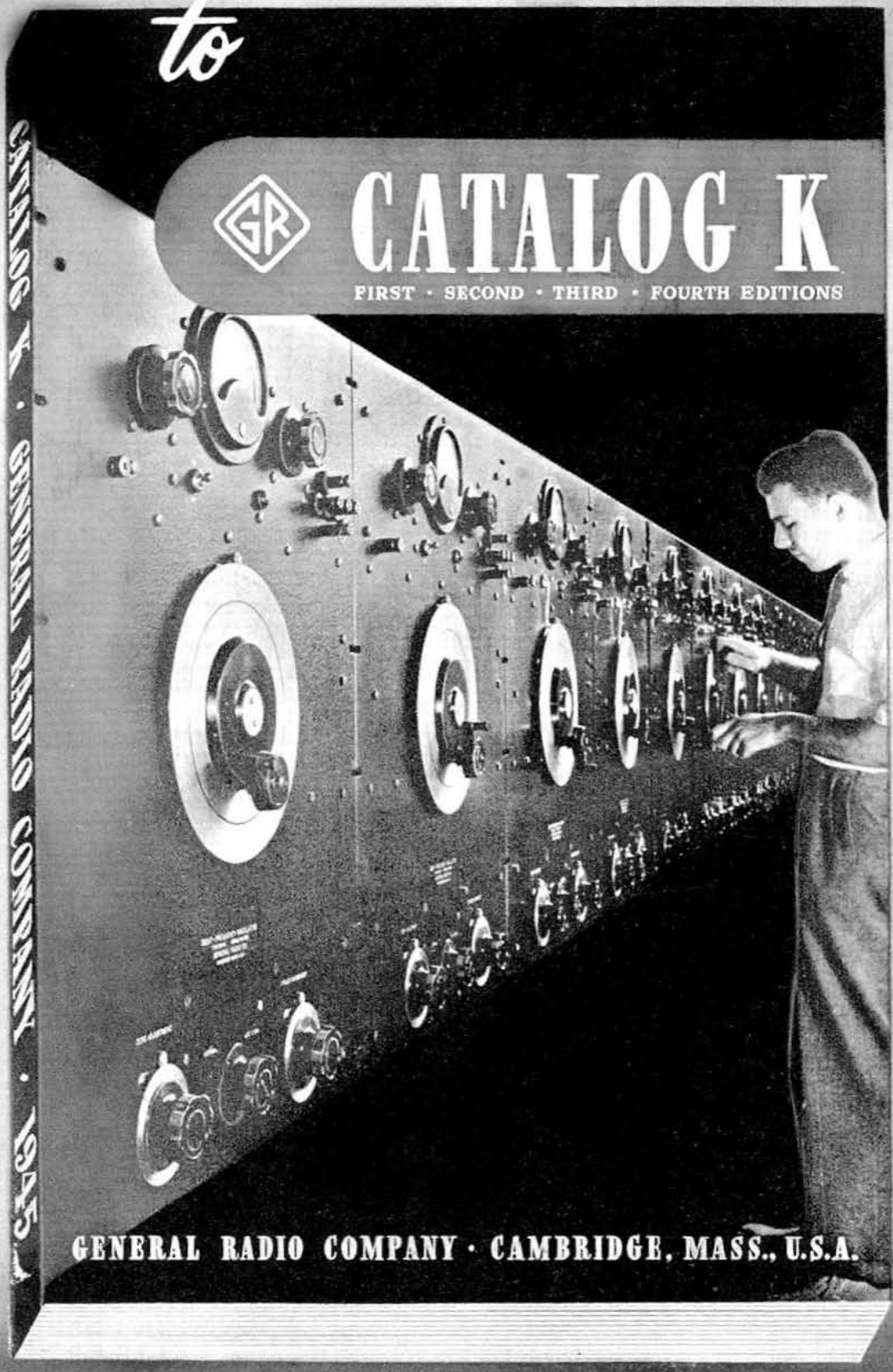
Postwar Supplement

to



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QUICK INDEX

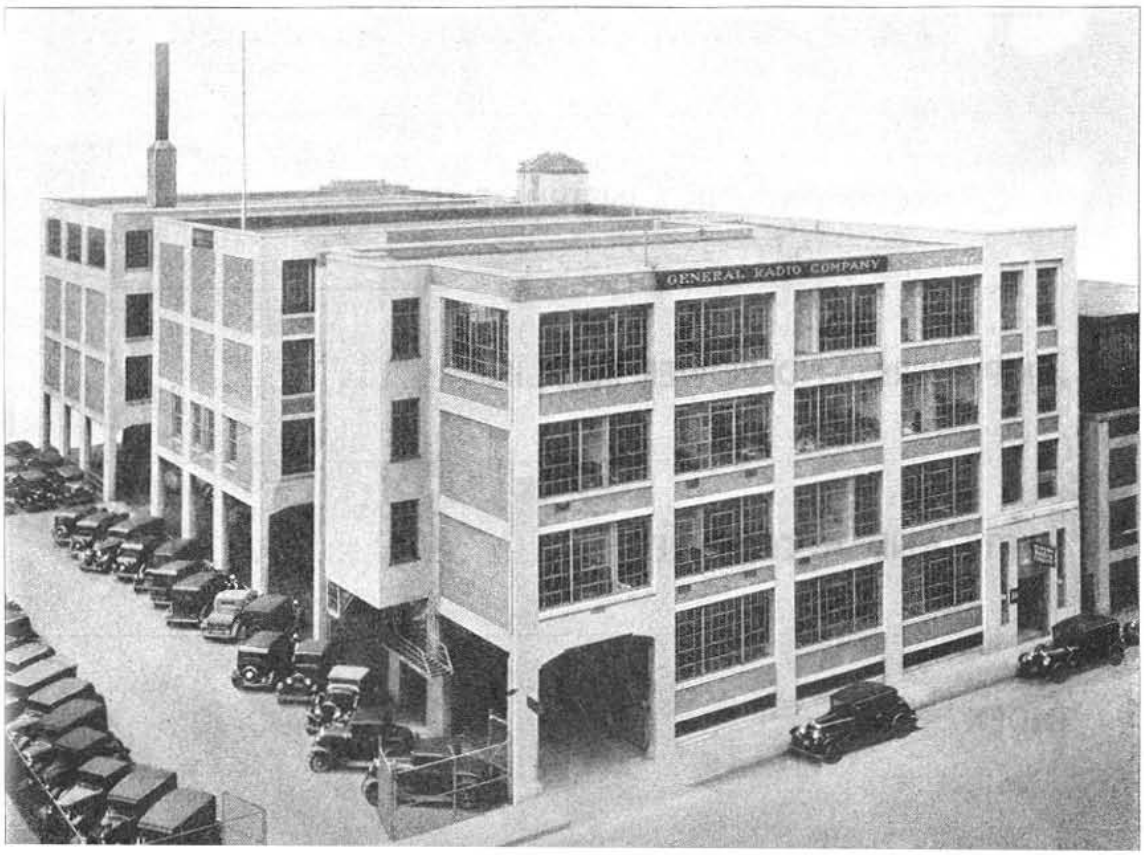
WE SELL DIRECT . . .

To develop the type of product manufactured by the General Radio Company requires a large staff of engineers, each a specialist in one or more phases of the work involved. One of the functions of this staff is to assist the customer in the selection of instruments in order that the correct equipment may be purchased with a minimum expenditure.

There has always been an intimate contact between our engineers and our customers. The technical nature and the manifold uses of our product make the maintenance of this contact essential. For this reason, the General Radio Company maintains no sales agencies in the United States, but distributes its products to the consumer on a net, no discount, basis directly from the factory or through branch engineering offices.

In order that customers outside the United States may receive equivalent technical service, exclusive representatives have been appointed in many other countries, each capable of giving technical and commercial information regarding General Radio products. In all matters regarding General Radio apparatus the customer should communicate with the representative from whom this catalog was received. Prices listed in the catalog are for domestic use only. Costs in other countries, where import duty, freight and insurance must be added, can be obtained from the representatives in those countries.

GENERAL RADIO COMPANY



SUPPLEMENT TO

CATALOG K

FIRST, SECOND, THIRD AND FOURTH EDITIONS

Since the publication of Catalog K in 1939, wartime demand made it necessary to publish a second edition in 1942, a third in 1944, and a fourth in 1945. With each new edition, some items were discontinued and new ones were added.

This supplement lists discontinued equipment and describes equipment made available since the publication of the first edition of Catalog K. It brings all editions completely up to date.

A new catalog of General Radio products will be published as soon as possible. In the meantime, as new items become available, new pages describing them will be sent to you.

GENERAL RADIO COMPANY
CAMBRIDGE, MASS., U.S.A.

DECEMBER, 1945

SUGGESTIONS FOR ORDERING

ORDER BY TYPE NUMBER

Always order by catalog type number, and whenever possible mention ranges or other significant specifications as protection against misunderstanding.

Be sure to include orders for any accessories desired or for calibrations which must be made before shipment.

TELEGRAPH AND CABLE ORDERS

We have direct telegraph printer connections with Western Union for the prompt handling of messages.

Use Bentley's code and the code words accompanying each catalog description. Our cable address is GENRADCO BOSTON.

SHIPPING INSTRUCTIONS

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

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

Cases are not returnable.

TERMS

Net 30 days. Unless credit has already been established, shipments are made C.O.D.

When full payment accompanies an order for new equipment, we pay transportation charges to any point in the continental United States, except Alaska.

REMITTANCES

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

SALES AGENCIES

Because of the Company's direct sales policy no general sales agencies are appointed. Complete stocks are carried only at the factory warehouse. A partial stock is maintained at Los Angeles

PRICE CHANGES

All prices are subject to change without notice. Billed prices will be in accordance with applicable Federal Regulations at time of shipment. Formal price quotations remain open for 30 days.

SPECIFICATION CHANGES

We reserve the right to discontinue instruments without notice, and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

TAXES

Prices are subject to such additions for Federal, state or local taxes as we are now or may be required to collect, and to revision as to any sales, excise, or similar taxes which may hereafter be imposed.

NO TRADE OR EDUCATIONAL DISCOUNTS

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

QUANTITY DISCOUNTS

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

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

The above discounts also apply to quantities of packages where the unit of sale is a package of small parts.

BRANCH ENGINEERING OFFICES

Engineering offices are maintained in the following cities:

New York 6: 90 West Street
Telephone WOrth 2–5837
Chicago 5: 920 South Michigan Avenue
Telephone WABash 3820
Los Angeles 38: 1000 North Seward Street
Telephone HOllywood 6321

Customers in or near these cities can quickly and conveniently obtain information about our products from these offices. Each office is in charge of a graduate engineer who has had several years' experience in the engineering department at the home office.

Although our domestic sales are made on a direct-to-the-consumer basis, we have arranged with numerous foreign representatives for the sale and servicing of our products outside of the United States.

WARRANTY

We warrant each new instrument manufactured and/or sold by us to be free from defects in material and workmanship; our obligation under this warranty being limited to repairing or replacing any instrument or part thereof, except tubes and batteries, which shall, within one year after delivery to the original purchaser, prove upon our examination to be thus defective. Material shall not be considered as defective or not in compliance with your order even though not in accordance with our catalog specifications or other specifications if it substantially fulfills performance specifications.

REPAIR PARTS

When ordering repair parts, be sure to describe carefully the parts required and to give the type number and serial number from the panel of the instrument.

SHIPMENTS TO GENERAL RADIO

When returning instruments for repair, recalibration, or for any other reason, please ask our Service Department for shipping instructions. Please state type number and serial number of instrument and date of purchase.

OTHER GENERAL RADIO PUBLICATIONS

In addition to this catalog we publish a monthly magazine, the *General Radio Experimenter*, for free distribution among interested persons. It contains technical and semi-technical engineering articles which are contributed, for the most part, by our engineering staff. To be placed on the mailing list, simply address a request to us containing your name, mailing address, and business affiliation.

PATENTS

Many of our products are manufactured and sold under United States Letters Patent owned by the General Radio Company or under license grants from other companies. To simplify the listing of these patents they are given here in a single list and referred to at each instrument only by appropriate reference number.

1. Vacuum-tube amplifier devices, electric wave filters, and vacuum-tube oscillators are licensed by Western Electric Company, Inc., under all United States Letters Patent owned or controlled by American Telephone and Telegraph Company, or Western Electric Company, Inc., and any or all other United States patents with respect to which Western Electric Company, Inc., has the right to grant a license, solely for utilization in research, investigation, measurement, testing, instruction, and development work in pure and applied science, including engineering and industrial fields.
2. Patent 1,871,886.
3. Patent 2,294,941.
4. Patent applied for.
5. Patent 1,901,343.
6. Patent 1,901,344.
7. Patent 1,944,315.
8. Patent 1,967,135.
9. Patent 2,173,427.
10. Patent 2,367,681.
11. Patent 2,009,013.
12. Licensed under all patents and patent applications of Dr. G. W. Pierce pertaining to piezo-electric crystals and their associated circuits.
13. Patent 2,069,934.
14. Patent 1,943,302.
15. Licensed under designs, patents and patent applications of Edgerton, Germeshausen and Grier, including Patents Nos. 2,185,189, 2,201,166, 2,201,167, 2,302,690, 2,331,317
16. Patent 2,376,394.
17. Patents 1,713,146 and 1,744,675.
18. Patent 1,933,447.
19. Patent 1,967,184.
20. Patent 2,012,497.
21. Patent 2,012,291.
22. Patent 1,999,369.
23. Patent 1,790,153 and other patents, covering electrical discharge devices and circuits with which said devices may be used, owned by the General Electric Company or under which it may grant licenses.
24. Patent 2,173,426.
25. Patent 2,298,177.
26. Patent 2,362,503.
27. Patent 2,029,358.
28. Patent 2,354,718.
29. Patent 2,025,775.
30. Patent 2,374,248.

INDUSTRIAL INSTRUMENTS

STROBOSCOPES

During the war, we have developed a light source, similar to those used for stroboscopic work, but designed specifically for high-speed, single-flash photography. This instrument, the TYPE 1530-A Microflash, has a flash duration of only 1 or 2 millionths of a second, yet the illumination produced is sufficiently intense to yield satisfactory photographs on commercially available film. It has found wide application in testing ammunition as well as in mechanical fields. (See page 2.)

VIBRATION METERS

Since the publication of the first edition of Catalog K in 1939, two vibration-measuring instruments have been cataloged, the TYPE 761-A Vibration Meter and the TYPE 762-B Vibration Analyzer. These instruments measure solid-borne vibrations in the same way that the sound-level meter and sound analyzer measure air-borne vibrations. (See pages 4 to 7.) A vibration pickup is also available for use with the sound-level meter (see page 6).

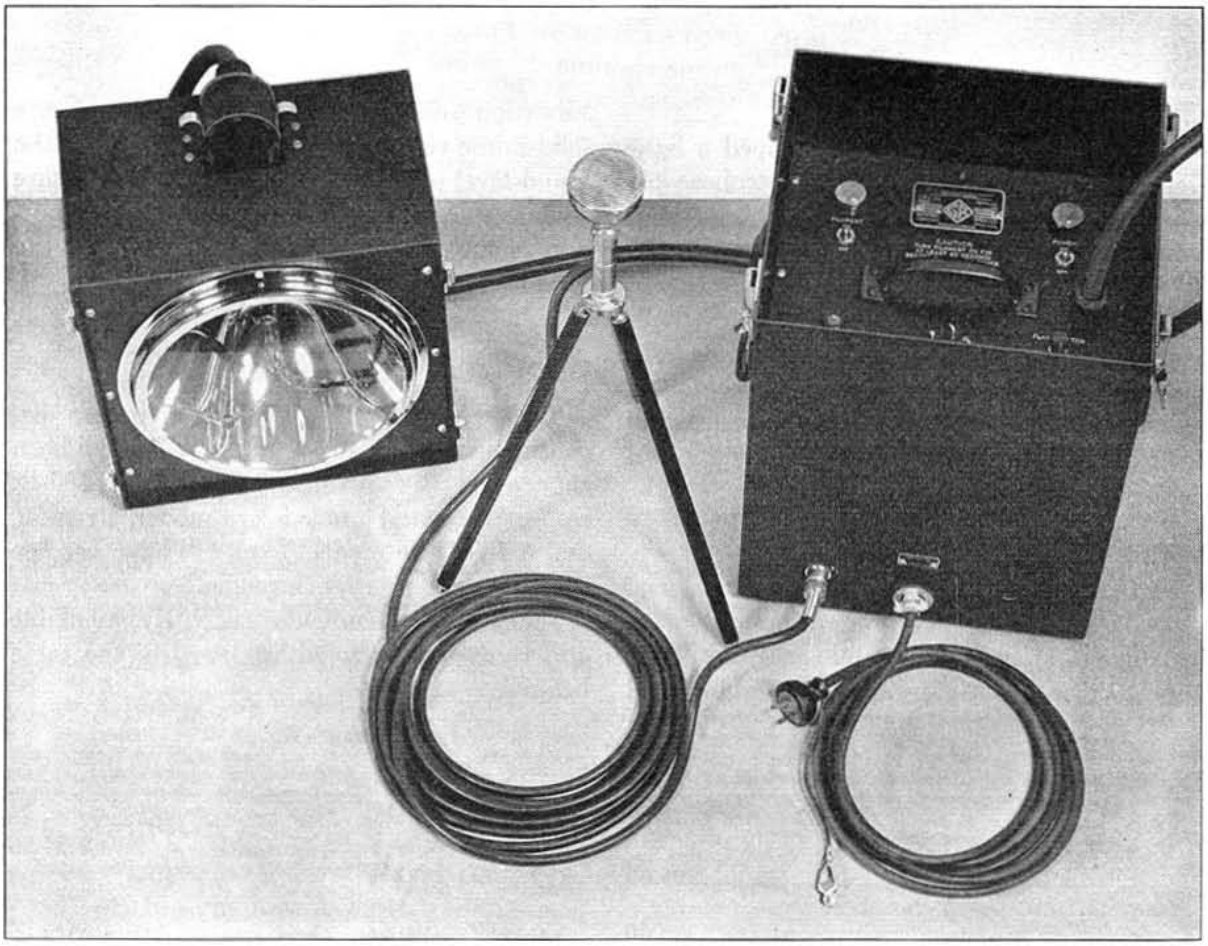
VARIACS

TYPES 70, 80 and 90 Variacs have been discontinued; TYPES 100-K and 100-L have been superseded by TYPES 100-Q and 100-R, respectively; and a new 5 kva model, TYPE 50, and a 400-cycle model, TYPE 60, have become available (see pages 8 through 10).

Industrial instruments currently available and those discontinued are listed in the table below:

Type	*Name*	*Price*
50-A	Variac	$100.00
50-AG2	2-Gang, TYPE 50-A Variac Assembly	225.00
50-AG3	3-Gang, TYPE 50-A Variac Assembly	335.00
50-B	Variac	100.00
50-BG2	2-Gang, TYPE 50-B Variac Assembly	225.00
50-BG3	3-Gang, TYPE 50-B Variac Assembly	335.00
50-P1	Choke	7.50
60-AM	Variac	15.00
60-AU	Variac	13.00
70	Variacs	*Discontinued*
80	Variacs	*Discontinued*
90-B	Variac	*Discontinued*
100-K	Variac	*Replaced by* TYPE *100-Q*
100-L	Variac	*Replaced by* TYPE *100-R*
100-Q	Variac	40.00
100-QG2	2-Gang, TYPE 100-Q Variac Assembly	85.00
100-QG3	3-Gang, TYPE 100-Q Variac Assembly	130.00
100-R	Variac	40.00
100-RG2	2-Gang, TYPE 100-R Variac Assembly	85.00
100-RG3	2-Gang, TYPE 100-R Variac Assembly	130.00
200-B	Variac	10.00
200-CM	Variac	17.50
200-CMH	Variac	21.50
200-CU	Variac	14.50
200-CUG2	2-Gang, TYPE 200-CU Variac Assembly	$ 36.50
200-CUG3	3-Gang, TYPE 200-CU Variac Assembly	56.00
200-CUH	Variac	18.50
200-CUHG2	2-Gang, TYPE 200-CUH Variac Assembly	44.50
200-CUHG3	3-Gang, TYPE 200-CUH Variac Assembly	68.00
621-M	Power Stroboscope	*Built to Order*
631-B	Strobotac	95.00
631-P1	Replacement Strobotron	4.50
648-A	Strobolux	150.00
648-P1	Replacement Lamp	15.00
715-AE	Direct-Current Amplifier	250.00
715-AM	Direct-Current Amplifier	225.00
759-B	Sound-Level Meter	195.00
	Replacement battery for above	3.50
759-P21	Tripod and Extension Cable	11.50
759-P35	Vibration Pickup	32.50
759-P36	Control Box	30.00
759-P50	A-C Power Supply	*Replaced by 1261-A*
760-A	Sound Analyzer	260.00
	Replacement battery for above	7.10
761-A	Vibration Meter	260.00
	Replacement battery for above	3.50
762-B	Vibration Analyzer	275.00
	Replacement battery for above	7.10
1261-A	A-C Power Supply for TYPE 759-B Sound-Level Meter	*See p. 63*
1530-A	Microflash	525.00*
1530-P1	Replacement Flash Lamp	15.00*

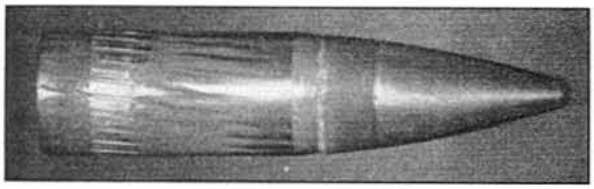
*Plus current Federal Tax on photographic equipment.



TYPE 1530-A MICROFLASH

USES: The Microflash is a light source for single-flash photography. It provides a high-intensity light flash whose duration is approximately 2 millionths of a second. Consequently, it is capable of arresting extremely rapid motion. Conventional camera equipment is quite satisfactory for use with the Microflash.

Photographs of bodies moving at extremely high speeds are possible with the Microflash, and it finds many applications in engineering and the physical sciences, particularly in such fields as ballistics, hydraulics, kinematics, and industrial chemistry.



The Microflash was used as a light source in taking this photograph of a projectile in flight.

DESCRIPTION: The elements of the Microflash are a power supply, a gas-filled lamp, and a trigger circuit. The high-voltage transformer and rectifier, operating from the a-c power line, charge a condenser across the lamp terminals. An electrical impulse, which may be derived in any one of several ways from the phenomenon to be photographed, ionizes the gas in the lamp, and the energy stored in the condenser is dissipated in a discharge through the lamp, producing a short brilliant flash. A minimum of 10 seconds is required between flashes for the condenser to become fully charged.

The trigger circuit includes an amplifier, so that the flash can be tripped with a conventional crystal microphone, if desired. The flash can also be triggered by a make or break contact.

FEATURES: The outstanding feature of the Microflash is its high intensity and very short flash. During the flash, an object moving at 1000 feet per second would be displaced only one or two hundredths of an inch. Consequently, sharp records can be obtained of bullets and other projectiles in flight.

SPECIFICATIONS

Duration of Flash: Approximately 2 microseconds.

Temperature and Humidity Effects: Temperature and humidity variations (32 to 100° F, 0 to 95% R.H.) have no appreciable effect upon the operation of the instrument.

Power Supply: 105 to 125, 210 to 250 volts, 50 to 60 cycles.

Power Input: 70 watts.

Tubes:

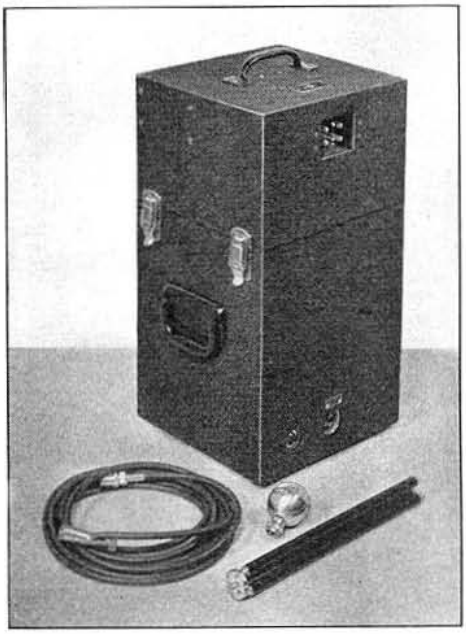
1 — 5T4 (RCA) 1 — FG-17 (GE)
1 — 2V3G(RCA) 1 — 6AC7 (1852) RCA
One 1530-P1 (General Radio)

Accessories Supplied: Microphone with cable; tripod; all tubes; spare pilot lamps and fuses; 2 spare flash lamps TYPE 1530-P1; plug for connection to contactor-trip jack.

Mounting: The power supply and trigger circuits are assembled in one metal case, the lamp in another. The two cases lock together for transportation, completely protecting the lamp and controls.

Dimensions: 24⅛ x 13¼ x 11¾ inches, overall.

Net Weight: 72 pounds.



(Right) View of the Microflash assembled for transportation.

Type		*Code Word*	*Price*
1530-A	Microflash	TAFFY	$525.00*
1530-P1	Replacement Flash Lamp	TONIC	15.00*

*Plus current Federal tax on photographic equipment.
PATENT NOTICE. See Notes 15, 23, page iv.

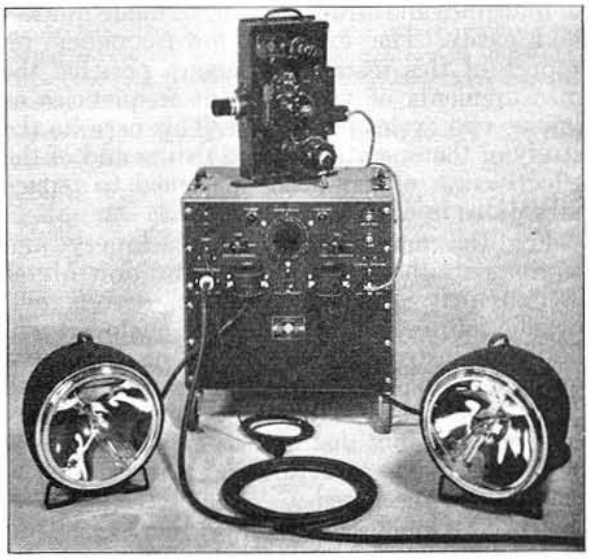
TYPE 621 POWER STROBOSCOPE

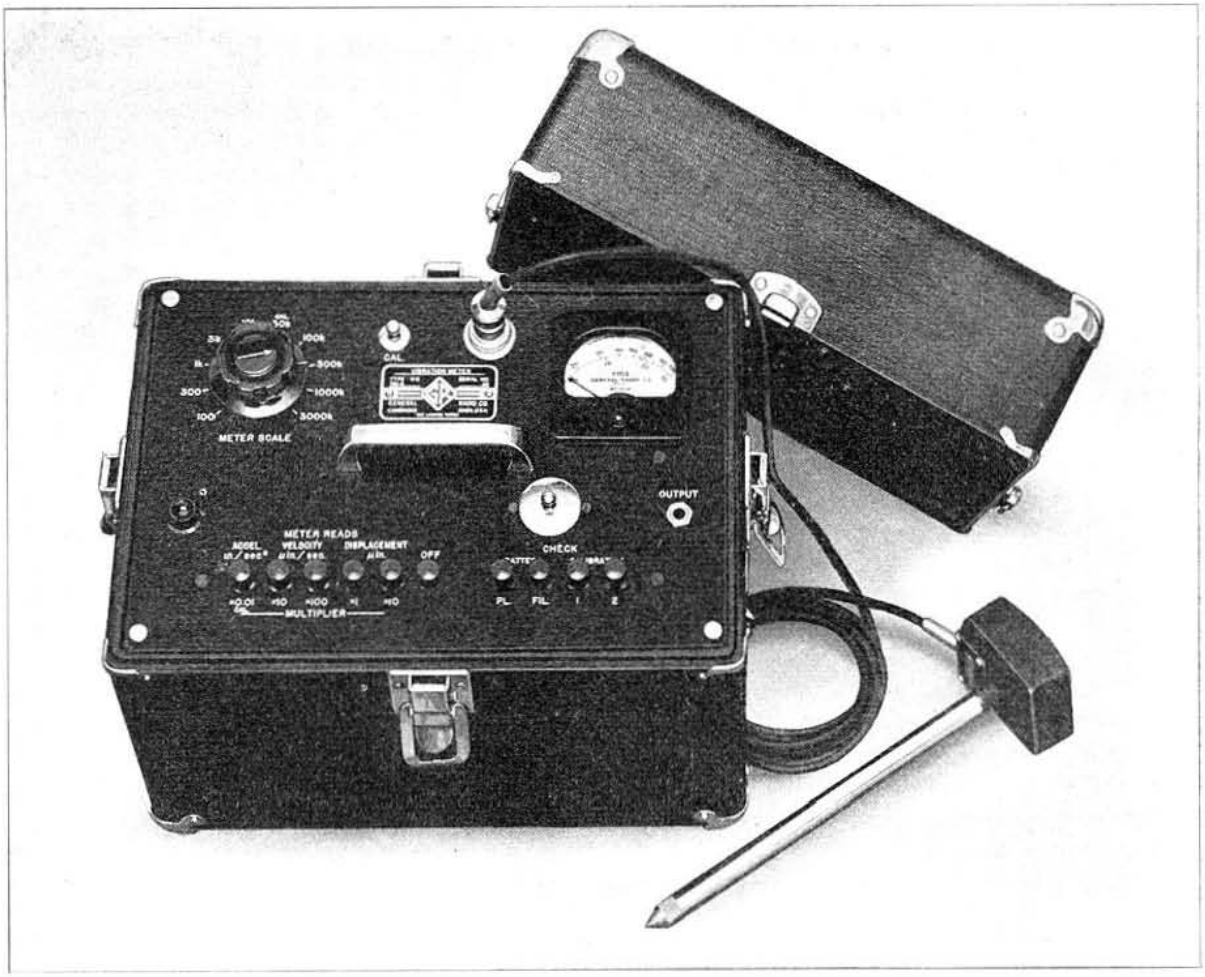
The TYPE 621 Power Stroboscope supplies even greater light intensity per flash than does the TYPE 648-A Strobolux and is capable of being flashed at much higher speeds. It is particularly designed as a light source for the TYPE 651-A Recorder. With this combination, motion pictures can be taken at speeds up to 1500 exposures per second, permitting the study of high-speed transient or non-repetitive motion, turbulence and cavitation in fluid flow, and other industrial and research problems.

When the Power Stroboscope is used in ultra-high-speed photography, the flashing rate is commonly controlled by a commutator on the camera. In this way the individual exposures are accurately framed for projection at normal speeds.

When stroboscopic lighting of high intensity at a high flashing rate is desired, considerable power is required, since the power that must be supplied to the light is directly proportional to the desired intensity, as well as to the frequency of flashing. Thus, although the TYPE 648-A Strobolux furnishes a light intensity adequate for illuminating small areas or for single-flash photography, the maximum useful flashing rate is limited by the power supply to about 100 per second. For applications involving very high flashing rates or for taking high-speed motion pictures, a stroboscope of considerable power capacity is required.

The power stroboscope is built to order only.
Prices on request.
PATENT NOTICE. See Notes 15, 23, page iv.





TYPE 761-A VIBRATION METER

USES: With the TYPE 761-A Vibration Meter measurements of the vibratory characteristics of machines and structures can be made quickly and easily. The excellent low-frequency response of this instrument makes possible the measurements of vibrations at frequencies as low as two cycles per second. This permits the study of the operation of belt drives and of the effectiveness of mountings designed to reduce vibrations in adjacent structures.

For the manufacturer of machinery and equipment, the TYPE 761-A Vibration Meter is extremely useful in research, design, and production testing. Maintenance engineers will find the instrument useful for checking the operating condition of bearings, gear trains, and other mechanisms. With this instrument excessive vibrations due to improper adjustment or design and to structural resonances may be located and measured.

When an analysis of the frequency spectrum of the vibration is desired, the TYPE 762-B Vibration Analyzer (see page 7) should be used, in conjunction with the vibration meter.

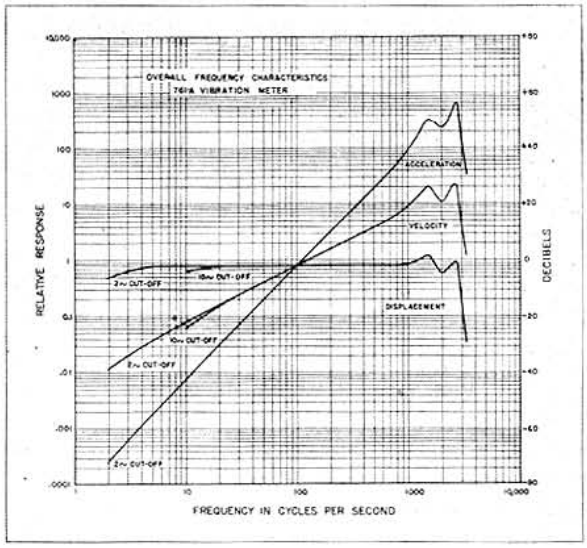
DESCRIPTION: The TYPE 761-A Vibration Meter consists essentially of a vibration pickup, an adjustable attenuator, an amplifier, and a direct-reading indicating meter. The pickup is of the inertia-operated crystal type which delivers a voltage proportional to the acceleration of the vibratory motion. An integrating network converts this output, when desired, to a voltage proportional to velocity or displacement. The type of response is selected by push-button switches. Thus the acceleration, velocity, and displacement of a vibrating body may be measured independently.

Calibrations are made in terms of r-m-s values. The basic units in which the instrument is calibrated, inches and seconds, are the simplest and least confusing of those commonly used. Acceleration is read directly in terms of inches per second per second, velocity in micro-inches per second, and displacement in micro-

inches. Calibrations are made on a motor-driven precision vibrator, which produces essentially sinusoidal vibrations.

FEATURES: Like the sound-level meter and sound analyzer this new vibration meter is small, portable, self-contained, and extremely simple in operation. The instrument reads directly the absolute value of the quantity under measurement so that no reference to calibration figures is necessary.

The inclusion of three response characteristics—namely, acceleration, velocity, and displacement—and the extension of the range down to 2 cycles per second with substantially flat response characteristics provide a degree of flexibility hitherto unapproached in commercially available vibration-measuring apparatus.



(Right) Over-all frequency characteristics of the vibration meter, including the vibration pickup.

SPECIFICATIONS

RANGES:

Vibration Displacement: Calibrated directly in r-m-s micro-inches from 16 micro-inches to 30 inches.

Vibration Velocity: Calibrated directly in r-m-s micro-inches per second from 160 micro-inches per second to 300 inches per second.

Vibration Acceleration: Calibrated directly in r-m-s inches per second per second from .160 inch per second per second to 3900 inches per second per second.

PICKUP UNIT: The vibration pickup is of the inertia-operated crystal type, housed in a cast aluminum container. The maximum vibration acceleration which can be impressed upon the pickup before non-linearity occurs is 10 g or 3900 inches per second per second. Point and ball tips and an 8-inch extension rod are supplied.

RESPONSE CHARACTERISTICS:

Acceleration Characteristic: The over-all response of the vibration pickup and vibration meter for acceleration measurements follows a theoretical curve of acceleration vs. frequency within ±10% from 4 to 500 cycles per second. Below 4 cycles per second the sensitivity drops gradually, so that at 2 cycles per second it is down approximately 25%.

Velocity Characteristic: The over-all response of the vibration pickup and vibration meter for velocity measurements between 1600 micro-inches per second and 300 inches per second follows a theoretical curve of velocity vs. frequency within ±10% from 5 to 500 cycles per second. Below 5 cycles per second the sensitivity drops gradually, so that at 2 cycles per second it is down approximately 40%. For velocity measurements below 1600 micro-inches per second the response is within ±15% from 20 to 500 cycles per second, and drops off approximately 25% at 10 cycles per second.

