CATALOG G

PART 2

MARCH, 1934

GENERAL RADIO CO.
CAMBRIDGE, MASS.

BLANK

GENERAL RADIO COMPANY

CAMBRIDGE A
MASSACHUSETTS

PART 2
CATALOG G

A Supplement to Catalog G

MARCH 1934

● To be filed with Catalog G. If you do not have a copy of Catalog G, write for one, and a copy will be forwarded by return mail. Post cards are provided for your convenience.

SUGGESTIONS FOR ORDERING

The following sections supersede the corresponding paragraphs on page 2, Catalog G

SHIPPING INSTRUCTIONS

Unless specific instructions accompany the order we shall use our best judgment as to the method of shipment.

All prices are F.O.B. Cambridge, Massachusetts. There is no domestic packing charge and no charge for shipping cases.

TERMS

Net 30 days. Unless credit has already been established we make all shipments C.O.D.

When cash accompanies the order, we pay transportation charges to any point in the continental United States (except Alaska).

REMITTANCES

Should be made payable at par in Boston or New York funds.

QUANTITY DISCOUNTS

When 10 or more identical items are ordered at the same time for a single shipment, the following quantity discounts are allowed:

10–19	5 per cent
20–99	10 per cent
100 or more	Special discounts quoted on request.

NO TRADE OR EDUCATIONAL DISCOUNTS

Our prices are made on a direct-to-consumer basis which permits of no discounts except quantity discounts.

PRICE CHANGES

All prices are subject to change without notice. Formal quotations remain open for 30 days, unless otherwise specified.

WARRANTY

The recently adopted Scientific Apparatus Makers' code specifies the following standard warranty which differs somewhat from the policy we have followed in the past:

"We warrant each new instrument manufactured and/or sold by us to be free from defects in material, workmanship, and design; our obligation under this warranty being limited to repairing or replacing any instrument or part thereof which shall, within one year after delivery to the original purchaser, prove by our examination to be thus defective."

This warranty supersedes all other guarantees on our instruments, unless otherwise specified.

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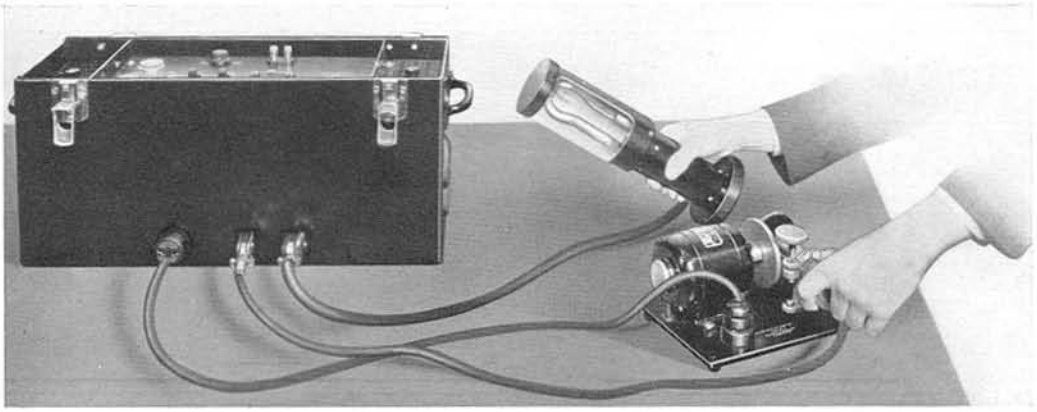
INDUSTRIAL DEVICES

Descriptions of the Edgerton Stroboscope, noise meter, and Variac are grouped together in this section because of their many applications to problems outside the communications industry. The stroboscope, for instance, furnishes the only convenient means for studying the operation of high-speed mechanisms in slow motion. The noise meter measures the intensity of sound and is, therefore, useful in noise-elimination studies either in the laboratory or in the field.

TYPE 548-A EDGERTON STROBOSCOPE



TYPE 548-A Edgerton Stroboscope (power supply and lamp) with TYPE 549-B Synchronous-Motor Contactor

The Edgerton Stroboscope is very useful for apparently arresting or slowing up cyclic motion, either rotary or reciprocating. It may also be used to make accurate speed measurements and comparisons. With suitable camera equipment, motion pictures several times normal speed may be obtained, and snapshots of arrested motion are readily possible with ordinary cameras.

The stroboscope consists of an intensely brilliant flashing mercury arc. The duration of the individual flash is only about 5 microseconds, and the time between successive flashes may be controlled over a wide range with great accuracy either by (1) closing any pair of electrical contacts, (2) by the 60-cycle supply mains (60 flashes per second), or (3) by any external source of alternating current.

The General Radio Company has built several larger-size stroboscopes giving as much as one hundred times the illumination provided by the TYPE 548-A Edgerton Stroboscope. We will be glad to correspond with anyone interested in stroboscopes delivering more illumination than that provided by the standard model.

Descriptive literature containing additional information about the Edgerton Stroboscope is available on request.

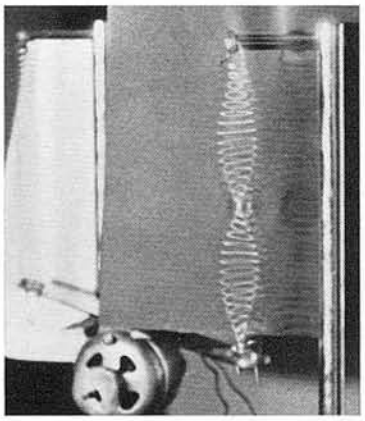
SPECIFICATIONS

Operating Range: Up to 12,000 flashes per minute.

Lamp: U-shaped mercury-arc lamp mounted in a bakelite protective housing which may be stood upright or held in the operator's hand. The life of the tube depends on service conditions to some extent.

Controls: Controls are provided for adjusting the intensity of the flash.

Tubes Required: One FG-17 thyratron, two UX-281 rectifier tubes, supplied with the instrument.

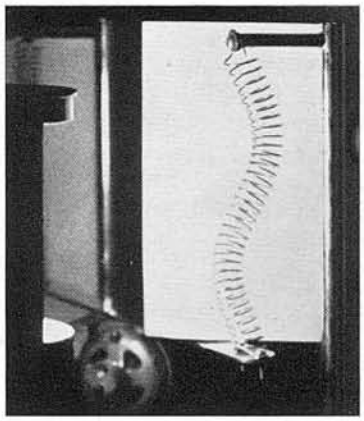


THE STROBOSCOPE STOPS MOTION

Two views of the same oscillating spring

BY ORDINARY LIGHT ←

BY STROBOSCOPE LIGHT →



from unretouched sections of 35-mm motion-picture film

Power Supply: 110 volts, 50–60 cycles (0.25 kw., maximum).

Mounting: The power supply is housed in a metal cabinet having a detachable cover in which the lamp, motor-driven contactor, and cables may be stored.

Dimensions: (Length) 23 x (width) 7½ x (height) 16½ inches, over-all, with cover closed. Dimensions of lamp housing, (height) 12 x (diameter) 4 inches.

Net Weight: 56 pounds, including lamp but without TYPE 549-B Synchronous-Motor Contactor.

Type		*Code Word*	*Price*
548-A	.....	MAGIC	**$290.00***

*Including lamp assembly and tubes, but not TYPE 549-B Synchronous-Motor Contactor.

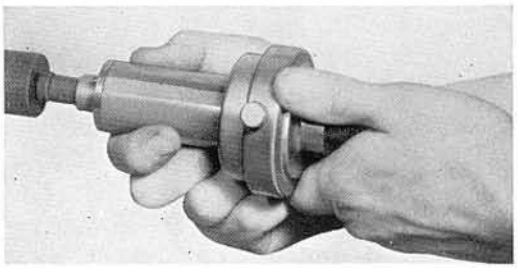
RENEWAL PARTS

Type	*Description*	*Code Word*	*Price*
550-P1	**Mercury Lamp Renewal (U-tube only)**	MAJOR	**$15.00**
FG-17	**Thyratron**.....	.....	**14.00**
UX-281	**Rectifier**.....	.....	**3.50**

TYPE 549-B SYNCHRONOUS-MOTOR CONTACTOR
TYPE 549-P1 CONTACTOR

The TYPE 549-B Synchronous-Motor Contactor provides a continuously-adjustable contactor calibrated directly in r. p. m. for convenient control of the flashing rate, and driven by a 60-cycle synchronous motor. Phase may be varied by rotating the contactor head.

The TYPE 549-P1 Contactor is the uncalibrated head of the TYPE 549-B Synchronous-Motor Contactor, which can be used in the manner of a tachometer. Phase may be varied by rotating the head or the contactor itself. A clamp for mounting the TYPE 549-P1 Contactor in the cover of the stroboscope power supply is furnished.



TYPE 549-P1 Contactor

SPECIFICATIONS

Calibrated Range: TYPE 549-B, 500–3000 flashes per minute. The contactor may be used for observing and measuring speeds up to 30,000 r.p.m. A calibrated scale (500–3000 r.p.m.) is provided.

TYPE 549-P1 has, of course, no calibration. It provides one flash for each revolution of the shaft against which it is held, operating satisfactorily at all speeds up to 10,000 r.p.m.

Controls: TYPE 549-B: One knob for adjusting flashing speed to any value. Knob is provided with a locking arrangement to hold it firmly in the desired position.

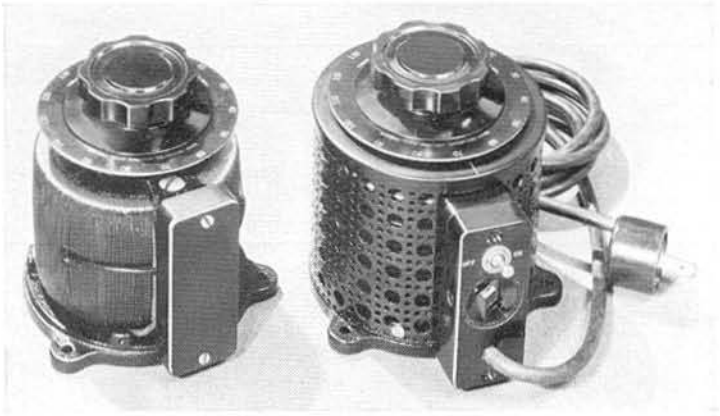
Frequency Stability: TYPE 549-B: Determined by the constancy of the 60-cycle mains.

Dimensions: TYPE 549-B Synchronous-Motor Contactor, (length) 9¾ x (width) 6 x (height) 4⅜ inches, over-all. TYPE 549-P1 Contactor, (length) 7 x (diameter) 3¼ inches, over-all.

Net Weight: TYPE 549-B Contactor, 10⅝ pounds. TYPE 549-P1 Contactor, 2⅝ pounds.

Type	*Code Word*	*Price*
549-B	MACAW	**$70.00**
549-P1	MADAM	**30.00**

TYPE 200-C VARIAC



TYPE 200-CU TYPE 200-CM

The Variac is a transformer having the smooth, uninterrupted voltage control of a rheostat. But, more than any rheostat or potentiometer, the Variac, when operated from a 115-volt line, can give any voltage anywhere between 0 and 130 volts, thus making it suitable for restoring low line voltages to normal. The voltage regulation and the efficiency, obviously, are much better.

The Variac is a toroidal auto-transformer in which the output voltage adjustment is obtained by sliding a carbon brush over the winding. The potential difference between turns is so small that the voltage changes smoothly and continuously as the knob is turned.

For more information, see the following specifications or the June-July, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Maximum Current: See price list. The current specified in the price list is the current that can be drawn from the Variac over the entire output-voltage range. Since the Variac is an auto-transformer, maximum loss for any given output current occurs at one-half line voltage. At full-line voltage, there is

no transformer action and the current passes directly from the line through the brush to the load; consequently, the output current at full-line voltage can be 150% of rated value.

Calibration: With TYPE 200-CM and TYPE 200-CU, a voltage calibration is provided on the dial which is accurate to ±2% when the line voltage has the rated value.

Terminals: TYPE 200-CM is furnished complete with cord for attaching to mains, an ON-OFF switch, and a standard plug receptacle.

TYPE 200-CU is provided with soldering lugs placed in a bakelite housing.

Mounting: TYPE 200-CM supplied with case as illustrated. Three mounting holes 120° apart on 2 3/16-inch radius are provided.

TYPE 200-CU supplied without case (see illustration). Mounting holes same as on TYPE 200-CM.

Dimensions: TYPE 200-CM, (height) 5½ x (radius) 3½ inches, over-all.

TYPE 200-CU, (height) 5⅜ x (radius) 3 inches, over-all. Over-all depth measured from *back* of panel, 4⅜ inches.

Net Weight: TYPE 200-CM, 10 pounds; TYPE 200-CU, 9 pounds.

Type	*Primary Voltage*	*Maximum Current*	*Output Voltage Range*	*Code Word*	*Price*
200-CM	**115 volts**	5 a	0–130 volts	BALMY	**$16.50**
200-CU	**115 volts**	5 a	0–130 volts	BAKER	**14.00**

TYPE 200-B VARIAC

This is an adjustable transformer, similar in operating principle to the TYPE 200-C Variacs described on the preceding page, but designed for use on lighter loads and on circuits where an output voltage greater than the actual line voltage is not required.

SPECIFICATIONS

Maximum Current: The current specified in the price list is the load current that can be safely drawn at any setting of the control knob. Current greater than rated value by 150% can be drawn in the vicinity of maximum output voltage.

Terminals: Threaded studs, nuts on which hold soldering lugs.

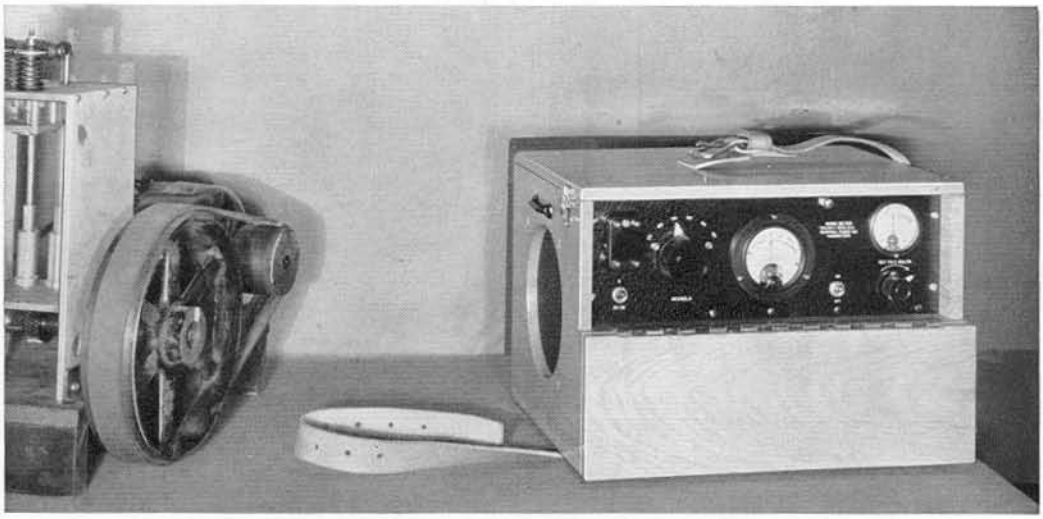
Mounting: Supplied as illustrated with TYPE 637-S Knob for either back-of-panel or baseboard mounting. In the base of the unit are three threaded holes 120° apart on a 1¼-inch radius. Flat head machine screws for mounting and drilling template are furnished.

Dimensions: (Height) 3¾ x (radius) 1⅞ inches, over-all. Depth measured from *back* of panel, 2⅝ inches.

Net Weight: 2¾ pounds.

