

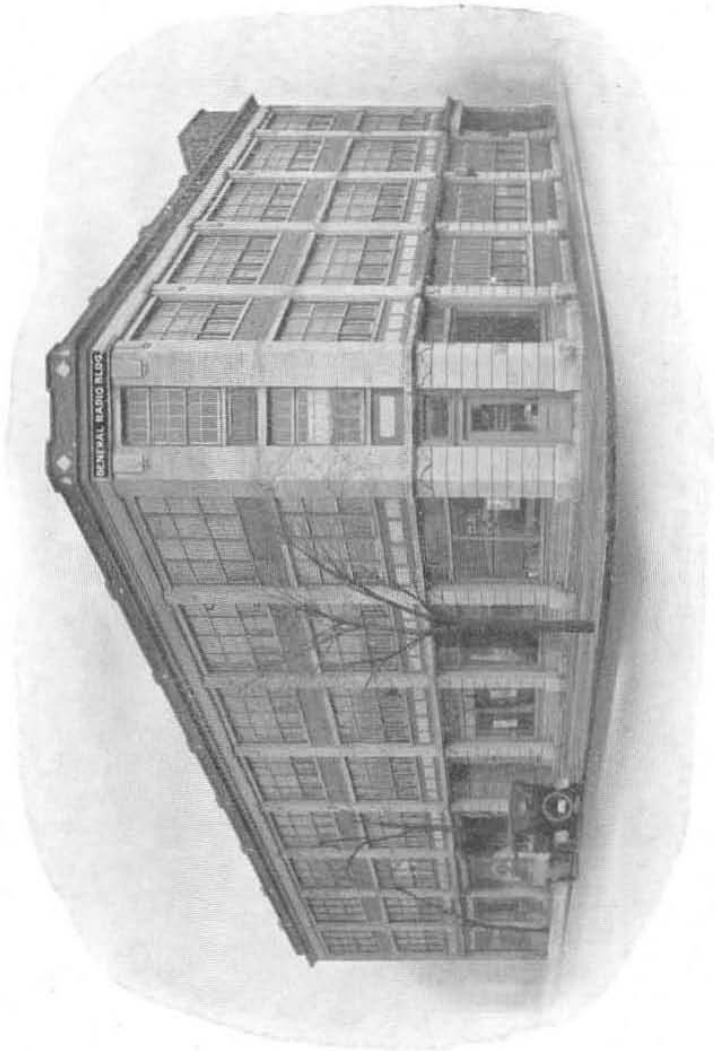
GENERAL RADIO COMPANY



CATALOGUE C RADIO LABORATORY APPARATUS

CAMBRIDGE, MASS.
U. S. A.





CATALOGUE OF
RADIO LABORATORY APPARATUS
MANUFACTURED BY
GENERAL RADIO COMPANY



TRADE MARK

11 Windsor Street
Corner of Massachusetts Avenue
CAMBRIDGE, MASSACHUSETTS

1919



FOREWORD

In the instruments shown in this catalogue we make every effort to maintain the highest possible standard of design, workmanship, and material. All new designs are thoroughly tested out in practice before any instruments are sold.

Whenever practicable we employ "Bakelite" as an insulating material, because of its superiority over hard rubber, both in strength and permanency of shape and of finish. While somewhat more expensive than hard rubber, its admirable electrical and mechanical qualities justify its use.

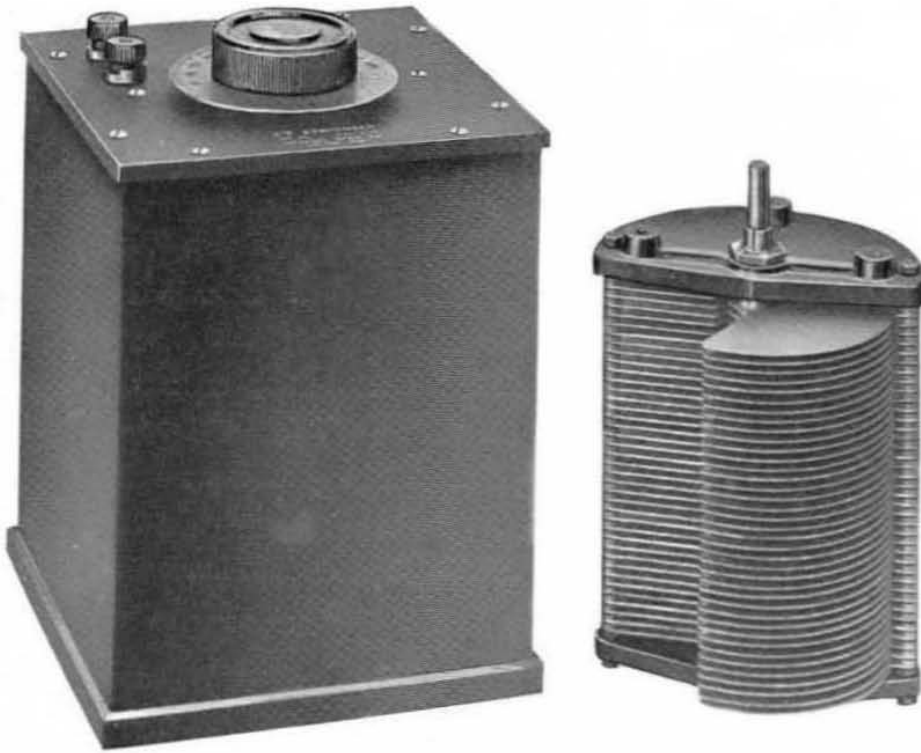
Most of the brass parts in our apparatus are plated with dull nickel, which gives a permanent and attractive finish. All binding posts, switch bases, and similar parts are securely pinned to prevent turning. Handles are either pinned on or held in place by a hardened set screw fitting a depression in the shaft. Cabinets are made of dull finished hard oak, which does not scratch or dent easily, while Bakelite Tubing is used for coil supports where slight changes of shape would be objectionable. Through the use of complete jigs, fixtures and gauges in the manufacture of our instruments, most of the parts are rendered readily interchangeable, a quality greatly appreciated when the purchaser wishes to make changes or repairs.

We shall be pleased to offer suggestions regarding apparatus, methods, or books for use in radio work, and hope that readers of this catalogue will feel free to call on us for information at any time.

All prices in this catalogue are strictly net. Cash should accompany orders from persons or firms not listed in the commercial directories. Unless otherwise instructed, we will use our own judgment regarding method of shipment.

General Radio Co., Cambridge, Mass., U. S. A.





VARIABLE AIR CONDENSER Type 101

This condenser is made of semicircular aluminum plates, one-half being insulated from the other and arranged to rotate on a vertical axis. The steel shaft has large 45 degree angle cone bearings, accurately machined after the assembly of the moving unit. This assures perfect alignment. The bearings which support the steel shaft are of brass, positively locked in place. When completely assembled, the condenser is placed in a lathe and the shaft rotated continuously at an approximate speed of 300 RPM for half an hour. This "wearing in" of the bearings makes them perfect before they leave the factory, and is insurance against future changing, sticking, or binding. Both sets of plates are .036" thick, and the clearance is .045", which, with the heavy end pieces of molded Bakelite, make a condenser which is not apt to change its capacity with time. It is therefore well adapted for use as a variable standard of capacity, and for wavemeter work where permanence of capacity is essential. The scale is engraved on a brass disc which is fastened directly to the handle and shaft, rotating with them. The condenser is mounted in a dull-finished

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oak case with Bakelite top. Care has been taken to have low resistance connections from both the moving and stationary plates to the binding posts, as well as to keep the dielectric losses as low as possible.

Type 101L Capacity .0015 M.F. Price \$19.00

Size $7\frac{1}{2}'' \times 7\frac{1}{2}'' \times 6\frac{1}{2}''$. Weight 7 lbs.

