APPARATUS • PARTS
ACCESSORIES

FOR
RADIO SERVICE MEN
AMATEURS
EXPERIMENTERS
SOUND TECHNICIANS
CUSTOM SET BUILDERS

BULLETIN 933
MAY, 1931

GENERAL RADIO COMPANY
OFFICES • LABORATORIES • FACTORY
CAMBRIDGE A, MASSACHUSETTS
PACIFIC COAST WAREHOUSE
274 BRANNAN STREET
SAN FRANCISCO • CALIFORNIA
How to Obtain
General Radio Apparatus

The General Radio Company's established policy of direct distribution brings you every advantage

INTELLIGENT SERVICE — A competent personnel, as familiar with your problems as it is with the General Radio line, is maintained to see that your order receives intelligent attention.

BETTER DELIVERIES — Complete stocks of all of the standard items described in this bulletin are maintained at the factory in Cambridge, Massachusetts, and at our Pacific Coast Warehouse in San Francisco. Most shipments are made the same day the order is received, seldom later than 24 hours thereafter.

FAIR PRICES — The fact that all list prices are the true net prices means that you pay the same price as anyone else, which explains, incidentally, why jobbers and dealers do not handle General Radio parts and accessories. Our one-price policy brings you added assurance that the low prices of General Radio apparatus have been obtained without sacrificing the quality of the engineering design, workmanship, or materials.

==

IMPORTANT

We endeavor to ship within 24 hours after receiving your order. Address the office nearest you.

We prepay the transportation charges to any point in the United States or Canada if full payment accompanies your order.

Be sure your order states clearly what you want. As a precaution against errors, include the name and range or size of each item as well as the type number.

GENERAL RADIO COMPANY
Offices + Laboratories + Factory
CAMBRIDGE A, MASSACHUSETTS

Pacific Coast Warehouse: 274 Brannan Street, San Francisco, California
FOREWORD

The General Radio Company was founded in 1915 to manufacture laboratory apparatus. The list of items included, in addition to the more technical ones, such articles as vacuum-tube sockets, rheostats, etc. With the advent of broadcasting these latter articles became in great demand.

Distribution was originally on a direct to the consumer basis. We found it necessary to accede to the changed conditions and raised our prices so that distribution could be through the jobber and dealer channels.

With the development of complete receivers the use of the separate parts became confined largely to the engineer experimenter, either in his professional activities or as a hobby. This class of consumer enjoyed a trade discount because he did not require the services of a retail dealer. In effect, therefore, list prices were fictitious since they were made large enough to permit a discount to engineer buyers.

With the more limited use of radio component parts, jobbers did not always find it economical to carry the full list of items required by the experimenter. This was particularly true with such a complete and diversified line as that of the General Radio Company.

In order that our engineer customers might obtain those items they desired with a minimum of inconvenience, we discontinued the sale of our products through jobbers and dealers on July 1, 1928. Instead, we arranged a plan of prompt shipment on a factory to consumer basis. We carry adequate stocks and maintain an engineering staff at Cambridge to handle technical correspondence.

Prices were all revised downward, so as to give all customers the advantage of a dealer discount. The prices as they now appear in this bulletin are, therefore, strictly net and are not subject to discount.

Unless credit has been established, all shipments are made on a C. O. D. basis. While prices are F. O. B. our factory at Cambridge, Massachusetts, or from our San Francisco, California, warehouse, we prepay transportation charges on United States and Canadian shipments whenever cash accompanies the order.

Prices have been revised to April 1, 1931, but are subject to change without notice. Shipment will, however, not be made at higher prices than those given in an order without further confirmation.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR CONDENSERS</td>
<td>3</td>
</tr>
<tr>
<td>VOLUME-CONTROL DEVICES</td>
<td>7</td>
</tr>
<tr>
<td>RHEOSTATS AND POTENTIOMETERS</td>
<td>10</td>
</tr>
<tr>
<td>EXPERIMENTAL INDUCTORS</td>
<td>14</td>
</tr>
<tr>
<td>TUNING-FORK AND MICROPHONE-BUTTON OSCILLATORS</td>
<td>16</td>
</tr>
<tr>
<td>COUPLING DEVICES</td>
<td>17</td>
</tr>
<tr>
<td>POWER TRANSFORMERS</td>
<td>22</td>
</tr>
<tr>
<td>RECTIFIER FILTERS</td>
<td>23</td>
</tr>
<tr>
<td>ACCESSORIES</td>
<td>23</td>
</tr>
<tr>
<td>AMATEUR FREQUENCY STANDARDS</td>
<td>25</td>
</tr>
<tr>
<td>SERVICE-TESTING INSTRUMENTS</td>
<td>27</td>
</tr>
<tr>
<td>METERS</td>
<td>33</td>
</tr>
<tr>
<td>RELAYS, SWITCHES, AND MISCELLANEOUS ACCESSORIES</td>
<td>44</td>
</tr>
</tbody>
</table>
GENERAL-PURPOSE AIR CONDENSERS

These condensers have frictionless hard-rubber end plates. All models are counter-weighted.

**TYPE 247-4**

-Patent No. 1,929,393

All condensers with frictionless plates are manufactured under U.S. Patent No. 1,929,393.

Well designed and assembled in U.S. and Canada. This makes the correct mechanical assembly convenient and still allows the use of a small amount of material and table mounting.

Variable high-resistance, vacuum, and frequency-plates, and for panel construction and for general experimental use, where accurate calibration is desired. In this section are listed condensers for radio receiver and transmitter.
GENERAL RADIO COMPANY

UNMOUNTED Models

UNMOUNTED models are similar except that panels, cases, and dials are not supplied, and rotor plates are straight-line wavelength.


<table>
<thead>
<tr>
<th>Type</th>
<th>Capacitance</th>
<th>Depth</th>
<th>Weight</th>
<th>Code</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>247-F</td>
<td>500 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>COCOA</td>
<td>$3.00</td>
</tr>
<tr>
<td>247-H</td>
<td>500 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>COMIC</td>
<td>3.75</td>
</tr>
<tr>
<td>247-N</td>
<td>350 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>ABASE</td>
<td>2.75</td>
</tr>
<tr>
<td>247-P</td>
<td>350 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>ABBET</td>
<td>3.50</td>
</tr>
<tr>
<td>247-K</td>
<td>250 μf</td>
<td>4 in.</td>
<td>1 3/4 lb.</td>
<td>CARGO</td>
<td>2.50</td>
</tr>
<tr>
<td>247-M</td>
<td>250 μf</td>
<td>4 in.</td>
<td>1 lb.</td>
<td>CIGAR</td>
<td>3.25</td>
</tr>
</tbody>
</table>

TYPE 334 VARIABLE AIR CONDENSERS

LOW-VOLTAGE Models

THESE condensers have stamped metal end plates. The various models are either counterweighted or balanced, as specified in the price list.

Range: See price list.
Rotor Plates: Straight-line wavelength.
Insulation: Hard-rubber plates.
Maximum Voltage: 500 volts, peak.

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacitance</th>
<th>Depth</th>
<th>Weight</th>
<th>Code</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>334-F</td>
<td>500 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>BEGIN</td>
<td>$3.25</td>
</tr>
<tr>
<td>334-H</td>
<td>500 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>BEILAY</td>
<td>4.00</td>
</tr>
<tr>
<td>334-N</td>
<td>350 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>BISSET</td>
<td>3.00</td>
</tr>
<tr>
<td>334-P</td>
<td>350 μf</td>
<td>4 1/4 in.</td>
<td>1 3/4 lb.</td>
<td>BERYL</td>
<td>3.50</td>
</tr>
<tr>
<td>334-K</td>
<td>250 μf</td>
<td>3 3/4 in.</td>
<td>1 lb.</td>
<td>BELOW</td>
<td>2.75</td>
</tr>
<tr>
<td>334-M</td>
<td>250 μf</td>
<td>3 3/4 in.</td>
<td>1 3/4 lb.</td>
<td>BERYL</td>
<td>3.50</td>
</tr>
</tbody>
</table>
**Type 382 Variable Air Condenser**

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>0.00</td>
<td>382</td>
<td>1000</td>
</tr>
<tr>
<td>90a</td>
<td>0.005</td>
<td>384</td>
<td>3.3</td>
</tr>
<tr>
<td>90f</td>
<td>0.05</td>
<td>386</td>
<td>5.5</td>
</tr>
<tr>
<td>90s</td>
<td>0.06</td>
<td>388</td>
<td>0.06</td>
</tr>
<tr>
<td>90c</td>
<td>0.06</td>
<td>500</td>
<td>0.06</td>
</tr>
<tr>
<td>90m</td>
<td>0.06</td>
<td>600</td>
<td>0.06</td>
</tr>
</tbody>
</table>

- **Dimensions:** Panel space, 8 1/2 x 8 1/2 in.
- **Mounting:** End-in-back plate.
- **Maximum Capacity:** 600 volts, peak.
- **Finish:** Straight-line capacitance.
- **Drive:** No vernier gears can be supplied.
- **Price:** See price list.

Below the 0.00 code, all types of the type 382 variable air condensers are similar to the type 382 variable air condensers except that the color plate are not to give a straight-line-frequency variation. The two single-section models are not connected to the type 382 variable air condensers, these condensers are similar in construction to the type 382 variable air condensers.

**Type 34 Variable Air Condensers**

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>0.00</td>
<td>34</td>
<td>1000</td>
</tr>
<tr>
<td>90a</td>
<td>0.005</td>
<td>344</td>
<td>3.3</td>
</tr>
<tr>
<td>90f</td>
<td>0.05</td>
<td>346</td>
<td>5.5</td>
</tr>
<tr>
<td>90s</td>
<td>0.06</td>
<td>348</td>
<td>0.06</td>
</tr>
<tr>
<td>90c</td>
<td>0.06</td>
<td>540</td>
<td>0.06</td>
</tr>
<tr>
<td>90m</td>
<td>0.06</td>
<td>640</td>
<td>0.06</td>
</tr>
</tbody>
</table>

- **Dimensions:** Panel space, 8 1/2 x 8 1/2 in.
- **Mounting:** End-in-back plate.
- **Maximum Capacity:** 600 volts, peak.
- **Finish:** Straight-line capacitance.
- **Drive:** No vernier gears can be supplied.
- **Price:** See price list.

High-Voltage Condensers

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TYPE 556 AMATEUR-BAND CONDENSER

This condenser has been designed for use in short-wave receivers and frequency meters where it is desired to spread a narrow band of frequencies over the whole 180° of the condenser scale. The spreading out is accomplished by giving the condenser a large value of zero capacitance. Three of the five rotor plates are complete circles, so that, in effect, the unit consists of a fixed condenser and a variable condenser in parallel. The circular plates also serve to shield the unit from "hand capacitance."

The capacitance values are such that, when the condenser is used in a dynatron-oscillator circuit, it will easily span the 3300 kc. to 4000 kc. amateur band with an approximately straight-line-frequency variation. By moving the outside circular rotor plate, which is held to the shaft by a collar and setscrew, it is possible to adjust the zero capacitance and, therefore, the frequency ratio over a considerable range.

This condenser supersedes the TYPE 557 Amateur-Band Condenser.

**Rotor Plates:** Three circular (360°) and two plates cut to give an approximately straight-line-frequency variation.

**Insulation:** Hard-rubber supports.

**Maximum Voltage:** 3500 volts, peak.

**Figure of Merit:** 0.03 x 10⁻¹².

**Mounting:** Unmounted model only. Supplied with mounting screws and drilling template. No counterweight is required for this condenser.

**Dimensions:** Panel space, 3 3/4 x 3 3/4 inches. "Depth" in the price list gives overall distance that the unit extends behind the panel.

<table>
<thead>
<tr>
<th>Capacitance</th>
<th>Code</th>
<th>Weight</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Max.</td>
<td>Min.</td>
<td>Depth</td>
</tr>
<tr>
<td>556</td>
<td>81 μf</td>
<td>53 μf</td>
<td>2 1/8 in.</td>
</tr>
</tbody>
</table>

TYPE 368 VARIABLE AIR CONDENSERS

These condensers are useful as balancing or vernier condensers in various vacuum-tube circuits, and many amateurs use them for tuning condensers on their receivers for the high-frequency (short-wave) bands. They have a single hard-rubber end plate, single bearing, and single-hole mounting as well as baseboard mounting.

**Rotor Plates:** Straight-line capacitance (semi-circular).

**Insulation:** Single hard-rubber end plate.

**Maximum Voltage:** 500 volts, peak.

**Drive:** TYPE 137-J Knob. No vernier.

**Finish:** Unmounted only.

**Dimensions:** Panel space, 2 inches diameter. Depth, see price list.

<table>
<thead>
<tr>
<th>Capacitance</th>
<th>Code</th>
<th>Weight</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Max.</td>
<td>Min.</td>
<td>Depth</td>
</tr>
<tr>
<td>368-A</td>
<td>15 μf</td>
<td>4 μf</td>
<td>1 1/4 in.</td>
</tr>
<tr>
<td>368-B</td>
<td>50 μf</td>
<td>4 μf</td>
<td>2 in.</td>
</tr>
<tr>
<td>368-C</td>
<td>100 μf</td>
<td>4 μf</td>
<td>2 1/4 in.</td>
</tr>
</tbody>
</table>
B ECAUSE so many factors affect the design and manufacture of volume controls and because the voice-frequency transmission, recording, and projection industries have grown so rapidly, engineers responsible for specifying and installing these devices have had to contend with whatever has been available on the market. The General Radio Company has been studying the requirements of the field and has completed the development of units that meet the most rigid and exacting service requirements. Full details are given in this section. The new line includes regular volume controls, mixing controls, and faders for sound projection.

There are three primary factors to be considered when specifying volume controls of any kind:

1. The values of terminal impedances, which the network must match to minimize reflection losses and the frequency discrimination resulting therefrom.

