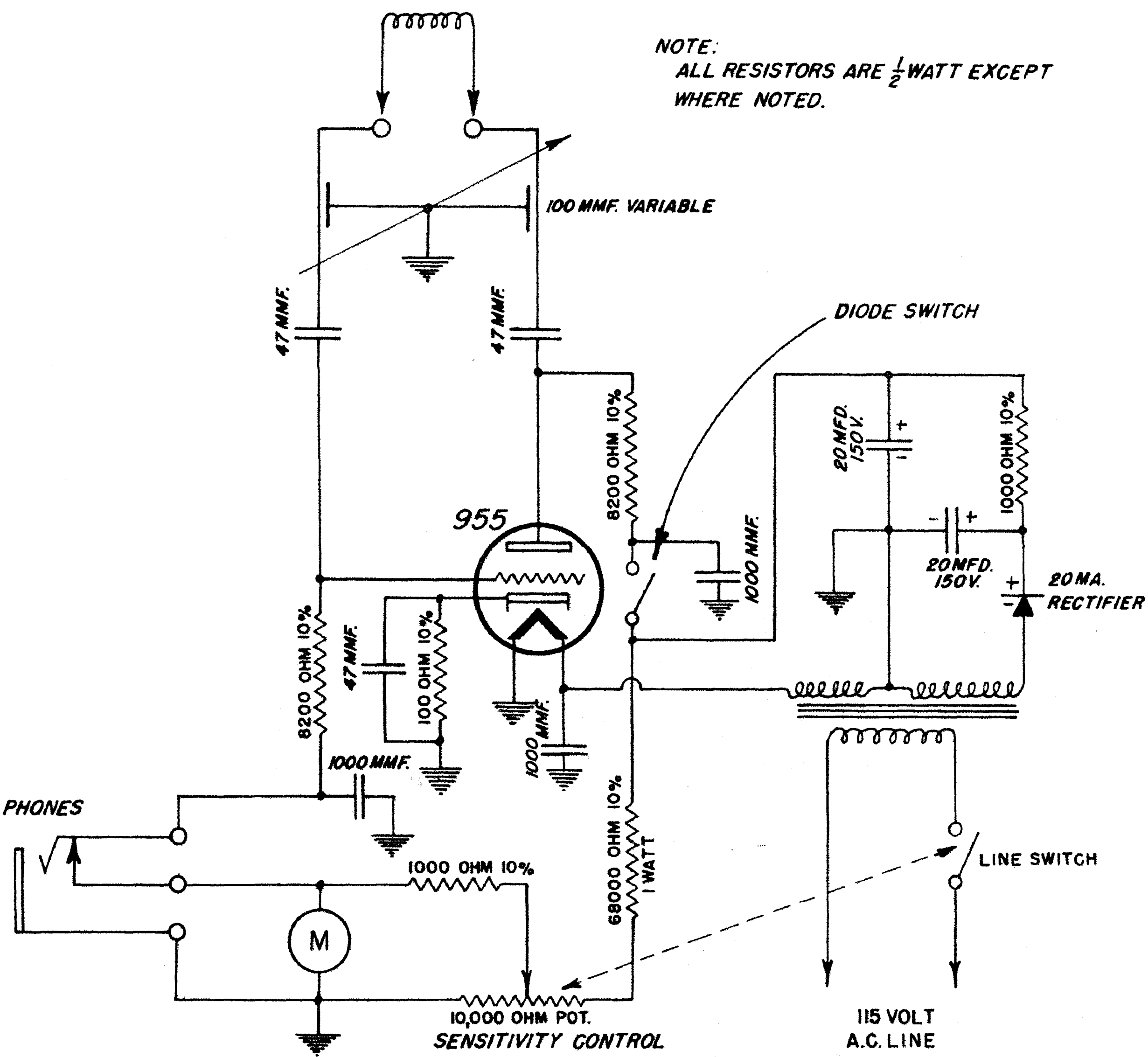

NOTE:
ALL RESISTORS ARE ½ WATT EXCEPT
WHERE NOTED.
100 MMF. VARIABLE
47 MMF.
47 MMF.
DIODE SWITCH
8200 OHM 10%
20 MFD.
150 V.
1000 OHM 10%
955
1000 MMF.
20 MFD.
150 V.
20 MA.
RECTIFIER
8200 OHM 10%
47 MMF.
100 OHM 10%
1000 MMF.
1000 MMF.
PHONES
68000 OHM 10%
1 WATT
1000 OHM 10%
LINE SWITCH
M
10,000 OHM POT.
SENSITIVITY CONTROL
115 VOLT
A.C. LINE

FIGURE 10

MAINTENANCE

When judiciously used and rough handling avoided, the instrument should give long and satisfactory service with a minimum of maintenance.

In time the instrument may show signs of reduced sensitivity and output, particularly on the higher frequencies. This is occasioned by tube aging and a new 955 oscillator tube should be employed.

To replace the tube, remove the two 6/32" round head screws on the back of the instrument near the bottom. The back will then lift off and the tube can be replaced.

Parts and values will be found in the schematic diagram, figure 10.