Displacement Characteristic: The over-all response of the vibration pickup and vibration meter for displacement measurements between 160 micro-inches and 30 inches is flat within ±10% from 10 to 500 cycles per second. Below 5 cycles per second the sensitivity drops off, so that at 2 cycles per second it is down approximately 50%. For measurements below 160 micro-inches the response is flat within ±10% to 20 cycles per second and drops off approximately 25% at 10 cycles per second.

Higher Frequencies: Above 500 cycles the error increases and may possibly reach ±30% at 1000 cycles. This is caused by the differences in response of individual pickups near resonance.

Meter: The indicating meter has a scale which reads directly in the quantity being measured—r-m-s micro-inches for displacement, r-m-s micro-inches per second for velocity, and r-m-s inches per second per second for acceleration.

Attenuators: A 10-step attenuator is provided which changes the meter scale calibration over a range of 30,000 to 1. Additional multipliers are provided which indicate the correct units of measurement and multiplying factors for each response characteristic.

Calibration: A calibrating circuit is provided in the instrument which, by connection to any a-c power line, makes it possible to check the over-all calibration of the vibration meter, excluding the vibration pickup. A seven-foot line connector cord is provided for this purpose.

Telephones: A jack is provided on the panel for plugging in a pair of head telephones in order to listen to the vibrations being measured, for connecting the TYPE 760-A Sound Analyzer, or for connecting a cathode-ray oscillograph. Practically any load impedance can be impressed across this output telephone jack without affecting the reading of the meter.

Tubes: Three 1N5-GT tubes and one 1D8-GT tube are required. A complete set of tubes is supplied.

Batteries: A single battery unit, Burgess type 6TA60, which supplies the necessary plate and filament voltages, is included.

Case: The unit is built into a shielded carrying case of airplane-luggage construction, covered with durable black waterproof material, and equipped with chromium-plated corners, clasps, etc.

Dimensions: The over-all dimensions are approximately: (height) 12½ inches x (length) 13½ inches x (width) 9½ inches.

Net Weight: Approximately 21 pounds with battery.

Type		*Code Word*	*Price*
761-A	Vibration Meter	VIRUS	$260.00
Replacement Battery for Above		VIRUSADBAT	3.50

PATENT NOTICE. See Note 1, page iv.

VIBRATION MEASUREMENTS WITH THE SOUND-LEVEL METER

By substituting a vibration pickup for the microphone, vibration measurements can be made with the TYPE 759-B Sound-Level Meter, provided the frequencies of components to be measured are above about 20 cycles per second. For this purpose, the use of the vibration pickup and control box described below is recommended.

VIBRATION PICKUP AND CONTROL BOX

The TYPE 759-P35 Pickup and TYPE 759-P36 Control Box have been designed for use with the TYPE 759-B Sound-Level Meter. To make vibration measurements with the sound-level meter it is merely necessary to replace the microphone by the control box and pickup.

The TYPE 759-P35 Vibration Pickup is an inertia-operated crystal device which generates a voltage proportional to the acceleration of the vibrating body. By means of integrating networks in the control box, voltages proportional to velocity and displacement can also be delivered to the sound-level meter. The desired response is selected by means of a three-point switch on the control box.

SPECIFICATIONS

Calibration: The db readings of the sound-level meter can be converted into absolute values of displacement, velocity, or acceleration by means of calibration figures supplied with each pickup and control box.

Range: The range of measurement of the pickup and control box when used with the TYPE 759-B Sound-Level Meter is approximately as follows:

Average Double Amplitude—100 micro-inches (minimum).

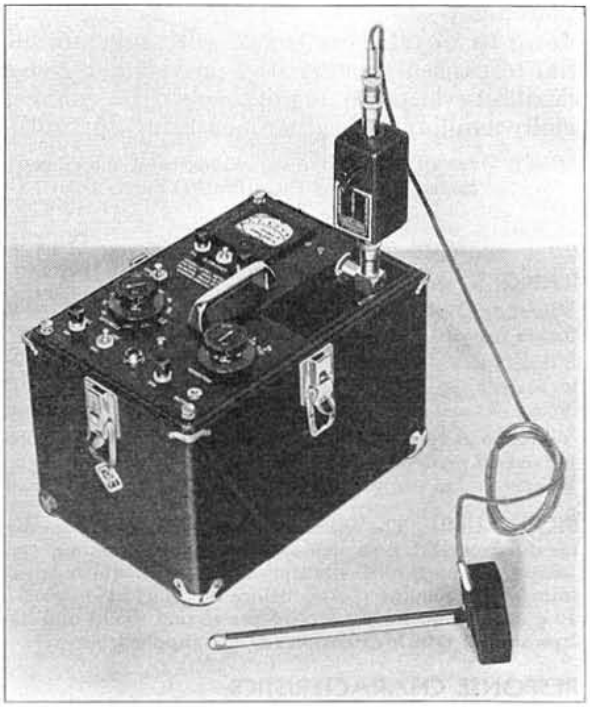
Average Velocity—1000 micro-inches per second (minimum). The upper limit of velocity and displacement measurements is dependent on the frequency and is determined by the maximum acceleration permissible before non-linearity occurs (10 g).

Average Acceleration—1000 micro-g to 10 g
$g = 32.2$ ft./sec./sec.

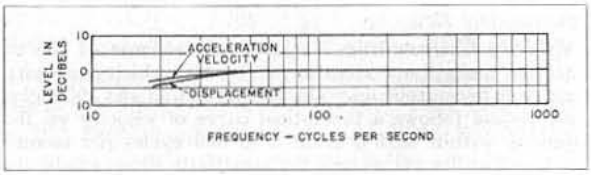
Frequency Characteristic: The over-all response is approximately flat up to 1000 cycles. A typical response curve is shown at the right.

Mounting: Both control box and pickup are housed in metal containers, finished in black lacquer. The control box plugs into the sound-level meter, and the pickup in turn plugs into the control box. A flexible cable 7 feet long is supplied.

Net Weight: TYPE 759-P35 Vibration Pickup, 8 ounces (pickup only); pickup plus cable and tips, 1 pound; TYPE 759-P36 Control Box, 1 pound, 6 ounces.



The vibration pickup and control box plug into the sound-level meter in place of the microphone, as shown here.

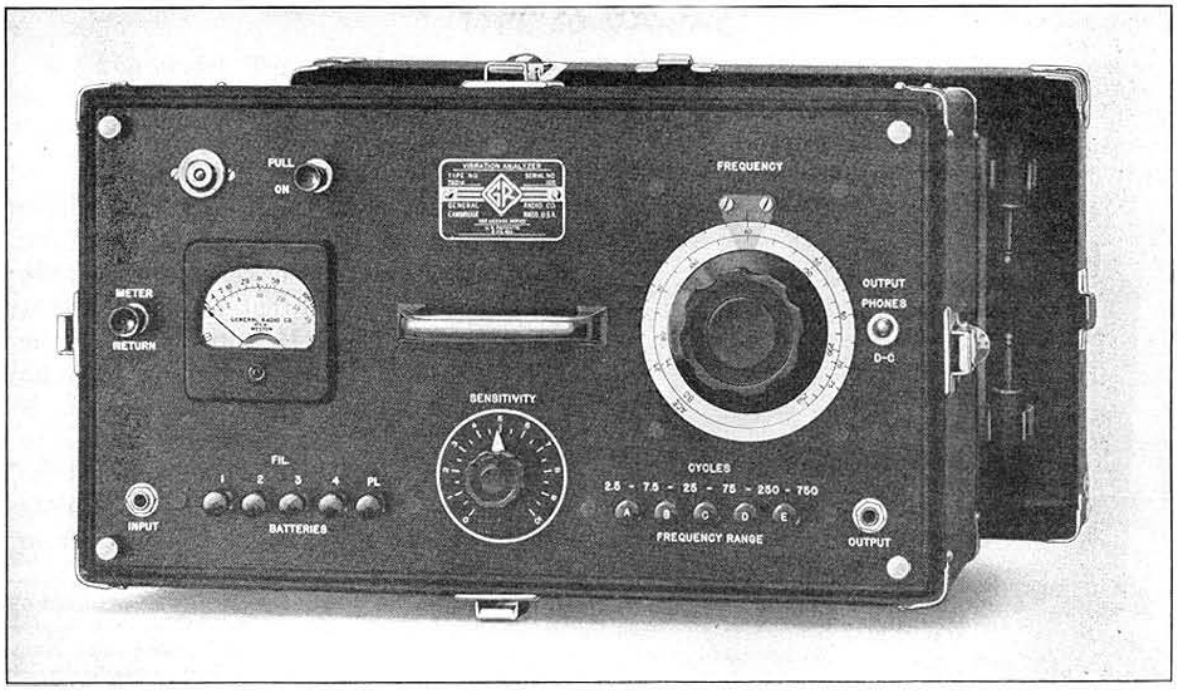


Over-all frequency response characteristic of the vibration pickup, control box, and sound-level meter.

Type		*Code Word*	*Price*
759-P35	Vibration Pickup....	NOSEY	$32.50
759-P36	Control Box.....	NANNY	30.00

A-C POWER SUPPLY FOR THE TYPE 759-B SOUND-LEVEL METER AND THE TYPE 761-A VIBRATION METER

The TYPE 759-P50 Power Supply formerly available has been discontinued and is superseded by the TYPE 1261-A Power Supply described on page 63.



TYPE 762-B VIBRATION ANALYZER*

USES: The TYPE 762-B Vibration Analyzer makes possible the analysis of vibration phenomena having fundamental frequencies as low as 2.5 cycles per second. It is intended primarily for use with the TYPE 761-A Vibration Meter but can also be used with other pickup and amplifier combinations that provide sufficient voltage to give useful deflections. It can also be used for general harmonic analysis of low audio- and sub-audible-frequency voltages in the laboratory.

The frequency range covered (2.5 cycles to 750 cycles) includes practically all frequencies normally encountered in vibration studies, from the fundamental vibrations of ships and other large structures to the unbalance vibrations of high-speed centrifuges.

DESCRIPTION: This analyzer is similar in all essential characteristics of performance, construction, operation, and appearance to the TYPE 760-A Sound Analyzer except that the frequency has been lowered by a factor of 10 and provision has been made for operation with broad selectivity if desired. The latter arrangement is particularly useful in identifying components in the two lowest frequency ranges (2.5 to 25 cycles per second) and in making analyses involving components that vary slightly about a mean frequency.

SPECIFICATIONS

Frequency Range: 2.5 to 750 cycles, covered in five ranges as follows: 2.5 to 7.5, 7.5 to 25, 25 to 75, 75 to 250, 250 to 750.

Band Width: For the sharp selectivity position, the relative attenuation is approximately 30% (3 db) at a frequency differing by 1% from that to which the analyzer is tuned. For the broad selectivity position, the attenuation is 30% for a frequency difference of 5%. At one octave from the peak, the relative attenuations are 98% (35 db) and 90% (20 db), respectively.

Frequency Calibration: The accuracy of frequency calibration of the sharp selectivity network is $\pm 1\frac{1}{2}\%$ or $\pm 1\frac{1}{2}$ cycles, whichever is the larger, over the three highest ranges (25 to 750 cycles); on the two lower ranges (2.5 to 25 cycles), the accuracy is $\pm 5\%$ or ± 0.2 cycle, whichever is the larger. The frequency as determined with the broad selectivity network deviates on the average by less than $\pm 2\%$ from that determined with the sharp selectivity network.

Frequency Response: The response of the sharp selectivity network is flat within ± 2 db over the entire range. At points where two ranges overlap, the sensitivity is the same on either range within ± 1 db. The sensitivity of the broad selectivity network is the same as that of the sharp selectivity network to within ± 2 db.

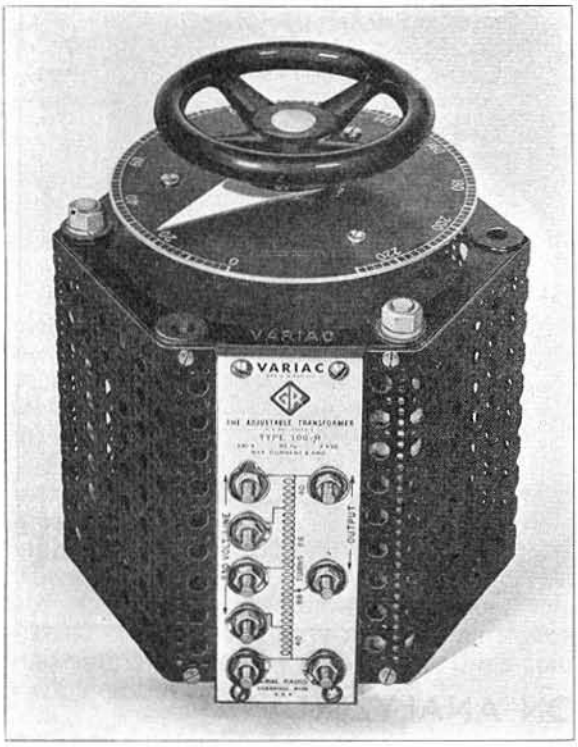
For other specifications see TYPE 760-A, described in Catalog K.

Type		*Code Word*	*Price*
762-B	Vibration Analyzer.....	AWARD	$275.00

PATENT NOTICE: See Notes 1, 24, page iv.

*Photograph shows earlier model, TYPE 762-A.

TYPE 100 VARIAC



TYPE 100-K and TYPE 100-L Variacs, described in Catalog K (first edition, 1939) have been superseded by TYPE 100-Q and TYPE 100-R, respectively. The newer models have the overvoltage feature, so that 135 volts output can be obtained from 115 volts input with the TYPE 100-Q, and 270 volts output for 230 volts input with the TYPE 100-R. A perforated case is provided on each model, to prevent damage to the winding. As shown in the photograph at the left, terminals and connections are plainly marked. Specifications are given in the table on the opposite page.

In these photographs, the TYPE 50 Variac is shown somewhat smaller than its true size relative to that of the TYPE 100. The TYPE 50 is described on the opposite page.

TYPE 50 VARIAC

A 5-kva model, TYPE 50 VARIAC, has become available since the publication of Catalog K, first edition. Specifications for both 115-volt and 230-volt models are given below.

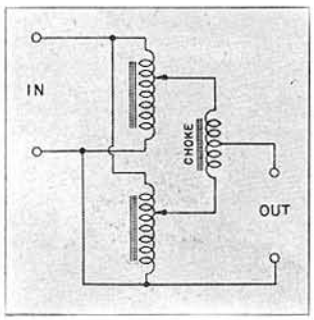
Both TYPE 100 and TYPE 50 VARIACS are available in 2-gang and 3-gang assemblies as listed on page 1. In addition to its use in polyphase circuits, TYPE 50 VARIAC can be operated with two units in parallel, if TYPE 50-P1 Choke is used. (See below.)

Type	100-Q	100-R	50-A	50-B
Load Rating (va)	2000	2000*	5000	7000*
Input Voltage	115	230 or 115	115	230 or 115
Output Voltage (Zero to ——)	135 115	270 230	135 115	270 230
Rated Current (Amps.)	18	9*	40	20*
Maximum Current (Amps.)	18	9	45	31
No-Load Loss (Watts) 60 —	20	25	60	75
Depth Behind Panel (Inches)	7	7	7⅛	7⅛
Over-all Height for Table Mounting	9	9	10⅛	10⅛
Maximum Panel Thickness (Inches)	⅜	⅜	1½	1½
Net Weight (Lbs.)	30¼	29¾	85	81
Driving Torque (Inch-Ounces)	← 50–70 →		← 250–500 →	
Code Word	BEAMY	BEARD	TOKEN	TOPAZ
Price	$40.00	$40.00	$100.00	$100.00

*For 115 volts applied across half the winding, the rating is reduced to one-half the value shown.

PATENT NOTICE. See Note 11, page iv.

PARALLEL OPERATION

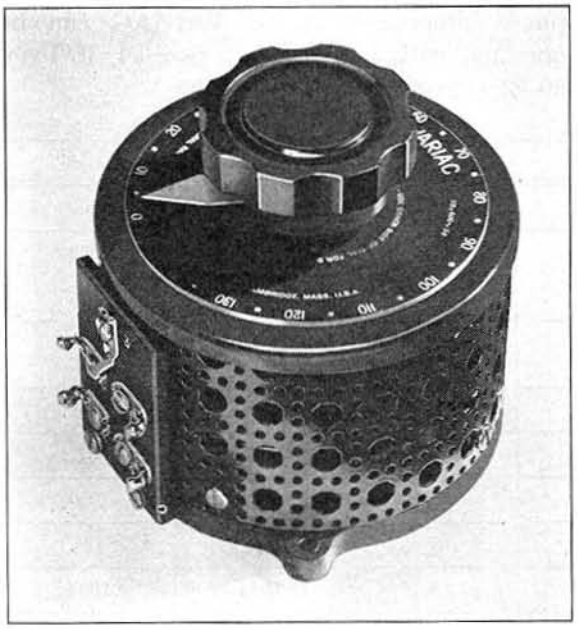


The TYPE 50-P1 Choke is available for parallel operation of two TYPE 50 VARIACS. Connections for this choke are shown in the sketch. The choke serves to equalize the currents from the two VARIACS and also to limit the flow of circulating currents. The use of a choke with smaller sizes of VARIACS is not recommended, because better results can be obtained by using a single larger unit.

Type	*Description*	*Net Weight in Pounds*	*Code Word*	*Price*
50-P1	Choke	1¼	PARALLCHOK	$7.50

TYPE 60-A VARIAC

400–2600 CYCLES



TYPE 60-AM VARIAC

The need for a voltage control to be used on high-frequency power supplies has resulted in the development of a 5-ampere, light-weight unit for operation at frequencies between 400 and 2600 cycles per second. Similar in general appearance to the 60-cycle, 5-ampere, TYPE 200-CM, this VARIAC has a number of new features:

Greatly decreased weight (60-AU, 3 lbs., 2 ozs. versus 200-CU, 8 lbs., 4 ozs.), accomplished by the use of a cast aluminum base, a hollow shaft, and a much smaller core made possible by the higher frequency and by the use of a "scroll" construction.

General Radio's new Unit Brush, requiring no tools for brush change, and, in cooperation with a rigid radiator structure, preventing contact between brush holder and winding, a frequent cause of burnout in the past.

Combination solder and screw terminals for greater convenience in wiring.

Elimination of the brush "pigtail."

A single screw adjustment for shaft reversal when changing from panel to table mounting or vice versa.

Fully insulated hollow steel shaft with no set screws bearing on bakelite.

Bearing adequate for motor-driven applications. Like other VARIACS, TYPES 60-AU and 60-AM are applicable to either adjustable load voltages or to line voltage regulation.

SPECIFICATIONS

Load Rating: 860 va.

Input Voltage: 115 volts.

Frequency: 400 to 2600 cycles per second.

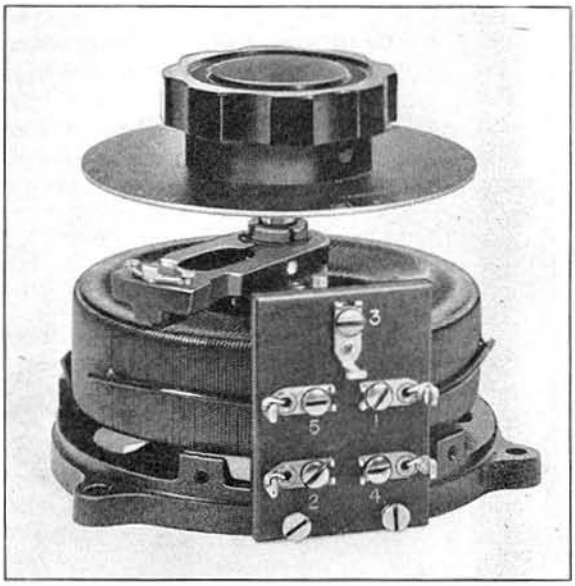
Output Voltage: 0 to 135 volts, or 0 to 115 volts.

Load Current: 5 amperes, rated; 7.5 amperes near zero and line voltages.

No-Load Loss: 7 watts at 400 cycles.

Dimensions: Over-all height for table mounting, 4⅛ inches; depth behind panel for panel mounting, 3 inches; over-all diameter of base, 5½ inches.

Net Weight: TYPE 60-AU, 3 pounds, 2 ounces. TYPE 60-AM, 3½ pounds



TYPE 60-AU VARIAC

Type		*Code Word*	*Price*
60-AU	VARIAC (uncased model)	BEGOT	$13.00
60-AM	VARIAC (cased model)	BEFOG	$15.00

Variacs are manufactured and sold under U. S. Patent 2,009,013.

RESISTORS, CAPACITORS AND INDUCTORS

A number of items listed in these sections of Catalog K have been discontinued. See price lists below for current listings.

RESISTORS

Note that resistance values for rheostat potentiometers have been changed to give a 1–2–5 distribution in each decade. (See page 12.)

Type	Name	Price
106-G, J, K, L	Standard Inductance	$25.00
106-M	Standard Inductance	30.00
107-J, K, L*	Variable Inductor	35.00
107-M, N*	Variable Inductor	40.00
154-A	Voltage Divider	*Discontinued*
214-A	Rheostat-Potentiometer (see page 12)	2.00
219-K	Decade Condenser	90.00
219-L	Decade Condenser	*Discontinued*
219-M	Decade Condenser	45.00
219-N	Decade Condenser	*Discontinued*
246	Variable Air Condenser	*Discontinued*
247	Variable Air Condenser	*Discontinued*
249-H	Attenuation Box	120.00
249-T	Attenuation Box	100.00
301-A	Rheostat-Potentiometer (5, 10, 20, 50, 100, 200, 400, 1000, 2000, 5000Ω)	1.00
301-A	Rheostat-Potentiometer (10,000; 20,000Ω)	1.50
314-A	Rheostat-Potentiometer	4.00
329-J	Attenuation Box	*Discontinued*
333-A	Rheostat-Potentiometer	*Discontinued*
334	Variable Air Condenser	*Discontinued*
335	Variable Air Condenser	*Discontinued*
368-A	Variable Air Condenser	.90
368-B	Variable Air Condenser	1.00
368-C	Variable Air Condenser	1.50
371-A	Rheostat-Potentiometer	4.00
371-T	Rheostat-Potentiometer	4.00
380-F	Decade Condenser Unit	58.00
380-L, N	Decade Condenser Unit	10.00
380-M	Decade Condenser Unit	12.00
380-P3	Switch	5.00
410-A	Rheostat-Potentiometer	*Discontinued*
433-A	Rheostat-Potentiometer	*Discontinued*
449-A	Adjustable Attenuator	*Discontinued*
471-A	Rheostat-Potentiometer	6.00
500-A, B, C, D, E, F, G, H, J	Resistor	2.00
505-A, B, E, F, G	Condenser	3.50
505-K	Condenser	4.00
505-L	Condenser	4.50
505-M	Condenser	5.50
505-R	Condenser	6.50
505-T	Condenser	7.50
505-U	Condenser	12.00
505-X	Condenser	20.00
509-F, G, K, L	Standard Condenser	12.50
509-M	Standard Condenser	15.00
509-R	Standard Condenser	18.00
509-T	Standard Condenser	22.00
509-U	Standard Condenser	25.00
509-X	Standard Condenser	32.00
509-Y	Standard Condenser	48.00

*See page 12 for new specifications.

Type	Name	Price
510-A, B, C, D	Decade-Resistance Unit	$ 8.50
510-E	Decade-Resistance Unit	12.00
510-F	Decade-Resistance Unit	14.00
510-G	Decade-Resistance Unit	30.00
510-P3	Switch	5.00
525-C, D, F, H, L	Resistor	*Discontinued*
526-A, B, C, D	Mounted Rheostat Potentiometer	*Discontinued*
533-A	Rheostat-Potentiometer	*Discontinued*
539-A, C, J, L, P, T, TA, X	Variable Air Condenser	*Discontinued*
539-B	Variable Air Condenser	23.00
	Calibration Curve	4.00
	Calibration Table	3.50
539-K	Variable Air Condenser	11.00
568-D	Variable Air Condenser	4.50
568-E	Variable Air Condenser	7.00
568-K	Variable Air Condenser	4.50
568-L	Variable Air Condenser	7.00
602-D	Decade-Resistance Box	25.00
602-E	Decade-Resistance Box	*Discontinued*
602-F, G	Decade-Resistance Box	35.00
602-J	Decade-Resistance Box	50.00
602-K	Decade-Resistance Box	45.00
602-L	Decade-Resistance Box	58.00
602-M	Decade-Resistance Box	70.00
602-N	Decade-Resistance Box	62.00
642-D	Volume Control	*Discontinued*
646-A	Logarithmic Resistor	*Discontinued*
653-MA, MB, MD, MC	Volume Control	*Discontinued*
654-A	Decade Voltage Divider	85.00
663-A, B, C, D, E, F, G	Resistor	5.00
668-A	Compensated Decade-Resistance Unit	10.00
668-B, C	Compensated Decade-Resistance Unit	12.50
669-A, R	Compensated Slide-Wire Resistor	*Discontinued*
670-BW, FW	Compensated Decade Resistor	*Discontinued*
670-F	Compensated Decade Resistor	45.00
722-D	Precision Condenser	110.00
	Worm Correction Data	50.00
722-F	Precision Condenser	85.00
	Worm Correction Data	35.00
722-FU	Precision Condenser	*Discontinued*
722-M	Precision Condenser	100.00
	Worm Correction Data	35.00
722-N	Precision Condenser	150.00
	Worm Correction Data	35.00
	Quartz Insulation for any TYPE 722	55.00
739	Logarithmic Condenser	*Discontinued*
755-A	Condenser	*Discontinued*

RHEOSTAT-POTENTIOMETERS
(VOLTAGE DIVIDERS)

Resistance values for rheostat-potentiometers have been changed to give an approximately logarithmic distribution in each decade. The following models are now available.

Type	Maximum Resistance	Maximum Current	Code Word	Price
301-A	5	0.9 a	PALSY	$1.00
301-A	10	0.65 a	REMIT	1.00
301-A	20	450 ma	RENEW	1.00
301-A	50	280 ma	RIFLE	1.00
301-A	100	200 ma	RIGID	1.00
301-A	200	140 ma	REBUS	1.00
301-A	500	90 ma	RIVAL	1.00
301-A	1000	65 ma	RAVEL	1.00
301-A	2000	45 ma	READY	1.00
301-A	5000	28 ma	ROMAN	1.00
*301-A	10,000	17 ma	CURRY	1.50
*301-A	20,000	12 ma	CRUMB	1.50

Type	Maximum Resistance	Maximum Current	Code Word	Price
214-A	10	1.0 a	RURAL	$2.00
214-A	20	0.7 a	RAZOR	2.00
214-A	50	450 ma	RAPID	2.00
214-A	100	320 ma	RIVET	2.00
214-A	200	220 ma	EMPTY	2.00
214-A	500	140 ma	ROSIN	2.00
214-A	1000	100 ma	ENACT	2.00
214-A	2000	70 ma	SYRUP	2.00
214-A	5000	45 ma	ROWEL	2.00
214-A	10,000	32 ma	RUMOR	2.00

*Supplied with linen-bakelite protecting strip.

Type	Maximum Resistance	Maximum Current	Code Word	Price
*314-A	1000	90 ma	DIVAN	$4.00
*314-A	2000	65 ma	ENEMY	4.00
*314-A	5000	40 ma	ENJOY	4.00
*314-A	10,000	28 ma	DIVER	4.00
*314-A	20,000	20 ma	ENROL	4.00
*314-A	50,000	13 ma	DONAX	4.00
*314-A	100,000	9 ma	DONGA	4.00

Type	Maximum Resistance	Maximum Current	Code Word	Price
371-A	1000	120 ma	REDAN	$4.00
371-A	2000	90 ma	REFIT	4.00
371-A	5000	55 ma	ROTOR	4.00
371-A	10,000	38 ma	ROWDY	4.00
371-A	20,000	28 ma	RULER	4.00
*371-A	50,000	16 ma	SATYR	4.00
*371-A	100,000	11 ma	SEPOY	4.00
371-T	10,000	28 ma	SULLY	4.00

Type	Maximum Resistance	Maximum Current	Code Word	Price
*471-A	10,000	35 ma	ERECT	$6.00
*471-A	20,000	25 ma	HUMAN	6.00
*471-A	50,000	15 ma	ERODE	6.00
*471-A	100,000	10 ma	ERUPT	6.00
*471-A	200,000	8 ma	ESKER	6.00

TYPE 107 VARIABLE INDUCTOR

Some changes have been made in the design of TYPE 107 Variable Inductors, resulting in the following changes in electrical specifications. All other specifications remain unchanged.

TABLE I

Type	Mutual Inductance	D-C Resistance	Maximum Current	Maximum Q*	Frequency for Maximum Q*	Natural Frequency*
107-J	0–10.8 μh	0.05 Ω	16 a	140	270 kc	3700 kc
107-K	0–110 μh	0.38 Ω	6 a	140	130 kc	1100 kc
107-L	0–1.1 mh	4.6 Ω	1.7 a	140	60 kc	360 kc
107-M	0–11 mh	32 Ω	0.65 a	100	25 kc	130 kc
107-N	0–110 mh	410 Ω	0.18 a	60	15 kc	35 kc

*For full-scale setting, series connection.

Type	Self-Inductance		Code Word	Price
	Series	Parallel		
107-J	7– 50 μh	1.7–12.5 μh	HAREM	$35.00
107-K	60–500 μh	15–125 μh	HARPY	35.00
107-L	0.6– 5 mh	0.15–1.25 mh	HARRY	35.00
107-M	6– 50 mh	1.5–12.5 mh	HOTEL	40.00
107-N	60–500 mh	15–125 mh	HOVER	40.00

PATENT NOTICE. See Note 17, page vi.

BRIDGES AND IMPEDANCE MEASURING EQUIPMENT

Two radio-frequency impedance-measuring instruments have been added since the publication of Catalog K, first edition. Collectively they replace the TYPE 516-C Radio-Frequency Bridge, but are capable of making measurements over a considerably wider frequency range.

The TYPE 916-C Radio-Frequency Bridge is primarily intended for the measurement of low impedance (series) circuits. It reads directly in series resistance and directly in reactance at 1 megacycle and hence is well suited for measuring antenna resistance and reactance. This bridge is described on page 14.

The TYPE 821-A Twin-T Impedance Measuring Network is intended for the measurement of high impedances, i.e., parallel circuits, and is described on page 16.

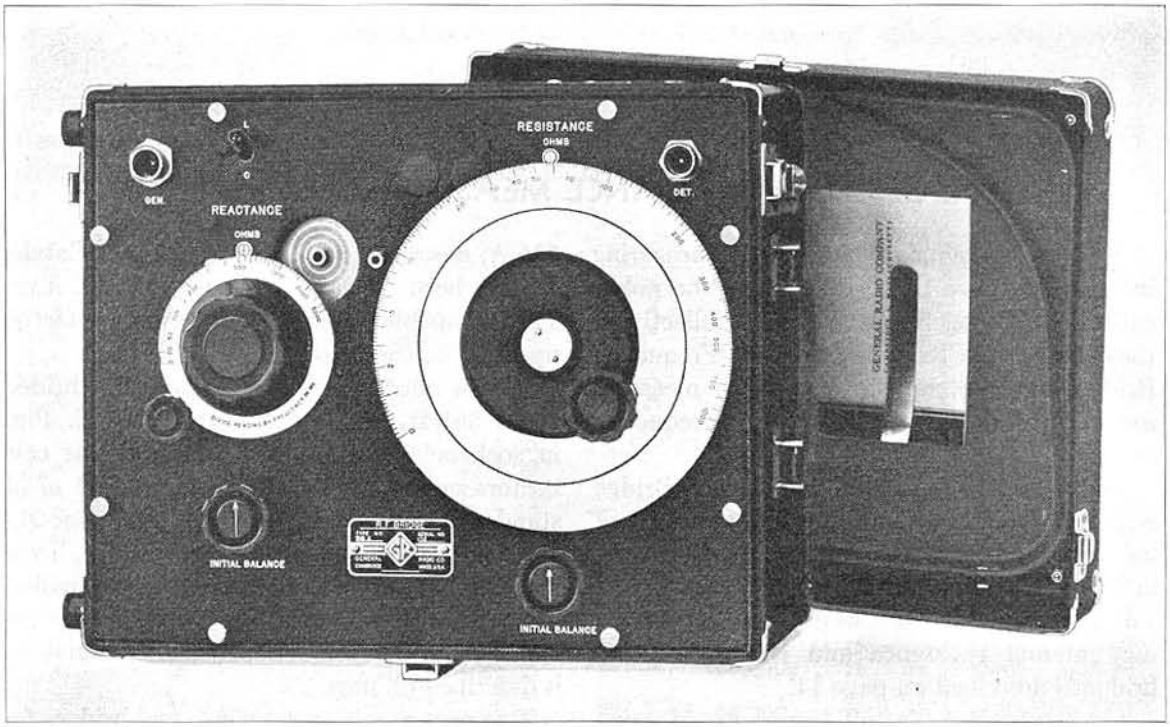
The precision capacitance bridge, TYPE 716-A, described in the first edition of Catalog K, has been replaced by a new model, TYPE 716-B, capable of measuring dissipation factors up to 56%. (See page 18.)

A new model of the vacuum-tube bridge, TYPE 561-D, replaces the TYPE 561-C. Plug in sockets and a system of coaxial line connectors make possible the measurement of all standard types of receiving tubes. (See page 24.)

An additional capacitance test bridge, TYPE 740-BG, capable of measuring grounded capacitors and well suited for power factor measurements on power system bushings and insulators, is described on page 20.

Two new simple, convenient, test bridges for capacitance and inductance, TYPE 1614-A and TYPE 1631-A, respectively, are described on pages 22 and 23.

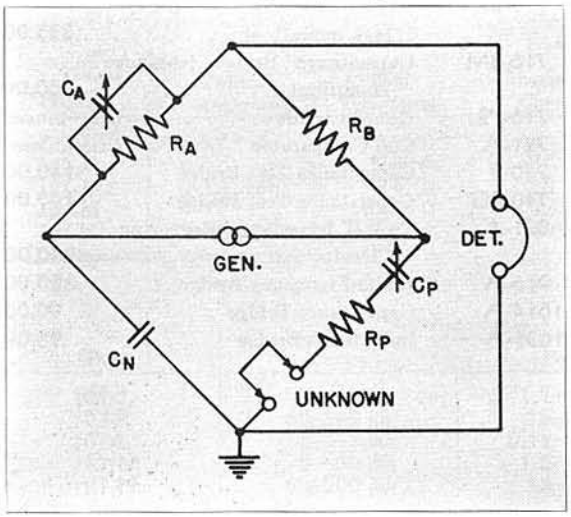
Type	*Name*	*Price*
293-A	Universal Bridge	*Discontinued*
293-P	Accessories	*Discontinued*
516-C	Radio-Frequency Bridge	*Discontinued*
516-P	Accessories	*Discontinued*
544-B	Megohm Bridge (battery operated)	$175.00
544-B	Megohm Bridge (a-c operated, 100 and 500 test volts)	235.00
544-B	Megohm Bridge (a-c operated, 90 test volts)	*Discontinued*
544-P2	A-C Power Supply	*Discontinued*
544-P3	Battery Power Supply	75.00
544-P10	Battery Power Supply	15.00
561-C	Vacuum-Tube Bridge	*Replaced by* TYPE 561-D
561-D	Vacuum-Tube Bridge	375.00
578-A, B, C	Shielded Transformers	15.00
578-AR, BR, CR, AT, BT, CT	Shielded Transformers	*Discontinued*
610-A	Ratio Arm Box	*Discontinued*
625-A	Bridge	*Discontinued*
625-P1	Condenser	*Discontinued*
650-A	Impedance Bridge	$175.00
667-A	Inductance Bridge	325.00
671-A	Schering Bridge	*Discontinued*
707-A	Cathode-Ray Null Detector	*Discontinued*
707-P	Accessories	*Discontinued*
716-A	Capacitance Bridge	*Replaced by* TYPE 716-B
716-BR	Capacitance Bridge (relay-rack mounting)	335.00
716-BM	Capacitance Bridge (cabinet mounting)	360.00
716-P2	Guard Circuit	*Discontinued*
721-A	Coil Comparator	*Discontinued*
740-B	Capacitance Test Bridge	140.00
740-BG	Capacitance Test Bridge	160.00
821-A	Twin-T Impedance Measuring Circuit	340.00
916-A	Radio-Frequency Bridge	350.00
1614-A	Capacitance Bridge	90.00
1631-A	Inductance Bridge	98.00



TYPE 916-A RADIO-FREQUENCY BRIDGE

USES: The TYPE 916-A Radio-Frequency Bridge is designed for impedance measurements at frequencies between 400 kc and 60 Mc. It can be used to measure directly the reactance and resistance of antennas, transmission lines, and circuit elements. Through the use of an external parallel condenser, parallel tuned circuits, high resistances, and other high impedances can be measured.