Type	*Primary Voltage*	*Maximum Current*	*Output Voltage Range*	*Code Word*	*Price*
200-B	**115 volts**	1 a	0-115 volts	BALSA	**$8.50**

TYPE 559-A NOISE METER



This instrument is an inexpensive noise meter intended to meet the demands of most commercial noise measurements. It can be used by manufacturers of machinery to ascertain the amount of disturbance caused by their products. It is also valuable to acoustical engineers and manufacturers of sound-proofing materials to test and to demonstrate the effectiveness of sound-proofing installations.

The noise meter is calibrated directly in decibels above the average threshold of hearing at 1000 cycles. To convert the scale to another zero-decibel reference level, it is only necessary to add or subtract a constant number of decibels for any given reading of the meter.

For more information, see the following specifications and the March, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Sound Level Range: 30 db to 146 db above the average threshold of hearing at 1000 cycles. This corresponds to a range of 23 db to 139 db above a reference level of 1 millibar at 1000 cycles; and to a range of 37 db to 153 db above a reference level of 10^{-16} watts per square centimeter. The instrument is calibrated directly in decibels.

Frequency Characteristic: The over-all frequency characteristic is similar to the response of the human ear.

Pickup Unit: A dynamic noise-pickup unit similar in construction to the usual permanent-magnet dynamic speaker, and of rugged construction, is built into the end of the cabinet.

Circuit: A stable high-gain screen-grid amplifier is employed. A removable plug in a 600-ohm input circuit allows filters of various characteristics to be inserted. It also enables an external microphone to be connected to the circuit in place of the noise-pickup unit.

Tubes: One 32-type and one 33-type, supplied with the instrument.

Power Supply: Two No. 6 dry cells, three 45-volt Burgess No. 5308 or equivalent, and one 7.5-volt Burgess No. 5540 or equivalent. Batteries are not included in the price of the instrument.

Mounting: The noise meter is built into an oak cabinet and provided with a heavy leather carrying strap. Space is provided inside the cabinet for all batteries.

Dimensions: (Width) 16½ x (height) 11 x (depth) 12¼ inches, over-all.

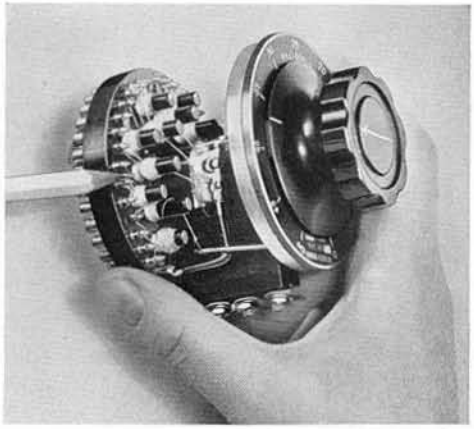
Net Weight: 33 pounds, without batteries; 47½ pounds with batteries.

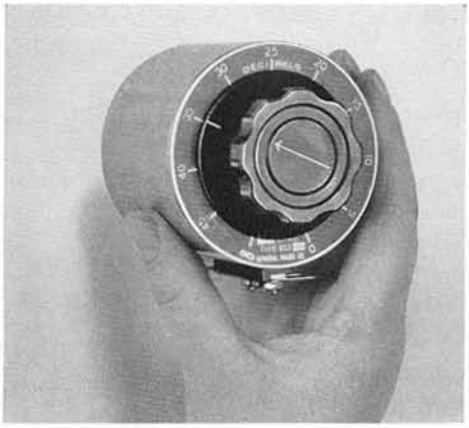
Type		*Code Word*	*Price*
559-A	.....	MITER	**$190.00***

*With tubes, but without batteries.

RESISTANCE DEVICES

TYPE 653 VOLUME CONTROL





This volume control is designed for use in any low-impedance, low-level circuit, and is particularly well adapted for mixer circuits. It has the following features: practically noiseless operation, rigid mechanical construction, ease of installation and maintenance, flat frequency characteristic, small size, light weight, and low price. This unit replaces the TYPE 652 Volume Control listed on page 19. For more information, see the following specifications and the February and March, 1933, issues of the General Radio *Experimenter*.

SPECIFICATIONS

Attenuation Range: 0 db to complete cut-off. Attenuation is adjustable and linear with dial setting from 0 to 45 db in steps of about ¾ db. (Attenuation between contacts is 1.5 db, but the switch bridges two contacts in passing from one to the other.) Above 45 db, the rate of attenuation increases rapidly to infinite attenuation.

Type of Section: A ladder-type network is employed. Has advantage of only one sliding contact while maintaining essentially constant impedance. Insertion loss, 6 db.

Type of Winding: Resistance units are wound on small cylindrical spools which are part of the bakelite moulding.

Terminal Impedance: 50-, 200-, and 500-ohm units are carried in stock, but others can be built to order at a slight additional cost, depending on the impedance desired. Prices will be quoted upon request.

Shielding: An aluminum cover is provided as a protection against dust and dirt and as an electrostatic shield.

Switch: A 3-bladed phosphor-bronze switch makes firm contact with bronze alloy contact points.

Terminals: Screw terminals are provided.

Dial Plate: A dial plate calibrated directly in decibels also serves as a drilling template in mounting volume control.

Knob: TYPE 637-K, with engraved white arrow.

Mounting: The unit is arranged for panel mounting by means of two screws which are supplied. The volume control may be mounted on panels up to ⅜ inch in thickness. Holes are spaced 1½ inches apart.

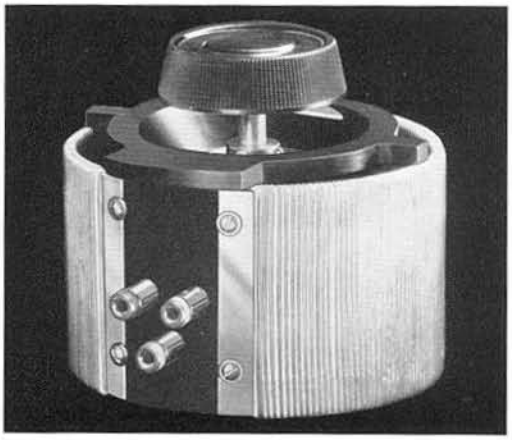
Dimensions: Maximum over-all radius, 1¾ inches. Maximum depth behind panel, 2⅝ inches. Shield diameter, 2¾ inches. Maximum shaft length measured from *back* of panel, ⅞ inch.

Net Weight: 13 ounces.

Type	*Impedance*		*Code Word*	*Price*
653-MA	**50 ohms**	.....	CLUMP	**$12.50**
653-MB	**200 ohms**	.....	COACH	**12.50**
653-MC	**500 ohms**	.....	COAST	**12.50**

TYPE 533-A RHEOSTAT AND POTENTIOMETER

A new heavy-duty rheostat-potentiometer which can dissipate 250 watts is available in seven resistance values.



SPECIFICATIONS

Power Rating: 250 watts.

Maximum Current: See price list below.

Construction: Wire-wound on asbestos-covered aluminum.

***Useful Angle of Rotation:** 305° approximately. No off position is provided.

Shaft: Steel, 3/8-inch diameter.

Knob: TYPE 537-L.

Mounting: Four holes, 90° spacing on 7/8-inch radius. Machine screws, nuts, and drilling template furnished. May be converted for baseboard mounting.

Dimensions: Maximum over-all radius, including terminals, 3¼ inches; diameter of winding form, 5¼ inches; maximum depth behind panel, 3⅝ inches; maximum shaft length measured from *back* of panel, 7/8 inch.

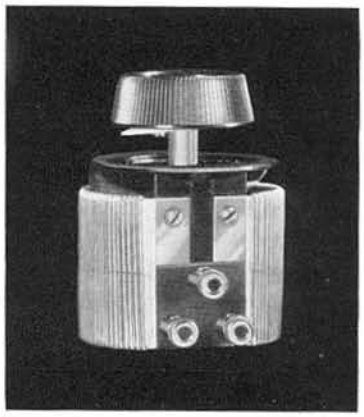
Net Weight: 1⅞ pounds.

*This is the total angle traversed by the blade between minimum and maximum resistance.

Type	*Total Resistance*	*Maximum Current*	*Code Word*	*Price*
533-A	**1 ohm**	15.8 a	MOLAR	**$6.00**
533-A	**3 ohms**	9.1 a	MONAD	**6.00**
533-A	**10 ohms**	5.0 a	MORAL	**6.00**
533-A	**30 ohms**	2.9 a	MOTTO	**6.00**
533-A	**100 ohms**	1.6 a	MUGGY	**6.00**
533-A	**300 ohms**	0.9 a	MUMMY	**6.00**
533-A	**600 ohms**	0.6 a	MUSTY	**6.00**

TYPE 333-A RHEOSTAT AND POTENTIOMETER

A new series of rheostat-potentiometer units, combining high power dissipation (100 watts), rugged construction, and low price, is available in seven sizes.



SPECIFICATIONS

Power Rating: 100 watts.

Maximum Current: See price list following.

Construction: Wire-wound on asbestos-covered aluminum.

***Useful Angle of Rotation:** 289°, approximately. No off position is provided.

*This is the total angle traversed by the blade between minimum and maximum resistance.

Shaft: Steel, 3/8-inch diameter.

Knob: TYPE 537-K.

Mounting: Three holes, 120° spacing on 7/8-inch radius. May be easily converted for baseboard mounting. Machine screws, nuts, and drilling template furnished.

Dimensions: Maximum over-all radius, including terminals, 2 inches; diameter of winding form, 2 5/8 inches; maximum depth behind panel, 2 5/8 inches; maximum shaft length measured from *back* of panel, 1 inch.

Net Weight: 11 ounces.

Type	*Total Resistance*	*Maximum Current*	*Code Word*	*Price*
333-A	**1 ohm**	10.0 a	VALOR	**$4.00**
333-A	**3 ohms**	5.8 a	VAPID	**4.00**
333-A	**10 ohms**	3.2 a	VENUS	**4.00**
333-A	**30 ohms**	1.9 a	VIGIL	**4.00**
333-A	**100 ohms**	1.0 a	VIGOR	**4.00**
333-A	**300 ohms**	0.6 a	VILLA	**4.00**
333-A	**600 ohms**	0.4 a	VIPER	**4.00**

TYPE 526 MOUNTED RHEOSTAT AND POTENTIOMETER

This serves as an inexpensive resistor with a direct-reading scale in ohms for use as a rheostat or voltage divider of moderate accuracy.

SPECIFICATIONS

Winding: The winding is a carefully adjusted TYPE 471-A Rheostat and Potentiometer (see pages 22 and 186).

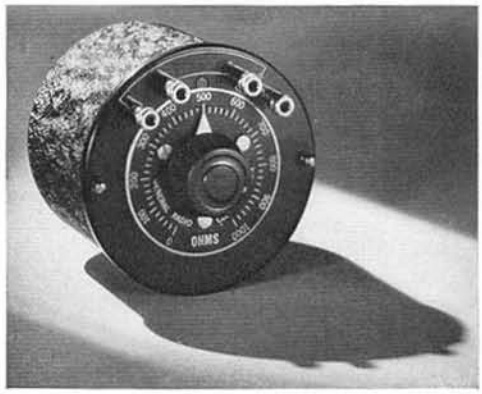
Accuracy: The total resistance has been adjusted to within 2.5% of the rated value given in the price list. The calibration is accurate to within 5%.

Mounting: Drawn steel cases with hard-rubber panel for protection of unit and for convenience in wiring into experimental circuits. The case may be used as an electrostatic shield.

Terminals: Two pairs of jack-top binding posts, one for input and one for output on standard General Radio spacing of 3/4 inch, are provided.

Dial Plate: Each unit has a 3-inch photo-engraved dial plate with 50 divisions and is calibrated directly in ohms.

Knob: TYPE 537-J.



Finish: Black crystalline lacquer.

Dimensions: (Diameter) 4 1/2 x (height) 4 3/8 inches, over-all.

Net Weight: 1 1/2 pounds.

Type	*Resistance*	*Code Word*	*Price*
526-D	**0- 100 ohms**	ETHER	**$8.50**
526-A	**0- 1000 ohms**	EVADE	**8.50**
526-B	**0- 10,000 ohms**	EVENT	**8.50**
526-C	**0-100,000 ohms**	EVOKE	**8.50**

TYPE 471-A RHEOSTAT AND POTENTIOMETER

This rheostat and potentiometer is now available in three more resistance ranges than were listed on page 23. The following specifications supplant those given in the earlier description. See price list for resistance values.

SPECIFICATIONS

Power Rating: 12 watts.

Maximum Current: See price list.

Mounting: Supplied for three-hole panel mounting, but can easily be converted to baseboard mounting (three holes, 120° apart on 7/8-inch radius). Machine screws, nuts, and drilling template are furnished.

Knob: TYPE 537-K.

***Useful Angle of Rotation:** 294°. No off position is provided.

Shaft: Bakelite, 3/8-inch diameter.

Dimensions: Over-all radius, including terminals, 1¾ inches; depth behind panel, 2⅝ inches; maximum shaft length measured from *back* of panel, 1 inch; flange diameter, 3 inches.

Net Weight: 9 ounces.

*This is the total angle traversed by the blade between minimum and maximum resistance.

Type	*Resistance*	*Maximum Current*	*Code Word*	*Price*
471-A	**100 ohms**	330.0 ma	EQUIP	**$6.00**
471-A	**1000 ohms**	104.0 ma	ERASE	**6.00**
471-A	**10,000 ohms**	33.0 ma	ERECT	**6.00**
471-A	**50,000 ohms**	14.7 ma	ERODE	**6.00**
471-A	**100,000 ohms**	10.4 ma	ERUPT	**6.00**
471-A	**200,000 ohms**	7.3 ma	ESKER	**6.00**

TYPE 214-A RHEOSTAT AND POTENTIOMETER

This unit is now carried in stock in three additional sizes. The following specifications and price list replace the ones given on page 25.

SPECIFICATIONS

Power Rating: 12 watts.

Maximum Current: See price list.

Mounting: Supplied for three-hole panel mounting, but can easily be converted to baseboard mounting (three holes, 120° apart on 7/8-inch radius). Machine screws, nuts, and drilling template are furnished.

Knob: TYPE 537-C.

***Useful Angle of Rotation:** 303°. No off position is provided.

Dimensions: Over-all radius, including terminals, 1¾ inches; depth behind panel, 1¼ inches; diameter of shaft, ¼ inch; maximum shaft length measured from *back* of panel, 15/16 inch; flange diameter, 3 inches.

Net Weight: 5 ounces.

*This is the total angle traversed by the blade between minimum and maximum resistance.

Type	*Resistance*	*Maximum Current*	*Code Word*	*Price*
214-A	**0.75 ohm**	4 a	SHINY	**$1.50**
214-A	**2 ohms**	2.5 a	RUDDY	**1.50**
214-A	**7 ohms**	1.3 a	RURAL	**1.50**
214-A	**20 ohms**	0.75 a	RAZOR	**1.50**
214-A	**50 ohms**	0.50 a	RAPID	**1.50**
214-A	**100 ohms**	350 ma	RIVET	**1.50**
214-A	**200 ohms**	250 ma	EMPTY	**1.50**
214-A	**400 ohms**	175 ma	ROSIN	**1.50**
214-A	**1000 ohms**	110 ma	ENACT	**1.50**
214-A	**2500 ohms**	70 ma	SYRUP	**1.50**

TYPE 301-A RHEOSTAT AND POTENTIOMETER

The TYPE 301-A Rheostat and Potentiometer can be supplied in a 10,000-ohm model designed particularly for use as a regenerative control in detector circuits. A bakelite protecting strip surrounds the unit. Otherwise it is similar to the TYPE 301-A Potentiometers described on page 26.

SPECIFICATIONS

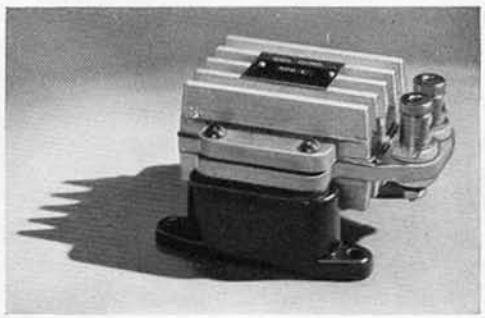
Power Rating: 3 watts.