2. The range of attenuation that the volume control must have and the amount of attenuation per step.

3. The type of section (whether voltage divider, L-type, T-type, H-type, etc.) which involves the considerations mentioned in (a) as well as the possibility of crosstalk resulting from line imbalances to ground. The construction of each of these different sections is illustrated schematically in the accompanying diagrams.
Other conditions which a good volume control must meet include: rugged mechanical design, ease of operation, freedom from reactance and stray admittances in the network, reasonable shielding from electrical disturbances and from dust, freedom from contact and switch noise. The latter is most frequently overlooked, probably because volume controls built from modified radio rheostats have been the cheapest and easiest to secure. (The General Radio Company’s experience with sliding contacts on wire justifies the belief that they have no place in a high-grade permanent installation. We can, however, supply them.)

**Type 598-A Fader**

This fader is as rugged in construction, convenient to operate, and free from contact noise and service troubles as good workmanship and material can make it. The mounting and switching mechanism will withstand an indefinite amount of ordinary use. The instrument can be supplied either with or without a dummy control. If a dummy control is used, there is no appreciable backlash between the dial of the dummy and master units, because the connecting drive is direct and involves no gears. The resistance units and contacts are carefully shielded to protect them from electrical disturbances and dust.

*Range: Fifteen steps on each side of zero, with 2 or 3 decibels per step as specified.*

*Type of Winding: Unifilar winding on bakelite cards.*

*Accuracy of Adjustment: Resistors adjusted to within 0.5 percent.*

*Type of Section: Modified T-type.*

*Terminal Impedances: 200 or 500 ohms terminal impedance are the most usual. Can be built for any terminal impedance specified.*

*Frequency Error: The above-mentioned accuracy holds to at least 10 kc.*

*Finish: Crackle-finish cast aluminum with an engraved bakelite terminal plate and specially engraved scale with large numerals.*

<table>
<thead>
<tr>
<th>Type</th>
<th>Power Level Range</th>
<th>Section</th>
<th>Impedance</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>598-A</td>
<td>To Order</td>
<td>Modified T</td>
<td>To Order</td>
<td>...</td>
<td>On Request</td>
</tr>
</tbody>
</table>

† As shown on page 7.

**Type 552 Volume Controls**

These units have been designed primarily to meet the voice-circuit requirements of high-grade broadcast transmission, sound recording and projection, and public-address equipment. Because of their accuracy, excellent frequency characteristics, and compactness, they will be found to be very useful for laboratory work in circuits where highly precise attenuation networks are not necessary.

Three types of section, the L, T, and Balanced-H, are available. The L-type should be used when it is desired to maintain the impedance constant in one direction only as the attenuation is varied, the T-type for constant impedance both ways from the attenuator, and the Balanced-H-type for constant impedance both ways and when the transmission circuit is to be balanced to ground.

The units are assembled so that clockwise rotation of the switch reduces the attenuation. The scale is engraved for each step from 20 to 0 with decreasing numbers in the clockwise
(continued on following page)

Termination Impedance: See price list.

All resistors are adjusted to within ± 0.5% of rated value.

Dissipation limits are within 85% of rated value.

1 db at all settings.

Type of Mounting: Either on limh base/guards or attacked by no more than 3 db at all settings.

Preference Error: The attenuation is in 0 to 30 db range in 5 steps of 1.5 db.

Type 225-HF

Type 225-V

Refer to panel hold the scale to the panel.

Randy mounting is accomplished by using the clamps attached to the panel.

Electronic control and will decrease wear considerably.

No side-wire contacts are used. This increases the reliability of the unit at the same time.

No blanking is provided for blanking of elements. This will not interfere in any way with the operation of the control. The input is located on the control and the output is located on the control. These contacts have been a consistent duty for years. They are made of simple construction. Step-by-step controls allow more manipulation of the control settings easily possible. Stop-by-step controls also have more manipulation of the control settings easily possible. Stop-by-step controls allow more manipulation of the control settings easily possible.

The scale readings are determined by the attenuation factor. The scale readings are determined by the attenuation factor.
<table>
<thead>
<tr>
<th>Type</th>
<th>Attenuation</th>
<th>Section</th>
<th>Impedance</th>
<th>Depth</th>
<th>Weight</th>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>553-LA</td>
<td>30 db in steps of 1.5 db</td>
<td>L</td>
<td>50 ohms</td>
<td>2 1/2 in.</td>
<td>1 1/4 lbs.</td>
<td>AFIRE</td>
<td>$28.00</td>
<td></td>
</tr>
<tr>
<td>553-LB</td>
<td>30 db in steps of 1.5 db</td>
<td>L</td>
<td>200</td>
<td>2 1/2 in.</td>
<td>1 1/4 lbs.</td>
<td>AFTER</td>
<td>$28.00</td>
<td></td>
</tr>
<tr>
<td>553-LC</td>
<td>30 db in steps of 1.5 db</td>
<td>T</td>
<td>500</td>
<td>3 in.</td>
<td>2 lbs.</td>
<td>AHEAD</td>
<td>$28.00</td>
<td></td>
</tr>
<tr>
<td>553-TB</td>
<td>30 db in steps of 1.5 db</td>
<td>T</td>
<td>200</td>
<td>3 in.</td>
<td>2 lbs.</td>
<td>ALDEN</td>
<td>$34.00</td>
<td></td>
</tr>
<tr>
<td>553-TC</td>
<td>30 db in steps of 1.5 db</td>
<td>T</td>
<td>500</td>
<td>3 1/2 in.</td>
<td>3 lbs.</td>
<td>ALARM</td>
<td>$34.00</td>
<td></td>
</tr>
<tr>
<td>553-HB</td>
<td>30 db in steps of 1.5 db</td>
<td>Balanced-H</td>
<td>200</td>
<td>5 1/2 in.</td>
<td>3 lbs.</td>
<td>ALBUM</td>
<td>$48.00</td>
<td></td>
</tr>
<tr>
<td>553-HC</td>
<td>30 db in steps of 1.5 db</td>
<td>Balanced-H</td>
<td>500</td>
<td>5 1/2 in.</td>
<td>3 lbs.</td>
<td>AGAIN</td>
<td>$48.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: These items are carried in stock. Units having detent contacts or different values of terminal impedance and attenuation per step can be built to order.

**Type 553 Volume Controls**

These are similar in general construction to the Type 552 Volume Controls. They are designed for transferring the amplifying system, or fading, between two microphones or phonograph pickup units, at the same time making available a volume control for the unit in use. A range of 30 db in level is available in 2-db steps.

The network used is the usual Modified-T-type. With this network the output impedance varies from 30 per cent. low to 20 per cent. high from the specified impedance value when going from minimum to maximum setting of the switch. At the same time the input impedance from the pickup or microphone is varying from 0 error to 27 per cent. low from the specified impedance. These errors, unavoidable in this type of network, are not sufficient to interfere with the performance of the pickup system.

Range: 0 to 30 db in 15 steps of 2 db each on each side of zero.

Frequency Error: A maximum error of ±0.2 db is maintained at all settings up to 20 kilocycles.

Type of Winding: Same as Type 552 Volume Controls.

Accuracy of Adjustment: 552 Volume Controls.

Terminal Impedance: Dimensions: Same as Type 552.

**Rheostats and Potentiometers**

The ruggedness of these units makes them ideal for general-purpose resistance controls, especially for filament rheostats and volume controls in apparatus using vacuum tubes. Wire is wound on non-absorbent strips which are held in place on bakelite bases.

Their flexibility is an important feature in experimental work. All (except Type 410, which is for panel mounting only) may be mounted either on table or panel. When panel-mounted, the resistance of all rheostats decreases for clockwise rotation of the control knob; when table-mounted, the resistance of all rheostats but one decreases for counterclockwise rotation, but it is an easy matter to reverse the connections if necessary. Potentiometers used as rheostats

*Type 214, 50-ohm Rheostat.
TYPE 87+ PNEUMATICS

### Maximum Power Distribution

- 15 Wells

### Linear Modes

- 10'00'0
- 10'00'1
- 10'00'2
- 10'00'3

### Linearization

- Standard linearization
- Approximate proportional

### Resistance

- All resistances are wound to within 10% of specified values.
- When the square of an angle equals 80°, the actual angle of rotation is proportional to any setting along the linear strip.
- The Type 87+ Potentiometer is wound on a tapered strip, the slope of which is proportional to the angle of rotation, and, of course, the greater the total resistance, the larger the winding.

### Current Carrying Capacities

- Current carrying capacities are limited by allowable heat dissipation in the terminal.
TYPE 371-T

TYPE 371

PANEL-MOUNTING MODELS

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Resistance</th>
<th>Maximum Current</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>214-A</td>
<td>0.75 ohm</td>
<td>4 amperes</td>
<td>SHINY</td>
<td>$1.50</td>
</tr>
<tr>
<td>214-A</td>
<td>2 ohms</td>
<td>2.5 &quot;</td>
<td>RUDDY</td>
<td>1.50</td>
</tr>
<tr>
<td>214-A</td>
<td>7 &quot;</td>
<td>1.3 &quot;</td>
<td>RURAL</td>
<td>1.50</td>
</tr>
<tr>
<td>214-A</td>
<td>20 &quot;</td>
<td>0.75 ampere</td>
<td>RAZOR</td>
<td>1.50</td>
</tr>
<tr>
<td>214-A</td>
<td>50 &quot;</td>
<td>0.50 &quot;</td>
<td>RAPID</td>
<td>1.50</td>
</tr>
<tr>
<td>214-A</td>
<td>2500 &quot;</td>
<td>70 milliamperes</td>
<td>SYRUP</td>
<td>2.00</td>
</tr>
</tbody>
</table>

TABLE MOUNTING MODELS

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Resistance</th>
<th>Maximum Current</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>214-B</td>
<td>0.75 ohm</td>
<td>4 amperes</td>
<td>SILLY</td>
<td>$1.50</td>
</tr>
<tr>
<td>214-B</td>
<td>2 ohms</td>
<td>2.5 &quot;</td>
<td>RUMOR</td>
<td>1.50</td>
</tr>
<tr>
<td>214-B</td>
<td>7 &quot;</td>
<td>1.3 &quot;</td>
<td>RUSTY</td>
<td>1.50</td>
</tr>
<tr>
<td>214-B</td>
<td>20 &quot;</td>
<td>0.75 ampere</td>
<td>READY</td>
<td>1.50</td>
</tr>
<tr>
<td>214-B</td>
<td>50 &quot;</td>
<td>0.50 &quot;</td>
<td>RAVEL</td>
<td>1.50</td>
</tr>
<tr>
<td>214-B</td>
<td>2500 &quot;</td>
<td>70 milliamperes</td>
<td>SYNOD</td>
<td>2.00</td>
</tr>
</tbody>
</table>

TYPE 214 POTENTIOMETERS

Type 214 Potentiometers are in every way like the Type 214 Rheostats described above except that they are provided with the third terminal. They are likewise available in both panel- and table-mounting models.

PANEL- AND TABLE-MOUNTING MODELS

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Resistance</th>
<th>Maximum Current</th>
<th>Mounting</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>214-A</td>
<td>400 ohms</td>
<td>175 milliamperes</td>
<td>Panel</td>
<td>ROSIN</td>
<td>$1.50</td>
</tr>
<tr>
<td>214-B</td>
<td>400 &quot;</td>
<td>175 &quot;</td>
<td>Table</td>
<td>ROWEL</td>
<td>1.50</td>
</tr>
</tbody>
</table>

TYPE 301 RHEOSTATS

These units are small and occupy little space on the panel or baseboard. Quantities of them are used in General Radio instruments.

Mounting: Supplied for 2-hole panel mounting, but can easily be converted for baseboard mounting. Machine screws and nuts furnished.
Dimensions: Overall radius including terminals, 1 5/16 inches; depth behind panel, 2 3/8 inches; shaft, 7/16 inch.
Angle of Rotation: 255°. Has "off" position.
Knob: Type 137-J.
Weight: 4 ounces.
<table>
<thead>
<tr>
<th>Type</th>
<th>Total Resistance</th>
<th>Code</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Type 110 Potentiometers**

<table>
<thead>
<tr>
<th>Value</th>
<th>Current</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>1.00</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>3.0</td>
<td></td>
</tr>
</tbody>
</table>

**Type 410 Potentiometers**

<table>
<thead>
<tr>
<th>Value</th>
<th>Current</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

**Type 401 Potentiometers**

<table>
<thead>
<tr>
<th>Value</th>
<th>Current</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

**Type 81 Potentiometers**

<table>
<thead>
<tr>
<th>Value</th>
<th>Current</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

**Type 414 Potentiometers**

<table>
<thead>
<tr>
<th>Value</th>
<th>Current</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

**Type 801 Potentiometers**

<table>
<thead>
<tr>
<th>Value</th>
<th>Current</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>
EXPERIMENTAL INDUCTORS

The Type 268 Variocoupler and the Type 269 Variometer are ideal for experimental set-ups in the radio laboratory. They are compact, mechanically rugged, and electrically efficient.

The Type 577 Inductors are the result of an investigation of losses in coils and coil forms conducted by the General Radio Company several years ago when the "low-loss" coil and condenser craze was at its height. This study showed that the proper ratio of diameter to length and a bakelite coil form gave substantially lower losses than any of the then popular "low-loss" coils. The plug-in bases greatly increase their usefulness. (Note: The Type 577 Inductors are the same as the old Type 277 Inductors in every respect except arrangement of the holes for mounting pins.)

**Type 268 Variocoupler**

Inductance Values: See table below.

*Shaft Diameter: ¼ inch.*

<table>
<thead>
<tr>
<th>Type</th>
<th>Stator Inductance</th>
<th>Rotor Inductance</th>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>268</td>
<td>350 microhenrys</td>
<td>106 microhenrys</td>
<td>valet</td>
<td>$2.50</td>
<td></td>
</tr>
</tbody>
</table>

**Type 269 Variometer**

Inductance Values: See table below.

*Shaft Diameter: ¼ inch.*

<table>
<thead>
<tr>
<th>Type</th>
<th>Inductance (Series)</th>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>269</td>
<td>820 microhenrys</td>
<td>valid</td>
<td>$3.50</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions: 4 x 4 x 2½ inches.