Schematic circuit diagram of the TYPE 916-A Radio-Frequency Bridge.



This instrument is intended for measuring low impedances and complements the TYPE 821-A Twin-T, which is best suited for measuring high impedances.

DESCRIPTION: A new type of bridge circuit is used, which is shown schematically in the diagram below. Measurements are made by a series-substitution method. The components of the unknown impedance are determined from the change in settings of condensers C_A and C_P. The unknown reactance at 1 Mc is read directly in ohms from the dial of C_P, and the unknown resistance in ohms from the dial of C_A.

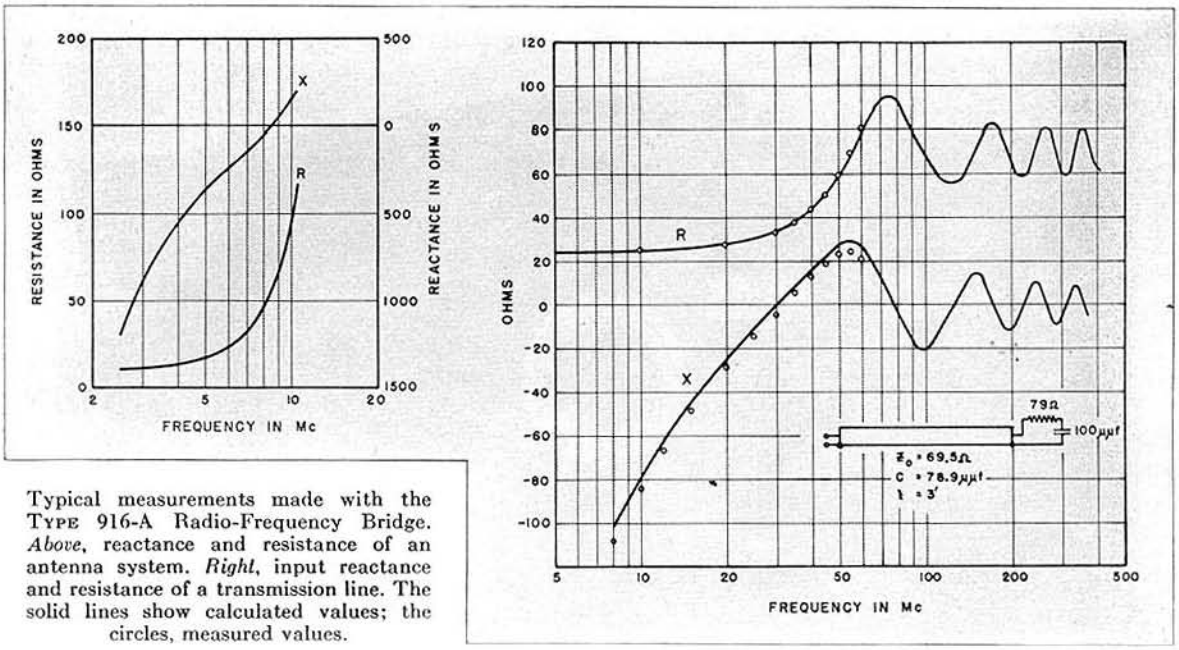
In making measurements the bridge is first balanced by means of condensers C_P and C_A with a short-circuit across the unknown terminals. The short is then removed, the unknown impedance connected, and the bridge rebalanced. The resistance is then given by

$$R_x = R_B \frac{(C_{A_2} - C_{A_1})}{C_N}$$

and the reactance by

$$X_x = \frac{1}{\omega}\left(\frac{1}{C_{P_2}} - \frac{1}{C_{P_1}}\right)$$

where the subscripts 1 and 2 denote the dial readings for the initial and final balances, respectively.



Typical measurements made with the TYPE 916-A Radio-Frequency Bridge. *Above*, reactance and resistance of an antenna system. *Right*, input reactance and resistance of a transmission line. The solid lines show calculated values; the circles, measured values.

FEATURES: This new bridge circuit with the use of a substitution method of measurement makes it possible to read resistance in ohms, independent of frequency, directly from the scale of an air condenser. This and the fact that the dial of C_p is calibrated in ohms reactance at 1 megacycle make the bridge particularly easy to use for antenna measurements.

The resistive component is measured in terms of a *fixed* resistor (R_B), a fixed condenser (C_N), and a variable condenser (C_A). This important feature makes possible the high-frequency performance of the bridge, because residual parameters can be made much smaller in a fixed resistor and a variable capacitor than in a variable resistor.

SPECIFICATIONS

Frequency Range: 400 kc to 60 Mc.

Reactance Range: 5000 Ω at 1 Mc. This range varies inversely as the frequency, and at other frequencies the dial reading must be divided by the frequency in megacycles.

Resistance Range: 0 to 1000 Ω.

Accuracy: For reactance, ±2% ±1 Ω.

For resistance, ±1% ±0.1 Ω, subject to correction for residual parameters. At high frequencies the correction depends upon the frequency and upon the magnitude of the unknown resistance component. At low frequencies the correction depends upon the frequency and upon the magnitude of the unknown reactance component. Plots of both these corrections are given in the instruction book that is supplied with the bridge.

Accessories Supplied: Two input transformers, one covering the range from 400 kc to 3 Mc, the other from 3 Mc to 60 Mc; two leads of different lengths (for connecting the unknown impedance); two coaxial cables for connecting generator and detector.

Accessories Required: A radio-frequency generator and detector are required. The TYPE 805-C Standard-Signal Generator is a satisfactory generator, as are the older TYPE 605-B and the TYPE 684-A Modulated Oscillator. A well shielded radio receiver covering the desired frequency range is recommended as the detector. The coaxial cable supplied for connection to the receiver is fitted with spade terminals at one end for connection to the receiver input terminals. For best results, however, it is recommended that the receiver be fitted with a TYPE 774-G Panel Plug and the cable with a TYPE 774-M Cable Jack. These coaxial terminals are described on page 66.

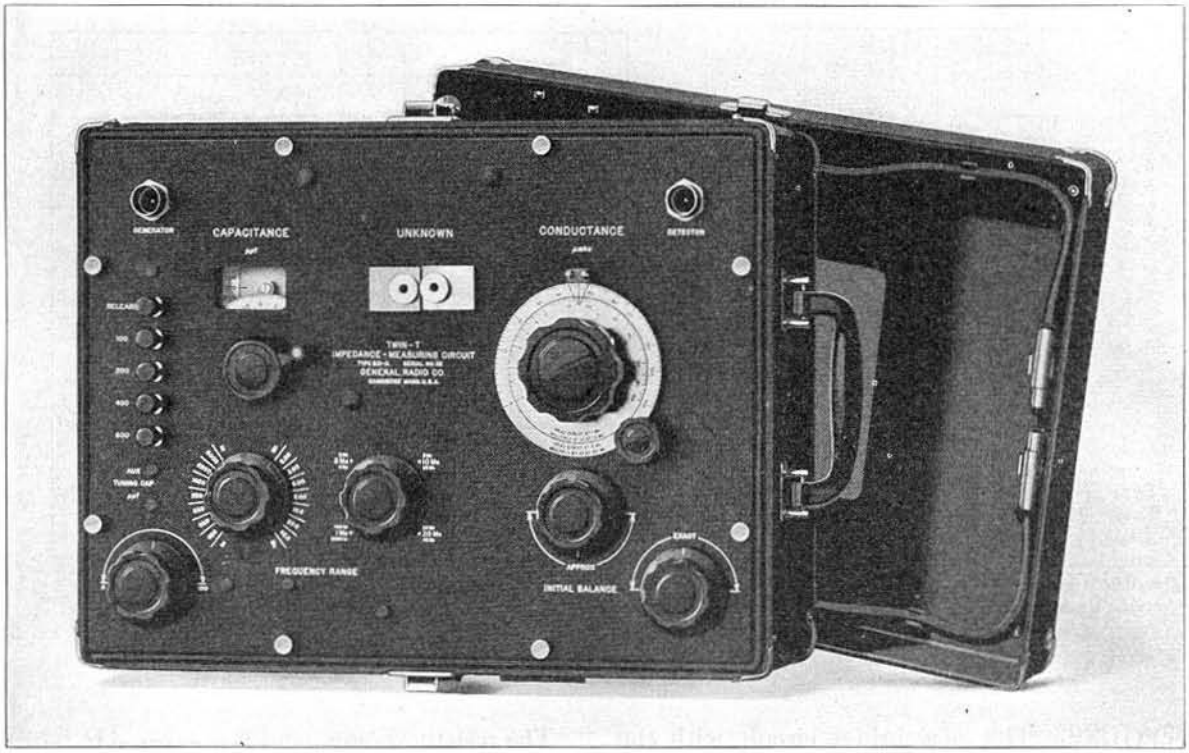
Mounting: Airplane-luggage type case with carrying handles. Both input transformers are mounted inside the case. Coaxial cables, leads, and instruction book are stored in the cover of the instrument when not in use.

Dimensions: 17 x 13½ x 11⅛ inches, over-all.

Net Weight: 35 pounds.

Type		*Code Word*	*Price*
916-A	Radio-Frequency Bridge.....	CIVIC	$350.00

PATENT NOTICE. See Notes 16, 17, page iv.



TYPE 821-A TWIN-T IMPEDANCE MEASURING CIRCUIT

USES: This instrument is used for impedance measurements at radio frequencies between 0.46 Mc and 40 Mc. It is calibrated in capacitance and conductance and can be used to measure directly the capacitance and power factor of condensers, the inductance and Q of coils, the resonant impedance of parallel tuned circuits, and the magnitudes and phase angles of high resistances. Through the use of an external fixed condenser, low resistances, grounded antennas, coaxial transmission lines, and impedance-matching networks can be measured. It is particularly useful for measuring impedances having small phase differences from zero or 90°, such as dielectric samples, low-loss condensers, high-Q coils, and r-f resistors.

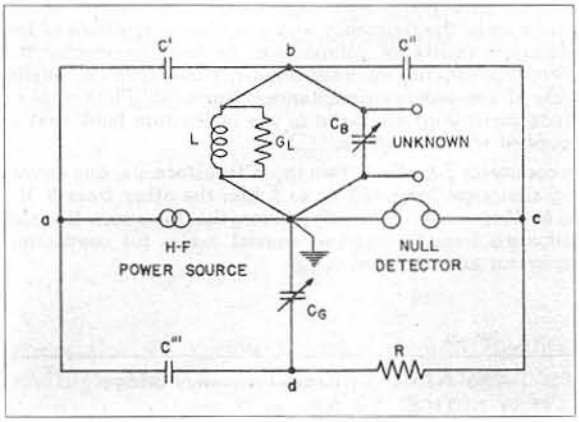
DESCRIPTION: The instrument uses a Parallel-T null circuit, as shown in simplified form in the schematic diagram. Measurements are made by a parallel-substitution method. An initial balance of the circuit is obtained with the unknown disconnected; the unknown impedance is then connected and the circuit rebalanced for a null. The components of the unknown impedance are determined from the changes in setting of condensers C_B and C_G. The measurement is made in terms of the admittance components of the unknown, susceptance and conductance.

The value of conductance is given by:

$$G_x = \omega^2 C' C'' R \frac{\Delta C_G}{C'''} = k\omega^2 \Delta C_G,$$

and the dial of C_G is calibrated to be direct reading at 1, 3, 10, and 30 Mc. For other frequencies, dial reading is multiplied by the ratio of the squares of the working and direct-reading frequencies. For the initial balance, the conductance dial is set at zero.

The setting of the condenser C_B determines the susceptive balance. The condenser dial is calibrated in micromicrofarads and is direct reading in capacitance. Condenser capacitance



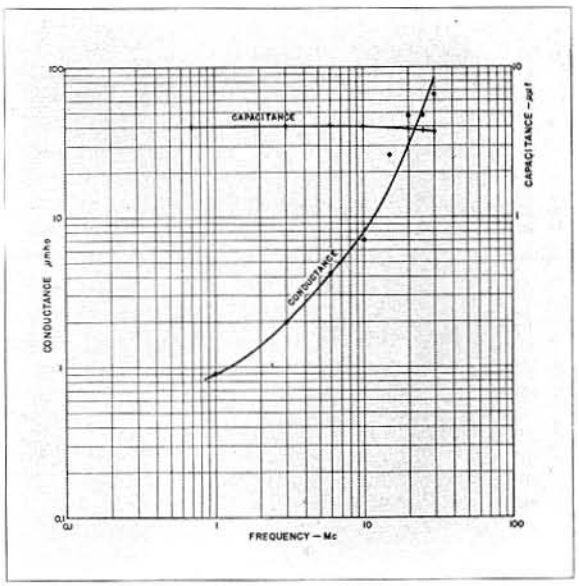
can therefore be measured directly. For other types of unknown, it is generally more convenient to use the susceptance,

$$B_x = \omega \Delta C_B.$$

Impedance components, reactance and resistance, can, of course, be calculated from the admittance components.

The Twin-T is mounted in a shielded, airplane-luggage type case and is completely portable. TYPE 774 Coaxial Plugs and Jacks are used for the generator and detector terminals. The unknown connects directly to terminals on the panel.

FEATURES: The null method used in measurements with the Twin-T yields highly precise settings. The circuit arrangement also contributes to accuracy of measurement at high frequencies by eliminating the effects of some of the residual capacitances that limit high-frequency performance in bridge circuits. In particular, no transformer is needed because the generator, the detector, the unknown, and the two standard condensers are brought to a common ground point. Lead impedances are minimized by a mechanical arrangement in which leads are short and direct. The circuit elements themselves are designed to have low residual impedances. Susceptance is measured in terms of an especially designed variable air condenser, and conductance in terms of a variable air condenser and a fixed resistor of the 663-type, thus avoiding errors inherent in variable resistors at high frequencies.



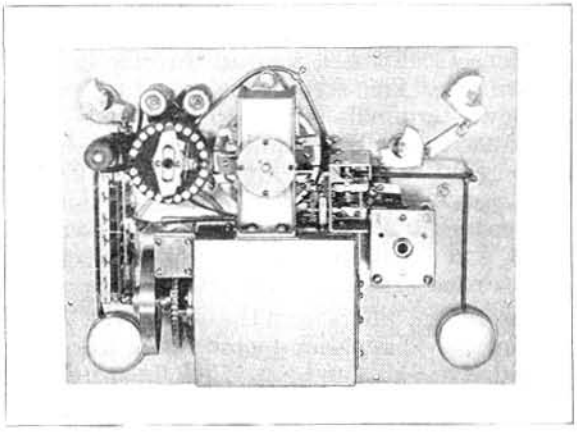
Capacitance and conductance of a TYPE 119-A R-F Choke as measured on the Twin-T.

SPECIFICATIONS

Frequency Range: 460 kc to 40 Mc.

Capacitance Range: The dial of the standard condenser is calibrated from 100 to 1100 $\mu\mu$f, and the range of capacitance measurement by the parallel-substitution method is therefore 0 to 1000 $\mu\mu$f.

Susceptance Range: -6000 μmho to $+6000$ μmho at 1 Mc. The range varies directly as the frequency, and at other frequencies the dial reading must be multiplied by the frequency in megacycles.



Interior view of the Twin-T, showing constructional details

Conductance Range:

0– 100 μmho at 1 Mc	Direct Reading
0– 300 μmho at 3 Mc	
0–1000 μmho at 10 Mc	
0–3000 μmho at 30 Mc	

Between these direct-reading ranges the range of the conductance dial varies as the square of the frequency.

Accuracy: ± 2 $\mu\mu$f $\pm 0.1\%$ for capacitance. For conductance, $\pm 0.1\%$ of full scale $\pm 2\%$ of actual dial reading. At the higher frequencies, corrections for residual parameters must be applied, and the correction data are included in the instruction book.

Accessories Supplied: Coaxial cables for connections to generator and detector.

Accessories Required: A suitable radio-frequency generator and detector are required. The TYPE 805-C Standard-Signal Generator is a satisfactory generator, as are the older TYPE 605-B and the TYPE 684-A Modulated Oscillator. A well shielded radio receiver covering the desired frequency range is recommended for the detector. The coaxial cable supplied for connection to the receiver is fitted with spade terminals at one end for connecting to the receiver input terminals. For best results, however, it is recommended that the receiver be fitted with a TYPE 774-G Panel Plug and the cable with a TYPE 774-M Cable Jack. These coaxial terminals are described on page 66.

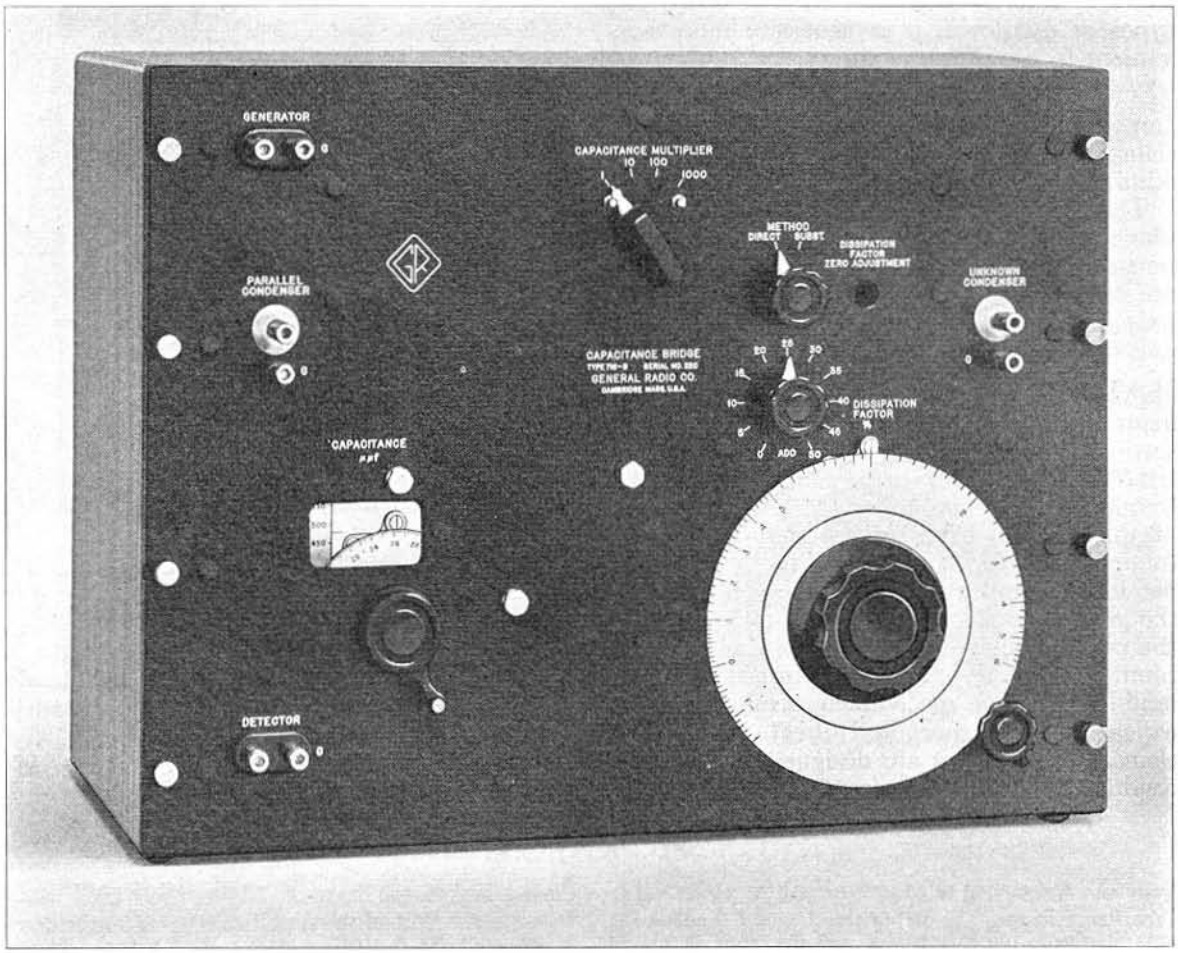
Mounting: The instrument is mounted in a shielded, airplane-luggage type of case with carrying handle.

Dimensions: 17¾ x 12 x 9½ inches, over-all.

Net Weight: 26 pounds

Type		*Code Word*	*Price*
821-A	Twin-T	LAGER	$340.00

PATENT NOTICE. See Notes 2, 17, page iv.



TYPE 716-B CAPACITANCE BRIDGE

USES: This direct-reading capacitance bridge can be used for a wide variety of capacitance and dissipation-factor measurements. Within its scope are the determination of dielectric constant, loss factor, power factor, phase angle, and other dielectric properties of insulating materials, as well as their change with such factors as temperature and humidity.

In the General Radio laboratories the TYPE 716-B Capacitance Bridge is used for all capacitance standardization measurements. In production, it is used for the testing and adjustment of TYPE 505 Condensers and TYPE 380 Decade-Condenser Units.

By adding an external decade resistance box, the bridge can be converted to a series- or parallel-resistance bridge. The latter is especially useful in measuring the resistance of electrolytes.

DESCRIPTION: The TYPE 716-B Capacitance Bridge is a modified Schering bridge, direct reading in capacitance and in dissipation factor at 1000 cycles.

A wide capacitance range is obtained by providing four sets of ratio arms giving multiplying factors from 1 to 1000 in decade steps. The standard condenser is a TYPE 722 Precision Condenser calibrated to read directly in total capacitance. The zero capacitance across the unknown terminals is not greater than 1 $\mu\mu$f. All capacitances to ground of the input transformer and ratio arms are removed from the capacitance arms by placing them in a shielded compartment insulated from the grounded panel and connected to the junction of the ratio arms.

This bridge differs from the older TYPE 716-A in that the dissipation-factor range has been extended to 56%, and a METHOD switch has been added.

Dissipation factor is read directly in per cent from the setting of a TYPE 539 Condenser and a decade step condenser connected across the fixed ratio arm. The 12-inch scale of the air condenser is approximately logarithmic, so that, while having a maximum reading of 6%, its

smallest division near zero is 0.01%, thus allowing the estimation of 0.002%. The accuracy of the dissipation factor reading over the wide capacitance range is made possible by adding capacitance across the lower-valued ratio arms, so that the product RC of all the ratio arms is the same.

The setting of the METHOD switch determines the ratio arm across which the dissipation-factor condenser is connected, so that the dissipation-factor dial is direct reading for either direct or substitution measurements.

FEATURES: Three highly desirable properties are combined in this bridge: wide range, high accuracy, and direct-reading dials. Operation is simple, and both terminals and controls are arranged for convenience and flexibility of operation. Because of these features, it can be used for practically any type of capacitance measurement.

SPECIFICATIONS

Ranges: Direct Reading—capacitance, 100 $\mu\mu$f to 1 μf; dissipation factor, 0.002% to 56% (0.00002 to 0.56 expressed as a ratio).

Substitution Method—capacitance, 0.1 μf to 1000 $\mu\mu$f with internal standard; to 1 μf with external standards; dissipation factor, $56\% \times \frac{C'}{C_x}$ where C' is the capacitance of the standard condenser and C_x that of the unknown.

Accuracy: Direct Reading—capacitance, $\pm 0.2\%$ or ± 2 $\mu\mu$f $\times$ multiplier reading (0.2% of full scale for each range) when the dissipation factor of the unknown is less than 1%; dissipation factor ± 0.0005 or $\pm 2\%$ of dial reading, for values of D below 10%.

Substitution Method—capacitance $\pm 0.2\%$ or ± 2 $\mu\mu$f; dissipation factor, ± 0.00005 or $\pm 2\%$ for change in dissipation factor observed, when the change is less than 6%.

When the dissipation factor of the unknown exceeds the limits given above, additional errors occur in both capacitance and dissipation-factor readings. Corrections are supplied, by means of which the accuracy given above can be maintained over the entire range of the bridge.

Ratio Arms: The arm across which the dissipation factor condenser is normally connected has a resistance of 20,000 ohms. The other arm has four values, 20,000 ohms, 2000 ohms, 200 ohms, 20 ohms, providing the four multiplying factors 1, 10, 100, 1000. Suitable condensers are placed across these arms, so that the product RC is constant.

A switch is provided for shifting the dissipation-factor condensers to the other ratio arm when the substitution method of measurement is used, so that the dissipation-factor dial will read up-scale.

Standards: Capacitance, TYPE 722 Precision Condenser direct reading from 100 $\mu\mu$f to 1100 $\mu\mu$f; dissipation factor, TYPE 539-T Condenser with semi-logarithmic scale and decade-step condenser calibrated directly in dissipation factor at 1 kc.

Shielding: Ratio arms, dissipation-factor condensers, and shielded transformer are enclosed in an insulated shield. The unknown terminals are shielded so that the zero capacitance across them is not greater than 1 $\mu\mu$f. A metal dust cover and the aluminum panel form a complete external shield.

Frequency Range: All calibration adjustments are made at 1 kc and the accuracy statements above hold for an operating frequency of 1 kc. The bridge can be used, however, at any frequency between 60 cycles and 10 kc. Dissipation-factor readings must be corrected by multiplying the dial reading by the frequency in kilocycles.

Voltage: Voltage applied at the GENERATOR terminals is stepped up by a 1-to-4 ratio shielded transformer. A maximum of 50 volts can be applied to the transformer. If desired, power can be applied to the bridge between the junctions of the pairs of resistance and capacitance arms. With equal ratio arms, a maximum of 700 volts can be applied.

Mounting: The bridge is supplied for mounting on a 19-inch relay rack or for cabinet mounting.

Accessories Required: Oscillator and amplifier. TYPE 608-A Oscillator and TYPE 913-B Beat-Frequency Oscillator (page 28) are satisfactory power sources. TYPE 1231-A Amplifier and Null Detector (page 60) is recommended for use as the detector. For aural null indications, Western Electric 1002-C Telephones can be used with the amplifier.

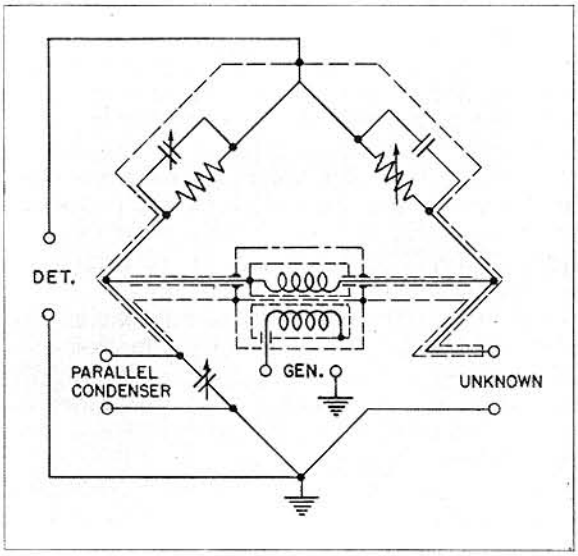
For substitution measurements, a balancing condenser is needed. This may be either an air-dielectric model, TYPE 539-C, or a fixed mica condenser of the TYPE 505 series.

Accessories Supplied: One TYPE 274-NC Shielded Conductor and one TYPE 274-NE Shielded Plug and Cable.

Dimensions: (Length) 19 x (height) 14 x (depth) 9 inches, over-all.

Net Weight: 41½ pounds, relay-rack model; 53¾ pounds, cabinet model.

A schematic circuit diagram of the TYPE 716-B Capacitance Bridge.



Type		*Code Word*	*Price*
716-BR	For Relay-Rack Mounting	BONUS	$335.00
716-BM	Cabinet Mounted	BOSOM	360.00

PATENT NOTICE. See Note 17, page iv.

TYPE 740-BG CAPACITANCE TEST BRIDGE

USES: The TYPE 740-BG Capacitance Test Bridge is designed for measurements where it is desired to ground one side of the test specimen. It meets the requirements of the electric power industry for shop tests on insulation, particularly the measurement of the power factor of bushings, insulators, transformer insulation, and cables. It is also useful for measurements in the field, where the adjacent bus potentials are not greater than a few thousand volts. A booklet describing these uses of the bridge will be sent on request.

Manufacturers of electrical equipment will also find this bridge useful for production tests of insulation. Typical of such tests are the measurement of bushings and insulators, of shielded cables, and of winding-to-ground capacitances of transformers.

In the communications industry there are many capacitance measurements that require one side of the unknown to be grounded, among them checking the capacitance of circuit elements to chassis in radio receivers, and the location of breaks in the inner conductors of coaxial cables.

DESCRIPTION: The bridge is similar in general design to the TYPE 740-B, but the circuit is so arranged that one of the unknown terminals is grounded.

FEATURES: In the measurement of small capacitances, the grounded terminal eliminates the disturbing effects of moderate 60-cycle fields, such as are usually encountered in laboratories. For power-factor measurements on bushings, the fact that the bridge operates at low voltage gives it a considerable advantage in cost and size over high-voltage equipment. Comparative tests have proved that the operating voltage has practically no effect on the accuracy of the results.

This instrument is quite usable in the presence of moderate electrostatic fields such as might be encountered in laboratories with overhead voltages of the order of a few thousand volts. For measurements of bushings and insulators in the neighborhood of high-tension bus structures or lines, however, the bridge cannot be used satisfactorily unless sufficient external shielding of the bushings is provided.

SPECIFICATIONS

Capacitance Range: 5 $\mu\mu$f to 110 μf in six ranges. Capacitance values are read directly from a logarithmic dial and multiplier switch.

Capacitance Accuracy: Within $\pm 1\%$ over the main decade (1 to 11) of the capacitance dial for all multipliers except the 0.0001. If the zero capacitance of the bridge (approximately 12 $\mu\mu$f) is taken into consideration, an accuracy of $\pm 1\%$ or ± 2 $\mu\mu$f can be obtained on this 0.0001 multiplier range. Below 100 $\mu\mu$f the error gradually increases to ± 4 $\mu\mu$f as zero is approached.

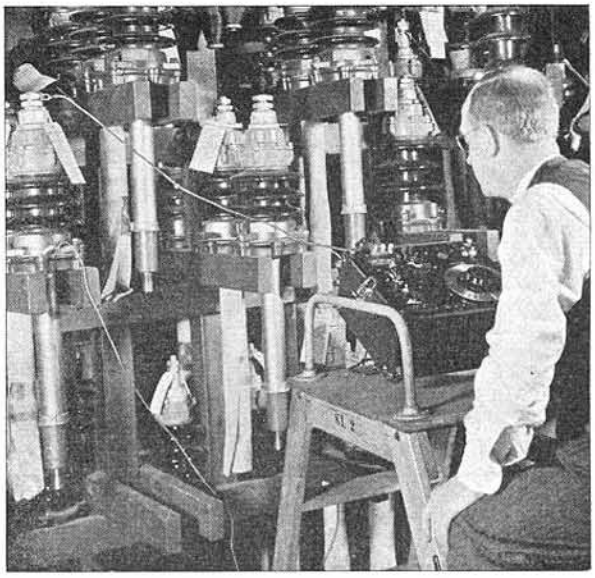
Because the sensitivity is low at high values of unknown capacitance, the bridge is not recommended for accurate measurements above 10 μf.

Dissipation Factor Range: 0 to 50% in two ranges. Dissipation factor values are read directly from an engraved scale and multiplier switch.

Dissipation Factor Accuracy: Within 1.5% of full-scale reading for all capacitance multipliers except 0.0001. On the 0.0001 capacitance multiplier measurements to within 1.5% of full-scale reading can be maintained, provided the initial dissipation factor reading is taken into consideration. The approximate DC product of the initial balance is 60, where C is expressed in micromicrofarads and D in per cent. These statements hold only over the main decade of the capacitance dial (1 to 11).

Temperature and Humidity Effects: Over the normal range of room conditions (65° Fahrenheit to 95° Fahrenheit, 0 to 90% relative humidity) the accuracy of capacitance indication is completely independent of temperature and humidity. Under severe humidity conditions, however, a small error in dissipation factor reading may occur. The error due to this cause, however, will be less than the nominal limits defined above.

Voltage Applied to Unknown: The voltage impressed across the bridge is approximately 80 volts, and the portion of that voltage that is impressed across the unknown condenser can be obtained from the ratio of the unknown capacitance to the standard capacitance. The standard condenser has a capacitance of 0.01 microfarad, so that, for small capacitances of the order of 1000 micromicrofarads or below, essentially 80 volts are impressed across the unknown terminals, whereas for larger capacitances the voltage across the unknown rapidly decreases with increasing capacitance.



Measuring bushings on a storage rack with the TYPE 740-BG Capacitance Test Bridge.

Power Supply: 105 to 125 volts, 60 cycles.

Power Input: 15 watts.

Controls: Capacitance dial and multiplier, dissipation factor dial and multiplier, sensitivity control, and power-supply reversing switch.

Accessories Supplied: A six-foot line connector cord, spare fuses and pilot lamps.

Vacuum Tubes: One each types 6X5, 6J7, 6E5 are all supplied with the bridge.

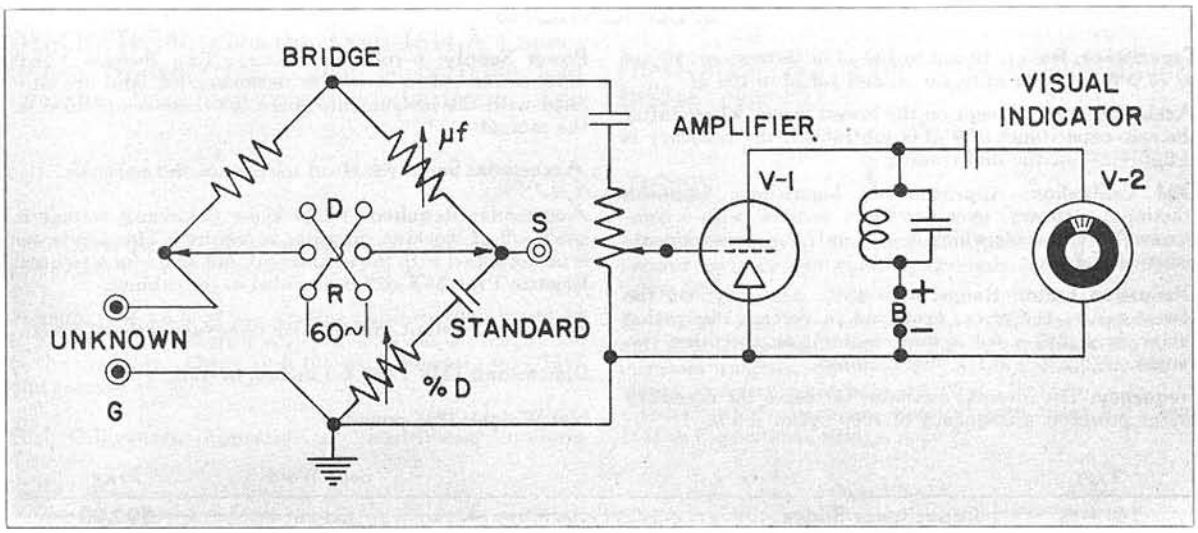
Mounting: Portable carrying case of airplane-luggage construction. Carrying case is lined with copper to insure freedom from electrostatic pickup in the instrument.