Net Weight: 3 ounces.

Type	*Resistance*	*Description*	*Maximum Current*	*Code Word*	*Price*
301-A	**10,000 ohms**	**Potentiometer-Rheostat**	17 ma	CURRY	**$1.25**

TYPE 525 RESISTOR

This is a heavy-duty precision-type resistor, designed for load purposes at radio frequencies, although it is well suited to all laboratory problems where an accurately known resistance of large power dissipation is desired. For more information about this resistor, refer to the April-May, 1933, issue of the General Radio *Experimenter*.



SPECIFICATIONS

Power Rating: All units will dissipate 50 watts for a 100°C. rise in temperature and 100 watts for a 150°C. rise.

Maximum Current: Values of current for a 100°C. rise in temperature are given in the price list.

Accuracy: All units are adjusted to be within 0.1% of the rated values specified in the price list.

Temperature Coefficient: +0.002% per degree C. for temperatures below 100°C.

Frequency Characteristic: Good radio-frequency characteristics. See the April-May, 1933, *Experimenter* for curves. The resistance of the 10-ohm size is within 20% of rated value at 5 Mc.

Shielding: The aluminum castings can be used as an electrostatic shield, both resistor terminals being insulated from them.

Terminals: Jack-top binding posts mounted on isolantite washers on standard General Radio spacing of ¾ inch.

Mounting: Resistors are wound unifilarly on mica and clamped between two pieces of mica and two heavily ribbed aluminum castings, the whole unit being supported on porcelain insulators.

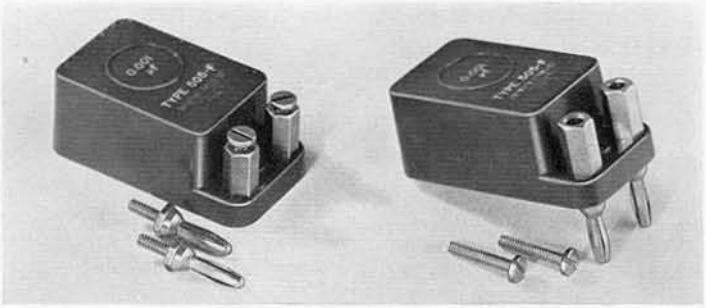
Dimensions: (Length) 4 x (width) 4 x (height) 2½ inches.

Net Weight: 1¼ pounds.

Type	*Resistance*	*Current*	*Code Word*	*Price*
525-C	**4 ohms**	3.5 a	CABAL	**$8.00**
525-D	**10 ohms**	2.2 a	CABIN	**8.00**
525-F	**40 ohms**	1.1 a	CABOB	**8.00**
525-H	**100 ohms**	0.7 a	CADDY	**8.00**
525-L	**600 ohms**	0.09 a	CADET	**8.00**

CONDENSERS

TYPE 505 CONDENSER



The TYPE 505 Condenser may easily be converted to a plug-terminal model

This is a precision mica condenser having low losses, stability of calibration, temperature compensation, and low price. See price list for capacitance values.

SPECIFICATIONS

Capacitance: Sizes are available in stock as shown in the price list below. (Other sizes, of values between those listed, can be built to order. Prices will be quoted upon request.)

Accuracy: Depends on the size; see price list. The temperature coefficient of capacitance is less than 0.006% per degree C. from 0° to 50°C.

Voltage Rating: Maximum voltage and frequency are listed in the price list below. The maximum voltage in connection with a given frequency means that the condenser will safely withstand the a-c voltage whose peak equals the given rating up to the given frequency. Above that frequency, the allowable voltage decreases inversely with the square root of the frequency because of the power loss.

Power Factor: Less than 0.05% for frequencies below 2 Mc, except as noted in the price list. Special precautions are taken in assembling and sealing the condensers to insure against change in capacitance or power factor due to varying moisture content of the air, and to aging.

Terminals: Screw terminals spaced ¾ inch apart. Two TYPE 274-P Plugs are supplied with each condenser so that it may be converted to plug-terminal model.

Mounting: The condensers are mounted in low-loss bakelite cases.

Dimensions: (Length) 2¾ x (width) 1 5/16 x (height) 1 inch, over-all.

Net Weight: 4 ounces.

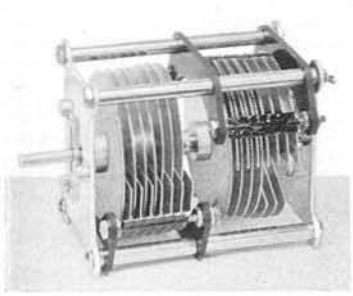
Type	*Capacitance*	*Adjusted to Within*	*Power Factor*	*Maximum Voltage*		*Code Word*	*Price*
				Voltage	*Frequency*		
505-A	**100 μμf**	10%	0.1 %	1200 volts	1100 kc	CONDENALLY	**$3.50**
505-B	**200 μμf**	5%	0.1 %	1200 volts	550 kc	CONDENBELL	**3.50**
505-E	**500 μμf**	2%	0.05%	1200 volts	220 kc	CONDENCOAT	**3.50**
505-F	**0.001 μf**	1%	0.05%	700 volts	320 kc	CONDENDRAM	**3.50**
505-G	**0.002 μf**	1%	0.05%	700 volts	160 kc	CONDENEYRE	**3.50**
505-K	**0.005 μf**	1%	0.05%	700 volts	64 kc	CONDENFACT	**4.00**
505-L	**0.01 μf**	1%	0.05%	350 volts	160 kc	CONDENGIRL	**4.50**
505-M	**0.02 μf**	1%	0.05%	350 volts	80 kc	CONDENHEAD	**5.50**
505-Q	**0.05 μf**	1%	0.05%	350 volts	32 kc	CONDENJACK	**7.50**

TYPE 756-A VARIABLE AIR CONDENSER

This condenser, used in the *TYPE 535-A Frequency Meter-Monitor, is a double-section band-spread type for use in circuits where two band-spread variable capacitances are required. Four of the seven rotor plates are complete circles, the position of several being adjustable along the shaft to give any desired spread.

*See the January, 1933, General Radio *Experimenter*.

SPECIFICATIONS



Capacitance Range: Maximum, 225 $\mu\mu$f, minimum, 140 $\mu\mu$f for each of the two sections.

Direction of Rotation: Clockwise for increasing capacitance.

Rotor Plate Shape: Approximately straight-line-frequency. Requires a dial with a scale spread over 180°.

Hard-Rubber Dielectric: Two small sections of first-quality hard rubber support the stator.

Low Losses: $R\omega C^2$ is approximately 0.07×10^{-12} based on measurements at 1000 cycles.

Voltage Rating: Breakdown voltage, 3500 volts, peak.

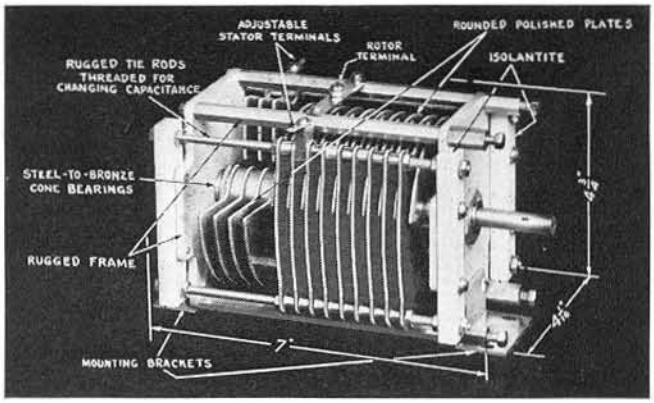
Mounting: Three tapped inserts 120° apart, attached to one end-plate on a $\frac{7}{8}$-inch radius, are provided for mounting the condenser on a panel of any thickness between $\frac{1}{8}$ and $\frac{5}{16}$ inch. Drilling template and three flat-head screws are furnished.

Dimensions: Panel space, $3\frac{3}{4} \times 3\frac{3}{4}$ inches; depth behind panel, 5 inches; shaft length measured from *back* of panel, $\frac{7}{8}$ inch; shaft diameter, $\frac{1}{4}$ inch.

Net Weight: 2 pounds.

	Capacitance per Section			
Type	*Maximum*	*Minimum*	*Code Word*	*Price*
756-A	225 $\mu\mu$f	140 $\mu\mu$f	METAL	$6.00

TYPE 639-A VARIABLE AIR CONDENSER



This condenser is a double-section, high-voltage type. It has $\frac{3}{16}$-inch aluminum end-plates, large hexagonal tie-rods, and self-aligning conical bearings. Condenser plates are of $\frac{1}{16}$-inch aluminum and all edges are rounded to reduce corona loss.

SPECIFICATIONS

Capacitance Range: Two sections are provided. Maximum capacitance of either section is readily adjustable from 25 $\mu\mu$f to 305 $\mu\mu$f, or the condenser may be used as a single-section type having a maximum capacitance of 330 $\mu\mu$f.

Voltage Rating: 3500 volts, d-c.

Plate Spacing: 0.098 inch.

Rotor Plate Shape: Semicircular plate, giving a linear capacitance variation with setting, and requiring a dial with a scale spread over 180°.

Isolantite Supports: Four bars of isolantite, treated to prevent absorption of moisture, support the stator assembly.

Low Losses: $R\omega C^2$ is approximately 0.03×10^{-12} based on measurements at 1000 cycles.

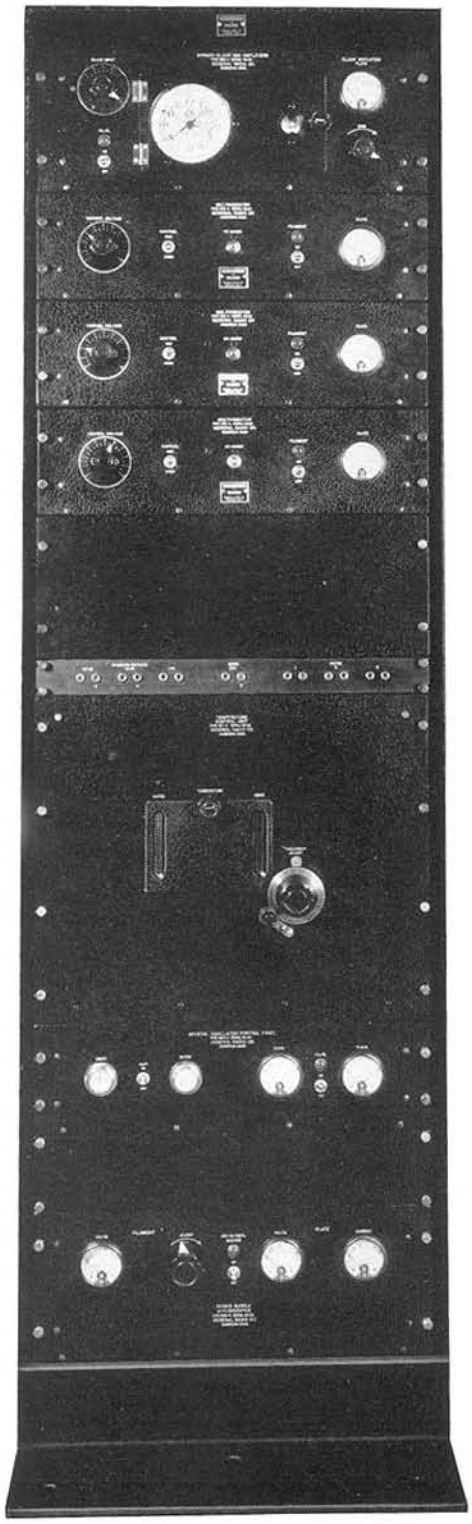
Dimensions: Panel space, $4\frac{3}{4} \times 4\frac{1}{4}$ inches, overall; depth behind panel, 7 inches; shaft length measured from *back* of panel, 1 inch; shaft diameter, $\frac{3}{8}$ inch.

Net Weight: $3\frac{3}{4}$ pounds.

Type	*Code Word*	*Price*
639-A	BARGE	$15.00

PATENT NOTICE. General Radio Condensers which incorporate the following special features are manufactured under United States Patents as noted: Soldered plates, No. 1,542,995; plates other than of semicircular shape, No. 1,258,423; plates with wide angle of rotation, No. 1,525,778.

FREQUENCY- AND TIME-MEASURING DEVICES



THE NEW PRIMARY STANDARD OF FREQUENCY

(Class C-21-H, Series 690)

100% A-C Operation if Desired

Frequency Stability Five Parts in Ten Million

The primary standard of frequency described on page 47 and in Bulletin 10 (Bulletin A) is capable of supplying a multitude of accurately-known standard-frequency reference points distributed at convenient intervals over a large part of the radio-frequency spectrum. In the past year this equipment has been completely redesigned, resulting in a marked improvement in both accuracy and reliability.

Here are some of the major features:

New crystal oscillator circuit in which the crystal operates at, or very near, its resonant frequency.

Self-starting syncro clock. An auxiliary motor brings the clock up to synchronous speed.

Fixed thermostats. All thermostat adjustments are, accordingly, eliminated.

Heater-type tubes permitting either 100% a-c operation, where power line failures are rare, or d-c operation from floating batteries.

Pre-formed cable, protected terminals. Easier installation; less danger of accidental interruption of service.

More stable multivibrators. A new circuit insures more stable operation than before.

Besides these, there have been many minor improvements, all of which contribute to more satisfactory operation.

This primary standard, used in conjunction with the interpolation and auxiliary equipment recommended in Bulletin 10 (Bulletin A), meets every practical need for accurate measurements at fre-

quencies now in general use for communication purposes. It is ideal for the frequency-monitoring work that the Madrid Treaty requires of national administrations. More than eleven different governmental authorities have installed this equipment. Yet its price is so low that every radio communication service and every college laboratory doing communication work can afford it.

PRICES OF THE NEW PRIMARY STANDARD

(Class C-21-H, Series 690)

$1950.00 for floating-battery operation
$1875.00 for a-c operation

For complete particulars, see Bulletin 10. A supplement describing the new primary frequency standard is in preparation.

A NEW SECONDARY FREQUENCY STANDARD

(Class C-10, Series 690)

A new secondary standard of frequency is now available for complete a-c operation. The same circuits and general design principles used in the primary standard just described are also employed in this secondary standard.

The Class C-10 Standard Frequency Assembly, Series 690, consists of a TYPE 675-L Piezo-Electric Oscillator and a TYPE 692-A Multivibrator. The quartz bar used in the assembly can be furnished to operate at either 100 kc or 50 kc. The multivibrator normally operates at 10 kc.

If harmonic series of other frequencies than 10 kc are desired, additional multivibrators can be furnished. In this way audio frequencies for standard precision purposes can be obtained from the system as well as standard radio frequencies. For instance, if a 100-kc quartz bar is used, three multivibrators operating at frequencies of 50 kc, 10 kc, and 1 kc, respectively, can be used.

The guaranteed accuracy is 20 parts in one million, but accuracies much better than this can be obtained if operating instructions are followed.

The a-c power supply is contained in the oscillator unit. It supplies sufficient power to operate a maximum of three multivibrators if desired.

PRICES OF THE NEW SECONDARY STANDARD

(Class C-10, Series 690)

$565.00 with 100-kc quartz bar
$595.00 with 50-kc quartz bar

$140.00 each for additional multivibrators for frequencies of 1 kc, 10 kc, and 50 kc. Prices for other frequency multivibrators will be quoted on request.

For complete details, see Bulletin 10. A supplement containing complete information on this secondary standard is in preparation.