Weight: 6 ounces.
<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Inductance</th>
<th>Filament Range</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>777-C</td>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
</tr>
<tr>
<td>1600</td>
<td>1600</td>
<td>1600</td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>6000</td>
<td>6000</td>
<td>6000</td>
<td>6000</td>
<td>6000</td>
</tr>
<tr>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
</tr>
<tr>
<td>1600</td>
<td>1600</td>
<td>1600</td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>6000</td>
<td>6000</td>
<td>6000</td>
<td>6000</td>
<td>6000</td>
</tr>
<tr>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
<td>777-D</td>
</tr>
<tr>
<td>1600</td>
<td>1600</td>
<td>1600</td>
<td>1600</td>
<td>1600</td>
</tr>
<tr>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>6000</td>
<td>6000</td>
<td>6000</td>
<td>6000</td>
<td>6000</td>
</tr>
</tbody>
</table>

These are available in three sizes to meet a need for high-grade limiting Inductors for Single-Winding Models.
TUNING-FORK AND MICROPHONE-BUTTON OSCILLATORS

TYPE 213 AUDIO OSCILLATORS

The Type 213 Audio Oscillators are intended for measurements at fixed frequencies in general, and bridge measurements in particular. They are of the tuning-fork-controlled type, simple and rugged in construction and reliable in operation.

*Frequency:* Fixed, see price list below.
*Power Output:* 50 milliwatts maximum.
*Harmonics:* Harmonic content varies with load impedance. Its magnitude is from 3 to 8 per cent, with normal resistive loads.
*Frequency Stability:* The maximum change in frequency with load is about 0.1 per cent. This and variations introduced by temperature are entirely negligible for practically all bridge measurements. The actual frequency may be less than the rated value by 0.5 per cent due to loading the fork with the microphone button.
*Output Impedance:* Three output ranges are provided permitting the use of loads from 20 to 10,000 ohms.
*Power Supply:* 6-volt battery, 180 milliamperes.

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Operated</th>
<th>Depth</th>
<th>Weight</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>213-B</td>
<td>1000 cps</td>
<td>6 volts, d.c.</td>
<td>5 in.</td>
<td>5 lb.</td>
<td>ANGEL</td>
<td>$34.00</td>
</tr>
<tr>
<td>213-C</td>
<td>400 cps</td>
<td>6 volts, d.c.</td>
<td>6⅛ in.</td>
<td>5½ lb.</td>
<td>AMUSE</td>
<td>42.00</td>
</tr>
</tbody>
</table>

*Oscillators for any 100-cycle multiple between 400 and 1500 cps. may be built to order: 400-600 cps. are Type 213-C, 700-1500 cps. are Type 213-B. To avoid confusion specify the desired frequency when ordering. Code words and prices apply only to frequencies here listed.

**TYPE 241 MICROPHONE HUMMERS**

This instrument is of the reed type operated by a microphone button. It is intended for use as a low-power alternating-current source for bridge measurements.

*Frequency:* About 1000 cycles.
*Power Output:* About 20 milliwatts maximum.
*Power Supply:* A 4½-volt battery of the type used as grid-bias batteries in vacuum-tube circuits.
*Dimensions:* 2½ x 1½ x 1¼ inches.
*Weight:* 1 pound.

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>Operated</th>
<th>Impedance</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-A</td>
<td>1000 cps</td>
<td>4½ volts, d.c.</td>
<td>350 ohms</td>
<td>APITIS</td>
<td>$10.00</td>
</tr>
<tr>
<td>241-B</td>
<td>1000 cps</td>
<td>4½ volts, d.c.</td>
<td>4.5 &quot;</td>
<td>APISH</td>
<td>10.00</td>
</tr>
</tbody>
</table>
They are mounted in Model B cases. Transformers are recommended for all high-grade radio and public-address installations. These transformers are designed to fit the audio-frequency specification, but their primary function is to give line and interstage isolation. These transformers, therefore, do not cover the audio-frequency range. They have a high primary-induction, consequently, are high-frequency isolating transformers.

THESE ARE HIGH-FREQUENCY ISOLATING TRANSFORMERS

**TYPE 35 AMPERER TRANSFORMERS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Turns</th>
<th>Primary</th>
<th>Secondary</th>
<th>Code Word, Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>1:1</td>
<td>000-11000</td>
<td>000-210000</td>
<td>35A</td>
</tr>
<tr>
<td>35</td>
<td>1:2</td>
<td>000-11000</td>
<td>000-210000</td>
<td>35B</td>
</tr>
</tbody>
</table>

May be devoted to other uses when not needed for the audio-frequency range. They are not recommended for use in coupling devices, but they may be used in interstage or output circuits. These transformers are not suitable for use in audio-frequency ranges. They are not recommended for use in audio-frequency ranges.

**CONFLATING DEVICES**

The group of coupling devices listed below include instruments to
Dimensions of General Radio Transformer-Mounting Cases

Line-to-Grid Models

Similar in electrical characteristics to the Type 585-D and Type 585-H, except that the impedance ratio is correct to couple the usual 500-ohm telephone lines to the grid of a vacuum tube, these transformers have a very excellent frequency characteristic. They are mounted in Model B cases.

Microphone-to-Grid Transformers

These are high-quality transformers of the proper impedance ratio for coupling low-impedance, 100-ohm microphones to the grid of the first stage amplifier tube. Type 585-M Amplifier Transformers are for single microphones, the Type 585-M2 Amplifier Transformers have a center-tapped primary winding to permit the use of a double-button microphone. Both transformers have a high-voltage step-up ratio and will carry 100 milliamperes, considerably more current than is usually used in microphone circuits. Both are mounted in Model B cases.

Oscillograph-Coupling Model

This transformer has a voltage step-down ratio of 18:1 which adapts it for coupling the Type 338 String Oscillograph to a vacuum tube. The string circuit has an approximate impedance of 45 ohms. This transformer is designed to work into a load of 80 to 60 ohms. It is mounted in a Model B case.

Tube-to-Dynamic-Speaker Model

This transformer will operate without impairment of audio quality with a direct current of 55 milliamperes in the primary windings. It is, therefore, adapted for use with any of the power output tubes such as the 245- or 250-types. It has a turns ratio suitable for coupling tubes of this type to low-impedance (5- or 10-ohm) dynamic speakers. It is mounted in a Model B case.
mounted in a Model C case. The unit and the frequency characteristic is particularly flat from 80 to 10,000 cycles. It is 0.96 condenser type. The voltage ratio of such an arrangement between input and output is a constant of 0.25. Inductance coil and a-magneto resistance connected in a 90° resistance-impedance combiner has been built up to furnish such a compact unit.

Characteristics: it is often accomplished by using impedance coupling. The Type 797-A RESISTANCE-IMPEDANCE COUPLER is often accomplished by using impedance coupling.

When it is desired to build an amplifier having an exceptionally good frequency response, the Type 797-A RESISTANCE-IMPEDANCE COUPLER is often accomplished by using impedance coupling.

PLATE-TO-PLATE MODEL

Model D

Model C

Model B

Plate-to-Plate Model
THE push-pull connection is becoming almost universal for the output circuits of audio amplifiers. This connection results in the elimination of a considerable part of the second harmonic distortion that results when approaching the overload point of a single tube.

The windings of these transformers have been split into several sections and arranged so that each half of the double secondary has an equal coupling with the primary. The frequency and performance characteristics are unusually good. They are mounted in Model B cases.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>541-A</td>
<td>...</td>
<td>1:3</td>
<td>40-8000</td>
<td>2500-15,000</td>
<td>42.8 h</td>
<td>10 mla</td>
<td>1750 ohms</td>
<td>234 lb</td>
<td>TALLY</td>
</tr>
</tbody>
</table>

**OUTPUT MODELS**

These two transformers have been designed for coupling the usual amplifier output tubes such as the 245-, 210-, or 250-types in the push-pull arrangement to their output circuits. The Type 541-B model is built with the auto-transformer connection for use with a magnetic (high-impedance) speaker. The direct current is eliminated from the speaker windings by two 4-uf condensers. It is mounted in a Model C case.

The Type 541-C model has two windings with the proper turns ratio for use with the dynamic (low-impedance) speaker. It is mounted in a Model B case.

The primary windings are adequately built to carry the plate current of the larger size tubes. When used in conjunction with the Type 541-A Push-Pull Input Transformer, a high-quality push-pull amplifier with an exceptionally flat frequency characteristic results.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>541-B</td>
<td>...</td>
<td>1:2:1</td>
<td>60-10,000</td>
<td>2500-15,000</td>
<td>15.0 h</td>
<td>45 mla</td>
<td>325 ohms</td>
<td>3 lb</td>
<td>TORSO</td>
</tr>
<tr>
<td>543-C</td>
<td>...</td>
<td>3:5:1</td>
<td>30-10,000</td>
<td>2500-15,000</td>
<td>10.0 h</td>
<td>45 mla</td>
<td>375 ohms</td>
<td>3 lb</td>
<td>TAPER</td>
</tr>
</tbody>
</table>

* Data is for one section of the double winding.

**TYPE 359 VARIABLE-RATIO TRANSFORMERS**

In a great many circuits it is necessary to couple two elements of different impedances together in such a way that there is no impedance mismatch at the junction. This impedance adjustment is necessary in order to minimize reflection loss at the junction; also necessary in order to terminate calibrated networks properly so that the calibration will be correct.

The Type 359 Variable Ratio Transformers are provided with secondaries tapped at seven places. The turns ratio is conveniently varied by means of the switch on which is engraved the secondary-to-primary turns ratio. These transformers are available in several models for different types of winding, impedance, and turns ratio as listed below. All are provided with jack-top binding posts to fit the Type 274 Plugs, which feature facilitates circuit changes. They are mounted in Model C cases and weigh 3½ pounds.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>500-20,000</td>
<td>500-20,000</td>
<td>700 ohms</td>
<td>PILOT</td>
<td>$20.00</td>
</tr>
<tr>
<td>A</td>
<td>40-4000</td>
<td>10.3 h</td>
<td>15 mla</td>
<td>$20.00</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>30-5000</td>
<td>10.3 h</td>
<td>15 mla</td>
<td>PIONEER</td>
<td>20.00</td>
</tr>
<tr>
<td>E</td>
<td>40-4000</td>
<td>0.7 h</td>
<td>40 mla</td>
<td>POKER</td>
<td>20.00</td>
</tr>
<tr>
<td>F</td>
<td>30-4000</td>
<td>0.7 h</td>
<td>40 mla</td>
<td>POLAR</td>
<td>20.00</td>
</tr>
</tbody>
</table>

**TWO-WINDING MODELS**
**Type 28-7-C Speaker Filter**

Weight: 4 1/2 pounds.

Lower frequency range than the Type 28-7-B model. A white appearance at 4 ft. in the speaker control. The Type 28-7-C Speaker Filter has a lower frequency range than the Type 28-7-B model, with a white appearance at 4 ft. in the speaker control. However, in the loudness of the speaker, the Type 28-7-C Speaker Filter has a lower frequency range than the Type 28-7-B model.

**Type 28-7-B Speaker Filter**

Weight: 4 pounds.

Either of the speaker windings becomes conductive for this type of work. Either of the speaker windings becomes conductive for this type of work. However, in the loudness of the speaker, the Type 28-7-B Speaker Filter has a lower frequency range than the Type 28-7-C model.

**Type 28-7-A Speaker Filter**

Weight: 3/4 pounds.

Either of the speaker windings becomes conductive for this type of work. Either of the speaker windings becomes conductive for this type of work.

**Type 166 Telephone Transformers**

Similar to use of the Type 399 Variable Ratio Transformer, the Type 166 Telephone Transformers are used for a 3-line telephone system.
POWER TRANSFORMERS

POWER transformers suitable for use with power-supply systems for all types of tubes used in radio receiver- and low-power-transmitter design are listed below.

TYPE 565 TRANSFORMERS

These are designed to supply plate and filament power for the 210- and 250-types of tube. They are supplied with an auxiliary filament winding for operating the 281-type rectifier tube, and are designed for operation from 105- to 115-volt, 50- to 60-cycle lines. They have a power rating of 200 watts. They are mounted in Model D cases. Filament windings have no center tap.

### HALF-WAVE MODEL

<table>
<thead>
<tr>
<th>Type</th>
<th>Secondary I</th>
<th>Secondary II &amp; III</th>
<th>Secondary IV</th>
<th>Power</th>
<th>Weight</th>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>565-A</td>
<td>600</td>
<td>0.2</td>
<td>7.5</td>
<td>2.5</td>
<td>2.25</td>
<td>4</td>
<td>200 watts</td>
<td>14½ lb.</td>
</tr>
</tbody>
</table>

### FULL-WAVE MODEL

<table>
<thead>
<tr>
<th>Type</th>
<th>Secondary I</th>
<th>Secondary II &amp; III</th>
<th>Power</th>
<th>Weight</th>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>565-B</td>
<td>600-0-600</td>
<td>0.2*</td>
<td>7.5</td>
<td>2.5</td>
<td></td>
<td>200 watts</td>
<td>14½ lb.</td>
</tr>
</tbody>
</table>

*For two windings in parallel as used with full-wave rectifier.

TYPE 545 TRANSFORMERS

These are designed to supply the plate and filament power for the 245-type tube. They are provided with an auxiliary winding for the filament of the 280-type rectifier tube. They have a power rating of 70 watts and are designed to operate from a 105- to 115-volt line at 50 to 60 cycles. When heavy current drain or high resistance in the filter circuit make a higher transformer voltage advisable, the Type 545-B Transformer is recommended. They are mounted in Model D cases. Filament windings have no center tap.

<table>
<thead>
<tr>
<th>Type</th>
<th>Secondary I</th>
<th>Secondary II</th>
<th>Secondary III</th>
<th>Power</th>
<th>Weight</th>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>545-A</td>
<td>300-0-300</td>
<td>0.06*</td>
<td>2.5</td>
<td>3.25</td>
<td>5.0</td>
<td>2.0</td>
<td>70 watts</td>
<td>4½ lb.</td>
</tr>
<tr>
<td>545-B</td>
<td>350-0-350</td>
<td>0.06*</td>
<td>2.5</td>
<td>3.25</td>
<td>5.0</td>
<td>2.0</td>
<td>70</td>
<td>5 lb.</td>
</tr>
</tbody>
</table>

*For two windings in parallel as used with full-wave rectifier.