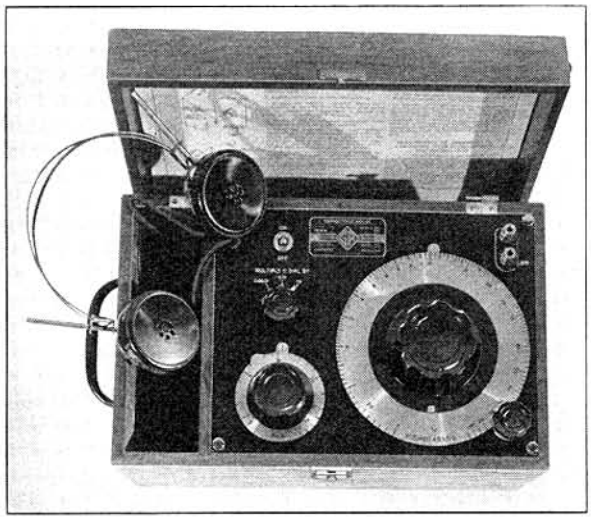
Net Weight: 20 pounds.

Dimensions: (Length) 14½ x (width) 15 x (height) 9¼ inches, over-all, including cover and handles.

Type		*Code Word*	*Price*
740-BG	Capacitance Test Bridge	BASAL	$160.00

PATENT NOTICE. See Notes 1, 17, page iv.





TYPE 1614-A
CAPACITANCE BRIDGE

USES: Designed for the rapid measurement of capacitors in industrial plants, the TYPE 614-A Capacitance Bridge finds applications in both production testing and in the laboratory. It is suitable for acceptance tests by both the manufacturer and the user of the many types of paper, mica, and electrolytic capacitors used in electrical equipment, and in the laboratory it is a handy means of making rapid checks on the condition of capacitors used in experimental circuits.

DESCRIPTION: This bridge is portable and operates from self-contained batteries. The measuring frequency is 1000 cycles, supplied by an internal electro-mechanical oscillator. A pair of head telephones, internally attached, are used in indicating balance. When not in use, the phones are stored in a compartment in the walnut cabinet. A removable hinged cover affords protection for the instrument, and a carrying handle is provided. Operating instructions are attached to the inside of the cover.

The circuit is that of a conventional 4-arm bridge, in which the resistive component of the unknown is balanced by means of a variable resistor in series with the standard capacitor. Provision is made for introducing a polarizing voltage, from an external source, in measuring electrolytic capacitors.

The capacitance of the unknown is indicated directly by the setting, at balance, of a 6-inch dial with slow-motion drive. A separate 3-position switch provides multiplying factor in steps of 100:1. The second balance control is a 2¾ inch dial that reads directly in dissipation factor.

FEATURES: Portability, ease of operation, and simplicity, combined with wide range and good accuracy are some of the principle features of this bridge.

SPECIFICATIONS

Capacitance: Range, 10 $\mu\mu$f to 100 μf in three steps: 10 $\mu\mu$f to 10,000 $\mu\mu$f; 0.01 μf to 1.0 μf; and 1.0 μf to 100 μf.

Accuracy: ±2%, except on the lowest range, where, after the zero capacitance of 9 μf is subtracted, the accuracy is ±2μf +2% of the dial reading.

Dial Calibration: Approximately logarithmic (uniform fractional accuracy) over two main decades, with a compressed lower decade which is used only for measurements below 100 μf.

Dissipation Factor: Range, 0 to 45%. Accuracy: On the lowest range, the error, expressed in percent dissipation factor, is ±(2% + 0.1 × dial reading); on the other two ranges, ±(0.2% + 0.1 × dial reading).

Frequency: The internal oscillator furnishes the necessary bridge power at a frequency of 1000 cycles ±5%.

Power Supply: 6-volt dry battery. Two Burgess F2BP units connected in series are recommended, and are supplied with the instrument. Space for these is provided in the cabinet.

Accessories Supplied: Head telephones and batteries.

Accessories Required: When a d-c polarizing voltage is used, a 2 μf blocking capacitor is required. This condenser is not supplied with the instrument, but space for a General Electric TYPE 55X-629 is provided in the cabinet.

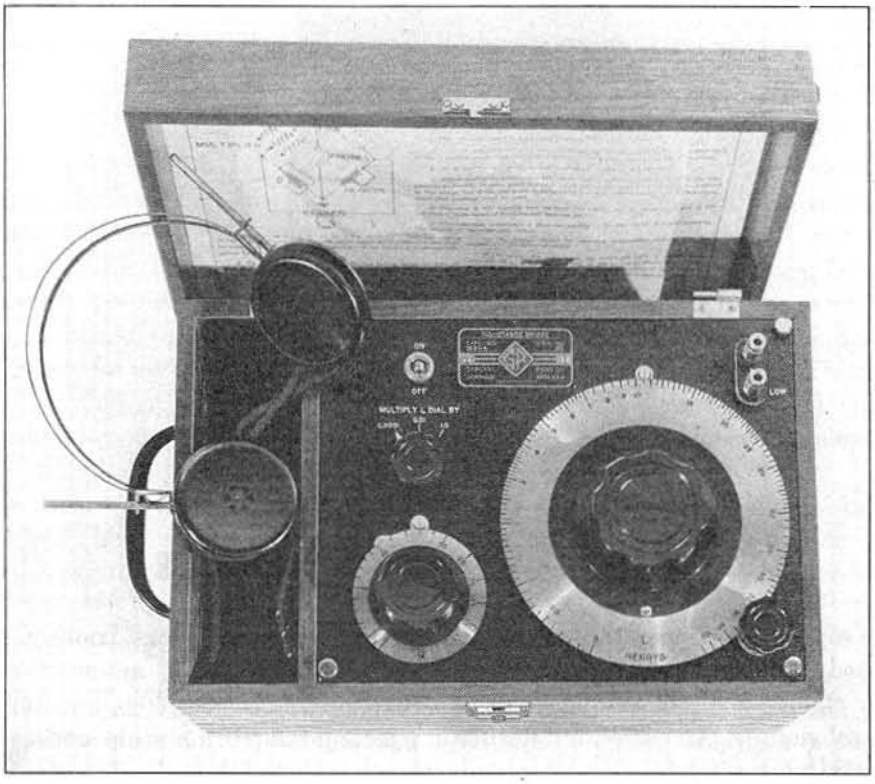
Mounting: Walnut cabinet with removable hinged cover.

Dimensions: 13½ x 8½ x 7 inches, overall.

Net Weight: 13¼ pounds.

Type		*Code Word*	*Price*
1614-A	Capacitance Bridge	LAPEL	$90.00

TYPE 1631-A INDUCTANCE BRIDGE



USES: This bridge, a companion instrument to the TYPE 1614-A Capacitance Bridge, is designed for the rapid measurement of the inductance and storage factor (Q) of inductors over a range of 100 μh to 100 h. Less accurate measurements can be made of inductors between 10 μh and 100 μh. It is suitable for production testing or for routine laboratory use. Iron-core inductors can be measured at an arbitrary value of impressed a-c voltage which is substantially in excess of the value corresponding to initial permeability.

DESCRIPTION: Like the TYPE 1614-A Capacitance Bridge, this bridge is portable and operates from self-contained batteries. The same type of oscillator and head telephones are used, and the bridge is housed in a similar cabinet. The circuit is that of the Maxwell bridge, in which a fixed capacitor is used as the standard, and the loss component is balanced by a variable resistor shunting the standard.

The inductance of the unknown is indicated directly by the setting, at balance, of a 6-inch dial with slow-motion drive. A 3-position switch provides multiplying factors in steps of 100:1. The second balance control is a $2\frac{3}{4}$ inch dial calibrated directly in Q.

FEATURES: See TYPE 1614-A Capacitance Bridge (page 22).

SPECIFICATIONS

Inductance: Range, 10 μh to 100 h in 3 steps, 10 μh to 10,000 μh; 0.1 h to 1 h; and 1 h to 100 h.

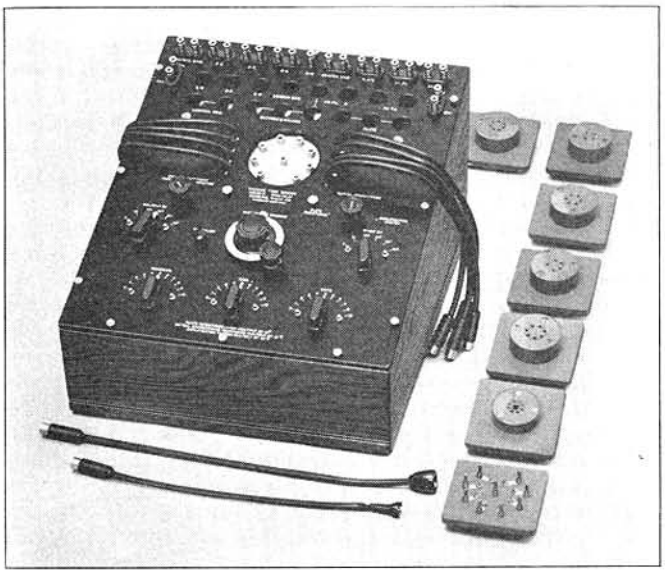
Accuracy: $\pm 2.5\%$ of dial reading between 100 μh and 10 h. Below 100 μh the error varies inversely as the magnitude of the unknown. Above 10 h the error increases to $\pm 10\%$ dial reading at 100 h.

Dial Calibration: Approximately logarithmic (uniform fractional accuracy) over two main decades, with a compressed lower decade which is used only for measurements below 100 μh.

Q: Range, 1 to 45. Accuracy, $\pm 10\%$ of dial reading for values of Q between 2 and 10. For higher values the error increases progressively to $\pm 15\%$ at a Q of 45. For lower values, the error increases to $\pm 20\%$ at a Q of 1.

Other specifications are identical with those for TYPE 1614-A Capacitance Bridge, page 22.

Type		*Code Word*	*Price*
1631-A	Inductance Bridge	LARVA	$98.00



TYPE 561-D VACUUM-TUBE BRIDGE

This bridge supersedes the older TYPE 561-C, which was listed in the 1939 edition of Catalog K. The major change is in the arrangement of the tube control circuits. An extremely flexible system of making connections is provided, which makes it possible to measure the tube parameters referred to any pair of electrodes. Connections from the tube under test to the measuring circuit are made by means of concentric cables and jacks, connected to an eight-terminal jack plate, mounted on the panel. Sixteen concentric plugs are mounted on the panel, permitting a wide variety of interconnections between the jack plate, the measuring circuit, and external batteries. Eight adapter plug plates, each carrying one of the standard type tube sockets, are provided, so that any commercial receiving tube can be measured.

SPECIFICATIONS

Range: Amplification factor (μ); 0.001 to 10,000.

Dynamic internal plate resistance (r_p); 50 ohms to 20 megohms.

Mutual conductance (s_m); 0.02 to 20,000 micromhos.

Under proper conditions, the above ranges can be exceeded. The various parameters can also be measured with respect to various elements, such as screen grids, etc. Negative, as well as positive, values can be measured.

Accuracy: Within $\pm 2\%$ for resistances (R_p switch position) from 1000 to 1,000,000 ohms. At lower and higher values the accuracy decreases slightly.

The expression $\mu = r_p s_m$ will check to $\pm 2\%$ when the quantities are all measured by the bridge, and when r_p is between 1000 and 1,000,000 ohms.

Tube Mounting: Socket adapters are provided, as follows: 4-prong, 5-prong, 6-prong, small 7-prong, medium 7-prong, octal, loctal, miniature 7-prong, and acorn 5- and 7-prong. Thus all standard commercial receiving tubes can be measured. In addition, a "universal" adapter, with eight soldering lugs, is provided so that unmounted tubes, or tubes with non-standard bases, can be measured conveniently. The panel jack plate and the adapters are made of low-loss yellow bakelite, reducing to a minimum the shunting effect of dielectric losses on the dynamic resistance being measured.

Accessories Supplied: Two TYPE 274-NC Shielded Conductors for connecting bridge to oscillator and detector, two grid-lead connectors, special connector.

Current and Voltage Ratings: The tube circuits have large enough current-carrying capacity and sufficient insulation so that low-power transmitting tubes may be tested in addition to receiving tubes. Maximum allowable plate current is 150 ma and maximum plate voltage is 1500 volts.

Electrode Voltage Supply: Batteries or suitable power supplies are necessary for providing the various voltages required by the tube under test.

Bridge Source: A source of 1000 cycles is required. The TYPE 813-A Audio Oscillator or the TYPE 723-A Vacuum-Tube Fork is suitable for this purpose.

Null Indicator: An amplifier in conjunction with a sensitive pair of head telephones is recommended.

Mounting: The instrument is mounted on a black crackle-lacquered aluminum panel and is furnished in a polished walnut cabinet. A wooden storage case is provided for the plug plates and leads.

Dimensions: (Length) 18⅜ x (width) 15¾ x (height) 11 inches.

Net Weight: 51 pounds.

Type		*Code Word*	*Price*
561-D	Vacuum-Tube Bridge	BEIGE	$375.00

PATENT NOTICE. See Note 17, page vi.

STANDARD-SIGNAL GENERATORS

The TYPE 805-C Standard-Signal Generator, described on page 26, is a high-quality instrument having a wide range of frequency, output voltage and modulation level, and low r-f and a-f distortion. The controls are arranged for convenient and rapid operation, so that the generator is suitable for use both as a laboratory standard and as a production testing device.

Additional signal generators are under development, including both a-m and f-m models, that will collectively cover frequencies from 16 kc to 1250 kc. These will be announced as soon as schedules permit.

OSCILLATORS

The TYPE 713-B Beat-Frequency Oscillator has been replaced by TYPE 913-B. Smaller and having a somewhat smaller frequency range than its predecessor, this new oscillator is characterized by a high degree of stability, low distortion, and essentially constant output as the frequency is varied (page 28).

For the ultra-high-frequency range, the TYPE 757-A Oscillator was announced in the second edition of Catalog K. This has now been replaced by the TYPE 857-A, a small, compact unit, using the newly-developed butterfly circuit (page 30).

TYPE 723, a new tuning-fork oscillator, vacuum-tube-driven, is available in models for 400 and 1000 cycles, with either batteries or an a-c power unit (page 34).

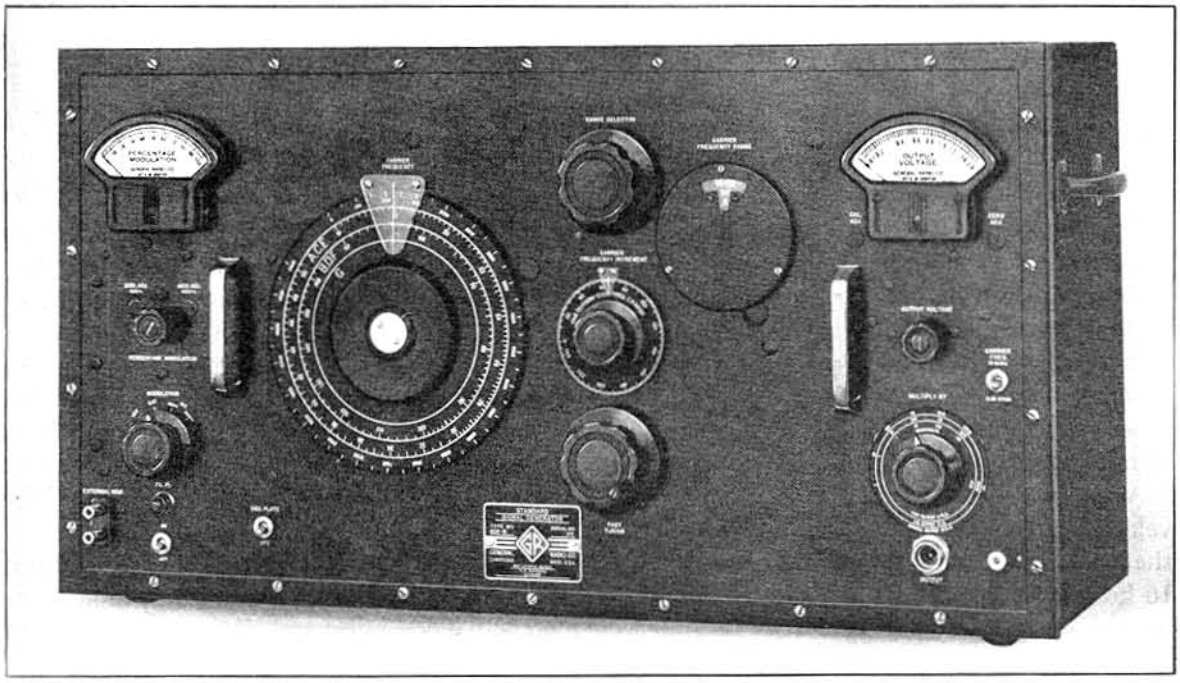
TYPE 869-A Pulse Generator is another wartime instrument now generally available. This generator, when driven from an external audio-frequency source, supplies pulses adjustable both in length and repetition rate (page 32).

STANDARD-SIGNAL GENERATORS

Type	*Name*	*Price*
418-G	Dummy Antenna	*Discontinued*
605-B	Standard-Signal Generator	*Discontinued*
804-B, C	Standard-Signal Generator	*Discontinued*
805-A, B	Standard-Signal Generator	*Replaced by* TYPE 805-C
805-C	Standard-Signal Generator	$850.00

OSCILLATORS

572-B	Microphone Hummer	$10.00
608-A	Oscillator	260.00
613-B	Beat-Frequency Oscillator	*Discontinued*
613-P1	Power Supply	*Discontinued*
684-A	Modulated Oscillator	*Discontinued*
700-A	Wide-Range Beat-Frequency Oscillator	555.00
713-B	Beat-Frequency Oscillator	*Replaced by* TYPE 913-B
723-A, B	Vacuum-Tube Fork	70.00
723-C, D	Vacuum-Tube Fork	90.00
723-P1	Power Supply	$22.00
723-P2	Replacement Battery	3.85
757-A	U-H-F Oscillator	*Replaced by* TYPE 857-A
813-A	Audio Oscillator	34.00
813-B	Audio Oscillator	*Discontinued*
857-A	U-H-F Oscillator	250.00
869-A	Pulse Generator	260.00
913-A	Beat-Frequency Oscillator	*Replaced by* TYPE 913-B
913-B	Beat-Frequency Oscillator	260.00



(Illustration shows earlier model, TYPE 805-B)

TYPE 805-C STANDARD-SIGNAL GENERATOR

USES: The TYPE 805-C Standard-Signal Generator is designed primarily as a precision laboratory instrument for rapid and accurate testing of radio receivers. Because of its accuracy, wide frequency range, and high voltage output, it is an almost indispensable instrument for laboratories engaged in research and design on radio receivers and allied apparatus, while its speed and simplicity of operation make it well adapted to production testing.

DESCRIPTION: Functionally this instrument consists of (1) a carrier-frequency oscillator, (2) a tuned radio-frequency amplifier, (3) a resistive output attenuator and a voltmeter to read the output level, (4) a modulating oscillator (400 cycles and 1000 cycles) with a voltmeter for reading percentage modulation, and (5) a well-regulated power supply.

The oscillator and amplifier assemblies are virtually identical in construction, and the coil switching assemblies, as well as the tuning condensers, are ganged and driven from common panel controls. Seven coils covering the frequency range from 16 kc to 50 Mc are carried on a selector disc in each assembly. An eighth coil position is also provided, so that an extra set of coils may be installed if desired. The discs are driven from a panel knob through a gear mechanism, which also brings into panel view a frequency range identification dial. As each coil is rotated into position, it is connected into circuit through silver-overlaid contact blades, which firmly engage silver alloy brushes, mounted on the tuning condenser. The contacts are mounted on polystyrene strips, insuring both low capacitance and low dielectric losses.

The main tuning condensers are exceptionally rugged, utilizing the cast frame type of construction, with ball-bearing supports for the rotor. The plates are shaped to give a logarithmic variation of frequency with angular rotation. The two condensers are driven through a set of gears, which also drive the direct-reading frequency dial. A gear-reduction vernier drive is provided, which permits an accuracy of setting of better than 0.01% for frequency increments. Backlash in the gear trains is kept to a minimum by automatic take-up springs.

The modulation level is indicated directly in per cent on a linear meter scale. Both 400-cycle and 1000-cycle internal modulation are available, continuously adjustable from 0–100%. An external oscillator can also be used to modulate the generator.

The output system consists of a vacuum-tube voltmeter, a resistive attenuator network, a 3-foot, 75-ohm output cable, and a terminating unit. This unit terminates the cable in its characteristic impedance. It provides, in addition to the normal output at 37.5 ohms, outputs reduced by 10 and 100, with corresponding output impedances of 7.1 and 0.75 ohms. A standard dummy antenna output is also provided.

Electronic stabilizer circuits are used in the plate power-supply circuits, while a ballast tube is used in the filament supply of the vacuum-tube voltmeters to insure stability of operation. The stabilization eliminates the effect of ordi-

nary line-voltage fluctuations over the range from 105 to 125 volts (or 210 to 250 volts).

FEATURES: This signal generator provides signals of accurately known intensity at the end of a properly terminated low impedance cable. The voltage is thus known at the point of application, and the necessity for computing or estimating lead effects is eliminated.

By unusually careful filtering and shielding, radio-frequency leakage and stray fields have been reduced to a minimum; measurements may be made at output levels as low as 0.5 microvolt. The tuned amplifier stage reduces reaction of the output circuit on carrier frequency, and side-band cutting is kept very low by heavy damping of the tuned plate circuit.

SPECIFICATIONS

Carrier Frequency Range: 16 kilocycles to 50 megacycles, covered in seven direct-reading ranges, as follows: 16 to 50 kc, 50 to 160 kc, 160 to 500 kc, 0.5 to 1.6 Mc, 1.6 to 5.0 Mc, 5.0 to 16 Mc, 16 to 50 Mc. A spare range position is provided so that a special set of coils can be installed if desired.

Frequency Calibration: Each range is direct reading to an accuracy of ±1% of the indicated frequency.

Frequency Drift: Not greater than 0.05% on any frequency range for a period of 5 hours' continuous operation.

Incremental Frequency Dial: A slow-motion vernier drive dial is provided, by means of which frequency increments as small as 0.01% may be obtained.

Output Voltage Range: Continuously adjustable from 0.1 microvolt to 2 volts. The output voltage (at the termination of the 75-ohm output cable) is indicated by a panel meter and seven-point multiplier.

Output System: The output impedance at the panel jack is 75 ohms, resistive. A 75-ohm output cable is provided, together with a termination unit that furnishes constant output impedances of 37.5, 7.1, and 0.75 ohms. The calibration of the panel voltmeter-multiplier combination is in terms of the actual voltage across the 37.5-ohm output. When the 7.1 and 0.75-ohm positions are used, the indicated output voltage must be divided by 10 and 100, respectively. A standard dummy antenna output is also available at the termination unit.

Output Voltage Accuracy: For multiplier settings below 1 volt the maximum error in output voltage is the sum of the attenuator and voltmeter errors listed below.

Maximum Voltmeter Error: ±5% up to 25 megacycles. Above 25 megacycles, a frequency error occurs, amounting to ±6% at 50 megacycles. At 1/10 full scale and 50 Mc, there is also a transit-time error of −5% in the voltmeter tube.

Maximum Attenuator Error:

Below 3 Mc, ± 3% of meter reading ±0.1 microvolt
3 to 10 Mc, ± 5% of meter reading ±0.2 microvolt
10 to 30 Mc, ±10% of meter reading ±0.4 microvolt
30 to 50 Mc, ±15% of meter reading ±0.8 microvolt

There is no attenuator error for the 1-volt multiplier setting.

Modulation: Continuously variable from 0 to 100%. The percentage of modulation is indicated by a panel meter to an accuracy of ±10% of the meter reading up to 80%, for carrier frequencies below 16 Mc; 15% for higher carrier frequencies.

Internal modulation is available at 400 cycles and 1000 cycles, accurate in frequency within ±5%.

The generator can be modulated by an external oscillator. Approximately 10 volts across 500,000 ohms are required for 80% modulation. The over-all modulation characteristic is as follows:

Carrier Frequency	*Audio Range*	*Level*
0.5—50 Mc	50—15,000	±1 db
0.1—0.5 Mc	50—10,000	±1.5 db
16—100 kc	50—10% Carrier Frequency	±1.5 db

Frequency Modulation: Negligible for all intended uses.

Distortion and Noise Level: The envelope distortion at a modulation level of 80% is less than 4% at 1 Mc carrier frequency. Carrier noise level is at least 40 db below 80% modulation.

Leakage: The magnetic induction leakage is less than 5 microvolts per meter at a distance of 2 feet from the generator. The 3-foot output cable permits the receiver under test to be kept beyond this limit. Radiation fields are negligible.

Power Supply: The instrument operates from any 40 to 60 cycle, 115-volt (or 230-volt) line. An electronic voltage regulator compensates for line voltage fluctuations from 105 to 125 volts (or from 210 to 250 volts). A maximum input power of 140 watts is required.

Tubes: Supplied with instrument:

2—type 1614	1—type 6SF5
1—type 6C8-G	1—type VR-150-30
1—type 6L6-G	1—type 955
1—type 5T4	1—type 6H6
2—type 2A3	1—Amperite 3-4

Accessories Supplied: Seven-foot line connector cord, spare pilot lamps and fuses, shielded output cable and termination unit.

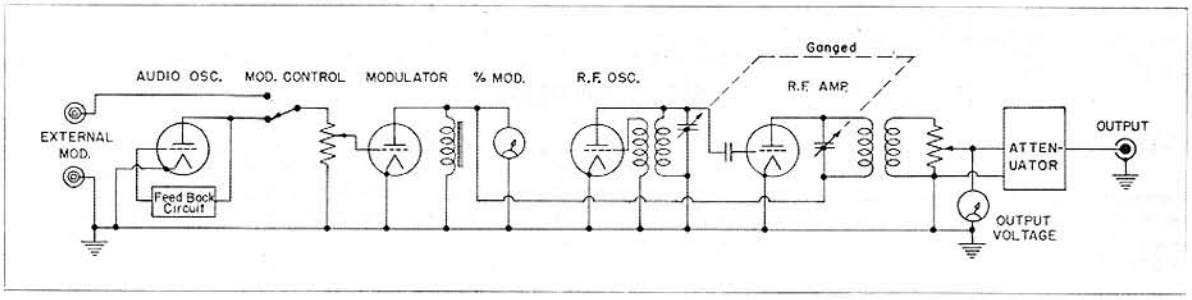
Mounting: The panel is finished in black crackle and the cabinet is black wrinkle finish.

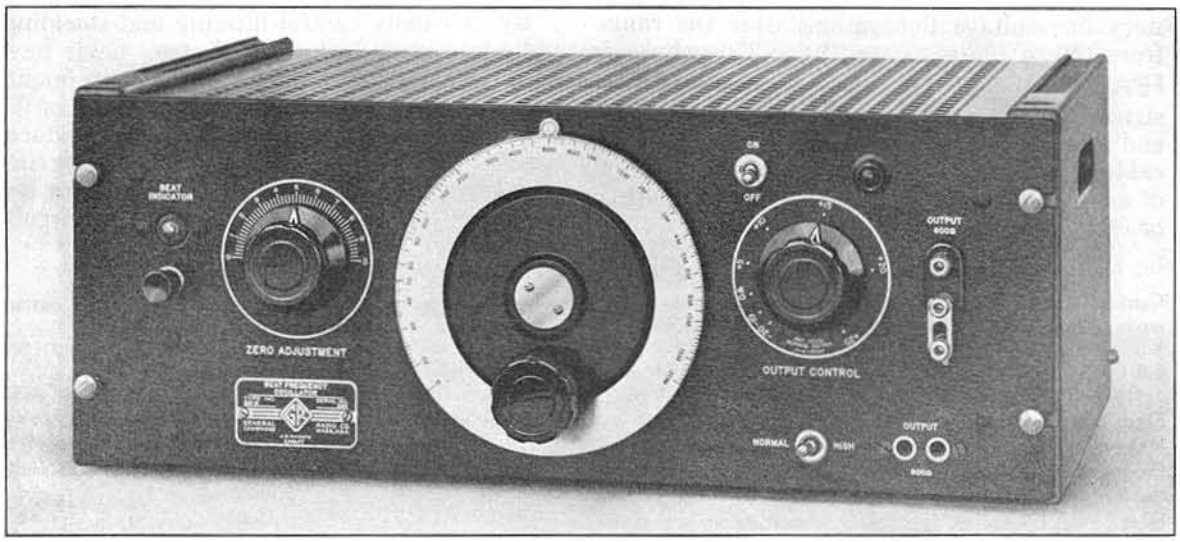
Dimensions: (Height) 16 x (width) 33 x (depth) 12 inches, over-all.

Net Weight: 120 pounds, approximately.

Type		*Code Word*	*Price*
805-C	Standard-Signal Generator	LEPER	$850.00

PATENT NOTICE. See Note 1, page iv.





TYPE 913-B BEAT-FREQUENCY OSCILLATOR

USES: This is a general-purpose beat-frequency oscillator that is particularly useful as a power source for tests on audio-frequency lines and associated networks. It is also useful as a voltage source for bridge measurements and for modulating signal generators and test oscillators. The oscillator can be used on either balanced or unbalanced systems.

DESCRIPTION: The TYPE 913-B utilizes the conventional beat-frequency oscillator design, but has a number of unusual design features that contribute to improved performance and ease of operation. Two radio-frequency oscillators, one fixed and one variable, feed a pentagrid converter. The resulting difference frequency, after passing through a low-pass filter, is amplified in a balanced, degenerative amplifier. The output level is controlled by a constant-impedance attenuator that is calibrated in decibels with respect to an output of one milliwatt into a 600-ohm line.

For permanent or relay-rack installation, duplicate output terminals are provided at the rear of the instrument, through standard multipoint connectors (Jones plug).

A neon lamp beat indicator is provided to assist in standardizing the frequency calibration of the oscillator by setting to zero beat. The frequency dial carries a logarithmic scale, and is driven by a vernier gear-reduction drive.

FEATURES: Because the output voltage is practically constant over the entire frequency band and the output control is calibrated in db, it is possible to use this oscillator to take frequency characteristics directly without a dummy generator resistance and oscillator voltmeter. The use of temperature compensated elements in the oscillator circuits, as well as stabilization of the power supply, contributes to a high degree of stability, in output voltage as well as frequency.

Careful design of the power-supply filter has reduced the power-frequency hum to a very low level, while excellent waveform is achieved by improved oscillator circuit design in conjunction with degeneration in the audio amplifier.

Small size and light weight facilitate moving the oscillator about the laboratory or radio station and contribute to its general utility.

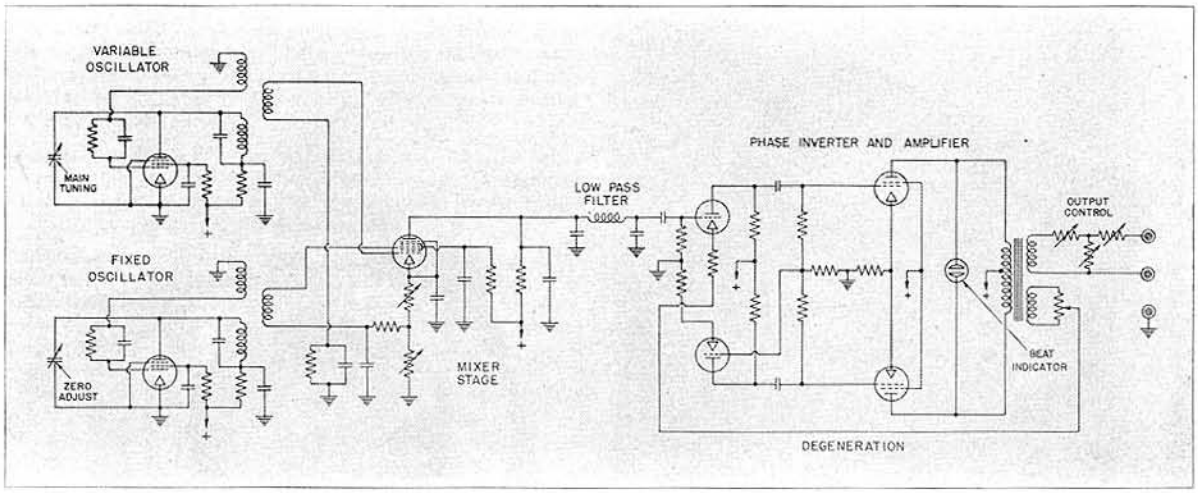
SPECIFICATIONS

Frequency Range: 20 to 20,000 cycles.

Frequency Control: The main control is engraved from 20 to 20,000 cycles per second and has a true logarithmic frequency scale. The total scale length is approximately 12 inches. The effective angle of rotation is 240°, or 80° per decade of frequency.

Frequency Calibration: The calibration can be standardized within 1 cycle at any time by setting the instrument to zero beat. The calibration of the frequency control dial can be relied upon within ±2% ±1 cycle after the oscillator has been correctly set to zero beat.

Zero Beat Indicator: A neon lamp is used to indicate zero beat.



Frequency Stability: Improved design of the oscillator circuits and the use of temperature-compensated capacitors and inductances result in an unusually high degree of stability.

Output Impedance: The output impedance is 600 ohms, either grounded or balanced-to-ground, and is essentially constant regardless of the output control setting. With load impedances of 2000 ohms or less, the output is balanced for all settings of the output control. With higher load impedances, unbalance may occur at low settings of the output control.

Output Voltage: Approximately 25 volts open circuit. For a matched resistive load the output voltage varies by less than ±0.25 db between 20 and 15,000 cycles. The open-circuit output voltage is approximately 40 volts with the output switch in the HIGH position.

Output Control: The output control is calibrated in db referred to 1 milliwatt into 600 ohms. The total range is from +25 to −20 db.

Output Power and Waveform: Normal output 0.3 watt maximum when operated into a matched load, with total harmonic content approximately 0.3% between 150 and 7000 cycles. Below 150 cycles the harmonic content increases, reaching approximately 2% at 50 cycles. A panel switch allows an increase in the output power to a maximum of 1 watt. For this HIGH position of the OUTPUT switch the distortion is approximately 1% between 150 and 7000 cycles and increases to 5% at 50 cycles. With the OUTPUT control turned fully on, the harmonic content is approximately doubled when the oscillator is operated into a very low impedance. If, however, the OUTPUT control is turned 3 db or more below the maximum setting, the load impedance has very little effect upon the waveform.

A-C Hum: For NORMAL output the a-c hum is less than 0.05% of the output voltage at a line frequency of 60 cycles, and is less than 0.1% at 50 cycles. Since the volume control is in the output circuit, the hum percentage does not increase for low output voltages. The hum may be slightly greater on the HIGH output range.

Temperature and Humidity Effects: Large changes in ambient temperature and humidity necessitate a readjustment of the zero-beat setting. High temperatures and humidity cause a slight increase in distortion and a slight decrease in output.

Terminals: Jack-top binding posts with standard ¾-inch spacing and standard Western Electric double output jack are provided on the panel. A Jones socket and plug provide duplicate output terminals on the back of the instrument for relay-rack installation.

Mounting: The panel is designed for mounting on a 19-inch relay rack, but removable wooden ends are supplied so that it may be used equally well on a table.

Power Supply: 105 to 125 volts, 40 to 60 cycles ac. A simple change in the connections to the power transformer allows the instrument to be used on 210 to 250 volts. The total consumption is about 100 watts.

Tubes:

2 — type 6SK7	2 — type 6V6-GT
1 — type 6SA7	2 — type 6X5-G
2 — type 6SF5	2 — type VR-150-30

1 — 139-949 Neon Lamp

All are supplied with the instrument.