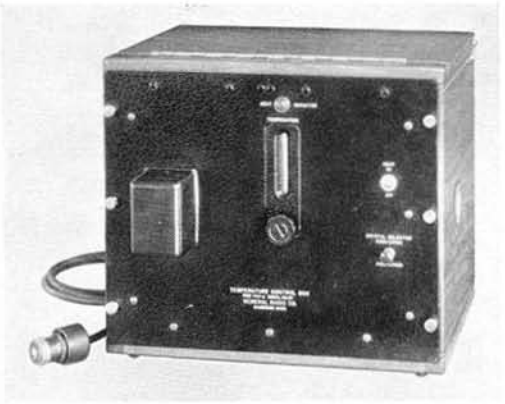
TYPE 747-A TEMPERATURE-CONTROL BOX

This instrument replaces the TYPE 547-A Temperature-Control Box listed on page 56. It is designed for use in controlling the temperature of quartz plates in order to assure constant frequency.

A terminal plate carrying two sets of jacks for TYPE 376 Quartz Plates is provided within the temperature-control space. Choice of the quartz plate which is in circuit is made by a switch mounted on the panel. Within the cabinet are placed a balsa-wood insulating layer, distributed heaters (placed on all six faces of the interior assembly), an aluminum distributing layer, an asbestos attenuation layer, and a second aluminum distributing layer which forms the wall of the temperature-controlled space. A thermometer graduated in 0.5°C. divisions from 40° to 60°C. is mounted behind a slot in the panel and is illuminated by the heat-control indicating lamp. This thermometer indicates the air temperature of the inner space.

The power supply is a 115-volt line, either a-c or d-c. A plug and cord for connecting the instrument to the 115-volt line are provided.

The thermostat is of the fixed mercury type and is normally supplied for operation at 50°C. Thermostats for operation at other temperatures can be supplied on special order.



The temperature of the inner space is controlled within ±0.1°C. against changes in room temperature of ±11°C. (±20°F.).

This instrument can be supplied mounted in a cabinet or on a standard 19-inch relay-rack panel. When supplied for relay-rack mounting, space is available at the right of the temperature-control box for the construction of oscillating circuits or other associated circuit elements. The terminals for the quartz plate are brought out at the right-hand side of the box, making it convenient to attach leads to other circuits and at the same time reducing the length of leads necessary.

SPECIFICATIONS

Accuracy of Temperature Control: The unit will control the temperature of the inner space to within ±0.1°C. for changes in room temperature of ±11°C. (20°F.). Where the crystal is operated at a power level so high that it generates heat, the temperature can be held to within the same limits if the heat generated by the crystal remains constant.

Operating Temperature: Normally 50° C., but other temperatures can be supplied on special order.

Mounting: Two types of mounting can be supplied, a walnut cabinet or a standard 19-inch relay-rack panel. See price list below.

Dimensions: TYPE 747-AM, (width) 13¼ x (height) 11⅝ x (depth) 13½ inches.

TYPE 747-AR, (width) 19 x (height) 10½ x (depth) 12⅝ inches.

Net Weight: TYPE 747-AM, 31¾ pounds; TYPE 747-AR, 29 pounds.

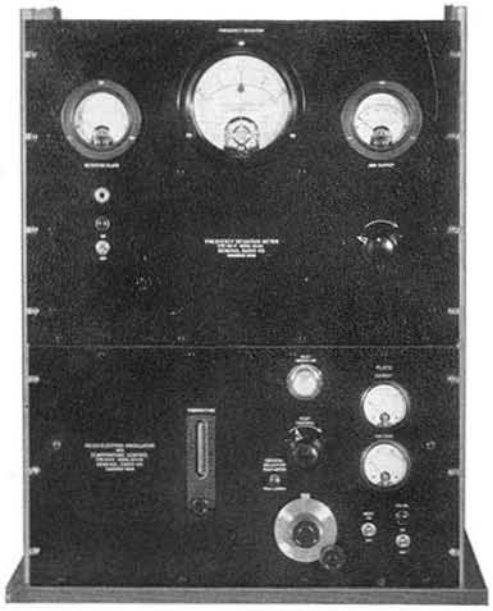
Type	*Description*	*Code Word*	*Price*
747-AM	Cabinet mounting	BURLY	$150.00
747-AR	Relay-rack mounting	BATHE	150.00

VISUAL-TYPE FREQUENCY MONITOR FOR BROADCASTING STATIONS

The General Radio visual-type frequency monitor for broadcasting stations is now supplied for complete a-c operation. Filament and plate power for operating the piezo-electric oscillator are derived from the power supply which is contained in the TYPE 581-B Frequency-Deviation Meter. This improvement makes no change in either accuracy specifications or price.

The complete monitor consists of the following units:

TYPE 575-E Piezo-Electric Oscillator	**$215.00**
TYPE 376-J Quartz Plate	**85.00**
TYPE 581-B Frequency-Deviation Meter	**250.00**
	$550.00



A-c Operated Frequency Monitor

Nearly two hundred similar monitors are now in use in radio broadcasting stations in the United States and several foreign countries. Many of them have been giving consistently reliable performance for several years.

See new supplement to Bulletin 10 for complete details.

TYPE 531-A POWER SUPPLY

For the convenience of those who have purchased the battery-operated TYPE 575-D Piezo-Electric Oscillator and who wish to convert it to 115-volt a-c operation, the General Radio Company can supply the TYPE 531-A Power Supply.

Type	*Description*	*Code Word*	*Price*
531-A	**Power Supply** (for battery-operated monitor)	VIVID	**$100.00**

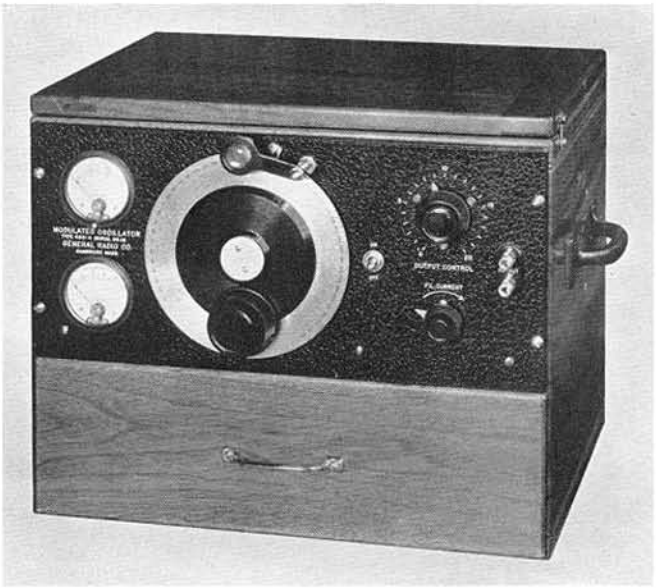
TYPE 434-B FREQUENCY METER

This instrument is described completely on pages 64, 65, and 66. The price has been changed as noted below. The frequency range is 20-20,000 cycles.

Type	*Frequency Range*	*Code Word*	*Price*
434-B	**20-20,000 cycles**	COLOR	**$135.00**

OSCILLATORS

TYPE 484-A MODULATED OSCILLATOR



This is a portable, general-purpose, radio-frequency generator, covering the wide range of frequencies so often needed for laboratory measurements. A straight-line-frequency condenser with a large precision dial is used for tuning. The oscillator has an unusually low external field. For more information, see the following specifications or the October, 1932, General Radio *Experimenter*.

SPECIFICATIONS

Frequency Range: 490 kc to 40 Mc by means of five plug-in inductors. In addition, two band-spread inductors are available for the bands 160 kc to 270 kc and 98 kc to 102 kc. The inductors are toroids to reduce the external field. Inductors are not included in the price of the instrument and must be ordered separately. See TYPE 484-P Inductors on page 195.

Calibration: Calibrations are not included in the price of either the oscillator or the inductors. On special order, however, a calibration curve accurate to within 1% can be supplied for any inductor. (See price list.) Inductors must be calibrated in the oscillator with which they are to be used.

Voltage Output: For frequencies in the broadcast band and below, the maximum output is 2.0 volts. At higher frequencies the voltage progressively decreases until at the highest frequencies it is approximately 0.2 volt. Over the range of one coil the output voltage varies by a ratio of approximately 1.5 to 1.

Modulation: Internal 1000-cycle vacuum-tube oscillator, providing approximately 30% modulation. Provision is made for modulating at other frequencies by either plugging in another modulation-oscillator unit in place of the 1000-cycle unit or by connecting a separate oscillator in the circuit. A 400-cycle modulating unit (TYPE 484-P21) is listed in the price list. Provision is made for furnishing an unmodulated carrier.

Tubes: Two 30-type tubes, supplied with the instrument.

Batteries: Two No. 6 dry cells and three 45-volt Burgess No. 5308 batteries, or equivalent, are necessary. These are not included in the price of the instrument. Space for batteries is provided in the cabinet.

Mounting: The oscillator is assembled on a black crackle finish aluminum panel and mounted in a shielded walnut cabinet. A drawer is provided for the inductors not in use.

Dimensions: (Length) 18 x (depth) 14½ x (height) 12¾ inches.

Net Weight: 32½ pounds without batteries; 46½ pounds with batteries.

Type		*Code Word*	*Price*
484-A	.....	CREST	**$145.00***

*Does not include batteries or inductors.

TYPE 484-P INDUCTORS

The inductors available are listed below.

SPECIFICATIONS

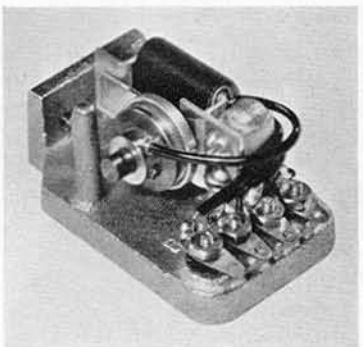
Dimensions: TYPE 484-P1 to TYPE 484-P12, (length) 3 x (diameter) 3¾ inches, over-all. TYPE 484-P21, (length) 2⅞ x (width) 2⅜ x (height) 5⅜ inches, including plugs.

Type	*Frequency Range*	*Net Weight*	*Code Word*	*Price*
*484-P1	23.5 Mc to 40 Mc	6 ounces	MODOSCBIRD	$8.00
*484-P2	8.9 Mc to 27 Mc	6 ounces	MODOSCDESK	8.00
*484-P3	3.2 Mc to 10.5 Mc	9 ounces	MODOSCFORD	8.00
*484-P4	1220 kc to 4225 kc	8 ounces	MODOSCGIRL	8.00
*484-P5	490 kc to 1650 kc	10 ounces	MODOSCGOAT	8.00
*484-P11	160 kc to 270 kc	9 ounces	MODOSCHYMN	8.00
*484-P12	100 kc ± 2 kc	9 ounces	MODOSCMILK	8.00
484-P21	400-cycle Modulating Unit	3⅜ pounds	MODOSCPALM	12.00
	Frequency Calibration (per Inductor)		CURVE	5.00

*Frequency calibration supplied only when ordered. To order calibrated inductors, use compound code words, *e.g.*, MODOSCBIRDCURVE, etc.

TYPE 572-A MICROPHONE HUMMER

This is an electro-mechanical oscillator in which the frequency is determined by a tuned reed. The hummer is intended for use as a low-power, a-c source for bridge and other measurements where the purity of wave-form, frequency stability, and other features of the TYPE 213 Audio Oscillator are not essential.



SPECIFICATIONS

Frequency: Very nearly 1000 cycles.

Output: 20 milliwatts, maximum.

Internal Output Impedance: 250 ohms.

Power Supply: This oscillator is designed to operate from a 4½-volt battery, Burgess No. 2370, or equivalent.

Mounting: Supplied unmounted as illustrated.

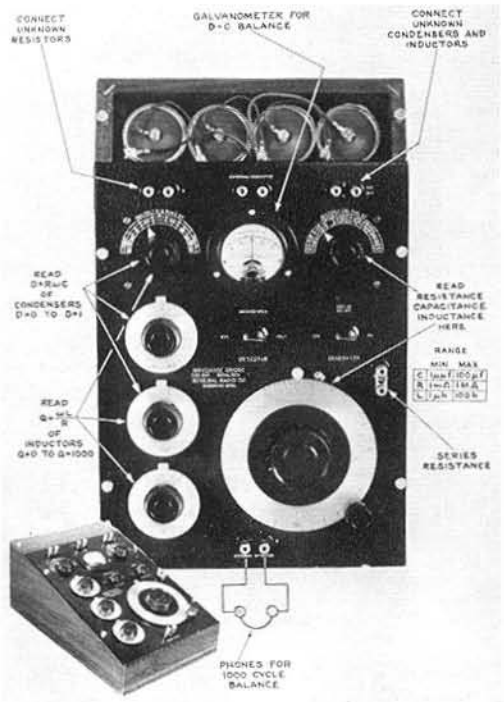
Dimensions: (Length) 3 x (width) 1⅞ x (height) 1½ inches, over-all.

Net Weight: 14 ounces.

Type	*Impedance*		*Code Word*	*Price*
572-A	**250 ohms**	.....	APHIS	**$10.00**

BRIDGES

TYPE 650-A IMPEDANCE BRIDGE



This bridge is direct-reading over wide ranges for

(1) D-c resistance
(2) A-c resistance at 1000 cycles
(3) Capacitance and dissipation factor ($R\omega C$) at 1000 cycles
(4) Inductance and energy factor ($Q = \omega L/R$) at 1000 cycles

The direct-reading feature is made possible by the use of variable resistors having logarithmic scales. All batteries, a d-c galvanometer, a 1000-cycle source, and all standards are self-contained. Brief operating instructions are given in the accompanying illustration. For convenience, the instrument is assembled on a sloping panel and is provided with a carrying handle.

For more information, see the following specifications and the April-May, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Range: The ranges of the instrument are given in the following table. The numerical values are the readings of the calibrated dials multiplied by the settings of the decade selector switches.

	Minimum	*Maximum*
Resistance	1 milliohm	1 megohm
Capacitance	1 micromicrofarad	100 microfarads
Inductance	1 microhenry	100 henrys
Dissipation Factor $\left(\frac{R}{X}\right)$	.002	1
Energy Factor $\left(\frac{X}{R}\right)$	.02	1000

Accuracy: The large direct-reading dial covers two decades, the main decade being spread out over 12 inches (three quarters of the dial). It may be set to 0.2%.

Accuracy of readings for resistance and capacitance is 1% for the intermediate multiplier decades; for inductance, 2%. The accuracy falls off in the lower ranges because of the extremely small values to be measured. It decreases to 5% for very large values of resistance and capacitance, and to 10% for large values of inductance.

Accuracy of reading for dissipation factor and energy factor is either 20% or 0.005, whichever is the larger.

The frequency of the microphone hummer is 1000 cycles to within $\pm 5\%$.

External Generator: Provision has been made for using an external generator, although its capacitance to ground may introduce some error. Subject to this limitation, the frequency may be varied over a wide range from a few cycles to 10 kc. The reading of the main dial is independent of frequency, while the readings of the energy and dissipation factor dials must be multiplied by or divided by the generator frequency in kilocycles to give the correct values. Provision is made for adding external resistance, if necessary.

Power Supply: Four No. 6 dry cells for the d-c measurements and for driving the microphone

hummer are required, and space for them is provided in the cabinet. Batteries are not supplied with the instrument. A higher d-c voltage may be connected to the bridge for high-resistance measurements.

Dimensions: (Width) 12 x (depth) 20 x (height) 8½ inches, over-all.

Net Weight: 22 pounds without batteries; 30½ pounds with batteries.

Type		*Code Word*	*Price*
650-A	.....	BEAST	**$175.00***

*Without batteries.

TYPE 625-A BRIDGE

This instrument consists of a skeleton bridge circuit, of which one arm contains a 10,000-ohm direct-reading logarithmic rheostat and the other three arms are brought out to pairs of terminals on the panel, making provision for plugging in standard and unknown units to obtain a variety of circuits. A 1000-cycle a-c voltage source is contained in the bridge. For more information, see the following specifications or the April-May, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Range: When used with the resistors and condensers listed in the "Accessories Recommended" paragraph, measurements can be made over the ranges given in the following table. (These are the same as for the TYPE 650-A Impedance Bridge. See page 196.) If a few additional units are provided, the upper limit of these ranges may be extended somewhat.