TYPE 540 FILAMENT TRANSFORMER

The heater-filament voltage for the popular alternating-current 237-type and 245-type tubes is standardized at 2.5 volts. This transformer is designed to supply sufficient filament power for any number up to about ten of these tubes in parallel. Two filament windings are provided.

It has a power rating of 70 watts and is designed for operation on 105- to 115-volt, 50- to 60-cycle lines. It is mounted in a Model C case.

<table>
<thead>
<tr>
<th>Type</th>
<th>Secondary I &amp; II</th>
<th>Power</th>
<th>Weight</th>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>540</td>
<td>2.5†</td>
<td>70 watts</td>
<td>5 lb.</td>
<td>TRIAD</td>
<td>$10.00</td>
<td></td>
</tr>
</tbody>
</table>

† With center tap.
TYPE 446 VOLTAGE DIVIDER

The outputs are described elsewhere.

The type 446 voltage divider is used for the adjustment of output voltages on power-supply units, and for the adjustment of output voltages on power-supply units and sockets and sockets and sockets.

ACCESSORIES

IN this section are described radio-frequency choke, voltage dividers.

TYPE 360 FILTER CHOKE

THIS consists of two inductors suitable for connection in a two-section filter of the type

TYPE 274-A RECTIFIER FILTER

THIS is a two-section type filter suitable for use as a smoothing filter in a high-voltage, high-power rectifier.

RECTIFIER FILTERS
TYPE 437 AND TYPE 439 CENTER-TAP RESISTANCE UNITS

The Type 437 and Type 439 Center-Tap Resistance Units, designed for mounting directly on the filament terminals of the tube socket, offer a convenient means of connection to the mid-potential point of the filament. The position of the tap on the Type 437 Center-Tap Resistance Unit is adjustable, permitting the balancing unit of hum by this means.

Characteristics: See price list.

Weight: 1 ounce.

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Resistance</th>
<th>Maximum Current</th>
<th>Center Tap</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>437</td>
<td>60 ohms</td>
<td>200 milliampere</td>
<td>Adjustable</td>
<td>PERSIL</td>
<td>$0.50</td>
</tr>
<tr>
<td>439</td>
<td>60 &quot;</td>
<td>200 &quot;</td>
<td>Fixed</td>
<td>PASTY</td>
<td>0.35</td>
</tr>
</tbody>
</table>

TYPE 379 RADIO-FREQUENCY CHOKEs

The Type 379 Radio-Frequency Chokes are available in two models, one of low inductance to carry a heavy current, and one of high inductance to carry a lower current. The specifications below give the details of the two models. The windings are sectioned and the effective capacity does not exceed 4 μF. Either model is suitable for use in circuits having a frequency up to 15,000 kc.

Dimensions: 2 x 1 ½ x 1 ½ inches.

Weight: 6 ounces.

D.C. Allowable Current

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency Range</th>
<th>Resistance</th>
<th>Induction</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>379-T</td>
<td>1875-15,000 kc.</td>
<td>35 ohms</td>
<td>800 mla.</td>
<td>JIMMY</td>
<td>$1.25</td>
</tr>
<tr>
<td>379-R</td>
<td>470-15,000 kc.</td>
<td>140 &quot;</td>
<td>140 mla.</td>
<td>JEWELL</td>
<td>1.25</td>
</tr>
</tbody>
</table>
calibration can be made. This indicator is built to order and is not carried in stock.

Presence meter with which this indicator is to be used must be supplied with order so that

Table: Frequency Standards

<table>
<thead>
<tr>
<th>Name</th>
<th>Frequency</th>
<th>% Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.00</td>
<td>0.0265</td>
<td></td>
</tr>
<tr>
<td>0.018</td>
<td>0.0265</td>
<td></td>
</tr>
</tbody>
</table>

Type: 459-A Amateur-Band Frequency Meter

These meters are the only meters of their kind available to amateur operators, and for this reason it was necessary to introduce a new and improved type.

The instruments described on this and the following page have been designed to assist the amateur in maintaining the frequency of his

Frequency Standards

The figures are taken from the Bureau of Standards.
THE TYPE 358 WAVEMETER

The Type 358 Wavemeter is intended for use as an inexpensive general-purpose device covering a rather wide frequency range with an accuracy of 1 per cent. The instrument is compact and is easily held in the hand while making measurements. In certain cases, the usefulness of the wavemeter may be increased through the addition of two inductors to extend the wavelength range. These inductors are available on special order.

Calibration: In wavelength; accuracy, 1 per cent.
Condenser: Type 247 Condenser in shielded case.
Inductors: Four on Type 277 forms, fitted with mounting pins to fit condenser terminals.
Resonance Indicator: Small flashlight bulb in special socket which closes circuit on removal of bulb.
Carrying Case: Space provided in wooden box for inductors, condenser and calibration chart.
Dimensions: Carrying case, 11¾ x 7¼ x 5½ inches.
Weight: 4½ pounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>Wavelength</th>
<th>Accuracy</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>358</td>
<td>[20,000–136¾ ke.]</td>
<td>15–220 meters</td>
<td>1%</td>
<td>UPPER</td>
</tr>
</tbody>
</table>

TYPE 276-A QUARTZ PLATE

The Type 276-A Quartz Plate is adjusted to have a frequency somewhere in the 160-meter amateur band. The crystals are not mounted. Their calibration may be relied upon to within 0.25 per cent.

Weight: 2 ounces.

<table>
<thead>
<tr>
<th>Type</th>
<th>Adjusted Within</th>
<th>Accuracy</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>276-A</td>
<td>2000–1715 ke.</td>
<td>0.25%</td>
<td>LABOR</td>
<td>$15.00</td>
</tr>
</tbody>
</table>

TYPE 356 QUARTZ-PLATE HOLDER

The Type 356 Quartz-Plate Holder is intended for amateur and experimental use, primarily with the Type 276-A Quartz Plates. The top electrode rests upon the crystal, but is held in place by a pin passing through a hole in a light spring.

Dimensions: 2½ x 2½ inches.
Weight: 2 ounces.

<table>
<thead>
<tr>
<th>Type</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>356</td>
<td>LASSO</td>
<td>$1.50</td>
</tr>
</tbody>
</table>
The modern radio receiver presents a difficult servicing problem. The cost of servicing such complicated equipment justifies the installation of proper test equipment wherever any considerable volume of service work is being done.

The troubles that may arise in a modern radio receiver may be roughly classified into the following three groups: (a) those due to defective tubes, (b) those due to defects in the audio-amplifier system and, (c) those that appear in the radio-frequency amplifier and detector units. Tube troubles will be disclosed by any one of a number of tube-testing units now on the market; many audio-amplifier troubles may be quite satisfactorily investigated by simple direct-current continuity tests. For fundamental testing, a modulated radio-frequency testing device that must be used is a modulated radio-frequency oscillator furnishing a test signal at one or more points in the broadcast band. When neutralizing, when making general radio-frequency constants, or aligning gang-tuning controls, when making general radio-frequency continuity tests, a test oscillator is an absolute necessity. Such an oscillator is described on page 30.

It should also be recognized that an approximate measurement of the sensitivity of a receiver undergoing test is a great help in locating faults since any serious fault is accompanied by a departure from normal sensitivity. A suitable instrument for measuring sensitivity is the Type 404 Test-Signal Generator described on page 29. It is the first time that such an instrument has been available to the service man although similar but more elaborate designs have been built by General Radio for the set manufacturer's laboratory.

We recommend that the Type 480 Output Meter be used in conjunction with the Type 404 Test-Signal Generator. The former instrument is described on page 39 of this bulletin. Two other important instruments for the service man are the Type 240 Capacity Meter and the Type 483 Mutual-Conductance Meter. They are not usually encountered in the service laboratory but the organization that operates with minimum amount of equipment, but the organization that operates itself on a completely outfitted laboratory will do well to investigate carefully the merits of these two devices.
TYPE 360-A TEST OSCILLATOR.

To meet the demand for a general-purpose driving oscillator, the General Radio Company has developed its Type 360-A Test Oscillator. This instrument consists of a modulated radio-frequency oscillator which will operate at any point in the broadcast band (500 to 1500 kc.) and in addition, deliver a signal at 175 and 180 kc. for making tests upon the intermediate-frequency stages of superheterodyne receivers. A meter for measuring the power output of the receiver as a means of indicating the optimum adjustment is included.

FREQUENCY: 500 to 1500 kc. continuous, as well as 175 kc. and 180 kc. adjustable, over a 5-kc. band on either side of specified channel frequencies for “peaking” intermediate-frequency transformers in superheterodynes.

The “Vernier” adjustment for the 175-kc. channel is calibrated at 1-kc. intervals between 170 and 180 kc. This calibration constitutes the only difference between the instrument and the Type 360 Test Oscillator which it replaces.

Calibration: Broadcast-band control calibrated directly in frequency with accuracy of ± 2 per cent.; 175 kc. and 180 kc. channels adjusted to ± 0.25 per cent.

Modulation: By means of grid leak and condenser combination at frequency of approximately 800 cycles, 100 per cent.

Output Meter: Consists of Type 488-A Alternating-Current Voltmeter connected at will across 4000-ohm resistance network for simulating high-impedance (cone-type) speaker or directly across a low-impedance voice coil. Pin jacks, connecting cable, and provision for telephone receivers provided.

Tubes and Batteries: One 1124-type tube (not included in price of instrument) is required. Replacement through hand-hole in bottom of cabinet. Battery cable for connecting 6-volt filament and 45-volt plate supplies provided. External batteries required. Connecting leads supplied.

Test Tool (shown in lid of box): Consists of bakelite rod with heavy closed loop at one end and flat spade at other. Used for aligning gang-controlled tuning condensers. Closed loop acts as short-circuited turn to reduce inductance of the coil; spade increases effective capacitance of the condenser.

Pilot Lamp: Provided to show when oscillator tube is in operation.

Finish: Engraved bakelite panel mounted in hand-rubbed walnut cabinet with cover and carrying handle. No shielding. All metal parts nickel-plated.

Dimensions: 10½ x 7½ x 7 inches.

Weight: 11½ pounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency Range</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>360-A</td>
<td>175, 180, and 500-1500 kc.</td>
<td>Ovate</td>
<td>$115.00</td>
</tr>
</tbody>
</table>

REMODELING OBSOLETE MODELS: TYPE 320 OR TYPE 360

We are prepared to remodel Type 320 and Type 360 Test Oscillators so that they can be used for testing present-day superheterodyne receivers. Full information will be supplied on request by the Service Department, General Radio Company. Be sure to give the following information about the test oscillator you propose to remodel: (a) type number, (b) serial number, (c) what if any remodeling has already been done?
The frequency range. The voltage variation is less than plus or minus 2 per cent.

The selector is so designed that the output voltage is nearly constant over the entire range of adjustment to the lowest output point of 10000.

The local voltage attenuation from the selector output is available for setting the input voltage to the attenuator from line to line without the need for any adjustment. This feature is particularly desirable when setting up a receiver.

The input to the attenuator is adjustable and is set at the factory. When the output is read from the change in the voltage, and may be corrected if the line voltage is known.

The absolute value of the voltage output may be read from the chart or in the chart provided on the instrument with an accuracy of 2 per cent.

The output of the instrument does not exceed 0.1 volt. This means that the output of the instrument will not affect the reading of other instruments in the same or adjacent circuits.

The instrument consists of two sections, each with a separate display. The first section performs the function of the attenuator and provides a means of selecting the output level. The second section performs the function of the detector and provides a means of adjusting the output level.

The General Radio TD 407 Signal Generator has been designed with the requirements of mind. It is portable, provides accurate measurements, and operates from the alternating current source.

The General Radio TD 407 Signal Generator is designed for operation in radio service work.
An early model of a Type 404 Test-Signal Generator and a Type 486 Output Meter set up for measuring the sensitivity of a receiver.

Complete isolation from the line is essential in a device of this sort, since it will usually be connected to the same circuit as the receiver under test, and any radiation into the line will be picked up by the receiver. Careful filtering of the power line has eliminated leakage through these leads.

Uses: The Type 404 Test-Signal Generator will be found useful in the usual aligning and neutralizing adjustments. A further wide range of usefulness is in assaying the condition of a receiver in question. Since it is portable, it may be taken to the job, and will indicate at once whether or not there is any radical difficulty with the receiver, or whether the trouble is in location, antenna or ground installation, or is only imaginary.

It can further be used to check on the improvement resulting from changing tubes, or making adjustments in the receiver. The test-signal generator may also be used as a test on receivers in factory production.

Modulation: Modulation is obtained from the rectifier tube, i.e., the output from the rectifier tube is not completely filtered. This provides a complex modulation, containing both even and odd harmonics of 60 cycles.

Accuracy: Adjacent ratios 5 per cent.

Cumulative error in attenuator 20 per cent. Change in output with frequency ± 5 per cent. Calibration of tuning dial 3 per cent.

Output Range: Roughly 10-1000 microvolts. 0.1-volt output also provided.

Shielding: The filtering and shielding are such that the instrument may be used with receivers of the highest sensitivity. When the test-signal generator is properly grounded the leakage does not exceed an amount equivalent to 2 microvolts applied directly to the receiver input terminals.

Tubes: Two 226-type tubes are required for operation of the generator.

Construction: The instrument is contained in a shielded compartment of a leatherette carrying case fitted with a carrying handle. Another compartment is provided for storing tools and accessories. The panel is of aluminum with black crackle lacquer. A six-foot extension cord for the power supply and a shielded cable for connecting to the receiver under test are provided.