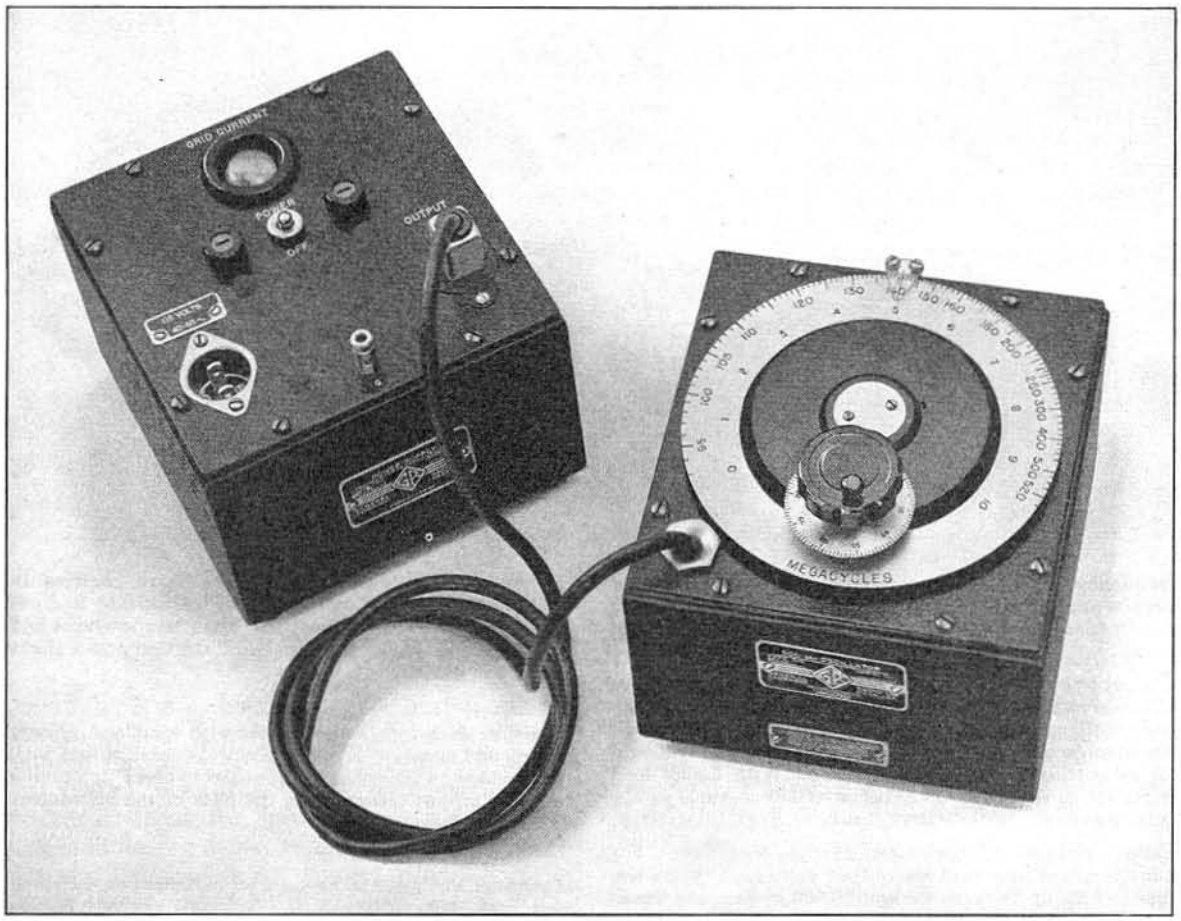
Accessories Supplied: A seven-foot connecting cord, a multipoint connector, and spare fuses and pilot lamp are supplied.

Dimensions: 19⅜ x 14¼ x 7½ inches, over-all.

Net Weight: 35 pounds.

Type		*Code Word*	*Price*
913-B	**Beat-Frequency Oscillator**	CAROL	**$260.00**

PATENT NOTICE. See Notes 1, 25, page iv.



TYPE 857-A U-H-F OSCILLATOR
100 Mc to 500 Mc

USES: The TYPE 857-A U-H-F Oscillator is a power source for measurements and testing in the frequency range between 100 Mc and 500 Mc.

DESCRIPTION: The oscillator consists of a butterfly-type tuned circuit and a W. E. 316-A Vacuum Tube, enclosed in a metal housing that provides a moderate amount of shielding. The a-c power-supply unit is in a separate cabinet.

Output is obtained at a coaxial jack on the side of the cabinet. Output coupling is inductive and can be varied continuously from maximum to practically zero.

The main dial is calibrated directly in megacycles. The vernier dial carries 100 uniform divisions and covers the tuning range in about 10 revolutions. An auxiliary scale indicates revolutions of the slow-motion dial.

Filament and plate power are supplied by the TYPE 857-P1 Power Supply. A 3-conductor shielded cord of 6-foot length, permanently connected to the oscillator, plugs into the power supply unit.

FEATURES: The TYPE 857-A U-H-F Oscillator delivers a moderate amount of power over a wide frequency range. Single-dial frequency control, with slow-motion drive, makes it possible to vary the oscillator frequency in small increments. The use of the butterfly circuit as a frequency-determining element eliminates output fluctuations from erratic electrical contact, since no electrical connections to the rotor are needed. The insulated rotor shaft is supported in ball bearings, and backlash is extremely low. The entire assembly is small, compact and light in weight.

SPECIFICATIONS

Frequency Range: 100 Mc to 500 Mc.

Frequency Calibration: The frequency dial reads directly in megacycles with an accuracy of ±1%. Replacement of the vacuum tube may cause a shift in the calibration. A trimmer capacitor is provided to compensate for variations in tube capacitance.

Output Power: The oscillator will deliver a maximum of approximately 0.5 watt at the highest frequency. At lower frequencies, the output increases.

Output Coupling: By rotating the output jack, the orientation of the small output coupling loop can be varied from zero to maximum coupling. By moving the jack in or out, the spacing between the oscillator tuned circuit and the loop can be adjusted in three steps. The output terminal is a coaxial plug.

Output Impedance: The output system, with its adjustable coupling, is adapted for use with coaxial lines. Maximum power can be delivered to load impedances in the range normally encountered in coaxial systems.

Power Supply: Filament and plate power is furnished by the TYPE 857-P1 Power Supply, which is mounted in a separate cabinet with connecting cord and plug. The plate voltage supplied by this unit is fixed at the maximum value for safe operation of the tube. It operates from a 105- to 125-volt (or 210- to 250-volt) a-c line, 40 to 50 cycles. When other types of power supply are used, the power requirements are:

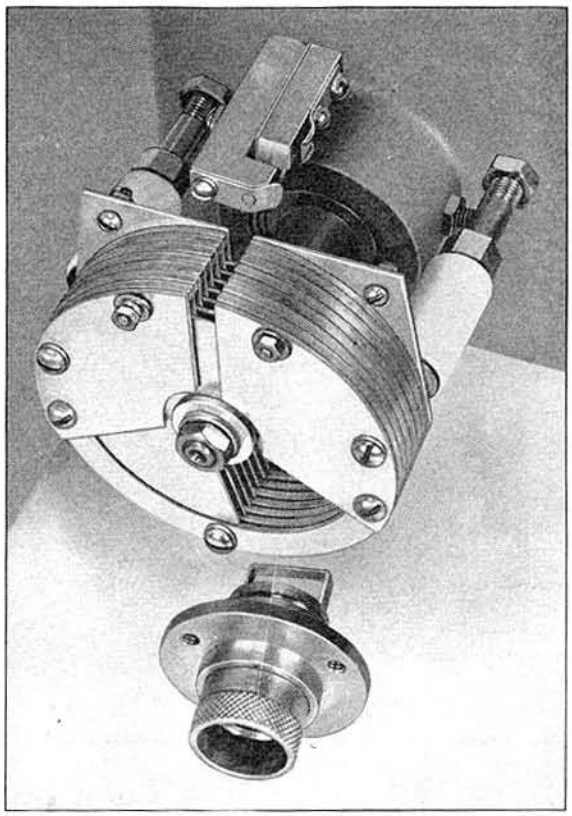
Filament	3.65 a at 2.5 volts
Plate	50 ma at 350 volts

Oscillation Indicator: An electron-ray tube is provided in the TYPE 857-P1 Power Supply to indicate grid current and thus furnish an indication of oscillation.

Mounting: Both oscillator and the power supply unit are mounted in metal cabinets.

Dimensions: Oscillator, 6⅞ x 7⅝ x 7¼ inches, overall; power supply, 5½ x 6⅝ x 6⅞ inches, overall.

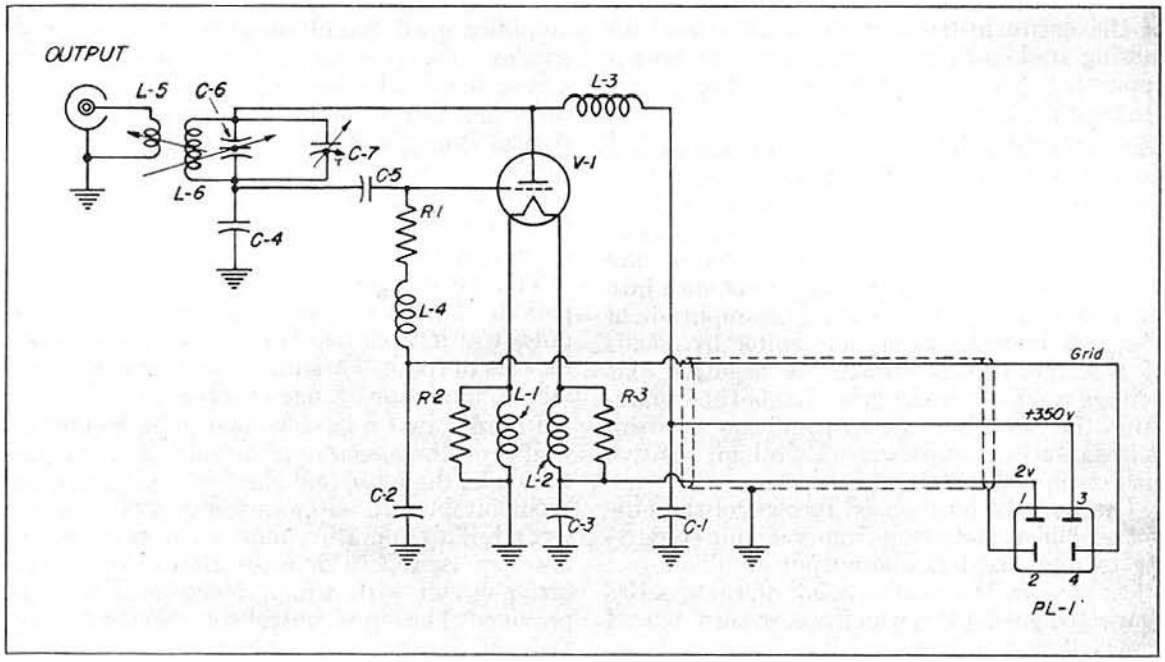
Net Weight: Oscillator, 6¼ pounds; power supply, 9½ pounds.

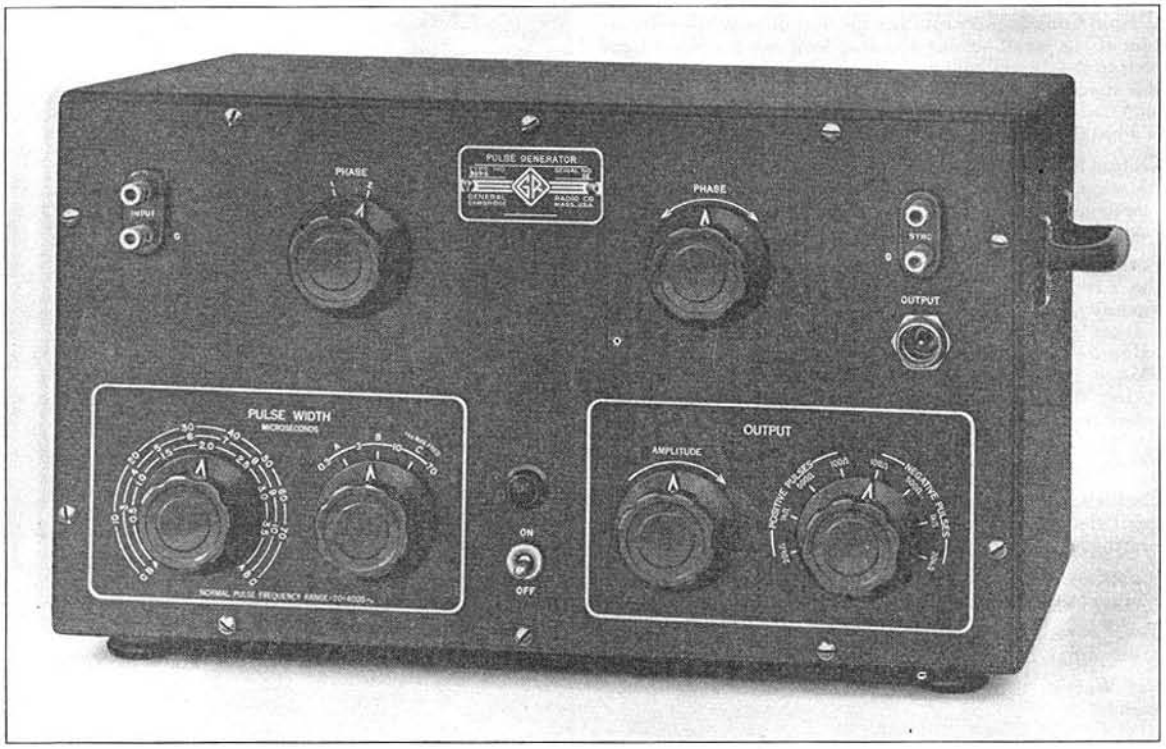


(Right) View of the tuned circuit of the TYPE 857-A Oscillator, showing also the output coupling loop and output jack in approximately their normal position.

Type		*Code Word*	*Price*
857-A	U-H-F Oscillator (with Power Supply)	OFTEN	$250.00

PATENT NOTICE: See Notes 1, 10, page iv.





TYPE 869-A PULSE GENERATOR

USES: The pulse generator is intended for use in tests on circuits designed to pass short electrical pulses. It generates pulses of either positive or negative polarity, whose width can be set to any value between 0.3 and 70 microseconds and whose repetition rate can be controlled between 20 and 4000 cycles per second from an external a-c source. Complete shielding of the entire instrument makes it useful for pulsing standard-signal generators and similar apparatus, where extremely low voltage levels are encountered.

DESCRIPTION: The microsecond pulses are generated in an output amplifier stage by driving the control grid between the limits of plate-current cutoff and plate-current saturation. Either positive or negative output pulses are provided by switching the load resistance into the cathode, or plate circuit. The amplitude of the pulse is continuously adjustable by means of a screen voltage control. A negative bias voltage applied to the grid of this tube maintains the tube in a cutoff condition between pulses. During the pulse period a high positive bias is applied to the grid.

The positive pulse, used to control the output amplifier, is derived from a circuit employing two gas-triodes. The output amplifier grid is coupled to the center point of these series connected gas-triodes which are, in turn, placed across a condenser. A positive d-c potential is developed across the condenser terminals by charging it from the power supply through a suitable series resistance.

When the first gas-triode becomes conducting, the positive condenser voltage appears across both the output amplifier grid and the other gas-triode. Conduction in the second gas triode removes the positive voltage from the amplifier grid. Simultaneously, the two gas-triodes now present a low-impedance path across the condenser and discharge it. When the condenser terminal voltage falls below a critical value, both gas-triodes deionize and resume their normal non-conducting state. The condenser then recharges through the series resistor and the circuit is ready for a second pulse operation.

The time delay between the conduction periods of the two gas-triodes determines the pulse width. A simple R-C circuit is employed for this purpose. Variable circuit elements provide a continuous range of adjustment.

In order that a microsecond pulse be clearly visible on the screen of a cathode-ray tube, the timing of the pulse and the sweep circuit must be maintained to within a fraction of a microsecond. This condition must exist even at the lowest pulse repetition rates. Hence, a synchronizing circuit with a high degree of control is provided. The input control voltage is first rectified, and then passed through a series of differen-

tiating amplifiers. This results in a peaked waveform with a sharp leading edge, and is used to control the action of the gas-triode circuit.

An output voltage is provided for controlling a high speed sweep circuit. A limited phase adjustment is provided between this point and the internal synchronizing amplifier. This permits adjustment of the timing of the pulse with respect to the high-speed sweep circuit of an external oscilloscope.

SPECIFICATIONS

Repetition Rate: 20 to 4000 cycles. Pulses longer than 10 microseconds are limited to a maximum frequency of 1000 cycles.

Input Voltage: Between 5 and 10 volts are required for normal control. For improved stability at the lowest frequencies, this may be increased to a maximum of 30 volts.

Input Voltage Waveform: This is not critical, and may vary from a sine wave to a triangular wave. Care must be taken, however, to keep this signal reasonably free from power supply hum voltage.

Synchronizing Output: A clipped sine wave appears across the synchronizing output terminals of approximately −160 and +50 peak volts. This may be used to control the high-speed sweep circuit of an oscillograph that has been provided with suitable triggering amplifiers.

Pulse Amplitude Control: A panel control permits the pulse amplitude to be adjusted from zero to maximum, with a negligible effect upon the pulse waveform.

Pulse Waveform: The pulse is essentially flat-topped, and has an effective rise time of 0.1 microsecond for pulse widths less than 10 microseconds. For longer pulses, the rise time is less than 10% of the pulse width.

Output Selector: A panel switch permits any one of four impedances to be inserted in the output amplifier, and also provides either positive or negative pulses

Pulse Width: The output pulse is continuously adjustable over three ranges. These are 0.3–3.0, 3–10, and 10–70 microseconds, respectively. The calibration of these controls is approximately correct over the entire frequency range.

Output Amplitude: See table below.

Phasing Controls: Panel controls are provided to permit adjustable phasing of the output pulse, with respect to the voltage obtained at the synchronizing output terminals, over a limited range.

Power Supply: Either 115 or 230 volts, 50–60 cycles may be used. A variation of ±10% in the supply voltage will cause a minor variation in the output pulse amplitude, and will generally tend to change the pulse width. For optimum performance, operation at the 115- or 230-volt value is recommended. Power input is 60 watts.

Accessories Required: To drive the generator an a-c source is needed. The General Radio TYPE 913-B Beat-Frequency Oscillator is recommended.

Accessories Supplied: A seven-foot line connector cord, two TYPE 274-M Plugs, one TYPE 774-R2 Patch Cord, spare fuses, and pilot lamps are supplied.

Tubes Supplied with Instrument:

2 — type 6H6	2 — type 884
1 — type 6AC7	1 — type 6SC7
1 — type 6X5	1 — type 6ZY5G
1 — type VR-150-30	1 — type VR-105-30
1 — type 6SN7GT	1 — type 6L6

Mounting: Metal cabinet.

Dimensions: (Length) 19 x (height) 9¾ x (depth) 12⅛ inches, overall.

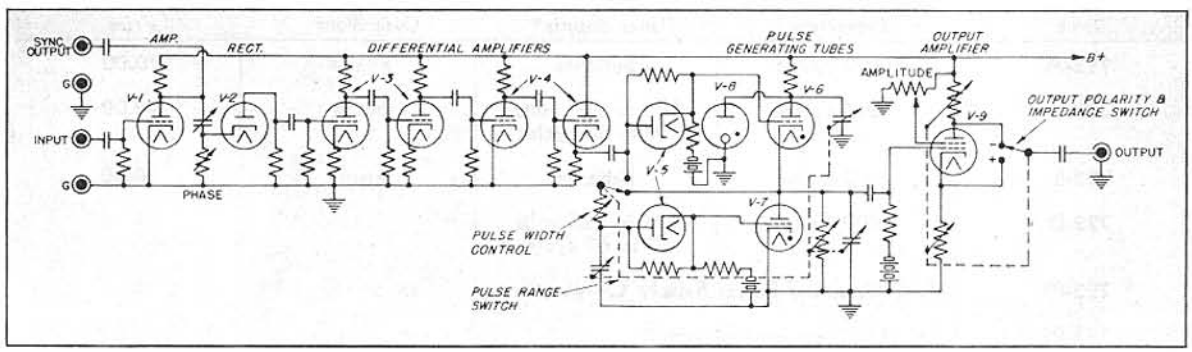
Net Weight: 38¼ pounds.

PEAK OUTPUT VOLTS—OPEN CIRCUIT

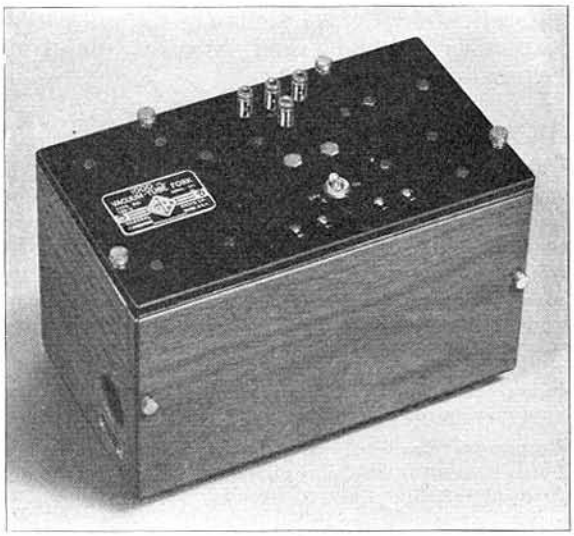
Pulse Polarity	*Positive*				*Negative*				*Operating Frequency**
Output Setting	20 KΩ	1000 Ω	500 Ω	100 Ω	100 Ω	500 Ω	1000 Ω	20 KΩ	
Range A	90	80	70	20	18	80	150	300	500 ∽
Range B	100	90	80	20	18	90	170	300	500 ∽
Range C	100	80	80	20	18	90	180	300	500 ∽

*For other operating frequencies, the voltages will be approximately within 20% of the values given above. In general, the open circuit output voltage will tend to decrease as the pulse width and operating frequency increase.

Type		*Code Word*	*Price*
869-A	Pulse Generator	OLIVE	$260.00



TYPE 723 VACUUM-TUBE FORK



USES: The TYPE 723 Vacuum-Tube Fork is a compact, stable, fixed-frequency oscillator. It is particularly useful as a modulating source for standard-signal generators and beacon transmitters, as a power source for transmission measurements on lines and cables, and as a test-tone generator for communication systems. Its waveform is sufficiently pure to permit its use as a test-signal source for many types of distortion measurements. It is an excellent source of timing pulses for oscillograms.

DESCRIPTION: This instrument is an electromechanical oscillator whose frequency is determined by a vacuum-tube driven tuning fork. The driving and pickup coils are so arranged as to load the tines of the fork equally and to affect only slightly its free vibration.

Space is provided in the cabinet for mounting batteries or an a-c power-supply unit. (See price list.)

A filter and an output transformer are included to suppress harmonics and to provide three output impedances.

FEATURES: The outstanding features of this new oscillator are accuracy and stability of frequency, low harmonic content, constant output, light weight, and the low cost.

SPECIFICATIONS

Frequency: Two frequencies are available, 1000 cycles and 400 cycles.

Frequency Stability: The temperature coefficient of frequency is approximately −0.008% per degree Fahrenheit. The frequency is entirely independent of load impedance. When the a-c power supply is used an initial downward drift of frequency occurs as the temperature of the fork is affected by heat generated in the power-supply unit. The total frequency drift is of the order of .15% to .2%. Most of this drift, however, occurs in the first 30 minutes of operation.

Accuracy: The frequency is adjusted to within ±0.01% of its specified value, at 77° Fahrenheit.

Output: The output to a matched load is approximately 50 milliwatts.

Internal Output Impedance: Output impedances of 50, 500, and 5000 ohms are provided.

Waveform and Hum Level: The total harmonic content is less than 0.5%. The hum is negligible.

Terminals: Binding posts for the output circuit are mounted on the panel. Battery terminals are brought out to sunken screw heads on the panel to permit measurement of the battery voltages.

Power Supply: The instrument is available for either battery operation or for operation from 105 to 125-volt, 50 to 60-cycle line. For battery operation one Burgess type 4FA (1½-volt) and two Burgess type Z30-N (45-volt) are required. The batteries and a-c power supply are interchangeable. The power supply, TYPE 723-P1, is available separately. (See price list.) The ON-OFF switch is arranged to control the a-c line or the battery current.

Vacuum Tubes:

For battery supply: 1 type 1A5-G
For a-c supply: 1 type 1A5-G
1 type VR-105-30

The necessary tubes are supplied.

Mounting: The oscillator assembly is mounted on a bakelite panel and is enclosed in a walnut cabinet.

Dimensions: (Length) 10⅝ x (width) 6¼ x (height) 7¾ inches, over-all.

Net Weight: 11¼ pounds, including batteries; 9 pounds, with a-c supply; a-c power supply alone, 1¼ pounds.

Type	*Frequency*	*Power Supply**	*Code Word*	*Price*
723-A	1000 cycles	Batteries	SNAKE	$70.00
723-C	1000 cycles	105 to 125 volts, 50 to 60 cycles	SOLID	90.00
723-B	400 cycles	Batteries	STORY	70.00
723-D	400 cycles	105 to 125 volts, 50 to 60 cycles	SULKY	90.00
723-P1	A-C Operated Power Supply Only.....		SNAKEYPACK	22.00
723-P2	Set of Replacement Batteries.....		SNAKEYBATT	3.85

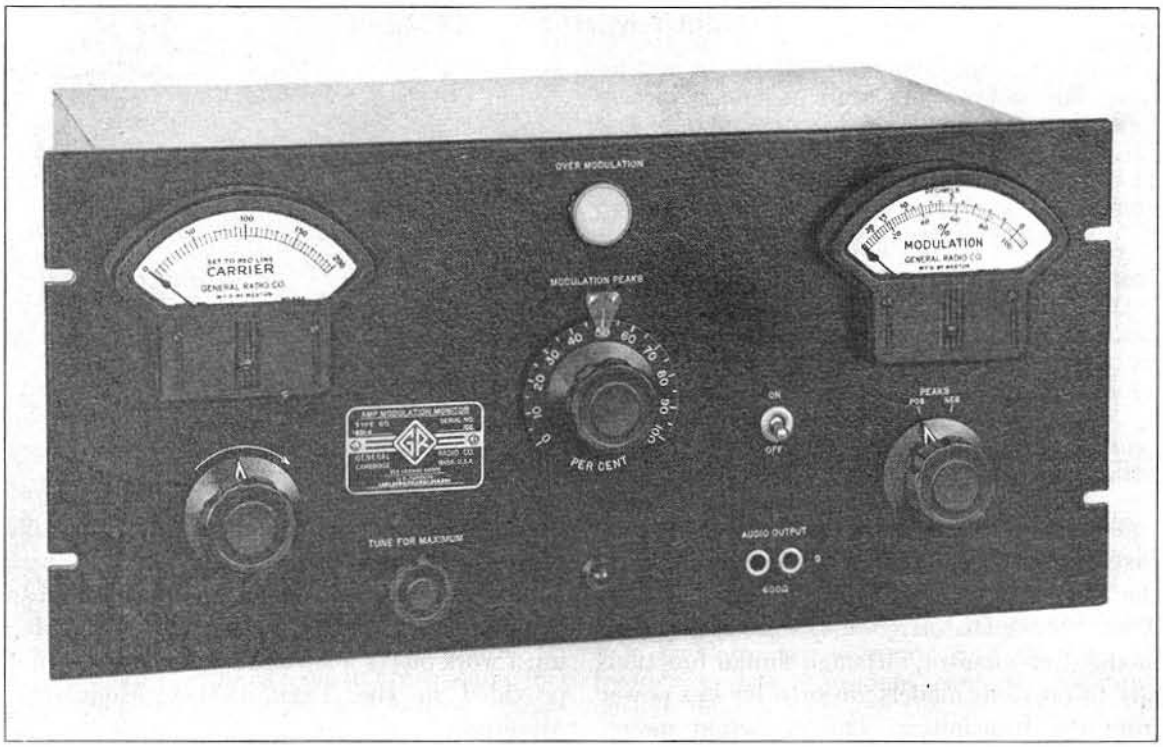
*Included in price.

WAVEFORM-MEASURING INSTRUMENTS

Two entirely new instruments for the broadcasting station are now ready for production, the TYPE 1931-A Modulation Monitor and the TYPE 1932-A Distortion and Noise Meter. The modulation monitor, although similar functionally to previous models, absorbs far less power from the transmitter. The distortion meter, which is useful for general distortion measurement as well as for broadcast testing, is continuously variable in frequency and is capable of measuring distortion down to 0.1%. It is an audio-frequency instrument, and when used to measure the distortion in a modulated signal, must work out of a linear detector, such as that provided in the TYPE 1931-A Modulation Monitor.

The current listing of instruments in this classification follows:

Type	*Name*	*Price*
530-A	Band-Pass Filter	**$30.00**
530-C	Band-Pass Filter	*Discontinued*
651-AE	Oscillograph Recorder, less lens	**410.00**
651-AG	High-Speed Camera, less lens	**510.00**
651-P1, P2	Lenses	*Replaced by* TYPE 651-P5
651-P5	Lens	**150.00**
731-B	Modulation Monitor	*Replaced by* TYPE 1931-A
732-B	Distortion and Noise Meter	*Replaced by* TYPE 1932-A
732-P1	Range-Extension Filters	*Discontinued*
733-A	Oscillator	*Discontinued*
736-A	Wave Analyzer	**$640.00**
769-A	Square-Wave Generator	*Discontinued*
830-A, C, D, E, F, G, H	Wave Filters	**18.50**
830-B	Wave Filter	**21.50**
830-R	Wave Filter	**19.50**
1931-A	A-M Monitor	**295.00**
1932-A	Distortion and Noise Meter	**450.00**



TYPE 1931-A AMPLITUDE-MODULATION MONITOR

USES: The modulation monitor is used to measure and to indicate continuously the percentage modulation of broadcast and other radio-telephone transmitters. The TYPE 1931-A Modulation Monitor performs the following specific functions:

1. Measurement of percentage of modulation on either positive or negative peaks.
2. Overmodulation indication.
3. Program level monitoring.
4. Measurement of carrier shift when modulation is applied.
5. Measurement of transmitter audio-frequency response.

DESCRIPTION: TYPE 1931-A Modulation Monitor consists of three essential elements: (1) a linear diode rectifier which gives an instantaneous output voltage proportional to the carrier envelope, (2) a peak voltmeter which gives a continuous indication of the peak modulation, and (3) a trigger circuit which flashes a light whenever the modulation momentarily exceeds any previously set value.

The linear rectifier is designed for operation at a low power level, which greatly simplifies the coupling to the transmitter. In the output of the linear rectifier is a d-c meter, which indicates the carrier level at which the instrument is operating and also shows any carrier shift during modulation.

In addition, two auxiliary audio output circuits operating from a separate diode rectifier are provided. One of these, at 600 ohms, is intended for audible monitoring; the other, a high-impedance circuit, gives a faithful reproduction of the carrier envelope with less than 0.1% distortion and can be used for distortion and noise-level measurements.

FEATURES: Speed and simplicity of operation, essential for monitoring instruments, are available in this instrument. It operates over a wide carrier-frequency range, and a tuned input circuit is provided to facilitate coupling to the transmitter.

The r-f power input is only a fraction of that required by older models. This greatly simplifies coupling to the transmitter.

The flashing lamp is extremely useful as a monitoring device. It is set to flash with moderate frequency when the transmitter is operating normally. If the flashing rate changes markedly the operator is made aware that the average level of modulation has changed.

The flashing circuits are so designed that the indication is unaffected by moderate changes in carrier amplitude.

Terminals are provided so that remote percentage modulation indicators can be connected to the instrument externally.

SPECIFICATIONS

Range: Modulation percentage, 0 to 110%, indicated by meter on positive peaks, 0 to 100% on negative peaks. The flashing lamp is adjustable to operate from 0 to 100% on negative peaks.

Carrier-Frequency Range: The monitor will operate at any carrier frequency from 0.5 to 60 megacycles. A single set of coils (either 0.5 to 8 megacycles or 3 to 60 megacycles) is supplied with each instrument, unless both sets are specifically ordered.

Carrier-Frequency Input Impedance: About 75 ohms in the broadcast band, increasing slightly at higher carrier frequencies and varying somewhat with input tuning.

Accuracy: The overall accuracy of measurement at 400 cycles is ±2% of full scale at 0% and 100%, and ±4% of full scale at any other modulation percentage.

Detector Linearity: The distortion in the diode detector is very low for frequencies up to 7500 cycles. Above this frequency, a small amount of negative peak clipping occurs, reaching 5% at the extreme high end of the audio range at 15,000 cycles and 100% modulation.

Audio-Frequency Response: The frequency response of the meter indication is constant within ±0.25 db between 30 and 15,000 cycles.

R-F Power: In the broadcast range the maximum r-f power requirement is about 0.5 watt.

Vacuum Tubes: The following tubes are used:

2—type 6SN7-GT	1—type 2050
2—type 6SJ7	2—VR-150-30
1—type 6H6	1—type 6X5

Warning Lamp Circuit: The OVERMODULATION lamp will flash whenever the negative modulation peaks exceed the setting of the MODULATION PEAKS dial by approximately 2% modulation, for audio frequencies between 30 and 7500 cycles. For higher audio frequencies, the percentage overmodulation required to flash the lamp increases slightly.

The accuracy of the dial calibration is approximately ±2%.

Meter Circuit: The response of the PERCENTAGE MODULATION meter circuit is flat, within ±0.1 db, between 50 and 15,000 cycles.

Either positive or negative modulation peaks may be read to an accuracy of ±2% at 0 and 100% modulation. At other modulation levels, the possible error increases to a maximum of ±4%.

The meter movement meets FCC specifications for modulation monitors.

Calibration in db below 100% modulation is provided.

Audio Monitoring Output: The audio output amplifier is flat, to within ±1.0 db, from 30 to 45,000 cycles. The internal impedance is 600 ohms. Distortion is less than 0.2%. Open-circuit output voltage is about 300 millivolts.

Fidelity-Measuring Output: Flat within ±1.0 db between 30-15,000 cycles with TYPE 1932-A Distortion and Noise Meter connected.

Output level varies inversely with setting of MODULATION PEAKS dial, thus providing reasonably uniform input to distortion meter at all modulation levels. Average output level, approximately 1.5 volts.

Residual noise and hum level will not exceed −80 db.

Auxiliary Output: A multipoint connector at the rear of the instrument provides a means of connecting:

1. A remote Percentage Modulation Meter.
2. Line for 600-ohm monitoring.
3. The TYPE 1932-A Distortion and Noise Meter.

Power Supply: 105 to 125 volts, 40 to 60 cycles. Power input is approximately 50 watts.

Accessories Supplied: Spare pilot lamps and fuses, multipoint connector, 7-foot connecting cord, one TYPE 274-M Plug, and one set of input tuning coils (specify frequency range desired).

Mounting: The instrument is relay-rack mounted. Walnut end frames are available for table mounting.