	Minimum	*Maximum*
Resistance	1 milliohm	1 megohm
Capacitance	1 micromicrofarad	100 microfarads
Inductance	1 microhenry	100 henrys

Dissipation Factor, Energy Factor: For accurate determination of these values, several TYPE 526 Mounted Rheostat and Potentiometers, having a scale calibrated in ohms, are required. If it is only a question of obtaining a good reactance balance, any adjustable resistor of suitable range will suffice, but the TYPE 526-B Rheostat and Potentiometer (0–10,000 ohms) is recommended. (See page 185.)

Accuracy: The accuracy of results depends upon the type of standards used. With the accessories recommended, an accuracy of 2% for measurements of resistance, inductance, and capacitance can be obtained. The accuracy of the component parts of the bridge itself is 1%. The frequency of the microphone hummer is 1000 cycles to within 5%.

Accessories Recommended: In addition to head telephones for a-c measurements and a zero-center, 200-μa, full-scale galvanometer for d-c measurements, purchase of the following units is recommended if the full range is to be covered. Omission of some items is possible if narrower ranges are satisfactory.

Resistors	*Condensers*
1—TYPE 500-A 1 Ω	1—TYPE 505-F 0.001μf
1—TYPE 500-B 10 Ω	1—TYPE 505-L 0.01μf (See page 188.)
1—TYPE 500-D 100 Ω	
1—TYPE 500-H 1000 Ω	1—TYPE 625-P1 1μf Condenser (Adjusted to within ±2%. Dimensions: 2⅝ x 1 x 3⅛ inches, over-all. Net Weight: 4 ounces.)
2—TYPE 500-J 10,000 Ω	
TYPE 526 Mounted Rheostat and Potentiometers as required. (See "Dissipation and Energy Factor.")	

Power Supply: Two 4½-volt batteries (Burgess No. 2370, Eveready No. 711, or equivalent) for the d-c measurements, and for driving the microphone hummer, are required, and space for them is provided in the cabinet. Batteries are not supplied with the instrument. An external a-c voltage source having any frequency up to 5000 cycles may be used.

Mounting: This instrument is assembled on a black crackle finish aluminum panel and mounted in a shielded walnut cabinet. A drawer in the lower part of the cabinet provides space for storing the standards suggested.

Dimensions: (Width) 9 x (depth) 13 x (height) 7 inches, over-all.

Net Weight: 9 pounds without batteries; 11 pounds with batteries.

Type	*Description*	*Code Word*	*Price*
625-A	**Bridge**	BEACH	**$65.00**
625-P1	**1μf Condenser**	BAIZE	**2.00**

TYPE 516-C RADIO-FREQUENCY BRIDGE

All the advantages of bridge methods are now made available for measuring capacitance and resistance at radio frequencies up to 5 megacycles. This new bridge is the result of three years of development in which the principal difficulties formerly considered insurmountable have been overcome.

The capacitance dial is direct-reading at all frequencies, and so is the power-factor dial at 1 megacycle. At other frequencies, the power-factor dial reading is multiplied by the frequency in megacycles. Inductance can be measured by placing in series with a known capacitance. The substitution method for capacitance and resistance measurements is recommended where

precise results are desired, as some accuracy is sacrificed when the bridge is used as a direct-reading instrument. For more information, see the following specifications and the December, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Capacitance Range: Main dial, 40 $\mu\mu$f to 1150 $\mu\mu$f; vernier dial, 0.1 $\mu\mu$f to 10 $\mu\mu$f. The range can be extended indefinitely by using a series condenser.

Resistance Range: 0.1 ohm to 111 ohms. The range can be extended indefinitely by using a known condenser in parallel with the unknown.

Power-Factor Range: 0.001% to 3% at 1 Mc.

Frequency Range: 500 kc to 5000 kc with output transformer furnished. With suitable output transformer (information on request), range can be extended downward to audio frequencies.

Accuracy: As a direct-reading bridge, 1% at 1 Mc. With direct substitution methods, greater accuracy can be obtained.

Accessories Recommended: The bridge is supplied with 100-ohm ratio arms and the .5 Mc to 5 Mc output transformer for the 500-kc to 5000-kc band. A suitable radio-frequency generator and detector are required. The TYPE 484-A Modulated Oscillator (see page 194) is suggested. As a detector, a radio receiver covering the desired range, or a TYPE 619-A or TYPE 619-B Heterodyne Detector, may be used (see page 52 or Bulletin 10).

Condensers: If measurements outside the direct-reading range of the bridge are to be made, plug-in fixed condensers are required. TYPE 505 Condensers are recommended. A set of four of these with capacitances of 100 $\mu\mu$f, 200 $\mu\mu$f, 500 $\mu\mu$f, and 1000 $\mu\mu$f, respectively, is adequate for most purposes. (See page 188.)

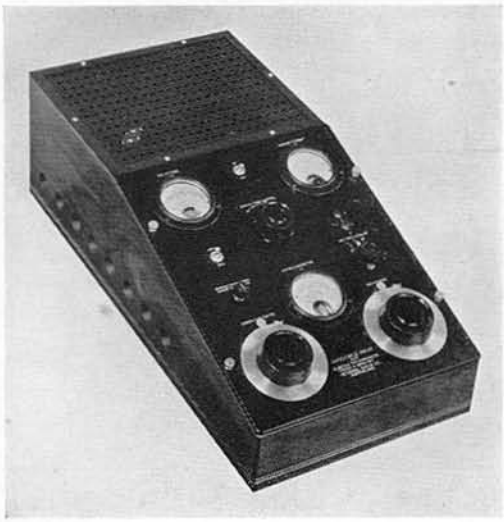
Dimensions: (Depth) 18 x (width) 12 x (height) 8 inches, over-all.

Net Weight: 23 pounds.

Type		*Code Word*	*Price*
516-C	.....	BATCH	**$225.00**

TYPE 632-A CAPACITANCE BRIDGE FOR ELECTROLYTIC CONDENSERS

This bridge is designed for measuring the high capacitance, large power factor, and appreciable leakage current characteristic of electrolytic condensers when polarized by a d-c voltage. It is completely a-c operated and is direct-reading in capacitance and power factor. For more information, see the following specifications and the June-July, 1933, General Radio *Experimenter*.



SPECIFICATIONS

Capacitance Range: The capacitance dial is calibrated with a logarithmic scale covering two decades from 0.25 μf to 25 μf, the main decade extending from 2.5 μf to 25 μf and covering about 8 inches or nearly three quarters of the dial. A multiplier switch having three positions (0.1, 1, and 10) extends the range by one decade on either side, making the total capacitance range 0.025 μf to 250 μf.

Power Factor: From 0.5% to 50%.

Polarizing Voltage: 0-600 volts, d-c, in two ranges.

Ripple Voltage: 10 volts r-m-s, 60 cycles, in series with 10 μf and the unknown condenser.

Accuracy: Capacitance dial is calibrated to within 2% over its main decade, and can be set to from 0.5% to 1%. Over-all accuracy of reading of the capacitance dial is 5%.

The accuracy of calibration of the dissipation-factor dial (power factor) is from 1 to 2%, and the over-all accuracy of its reading is 10% or 0.02, whichever is the greater.

D-C Voltage: Obtained from the rectifier, controlled by a potentiometer, and measured by a double-range voltmeter (0-200 volts and 0-600 volts). Polarizing voltage may be read to within 5% of full-scale reading.

Leakage Current: Measured by a d-c meter having an approximately logarithmic scale (obtained by means of a copper-oxide rectifier shunt) covering the decades from 0.05 ma to 50 ma on one scale. Leakage current may be read to within 10% for 50 ma, 20% for 5 ma. Smallest division, 0.05 ma.

Null Detector: Oxide-rectifier type a-c galvanometer.

Tubes Required: Two 57-type tubes and one 5Z3 rectifier, supplied with the instrument.

Power Supply: 110 volts, 60 cycles, 60-90 watts. Cord for connecting to the power supply is included.

Mounting: Bridge and power supply are built into a walnut cabinet.

Dimensions: (Width) 12 x (depth) 24¾ x (height) 8 inches, over-all.

Net Weight: 46 pounds.

Type	*Code Word*	*Price*
632-A	BEADY	**$300.00**

TYPE 610-A RATIO-ARM BOX

A ratio-arm box is a suitable nucleus around which to design any bridge circuit. It contains a pair of ratio arms giving ratios from 0.001 to 1000 in twelve steps.

SPECIFICATIONS

Resistances: Each arm, 1, 3, 10, 30, 100, 300, 1000 ohms.

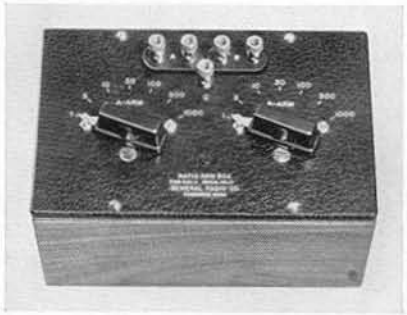
Type of Winding: Ayrton-Perry, manganin wire, having characteristics identical with those listed under TYPE 602 Decade-Resistance Box.

Switches: TYPE 510, 7-point. Contacts are enclosed.

Mounting: Switches and terminals mounted on black crackle finish aluminum panel and enclosed in a shielded walnut cabinet.

Terminals: Jack-top binding posts with separate ground terminal.

The switches used with the ratio-arm box are similar to those employed in the TYPE 602 Decade-Resistance Box. (See description on page 8.)



Dimensions: (Length) 7¾ x (width) 5 x (height) 5¼ inches, over-all.

Net Weight: 3⅝ pounds.

Type	*Code Word*	*Price*
610-A	RABID	**$32.00**

TYPE 561-A VACUUM-TUBE BRIDGE

All dynamic characteristics of all the new tubes can be measured with this bridge, described in detail on pages 88-90. The price has been revised as follows:

Type	*Code Word*	*Price*
561-A	BEIGE	**$375.00**

TYPE 544-A MEGOHM METER

This is a portable bridge-type instrument for the accurate measurement of high resistance, either in the field or in the laboratory. Balance is indicated by means of a vacuum-tube-operated pointer galvanometer. An important feature is the long direct-reading scale, the range from 10,000 ohms to 10,000 megohms being spread out over 44 inches. The megohm meter is compact, rugged, and simple to operate. The power source may be either batteries or the 115-volt, a-c line.

The meter is suitable for measuring the insulation resistance of all low-voltage electrical apparatus, of high-voltage cables, and of flat slabs of most insulators.

For more information, see the following specifications and the June-July, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Range: 10,000 Ω to 10,000 MΩ covered by a dial and 5-position multiplier switch. Resistances up to 100,000 MΩ can be measured by simple, indirect methods.

Accuracy: To within 3% between 10,000 Ω and 100 MΩ and to within 5% between 100 MΩ and 10,000 MΩ.

Dial: The 2-decade dial is individually engraved with an approximately logarithmic scale, thus giving the same precision of setting over the entire range.

Null Indicator: Balance is indicated by the zero-center galvanometer on the panel.

Extraneous Voltages: The megohm meter operates to best advantage on resistors across which there are neither a-c nor d-c voltage drops. The effects of constant amplitude a-c voltages up to about 10 volts, r-m-s, and steady d-c voltages up to about 0.5 volt can be allowed for, but erratic voltage variations and voltages greater than those mentioned above render the instrument inoperative.

Tubes: One 32-type, supplied with the instrument.

Power Supply (Batteries): *Filament*, two No. 6 dry cells. *Plate*, two 45-volt block batteries, Burgess No. 5308 or equivalent. Space for mounting all batteries is provided inside the cabinet. Connections are made by a 7-prong plug and coded cable supplied. Batteries are not supplied with the instrument.

Power Supply (60-cycle a-c): A TYPE 544-P1 Power-Supply Unit that fits the battery compartment can be ordered separately to supply both plate and filament power from a 115-volt line. The one 82-type tube, one 874-type tube, and the line cord required are supplied. *Power Consumption*, about 44 watts. *Dimensions*, 7¾ x 7⅜ x 5½ inches. *Net Weight*, 9¼ pounds. (See price list below.)

Mounting: Mounted in shielded oak cabinet.

Dimensions: Cabinet with cover closed, (width) 8½ x (length) 22½ x (height) 8 inches, over-all.

Net Weight: 15¾ pounds without batteries or TYPE 544-P1 Power-Supply Unit; 26½ pounds with batteries; 25 pounds with TYPE 544-P1 Power-Supply Unit.

Type	*Description*	*Code Word*	*Price*
544-A	**Megohm Meter**	ALOOF	**$165.00**
544-P1	**Power-Supply Unit**	ALOOFAPACK	**35.00**

STANDARD-SIGNAL GENERATORS

TYPE 604-B TEST-SIGNAL GENERATOR

This portable test-signal generator is an inexpensive instrument for measuring and testing receivers at ultra-high frequencies. It operates at frequencies from 3 to 100 megacycles. Two output systems are provided; the usual attenuation network, and a rod-type antenna. For more information, see the following specifications and the February, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Carrier-Frequency Range: 3 Mc to 100 Mc, covered with 13 plug-in inductors supplied with the instrument, Special inductors can be built to order for frequencies as low as 300 kc. Prices on request.

Frequency Calibration: All inductors are normally supplied without frequency calibration, but on special order a calibration curve accurate to ±1% can be supplied. (See price list.)

Output System: By means of a micro-ammeter in series with the grid leak of the radio-frequency oscillator, the amplitude of oscillation may be set to a predetermined value. Two output systems are provided. A capacitance attenuator network, the output impedance of which is that due to 200 $\mu\mu$f, provides a continuously variable voltage which can be connected to a receiver by a shielded connecting cable in the conventional manner. In addition, a plug to which a rod-type antenna may be connected is maintained at 1 volt above ground.

Range of Output Voltage: The output voltage at the antenna terminals is 1 volt. The voltage at the output terminal is continuously variable from 5 to 10,000 microvolts.

Accuracy of Output Voltage: The accuracy of the voltage at the antenna terminals up to frequencies of 10 megacycles is ±5%; up to frequencies of 30 megacycles, ±20%. The accuracy of the voltage at the OUTPUT terminal up to 10 megacycles is ±10%; up to 30 megacycles, ±30%; above 30 Mc, no brief statement as to the voltage accuracy would be useful, since the error introduced by connecting any lead to the output of the generator is much greater than that inherent in the instrument itself. The greatest care has been taken, however, to obtain the best possible accuracy up to the upper-frequency limit of the generator.

Modulation: The internal modulating oscillator is adjusted to 400 cycles to within ±5%. Oscillator units for other internal modulation frequencies can be built to order. Provision has been made for external modulation (up to frequencies of 200 kc). When the grid-current meter is set at the proper point the modulation is between 20% and 40%.

Accessories: A shielded connecting cable and 13 inductors with storage rack are provided, as well as an antenna which is in three sections to provide different values of field strength.

Tubes: Two 31-type tubes, supplied with instrument.

Power Supply: Two No. 6 dry cells and four 45-volt Burgess No. 5308 batteries or equivalent. Batteries are not supplied with the instrument.

Mounting: The unit is mounted on a black crackle aluminum panel and placed in a shielded walnut cabinet. Space has been provided inside the cabinet for batteries and inductor storage rack.

Dimensions: (Width) 18¾ x (height) 9 x (depth) 16½ inches.