Code Word "CABIN"

Type 101L Same as above, but with calibration curve and extension handle for accurate adjustment Price \$24.50

Code Word "CADDY"

Type 101M Capacity .003 M.F. Price \$25.00

Size $7\frac{1}{2}'' \times 7\frac{1}{2}'' \times 9\frac{1}{2}''$. Weight $9\frac{1}{4}$ lbs.

Code Word "CADET"

Type 101M Same as above, but with calibration curve and extension handle for accurate measurement Price \$30.50

Code Word "CALIF"

Type 101P Capacity .005 M.F. Price \$29.00

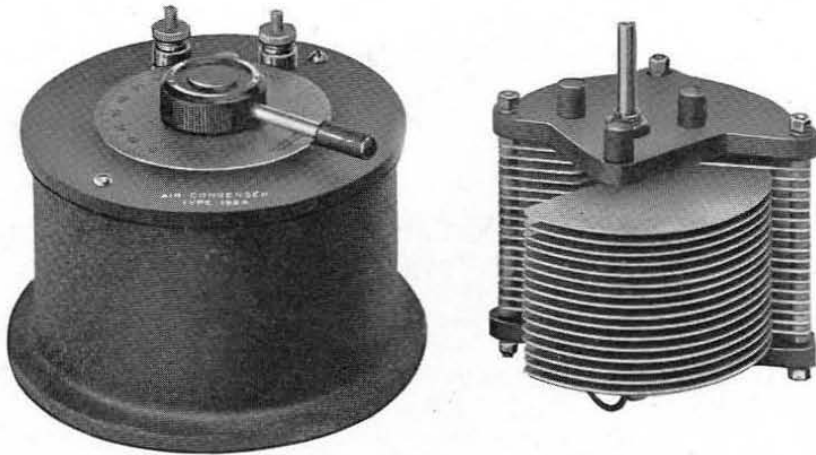
Size and weight same as Type 101M.

Code Word "CANAL"

Type 101P Same as above, but with calibration curve and extension handle for accurate adjustment Price \$34.50

Code Word "CALYX"

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VARIABLE AIR CONDENSER
Type 182

This condenser follows closely the fundamental design proved satisfactory by years of use of our Type 101 Condenser. It has two cone bearings, steel on brass, which permit of any desired degree of turning resistance, and of taking up perfectly any wear in the bearings after years of service. Electric connection to the moving plates is accomplished by two flexible leads, thereby preventing any possibility of varying resistance such as might result were the bearings used for this purpose. The plates are made heavier than those of any other variable condenser of this size, and the end supports are arranged to reduce the usual dielectric losses. The plates are different from our other condensers, however, in that they are curved out of round, as shown in the cut, in such a way as to give a more nearly even progression of wavelength when used with an inductance than would the ordinary semi-circular plates. This is particularly valuable in circuits, such as those used with vacuum tubes, where the ratio of inductance to capacity is large. It further results in a remarkably low capacity at the zero end of the scale.

A small extension handle is provided for accurate adjustment.

The case is of cast metal, finished with our permanent crystalline black finish.

Maximum capacity approximately .0007.

Minimum capacity approximately .00002.

Size 5½" d. x 4⅛". Weight 2 lbs.

Type 182A Variable Air Condenser.....\$10.00

Code Word "CUDDY"

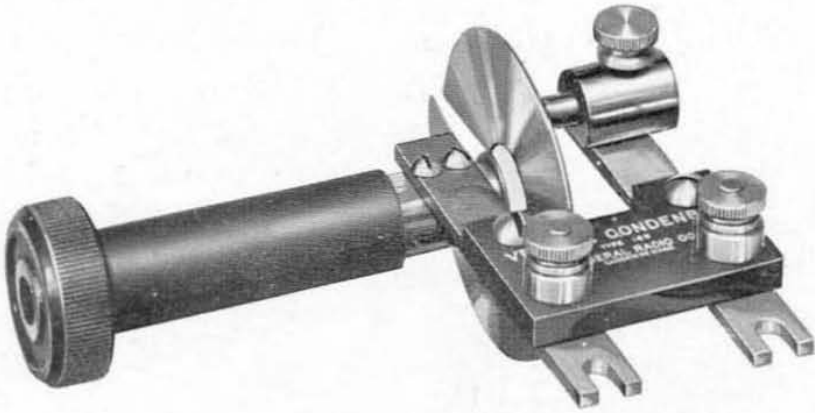
Type 182B Same as above, calibrated at 10 points..\$11.50

Code Word "CUMIN"

Type 182C Without case, top or binding posts, but
with scale and handle.....\$ 7.50

Code Word "CUPID"

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VERNIER CONDENSER

Type 169

Resonance between oscillating circuits using vacuum tubes as sources of oscillations is usually so sharply defined that it is somewhat difficult to obtain by adjusting the ordinary variable air condenser in the circuit being tuned. Very often a movement of one degree on the condenser scale will go beyond the point of resonance. For overcoming this inconvenience Type 169 Vernier Condenser has been designed. The stationary plate may be varied in distance from the moving plate, thereby allowing as fine or coarse an adjustment as desired. An extension handle is provided to avoid effects from placing the hand too near the condenser. It is so constructed as to slip into the binding posts of any of our condensers, thereby placing it in parallel connection. When accurate work in a laboratory is being done, we recommend these Verniers for convenience in making fine adjustments of capacity.

Type 169 Vernier Condenser.....\$8.00

Size $5\frac{1}{2}$ " x $4\frac{1}{4}$ " x $2\frac{3}{4}$ ". Weight $\frac{3}{4}$ lbs.

Code Word "CUBBY"

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STANDARD AIR CONDENSERS

Type 120

Our Standard Air Condensers are very useful in laboratories where accurate and permanent standards of capacity are needed. They are used for checking variable condensers, in alternating current bridge work, for accurate measurements of frequencies, and many other purposes.

The plates are made of heavy aluminum spaced by means of very accurately machined separators. These ring shaped separators have a large area in contact with the aluminum to avoid any variation in capacity from a change in the spacing of plates. The whole unit is held on a heavy insulating top by means of eight rods. It is contained in a substantial metal case, with our permanent black flaky finish.

It is adjusted to 1/5% accuracy by means of oscillating vacuum tubes at a frequency of 300,000 cycles, and the mechanical construction is such as to insure its adjustment remaining constant at all times.

Great care has been used in the design of this condenser to keep the dielectric losses very low in order that the capacity may remain constant at low and high frequencies.

Size $7\frac{1}{2}$ " x $7\frac{1}{2}$ " x $6\frac{1}{2}$ ". Weight $8\frac{3}{4}$ lbs.

Type 120A Standard Air Condenser.....	\$30.00
Capacity, .001 M.F.	
Code Word "CAROL"	
Type 120B Standard Air Condenser.....	\$35.00
Capacity, .002 M.F.	
Code Word "CARRY"	
Type 120C Standard Air Condenser.....	\$40.00
Capacity, .004 M.F.	
Code Word "CATER"	