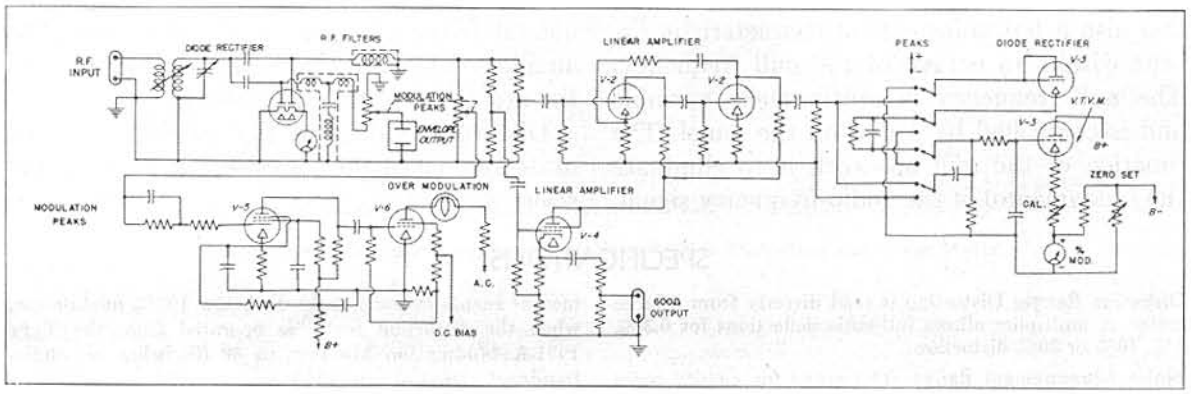
Other Finishes: Standard General Radio black crackle. Standard grays and flat black used by transmitter manufacturers can be supplied at a price increase of $10.00. For the same price a plain aluminum dress panel can be furnished the customer for finishing in any color desired, after which it can be returned to us for engraving and installation on the instrument.

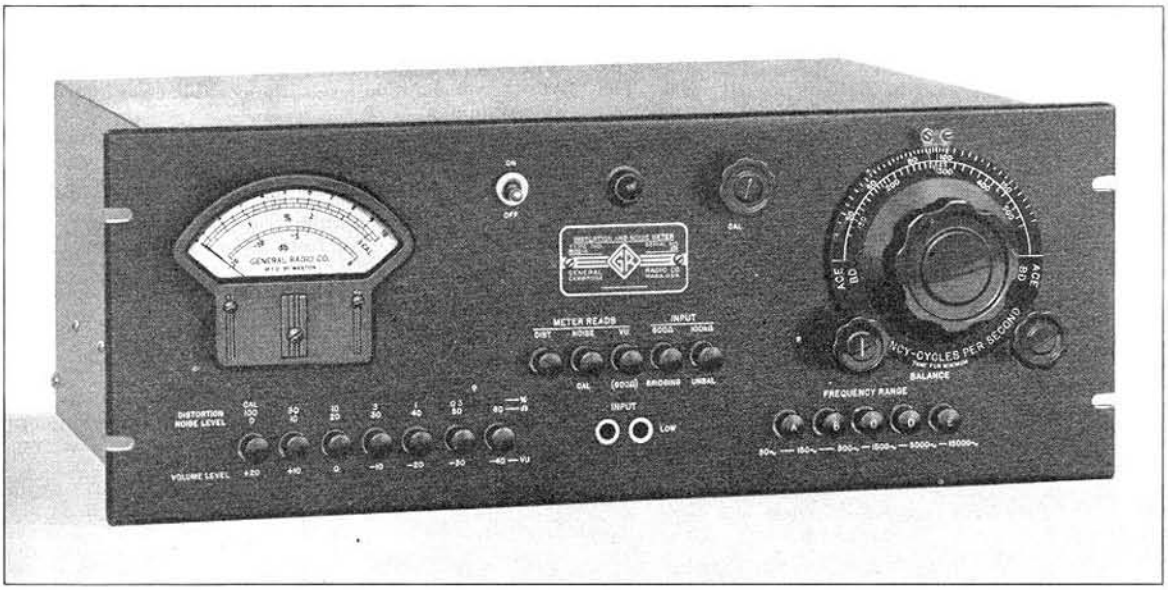
Dimensions: Panel (length) 19 x (height) 8¾ inches. Depth behind panel, 10 inches.

Net Weight: 31 pounds.

Type		*Code Word*	*Price*
1931-A	Modulation Monitor, 0.5 to 8 Mc.....	TARRY	$295.00
1931-A	Modulation Monitor, 3 to 60 Mc.....	TOPIC	295.00

PATENT NOTICE: See Notes 1, 13, 21, 22, 25, page iv.





TYPE 1932-A DISTORTION AND NOISE METER

USES: The TYPE 1932-A Distortion and Noise Meter measures distortion, noise, and hum level in audio-frequency circuits. In conjunction with the TYPE 1931-A Modulation Monitor, it can be used to measure these quantities directly in the output of radio broadcasting transmitters. It finds many uses in the communications laboratory and in the production testing of radio receivers as a wide-range, highly sensitive voltmeter for such measurements as signal-to-noise ratio, AVC characteristics and hum level.

DESCRIPTION: The principal elements of the distortion and noise meter are a high-gain amplifier with an R-C interstage coupling unit that balances to a sharp null, a calibrated attenuator for adjusting the sensitivity, and a vacuum-tube voltmeter. Degeneration maintains a high degree of stability in amplifier gain and also a flat transmission characteristic except within an octave of the null frequency. The null frequency is continuously variable and is controlled by a dial on the panel. The function of the null net-work is to eliminate the fundamental of the audio-frequency signal, leaving only the distortion products, which are indicated directly on the panel meter.

The null network is switched out of the circuit for noise and hum measurements, and the instrument then operates as a highly sensitive voltmeter. Two input circuits are provided: (1) a transformer for bridging a 600-ohm line; and (2) a direct connection to the 100,000 ohm gain control. The latter is used when measurements are made on the modulated output of a radio transmitter in conjunction with the TYPE 1931-A Modulation Monitor.

FEATURES: This instrument is continuously adjustable in frequency over the audio range. It is quickly set to any frequency since it has only one main tuning control, with an auxiliary trimmer. Frequencies up to 45,000 cycles are passed by the amplifier circuits so that distortion measurements can be made on fundamental frequencies up to 15,000 cycles. The auxiliary VU calibration adds considerably to the usefulness of the instrument.

Distortion values as low as 0.1% can be measured, since the lowest range is 0.3% full scale.

SPECIFICATIONS

Distortion Range: Distortion is read directly from a large meter. A multiplier allows full-scale deflections for 0.3%, 1%, 10% or 30% distortion.

Noise Measurement Range: The range for carrier noise measurements extends to 80 db below 100% modulation, when the distortion meter is operated from the TYPE 1931-A Modulation Monitor, or 80 db below an audio-frequency signal of zero VU level.

Audio-Frequency Range: 50 to 15,000 cycles (fundamental) for distortion measurements; 30 to 45,000 cycles for noise and hum measurements.

VU Range: The power-level range is from +20 to −60 VU. Full scale values of +20, +10, 0, −10, −20, −30, and −40 VU are provided. The scale is calibrated in terms of a reference level of one milliwatt in 600 ohms.

Input Voltage Range: The input signal level should be between 1.2 and 30 volts for the 100-kilohm input, and between 0.3 and 30 volts for the 600-ohm bridging input.

Accuracy: For distortion measurements, ±5% of full scale for each range ± residual distortion as noted below; for noise and VU measurements, ±5% of full scale.

Input Impedance: Two input impedances are provided, 100,000 ohms balanced, and 600-ohm bridging input (10,000 ohms), balanced or unbalanced.

Residual Distortion Level:

100-Kilohm Input:	0.05%, maximum, below 10,000 cycles
	0.10%, maximum, above 10,000 cycles
Bridging Input:	0.10%, maximum, between 50 and 70 cycles
	0.05%, maximum, between 70 and 10,000 cycles
	0.10%, maximum, above 10,000 cycles

Residual Noise Level: Less than −80 db.

Meter: A large meter with an easily read, illuminated scale is provided. Percentage, decibel and VU calibrations are included.

Vacuum Tubes:

4—type 6J5	1—type 6H6
1—type 6SN7-GT	1—type 6X5
1—type 6K6-GT	2—type VR-150-30

Accessories Supplied: Spare fuses and pilot lamps, 7-foot connecting cord, TYPE 274-M Plug.

Other Accessories Required: For measuring the distortion in oscillators and other audio-frequency sources, no additional equipment is required. For measurements on amplifiers, lines, and other communication networks, a low-distortion oscillator is required to furnish the test tone. TYPE 1301-A Low-Distortion Oscillator is recommended. When the modulated output of a radio transmitter is to be measured, a linear rectifier to produce the audio envelope is necessary. The TYPE 1931-A Modulation Monitor is recommended for this purpose. However, any detector system having an undistorted output of 1.5 volts rms can be used.

Terminals: Input terminals are provided at the rear of the instrument for direct connection to the modulation monitor. A Western Electric jack is provided at the panel also, as an auxiliary input circuit. Plugging into this jack automatically disconnects the rear connectors.

Power Supply: 105 to 125, or 210 to 250, volts, 40 to 60 cycles. The line input power is 60 watts. The power supply is voltage regulated. Line surges will have no appreciable effect, except when the instrument is operated on the 0.3% distortion or −60 db scale.

Mounting: The instrument is relay rack mounted. Walnut end frames are available to adapt the instrument for table mounting.

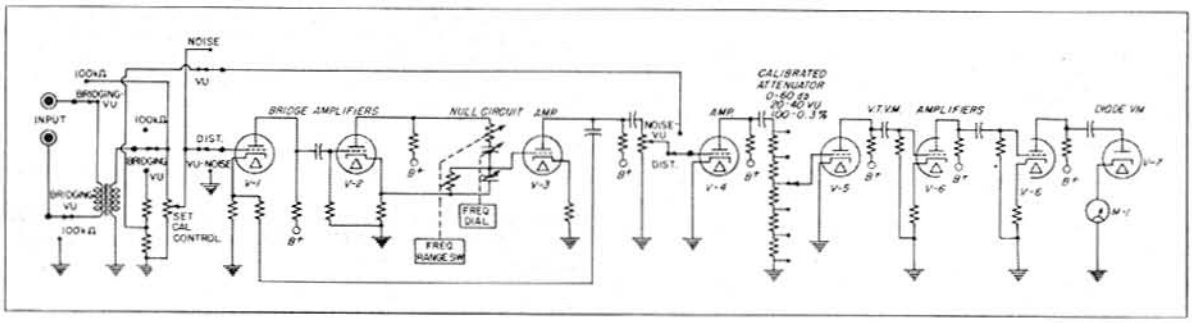
Other Finishes: Standard General Radio black crackle. Standard grays and flat black used by transmitter manufacturers can be supplied at a price increase of $10.00. For the same price a plain aluminum dress panel can be furnished the customer for finishing in any color desired, after which it can be returned to us for engraving and installation on the instrument.

Dimensions: Panel (length) 19 x (height) 7 inches; depth behind panel, 12 inches.

Net Weight: 35½ pounds.

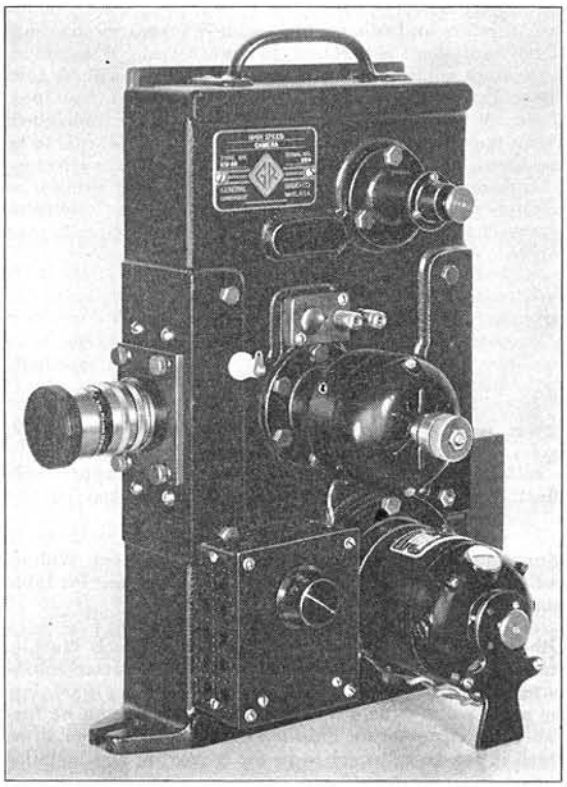
Type		*Code Word*	*Price*
1932-A	Distortion and Noise Meter.....	TABOO	$450.00

PATENT NOTICE: See notes 1, 17, 25, page iv.



Elementary Schematic Diagram of the TYPE 1932-A Distortion and Noise Meter.

TYPE 651-AG CAMERA



USES: The TYPE 651-AG Camera is intended for use in taking high-speed stroboscopic motion pictures at rates between approximately 500 and 1500 frames per second. Since no shutter is provided, and the film is continuously in motion, the illumination must be provided by a high-speed, high-power, stroboscope, such as the TYPE 621-M, which provides the necessary switching contacts. This camera can also be adapted for taking high-speed oscillograms in conjunction with a cathode-ray oscilloscope.

DESCRIPTION: The camera is similar in general construction to the TYPE 651-AE Oscillograph Recorder. Only a single motor is used, which drives the lower or take-up reel. A governor is mounted on the sprocket shaft, which controls the speed of the motor to give a constant film speed. Also mounted on the sprocket shaft is a commutator, which trips the stroboscope at single-frame intervals on the film. The lens recommended is the TYPE 651-P5, which has a speed of f/1.5 and a focussing range of 10 inches to 10 feet. A spark coil is provided in the camera to furnish timing marks on the film, when excited from an external source.

FEATURES: This camera in conjunction with the TYPE 621-M Power Stroboscope will take motion pictures up to 1500 frames per second, with an exposure time per frame of approximately 1/100,000 of a second. For recording cathode-ray oscillograms, its maximum film speed of about 100 feet per second makes it possible to record extremely rapid transients.

SPECIFICATIONS

Film: Any type of 35-mm film with standard perforations can be used. A high-speed-emulsion type is recommended.

Lens System: Lens must be purchased separately. The TYPE 651-P5 (see price list below) is recommended. This lens is supplied complete in focussing mount, installed in the camera.

Focussing: With TYPE 651-P5 Lens as supplied, the focussing range is 10 inches to 10 feet. Focussing is accomplished by viewing the image on a translucent screen by means of a telescope at the rear of the camera. Windows are provided in the sprocket for this purpose.

Reels: Specially-made loading and take-up reels are supplied. It is important that these be used, since ordinary commercial reels do not operate satisfactorily at high film speeds.

Drive System: The film is driven by a 115-volt universal motor on the take-up reel. For high speeds, the motor is driven by higher voltages, and 230 volts can be supplied without damage for the short period that the camera operates.

Speed Control: The voltage applied to the motor must be adjustable, and a TYPE 200-CUH or 200-CMH Variac is recommended for this purpose. An electrical governor is mounted on the sprocket shaft, which keeps the film at constant speed. Speed is changed by adjusting the governor and setting the Variac at approximately the correct voltage for the desired speed.

Starting: Full speed is attained in from 10 to 40 feet of film travel, depending upon the amount of film on the reel.

Commutator: The commutator is integral with the sprocket inside the housing, and is provided with a contact pressure adjustment.

Net Weight: 32 pounds.

Type		*Code Word*	*Price*
651-AG	Camera	DIRGE	$510.00
651-P5	Lens f/1.5	DIARY	150.00

PATENT NOTICE: See Note 15, page v.

METERS

Three battery-operated, portable instruments have been listed since the publication of the first edition of Catalog K. These are the TYPE 727-A Vacuum-Tube Voltmeter, the TYPE 728-A D-C Vacuum-Tube Voltmeter and the TYPE 729-A Megohmmeter. All three are similar in appearance and nearly identical in size.

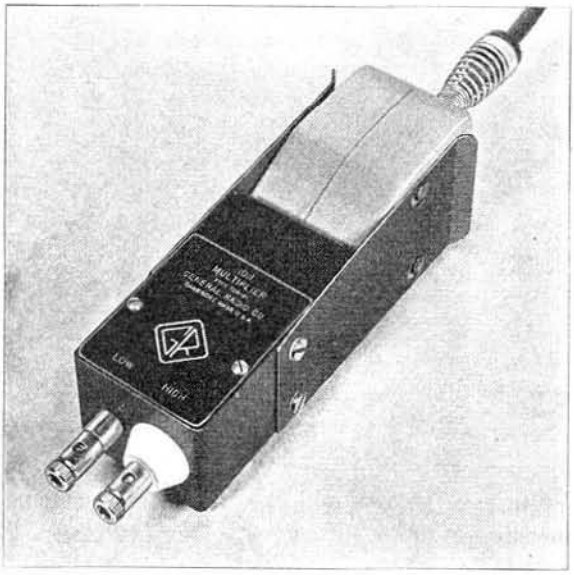
A multiplier, TYPE 726-P1, is now available for use with the TYPE 726-A Vacuum-Tube Voltmeter, so that voltages up to 1500 can be measured.

Other new items include TYPE 783-A Output Power Meter with a range up to 100 watts, and a new a-c operated megohmmeter, TYPE 1861-A, which supersedes the TYPE 487-A. An added feature of the latter instrument is an extra scale for reading d-c voltage.

Type	*Name*	*Price*
483-F	Output Meter	**$54.00**
487-A, B	Megohmmeter	*Replaced by* TYPE 1861-A
492-A	Oxide Rectifier	*Discontinued*
493-A	Thermocouples	*Discontinued*
546-A	Microvolter	*Replaced by* TYPE 546-B
546-B	Microvolter	**80.00**
583-A	Output Power Meter	**95.00**
586	Power-Level Indicators	*Discontinued*
588-AM	D-C Meter	*Discontinued*

Type	*Name*	*Price*
664-A	Thermocouple	*Discontinued*
686-A	Power-Level Indicator	*Discontinued*
726-A	Vacuum-Tube Voltmeter	**$165.00**
726-P1	Multiplier	**15.00**
727-A	Vacuum-Tube Voltmeter	**115.00**
728-A	D-C Vacuum-Tube Voltmeter	**110.00**
729-A	Megohmmeter	**85.00**
783-A	Output Power Meter	**185.00**
1861-A	Megohmmeter	**95.00**

TYPE 726-P1 MULTIPLIER



This multiplier extends the range of the TYPE 726-A Vacuum-Tube Voltmeter to 1500 volts.

It consists of a capacitive voltage divider which provides a ten-to-one reduction between the voltage applied to the multiplier and the voltage appearing across the voltmeter terminals. The multiplier fits snugly to the voltmeter probe, adding about three inches to the effective length of the probe. The flanges which secure the multiplier to the probe also act as an electrostatic shield for the probe.

SPECIFICATIONS

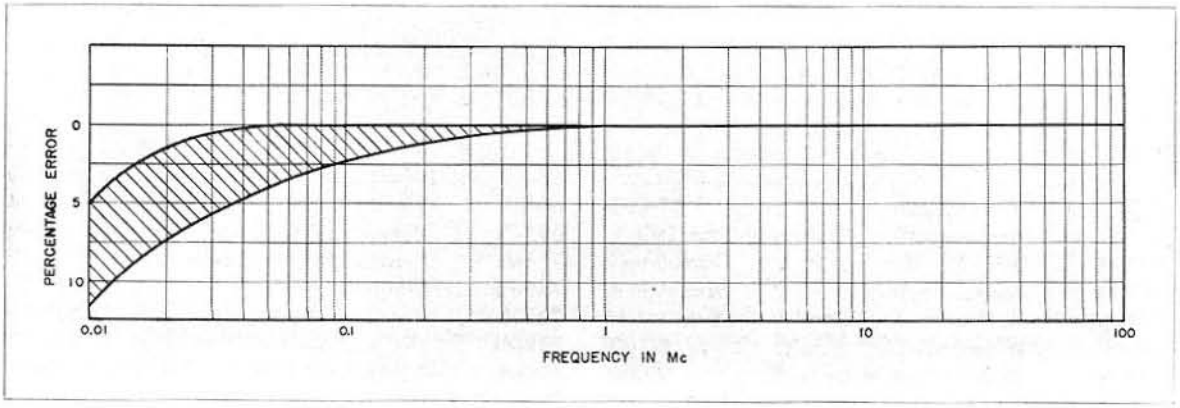
Multiplier Ratio: 10 to 1, within ±1%.

Input Impedance: From 1 Mc to 100 Mc, the input impedance is effectively that of a 4.5 $\mu\mu$f condenser of less than 0.5% power factor.

Frequency Error: The frequency error is shown in the plot. No appreciable error occurs between 1 Mc and 100 Mc. The multiplier is not recommended for frequencies below 1 Mc.

Net Weight: 12 ounces.

Type		*Code Word*	*Price*
726-P1	Multiplier	ALOUD	$15.00



Plot of frequency error for TYPE 726-P1 Multiplier.

TYPE 727-A VACUUM-TUBE VOLTMETER (BATTERY OPERATED)

USES: This is a general-purpose vacuum-tube voltmeter for use at frequencies up to about 100 megacycles. Because it is battery operated and portable, it has many applications in the field, where an a-c power line is not always available.

DESCRIPTION: A diode rectifier circuit is employed as in the TYPE 726-A Voltmeter but with a more sensitive two-stage d-c amplifier, permitting the measurement of a-c voltages down to 50 millivolts over the entire frequency range. The high-voltage limit is also extended, to 300 volts.

FEATURES: The high input impedance, wide voltage range, and wide frequency range of this instrument combined with its convenience and portability make the TYPE 727-A Vacuum-Tube Voltmeter an extremely useful meter for the communications laboratory, as well as for field work.

SPECIFICATIONS

Range: 0.05 volt to 300 volts ac, in seven ranges (0.3, 1, 3, 10, 30, 100, 300 volts, full scale).

Accuracy: The meter reads peak values of the applied voltage, and is calibrated in r-m-s values of a sine wave. With sinusoidal voltages applied, the accuracy is as follows:

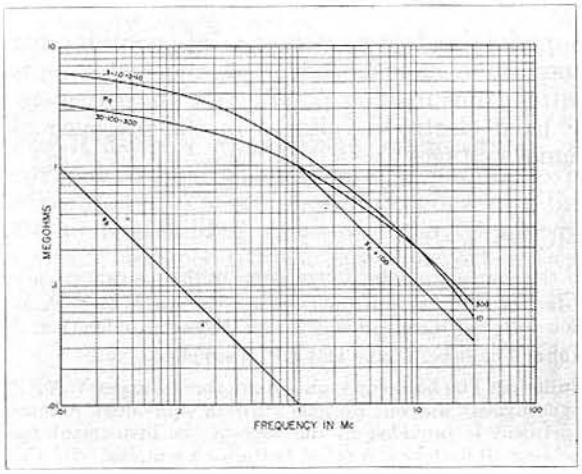
±3% of full scale on the 0.3-volt range
±2% of full scale on the 1, 3, and 10-volt ranges
±5% of full scale on the 30, 100, and 300-volt ranges

Waveform Error: The instrument is calibrated to read the r-m-s value of a sinusoidal voltage. On the higher voltage ranges, however, it is essentially a peak reading device, calibrated to read 0.707 of the peak value of the applied voltage, and on distorted waveforms the percentage deviation of the reading from the r-m-s value may be as large as the percentage of harmonics present. On the lowest ranges the instrument approximates a true square-law device.

Frequency Error: Less than 1% between 20 cycles and 30 Mc. At higher frequencies, the error is about +5% at 65 Mc and about +10% at 100 Mc.

Input Impedance: The input capacitance is approximately 16 $\mu\mu$f. The parallel input resistance (at low frequencies) is about 5 megohms on the lower ranges and about 3 megohms on the 30, 100, and 300-volt ranges. The accompanying curves give the variation of RP and XP with frequency.

Temperature and Humidity Effects: Over the normal range of room conditions (65° Fahrenheit to 95° Fahrenheit; 0 to 95% relative humidity) the accuracy of indication is substantially independent of temperature and humidity conditions. Somewhat reduced accuracy may be expected, however, if the instrument is subjected to extremes of temperature.



Plot of resistive and reactive components of input impedance of TYPE 727-A Vacuum-Tube Voltmeter.

Zero Adjustment: A zero adjustment is provided on the panel. The setting is the same for all ranges.

Vacuum Tubes: Two 1S5 tubes and one 957 tube are used and are supplied with the instrument.

Batteries: Two Burgess W20P1, one Burgess W5BP, and three Burgess 2F batteries are required, and are supplied with the instrument. Battery life is approximately 250 hours of intermittent operation.

Mounting: The instrument is supplied in a walnut case with cover and is mounted on an engraved black crackle-finish aluminum panel.

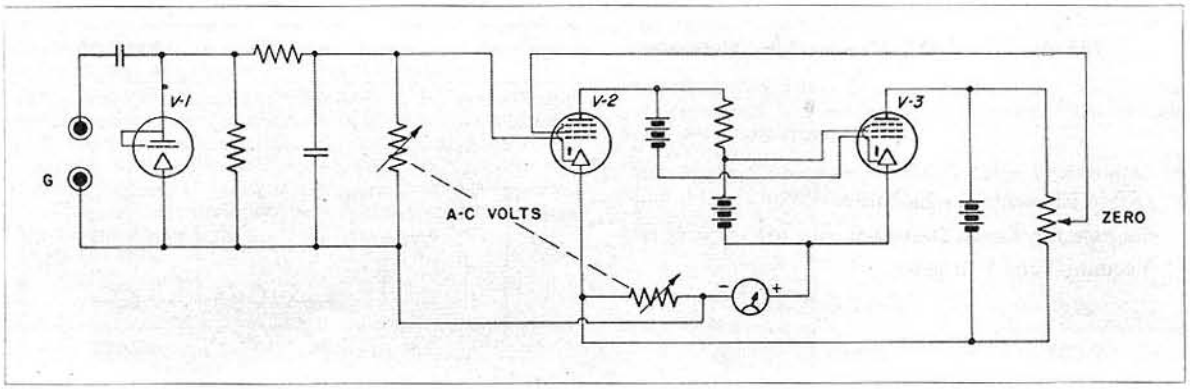
Dimensions: 11 x 6⅝ x 5⅞ inches, over-all (cover closed).

Net Weight: 10⅞ pounds, including batteries.

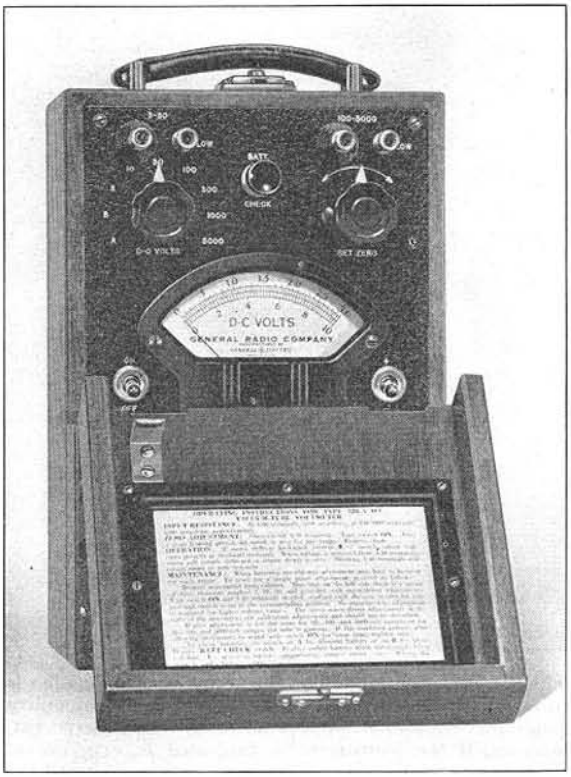
Type		*Code Word*	*Price*
727-A	**Vacuum-Tube Voltmeter**.....	PIGMY	$115.00

PATENT NOTICE. See Note 28, page iv.

Schematic circuit diagram of TYPE 727-A Vacuum-Tube Voltmeter.



TYPE 728-A D-C VACUUM-TUBE VOLTMETER
(BATTERY OPERATED)



USES: This voltmeter is intended for measuring d-c voltages in low-power circuits where no appreciable power can be taken by the meter. It is particularly useful for measuring electrode voltages on vacuum tubes and cathode-ray oscillographs.

DESCRIPTION: The circuit is that of a degenerative d-c amplifier. The voltage to be measured is applied directly to the grid on the lower ranges, and through a high resistance voltage divider for the high ranges. The instrument is portable, and power supply is obtained from self-contained batteries.

FEATURES: The input resistance is extremely high, greater than 1000 megohms on all ranges. Wide range and complete portability are also important features. A reversing switch is provided on the panel so that either the positive or the negative terminal of the source under measurement can be grounded to the panel. Superimposed a-c voltages of considerable magnitude have no effect on the meter indication, thus making possible the measurement of fixed electrode voltages in the presence of signal voltages.

SPECIFICATIONS

Range: 0.05 to 3000 volts in seven ranges (3, 10, 30, 100, 300, 1000, 3000 volts, full scale).

Accuracy: Within ±3% of full scale for the lower voltage ranges (3, 10, 30 volts, full scale). Within ±5% of full scale for the higher voltage ranges (100, 300, 1000, 3000 volts, full scale). Battery aging may cause an additional error of 2% of full scale on the 3-volt range.

Input Resistance: 1000 megohms on the higher voltage ranges (100, 300, 1000, 3000 volts, full scale). Greater than 5000 megohms on the low voltage ranges.

Terminals: Two sets of input terminals are provided on the panel. One set is used for measurements at the low voltage end of the range (0 to 30 volts) and the other set is used for the higher voltage measurements (30 to 3000 volts).

Polarity: A reversing switch on the panel permits measurements with either the positive or the negative terminal of the source grounded to the panel of the instrument.

Effect of A-C: A superimposed a-c voltage of as high as 200 volts has a negligible effect on the meter indication.

Tube: The tube, a type 1E5-GP, is supplied.

Batteries: The batteries required are three Burgess W30BP or equivalent and one Burgess F2BP or equivalent. A compartment is provided in the case of the instrument for holding all batteries. A set of batteries is supplied with the instrument.

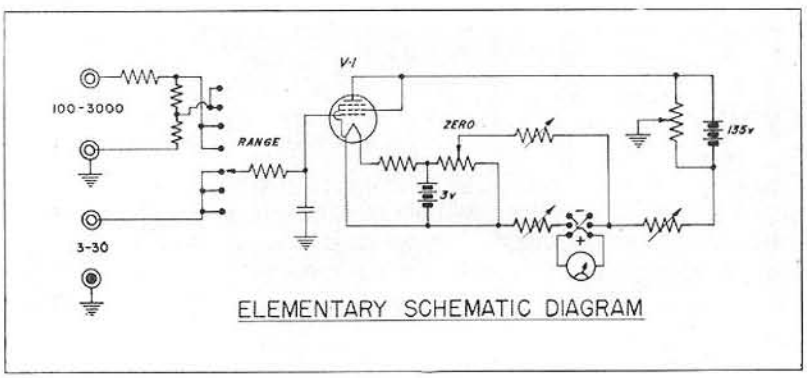
Mounting: The instrument is supplied in a walnut case with cover and is mounted on an engraved black crackle-finish aluminum panel.

Dimensions: With cover closed, (length) 11 x (width) 6⅝ x (height) 5⅞ inches, over-all

Net Weight: 9¾ pounds, including batteries.

Type		*Code Word*	*Price*
728-A	D-C Vacuum-Tube Voltmeter	PILOT	$110.00

(*Right*) Elementary schematic diagram for TYPE 728-A D-C Vacuum-Tube Voltmeter.



TYPE 729-A MEGOHMMETER
(BATTERY OPERATED)

USES: This megohmmeter is a new battery-operated design particularly intended for applications where portability is required. It is well adapted for field use in the measurement of the leakage resistance of cables and insulation. The wide range of resistance covered by this instrument makes it suitable for use as a moisture content indicator for such materials as lumber, paper, and leather, where a definite relationship exists between moisture content and electrical conductivity.

DESCRIPTION: The circuit employed is that of a conventional ohmmeter. The necessary sensitivity for measuring high resistance is obtained by using a vacuum-tube voltmeter as the indicating element.

The highest resistance standard (1000 megohms) is sealed in glass and especially treated to prevent surface leakage. This construction insures that the readings of the instrument are essentially independent of humidity. This feature is particularly valuable in field use, where adverse humidity conditions are frequently encountered.

FEATURES: A wide range of resistance is covered with excellent accuracy. The meter is calibrated at mid-scale for each range, and the circuit is stabilized to insure accuracy of calibration, independent of tube characteristics. The features of portability and self-contained power supply are important for many applications.

SPECIFICATIONS

Range: 2000 ohms to 50,000 megohms in five overlapping ranges.

Scale: The standard direct-reading ohmmeter calibration is used: center scale values are .1, 1, 10, 100, and 1000 megohms. Length of scale, 3¼ inches; central decade, 1⅝ inches.

Accuracy: Within ±5% of the indicated value between 30,000 ohms and 3 megohms, and within 8% between 3 megohms and 3000 megohms when the central decade of the scale is used. Outside the central decade the error increases because of the compressed scale. For voltage measurements the accuracy is ±2% of full scale.

Temperature and Humidity Effects: Over the normal range of room conditions (65° Fahrenheit to 95° Fahrenheit; 0 to 95% relative humidity) the accuracy of indication is substantially independent of temperature and humidity conditions. Somewhat reduced accuracy may be expected, however, if the instrument is subjected to temperatures beyond the above range.

Voltage on Unknown: The voltage applied on the unknown does not exceed 22½ volts and varies with the meter indication.

Tube: The tube, a type 1E5-GP, is supplied.

Batteries: The batteries required are two Burgess W30BP or equivalent and one Burgess 2F2H or equivalent. A compartment is provided in the case of the instrument for holding all batteries. A set of batteries is supplied with the instrument. Battery life is approximately 250 hours of intermittent operation.

Mounting: The instrument is supplied in a walnut case with cover and is mounted on an engraved black crackle-finish aluminum panel.

Dimensions: With cover closed: (Length) 11 x (width) 6⅝ x (height) 5⅞ inches, over-all.

Net Weight: 8⅞ pounds, including batteries.

Type		*Code Word*	*Price*
729-A	Megohmmeter.....	PIOUS	$85.00

TYPE 1861-A MEGOHMMETER AND VOLTMETER (A-C OPERATED)

USES: The TYPE 1861-A Megohmmeter is a direct-reading ohmmeter for measuring relatively high resistances, such as carbon resistors, and the leakage resistance of cables and samples of insulating material. It can also be used to locate defective insulation in electrical equipment.

The leakage resistance of condensers can also be measured, but in measuring large condensers with low leakage, the time constant results in equilibrium being reached slowly. For example, a condenser of 1 μf capacitance, having a leakage resistance of 1000 megohms, could be shown in a few seconds to have a resistance greater than 500 megohms, but perhaps a minute would be required to obtain the resistance within 10%. If a higher test voltage or a lower time constant is required, the TYPE 544-B Megohm Bridge is recommended (see Catalog K).

This instrument can also be used as a vacuum-tube voltmeter for measuring d-c voltage up to 100 volts.

DESCRIPTION: This instrument is very similar to the ordinary ohmmeter, except that, in order to obtain high ranges,a vacuum-tube voltmeter is used instead of the conventional indicator. A zero adjustment is provided for setting all five ranges in a single operation.

FEATURES: The TYPE 1861-A Megohmmeter indicates resistance directly on the large meter scale. Its operation is just as simple as that of an ordinary ohmmeter, and a wide range of resistances can be measured on the five overlapping ranges. The instrument is completely a-c operated and has a voltage-regulated power supply. The d-c voltage scale greatly increases the usefulness of this instrument over that of previous models.

SPECIFICATIONS

Range: 2,000 ohms to 50,000 megohms in five overlapping ranges; zero to 100 volts, dc.

Scale: The standard direct-reading ohmmeter calibration is used; center scale values are 0.1, 1, 10, 100, and 1000 megohms. Length of scale, 3¼ inches; center decade, 1⅝ inches. The scale is illuminated by a lamp in the indicating meter. The voltage scale is linear.

Accuracy: Within ±5% of the indicated value between 30,000 ohms and 3 megohms, and within 8% between 3 megohms and 3000 megohms when the central decade of the scale is used. Outside the central decade the error increases because of the compressed scale. For voltage measurements the accuracy is ±2% of full scale.

Input Impedance: For voltage measurements the input impedance in megohms is indicated by the selector switch.

Temperature and Humidity Effects: Over the normal range of room conditions (65° Fahrenheit to 95° Fahrenheit; 0 to 95% relative humidity) the accuracy of the instrument is substantially independent of temperature and humidity.