<table>
<thead>
<tr>
<th>Type</th>
<th>Tuning Range</th>
<th>Dimensions</th>
<th>Weight</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>404</td>
<td>500-1500 kc.</td>
<td>14 3/4 x 11 3/4 x 7 1/2 in.</td>
<td>16 lb.</td>
<td>SULKY</td>
<td>$395.00</td>
</tr>
</tbody>
</table>
Type 40 Capacity Meter

10 Ohms

Addition: 40.000 01.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

500 Ohms

Addition: 50.000 51.000 52.000 53.000 54.000 55.000 56.000 57.000 58.000 59.000 60.000

Voltage: 10% Bands

0.1 Ohms

Addition: 0.01.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.01 Ohms

Addition: 0.001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.001 Ohms

Addition: 0.0001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.0001 Ohms

Addition: 0.00001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.00001 Ohms

Addition: 0.000001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.000001 Ohms

Addition: 0.0000001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.0000001 Ohms

Addition: 0.00000001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.00000001 Ohms

Addition: 0.000000001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands

0.000000001 Ohms

Addition: 0.0000000001.000 02.000 03.000 04.000 05.000 06.000 07.000 08.000 09.000 10.000

Voltage: 10% Bands
TYPE 443 MUTUAL-CONDUCTANCE METER

Of the three important dynamic factors of the three-element vacuum tube, amplification factor, plate resistance, and mutual conductance, the last is the best figure of merit for a tube. While mutual conductance is not a complete indication of the comparative merit of tubes of different types, it offers positive indication among tubes of the same type. This meter will measure the mutual conductance of any receiving tube with a direct-current or alternating-current filament up to 2500 micromhos. It is a bridge which tests the tube under normal conditions. At no time is the tube overloaded.

**Range:** 0 to 2500 micromhos.

**Meter:** Filament voltmeter, Weston Model 506, 8-volt.

** Resistances:** Variable resistance, Type 214 Rheostat, tapered, 250 ohms. Fixed resistance, 100-ohm and 1000-ohm cards.

** Power Source:** Type 241-B Microphone Hummer, 1000 cps.

**Filament Rheostats:** Type 214 Rheostat, 4.5 ohms; Type 214 Rheostat, 50 ohms.

<table>
<thead>
<tr>
<th>Code</th>
<th>Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>443</td>
<td></td>
<td>$55.00</td>
</tr>
</tbody>
</table>

Sockets: Type 349 Socket for UX-base,
Type 488 Socket for UY-base.

Accessories: Filament, plate, and grid batteries, 4.5-volt dry battery for hummer, plate and grid voltmeters, telephones.

Finish: Units mounted on bakelite panel and enclosed in hand-rubbed walnut cabinet.

Dimensions: Panel, 10 x 10 inches; depth, 4½ inches.

Weight: 6½ pounds.
TYP 48-A THERMIONIC VOLTMETERS

THE VACUUM TUBE LEADS ISENT PARTICULARLY well to use as a voltmeter

Thermionic voltmeters are described under the following six general headings:

1. Oxide Rectifiers and Thermocouples
2. Output Meters and Power-Level Indicators
3. Ohmmeters
4. Hot-Wire Meters
5. Copper-Oxide Rectifier Voltmeters
6. Thermionic Voltmeters

The vacuum tube leads isent particularly well to use as a voltmeter.
brated against root-mean-square values of a sinusoidal wave.

Accuracy of Calibration: Within 0.5 per cent. up to 1000 hours, at which time the instrument should be returned to the factory for a new tube and calibration. See price list.

Frequency Error: Less than 2 per cent. of full scale at 30 kc. Less than 3 per cent. at 300 kc. Although calibration is not reliable at broadcast and higher radio frequencies, the voltmeter may be used for making voltage comparisons in that range.

Waveform Error: Slight when due to third harmonic. Appreciable when due to second harmonic. Second harmonic error can be almost wholly corrected by reversing the leads to the meter and averaging the two readings obtained.

Adjustment: With voltmeter terminals short-circuited, the meter pointer is set at zero by means of a rheostat mounted in the case.

Overvoltage: Will withstand 50 volts momentarily.

Tube: Special tube, similar in power requirements to 199-type, soldered in place.

Mounting: Polished walnut case.

Dimensions: 9 x 7\(\frac{3}{4}\) x 10\(\frac{1}{4}\) inches.

Weight: 11 pounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>426-A</td>
<td>0-3 volts, r.m.s.</td>
<td>SERUM</td>
<td>$160.00</td>
</tr>
<tr>
<td></td>
<td>Recalibration, including replacement tube</td>
<td></td>
<td>20.00</td>
</tr>
</tbody>
</table>

COPPER-OXIDE-RECTIFIER VOLTMETERS

These instruments are designed for the measurement of alternating-current voltages at frequencies from 20 to 10,000 cycles per second. The indicating element consists of small copper-oxide units arranged in the form of a bridge for obtaining full-wave rectification. The alternating-current voltage applied to the input terminals of this type of structure results in a direct current through the meter circuit. The direct current is proportional to the root-mean-square value of the alternating voltage.

A change of impedance with applied voltage is a characteristic of all copper-oxide rectifiers, and hence it is desirable that some means be provided for maintaining the input impedance to this type of instrument at a constant value. In the two types listed below, the proper choice of resistances external to the indicating element has provided a suitable means for meeting this problem.

Type 427-F Alternating-Current Voltmeter

This is a precision laboratory instrument of the portable type, having a high impedance. It consists of a rectifier unit working in conjunction with an accurately balanced d’Arsonval movement of the two-pivot type. The double-pivot movement is mounted on selected jewels. The large hand-drawn legible scale with mirror to prevent parallax, and with a knife-edge pointer, has 100 scale divisions, thus insuring accurate
Type 486-A Alternating-CURRENT VOLTMETER

Range: 1 to 2000 volts, 0 to 100,000 volts

Specifications:
- Voltage range: 0 to 2000 volts
- Accuracy: ±2% of full-scale reading
- Impedance: Approximately 2000 ohms
- Power: 240V ±15% or 75V ±15%
- Dimensions: 12 x 12 x 3 inches
- Weight: 50 pounds

This instrument is panel-mounted and consists of a copper-oxide rectifier and a panel-mounting type and consists of a copper-oxide rectifier and a panel-mounting type. The scale has 20 divisions and the moveable reading is compared with a microammeter. The scale has 20 divisions and the moveable reading is compared with a microammeter. The scale has 20 divisions and the moveable reading is compared with a microammeter.
HOT-WIRE METERS

An instrument for the measurement of currents at high frequencies must keep its inductance and capacitance as small as possible. High reactance would cause the readings to vary with frequency. For many radio-frequency measurements a suitably designed hot-wire ammeter has the necessary characteristics which particularly adapt it to this work. It should, however, be recognized that a hot-wire ammeter is inherently less accurate than an ammeter of the moving-coil type, which of course is unsuitable for measuring current at high frequencies. In the Type 127 Hot-Wire Meter, careful design and good workmanship have produced instruments which are electrically and mechanically rugged and reliable. These meters are used extensively in wavemeters for determining the resonance point and are also used for measuring the radiation, filament, and plate currents in experimental transmitting stations. They are equally suitable for use on direct and alternating current.

Type 127 Hot-Wire Meters

Type 127-A
Type 127-B
Type 127-C

Flush-Mounting Models

Range: See price list.
Resistance: See price list.
Scale Length: 2 inches.
Movement: Hot-wire type. The expanding strip is of a platinum-silver alloy, proportioned to work at a low temperature. Its low resistance permits reasonable overload and minimizes losses.

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Approx. Resistance</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>127-A</td>
<td>100 milliamperes</td>
<td>25.0 ohms</td>
<td>MEDAL</td>
<td>$6.00</td>
</tr>
<tr>
<td>127-A</td>
<td>250</td>
<td>8.5 &quot;</td>
<td>MERCY</td>
<td>6.00</td>
</tr>
<tr>
<td>127-A</td>
<td>0.5 ampere</td>
<td>2.5 &quot;</td>
<td>MERIT</td>
<td>6.00</td>
</tr>
<tr>
<td>127-A</td>
<td>1</td>
<td>0.9 ohm</td>
<td>MERRY</td>
<td>6.00</td>
</tr>
<tr>
<td>127-A</td>
<td>3 amperes</td>
<td>0.35 &quot;</td>
<td>MIMIC</td>
<td>6.00</td>
</tr>
<tr>
<td>127-A</td>
<td>5</td>
<td>0.07 &quot;</td>
<td>MINIM</td>
<td>6.00</td>
</tr>
<tr>
<td>127-A</td>
<td>10</td>
<td>0.052 &quot;</td>
<td>MINNY</td>
<td>6.00</td>
</tr>
<tr>
<td>*127-A</td>
<td>270 milliamperes (approx.)</td>
<td>9.0 ohms</td>
<td>METER</td>
<td>5.75</td>
</tr>
</tbody>
</table>

* When ordering, specify Type 127-A Galvanometer.

(Continued on following page)
TYPE 297 DIRECT-READING OHMMETER

There are many occasions in laboratories, service stations, and fac-

ometers

When ordering, specify TYPE 297-C Calibrator.

When ordering, specify TYPE 297-B (B) Calibrator.

Dimensions: 5 x 3% x 1.5 inches over all.

Weight: 6 ounces.

See the illustration.

CASE-MOUNTING MODELS

Dimensions: 6 x 3 x 1.5 inches. See the illustration.

Weight: 4 ounces.

Case: Mounting Models

Panel-Mounting Models

Table: Types and Resistances

<table>
<thead>
<tr>
<th>Value (approx.)</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>50.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>25.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>10.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>5.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>2.5 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>1.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.5 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.25 ohms</td>
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<td>10</td>
</tr>
<tr>
<td>0.1 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
</tbody>
</table>

Table: Models and Resistances

<table>
<thead>
<tr>
<th>Value (approx.)</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
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<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>5.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>2.5 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>1.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.5 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.25 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.1 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
</tbody>
</table>

Table: Models and Resistances

<table>
<thead>
<tr>
<th>Value (approx.)</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>50.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
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<td>1000</td>
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<td>10</td>
</tr>
<tr>
<td>5.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>2.5 ohms</td>
<td>1000</td>
<td>10</td>
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<tr>
<td>1.0 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.5 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.25 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
<tr>
<td>0.1 ohms</td>
<td>1000</td>
<td>10</td>
</tr>
</tbody>
</table>
Range: See price list.

Operation: Before using the ohmmeter, the zero should be checked by connecting the terminals together and adjusting the knob until the meter registers zero resistance. The short-circuiting connection is then removed and the meter is ready for use.

Battery: A 4.5-volt battery for Type 287-A and a 1.5-volt battery for Type 287-B are furnished with the instrument.

Mounting: Polished walnut. Leather strap provided for carrying.

Dimensions: 6 3/4 x 5 3/4 x 4 1/2 inches.

Weight: 2 1/2 pounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>287-A</td>
<td>0-10,000 ohms, 500 ohms, center-scale</td>
<td>ORION</td>
<td>$30.00</td>
</tr>
<tr>
<td>287-B</td>
<td>0-2000 &quot; , 100 &quot; , &quot; &quot;</td>
<td>ORBIT</td>
<td>$30.00</td>
</tr>
</tbody>
</table>

OUTPUT METERS AND POWER-LEVEL INDICATORS

Until the development of copper-oxide-rectifier-type meters, the vacuum-tube voltmeter was practically the only instrument suitable for making voltage measurements over the audio-frequency spectrum. It has the obvious disadvantage of requiring tubes and batteries, both of which require frequent replacement and limit the portability of any instrument in which they are used.

The two instruments described in this section, an output meter and a power-level indicator, make use of the copper-oxide-rectifier voltmeter for the measurement of voice-frequency power. The output meter consists of a 0–3-volt voltmeter and a network for extending its range to 150 volts. Since the input impedance remains practically constant at 4000 ohms regardless of frequency and setting of multiplier, it furnishes a convenient means of measuring the power output of a radio receiver.

The power-level indicator is similar to the output meter, except that the voltmeter and the multiplier network are calibrated in decibels. It is useful for monitoring as well as measuring the voice-power level in all kinds of transmission and recording circuits.
The instrument always presents a purity reading to the measurement and the possibility of deriving the Photo-Diode current, which is equal to the power level. This is particularly useful in the measurement of line-cord output where a sudden increase in power output may indicate a fault.

The Type 366 Power-Level Indicator is used to measure the output level of various devices, particularly in the measurement of the power output of audio amplifiers. It has a sensitivity range of 0 to 1000 ohms, and is capable of measuring the output power of any device.

The instrument is designed primarily for use as a general-purpose multimeter, and is also capable of measuring the output power of any device.
Range: See price list.
Impedance: 5000 ohms.

Scale Reading: Zero level at mid-scale. This corresponds to 6 milliwatts or 1.75 volts when connected across a 500-ohm line. Graduated in steps of 2 decibels to cover the range from -10 to +6 decibels. Network adjustable in steps of 2 decibels.

Indicating Element: Copper-oxide-rectifier voltmeter calibrated to read power level in decibels.

Accuracy: Slight variation in oxide-rectifier impedance with current passing through introduces a small error. Effective greatest at -10-decibel mark on meter where the reading may be 0.5 decibel low.

Average error is from 0.1 to 0.2 decibel, entirely negligible. No appreciable frequency error up to 10,000 cycles per second.


Calibration: Calibrated to read directly when across a 500-ohm line. Constant correction term taken from a correction chart furnished with the instrument must be applied when instrument is used across lines of impedance other than 500 ohms.

Dimensions: 10 x 5 x 5 inches.

Weight: 2½ pounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Dimensions</th>
<th>Weight</th>
<th>Code</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>586-A</td>
<td>-10 db to +36 db with zero level at 0.006 watts and 500-ohm line</td>
<td>10 x 5 x 5 in.</td>
<td>2½ lb.</td>
<td>HABIT</td>
<td>$60.00</td>
</tr>
</tbody>
</table>

**RELAY-RACK MODEL**

This model is identical with the cabinet model except for the method of mounting. It is arranged for mounting on a standard 19-inch relay rack. It has a ⅝-inch bakelite panel and is protected by a dust cover of nickel-plated brass.

When the power-level indicator is used on recording circuits, it is sometimes desirable to have an auxiliary meter located at a distance from the point where the instrument is installed. This enables a second operator to keep in touch with what is going on in the recording circuit.