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STANDARDS OF INDUCTANCE

Type 106

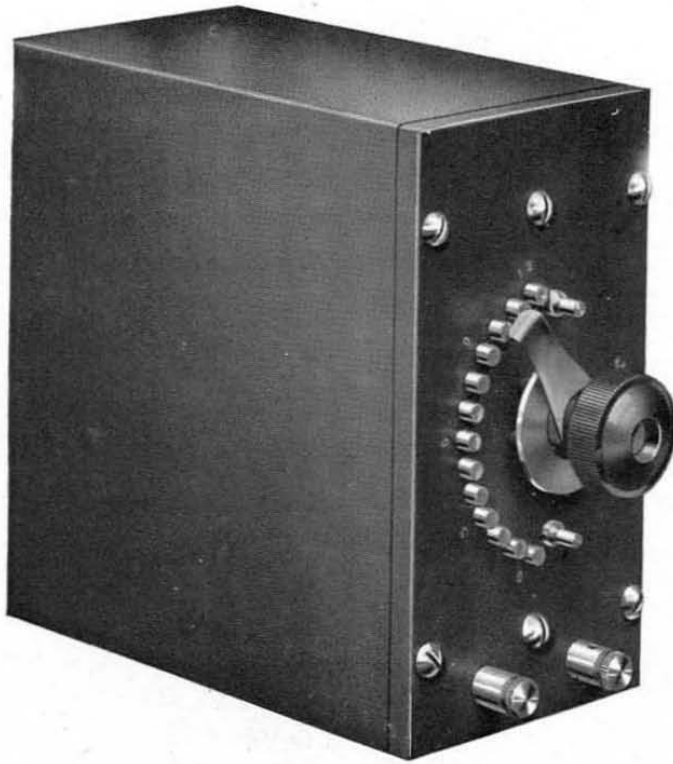
These coils are wound on non-shrinkable forms, and are so designed as to keep the distributed capacity low. They are mounted in oak cases for the protection of the forms, and are so arranged as to take fairly heavy jars without damage. Only absolutely non-magnetic materials are used, and the amount of metal in the field is very slight. The continuous carrying capacity of No. 106 A and B is about 2 amperes, and of No. 106 C and D is about $\frac{3}{4}$ ampere.

Size 6" d. x 5". Weight 2 lbs.

Type 106A.	.05 Millihenry.....	Price \$15.00
	Code Word "INLAY"	
Type 106B.	.20 Millihenry.....	Price \$15.00
	Code Word "INLET"	
Type 106C.	1.00 Millihenry.....	Price \$17.00
	Code Word "INFER"	
Type 106D.	5.00 Millihenrys.....	Price \$20.00
	Code Word "INKLE"	

Other ranges will be made to order.

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12 STEP INDUCTOR Type 111

This inductance is wound in three coils, separated from each other, and contained in an oak case with a Bakelite front. The design is such as to permit two or more of these inductances to be placed side by side, coupling being varied by moving them nearer to or farther away from each other. Thus every degree of coupling may be obtained, from very close, to nil. The further possibility of obtaining mutual coupling between three or four different circuits is of considerable importance. Dead-end switches are arranged to automatically cut out the coils not in use, thus avoiding losses in oscillating circuits.

No. 111C has about 1 M. H. inductance, with approximately 1 ohm resistance and oscillates at 1300 meters with a capacity of .0005 M. F.

No. 111D has about 10 M. H. inductance, with approximately 6 ohms resistance, and oscillates at 4000 meters with a capacity of .0005 M. F.

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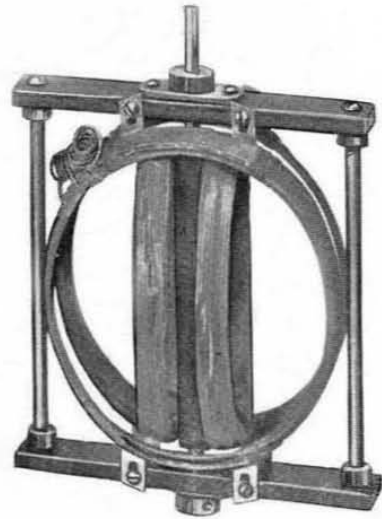
No. 111E has about 75 M. H. inductance, with approximately 45 ohms resistance, and oscillates at 11,000 meters with a capacity of .0005 M. F.

No. 111F has about 150 M. H. inductance, with approximately 68 ohms resistance, and oscillates at 16,000 meters with a capacity of .0005 M. F.

Size 8" x 7" x 4". Weight 3 lbs.

Type 111C Variable Inductance.....	\$12.00
Code Word "ABBOT"	
Type 111D Variable Inductance.....	\$12.00
Code Word "ABHOR"	
Type 111E Variable Inductance.....	\$14.00
Code Word "ABIDE"	
Type 111F Variable Inductance.....	\$16.00
Code Word "ABYSS"	

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VARIABLE INDUCTOR Type 107

This variable inductance, commonly called a "variometer," is wound with well-stranded copper wire, and has been carefully designed to give satisfactory results at high frequencies.

The coils are sections of spheres and are form wound.

The scale is engraved on a brass disc which is securely fastened to the handle and shaft.

The connections to the moving coil are made through multiple contacts, giving a low and constant resistance. Coils are thrown into series or parallel arrangement by means of a simple change of connection on the panel; or the coils may be used separately as a mutual inductor.

The entire instrument is mounted in an oak case with a Bakelite top, and very little solid dielectric or metal in the field of the coils.

Ranges other than those listed below will be made at a slightly increased cost.

Size 6" x 6" x 8". Weight 4¾ lbs.

No. 107C. About .008 to .4 M. H. Price \$24.00

Carries 3 amperes continuously.

Code Word "HAPPY"

No. 107D. About .12 to 6 M. H. Price \$24.00

Carries 1 ampere continuously.

Code Word "HARDY"

No. 107E. About .4 to 20 M. H. Price \$24.00

Carries ½ ampere continuously.

Code Word "HAVEN"

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STANDARDS OF RESISTANCE

Type 133

The resistance coils used in these standards are wound on a sheet of Bakelite, with a double winding of manganin wire, so arranged that the currents in adjacent wires are opposite in direction and at practically the same potential. This construction keeps both inductance and capacity extremely low. It is desirable that resistances used at high frequencies have a low inductance, in order that the inductance of the circuit shall not be materially changed as the resistance is varied. The effect of capacity in a resistance coil is to reduce the apparent resistance at high frequencies caused by the current shunted through the capacity of the coil. The capacity of these coils is only about .000009 M. F., the effect of which is not appreciable in most high frequency measurements.

As these standards are also reliable on direct and low frequency alternating currents, they make very convenient standards for general laboratory use.

The case is of cast brass, well lacquered, and has a Bakelite top. The resistance is adjusted to .1%, and every precaution is used in construction to aid in maintaining its accuracy.

133A	RECUR	Standard Resistance,	1 ohm.	\$.50
133B	REFER	“ “	5 ohms.	5.00
133C	REGAL	“ “	10 ohms.	5.00
133D	RELAX	“ “	50 ohms.	5.00
133E	RELIC	“ “	100 ohms.	5.50
133F	REPAY	“ “	500 ohms.	6.50
133G	REPEL	“ “	1000 ohms.	7.75

Size 3" d. x 2¼". Weight 11 oz.

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DECADE RESISTANCE BOXES

Type 102

The decade resistance box, in addition to its many uses on direct current, may, if properly designed and built, be employed in both low and high frequency alternating current tests.

In these resistance boxes great care has been taken to make the resistance on high frequency currents the same as the direct current resistance, and to keep the inductance as low as possible.

The resistance material used in all units is manganin, which has a very low temperature coefficient of resistance (.0005% per degree C.) and contains no iron.

In the one-tenth ohm units, the conductor is a thin, narrow ribbon, with very low inductance. The one, ten, and one hundred ohm units are wound on Bakelite forms, with two insulated manganin wires, so arranged that the inductance is as low as possible, without increasing the distributed capacity, which with ordinary resistance coils causes serious errors at high frequencies.

The tops of these instruments are made of Bakelite having a permanent, dull black finish.

The contact points are forced in and held in place with nuts. The terminals of the resistance units are soldered directly to the projecting ends of the contact points.

The switch blades have 4 phosphor bronze laminations, which make good connection with the contact points.

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The insulating handle and the switch blades are securely pinned to the steel shaft, which rotates in a brass base pinned to the Bakelite top.