Voltage on Unknown: The applied voltage on the unknown does not exceed 106 volts and varies with the indication.

Tubes: The necessary tubes, one type 1-v, one type 85, and one VR-105 are supplied.

Power Supply: 105 to 125 (or 210 to 250) volts, 40 to 60 cycles ac. The power required is 10 watts.

Accessories Supplied: A seven-foot connecting cord.

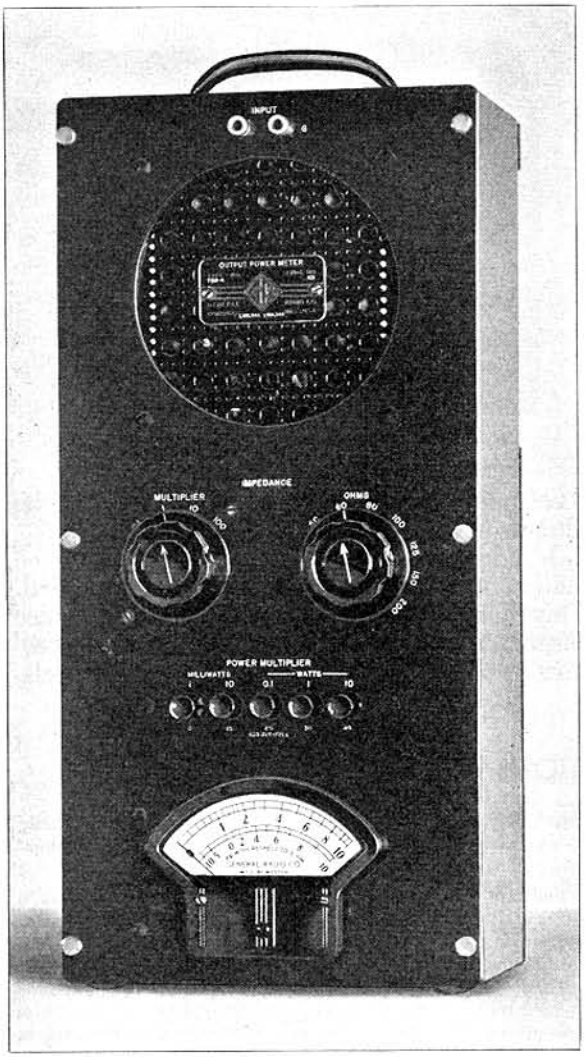
Mounting: The instrument is supplied in a walnut case and is mounted on an engraved black crackle-finish aluminum panel.

Dimensions: (Width) 10 x (height) 8 x (depth) 5½ inches, over-all.

Net Weight: 8¼ pounds.

Type		*Code Word*	*Price*
1861-A	Megohmmeter.....	ONION	$95.00

TYPE 783-A OUTPUT-POWER METER



USES: The TYPE 783-A Output-Power Meter is a direct-reading instrument for measuring the power output of audio-frequency circuits.

Some of its specific uses include the testing of amplifiers, transformers, and other networks. It is particularly useful for simulating loudspeaker or other load impedances in testing the output characteristics of high-power audio systems, since it will measure power outputs as high as 100 watts. It is sufficiently sensitive, on the other hand, to be useful in measuring very low-level circuits.

DESCRIPTION: Functionally the TYPE 783-A Output-Power Meter is equivalent to an adjustable load impedance across which is connected a voltmeter that is calibrated directly in watts dissipated in the load.

This instrument is very similar to the TYPE 583-A Output-Power Meter described in Catalog K but has a much higher power range (100 watts, maximum) as well as better frequency and impedance characteristics.

FEATURES: This instrument gives accurate power indications over a wide range of power, impedance, and frequency. The auxiliary decibel scale is convenient for many types of measurement.

SPECIFICATIONS

Power Range: 0.2 milliwatt to 100 watts in five ranges (10 and 100 milliwatts, 1, 10, and 100 watts, full scale). An auxiliary decibel scale reads from −10 to +50 db referred to a level of 1 milliwatt.

Impedance Range: 2.5 to 20,000 ohms. Forty discrete impedances, distributed approximately logarithmically, are obtained by means of a ten-step OHMS dial and a four-step MULTIPLIER.

Impedance Accuracy: The input impedance is within ±2% of the indicated value, except at the higher audio frequencies, where the error for the higher impedance settings may exceed this value. At 15,000 cycles the input impedance error is about 5% for impedances from 10,000 to 20,000 ohms.

Power Accuracy: The indicated power is accurate to ±0.25 db at full-scale reading. At the lowest impedance multiplier setting (2.5 to 20 ohms) there may be an additional error of 0.2 db due to switch contact resistance when the power multiplier is set at 10 (10 to 100 watt range).

The over-all frequency characteristic of the power indication is flat within ±0.5 db from 20 cycles to 10,000 cycles; within ±0.75 db to 15,000 cycles.

Waveform Error: The indicating instrument used is a copper-oxide rectifier meter, calibrated in r-m-s values for a sinusoidal applied voltage. When non-sinusoidal voltages are applied an error in indication may occur, since the meter is not a true r-m-s indicating device. The error will depend on the magnitude and phase of the harmonics present, but, with waveforms normally encountered in measurement circuits at communications frequencies, will not be serious.

Temperature and Humidity Effects: Humidity conditions have a negligible effect on the accuracy of the instrument.

The instrument is calibrated at 77° Fahrenheit and, if the ambient temperature departs widely from this value, additional errors of indication may be expected. At high temperatures (95° Fahrenheit) this additional error may approach the nominal calibration error, particularly at the higher frequencies.

The heat dissipated by the instrument itself has no effect on the accuracy.

Mounting: The instrument is mounted on a bakelite panel in a walnut cabinet.

Dimensions: 8 x 18 x 7 inches, over-all.

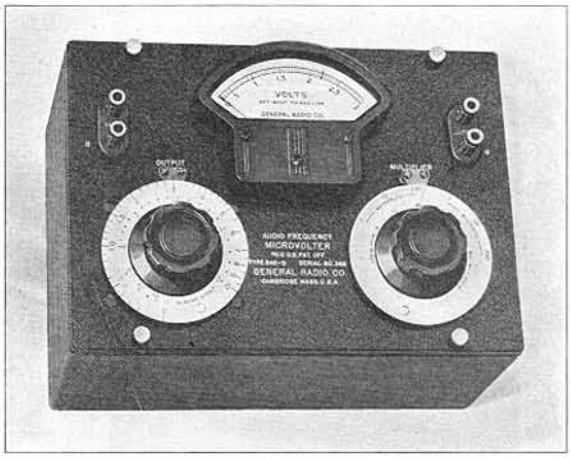
Net Weight: 17 pounds.

Type		*Code Word*	*Price*
783-A	Output-Power Meter	ABBEY	$185.00

PATENT NOTICE. See Notes 5, 6, page iv.

TYPE 546-B AUDIO-FREQUENCY MICROVOLTER

USES: The TYPE 546-B Audio-Frequency Microvolter is a useful source of small, known, audio-frequency voltages. In measuring the response of amplifiers, transformers, and other audio equipment, such a source of known input voltage is extremely valuable. The microvolter can also be used to measure other small voltages by substitution methods.



DESCRIPTION: This instrument consists, essentially, of a constant impedance attenuator and a voltmeter by means of which the input to the attenuator is standardized. A switch controls the output voltage in decade steps while an individually calibrated dial provides continuous control over each decade.

FEATURES: This instrument has an excellent frequency characteristic, extending from very low frequencies up to 20,000 cycles. The low-frequency limit is determined by the characteristics of the meter. Excellent accuracy is obtainable for absolute voltage levels, and for voltage ratios, as are used in gain or loss measurements, still better accuracy can be obtained.

In addition to the voltage calibration of the meter and multiplier, a decibel scale is provided. This facilitates the work of obtaining response characteristics, since no calculations are necessary to obtain the relative response in decibels.

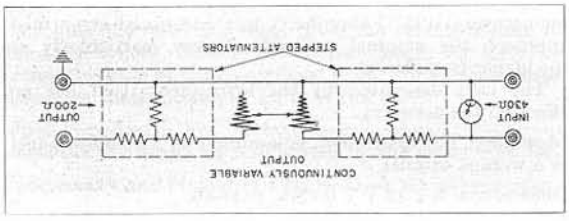
SPECIFICATIONS

Output Voltage Range: From 0.1 microvolt to 1.0 volt, open circuit, when the input voltage is set to the standardized reference value.

Accuracy: For open-circuit output voltages the calibration is accurate within ±3% ±0.1 microvolt for output settings above 1 microvolt and for all frequencies between 20 and 20,000 cycles. This accuracy applies only where waveform and temperature errors are negligible (see below). Below 1 microvolt the error increases owing to crowding of the scale.

For ratios or increments of voltage, at a given frequency, the accuracy of any reading is within ±2% ±0.1 microvolt, at frequencies up to 100,000 cycles. At the higher frequencies this accuracy applies only at levels above 100 microvolts.

Output Impedance: The output impedance is approximately 200 ohms and is constant with setting within ±5%. This impedance is sufficiently low so that no correction on the output voltage is necessary for load impedances of the order of 50,000 ohms and greater.



Input Impedance: Approximately 430 ohms, substantially independent of output setting on all but the highest multiplier position.

Waveform Error: The accuracy of the microvolter as a calibrated attenuator or voltage divider is independent of waveform. The absolute accuracy of the output voltage calibration depends on the characteristics of the input voltmeter, which has a small waveform error that depends in turn on both the phase and the magnitude of harmonics present in the input. This error in the voltmeter can, in general, be neglected when the microvolter is used with ordinary laboratory oscillators.

Temperature Error: The accuracy of the calibration is independent of temperature when the microvolter is used as an attenuator or voltage divider. The absolute accuracy is affected slightly by temperature because of change in the voltmeter characteristics. The necessary correction for temperatures from 65° to 95° Fahrenheit is furnished with the instrument. The effects of humidity are negligible.

Power Source: The driving oscillator must be capable of furnishing about 2.2 volts across 430 ohms, or about 11 milliwatts.

Terminals: Jack-top binding posts are mounted on standard ¾-inch spacing.

Mounting: The instrument is mounted on an aluminum panel in a shielded walnut cabinet.

Dimensions: (Length) 10 x (width) 7 x (height) 6⅜ inches, over-all.

Net Weight: 6½ pounds.

Type		*Code Word*	*Price*
546-B	Audio-Frequency Microvolter*	CROWN	$80.00

*Reg. U. S. Pat. Off.

FREQUENCY-MEASURING EQUIPMENT

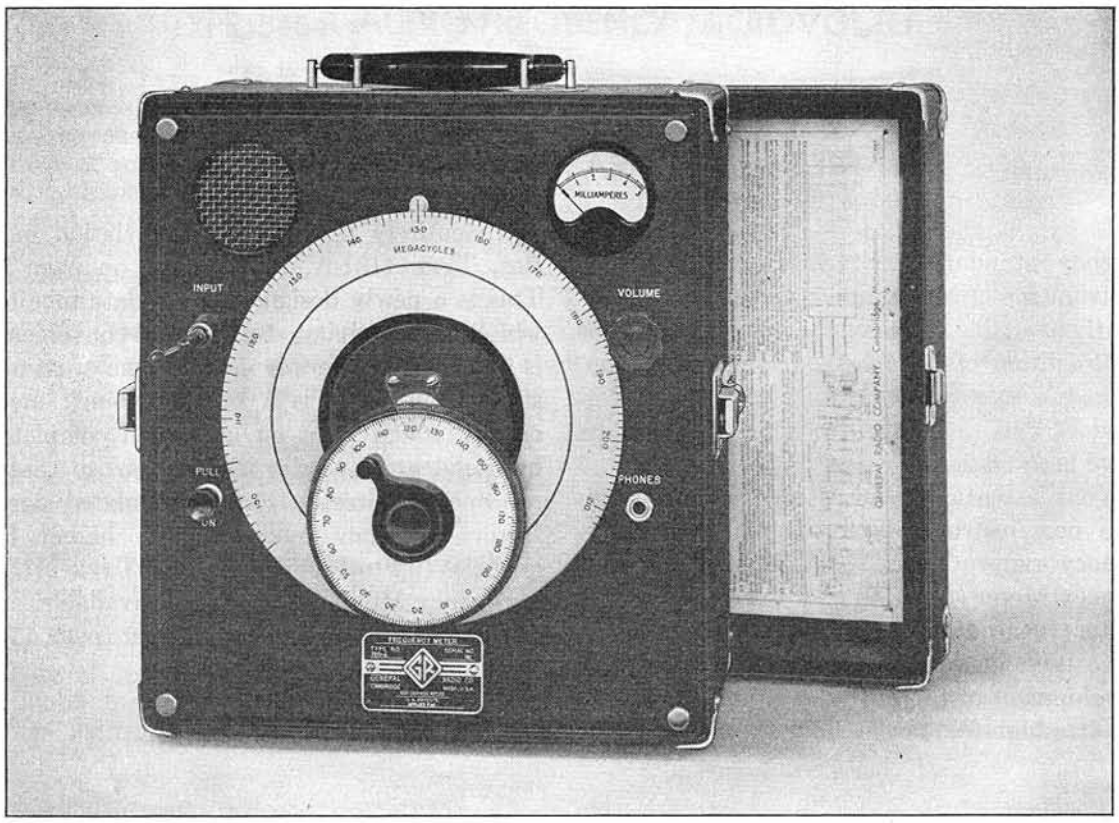
Listed in the following table are all frequency standards and frequency-measuring instruments of our manufacture which are currently available. Some of the items listed in the 1939 edition of Catalog K have been discontinued; others have been replaced by new models, and several entirely new instruments have been added.

Your attention is directed particularly to two new instruments for the ultra-high-frequency range, TYPE 720-A Heterodyne Frequency Meter (page 50) and TYPE 1140 Wavemeter (page 59). Both of these instruments have been made possible by General Radio's development of the butterfly circuit for tuning at ultra-high-frequencies.

An entirely new frequency-deviation monitor, TYPE 1181-A, is described on page 52. This is a newly designed, up-to-date monitor, which, in sensitivity, stability and convenience, is far ahead of pre-war models. One of its outstanding features is a new frequency meter circuit, which gives an indication completely independent of carrier modulation, so that it can operate directly from a modulated signal.

For frequency monitoring at higher frequencies (up to 150 Mc) the new TYPE 1175-A Frequency Monitor (page 54) is available, and the TYPE 1176-A Frequency Meter (page 55).

Type	*Name*	*Price*
C-10-H	Secondary Frequency Standard	$795.00
C-10-H	Secondary Frequency Standard with Frequency Measuring Equipment	1920.00
C-21-HLD	Primary Frequency Standard, a-c operated	2595.00
C-21-HLD	Primary Frequency Standard, battery operated (less batteries)	2720.00
	Frequency Measuring Equipment for C-21-HLD	2325.00
25-A	Broadcast Frequency Monitor *Replaced by* TYPE 1181-A	
358	Wavemeter	*Discontinued*
376-L	Quartz Plate	85.00
376-M	Quartz Plate	35.00
419-A	Rectifier-Type Wavemeter	*Discontinued*
434-B	Audio-Frequency Meter	*Discontinued*
475-B-C	Frequency Monitor *Replaced by* TYPE 1181-A	
476-A	Quartz Bar	*Discontinued*
566-A	Wavemeter	45.00
574-	Wavemeter	*Discontinued*
611-C	Syncro Clock	*Discontinued*
612-C	Coupling Panel	190.00
612-K	Coupling Panel	125.00
614-B	Selective Amplifier *Replaced by* TYPE 614-C	
614-C	Selective Amplifier	275.00
616-C	Heterodyne-Frequency Meter *Replaced by* TYPE 616-D	
616-D	Heterodyne-Frequency Meter	575.00
617-C	Interpolation Oscillator	$500.00
619-E	Heterodyne Detector	360.00
620-AM	Heterodyne Frequency Meter	555.00
620-AR	Heterodyne Frequency Meter	490.00
676-	Quartz Bar	145.00
681-A, B	Frequency Deviation Meter *Replaced by* TYPE 1181-A	
692-B	Multivibrator	140.00
698-A	Multivibrator	220.00
699-A	Comparison Oscilloscope	215.00
720-A	Heterodyne Frequency Meter	250.00
724-A	Precision Wavemeter	190.00
758-A	Wavemeter	28.00
775-A	Frequency-Limit Monitor *Replaced by* TYPE 1175-A *and* TYPE 1176-A	
815-A	Precision Fork, 50 cps	165.00
815-B	Precision Fork, 60 cps	175.00
815-C	Precision Fork, 100 cps	175.00
815-P1	Transformer	6.00
816-A	Vacuum-Tube Precision Fork (50 cps)	385.00
816-B	Vacuum-Tube Precision Fork (60 cps)	385.00
834-A, B	Electronic Frequency Meter *Replaced by* TYPE 1176-A	
1140-A	U-H-F Wavemeter	65.00
1175-A	Frequency Monitor	250.00
1176-A	Frequency Meter	185.00
1181-A	Frequency Deviation Monitor (approx.)	550.00



TYPE 720-A HETERODYNE FREQUENCY METER

USES: The TYPE 720-A Heterodyne Frequency Meter is used for the measurement of frequency in the v-h-f and u-h-f bands. It extends the field of the familiar heterodyne method of measurement to a frequency of 3000 Mc.

DESCRIPTION: The principal elements of the instrument are a calibrated oscillator, a crystal detector and an audio amplifier. The frequency-determining element of the oscillator is a butterfly circuit in which the capacitance and the inductance are varied simultaneously. The movable part of the circuit rotates in ball bearings. No sliding contacts are used, and no current is carried by the bearings. This permits a smooth and stable adjustment of frequency. The oscillator frequency is adjustable between 100 and 200 Mc. Harmonics of the oscillator are used to measure frequencies above 200 Mc, and harmonics of the unknown are used at frequencies below 100 Mc.

The detector is an iron-pyrites crystal, so mounted that it is easily accessible for replacement. A spare is furnished.

The three-stage audio amplifier has an effective band width of 50 kc. The output of the amplifier operates a panel meter and a built-in loud speaker. A jack is provided as well for head telephones.

The entire assembly is battery-operated, completely self-contained, and mounted in a portable, fabric-covered cabinet. Complete operating instructions are mounted in the cover of the cabinet.

The sensitivity of the instrument is high, and no direct connection to the source under measurement is required. The pickup obtained by the adjustable antenna mounted on the panel is usually adequate, but provision is made for connecting an additional pickup wire, if necessary.

FEATURES: The sensitivity obtainable with the heterodyne method of measurement permits this instrument to be used on comparatively weak signals, and permits a wide range of frequencies to be measured with a single fundamental frequency band. The design of the tuned circuit avoids most of the difficulties inherent in variable-frequency elements at ultra-high frequencies and makes possible stable and repeatable frequency settings.

The small size and portability of the instrument is a considerable convenience.

SPECIFICATIONS

Frequency Range: The fundamental frequency range is from 100 to 200 megacycles. This range is covered in a single band with approximately logarithmic frequency distribution. By harmonic methods frequencies between 10 megacycles and 3000 megacycles can be measured. Since harmonics of the internal oscillator are considerably stronger than harmonics of the unknown as generated in the detector, the sensitivity of the instrument for frequencies below the range of the oscillator fundamental is considerably less than that at frequencies equal to or above the oscillator fundamental.

The unknown frequencies are measured by setting the frequency meter to a point where a beat note is produced with the unknown frequency.

Beat Indication: A strong beat note will be heard in the small dynamic speaker in the front panel. For weaker signals a pair of headphones should be used. In addition to the audible beat, a visual indication is obtained by the deflection of the panel meter. Since the band width of the detector circuit is 50 kilocycles, the panel meter will deflect even when the frequency measured is unstable and does not produce a steady audible beat note.

Calibration: The main dial is calibrated in frequency, each division corresponding to one megacycle.

The vernier dial is geared to the tuning unit to make one-half turn of the dial correspond to 1% change in frequency over the major part of the tuning range. The vernier dial carries 200 uniform divisions.

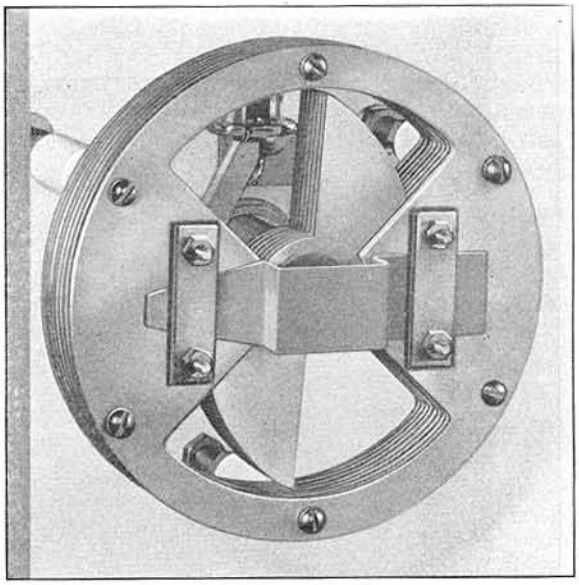
Accuracy: The overall accuracy of measurement is 0.1%.

Temperature and Humidity Effects: Over the range of room conditions normally encountered temperature and humidity do not affect the accuracy of the instrument.

Vacuum Tubes: The following tubes are used and are supplied with the instrument:

1—type 1N5-GT (RCA or equivalent)
1—type 1D8-GT (RCA or equivalent)
1—type 958

Battery: A single-block Burgess TYPE 6TA60 Battery is used and is supplied with the instrument. The power required is approximately 90 volts, 6 ma, and 1.4 volts, 250 ma.



View of the butterfly-type tuned circuit used in the TYPE 720-A Heterodyne Frequency Meter.

Case: The TYPE 720-A Heterodyne Frequency Meter is mounted in a shielded carrying case of durable airplane luggage construction. Complete operating instructions are attached to the cover, and a complete wiring diagram, with circuit constants, is attached to the inside of the cabinet.

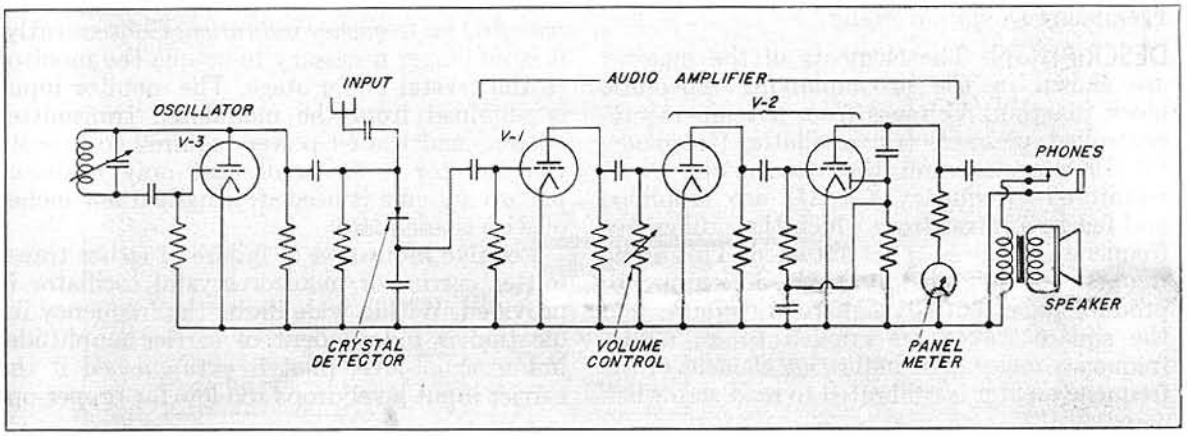
Spare Parts: One TYPE Z2DEC-1 Detector is supplied as spare in addition to the one in the instrument.

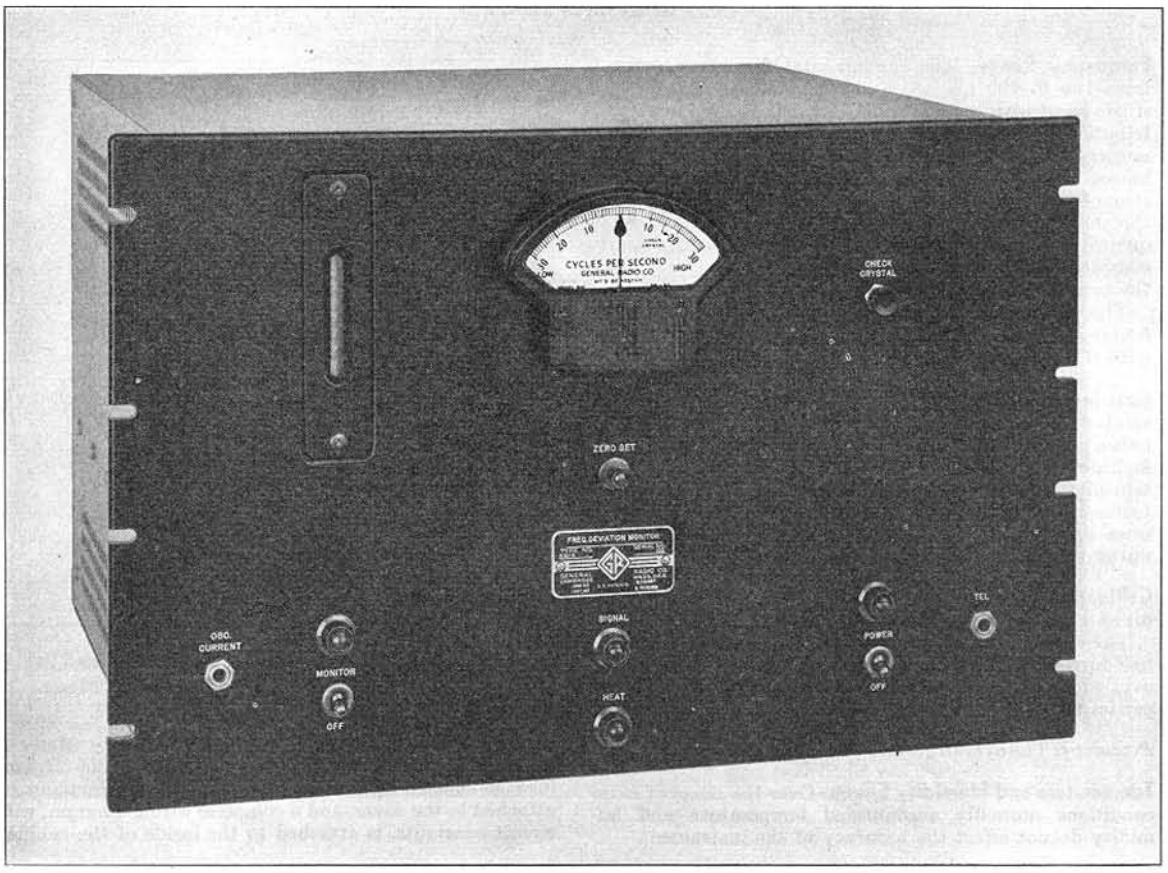
Accessories Required: Headphones which can be plugged in on the front panel, and which can be stored in the cover of the instrument.

Dimensions: Overall, 12½ x 13½ x 10½ (depth) inches. Panel, 10¾ x 11¾ inches.

Net Weight: 27¾ pounds, with battery.

Type		*Code Word*	*Price*
720-A	**Heterodyne Frequency Meter**	FANCY	**$250.00**





TYPE 1181-A FREQUENCY DEVIATION MONITOR FOR A-M TRANSMITTERS

USES: The Frequency Deviation Monitor indicates directly the magnitude and direction of the frequency deviation of a broadcast transmitter from its assigned channel frequency. A monitor of this general type is required for each station by the Federal Communications Commission.

This monitor replaces the TYPE 25-A Broadcast Frequency Monitor which consisted of TYPE 475 Frequency Monitor and TYPE 681 Frequency Deviation Meter.

DESCRIPTION: The elements of the monitor are shown in the accompanying schematic block diagram. Voltages from a temperature-controlled piezo-electric oscillator (frequency $f \pm 1000$ cycles) and the transmitter to be monitored (frequency $f \pm \Delta f$) are amplified and fed to a mixer from which their difference frequency ($1000 \pm \Delta f$) is obtained. This audio frequency is amplified, its peaks are clipped to produce an essentially square waveform, and the square waves are applied to an audio-frequency meter. The indicating element of the frequency meter is calibrated to read zero when the audio beat is exactly 1000 cycles per second. Deviations from 1000 cycles (Δf) are indicated directly as frequency deviation of the transmitter in cycles per second.

The monitor is a-c operated and is mounted on a single relay rack panel. Coupling to the transmitter is obtained from a short length of wire attached to the input terminals to act as an antenna.

FEATURES: *Modulation of the transmitter does not affect the frequency indication.* Consequently, it is no longer necessary to couple the monitor to the crystal buffer stage. The monitor input is obtained from the modulated transmitter output, and the r-f power required to operate the monitor is so small that only a simple pickup antenna is needed; usually a few inches of wire is adequate.

Positive indication of failure of either transmitter carrier or monitor crystal oscillator is provided. Within wide limits the frequency indication is independent of carrier amplitude, but a signal-level pilot is extinguished if the carrier input level drops too low for proper op-

(Photograph shows engineering model. Final model will differ in appearance and shape.)

eration of the monitor. In addition, the lamp in the frequency indicating meter is extinguished. Similarly, a push-button test indicates whether or not the monitor crystal voltage is adequate. Other lamps serve as indicators of power circuits, tube circuits, and thermostat operation. Thus, a glance will determine whether or not the monitor is operating properly.

These features alone constitute a vast improvement over previous models. They are achieved through a thoroughly coordinated electrical and mechanical design. The TYPE 1181-A Frequency Deviation Monitor is so designed that installation is extremely simple and that a minimum of attention is required from the station operating staff.

SPECIFICATIONS

Frequency Deviation Range: ±30 cycles, readable to one cycle.

Carrier Frequency Range: 500 to 2000 kc.

Accuracy: When received, within ±10 parts per million. An adjustment is provided to bring the reading into agreement with monitoring station measurements.

Stability: Under normal operating conditions, the frequency stability is better than one part in a million. Adjustments are provided to correct the indicated frequency in terms of standard-frequency transmissions whenever necessary.

Vacuum Tubes: The following tubes are required and supplied with the instrument:

3—type 6SJ7	1—type 5V4-G
2—type 6AC7	1—type 6B4-G
2—type 6H6	1—type VR-105 (0C3)
2—type 6SQ7	1—type 2051
1—type 6V6-GT	

Coupling to Transmitters: A few inches of wire serving as an antenna is usually sufficient. A minimum of 100 millivolts pickup is required into a high-impedance grid circuit.

Accessories Supplied: Quartz plate, spare pilot lights, and spare fuses.

Power Supply: 105 to 125 or 210 to 250 volts, 50 to 60 cycles.

Power Input: 25 watts for heater circuits, 100 watts for monitor circuits.

Mounting: The instrument is relay-rack mounted. Walnut end frames are available to adapt the instrument for table mounting.

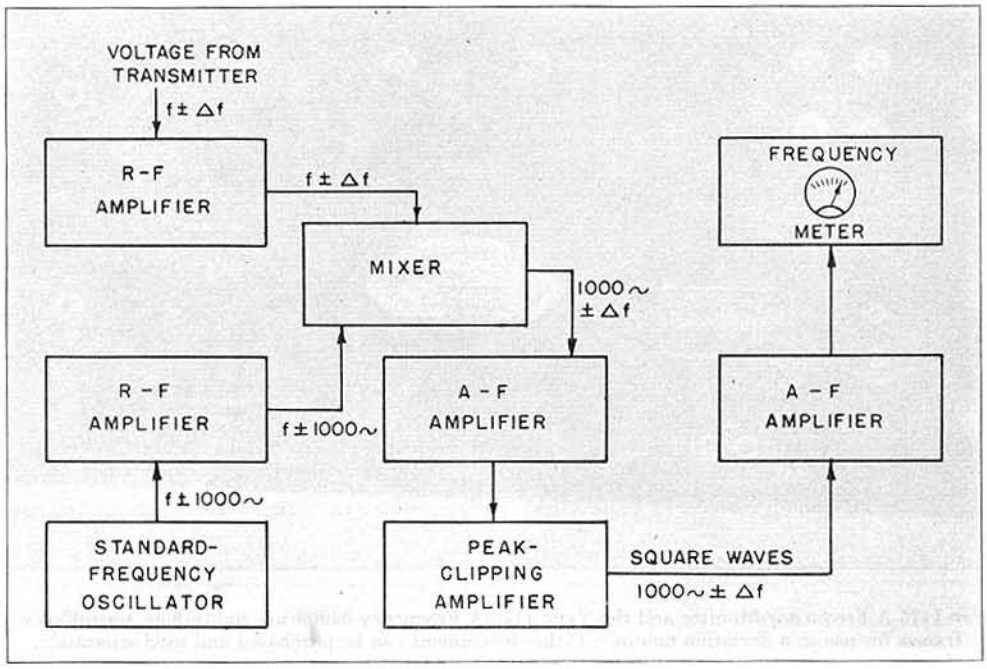
Other Finishes: Standard General Radio black crackle. Standard grays and flat black used by transmitter manufacturers can be supplied at a price increase of $10.00. For the same price a plain aluminum dress panel can be furnished the customer for finishing in any color desired, after which it can be returned to us for engraving and installation on the instrument.

Dimensions: Panel (length) 19 x (height) 15¾ inches. Depth behind panel, 13 inches.

Net Weight:

Type		*Code Word*	*Price*
1181-A	Frequency Deviation Monitor.....	MALAY	$550.00 (APPROXIMATE)

PATENT NOTICE. See Notes 1, 7, 8, 12, 20, 26, page iv.



TYPE 1175-A FREQUENCY MONITOR

USES: The TYPE 1175-A Frequency Monitor is designed to monitor the carrier frequency of amplitude-modulated radio transmitters in the high-frequency range, particularly those operated by police, fire, and other municipal departments. It is a high-sensitivity monitor and hence can be used to monitor the frequencies of mobile transmitters from a distance as well as for monitoring the main transmitter.

Used either singly or in groups, it provides an excellent means of monitoring the frequencies used by airlines and airports.

A voltage of the audio beat frequency between transmitter and monitor crystals is available at an output jack. Where a continuous indication of frequency deviation is desired, the TYPE 1176-A Frequency Meter should be used.