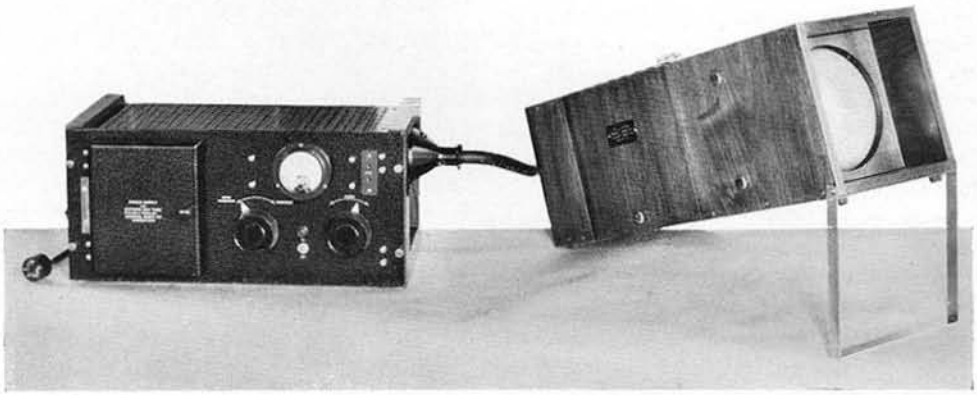
Net Weight: 40 pounds, without batteries; 57¼ pounds, with batteries.

Type		*Code Word*	*Price*
*604-B	.....	DENSE	$300.00
	Frequency Calibration (per Inductor)		3.00

*Frequency calibrations supplied only when specifically ordered with the instrument. Use code word DENSECURVE when the entire set of 13 inductors is to be calibrated.

MODULATION AND DISTORTION MEASUREMENTS, OSCILLOGRAPHS, AND FILTERS

TYPE 528 CATHODE-RAY OSCILLOGRAPH



Complete TYPE 528 Cathode-Ray Oscillograph

This cathode-ray oscillograph offers improved operation over the equipment described beginning on page 107. The tube is of the high-vacuum type with hot cathode designed for electrostatic deflection of the beam. Focusing is accomplished by means of electric fields rather than by the gas content of the tube, providing a convenient method for changing the brilliancy of the pattern. Excellent visual and good photographic characteristics are provided by the willemite screen.

The complete TYPE 528 Cathode-Ray Oscillograph consists of three units: the TYPE 528-A Cathode-Ray Tube, the TYPE 579-A Tube Mounting, and the TYPE 580-A Power-Supply Unit. For more information, see the following specifications and the June-July, 1933, General Radio *Experimenter*.

SPECIFICATIONS

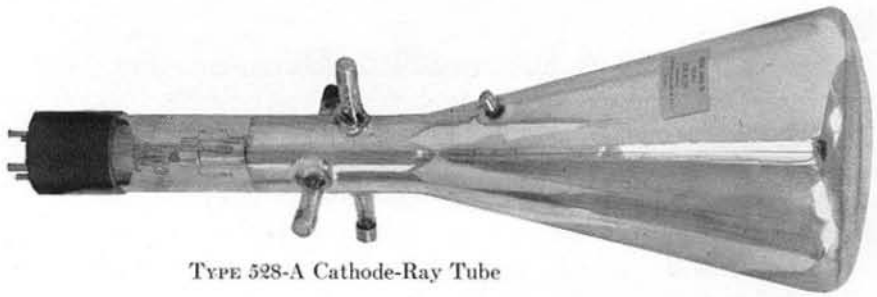
Brilliance: Patterns are brilliant and are easily visible in daylight.

Photographs may be taken of single transits of the spot across the screen at velocities up to 400 inches per second, using verichrome-type film and an *f*./4.5 lens. Slightly greater velocities can be recorded on supersensitive panchromatic film (3000 volts).

Fluorescent Screen: Willemite, giving a green trace of excellent visual and good photographic brilliance. Useful diameter of screen, 6¼ inches.

Voltage Sensitivity: The voltage sensitivity for either pair of deflecting plates is inversely proportional to the anode voltage and is 120 d-c volts per inch and 20 d-c volts per inch for anode potentials of 3000 volts and 500 volts, respectively.

Impedance of Deflecting Plates: Four separate plates are provided for deflecting purposes. The capacitance across either pair of plates is so



TYPE 528-A Cathode-Ray Tube

small as to be negligible up to approximately 100 Mc (where the inductance of the connecting wires becomes appreciable).

Tube Mounting: The TYPE 579-A Tube Mounting is a universal mounting for holding the cathode-ray tube and for making connections between it and the TYPE 580-A Power-Supply Unit. It has a number of features which facilitate the use of the oscillograph and prolong tube life by minimizing the danger of accidental burnout and breakage. The mounting is supplied complete with plug-in cable for making all connections to the TYPE 580-A Power-Supply Unit.

Power-Supply Unit: The TYPE 580-A Power-Supply Unit supplies from the 110-volt, a-c line all the voltages needed for the operation of the TYPE 528-A Cathode-Ray Tube. *Anode Voltage*, adjustable between 500 volts and 3000 volts, and is indicated by meter on panel. *Focusing Voltage*, adjustable between 7% and 25% of anode voltage. *Negative Grid Voltage*, adjustable between 0 and 15% of the anode voltage. A jack plate is mounted on the panel to which external modulating voltage may be applied. *Cathode-Heater Supply*, 60 cycles, a-c; maximum of 3 volts and 3 amperes. A rheostat and ammeter are part of this circuit.

The power supply unit is mounted on a black crackle aluminum panel in a well-ventilated metal cabinet and supplied with a 7-foot attachment cord. The controls not often adjusted are covered by a hinged door.

Terminals: Jack-top binding posts connected by flexible leads to the deflecting plates are mounted on the top of the TYPE 579-A Tube Mounting. A ground binding post is provided.

Tube Life: The TYPE 528-A Cathode-Ray Tube is guaranteed for 500 hours of operation or for one year, whichever comes first.

The guarantee is void if the tube is abused, handled carelessly, operated at voltages greater than those recommended in the instruction book, or used in any other than a General Radio Power-Supply Unit.

Rectifier Tube Required: One TYPE 143-D Rectifier Tube, furnished with the power supply.

Power Rating: 105-115 volts, 50-60 cycles, a-c; 100 watts, maximum.

Dimensions: TYPE 528-A Cathode-Ray Tube, (diameter) 7 inches x (length) 21½ inches, over-all. TYPE 579-A Tube Mounting, (length) 25 x (height) 9¾ x (depth) 9¾ inches, over-all, exclusive of cable. TYPE 580-A, (width) 19½ x (height) 9⅛ x (depth) 10¾ inches, over-all.

Net Weight: TYPE 579-A, 18½ pounds, including TYPE 528-A Tube and cable. TYPE 580-A, 36½ pounds.

Type	*Description*	*Code Word*	*Price*
528	**Cathode-Ray Oscillograph**	CALYX	**$330.00**

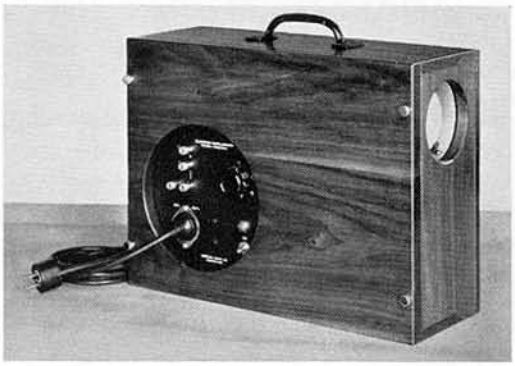
Component Parts of Type 528 Cathode-Ray Oscillograph

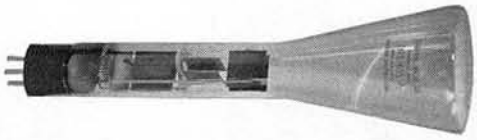
Type	*Description*	*Code Word*	*Price*
528-A	**Cathode-Ray Tube**	CAMEL	**$115.00**
579-A	**Tube Mounting**	COFIN	**45.00**
***580-A**	**Power-Supply Unit**	CULPA	**170.00**
143-D	**Rectifier Tube**	FAIRY	**3.00**

*Can be used with cathode-ray tubes of other manufacture which have voltage requirements in the ranges listed on this page for the Type 580-A Power-Supply Unit.

TYPE 635-A ELECTRON OSCILLOGRAPH

This instrument is a complete cathode-ray oscillograph and power supply built into a single cabinet, thus combining simplicity and reliability of operation with low cost. The tube is of the high-vacuum type designed for electrostatic deflection of the beam. The oscillograph is readily portable and is ideal for use in the laboratory and in the field. For more information, see the following specifications and the June-July, 1933, General Radio *Experimenter*.





At the left is shown the complete TYPE 635-A Electron Oscillograph (tube and power supply mounted in one cabinet). The TYPE 635-P1 Cathode-Ray Tube itself is illustrated above

SPECIFICATIONS

Brilliance: Patterns are brilliant and are easily visible in daylight.

Photographs may be taken of single transits of the spot across the screen at velocities up to 11 inches per second, using verichrome-type film and an *f*./4.5 lens. Velocities twice as great can be recorded on supersensitive panchromatic film. (Accelerating potential, 1000 volts.)

Fluorescent Screen: Willemite, giving a green trace of excellent visual and good photographic brilliancy. Useful diameter of screen, 3 inches.

Voltage Sensitivity: Approximately 75 d-c volts per inch for one pair of deflecting plates and 100 d-c volts per inch for the other.

Impedance of Deflecting Plates: The capacitance across either pair of deflecting-plate terminals as measured at the panel of the oscillograph is from 35 $\mu\mu$f to 45 $\mu\mu$f.

Frequency Characteristic: Theoretically, there is no limit to the frequency which may be applied to the deflecting plates of the tube. Since the leads to the deflecting plates are not brought out separately but are brought out together through the base of the tube, interaction between these circuits results at high radio frequencies, causing an error in amplitude and phase. The actual resonant frequency of either deflecting-plate circuit is in the neighborhood of 45 Mc.

Tube Mounting: Cathode-ray tube and power supply are placed in a walnut carrying case, access to the tube being obtained by removing four thumbscrews.

Power Supply: All of the voltages necessary are obtained from the self-contained power supply which operates from the 110-volt, a-c line. *Anode Voltage*, remains fixed at 1000 volts. *Focusing Voltage*, adjustable between 0 and 300 volts either positive or negative by reversing the connections. *Cathode-heater supply*, 60 cycles, a-c; maximum of 2.5 volts and 2.2 amperes. Adjusted by means of a rheostat inside the cabinet. Supplied complete with ON-OFF switch and 7-foot attachment cord.

Terminals: Jack-top binding posts, mounted on the panel of the oscillograph as shown in the illustration.

Tube Life: The cathode-ray tube is guaranteed for 300 hours of operation or for six months, whichever comes first.

The guarantee is void if the tube is abused, handled carelessly, operated at voltages greater than those recommended in the instruction book, or used in any other than a General Radio Power-Supply Unit.

Rectifier Tube Required: One TYPE 143-D Rectifier Tube, supplied with the instrument.

Power Rating: 105-115 volts, 50-60 cycles; 25 watts.

Dimensions: (Height) 13½ x (width) 16 x (depth) 6¼ inches, over-all.

Net Weight: 19¼ pounds, including tubes.

Type	*Description*	*Code Word*	*Price*
635-A	**Electron Oscillograph**	CUPID	**$80.00**

REPLACEMENTS

Type	*Description*	*Code Word*	*Price*
635-P1	**Cathode-Ray Tube**	CURLY	**$20.00**
143-D	**Rectifier Tube**	FAIRY	**3.00**

TYPE 636-A WAVE ANALYZER

This harmonic analyzer can be considered as a wide-range, direct-reading voltmeter which responds to one very narrow band in the vicinity of any frequency between 20 and 16,000 cycles, as chosen by the 8-inch dial which is direct-reading in frequency. The analyzer contains a heterodyne oscillator, balanced modulator, and 50-kc quartz-crystal filter and amplifier. The voltmeter range is from less than one millivolt to two hundred volts by means of a multiplier switch and an external multiplier. The accuracy of the voltmeter reading is five per cent. The instrument has a high input impedance.

For more information, see the following specifications and the June-July, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Frequency Range: 20 to 16,000 cycles.

Voltage Range: 1 millivolt to 200 volts. The meter in conjunction with its multiplier has a full-scale range of 0.001, 0.002, 0.005, 0.010, 0.020, 0.050, 0.1, 0.2, 0.5, 1, and 2 volts. An external 100 to 1 multiplier is provided to increase the input impedance, and to extend the range to 200 volts. Range with multiplier, 0.1 volt to 200 volts.

Voltage Accuracy: Within 5% on all ranges except on the 1-mv and 2-mv (full-scale) settings of the multiplier switch where the accuracy is within 10%. Spurious voltages due to higher-order modulation products introduced by the detector are suppressed by at least 70 db.

Input Impedance: 100,000 ohms; 10 megohms with the external multiplier. The 100 to 1 external multiplier is well shielded and has such a high input impedance that the analyzer may be connected almost anywhere in a circuit without using series condensers or taking any other precautions usually necessary with harmonic analyzers.

Accuracy of Calibration: The frequency scale of the main tuning control is individually engraved and is approximately logarithmic over its full spread of almost 18 inches. For one year from the date of purchase, the calibration can be relied upon to within 2% when the analyzer has been carefully set to zero.

Selectivity: Discrimination, 40 db for 30 cycles separation; 60 db for 90 cycles.

Tubes Required: Three 41-type, two 78-type, and one 37-type tubes, supplied with the instrument.

Power Supply: The filament supply is obtained from a 6-volt storage battery by means of cable provided. The plate supply is obtained from three 45-volt Eveready No. 872 batteries or equivalent, space for which is provided in the lower compartment of the instrument. Batteries are not included in the price of the instrument.

Dimensions: (Height) 27¼ x (width) 21 x (depth) 12 inches, over-all.

Net Weight: 68½ pounds.

Type		*Code Word*	*Price*
636-A	.....	ABOVE	**$490.00***

*With tubes and multiplier, but without batteries.

METERS

TYPE 546-A MICROVOLTER

This instrument provides a convenient method for obtaining small, known audio-frequency voltages when a voltage large enough to be determined accurately is connected to the input. For more information, see the following specifications and the June-July, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Power Source: An oscillator capable of maintaining about 9 volts across 7000 ohms is connected to the input terminals and adjusted until the meter connected across the secondary of the input transformer indicates 2 volts, the "reference voltage." When this "reference voltage" is maintained at 2 volts, the *open-circuit* output voltage is given by the settings of the attenuator and two multiplier switches. Other reference levels produce proportional deviations in output voltage from the calibrated values.

Output Voltage Range: From 1 volt to 1 microvolt for a "reference voltage" of 2 volts.

Output Impedance: The internal output impedance of 200 ohms must be taken into account when supplying voltage to low-impedance loads.

Input Transformer: The transformer is designed to have a reasonably flat characteristic over the frequency range, but since it precedes the voltmeter, its losses do not enter into the measurements.

Accuracy: The following accuracy data represent the largest errors that will be encountered even under unfavorable conditions of operation. When voltage ratios only (and not absolute voltages) are being measured, the accuracy above 100 microvolts is within 2%, since it depends only on the accuracy of the attenuation networks. The error is somewhat greater for smaller output voltages. (See curves in the June-July, 1933, General Radio *Experimenter*.)

In absolute voltage measurements, the accuracy and frequency characteristics of the copper-oxide voltmeter must be taken into account. For output voltages greater than 100 microvolts, the error increases slightly with frequency, being less than

10 % at 1000 cycles,
12.5% at 5000 cycles,
17 % at 10,000 cycles.

Dimensions: (Length) 10 x (width) 7⅛ x (height) 5¾ inches, over-all.

Net Weight: 8⅜ pounds.

Type		*Code Word*	*Price*
546-A	.....	CROWN	**$70.00**

TRANSFORMERS

TYPE 541-D OUTPUT TRANSFORMER

Designed as an output transformer for use with two 2A3-type tubes in a balanced (push-pull) stage. For more information, see the following specifications and the April-May, 1933, General Radio *Experimenter*.