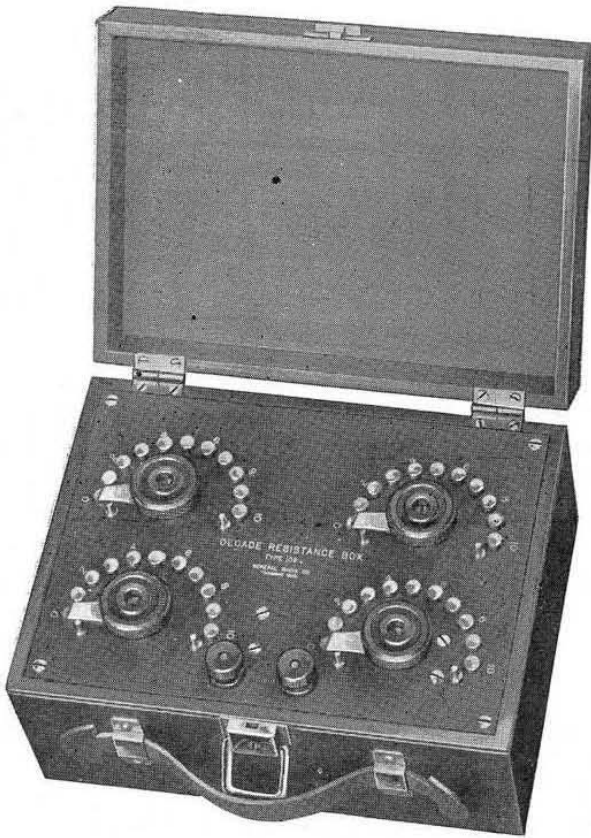
Contact between the shaft and the switch base is made through a radially slotted bronze washer. The resistance of the complete switch is approximately .004 ohm, and will not appreciably increase, even after long use.

The one-tenth ohm units will carry 1 ampere, the one ohm units .25 ampere, the ten ohm units .1 ampere, and the one hundred ohm units .05 ampere—all without heating enough to change the resistance. The accuracy of the coils is better than $\frac{1}{4}\%$ on direct current and about $\frac{1}{2}\%$ at 1,500,000 cycles (200 meters wave length).

These boxes are furnished in four general sizes:—Types 102A, B and C of one section each; Types 102D, E and H of two sections each; Types 102F and G of three sections each, and Types 102J and K of four sections. The first three types are mounted in metal cases, the others in oak cases.

Type 102A	10 one-tenth ohm coils.....	\$10.00
	Size $4\frac{5}{8}$ " d. x $2\frac{3}{16}$ ". Weight $1\frac{3}{4}$ lbs.	
	Code Word "DAILY"	
Type 102B	10 one ohm coils.....	10.00
	Size and weight same as Type 102A.	
	Code Word "DATUM"	
Type 102C	10 ten ohm coils.....	10.00
	Size and weight same as Type 102A.	
	Code Word "DEBAR"	
Type 102D	10 one-tenth ohm coils.....	
	plus 10 one ohm coils.....	19.00
	Size $7\frac{5}{8}$ " x $5\frac{1}{2}$ " x 4". Weight $3\frac{1}{4}$ lbs.	
	Code Word "DECOY"	
Type 102E	10 one ohm coils.....	
	plus 10 ten ohm coils.....	19.00
	Size and weight same as Type 102D	
	Code Word "DECRY"	
Type 102H	10 ten ohm coils.....	
	plus 10 one hundred ohm coils.....	20.00
	Size and weight same as Type 102D	
	Code Word "DIVAN"	
Type 102F	10 one-tenth ohm coils.....	
	plus 10 one ohm coils.....	
	plus 10 ten ohm coils.....	28.00
	Size $10\frac{5}{8}$ " x $5\frac{1}{2}$ " x 4". Weight $3\frac{1}{2}$ lbs.	
	Code Word "DELTA"	

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Type 102G 10 one ohm coils.....
 plus 10 ten ohm coils.....
 plus 10 one hundred ohm coils..... 29.00

Size and weight same as Type 102F

Code Word "DIGIT"

Type 102K 10 one-tenth ohm coils.....
 plus 10 one ohm coils.....
 plus 10 ten ohm coils.....
 plus 10 one hundred ohm coils..... 40.00

Size 7" x 9½" x 5¼". Weight 5¼ lbs.

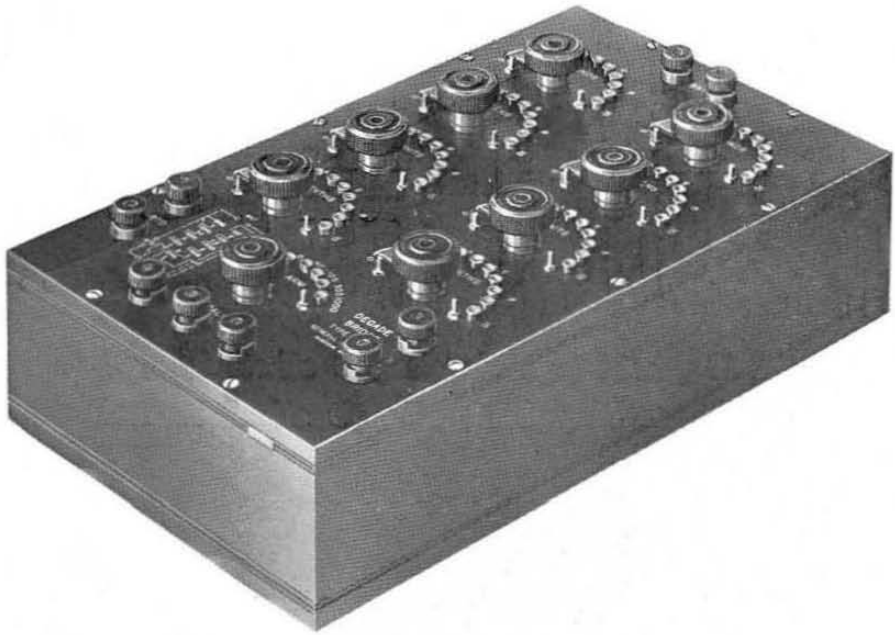
Code Word "DEFER"

Type 102J 10 one ohm coils.....
 plus 10 ten ohm coils.....
 plus 10 one hundred ohm coils.....
 plus 10 one thousand ohm coils..... 45.00

Size and weight same as Type 102K

Code Word "DEBIT"

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DECADE BRIDGE

Type 193

This bridge is made up of the same resistance units as are employed in our Decade Resistance Boxes, Type 102, in a suitable arrangement for bridge measurements. As these resistances are accurate on frequencies to 1,500,000 cycles, this bridge is adapted to measurements of inductance, capacity and resistance at high frequencies using a sine-wave generator or oscillating vacuum tube, as well as to DC measurements. In capacity and inductance measurements one arm of the bridge is arranged to compensate for the resistance of the capacity or inductance under measurement as compared to that of the standard, thus indicating the resistance as well as the capacity or inductance at the particular frequency being used.