So that this can be done, all rack-mounting models (Type 586-B) are provided with an extra pair of terminals to which the external meter may be connected. These terminals
The Type 360-P Meter is a copper-oxide-rectifier voltmeter, identical with the
Type 360-P Voltmeter. Its range is 0 to 1200 volts. It is used for
measuring the line-to-neutral voltage of the Type 360-B Power-Level
Indicator. It is intended as the external meter.

The following data apply to both meters:

- The Type 360-P Meter is similar to the Type 360-B Power-Level
  Indicator. It is intended as the external meter for use with the Type
  360-B Power-Level Indicator.
- The Type 360-P Meter is connected to the Type 360-B Power-Level
  Indicator. It has a range of 0 to 1200 volts.
- The Type 360-P Meter is a copper-oxide-rectifier voltmeter, identical with
  the Type 360-P Voltmeter.
OXIDE RECTIFIERS AND THERMOCOUPLES

THIS chapter describes for the first time two new elements for electric measuring circuits: the Type 492-A Oxide Rectifier and the Type 493 Thermocouples. They are intended for use with the user's own meters, a wide variety of suitable types being commercially available.

TYPE 492-A OXIDE RECTIFIER

THE Type 492-A Oxide Rectifier is provided for use with relays and direct-current indicating instruments on alternating-current service. The unit is at present offered primarily for experimental use and the following specifications are indicative rather than positive.

It must be realized that the copper-oxide type of rectifier is subject to changes in both sensitivity and frequency characteristics with output load. The sensitivity also varies with impressed voltage. The values given below approximate those obtained under usual conditions of voltage and load.

This rectifier unit is made for us by the General Electric Company.

Frequency Error: The rectifier may be used without appreciable frequency error at frequencies below 5000 cycles per second.

Temperature Error: Temperature errors of about 5% may be expected between normal extreme temperatures. Maximum sensitivity is obtained with a load of 5000 to 7000 ohms. This value should be used when the instrument is operating a relay. If a 200-milliamphere micro-ammeter of about 500 ohms resistance is used, full-scale deflection will be obtained at about 2 volts across the rectifier input.

The maximum current output from the

Mounting case for Type 492-A Oxide Rectifier and Type 493 Thermocouples with Type 274-RJ Mounting Base

[ 42 ]
OXIDE RECTIFIERS AND THERMOCOUPLES

43

Type 493 THERMOCOUPLES

While indicating direct-current instruments can be made for currents as low as a few micro-amperes, dynanometer instruments for the measurement of alternating currents are not available in low ranges due to the inherent low efficiency of this type of instrument.

In the measurement of alternating currents of small magnitudes, the heating effect of the current is generally utilized. In the thermocouple the heat caused by the flow of current through the wire, develops a sufficient temperature differential to cause a voltage which acts upon a sensitive direct-current recording meter reading meter. This instrument consists of a set of resistance elements, the average current through which is the heat caused by the direct current through the wires. A type of instrument made for use with a direct-current meter reading meter, depending on wave form errors. Frequency errors occur only at frequencies high enough to make the shunting effect of stray capacitances in the instrument significant.

Construction: The thermocouples used in the Type 493 Thermocouples are mounted in an evacuated glass bulb. The thermocouple junction is in direct contact with the bulb. A bolt and plug passes through the bulb, and the glass bulb is surrounded by felt and mounted in a bakelite container. The plug passes through a Type 74-RJ. The plug or plug (G) of the Type 74-RJ is 0.00013 in step with the Type 74-RJ.

Plugs: Type 74-RJ

<table>
<thead>
<tr>
<th>Type</th>
<th>Code</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>498-A</td>
<td>$12.00</td>
<td>12.00</td>
</tr>
<tr>
<td>498-C</td>
<td>12.00</td>
<td>12.00</td>
</tr>
<tr>
<td>498-E</td>
<td>12.00</td>
<td>12.00</td>
</tr>
<tr>
<td>498-H</td>
<td>12.00</td>
<td>12.00</td>
</tr>
<tr>
<td>498-L</td>
<td>12.00</td>
<td>12.00</td>
</tr>
</tbody>
</table>

Maximum Current: 10 milliamps. Open Circuit Safe Current: 1.5 milliamps.
RELAYS, SWITCHES, AND MISCELLANEOUS ACCESSORIES

CAREFULLY designed and well-made accessories are essential in all kinds of experimental work around the laboratory. The General Radio Company has always given due attention to its line of accessories and several new items are added each year.

Particular attention is directed to the section which describes the Type 274 Jacks, Plugs and Mounting Bases. They offer limitless possibilities.

RELAYS

TYPE 481 POLAR RELAY

This relay has a permanent horseshoe magnet which provides the field and at the same time forms a protecting shield about the coil and reed. An unusual feature is the wide separation between the pole pieces (0.47 inch) which provides a uniform magnetic field in the region through which the reed moves. It also makes the neutral position less critical.

*Operating Characteristics:* See price list.

*Current-carrying Capacity:* The contact points are rugged and will break one ampere without undue burning.

*Dimensions:* 6 x 9 x 1 inches.

*Weight:* 2 1/2 pounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>Resistance</th>
<th>Operating Current</th>
<th>Maximum Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>481</td>
<td>1500 ohms</td>
<td>2 milliamperes</td>
<td>125 cycles/second</td>
</tr>
</tbody>
</table>

**TYPE 507 NON-POLAR RELAY**

These relays contain an armature which has no permanent magnetization and which will not therefore distinguish between the direction of current flow.

*Sensitivity:* See price list. Values given are for currents corresponding to positive operation in either vertical or horizontal positions.

*Resistance:* Held to within ±10 per cent.

*Dimensions:* 4 1/8 x 3 x 2 inches.

*Weight:* 1 pound.

<table>
<thead>
<tr>
<th>Type</th>
<th>Resistance</th>
<th>Current to close</th>
<th>Current to open</th>
</tr>
</thead>
<tbody>
<tr>
<td>507-A</td>
<td>250 ohms</td>
<td>10 milliamperes</td>
<td>6 milliamperes</td>
</tr>
<tr>
<td>507-B</td>
<td>4000</td>
<td>2</td>
<td>1 milliamperes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMAD</td>
<td>$20.00</td>
</tr>
<tr>
<td>NITRE</td>
<td>$12.00</td>
</tr>
<tr>
<td>NOBLE</td>
<td>15.00</td>
</tr>
</tbody>
</table>
The Type 318 Dial Plate is a photo-etched metal sheet.

**Knobs and Dials**
Type 502 and Type 503 Dials

The Type 502 and Type 503 Dials are, respectively, the new Type 310 and Type 317 Dials equipped with a simple but effective slow-motion control. The dials and indicators are identical with the corresponding Type 310 and Type 317 Dials previously described.

The slow-motion device was originally designed for use on our line of laboratory measuring instruments, but we are offering it for general use in the belief that its ruggedness and simplicity will appeal to laboratory workers and amateurs. It is easy to mount, a center punch and a 7/16-inch drill being the only tools required. It is so designed that it in no way interferes with the mounting of the dial. Adjustments on the friction drive can be made without disturbing the calibration of the instrument to which the dial is attached.

Beneath the face of the dial is mounted a disc of slightly smaller diameter which is gripped by a friction wheel attached to the slow-motion drive knob. The friction-drive shaft is carried in a bushing inserted in the panel. The shaft hole in the bushing is slightly eccentric with respect to the center of the hole holding the bushing, thus affording a simple means of adjusting the amount of friction between the friction wheel and the disc behind the dial.

The Type 502 and Type 503 Dials are supplied complete with friction drive, indicator, indicator fastening screw and nut, and drilling template.

<table>
<thead>
<tr>
<th>Type</th>
<th>Dial Diameter</th>
<th>Arc</th>
<th>Shaft Diameter</th>
<th>Dial Type</th>
<th>Approx. Reduction Ratio</th>
<th>Weight</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>502-A</td>
<td>23/4 in.</td>
<td>180°</td>
<td>1/4 in.</td>
<td>310-A</td>
<td>1.3:3</td>
<td>3 oz.</td>
<td>DRUID</td>
<td>$1.50</td>
</tr>
<tr>
<td>502-F</td>
<td>23/4 in.</td>
<td>180°</td>
<td>5/8 in.</td>
<td>310-F</td>
<td>1.3:3</td>
<td>3 oz.</td>
<td>DYING</td>
<td>1.50</td>
</tr>
<tr>
<td>502-G</td>
<td>23/4 in.</td>
<td>180°</td>
<td>5/8 in.</td>
<td>310-G</td>
<td>1.3:3</td>
<td>3 oz.</td>
<td>DAILY</td>
<td>1.50</td>
</tr>
<tr>
<td>503-A</td>
<td>4 in.</td>
<td>180°</td>
<td>1/4 in.</td>
<td>317-A</td>
<td>1:3</td>
<td>6 oz.</td>
<td>DRYAD</td>
<td>2.00</td>
</tr>
<tr>
<td>503-F</td>
<td>4 in.</td>
<td>180°</td>
<td>5/8 in.</td>
<td>317-F</td>
<td>1:3</td>
<td>6 oz.</td>
<td>DUCAT</td>
<td>2.00</td>
</tr>
<tr>
<td>503-G</td>
<td>4 in.</td>
<td>270°</td>
<td>5/8 in.</td>
<td>317-G</td>
<td>1:3</td>
<td>6 oz.</td>
<td>DUMMY</td>
<td>2.00</td>
</tr>
</tbody>
</table>
are the same as type 202 and type 203 discs. type 210 and type 211 discs have no friction drive, otherwise they

General Radio Co.

270° scales

Note the

Friction Drive

Type 203 Discs

100° scales

Type 202 Discs

Relays, Switches, Accessory
GENERAL RADIO COMPANY

**TYPE 137 KNOBS**

These are shown half-size in the photographs on page 49. They are made of moulded bakelite with inserts of brass, and all but the Type 137-K Knob are furnished with a single setscrew.

<table>
<thead>
<tr>
<th>Type</th>
<th>Shaft</th>
<th>Diameter</th>
<th>Height</th>
<th>Weight</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>137-D</td>
<td>With Pointer</td>
<td>1/8 in.</td>
<td>1 1/2 in.</td>
<td>3/4 in.</td>
<td>2 oz.</td>
<td>STANNOBANT</td>
</tr>
<tr>
<td>137-D</td>
<td>Without</td>
<td>1/8 in.</td>
<td>1 1/2 in.</td>
<td>3/4 in.</td>
<td>1 oz.</td>
<td>STANNOBUG</td>
</tr>
<tr>
<td>137-H</td>
<td>Without</td>
<td>1/4 in.</td>
<td>2 3/4 in.</td>
<td>7/8 in.</td>
<td>1 oz.</td>
<td>STANNOBAC</td>
</tr>
<tr>
<td>137-J</td>
<td>With</td>
<td>1/4 in.</td>
<td>1 5/8 in.</td>
<td>3/4 in.</td>
<td>1 oz.</td>
<td>STANNOBOG</td>
</tr>
<tr>
<td>137-J</td>
<td>Without</td>
<td>1/4 in.</td>
<td>1 5/8 in.</td>
<td>3/4 in.</td>
<td>1 oz.</td>
<td>STANNOBEYE</td>
</tr>
<tr>
<td>137-K</td>
<td>Without</td>
<td>10-32</td>
<td>15/16 in.</td>
<td>7/16 in.</td>
<td>1 oz.</td>
<td>STANNOBFA</td>
</tr>
<tr>
<td>137-L</td>
<td>With</td>
<td>1/4 in.</td>
<td>1 11/16 in.</td>
<td>7/8 in.</td>
<td>1 oz.</td>
<td>STANNOBS</td>
</tr>
</tbody>
</table>

**BINDING POSTS, SWITCH CONTACTS, AND STOPS**

All of these items are used on General Radio instruments. The Type 138-V and Type 138-X Binding Posts are recessed to receive a Type 274-P Plug. They are extremely useful for use on portable instruments in the laboratory.

**TYPE 138 BINDING POSTS, SWITCH CONTACTS, AND SWITCH STOPS**

The dimensions of these accessories are given in the price list. They are shown half-size in the photographs on page 49.

**BINDING POSTS**

<table>
<thead>
<tr>
<th>Type</th>
<th>Material</th>
<th>Diameter</th>
<th>Height</th>
<th>Max. Panel Thickness</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>138-A</td>
<td>Bakelite and N.P. Brass</td>
<td>5/8 in.</td>
<td>3/4 in.</td>
<td>10-32</td>
<td>STAN PARCUP</td>
<td>$0.18</td>
</tr>
<tr>
<td>138-W</td>
<td>Nickel-Plated Brass</td>
<td>7/16 in.</td>
<td>5/8 in.</td>
<td>10-32</td>
<td>STAN PARCAP</td>
<td>0.08</td>
</tr>
<tr>
<td>*138-V</td>
<td>*</td>
<td>7/32 in.</td>
<td>5/8 in.</td>
<td>STAN PARANT</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>*138-X</td>
<td>*</td>
<td>7/32 in.</td>
<td>5/8 in.</td>
<td>STAN PARBOY</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>138-Y</td>
<td>*</td>
<td>7/32 in.</td>
<td>5/8 in.</td>
<td>STAN PARMIK</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>138-Z</td>
<td>*</td>
<td>7/32 in.</td>
<td>5/8 in.</td>
<td>STAN PATRHI</td>
<td>0.07</td>
<td></td>
</tr>
</tbody>
</table>

* See also, Types 274-K and 274-L Binding Post Assemblies

**SWITCH CONTACTS**

<table>
<thead>
<tr>
<th>Type</th>
<th>Material</th>
<th>Diameter</th>
<th>Height</th>
<th>Max. Panel Thickness</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>138-B</td>
<td>Nickel-Plated Bronze</td>
<td>9/32 in.</td>
<td>0.190 in.</td>
<td>5/16 in.</td>
<td>CONTACTANT</td>
<td>$0.04</td>
</tr>
<tr>
<td>138-C</td>
<td>*</td>
<td>5/16 in.</td>
<td>0.190 in.</td>
<td>7/16 in.</td>
<td>CONTACTBAC</td>
<td>0.04</td>
</tr>
<tr>
<td>138-D</td>
<td>*</td>
<td>3/16 in.</td>
<td>0.193 in.</td>
<td>7/16 in.</td>
<td>CONTACTCAT</td>
<td>0.83</td>
</tr>
</tbody>
</table>

**SWITCH STOPS**

<table>
<thead>
<tr>
<th>Type</th>
<th>Material</th>
<th>Diameter</th>
<th>Height</th>
<th>Max. Panel Thickness</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>138-Q</td>
<td>Nickel-Plated Brass</td>
<td>7/32 in.</td>
<td>3/8 in.</td>
<td>5/16 in.</td>
<td>STAN PARBUL</td>
<td>$0.04</td>
</tr>
</tbody>
</table>
SWITCHES

The three single-blade switches described in this section are all used in various General Radio instruments. The Type 337 Switches are useful around the laboratory and fit in well with the Type 274 Plugs.