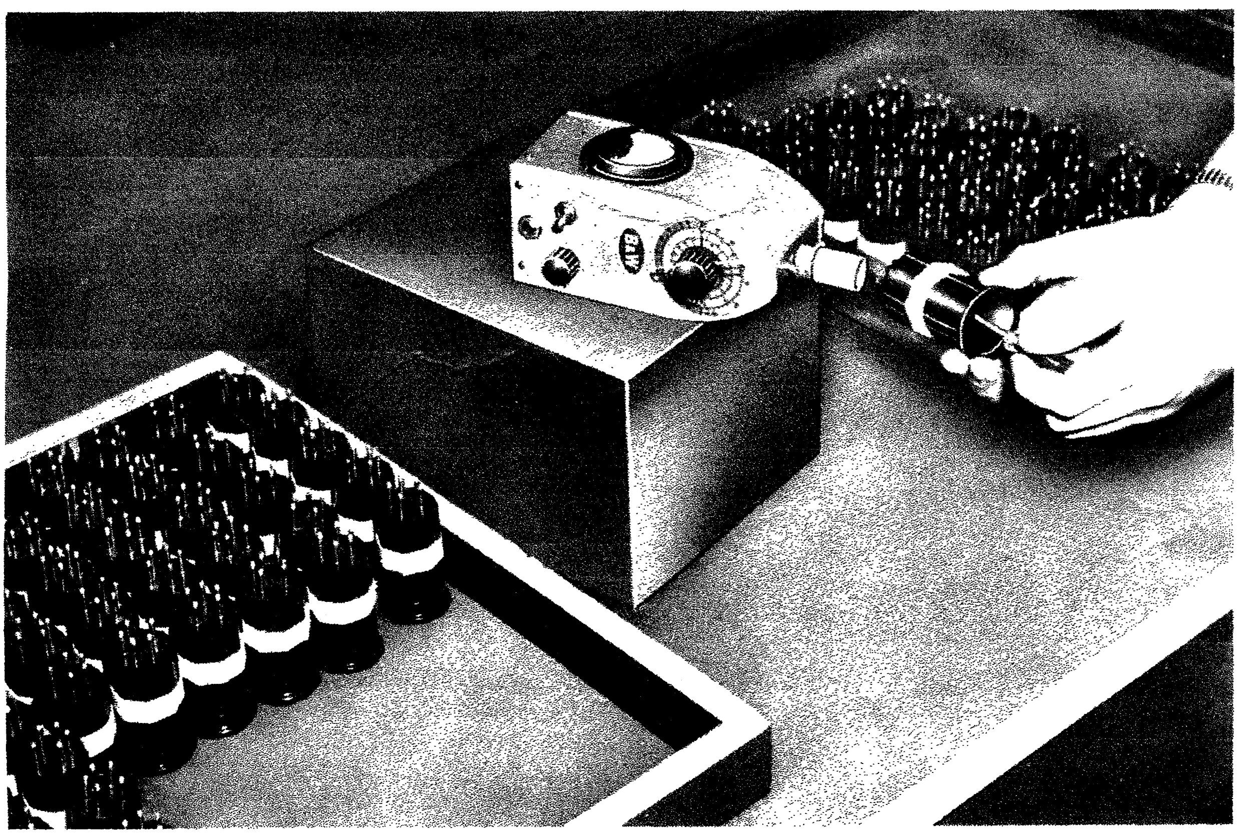
In case of severe damage to vital parts of the instrument it should be returned to the factory for repairs.

A serial number is stamped on the bottom of each instrument and a registration card attached to this instruction book.

Each registration card has provisions for the insertion of the name and address of the customer, the date of purchase, and the distributor from whom it was purchased.

These registration cards must be properly filled out and immediately returned to the factory. Failure to return your registration card automatically voids our guarantee given on the back cover of the instruction book.

Additional copies of the Instruction Manual are available for 25 cents each.



PRODUCTION LINE

Production line testing can be speeded up by using the B & W Model 600 Dip Meter.

The above photograph is a typical example in which the instrument is left in a fixed position. This is only one of the many ways in which the instrument can be useful in electronic component production.

SPECIAL USES

Many special uses for the B&W Model 600 Dip Meter will suggest themselves as familiarity with the instrument is gained. A few of these special applications are described below.

Mutual Inductance Between Two Coils

Connect the two coils in series and the combination across a standard capacitor. Measure the resonant frequency and determine the combined inductance as outlined in an earlier paragraph under "Applications—*L C Circuits.*" The connections to one of the coils is then reversed and the inductance of the combination again determined. The effective mutual inductance between the two coils is equal to one-fourth the difference between the two resultant measurements.

Coefficient of Coupling Between Two Coils

Measure the inductance of each coil leaving the other coil open. The coefficient of coupling is given by the following formula:

$$K = \frac{M}{\sqrt{L_1 \times L_2}}$$

where M is the mutual inductance and L_1, L_2 are the self inductances of the two coils respectively.

Measurement of Length of Cable

Open one end of the cable and short the other end with a small loop. Couple the instrument to the shorted end, and starting with the lowest frequency, note the frequencies of successive dips. The fundamental resonant frequency (based on a quarter wave) is approximately equal to one half the difference between two successive dips.

The physical length of the cable may now be calculated by the following formula:

$$L = \frac{246 \times k}{f\ (mc)} \text{ feet}$$

where L = length of cable (feet)
f = resonant frequency (megacycles)
k = relative propagation constant as given by cable manufacturer.

This scheme for finding cable length is of great utility when the cable is wound on a drum and it is not feasible to unwind it. Sometimes false dips are evident, due to proximity and sheath resonances, so that several determinations should be made until the results seem reasonable.

Use of Arbitrary Scale

One arbitrary scale (0-100) has been provided on the instrument for the purpose of calibrating coils that have been made by the user for covering special frequency ranges. Blank coil forms may be purchased for this purpose from B&W.

For a particular purpose the overlaps of the frequency ranges provided may be insufficient. A special coil can then be wound for bringing a particular frequency into the center of the range.

The frequency spread of the instrument may be greater than needed. It is possible, by means of special coil and condenser combinations, to bandspread a particular section of the range. This is done by the judicious variation of coil turns and shunting capacity until a desired result is attained.