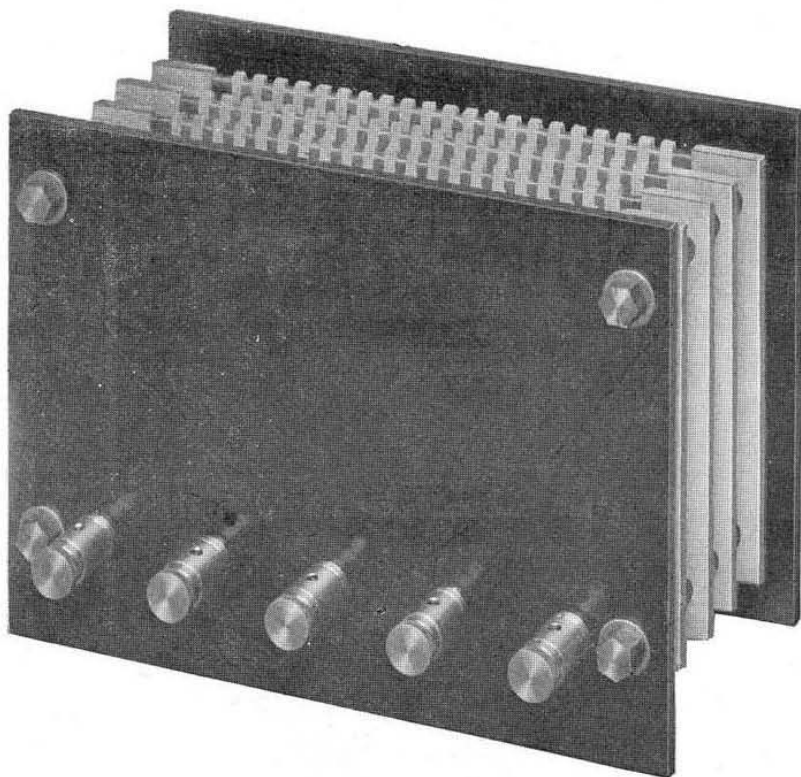
The units have been mounted in a compact and convenient arrangement, and great care taken to eliminate errors at high frequencies.

Type 193 Decade Bridge..... Price \$112.00

Size 17" x 10½" x 5". Weight, 12¾ lbs.

Code Word "BIGOT"

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PHANTOM ANTENNA RESISTANCE

Type 125

For many tests of transmitting apparatus it is desirable to replace the antenna with a local circuit, the constants of which are more easily and accurately determined. It also prevents interference with neighboring stations.

This resistance is made in two sizes, Type 125A of 4 units of 4 ohms each, and Type 125G of 2 units of 2 ohms each. Separate binding posts are brought out, so that 2-4-8-12 and 16 ohms may be obtained on Type 125A, and 1-2 and 4 ohms on Type 125G. The separate units have a carrying capacity of 5 amperes in Type 125A, and 15 amperes in Type 125G, thereby allowing a maximum current of 10 amperes at 2 or 4 ohms in Type 125A, and 30 amperes at 1 ohm in Type 125G.

The resistance material is in the form of a ribbon, and has a very low temperature coefficient of resistance and a constant resistance up to very high frequencies. It is wound on asbestos-board forms, mounted vertically, an arrangement which insures a good circulation of air.

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The resistance is accurately adjusted and the inductance is so low as to be negligible.

Type 125A Phantom Antenna Resistance.....\$15.00

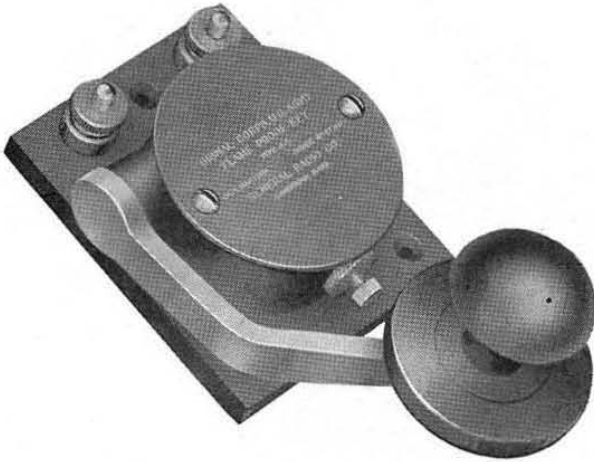
Size $7\frac{3}{4}$ " x 6" x $4\frac{1}{4}$ ". Weight $3\frac{1}{4}$ lbs.

Code Word "RAVEN"

Type 125G Phantom Antenna Resistance.....\$32.00

Size $10\frac{3}{4}$ " x $7\frac{5}{8}$ " x $5\frac{1}{2}$ ". Weight 7 lbs.

Code Word "REBEL"



FLAME-PROOF KEY

Type 151

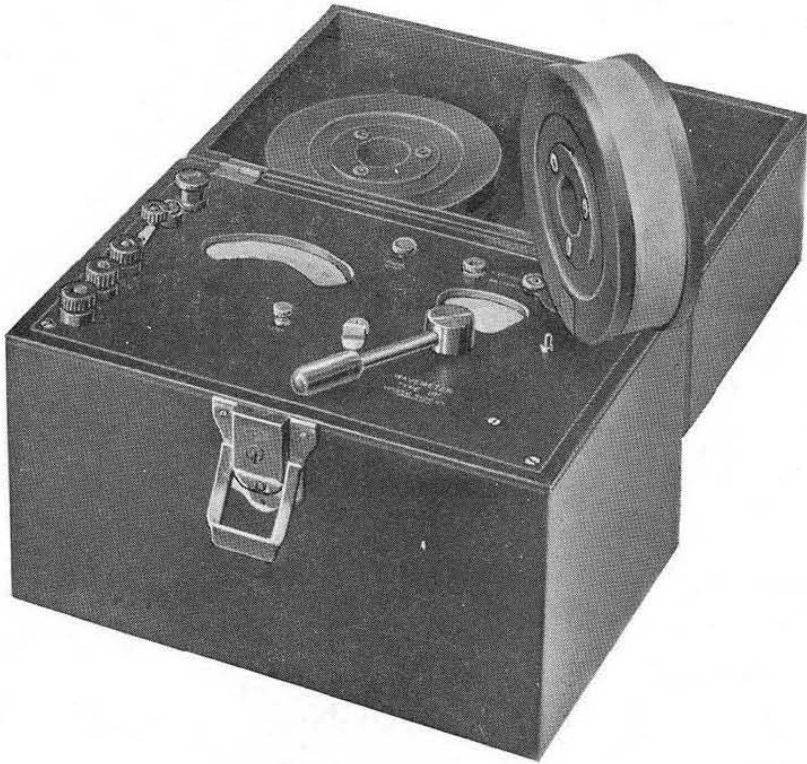
This key is designed to be used wherever there is any danger of fire or explosion due to a spark such as takes place when the key of a transmitter is operated. It has been used extensively by the United States Signal Corps and Navy Departments, and is especially adapted for submarines and areoplanes, but may be used with satisfaction in many places to which the ordinary open key is not well suited. The contacts are easily accessible, as well as the adjustments,—a valuable feature. The movement is smooth and easy,—the construction rugged. It will carry 10 amperes continuously without heating.

Type 151 Flame-proof Key\$6.00

Size 5" x $2\frac{3}{4}$ " x 3". Weight 14 oz.

Code Word "KIMBO"

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UNIVERSAL WAVEMETER Type 191

This wavemeter has a range from 150 to 12,000 meters, and is adapted to measuring the wave length of transmitters and of received signals. It consists of an air condenser, four low resistance inductance coils, a crystal detector for use with high resistance telephones, a high frequency buzzer with battery, and a hot wire meter, all mounted in a strong oak case.

The condenser is the same as our 101L, having a capacity of about .0015 M. F., and being completely shielded by copper sheet. The inductance coils are wound with stranded copper wire in substantial forms, and are connected by a rotary plug connector which supports the coil on the meter.

A very simple crystal detector which may be connected either unilaterally or double to a pair of high resistance telephones (2000 ohms) is supplied for measuring incoming signals.

The instrument can be used to generate currents from 150 to 12,000 meters in wave length by means of the battery and high frequency buzzer. This is very useful in a

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receiving station, as the receiving set may be tuned to any wave length on which signals are expected. It is also convenient for testing detectors or receiving sets at any wave length, as well as for measurements of capacity and inductance in apparatus of all kinds.

The wave lengths are determined from a direct reading scale and indicator operated by the coil plugs.

Type 191 Universal Wavemeter Price \$133.00

Size $12\frac{1}{4}$ " x $7\frac{3}{4}$ " x $10\frac{1}{8}$ ". Weight 16 lbs.