Type 337 Switches

The experimenter will find the Type 337 Switches extremely convenient. The construction is such that a quick change-over may be effected.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Weight</th>
<th>Panel Size</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>337-A</td>
<td>2 Pole Double Throw</td>
<td>½ lb.</td>
<td>4 in. x 2¾ in.</td>
<td>SWITCHFROG</td>
<td>$3.00</td>
</tr>
<tr>
<td>337-B</td>
<td>4 Pole Double Throw</td>
<td>1 lb.</td>
<td>6¾ in. x 5 in.</td>
<td>SWITCHGOAT</td>
<td>7.00</td>
</tr>
<tr>
<td>337-C</td>
<td>6 Pole Double Throw</td>
<td>1½ lb.</td>
<td>6⅔ in. x 6¾ in.</td>
<td>SWITCHBIRD</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Type 139 and Type 202 Switches

These are shown half-size in the photographs on page 49. The blades are of nickel-silver which, with bronze contact points, make for a minimum of cutting. Knobs are of moulded bakelite.

<table>
<thead>
<tr>
<th>Type</th>
<th>Radius</th>
<th>Max. Panel Thickness</th>
<th>Knob</th>
<th>Over all Axial Length</th>
<th>Weight</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>139-A</td>
<td>1½ in.</td>
<td>5/16 in.</td>
<td>187-D</td>
<td>2 in.</td>
<td>¾ lb.</td>
<td>SWITCHFORD</td>
<td>$0.50</td>
</tr>
<tr>
<td>202-A</td>
<td>1½ in.</td>
<td>5/16 in.</td>
<td></td>
<td>2 in.</td>
<td>¾ lb.</td>
<td>SWITCHTOAD</td>
<td>0.75</td>
</tr>
<tr>
<td>202-B</td>
<td>1½ in.</td>
<td>5/8 in.</td>
<td></td>
<td>2 in.</td>
<td>¾ lb.</td>
<td>SWITCHGOOD</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Type 339 Switches

This switch consists of a moulded bakelite bracket which carries the bushing for the switch shaft. The moving poles of the switch are controlled by the worm, one-quarter of a turn of which will make the contacts close.

Knob: Special. See illustration. Dimensions: Those given in price list are over all. Shaft, ¾ inch. Weight: 6 ounces.

Mounting: Entire switch supported from panel by the bushing.
**Type 809 Socket Cushion**

- Type and Price
- Code Word
- 809

**Type 898**

- Base
- Diameter
- Weight
- Price

**Type 898**

- Base
- Diameter
- Weight
- Price

**Type 488 and Type 488 Sockets**

- Type
- Code Word
- Price

**Type 488**

- Code Word
- Price

**Type 488**

- Code Word
- Price

**Type 166**

- Type
- Code Word
- Price

**Type 166**

- Type
- Code Word
- Price

**Vacuum Tube Sockets**

- Type
- Code Word
- Price

**300-50**

- Qty 50
- Price

**300-25**

- Qty 25
- Price

**300-6**

- Qty 6
- Price

**898-4**

- 4 Pole Double Throat
- Code Word
- Price

**898-8**

- 8 Pole Double Throat
- Code Word
- Price

In the design of all General Radio vacuum-tube sockets, care has been taken in each case to see that they meet all size requirements of the tubes with which they are to be used.
Type 638 and Type 649 Sockets

These have been designed for general laboratory use where sockets even more sturdy than the Type 438 and Type 349 Sockets are required. The contact springs are made of phosphor bronze, specially tempered and shaped to resist fatigue. The mounting holes in the moulded bakelite bases are arranged so that the new sockets may be used as replacements for the Type 438 and Type 349 Sockets.

Ordinarily the new sockets are mounted behind holes in a thin bakelite or metal panel. They may, however, be mounted on the surface of a panel by using a Type 638-P1 Socket-Mounting Ring. The ring is required when the new sockets are used as replacements for the Type 438 and Type 349 Sockets.

Dimensions: "Diameter," given in price list is actual diameter of base exclusive of terminals. When socket is mounted behind panel; diameter of hole in panel is 1 3/16 inches; contact springs extend 13/16 inch behind panel.

<table>
<thead>
<tr>
<th>Type</th>
<th>Base</th>
<th>Diameter</th>
<th>Weight</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>638</td>
<td>UY—3-prong</td>
<td>2 in.</td>
<td>1 oz.</td>
<td>ALOFT</td>
<td>$0.50</td>
</tr>
<tr>
<td>649</td>
<td>UX—4-prong</td>
<td>2 in.</td>
<td>1 oz.</td>
<td>ALOFT</td>
<td>$0.45</td>
</tr>
</tbody>
</table>

Type 638-P1 Socket-Mounting Ring

This is a bakelite ring for use with either the Type 638 or the Type 649 Socket as described on the preceding page. When the socket is so mounted, its upper surface is raised 1 1/32 inches above the panel surface.

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>638-P1</td>
<td>1/2 oz.</td>
<td>ALONE</td>
<td>$0.15</td>
</tr>
</tbody>
</table>

Type 656, Type 657, and Type 658 Sockets

By special arrangement with the Isolantite Company of America we are listing the equivalent of our Type 156, Type 349, and Type 438 Sockets with glazed isolantite bases. The new sockets are designated, respectively, Type 656, Type 657, and Type 658.

Isolantite is an insulating material similar in appearance to white porcelain. The manufacturer claims that it is non-porous, that the dielectric losses are unusually low at very high frequencies, and that it has low surface conductivity. The latter is a desirable feature in sockets that are to be used with photo-electric cells and their associated amplifiers.

The Type 656 Socket has a metal shell and is suitable for mounting 4-prong tubes either with or without the bayonet lock. If desired, the location of the bayonet lock may be
The Type 860 strain insulator will be found particularly useful and ground wires may be used for supporting wires or instruments as well as lead-in equipment in high-tension trestle or core circuits. In addition, the Type 860 wall insulator is often used in combination with the Type 860 strain insulator as part of the radial construction of the tower.

**Type 860 and Type 860 Porcelain Insulators**

Carefully designed for use in high-voltage, high-frequency work, these insulators are an extremely satisfactory means of securing line conductors to the ground. They are designed to provide maximum electrical strength and resistive strength, and are manufactured to meet the rigid specifications of the National Electrical Manufacturers Association. Dimensions given in the accompanying diagrams are actual measurements taken from the actual insulators.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 860</td>
<td>Strain Insulator</td>
<td>860</td>
<td>220</td>
</tr>
<tr>
<td>Type 860</td>
<td>Wall Insulator</td>
<td>860</td>
<td>220</td>
</tr>
</tbody>
</table>

**Porcelain Insulators**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 267</td>
<td></td>
<td>267</td>
<td>220</td>
</tr>
<tr>
<td>Type 67</td>
<td></td>
<td>67</td>
<td>220</td>
</tr>
</tbody>
</table>

**Relays, Switches, Accessories**

53
# PLUGS, JACKS, AND MOUNTING BASES

## Type 274 Plugs, Jacks, and Mounting Bases

All of the devices listed in this section are built up from various combinations and modifications of the Type 274-P Plug and the Type 274-J Jack.

### Plugs

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>274-P</td>
<td>Single Plug (Basic Unit)</td>
<td>STANPARCAT</td>
<td>$.96</td>
</tr>
<tr>
<td>274-E</td>
<td>Single Plug with Jack Shank</td>
<td>STANFADOG</td>
<td>.80</td>
</tr>
<tr>
<td>274-D</td>
<td>Single Insulated Plug with Jack Shank</td>
<td>STANPARBYE</td>
<td>.25</td>
</tr>
<tr>
<td>274-G</td>
<td>Open-Type Double Plug with Jack Shanks</td>
<td>STANPARPUG</td>
<td>.50</td>
</tr>
<tr>
<td>274-M</td>
<td>Insulated Double Plug with Jack Shanks</td>
<td>STANPARBUG</td>
<td>.40</td>
</tr>
</tbody>
</table>

### Jacks

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>274-J</td>
<td>Single Jack (Basic Unit)</td>
<td>STANPARTOP</td>
<td>$.05</td>
</tr>
<tr>
<td>274-T</td>
<td>Double Adjustable Jack</td>
<td>STANPARTIP</td>
<td>.50</td>
</tr>
</tbody>
</table>

### Mounting Bases

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>274-AP</td>
<td>2-Gang Plug Base</td>
<td>STANFARRIB</td>
<td>$.50</td>
</tr>
<tr>
<td>274-AJ</td>
<td>2-Gang Jack</td>
<td>STANFARRHUM</td>
<td>.50</td>
</tr>
<tr>
<td>274-BP</td>
<td>3-Gang Plug</td>
<td>STANFARRBUN</td>
<td>.60</td>
</tr>
<tr>
<td>274-DJ</td>
<td>3-Gang Jack</td>
<td>STANFARRBSIN</td>
<td>.60</td>
</tr>
<tr>
<td>*274-CI</td>
<td>4-Gang Plug</td>
<td>STANFARRSUM</td>
<td>.60</td>
</tr>
<tr>
<td>*274-CJ</td>
<td>4-Gang Jack</td>
<td>STANFARRGIN</td>
<td>.60</td>
</tr>
<tr>
<td>*274-EP</td>
<td>4-Gang Transformer Mounting Plug Base</td>
<td>STANFARRGAS</td>
<td>.75</td>
</tr>
<tr>
<td>*274-EJ</td>
<td>4-Gang Transformer Mounting Jack Base</td>
<td>STANFARRFAD</td>
<td>.75</td>
</tr>
<tr>
<td>274-HP</td>
<td>6-Gang Transformer Mounting Plug Base</td>
<td>STANFARRBED</td>
<td>.90</td>
</tr>
<tr>
<td>274-HJ</td>
<td>6-Gang Transformer Mounting Jack Base</td>
<td>STANFARRNOT</td>
<td>.90</td>
</tr>
<tr>
<td>274-Q</td>
<td>Locating Pin</td>
<td>STANFARCAD</td>
<td>.05</td>
</tr>
</tbody>
</table>

* Drilled to accommodate two more Types 274-P Plugs and 274-J Jacks for converting 4-gang bases into 6-gang bases. Type 274-Q Locating Pins for preventing insertion of jack bases in wrong position are supplied, although the illustration does not show them.

† Added to line after illustrations were prepared. Locating pins supplied.

## Binding-Post Assemblies

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>274-K</td>
<td>With Type 138-V Binding Posts</td>
<td>STANFARBAG</td>
<td>$.65</td>
</tr>
<tr>
<td>274-L</td>
<td>&quot; Type 138-X &quot;</td>
<td>STANFARTAG</td>
<td>.65</td>
</tr>
</tbody>
</table>

## Type 274-RJ Mounting Base

The new Type 274-RJ Mounting Base has been designed particularly for use with the Type 492-A Oxide Rectifier and the Type 493 Thermocouples described on page 42. The jacks are placed so that the Type 274-CP Transformer Mounting Base may be used with it.

The new base is made of moulded bakelite, is fitted with four jacks and four jack-top binding posts, and is drilled to accommodate a locating pin. Two countersunk screw holes are provided.

Dimensions: Size of base, exclusive of binding posts, $3\frac{3}{4} \times 1\frac{1}{2} \times \frac{3}{4}$ inches.