SPECIFICATIONS

Voltage Ratio: The voltage ratios from the whole of the primary to the three secondary taps are, respectively, 24:1, 33:1, and 47:1 for the taps marked 8, 4, and 2.

Frequency Range: The voltage ratio from 20 cycles to 12,000 cycles lies between 0 and —2 db of its value over the flat portion of the characteristic. At 10,000 cycles, the response is only 0.3 db below that at 400 cycles.

Load Impedance: The correct load impedance for the 2A3 tubes varies, depending whether fixed bias or self-bias is used. The following table shows the impedance ranges which may be connected to the various taps on the transformer secondary for both conditions of the tube bias.

Load Impedance		*Terminals to Which*
(Self-Bias)	*(Fixed Bias)*	*Load is Connected*
1.5– 3 ohms	1– 2 ohms	0–2
3 – 5.7 ohms	2– 4 ohms	0–4
5.7–12 ohms	4–10 ohms	0–8

Impedance Range: The transformer is designed for operation from an impedance of 1400-1500 ohms which is the equivalent of two 2A3-type tubes in push-pull. Actually, the transformer will operate over a range of 700 ohms to 2000 ohms with no appreciable change in the frequency characteristic.

Primary Winding: The average inductance of the whole primary is about 12 henrys for low signal volumes. At high signal levels, this inductance may be as high as 15 henrys. The approximate resistance of the whole primary winding is 65 ohms.

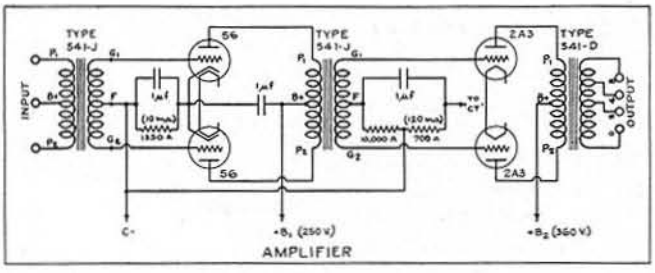
Secondary Winding: Tapped to match impedances from 1.5 to 12 ohms. The approximate resistance of the whole secondary winding is 0.5 ohm.

Mounting: The transformer is mounted in a standard Model B drawn-steel, wax-filled case shown on page 140.

Dimensions: (Length) 3⅛ x (width) 2 13/16 x (height) 4⅛ inches, over-all.

Net Weight: 3⅛ pounds.

Type		*Code Word*	*Price*
541-D	.....	TULIP	**$7.50**

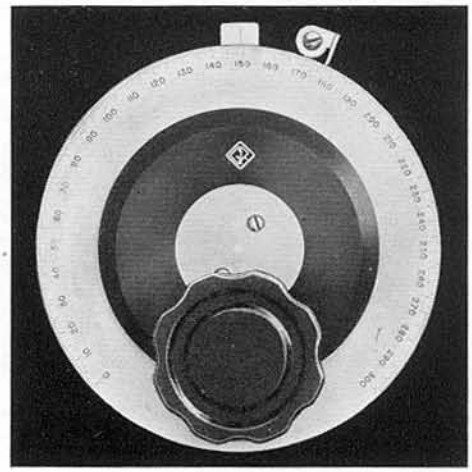


Typical high-quality audio amplifier circuit employing General Radio transformers and 2A3-type tubes. The TYPE 541-D Transformer is described above and the TYPE 541-J Transformer is listed on page 143

SWITCHES, DIALS, AND ACCESSORIES

TYPES 704 AND 706 PRECISION DIALS

These dials are for use wherever the dial setting must be determined with a high degree of accuracy. The scales are individually machine engraved, which results in very fine lines accurately spaced. The scale turns in the same direction as the slow-motion knob. An adapter is furnished which permits the dial to be installed on a ¼-inch or ⅜-inch shaft. Only one additional hole is necessary to mount the dial. An indicator is furnished with each dial. The TYPE 519-A Dial Lens (see page 153) may be used to make possible the reading of the dial to a higher degree of precision.



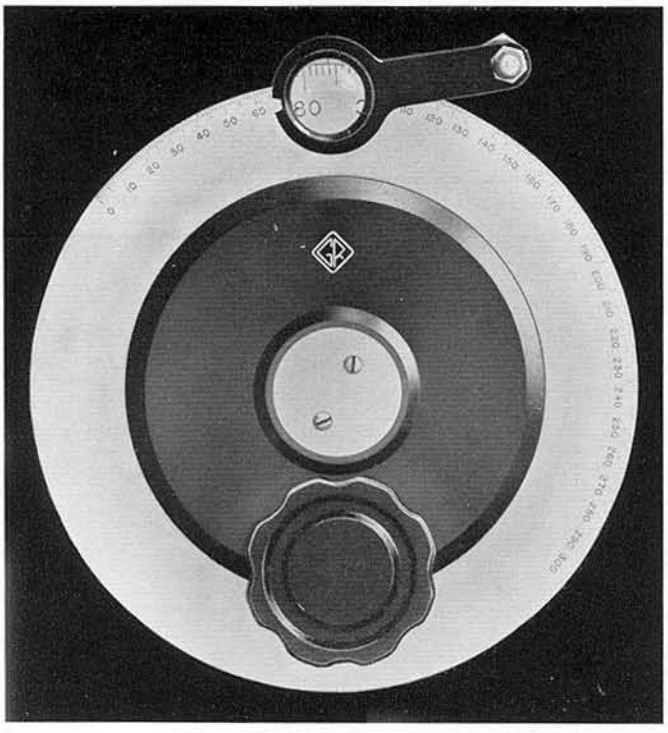
TYPE 704-D

● 4-INCH DIAMETER PRECISION DIALS

Type	*Dial* Arc	*Dial* Divisions	*Friction Drive Ratio*	*Net Weight*	*Code Word*	*Price*
704-C	**180°**	**200**	1:6	9 ounces	DABBY	**$7.50**
704-D	**270°**	**300**	1:6	9 ounces	DAIRY	**7.50**

● 6-INCH DIAMETER PRECISION DIALS

Type	*Dial* Arc	*Dial* Divisions	*Friction Drive Ratio*	*Net Weight*	*Code Word*	*Price*
706-C	**180°**	**300**	1:8	1 pound	DASHY	**$8.00**
706-D	**270°**	**450**	1:8	1 pound	DATUM	**8.00**

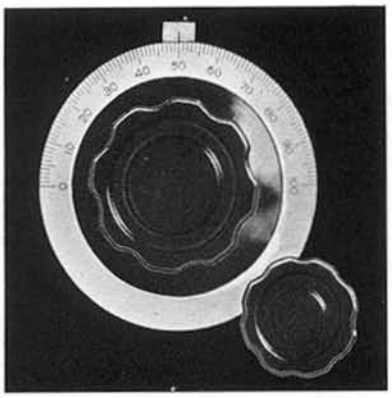


TYPE 706-C Precision Dial with TYPE 519-A Dial Lens

Illustrations ½ actual size.

Friction drive licensed under U. S. Patents 1,713,146 and 1,744,675

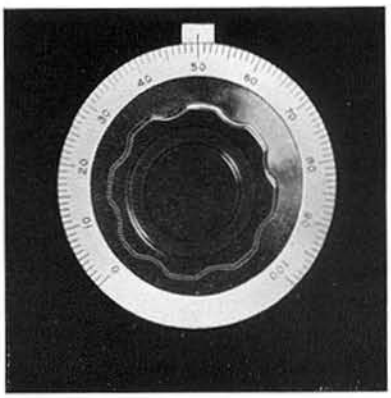
FRICTION-DRIVE AND PLAIN DIALS



TYPES 702-A and 702-F

The dials illustrated on this page are provided with the fluted, polished bakelite knobs described on the opposite page. The scales are photo-etched, nickel-silver, insulated from the shaft by the bakelite knob.

Two sizes are available, with or without friction drive, and with the scale spread over either 180° or 270°. An indicator and a drilling template are furnished with each dial.



TYPES 710-B and 710-G

● 2¾-INCH DIAMETER — TYPE 702 FRICTION-DRIVE DIALS

Type	*Shaft Diameter*	*Dial Arc*	*Dial Divisions*	*Friction-Drive Ratio*	*Net Weight*	*Code Word*	*Price*
702-A	¼ in.	180°	100	1:3.3	4 oz.	DIACK	$1.75
702-B	¼ in.	270°	100	1:3.3	4 oz.	DIBOG	1.75
702-F	⅜ in.	180°	100	1:3.3	4 oz.	DIFAG	1.75
702-G	⅜ in.	270°	100	1:3.3	4 oz.	DIGOD	1.75

● 2¾-INCH DIAMETER — TYPE 710 PLAIN DIALS

710-A	¼ in.	180°	100	.....	2½ oz.	DIALY	$1.00
710-B	¼ in.	270°	100	.....	2½ oz.	DIBIN	1.00
710-G	⅜ in.	270°	100	.....	2½ oz.	DIGUT	1.00

● 4-INCH DIAMETER — TYPE 703 FRICTION-DRIVE DIALS

703-A	¼ in.	180°	100	1:5	8 oz.	DIANT	$2.00
703-B	¼ in.	270°	200	1:5	8 oz.	DIBUT	2.00
703-F	⅜ in.	180°	100	1:5	8 oz.	DIFUN	2.00
703-G	⅜ in.	270°	200	1:5	8 oz.	DIGUM	2.00

● 4-INCH DIAMETER — TYPE 717 PLAIN DIALS

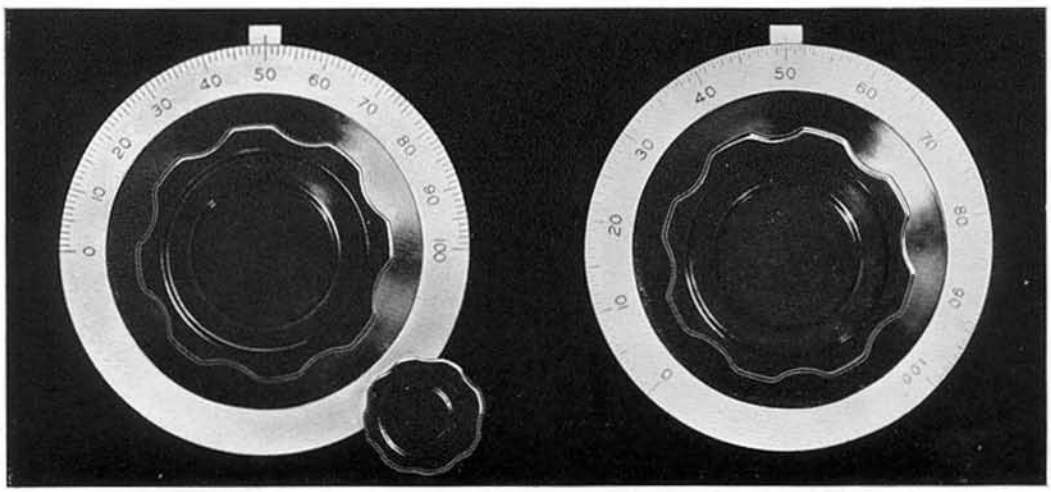
717-A	¼ in.	180°	100	.....	5 oz.	DIARM	$1.50
717-B	¼ in.	270°	200	.....	5 oz.	DIBAR	1.50
717-F	⅜ in.	180°	100	.....	5 oz.	DIFIT	1.50
717-G	⅜ in.	270°	200	.....	5 oz.	DIGAR	1.50

All illustrations ½ actual size

Friction drive licensed under U. S. Patents 1,713,146 and 1,744,675

TYPES 703-A and 703-F

TYPES 717-B and 717-G



TYPE 637 FLUTED KNOBS

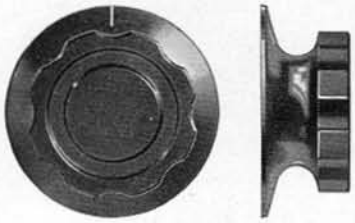
The newly designed knobs illustrated below are of polished black bakelite. All edges which come in contact with the fingers are rounded. Knobs are available with either a white pointer of non-conducting material, which may be pried off if desired, or with a wide-flanged skirt with a white engraved index line. All of these knobs have two setscrews to insure permanent setting of the knob on the shaft.

1⅛-INCH DIAMETER

Type	*Shaft Diameter*	*Net Weight*	*Code Word*	*Price*
637-A	¼ inch	½ ounce	NURLNOBANT	$0.25
637-B	⅜ inch	½ ounce	NURLNOBBOY	.25

1⅝-INCH DIAMETER

Type	*Shaft Diameter*	*Net Weight*	*Code Word*	*Price*
637-G	¼ inch	1 ounce	NURLNOBGUN	$0.35
637-H	⅜ inch	1 ounce	NURLNOBHAT	.35



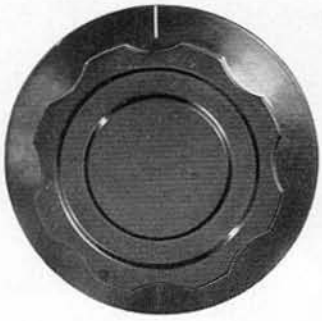
1⅝-INCH DIAMETER

Type	*Shaft Diameter*	*Net Weight*	*Code Word*	*Price*
637-J	¼ inch	2 ounces	NURLNOBJIM	$0.40
637-K	⅜ inch	2 ounces	NURLNOBKOP	.40

(Diameter of skirt, 2 1/16 inches)

2⅜-INCH DIAMETER

Type	*Shaft Diameter*	*Net Weight*	*Code Word*	*Price*
637-P	¼ inch	3 ounces	NURLNOBPIG	$0.40
637-Q	⅜ inch	3 ounces	NURLNOBQUO	.40



2⅜-INCH DIAMETER

Type	*Shaft Diameter*	*Net Weight*	*Code Word*	*Price*
637-R	¼ inch	4 ounces	NURLNOBRAM	$0.50
637-S	⅜ inch	4 ounces	NURLNOBSUM	.50

(Diameter of skirt, 3 inches)

All illustrations ½ actual size

TYPES 522-A, 318-A, AND 523-A DIAL PLATES

The metal dial plates illustrated below have photo-etched scales with raised nickel-silver markings on a flat black background. The screws supplied with the various General Radio rheostat-potentiometers hold the respective dial plates in place on the panel. TYPES 522-A and 318-A Dial Plates have twenty divisions and TYPE 523-A has fifty divisions. Complete specifications are given below.

TYPE 522-A

TYPE 318-A

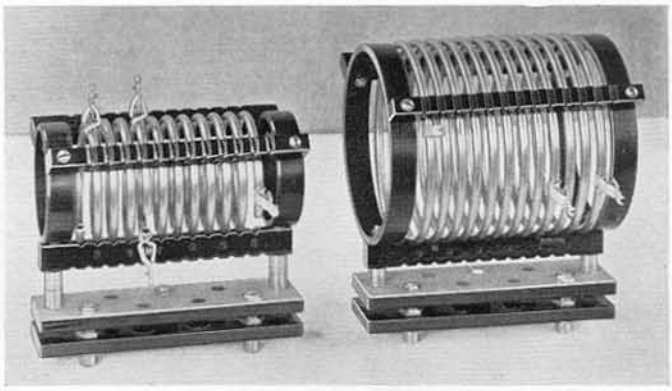
TYPE 523-A

SPECIFICATIONS

Type:	522-A	318-A	523-A
Divisions:	20 around 254°	20 around 303°	50 around 298°
For Use with these Rheostats:	TYPE 301-A TYPE 410-A	TYPE 214-A TYPE 314-A TYPE 333-A TYPE 371 TYPE 471-A	TYPE 214-A TYPE 314-A TYPE 333-A TYPE 371 TYPE 471-A
Suitable for Use with these Knobs:	TYPE 537-A TYPE 637-A TYPE 637-B	TYPE 137-D TYPE 537-B TYPE 537-J TYPE 637-G TYPE 637-H TYPE 637-J TYPE 637-K	TYPE 537-C TYPE 537-K
Dimensions:	See price list		
Net Weight:	½ ounce	1 ounce	1 ounce

Type	*Diameter*	*Code Word*	*Price*
522-A	2½ inches	DOGMA	$0.35
318-A	3 inches	DEVIL	.35
523-A	3½ inches	DOILY	.35

TYPE 679 INDUCTOR



TYPE 679-B TYPE 679-A

This plug-in inductor is wound with copper tubing on glazed porcelain supports and is suitable for use in power oscillators and amplifiers. Coupling windings can be wound on the outside of the supports by the user. Inductor is supplied complete with copper clips and three jumbo plugs in a porcelain plug base for use with TYPE 680-J Jack Base. Two sizes are available; see specifications.