Code Word "WOVEN"

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DIRECT READING WAVEMETER
Type 174

For many purposes a wavemeter is desirable which will embody the direct reading, accuracy and utter simplicity features of our Type 145 Direct Reading Wavemeter, but which will also permit of a greater range of wavelengths than can be obtained with one coil and condenser. Type 174 Direct Reading Wavemeter has been designed to meet these requirements. It contains three coils mounted permanently within the case, with three individual scales mounted together and calibrated directly in wavelengths. A simple switch sets the wavemeter to any of these scales. A sensitive Hot Wire Galvanometer and crystal detector is supplied as with Type 145. In addition, our High Frequency Buzzer is mounted directly beneath the panel for generating damped oscillations, and a battery compartment, accessible without disturbing the panel, is provided. This Wavemeter is therefore adaptable to producing oscillations of known frequency, and to measuring wave lengths of transmitters or receivers. It is simple to operate and is calibrated by means of oscillating vacuum tubes to better than one per cent. Its range is 130 to 3000 meters.

Type 174 Direct Reading Wavemeter.....\$60.00

Size 9" x 7" x 6"; weight 6¾ lbs.

Code Word "WITTY"

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DIRECT-READING WAVEMETER

Type 145

This wavemeter is constructed to read from 180 to 650 meters, resonance for transmitted signals being indicated by a sensitive hot wire meter. For use with received signals a simple crystal detector is mounted on the panel connected unilaterally, with binding posts for phones. The wave length is read directly from a scale which passes beneath a circular window with cross-hair. The inductance is mounted out of sight beneath the panel, together with the variable air condenser and the body of the hot wire meter. The entire instrument is mounted in a strong oak box with a handle for carrying.

These can be furnished in special ranges with an approximate ratio of 1 to 3,—*i. e.*, 100 to 300 meters, etc. In their present range they are particularly adapted to use on small transmitters such as supplied to motorboats. Their extreme compactness and ruggedness are further commendable features, while the direct-reading feature makes for quick and accurate readings.

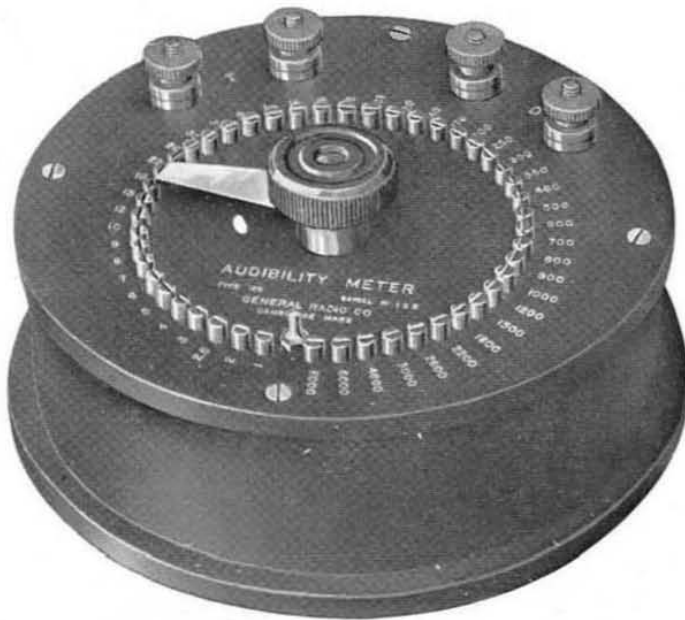
Direct-reading Wavemeter No. 145B

Range 180 to 650 meters.....Price \$38.00

Size $8\frac{1}{4}$ " x $5\frac{1}{2}$ " x $5\frac{1}{2}$ ". Weight $4\frac{1}{4}$ lbs.

Code Word "WOMAN"

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AUDIBILITY METER
Type 122

If a telephone in which signals are being received is shunted by a resistance until the signals are just audible, the ratio of the current in the telephone to the current in the shunt is an indication of the strength of the signal. For instance, if the signal is just audible when 99% of the detector current flows through the shunt and 1% through the 'phones, the signal is said to be 100 times as great as that necessary to produce a just audible signal.

This meter has 47 resistance coils so adjusted that the audibility is directly indicated by the numbers opposite the contact points, giving direct readings in audibility. The range is from 8000 times audibility down to 1, by steps of about 20% each.

Since there is no shunt on the 'phones at the point marked "1," the instrument may be left constantly in circuit without affecting the signal strength. One pair of binding posts is provided for connection to the detector, a second pair for the telephones. A small inductance coil is placed in the instrument to prevent the low resistance shunts from changing the conditions in the detector circuit.

This meter is of great value in a receiving station, since through its use the efficiency of various detectors, receiving transformers, aerials or "hook-ups" can be compared, and the increase of signal strength due to amplifiers can be determined. It is particularly adapted for use with

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a crystal detector in measuring the intensity of received signals, and, thereby, the actual energy received. The crystal is probably the most satisfactory detector for these measurements, because it usually does not supply any local energy to the 'phones, as does a vacuum tube detector. Hence any energy received in the 'phones with a crystal detector can be accepted as received energy, and comparisons made accurately.

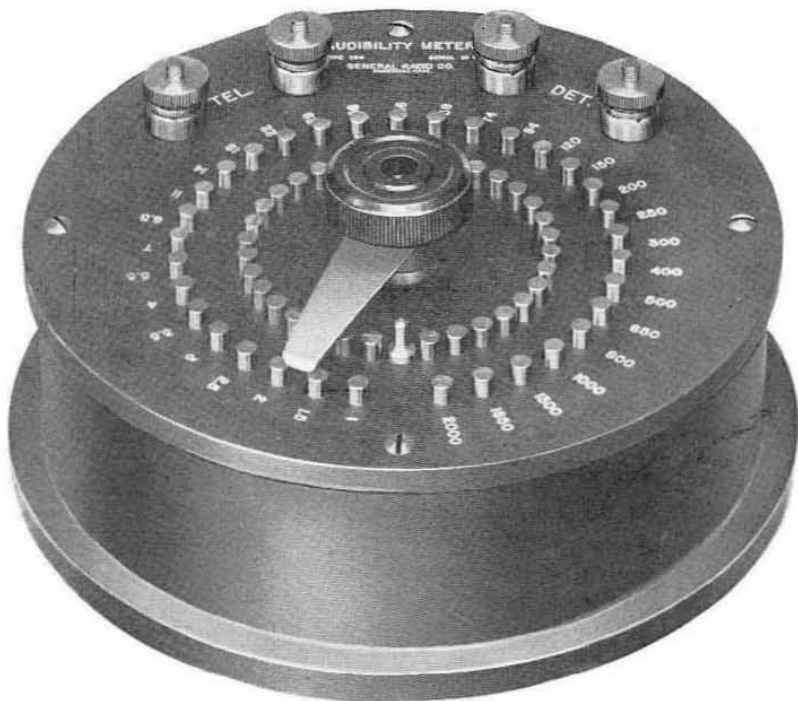
This meter will give satisfactory results on any ordinary 2000 ohm telephone, or we will adjust it to any special telephone.

Type 122 Audibility Meter.....\$22.00

Size $7\frac{5}{16}$ " d. x 3". Weight $2\frac{1}{4}$ lbs.

Code Word "AUDIT"

General Radio Co., Cambridge, Mass., U. S. A.



CONSTANT IMPEDANCE AUDIBILITY METER Type 164

The increasing use of oscillating circuits for vacuum tube detectors has necessitated the development of a special type of meter for comparing the audibilities of signals. This is because the oscillating circuits are affected by changes in their constants, very slight changes often causing variations of telephone current quite out of proportion to the changes introduced. This has made it impractical to depend upon the ordinary type of audibility meter such as our type 122, for it introduces slight changes of impedance which, while not affecting crystal detector circuits, may well upset a carefully balanced oscillating tube circuit.