<table>
<thead>
<tr>
<th>Type</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>274-RJ</td>
<td>STANFARPUP</td>
<td>$1.00</td>
</tr>
</tbody>
</table>
TRANSFORMER MOUNTING BASES

MOUNTING BASES

BINDING POST ASSEMBLIES

JACKS

PLUGS
### INDEX BY TYPE NUMBER

<table>
<thead>
<tr>
<th>Type</th>
<th>Instrument</th>
<th>Page</th>
<th>Type</th>
<th>Instrument</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>127</td>
<td>Hot-Wire Meters</td>
<td>36, 37</td>
<td>387-A</td>
<td>Speaker Filter</td>
<td>21</td>
</tr>
<tr>
<td>137</td>
<td>Knobs</td>
<td>48</td>
<td>404</td>
<td>Test-Signal Generator</td>
<td>29, 30</td>
</tr>
<tr>
<td>138</td>
<td>Binding Posts, Switch Contacts, and Stops</td>
<td>48</td>
<td>410</td>
<td>Rheostats and Potentiometers</td>
<td>13</td>
</tr>
<tr>
<td>157</td>
<td>Switch</td>
<td>50</td>
<td>427-F</td>
<td>Thermionic Voltmeter</td>
<td>33, 34</td>
</tr>
<tr>
<td>156</td>
<td>Sock Plate</td>
<td>51</td>
<td>430-A</td>
<td>A. C. Voltmeter</td>
<td>34, 35</td>
</tr>
<tr>
<td>166</td>
<td>Telephone Transformer</td>
<td>21, 43</td>
<td>437</td>
<td>Center-Tap Resistance</td>
<td>24</td>
</tr>
<tr>
<td>202</td>
<td>Switch</td>
<td>50, 439</td>
<td>443</td>
<td>Socket</td>
<td>51</td>
</tr>
<tr>
<td>213</td>
<td>Audio Oscillator</td>
<td>16, 444</td>
<td>446</td>
<td>Center-Tap Resistance</td>
<td>24</td>
</tr>
<tr>
<td>214</td>
<td>Rheostats and Potentiometers</td>
<td>11, 12, 448</td>
<td>448</td>
<td>Mutual-Conductance Meter</td>
<td>32</td>
</tr>
<tr>
<td>240</td>
<td>Capacity Meter</td>
<td>31</td>
<td>451</td>
<td>Voltage Divider</td>
<td>23</td>
</tr>
<tr>
<td>241</td>
<td>Microphone Hummer</td>
<td>16</td>
<td>461</td>
<td>Polar Relay</td>
<td>44</td>
</tr>
<tr>
<td>247</td>
<td>Variable Air Condenser</td>
<td>5, 4</td>
<td>486</td>
<td>Output Meter</td>
<td>39</td>
</tr>
<tr>
<td>280</td>
<td>Porcelain Insulator</td>
<td>53</td>
<td>486-A</td>
<td>A. C. Voltmeter</td>
<td>35</td>
</tr>
<tr>
<td>288</td>
<td>Varicoupler</td>
<td>14</td>
<td>492-A</td>
<td>Oxide Rectifier</td>
<td>43, 43</td>
</tr>
<tr>
<td>289</td>
<td>Variable</td>
<td>14</td>
<td>495</td>
<td>Thermocouples</td>
<td>43</td>
</tr>
<tr>
<td>274</td>
<td>Plugs, Jacks, and Bases</td>
<td>54</td>
<td>502</td>
<td>Dial</td>
<td>46</td>
</tr>
<tr>
<td>274-RJ</td>
<td>Mounting Base</td>
<td>54</td>
<td>503</td>
<td>Dial</td>
<td>46</td>
</tr>
<tr>
<td>276-A</td>
<td>Quartz Plate</td>
<td>26</td>
<td>507</td>
<td>Non-Polar Relay</td>
<td>44</td>
</tr>
<tr>
<td>280</td>
<td>Porcelain Insulator</td>
<td>53</td>
<td>527-A</td>
<td>Rectifier Filter</td>
<td>23</td>
</tr>
<tr>
<td>285</td>
<td>Amplifier Transformer</td>
<td>17</td>
<td>540</td>
<td>Filament Transformer</td>
<td>22</td>
</tr>
<tr>
<td>287</td>
<td>Direct-Reading Ohmmeter</td>
<td>37, 38</td>
<td>541</td>
<td>Push-Pull Transformer</td>
<td>20</td>
</tr>
<tr>
<td>301</td>
<td>Rheostats and Potentiometers</td>
<td>12, 13</td>
<td>545</td>
<td>Transformer</td>
<td>22</td>
</tr>
<tr>
<td>309</td>
<td>Socket Cushion</td>
<td>45</td>
<td>552</td>
<td>Volume Control</td>
<td>8</td>
</tr>
<tr>
<td>310</td>
<td>Dial</td>
<td>45</td>
<td>553</td>
<td>Volume Control</td>
<td>10</td>
</tr>
<tr>
<td>317</td>
<td>Dial</td>
<td>45</td>
<td>556</td>
<td>Amateur-Band Condenser</td>
<td>6</td>
</tr>
<tr>
<td>318</td>
<td>Dial</td>
<td>45</td>
<td>557</td>
<td>Amateur-Band Condenser</td>
<td>6</td>
</tr>
<tr>
<td>334</td>
<td>Variable Air Condenser</td>
<td>4, 5</td>
<td>558-P</td>
<td>Frequency Meter</td>
<td>25</td>
</tr>
<tr>
<td>385-Z</td>
<td>Variable Air Condenser</td>
<td>5</td>
<td>565</td>
<td>Transformer</td>
<td>22</td>
</tr>
<tr>
<td>337</td>
<td>Switch</td>
<td>50</td>
<td>573-A</td>
<td>Resistance-Impedance Coupler</td>
<td>19</td>
</tr>
<tr>
<td>339</td>
<td>Switch</td>
<td>50, 51</td>
<td>577</td>
<td>Inductors</td>
<td>15</td>
</tr>
<tr>
<td>349</td>
<td>Socket</td>
<td>51</td>
<td>585</td>
<td>Amplifier Transformer</td>
<td>17–19</td>
</tr>
<tr>
<td>356</td>
<td>Quartz-Plate Holder</td>
<td>20, 586</td>
<td>Power-Level Indicator</td>
<td>38–41</td>
<td></td>
</tr>
<tr>
<td>358</td>
<td>Wavemeter</td>
<td>20</td>
<td>588-P</td>
<td>Accessories</td>
<td>41</td>
</tr>
<tr>
<td>359</td>
<td>Variable-Ratio Transformer</td>
<td>20, 21</td>
<td>587</td>
<td>Speaker Filter</td>
<td>21</td>
</tr>
<tr>
<td>360-A</td>
<td>Test Oscillator</td>
<td>28</td>
<td>598-A</td>
<td>Fader</td>
<td>8</td>
</tr>
<tr>
<td>366</td>
<td>Filter Choke</td>
<td>28</td>
<td>638</td>
<td>Socket</td>
<td>52</td>
</tr>
<tr>
<td>368</td>
<td>Variable Air Condenser</td>
<td>6, 649</td>
<td>638-P</td>
<td>Socket-Mounting Ring</td>
<td>52</td>
</tr>
<tr>
<td>371</td>
<td>Potentiometers</td>
<td>11, 656</td>
<td>649</td>
<td>Socket</td>
<td>52</td>
</tr>
<tr>
<td>374</td>
<td>Variable Air Condenser</td>
<td>5, 657</td>
<td>658</td>
<td>Socket</td>
<td>52, 53</td>
</tr>
<tr>
<td>379</td>
<td>Radio-Frequency Chokes</td>
<td>24, 658</td>
<td>658</td>
<td>Socket</td>
<td>52, 53</td>
</tr>
</tbody>
</table>

### INDEX BY TITLE

- Air condensers, see **Condensers**
- Ammeters, hot-wire, 36–37
- Amplifier, coupling devices, 17–21
- Anti-capacity switches, 50–51
- Assemblies, binding-post, 54
- Audio oscillator, 16
- Bases, mounting, 54
- Binding posts, 48
- Binding-post assemblies, 54
- Bridge, capacity, 31
- mutual-conductance, 32
- vacuum-tube, 32
- Calibrated condensers, 3

---

- Capacitance, see **Capacity**
- Capacitors, see **Condensers**
- Capacity bridges, 31
- meter, 31
- Center-tap resistors, 24
- Choke, filter, 23
- radio-frequency, 24
- Condensers, amateur-band, 6
- calibrated, 3
- high-voltage, 4–5
- micro, 6
- variable air, 3–6
- vernier, 6
- Contacts, switch, 48
INDEX BY TITLE

Control, volume, 7-19
Copper-oxide-rectifier voltmeter, 34-35, 38-42
Coupler, resistance-impedance, 19
Coupling devices, 17-21
Cushion, socket, 51
Dial plate, 45
Dials, geared, 46
plain, 45
verner, 46
Divider, voltage, 7-13, 23
Experimental inductors, 14-15
wavemeters, 25-26
Fader, 8-10
Filament transformer, 22
Filter choke, 23
rectifier, 23
speaker, 21
Frequency meter, amateur-band, 25
see Wavemeter
Galvanometer, hot-wire, 36-37
Geared dials, 46
Generator, test-signal, 29-39
see Oscillators
Holder, quartz-plate, 26
Hot-wire meters, 36-37
Hum-balancing resistors, 24
Hummer, microphone, 16
Impedance-resistance coupler, 19
Inducers, 14-15
fixed, 15
variable, 14
Insulators, porcelain, 53
Jacks, 54
Knobs, moulded, 48
Meters, ammeters, 36-38
capacity, 31
frequency, see Wavemeters
hot-wire, 36-37
mutual-conductance, 32
ohmmeters, 37-38
output, 38-41
power-level indicators, 39-41
voltmeters, 33-35, 39-41
wave, 25-26
Microphone hummer, 16
mixing controls, 7-13
transformer, 18
Mixing controls, 7-13
Moulded knobs, 48
Mounting bases, 54
Mutual-conductance meter, 32
Non-polar relay, 44
Ohmmeters, 37-38
Oscillators, audio, 16
microphone-button, 10
microphone-hummer, 16
piezo-electric, 26
reed-type, 16
test, 27-28
test-signal, 29-30
tuning-fork, 16
Output meter, 38-41
Oxide rectifier, 42
voltmeters, 34-35, 39-42
Plate, quartz, 26
Plugs, 54
Polar relay, 44
Porcelain insulators, 53
Portable capacity bridges, 31
Potentiometers, 7-8, 10-13, 23
Power-level indicator, 30-41
Push-pull transformers, 20
Quartz plate, 26
plate-holder, 26
Radio-frequency chokes, 24
Rectifier filter, 23
Relay, low-current, 44
non-polar, 44
polar, 44
Resistance-impedance coupler, 19
unit, center-tap, 24
Rheostats, 10-13
Service-testing equipment, 27-32
Socket, 59
cushion, 51
mounting ring, 52
vacuum-tube, 51-53
Speaker filters, 21
Strain insulators, 53
Switch contacts, 48
stops, 48
Switches, 50
Telephone transformer, 21
Test oscillator, 27-28
signal generator, 29-30
Thermionic voltmeter, 33-34
Thermocouples, 43
Transformers, amplifier, 17-20
filament-heating, 22
mounting bases, 54
plate-supply, 22
power-supply, 22
push-pull, 20
telephone, 21
Transformers
variable-ratio, 20-21
Tube, vacuum, bridge, 32
Vacuum-tube bridge, 32
voltmeter, 33-34
Variable air condensers, 3-6
inducers, 14
ratio transformer, 20-21
Variocoupler, 14
Variometer, 14
Vernier condenser, 6
dial, 46
Voltage divider, 7-8, 10-13, 23
Voltmeter, oxide-rectifier, 34-35, 39-42
thermonic, 33-34
vacuum-tube, 33-34
Volume controls, 7-13
Wall insulators, 53
Wavemeter, experimental, 25-26
CONDENSERS FOR FIVE-METER WORK

TYPE 568 VARIABLE AIR CONDENSERS

These are condensers of rugged construction for use as tuning elements in short-wave receivers, transmitters, and wavemeters. They are designed for tandem mounting, a hollow shaft permitting the use of a single long bakelite or metal shaft for driving several units. The isolantite end plates help to keep the losses at a minimum, a particularly important feature when working at 5 meters.

Range:
Two sizes are available. See the price list.

Rotor Plates:
Straight-line capacitance for the Type 568-D and straight-line frequency for the Type 568-K Variable Air Condensers.

Insulation:
Isolantite end plates.

Maximum Voltage:
500 volts, peak.

Figure of Merit:
\[ R \omega C^2 = 0.03 \times 10^{-12} \] based on measurements at 1000 cps.

Drive:
The rotor is attached to a hollow shaft through which a \( \frac{3}{8} \)-inch insulating or conducting shaft may be slipped and fastened with two set screws. This permits driving several units which have been mounted in tandem with the same shaft. Bakelite shaft extending a maximum of 1\( \frac{1}{2} \) inches from rear face of mounting panel is supplied with each condenser.

Mounting:
Three tapped inserts attached to one end plate on a \( \frac{3}{4} \)-inch radius are provided for mounting the condenser on a panel of any thickness between \( \frac{3}{8} \) and \( \frac{5}{16} \) inch. Drilling template and three flat head machine screws are furnished.

Dimensions:
Panel space, 2\( \frac{1}{4} \) x 2\( \frac{3}{8} \) inches required. Overall depth behind panel (exclusive of the shaft), 2\( \frac{3}{4} \) inches.

Weight:
\( \frac{3}{4} \) pound.

---

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacitance</th>
<th>Plate Shape</th>
<th>Rotation Angle</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>568-D</td>
<td>175 ( \mu )f</td>
<td>SLC</td>
<td>180°</td>
<td>CLOVE</td>
<td>$4.00</td>
</tr>
<tr>
<td>568-K</td>
<td>50 ( \mu )f</td>
<td>SLF</td>
<td>270°</td>
<td>CLOUD</td>
<td>4.00</td>
</tr>
</tbody>
</table>

A Type 568-D Variable Air Condenser.
Note the isolantite end plates and the removable bakelite shaft.

---

WE PREPAY POSTAGE IN U.S. OR CANADA
IF PAYMENT ACCOMPAINTS ORDER
CLASS B MODULATION TRANSFORMERS

TYPE 292 TRANSFORMERS

A Class B modulation system is ideal for the amateur, combining as it does good quality with a minimum of tubes and other equipment. Complete descriptions of the theory and operation of this system appear in QST for November and December, 1931.

TYPE 292-A

TRANSFORMERS

TYPE 292 Transformers are intended for use in the input and output circuits of a Class B modulation stage utilizing two 210-type tubes. TYPE 292-A is used for input; TYPE 292-B is used for output. Both units have been designed to work together and secure the best possible frequency characteristic.

Another important consideration is the high values of surge voltage that the output transformers must withstand. Both the TYPE 292-A and TYPE 292-B Transformers are tested on 4000 volts direct current between windings and between winding and core.

Both transformers are of General Radio quality, made with the best materials and workmanship. Like other General Radio transformers they are designed to have good electrical characteristics.

The TYPE 292-A Transformer is mounted in a Model B Case (see Bulletin 933, Pages 18 and 19) and weighs 2% pounds. The TYPE 292-B Transformer is mounted in a Model C Case (See Pages 18 and 19 of Bulletin 933) and weighs 4% pounds.

<table>
<thead>
<tr>
<th>Type</th>
<th>Use</th>
<th>Code Word</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>292-A</td>
<td>Class B Input</td>
<td>TUNIC</td>
<td>$7.00</td>
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<tr>
<td>292-B</td>
<td>Class B Output</td>
<td>TUDOR</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

DIALS

The TYPE 317-A, TYPE 317-F, TYPE 503-A, and TYPE 503-F Dials described on Pages 45, 46, and 47 of Bulletin 933 are now made with 100 divisions instead of 200 divisions as formerly. The dials affected by this change are those 4 inches in diameter which are graduated over 180° of their circumference.

WE SHIP WITHIN 24 HOURS AFTER RECEIVING YOUR ORDER