	TYPE 679-A	TYPE 679-B
Turns	12	7 and 4
Number of sections	1	2
Inductance	10μh	2μh, 1.5μh
Clips supplied	3	4
TYPE *674-P Plugs supplied*	3	3
Outside diameter of coil	5¾ in.	3¼ in.
Length, over-all	7¼ in.	7¼ in.
Height, over-all	8½ in.	6¾ in.
Depth, over-all	6½ in.	4½ in.
Net weight	3⅛ lbs.	2⅜ lbs.

SPECIFICATIONS

Tubing: ¼-inch copper, nickel plated to prevent tarnish.

Mounting: The terminal plate of each inductor is fitted with three TYPE 674-P Plugs so that the whole unit may be plugged into a TYPE 680-J Jack Base. Four additional plugs may be added to terminal plate of inductor if desired. (See illustration.)

Type	*Code Word*	*Price*
679-A	CANAL	**$7.50 ***
679-B	CANDY	**6.50 ***

*Does not include TYPE 680-J Jack Base shown in illustration.

TYPE 680-J JACK BASE

This jack base is for use with the TYPE 679 Inductor, and is supplied complete with three jacks arranged to fit plug base of inductor. (See inductors above.)

SPECIFICATIONS

Jacks: Three TYPE 674-J Jacks are supplied.

Material: Moulded porcelain.

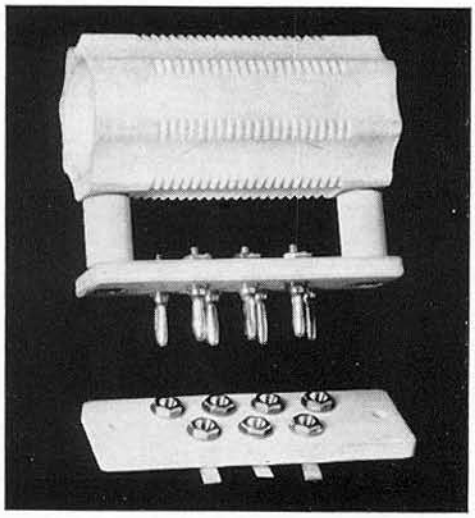
Mounting: Two holes are provided for mounting jack base on baseboard; four holes in porcelain base for additional TYPE 674-J Jacks. (See illustration.)

Dimensions: (Length) 7¼ x (width) 2¼ x (height) 1 inch, over-all.

Net Weight: 10 ounces.

Type	*Code Word*	*Price*
680-J	CANOE	**$1.25**

TYPE 677 INDUCTOR FORM ASSEMBLY



The TYPE 677-U Inductor Form is made of moulded porcelain having low losses. The coil is wound on six heavy ribs. Spacers, plug base, and jack base are available so that the inductor may be plugged into the circuit. The necessary machine screws, lead washers, and nuts are supplied with the TYPE 677-P1 Inductor-Form Spacers. Plugs and jacks are furnished with the plug base and jack base, respectively. A series of small holes along one of the ribs of the inductor form is provided in order to facilitate winding.

SPECIFICATIONS

Winding Dimensions: (Diameter) 2½ x (length) 3 inches, provided with 21 V-cut threads, permitting use of any wire size up to No. 10 B. & S. gauge.

Dimensions: TYPE 677-U Coil Form, (outside diameter) 2½ x (length) 4⅝ inches. TYPE 677-P1 Inductor Form Spacer, (diameter) 1 1/16 x (length) 1 inch. TYPE 678-P Plug Base, (length) 4¾ x (width) 1¾ x (height) 1⅜ inches, over-all (including plugs). TYPE 678-J Jack Base, (length) 4¾ x (width) 2 x (height) ⅝ inches, over-all (including jacks).

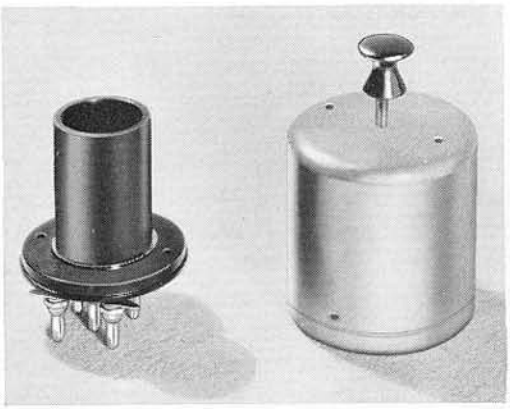
Net Weight: TYPE 677-U, 10 ounces. TYPE 677-P1 (per pair), 2 ounces. TYPE 677-P, 4 ounces. TYPE 677-J, 4 ounces.

Type	*Description*	*Code Word*	*Price*
677-U	**Coil Form**	MIMIC	**$0.35**
677-P1	**Coil Form Spacer** (2 Required)	MINIM	**.30** (for two)
678-P	**Plug Base** with 7 TYPE 274-P Plugs	MINOR	**.70**
678-J	**Jack Base** with 7 TYPE 274-J Jacks	MINNY	**.65**

TYPE 177 INDUCTOR FORM AND SHIELD

Although originally designed for use with TYPE 661 Unit Panels, the TYPE 177-B Inductor Form and the TYPE 177-K Shield are generally useful for winding high-frequency inductors.

The inductor form is moulded bakelite and, to provide large contact area, is supplied with eight TYPE 274-P Plugs any of which may be removed when not required by the circuit. The aluminum shield is in two parts as shown in the illustration. The inductor form can be used with or without the TYPE 177-K Shield in the TYPE 661-P10 Jack Base.



TYPE 177-B Inductor Form and TYPE 177-K Shield

SPECIFICATIONS

Dimensions: TYPE 177-B Inductor Form, (diameter) 2 5/16 x (length) 3 inches, over-all (including plugs). TYPE 177-K Shield, (diameter) 2 1/2 x (length) 2 3/4 inches, over-all.

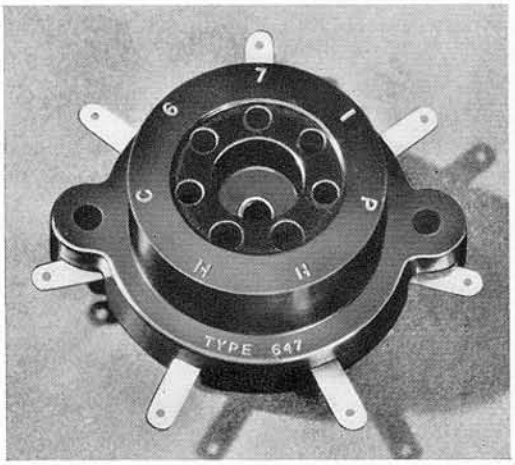
Winding Form Dimensions: (Length) 1 3/4 x (diameter) 1 1/4 inches.

Net Weight: TYPE 177-B, 2 ounces. TYPE 177-K, 2 ounces.

The above assembly for use with TYPE 661 Unit Panels (see page 216) consists of the TYPE 177-B Inductor Form, the TYPE 177-K Shield and a TYPE 661-P11 Cover Plate. Many uses for this inductor form will suggest themselves

Type	*Description*	*Code Word*	*Price*
177-B	**Inductor Form (with 8 plugs)**	INDUCTBOAT	**$0.85**
177-K	**Shield**	INDUCTKEMP	**.65**

VACUUM-TUBE SOCKETS



Seven-prong sockets are now available for both the small and the medium 7-pin bases. The sockets are of moulded bakelite and are equipped with soldering-lug terminals as shown in the illustration. A center mounting hole is provided in addition to the two outer ones. (The price of the TYPE 444 Small 6-Prong Socket has been reduced. See price list below.)

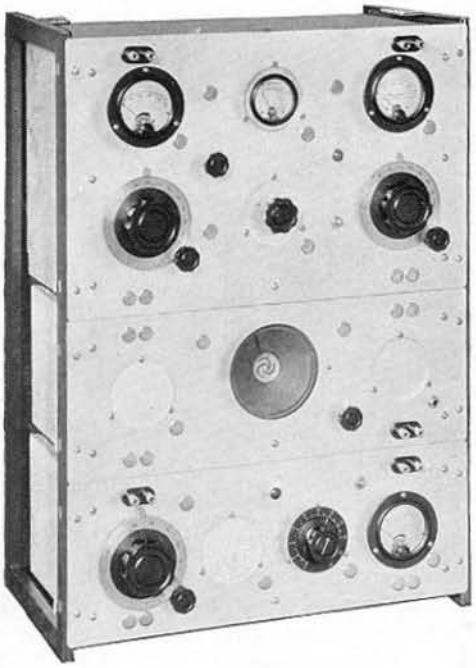
SPECIFICATIONS

Dimensions: (Diameter) 2 1/2 inches, (height) 7/8 inch, over-all.

Net Weight: 2 ounces.

Type	*Description*	*Code Word*	*Price*
444	**Small 6-prong**	NOVEL	**$0.40**
647-A	**Small 7-prong**	GIPSY	**.40**
647-B	**Medium 7-prong**	GUNNY	**.40**

TYPE 661 UNIT-PANEL EQUIPMENT



SPECIFICATIONS

Dimensions: TYPE 661-P10 Jack Base, (length) 3¼ x (width) 3 x (height) 1 inch, over-all, exclusive of the 3⅛-inch spacers provided for panel mounting.
Net Weight: TYPE 661-P10 Jack Base, 6 ounces.

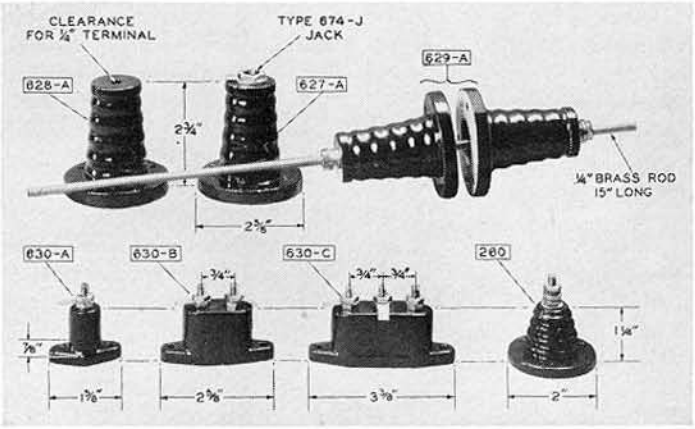
The General Radio Company has available relay-rack unit-panel equipment and associated apparatus to enable transmitters, receivers, and experimental setups to be assembled at will. When the assembly no longer is needed, the equipment can be easily disassembled and converted into another setup without disfiguring any of the apparatus. Plenty of ½-inch holes and mounting plates are provided so that almost any conceivable layout may be accommodated. This equipment is intended for use by amateurs, but is readily adapted to laboratory and other needs.

If you are interested in such apparatus, write for Bulletin No. 935-G, which describes completely this new equipment. For convenience, code words and prices are listed below.

Specifications are given here for the TYPE 661-P10 Jack Base because it can be used in conjunction with TYPE 177-B Inductor Form and the TYPE 177-K Shield. (See page 214.)

Type	*Description*	*Code Word*	*Price*
660-A	Universal Relay Rack	NINNY	$5.00
661-A	Unit Panel	UNIPANALLY	6.00
661-B	Unit Panel	UNIPANBOAT	4.00
661-C	Unit Panel (with speaker)	UNIPANCOMB	8.00
661-K	End- and Base-Plate Assembly	UNIPANKEMP	5.00
661-L	End- and Base-Plate Assembly	UNIPANLOUT	4.00
661-R	Dust Cover	UNIPANREAM	2.00
661-S	Dust Cover	UNIPANSOUP	1.50
661-P1	Blank Mounting Disc	UNIPANPART	.15
661-P2	Three-Hole Mounting Disc	UNIPANPERK	.20
661-P3	Adaptor Disc	UNIPANPIKE	.20
661-P4	Snap Button	UNIPANPOLE	2 for .05
661-P5	Panel Clamp	UNIPANPUNT	2 for .20
661-P6	Mounting Spacer	UNIPANSPAC	6 for .10
661-P7	Dial Indicator	UNIPANPAIL	.25
661-P8	⅜-in. Bushing	UNIPANPINT	4 for .10
661-P9	7/16-in. Bushing	UNIPANPROW	3 for .10
661-P10	Jack Base	UNIPANBASE	1.50
661-P11	Cover Plate	UNIPANPILE	.20

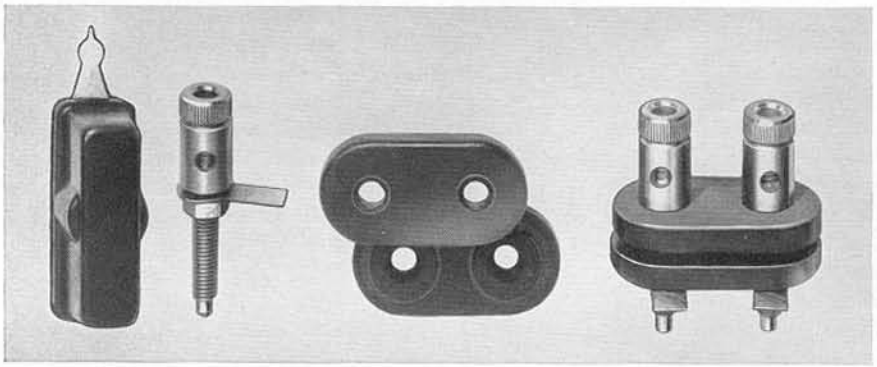
PORCELAIN INSULATORS



Type	*Description*	*Net Weight*	*Code Word*	*Price*
628-A	**Insulator**	6 ounces	MEDAL	**$0.30**
627-A	**Jack-Top Insulator**	7 ounces	MAYOR	**.60**
629-A	**Lead-In Assembly**	14 ounces	MERCY	**.90**
630-A	**Single-Terminal Stand-Off Insulator**	2 ounces	EDUCE	**.10**
630-B	**Double-Terminal Stand-Off Insulator**	3 ounces	EGRET	**.20**
630-C	**Triple-Terminal Stand-Off Insulator**	4 ounces	EJECT	**.25**
260	**Wall Insulator**	2 ounces	CONIC	**.20**

All insulator assemblies are supplied with wood screws and the lead washers so necessary to prevent breakage.

KNOBS AND PANEL TERMINAL INSULATORS



TYPE 202-Y
TYPE 202-Z
Switch Knob

TYPE 138-VD
Binding Post

TYPE 274-Y
TYPE 274-Z
Panel Terminal Insulators

TYPE 274-Y Panel Terminal Insulators with TYPE 138-VD Binding Posts

Type	*Description*	*Code Word*	*Price*
202-Y	**Switch Knob (⅜-inch shaft)**	SWITCHARMY	**$0.40**
202-Z	**Switch Knob (¼-inch shaft)**	SWITCHBURG	**.40**
138-VD	**Long-Shank Binding Post (10-32)** (For use with Panel-Terminal Insulators)	STANPARFUN	**.20**
274-Y	**Black Bakelite Panel Terminal Insulators**	STANPARBEL	**.16 per pair**
274-Z	**Low Loss (Yellow) Bakelite Panel Terminal Insulators**	STANPARHOD	**.24 per pair**

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