Type 164 Constant Impedance Audibility Meter is designed to take care of this difficulty by keeping the impedance in the oscillating circuit practically constant, thereby eliminating the difficulties above mentioned. It is calibrated directly in times audibility, and reads from 1 to 2000. It is well adapted for measuring the amplifications of vacuum tubes and circuits, as well as for the measurement of received signals. It is adapted for use with any good 2000 ohm telephone receiver.

Type 164 Constant Impedance Audibility Meter . . . \$36.00

Size $7\frac{5}{16}$ " d. x 4". Weight 3 lbs.

Code Word "AWAKE"

General Radio Co., Cambridge, Mass., U. S. A.



THERMO COUPLES

Type 134

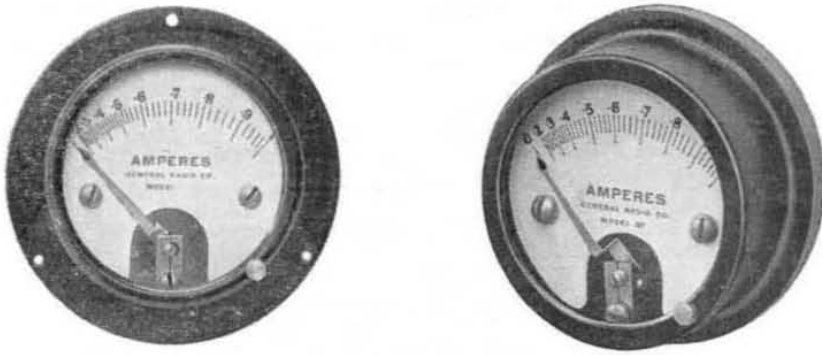
Extensive experience has shown that a couple of copper and constantan is most satisfactory for use with a galvanometer for all ordinary purposes. To those unfamiliar with thermo couples it may be stated that fine points of unlike metals, such as copper and constantan, when welded together, generate a direct current when an oscillating or alternating current is passed through the junction. This is caused by the heat which arises from the passage of the alternating current through the fine junction. Thus a galvanometer such as Type 189A in connection with this thermo couple may be readily used to register resonance in a wavemeter circuit, and for other feeble oscillating currents. A current of only 50 milliamperes in one of these couples will cause a full scale deflection of galvanometer Type 189A. The average resistance of these couples is 1.5 ohms, but they may be supplied on special order from $\frac{1}{2}$ to 5 ohms,—the watt sensitivity remaining the same.

Type 134 Thermo Couple (copper-constantan) Price \$6.00

Size $2\frac{1}{2}$ " x $1\frac{1}{4}$ " x 2". Weight 4 oz.

Code Word "TABBY"

General Radio Co., Cambridge, Mass., U. S. A.



HOT WIRE METERS

Type 127

A high-grade hot wire meter should contain three definite qualities—ruggedness of construction, quickness of action, and permanence of operating characteristics. In the meters listed below careful design and good workmanship are co-ordinated to produce an instrument which is electrically and mechanically good, and which has found a multiplicity of uses in the electrical art.

TYPES:

These meters are made in ranges from 100 milliamperes to 10 amperes, and mounted in flush, front of board or portable cases. The portable cases are of moulded Bakelite, and are very handy for laboratory use. The flush and front of board types are approximately 3 inches in diameter.

CONSTRUCTION:

All parts are interchangeable,—as well as the movements of the different cases. The expanding strip in these meters is of thin platinum. Most other materials will oxidize, which gradually changes the readings of the instrument. It is so proportioned that it works at low temperature and is of low resistance,—two very highly desirable features,—the first allowing a heavy overload without burning out, as well as keeping the case from heating up; the second insuring minimum losses in the circuit.

MOVEMENT:

The multiplying action which is used in these meters gives an open scale with the divisions at the beginning of the scale more nearly equal to those at the other end than is usual in hot wire meters. The bearings which support the steel shaft are of finest sapphire, a point which needs no further comment.

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They have been corrected for temperature, so that there is very little shift of zero, and are equally accurate on direct and alternating current.



**HOT WIRE METER, 3-inch
Type 127**

Range	Code Word	Case	Price
100 Milli-Amps.	MAYOR	Front of Board	\$15.00
$\frac{1}{4}$ amp.	MADAM	Front of Board	11.00
$\frac{1}{2}$ amp.	MAJOR	Front of Board	10.00
1 amp.	MANOR	Front of Board	10.00
2 amps.	MARRY	Front of Board	10.00
3 amps.	MASON	Front of Board	10.00
5 amps.	MATIN	Front of Board	10.00
10 amps.	MAXIM	Front of Board	10.00

Size 3" d. x 1½". Weight 9 oz.

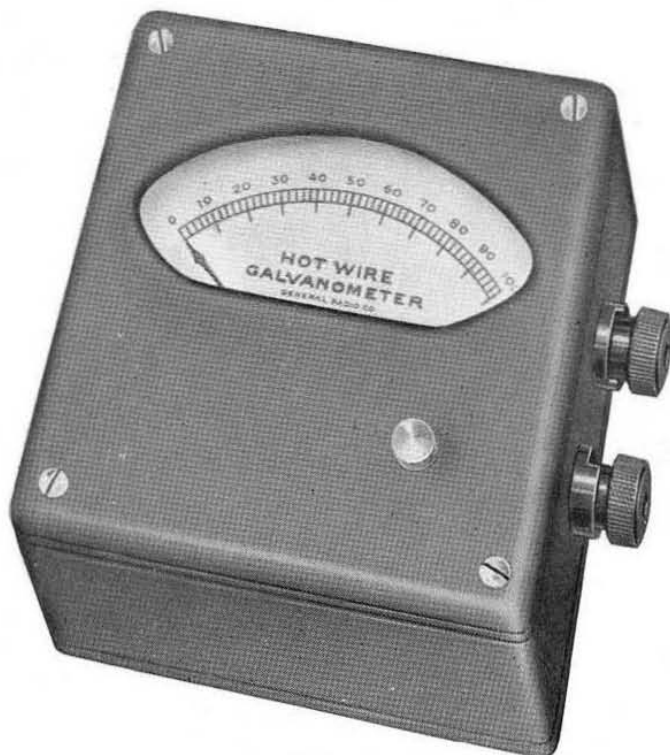
100 Milli-amps.	MEDAL	Flush Mounting	15.00
$\frac{1}{4}$ amp.	MERCY	Flush Mounting	11.00
$\frac{1}{2}$ amp.	MERIT	Flush Mounting	10.00
1 amp.	MERRY	Flush Mounting	10.00
2 amps.	METAL	Flush Mounting	10.00
3 amps.	MIMIC	Flush Mounting	10.00
5 amps.	MINIM	Flush Mounting	10.00
10 amps.	MINNY	Flush Mounting	10.00

Size 3" x 1½". Weight 9½ oz.

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100 Milli-amps.	MUGGY	Portable	16.00
$\frac{1}{4}$ amp.	MOCHA	Portable	12.00
$\frac{1}{2}$ amp.	MOGUL	Portable	11.00
1 amp.	MOLAR	Portable	11.00
2 amps.	MONAD	Portable	11.00
3 amps.	MORAL	Portable	11.00
5 amps.	MUMMY	Portable	11.00
10 amps.	MUSTY	Portable	11.00

Size 3" x 4" x 1½". Weight 10½ oz.



HOT WIRE METER

Type 170

Similar in construction, but of larger proportions than our 127 meters are our Type 170 Hot Wire Meters. These can be made susceptible to even smaller currents than the smaller size instrument, by reason of the longer filament; and they may also be made to carry heavy currents by means of a symmetrical shunting arrangement. This insures accuracy at high and low frequencies alike, and is a valuable feature.

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This meter may be purchased from stock in three styles—Flush, Front-of-Board, and Portable. The Flush and Front-of-Board types are similar in appearance to the 127 models, while the Portable instrument is mounted in the handsome walnut cabinet shown in the cut.

170A (Flush Type Mounting).

170A	EAGLE	Galvanometer	.....	\$20.00
170A	EARLY	250 M. A.	.....	20.00
170A	EASEL	500 M. A.	.....	20.00
170A	EDUCE	1 amp.	.....	20.00
170A	EGRET	2 amp.	.....	20.00
170A	ELDER	3 amp.	.....	20.00
170A	ELBOW	5 amp.	.....	20.00
170A	ELECT	10 amp.	.....	20.00
170A	EMPTY	15 amp.	.....	20.00
170A	ENACT	20 amp.	.....	20.00

Size $4\frac{1}{8}$ " dia. x 3" high. Weight $1\frac{1}{2}$ lbs.

170B (Front-of-Board Mounting).

170B	ENDOW	Galvanometer	.....	\$20.00
170B	ENJOY	250 M. A.	.....	20.00
170B	ENTER	500 M. A.	.....	20.00
170B	ENTRY	1 amp.	.....	20.00
170B	ENVOY	2 amp.	.....	20.00
170B	EQUAL	3 amp.	.....	20.00
170B	EQUIP	5 amp.	.....	20.00
170B	ERECT	10 amp.	.....	20.00
170B	ERUPT	15 amp.	.....	20.00
170B	ESSAY	20 amp.	.....	20.00

Size $4\frac{1}{8}$ " dia. x 3" high. Weight $1\frac{1}{2}$ lbs.

170C (Portable Type).

170C	ETHER	Galvanometer	.....	\$22.00
170C	EXULT	100 M. A.	.....	24.00
170C	EVOKE	250 M. A.	.....	22.00
170C	EXACT	500 M. A.	.....	22.00
170C	EXCEL	1 amp.	.....	22.00
170C	EXERT	2 amp.	.....	22.00
170C	EXILE	3 amp.	.....	22.00
170C	EXIST	5 amp.	.....	22.00
170C	EXPEL	10 amp.	22.00
170C	EXTOL	15 amp.	22.00
170C	EXTRA	20 amp.	22.00

Size $4\frac{3}{4}$ " x 5 x $3\frac{1}{2}$ ". Weight 16 oz.

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POINTER GALVANOMETERS

Type 189

The galvanometers listed below have been designed to supply the demand for an instrument of great sensitivity, ruggedness, and adaptability. They may be had in four styles to cover a wide range of uses. These include Numbers 189A and B of 10 ohms resistance, particularly adapted for use with thermo couples, and Numbers 189C and D of 100 ohms resistance, which are extremely sensitive for bridge work.

The coils are so constructed as to allow safe clearance from the stationary parts at all times, so that any chance particles, lint or dust cannot interfere with their proper movement. They are wound upon damping forms, properly adjusted to bring the coils to just under critical damping, as this point has been found most satisfactory for general use. This allows the pointer to swing quickly to its position, but does not permit it to swing back and forth indefinitely as it would if it were not correctly damped.

The suspension is of the strained type. This permits of much greater sensitivity in the meter than a pivot type, and requires no leveling of the instrument. This last feat-

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ure is extremely desirable, as moving the galvanometer from one table to another entails no careful readjustments. Thin phosphor bronze strip has been found to be the most satisfactory material for the suspensions, combining great strength and durability with freedom from "set" when the coil is deflected. This insures a stable zero. Instead of being fastened directly to the top of the coil, the suspending strip is soldered to a lateral U-shaped spring. This acts in the role of a shock-absorber, so that even very severe bumps are perfectly neutralized without danger of snapping the suspension.

Care has been exercised to produce a scale of considerable length,—over three inches,—easily read to a fine degree.

Models 189 B and D have zero center, with 50 divisions either side.

Models 189 A and C have zero left and 100 divisions. They are mounted in walnut cases of rugged construction, with external adjustments for zero and for clamping the coils firmly while moving them from place to place.

Type 189A resistance 10 ohms, zero left, 1 micro-ampere moves the pointer approximately one division,—100 micro-amperes full scale.

Code Word "GABLE"

Type 189B resistance 10 ohms, zero center, 1 micro-ampere moves the pointer approximately one division,—50 micro-amperes full scale.

Code Word "GAILY"

Our Thermo Couple No. 134 is well adapted to these models.

Type 189C resistance 100 ohms, zero left, $\frac{1}{4}$ micro-ampere moves the pointer approximately one division,—25 micro-amperes full scale.

Code Word "GALOP"

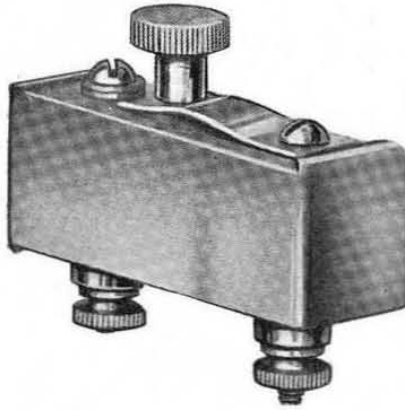
Type 189D resistance 100 ohms, zero center, $\frac{1}{4}$ micro-ampere moves the pointer approximately one division,—12 micro-amperes full scale.


Code Word "GAMIN"

Price, any type.....\$26.00

Size $4\frac{3}{4}$ " x 5" x $3\frac{1}{2}$ ". Weight $2\frac{1}{2}$ lbs.

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THE  **BUZZER**
Type 178

In the design of a buzzer for laboratory use, it is desirable to procure an instrument that combines pureness of tone, simplicity of adjustment and durability.

The GR (Trade Mark) Buzzer owes its permanence of tone to the comparatively low damping of the vibrating reed. By causing the reed to vibrate at its natural period instead of at a forced period, a much greater amplitude is obtained.

Pureness of tone is obtained by means of a high resistance coil shunted across the magnetizing coil to absorb the energy released when the contact is opened. Otherwise, sparking would occur between the contacts, giving a harsh tone.

The contacts are pure tungsten and very large in proportion to the size of the instrument. The only adjustment is made by means of a convenient knurled screw of ample proportions. The buzzer will operate continuously on one or two dry cells for several hours without adjustment. The current drawn is approximately 30 milliamperes.

The buzzer is supplied for mounting above or below the panel, and may be procured from stock for either $\frac{1}{4}$ " or $\frac{3}{8}$ " panels.

Size 2" x 1 $\frac{3}{4}$ " x 1". Weight 3 oz.

Type 178A Buzzer (for mounting above panel)	Price \$2.00
Code Word "BEFAG"	
Type 178B Buzzer (for mounting below panel)	Price \$2.00
Code Word "BEGET"	

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TELEPHONE TRANSFORMER

Type 166

For many purposes about a laboratory a small iron-core transformer of high and variable impedance is extremely useful. This is especially true where any work is being done with amplifiers and vacuum tubes.

This telephone transformer is very compact, and still obtains a high value of impedance. Taps are brought from the windings to binding posts on a Bakelite panel, so that practically any ratio of turns may be obtained between primary and secondary, and it may also be used as an auto-transformer. The iron core is so arranged that an air gap is utilized to avoid speech distortion due to magnetic saturation of the iron. This is a highly important feature where vacuum tubes are used to amplify telephone speech. This transformer thereby obtains all the advantages of an open core transformer, with the added compactness and efficiency of the closed iron core.

<i>Primary Taps</i>		<i>Secondary Taps</i>	
1—2	..... 150 Turns	5—6	..... 1200 Turns
2—3	..... 300 Turns	6—7	..... 2400 Turns
3—4	..... 600 Turns	7—8	..... 4800 Turns
Type 166 Telephone Transformer	 \$12.00	

Size $2\frac{3}{4}$ " x $2\frac{1}{2}$ " x $2\frac{1}{4}$ ". Weight 2 lbs.

Code Word "TOPIC"

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