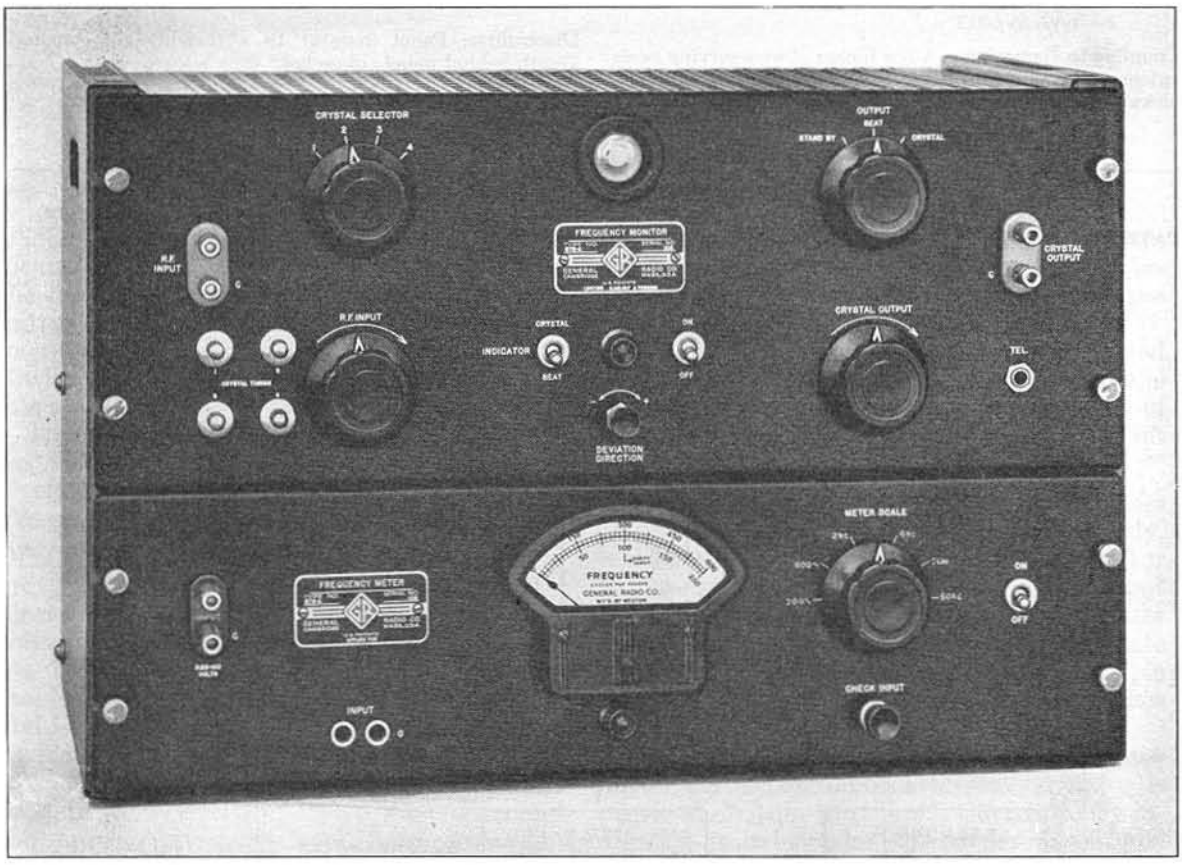
DESCRIPTION: The monitor consists of a temperature-controlled piezo-electric oscillator with mounting facilities for 4 crystals; 2 buffer amplifiers, one for the crystal frequency and one for the transmitter frequency; a mixer; and an audio-frequency amplifier.

The audio output is available at a telephone jack on the panel, and the output of the crystal buffer stage is available at panel terminals for calibrating or adjusting other equipment, such as receivers and mobile transmitters. By means of a switch, the monitor can be kept in a stand-by condition, where the vacuum-tube circuits are not operating but temperature control is maintained.

A test for deviation direction is provided, as well as tests for crystal and beat output.

FEATURES: An outstanding feature of this monitor is its high sensitivity, which greatly increases its field of usefulness. Other features include two buffer stages, deviation direction test and stand-by operation.

In conjunction with the TYPE 1176-A Frequency Meter, an indication of deviation magnitude is obtained, which is completely unaffected by amplitude modulation of the transmitter carrier. Crystal output terminals and an output level control are provided.



The TYPE 1175-A Frequency Monitor and the TYPE 1176-A Frequency Meter are shown here assembled with end frames for use as a deviation monitor. Either instrument can be purchased and used separately.

SPECIFICATIONS

Carrier Frequency Range: 1500 kc to 150 Mc.

Accuracy: With TYPE 376-M Quartz Plate, 0.002%.

Quartz Plate: No crystals are included in the price. See price list below. Crystals are ground to channel frequency.

Power Supply: 105 to 125 volts, 50 to 60 cycles. By changing connections on the power transformer, the monitor can be operated from a 210- to 250-volt line.

Power Input: 75 watts, including temperature control.

Accessories Supplied: All tubes; multipoint connector; spare fuses; spare pilot lamp.

Vacuum Tubes:

1—type 6AC7	1—type 6J5
1—type 6AG7	1—type 6X5
1—type 6E5	1—type 7A8
1—type 6SN7GT	1—type VR-150-30

All vacuum tubes are supplied.

Mounting: Standard 19-inch relay-rack panel. Walnut end frames are available for adapting the instrument for table mounting.

Dimensions: Panel, 19 x 7 inches; depth behind panel, 11¼ inches.

Net Weight: 22 pounds.

Type		*Code Word*	*Price*
1175-A	Frequency Monitor	TIPSY	$250.00
376-M	Quartz Plate	LABOR	35.00

PATENT NOTICE. See Notes 1, 8, 12, 20, page iv.

TYPE 1176-A FREQUENCY METER

USES: The TYPE 1176-A Frequency Meter may be used as a general-purpose instrument for determining the frequency of an unknown source, or continuously monitoring the frequency of a system.

For the electronics laboratory it provides a convenient means of measuring audio and supersonic frequencies up to 60 kc, regardless of waveform. For monitoring radio transmitters, it can be used in conjunction with a crystal monitor, such as the TYPE 1175-A, to indicate continuously the deviation from assigned channel frequency.

DESCRIPTION: The circuit consists of (1) an input amplifier followed by (2) a series of clipping and limiting amplifiers, and (3) a frequency-indicating circuit composed of a capacitor, a diode, and a d-c microammeter. The function of the clippers and limiters is to convert the input signal to a square waveform so that the indication is not affected by changes in amplitude or waveform of the input signal.

A well regulated power supply eliminates all effects of line voltage changes.

FEATURES: Direct-reading scales, and a single range-selector switch, permit rapid frequency measurements to be made.

Individual scale calibration adjustments are provided for each range. An external meter may be connected to the instrument through a multipoint connector on the rear of the unit. Two sets of input terminals are provided on the panel and, on the rear of the unit, a multipoint connector provides a means of attaching more permanent connections. Plugging into the W. E. panel jacks automatically disconnects the rear terminals.

SPECIFICATIONS

Range: 25-60,000 cycles per second in six ranges. Full-scale values are 200, 600, 2000, 6000, 20,000, 60,000 cycles.

Accuracy: ±2 cycles, ±2% of full scale, for all ranges. When operating on the 60,000-cycle range, with less than 0.5 volt input, the accuracy becomes ±3% of full scale.

Input Voltages: 0.25-150 volts.

Input Resistance: 500,000 ohms, for all ranges. One side grounded.

Input Waveform: The readings are substantially independent of waveform, so long as the dissymmetry of the positive and negative portions of the wave is less than 8:1.

Power Supply: 105-125 (or 210 to 250) volts, 50-60 cycles.

Power Input: Approximately 50 watts.

Vacuum Tubes:

1—type 6H6	1—type 6SN7-GT
1—type 6SQ7-GT	1—type 6J5
1—type 6X5-GT	2—type 6SJ7
1—type 6V6-GT	1—type 0A3/VR75

1—Amperite 3-4

Mounting: Relay-rack panel; walnut end frames are available to convert to table mounting.

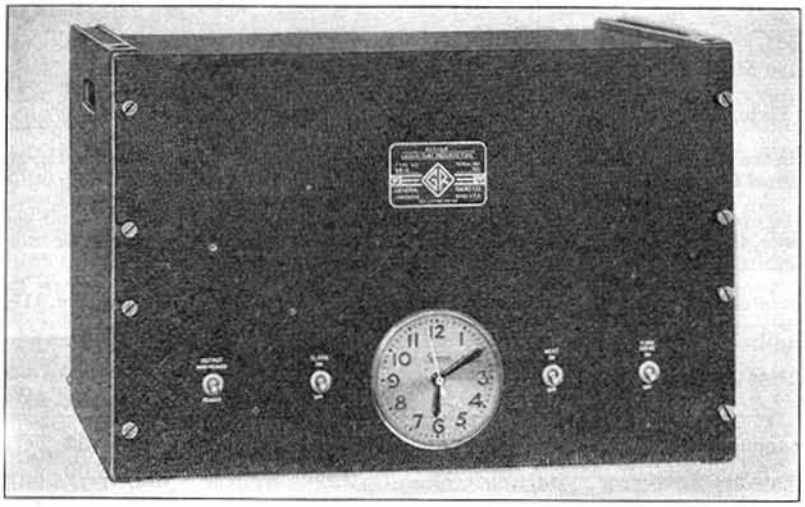
Accessories Supplied: Spare fuses; spare pilot lamp, multi-point connector, all vacuum tubes.

Dimensions: Panel, 19 x 5¼ inches, depth behind panel, 11¼ inches.

Net Weight: 19½ pounds.

Type		*Code Word*	*Price*
1176-A	Frequency Meter	TIMID	$185.00

PATENT NOTICE. See Notes 1, 26, page iv



TYPE 816

VACUUM-TUBE

PRECISION FORK

USES: The TYPE 816 Vacuum-Tube Precision Fork is a primary standard of frequency. It can be used for the same purposes as TYPE 815 Precision Fork but its higher precision and stability make it adaptable to considerably more accurate measurements and, in addition, to timekeeping and chronographic measurements.

DESCRIPTION: The complete instrument consists of a tuning fork similar to that used in TYPE 815 Precision Fork, a temperature control system, a vacuum-tube amplifier, and a synchronous motor clock. The fork is made of low-temperature-coefficient stainless steel. It is mounted at the heel on a metal panel, which is attached to the base of the temperature-control box by means of four vertical helical springs to reduce energy dissipation through the mounting. The fork is driven electromagnetically, and the drive and pickup coils are symmetrically placed with respect to the tines in order to keep the decrement low and give a Q of the order of 20,000.

A two-stage amplifier couples the pickup and the driving coils. An a-v-c circuit is included, and a fourth vacuum tube supplies output power at the fork frequency. The general circuit is shown in the accompanying schematic diagram.

The temperature-controlled chamber in which the fork is mounted is a metal box enclosed in a balsa-wood case. Heaters are provided for 115-volt, d-c or a-c operation.

The synchronous clock is designed to register correct time when the fork is exactly on its rated frequency. Comparison of the readings of this clock with standard time signals as transmitted by radio provides a means of checking the frequency of the fork over 24-hour periods of continuous operation.

FEATURES: High accuracy and a high degree of frequency stability are important characteristics of this fork. Because provision is made for using either of two types of power supply, the fork can be operated under a wide variety of conditions, in the field as well as in the laboratory.

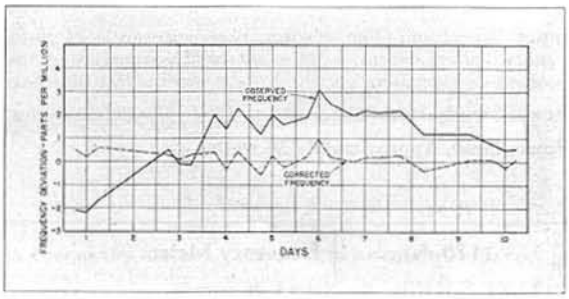
SPECIFICATIONS

Frequency: 50 cycles per second or 60 cycles per second.

Calibration: The frequency is adjusted within 0.0005% of its rated value and is measured to 0.0001% in our standardizing laboratory.

Screws are provided in the ends of the tines of the fork for adjusting the frequency. These are accessible from the outside of the temperature-control box. Minute changes are accomplished by adjusting the a-v-c circuit while in operation.

Stability: When the temperature-control system is operated, the frequency is within one part in 100,000 (0.001%) of its mean value, thus timing to better than one second per day. Without temperature control, the frequency will follow (with a considerable lag) variations in ambient temperature. At ordinary room temperatures, the temperature



(*Right*) Plot of a 10-day frequency record of TYPE 816 Vacuum-Tube Precision Fork. The full line shows the observed frequency, the dotted line the frequency after the barometer correction was applied.

coefficient of frequency is negative and is −22 parts in 10^6 (0.0022%) per degree Centigrade. Frequency changes with supply voltage and atmospheric pressure are usually negligible in comparison to the rated accuracy of the fork.

Power Supply: The amplifier circuit and the heaters for temperature control are arranged to operate on either of two types of power supply, selection being made by plug and jack terminals:

(1) a-c line, 100 to 130 volts, 50 to 60 cycles.
(2) d-c line, 100 to 130 volts.

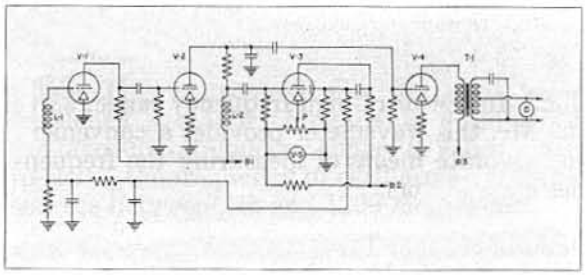
Power Input: For temperature control, 30 watts; for fork and amplifier, 45 watts.

Output: Peaked or sinusoidal, as selected by a switch. When the synchronous clock is operated, maximum output is 1 watt. When clock is not used, maximum output is 2 watts. Output circuit is not grounded and is free from any d-c polarization. Various output impedances between 200 and 30,000 ohms are provided.

Maximum peaked open-circuit output voltage is 350 volts.

Tubes: Supplied with instrument:

2—type 6J7-G 1—type 6Q7-G
1—type 25L6GT 1—type 25Z6
1—type 139-949-A



Schematic circuit diagram of the fork amplifier and output circuits. L_1 and L_2 are the pickup and driving coils.

Accessories Supplied: Spare fuses, 2 multipoint connectors, one line connector cord.

Mounting: The entire assembly is mounted on a standard 19-inch relay-rack panel, which can be adapted for table mounting by the use of the wooden end frames supplied. The instrument is readily portable in an operating condition if kept in approximately its operating position.

Dimensions: Panel, 19 x 12¼ inches; depth, 12½ inches.

Net Weight: 49½ pounds.

Type		*Frequency*	*Code Word*	*Price*
816-A	Vacuum-Tube Precision Fork	50 cps	FERRY	$385.00
816-B	Vacuum-Tube Precision Fork	60 cps	FABLE	385.00

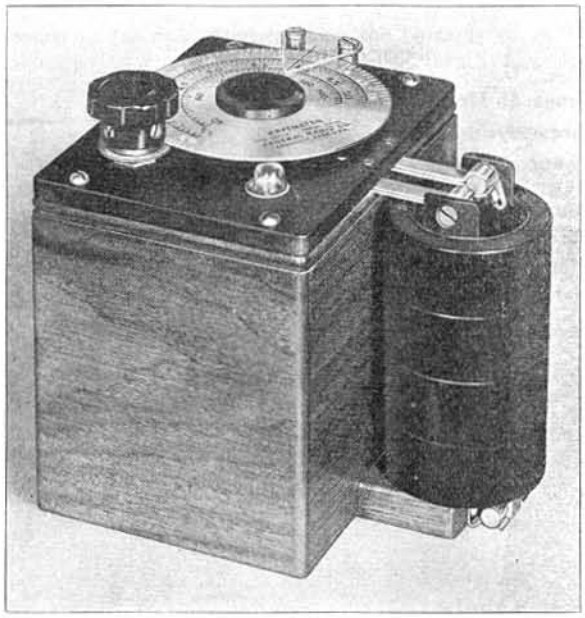
PATENT NOTICE. See Note 1, page vi.

TYPE 566-A WAVEMETER
(SUPERSEDING TYPE 358 WAVEMETER)

USES: TYPE 566-A Wavemeter is a wide-range, general-purpose, absorption-type instrument intended for rapid frequency checks in the laboratory or the field. Of moderate accuracy, it replaces the TYPE 358 and the TYPE 574, formerly listed in our catalog.

DESCRIPTION: The wavemeter consists of an air condenser similar in construction to the TYPE 568, a set of five plug-in inductors, and an incandescent lamp, which is used to indicate resonance. The condenser is mounted in a walnut cabinet. A friction-type slow-motion drive is provided on the condenser, and the dial carries three scales, which are calibrated directly in frequency.

FEATURES: Compactness and low price are important features of this wavemeter. The plug-in terminals are so arranged that the inductor can be moved in one plane to vary the coupling to the source under measurement. A rack is provided on the side of the cabinet for storing the coils when the wavemeter is not in use.



SPECIFICATIONS

Frequency Range: 0.5 to 150 Mc (600 to 2 meters) using the five plug-in inductors furnished with the instrument. The condenser dial is direct reading in frequency. The precision with which the dial can be read is 2% or better.

Accuracy: The accuracy of dial indication is ±2%, 0.5 to 16 Mc; and ±3%, 16 to 150 Mc.

Accessories Supplied: Two spare indicator lamps.

Dimensions: 4¾ x 5⅞ x 5¾ inches, over-all.

Net Weight: 3 pounds.

Type		*Code Word*	*Price*
566-A	Wavemeter.....	WAGON	$45.00

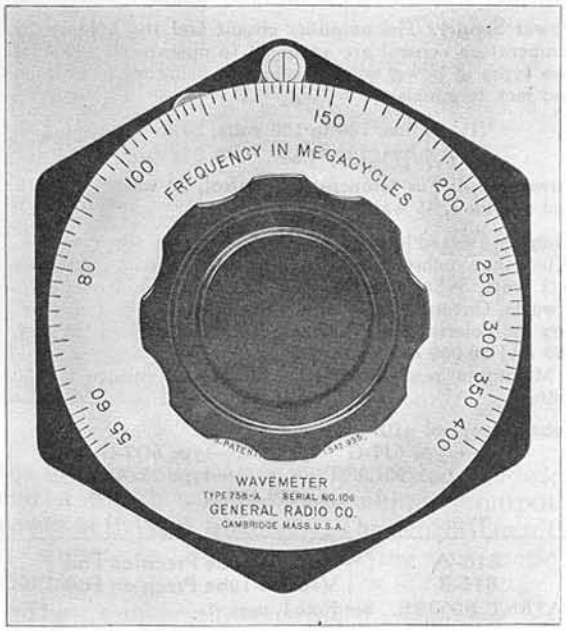
TYPE 758-A WAVEMETER
(SUPERSEDING TYPE 419-A)

USES: In the ultra-high-frequency range, 55 to 400 Mc, this wavemeter provides a convenient and accurate means of measuring the frequencies of oscillators.

DESCRIPTION: TYPE 758-A Wavemeter is a tuned-circuit, absorption-type of instrument, in which the capacitance and inductance are varied simultaneously. This permits a wide range of frequency to be covered with a single coil. The coil is connected permanently into the circuit. The resonance indicator is an incandescent lamp.

FEATURES: An outstanding feature of this wavemeter is the wide range of frequency which is covered without the bother of changing coils.

Although both coil and condenser are completely enclosed, the case is of transparent material so that the circuit elements can be seen at all times. This is a considerable aid in coupling the wavemeter to an oscillating circuit. The dial is direct reading in frequency. The lamp will glow on an oscillator of about 2 watts output. For low-power oscillators, the reaction of the wavemeter on the plate or grid current can be used to indicate resonance.



SPECIFICATIONS

Range: 55 Mc to 400 Mc, direct reading.

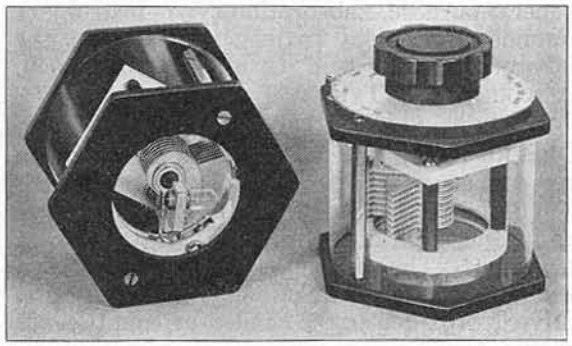
Accuracy: ±2%.

Temperature and Humidity: The accuracy of this wavemeter is completely independent of temperature and humidity effects over the ranges normally encountered.

Resonance Indicator: Incandescent lamp.

Dimensions: 5 x 5 x 4¾ inches, over-all.

Net Weight: 1 pound, 12 ounces.



Type		*Code Word*	*Price*
758-A	Wavemeter	WITTY	$28.00

TYPE 1140-A U-H-F WAVEMETER

USES: This instrument fills the need for a frequency standard of moderate accuracy in the ultra-high frequency range. It will measure to ±1% the frequency of oscillators and other sources between 240 and 1200 megacycles.

DESCRIPTION: The frequency-determining element in the TYPE 1140-A Wavemeter is a butterfly circuit in which capacitance and inductance are varied simultaneously by a single control. The resonance-indicating circuit consists of a crystal detector and a microammeter. These elements, together with the direct-reading drum-type frequency scale and a slow-motion drive, are mounted in a convenient molded bakelite case.

FEATURES: Low losses, high sensitivity, and permanence of calibration are assured by the butterfly circuit, which requires no moving contacts, and which permits a wide frequency range to be covered by a single rotation of the dial. The detector is a small cartridge, which, if burned out or damaged, can easily be replaced without affecting the calibration.

(Left): View of wavemeter showing tuning control and resonance indicator. A window is provided at the rear through which the butterfly circuit is visible.

SPECIFICATIONS

Range: 240 to 1200 Mc.

Accuracy: ±2%.

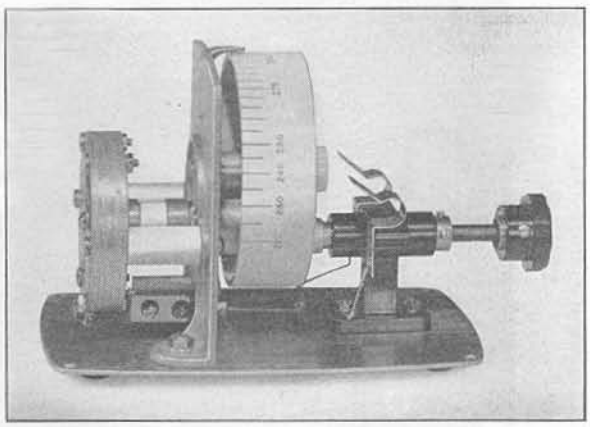
Sensitivity: An oscillator delivering 10 milliwatts will usually produce a meter deflection. Where sufficient power is not available, the reaction of the wavemeter upon the plate or grid current of the oscillator can be used to indicate resonance.

Temperature and Humidity: The accuracy of this wavemeter is completely independent of temperature and humidity effects over the normal range of room temperatures and humidities normally encountered in the laboratory.

Detector: The detector is mounted in a standard cartridge and can be replaced if damaged by overloading. Silicon detectors (as 1N21, 1N22, or 1N21B) are recommended.

Dimensions: 4 x 4½ x 7⅛ inches, overall.

Net Weight: 3¼ pounds.



View with case removed. The two clips shown above the shaft bearing make contact with the meter terminals when the case is on.

Type		*Code Word*	*Price*
1140-A	Wavemeter	WAGER	$65.00

PATENT NOTICE: See Note 10, page iv.

AMPLIFIERS AND POWER SUPPLIES

The TYPE 814-A Amplifier for use as a bridge detector has been discontinued and is replaced by a new instrument, the TYPE 1231-A Amplifier and Null Detector, which provides a built-in visual null indicator.

TYPE 672-A and TYPE 673-A Power Supplies have been discontinued, and two new units are now available. The TYPE 1260-A Variac-Rectifier is designed to be a substitute for a 6-volt storage battery, and the TYPE 1261-A Power Supply is a power pack interchangeable mechanically and electrically with the BA48 combination battery.

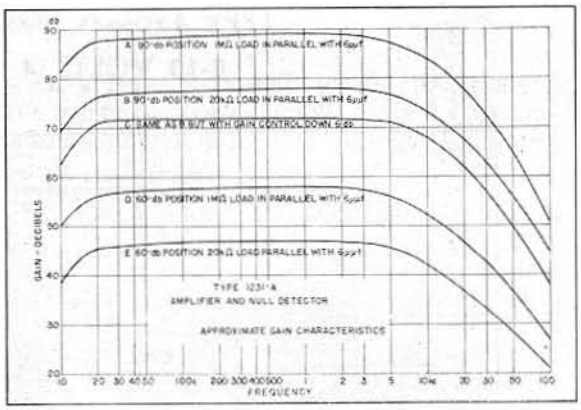
Type	*Name*	*Price*
672-A	Power Supply	*Discontinued*
673-A	Power Supply	*Discontinued*
814-A	Amplifier	*Discontinued*
1260-A	Variac-Rectifier	$90.00
1261-A	Power Supply	55.00

TYPE 1231-A AMPLIFIER AND NULL DETECTOR

USES: The TYPE 1231-A Amplifier Null Detector can be used as a high-gain amplifier for general laboratory use or as a sensitive visual null detector for bridge measurements. Used in conjunction with head telephones, it provides an aural null indication. It may also be used as a pre-amplifier for crystal microphones, vibration pickups and cathode-ray oscilloscopes. Means have been provided for sharply tuning the instrument to audio frequencies commonly used for measurements.

DESCRIPTION: The instrument consists of a high-gain amplifier with an output stage that can be operated as a linear amplifier for general laboratory use or as a logarithmic amplifier for null-detector use. The null indicator is a panel meter which is also used to check the condition of the battery. The null-detector response is approximately logarithmic over a 40-db range. A 30-db input attenuator is provided for attenuation of high input voltages. Either a BA48 battery pack or the 1261-A

Power Supply can be placed within the cabinet to operate the instrument. Blocking condensers at both input and output jacks isolate the instrument from direct current in the external circuits to which it may be connected. A filter jack on the panel of the instrument permits insertion of an anti-resonant filter such as the TYPE 814-P in the grid circuit of the last stage for modifying the frequency characteristic of the instrument. Thus a simple and effective means is provided for restricting the response to a narrow range, resulting in the eliminating of harmonics or noise outside that range.



FEATURES: Designed for maximum usefulness in the measurements laboratory, this amplifier provides a number of important operating conveniences. Switching is accomplished by push buttons, operating controls are simple, and both are plainly labelled. Input and output terminals are arranged to take both TYPE 274 Plugs and TYPE 774 Coaxial Connectors. Convenient and attractive handles at each end of the panel provide a means of removing the chassis from the cabinet for installing or replacing the batteries.

SPECIFICATIONS

Input Impedance: 1 megohm in parallel with 50 micromicrofarads.

Maximum Gain: 90 db with 1 megohm load — down 6 db at 12 and 11,000 cycles — 24 db down at 50 kc.

Null Detector Sensitivity: Less than 100 microvolts input is required to give 10% indication on the meter at 1 kc.

Output Impedance: Approximately 50,000 ohms.

Output Voltage: 5 volts into 20,000 ohms; 20 volts into 1 megohm.

Battery Life: Between 200 and 250 hours at 8 hours per day.

Frequency Response: See curves.

Tubes: The instrument requires two TYPE 1L4 and one TYPE 1D8GT Tubes which are supplied in the instrument.

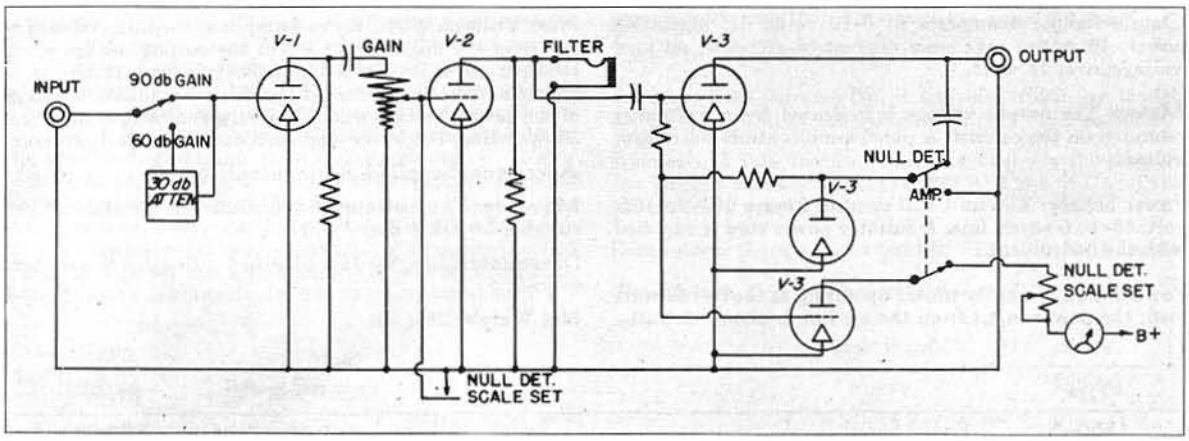
Power Supply: Burgess TYPE 6TA60 (Signal Corps BA48) Battery Pack is supplied in place in the instrument. When a-c supply is desired, TYPE 1261-A Power Supply (see page 63) can be used. The internal noise level is slightly higher with a-c supply.

Accessories Available: TYPE 814-P2 (400 and 1000 cycles) and TYPE 814-P3 (60 cycles) Tuned Circuits are available for providing selectivity. These were described in Catalog K, first (page 112) and second (page 90) editions. For facilitating connections to the input and output, two TYPE 274-M Plugs are supplied. TYPE 274-NC or TYPE 274-NE Shielded Connectors may be used. Where complete shielding is required, TYPE 774 Coaxial Connectors (page 65) are recommended.

Dimensions: 12¼ x 8 x 10¾ inches, overall.

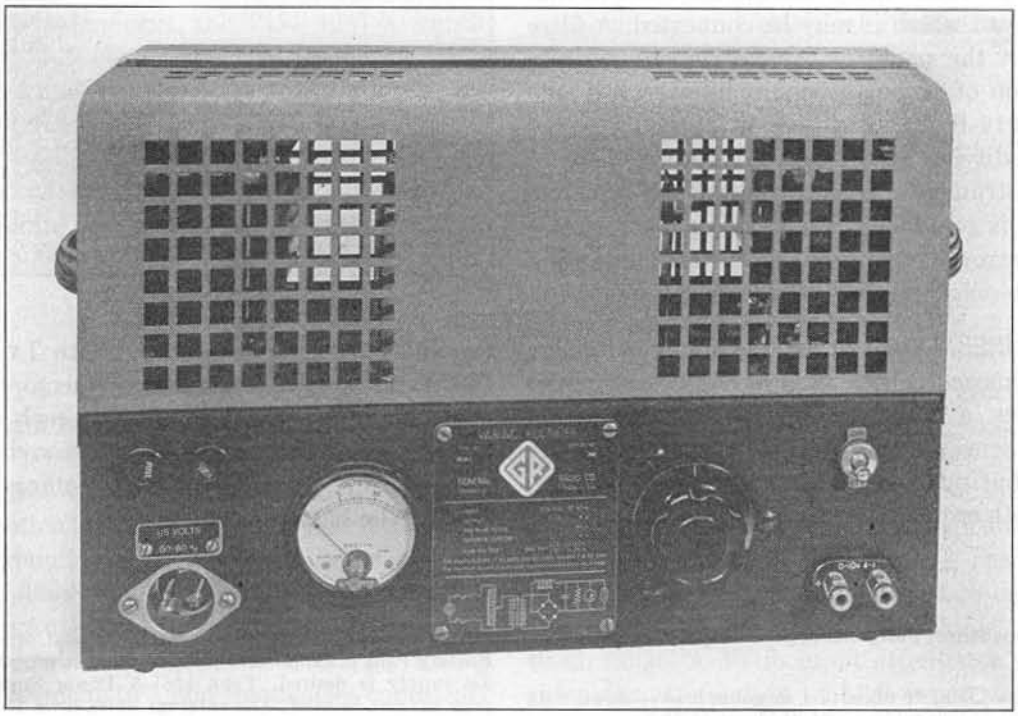
Net Weight: 23¼ pounds, including batteries.

Type		*Code Word*	*Price*
1231-A	Amplifier and Null Detector.....	VALID	$160.00



TYPE 1260-A VARIAC-RECTIFIER

0-10 VOLTS, 4 AMPERES D-C



USES: TYPE 1260-A Variac-Rectifier is intended for general laboratory use as a dependable substitute for storage batteries. It is a convenient source of filament and bias voltages for vacuum tubes in experimental circuits.

DESCRIPTION: The elements of the power supply unit are a transformer, a selenium rectifier and an output filter. The output voltage is controlled by a Variac feeding the transformer primary, and is indicated by a panel meter.

FEATURES: Ease of voltage control from zero to maximum, low hum level, and low internal resistance are the important features of this power supply.

SPECIFICATIONS

Output Range: 4 amperes at 0–10 volts, dc; maximum power, 40 watts; maximum current, 6 amperes; no load voltage, over 15 volts.

Meters: The output voltage is indicated by a voltmeter mounted on the cabinet. A panel knob controls the output voltage.

Power Supply: The unit will operate from a 105- to 125-volt, 50- to 60-cycle line. A suitable power cord is supplied with the instrument.

Power Input: When the unit is operating at the full 40-watt load, the power input from the a-c line is about 75 watts.

Hum Voltage: At 10 volts, 4 amperes, the hum voltage is less than 100 millivolts or 1% of the output voltage when the instrument is operated on a 60-cycle line. At 2 volts, 6 amperes, the hum voltage is less than 60 millivolts or 3% of the output voltage when the instrument is operated on a 50-cycle line. For lower load currents, the hum decreases.

Accessories Supplied: Spare fuses.

Mounting: The instrument is mounted in a metal cabinet suitable for table use.

Dimensions: (Length) 16 x (depth) 7 x (height) 9½ inches, overall.

Net Weight: 26¾ lbs.

Type		*Code Word*	*Price*
1260-A	Power Supply	VALET	$90.00

TYPE 1261-A POWER SUPPLY

USES: The TYPE 1261-A Power Supply is an a-c power pack for use in place of batteries in battery-operated instruments where continuous operation, such as production testing, makes it desirable to operate the instrument from an a-c power line. The power pack is designed to be the equivalent of a BA48 combination battery in voltages, current, size and shape, so that it is interchangeable electrically and mechanically with the battery. It can be used in the following General Radio instruments:

TYPE 759-A TYPE 759-B TYPE 761-A
TYPE 720-A TYPE 1231-A

It can be used as a general-purpose replacement for the BA48 battery.

DESCRIPTION: This power supply is a light compact unit that fits into the battery compartment of General Radio instruments which use the BA48 battery block.

A selenium rectifier and L-C filter with two flashlight cells floating across the output provide a low-impedance well-filtered and regulated d-c filament supply. A conventional vacuum-tube rectifier and R-C filter provide the plate supply. A four-terminal output socket fits the plug on the battery cable of instruments which use the BA48 battery.

Octal Selector Plugs inserted into a socket on the top of the power supply make it possible to select filament and plate voltages for various needs.

FEATURES: The two flashlight cells which are floated across the output of the filament supply not only function well as a large filtering condenser, but they have the additional feature that they maintain essentially constant filament voltage. A small push button switch mounted on top of the power supply makes it possible to disconnect the cells at any time and set the output voltage equal to the cell voltage. When the power supply is in operation, normal line voltage variations cause the cells to either charge slightly or deliver small amounts of power to the load. When the instrument is turned off, a small relay, built as part of one of the filter chokes, opens the circuit so that the cells will not run down. The life of the cells is practically equal to their normal shelf life.

When used to replace the BA48 battery block, the power supply can be readily interchanged with that unit. For new instruments purchased with the TYPE 1261-A Power Supply, or since the power supply became available, no rewiring or circuit changes are required. Older instruments may require a minor change in the wiring of the battery cable.

SPECIFICATIONS

OUTPUT:

Filament Supply: 1.5 volts or 3.0 volts up to 350 ma. Normal current through filter choke to operate relay = 300 ma. Bleeder resistor in selector plug needed for lower current requirements.

Plate Supply:

133 volts open circuit
107 volts at 3 ma
89 volts at 5 ma
72 volts at 7 ma
Maximum output current = 8 ma

} For 115-volt 60-cycle power line with normal filament current of 300 ma.

Selector Plugs: One of the following is furnished. Please specify type wanted.

Selector Plug 1261-P1 — Provides proper voltages for TYPE 759-A Sound-Level Meter. Battery Plate of Sound-Level Meter must be replaced by four-terminal plug to fit output socket of TYPE 1261-A Power Supply. Full sensitivity of instrument cannot be used. Attenuator settings below 50 db on B and C weighting networks and below 40 db on the A weighting network are not recommended.

Selector Plug 1261-P2 — Provides proper voltages for TYPE 759-B Sound-Level Meter.

Can also be used with TYPE 761-A Vibration Meter in cases where full sensitivity of meter is not required. When using the Velocity and Displacement Networks, attenuator settings below 1 kilocycle are not in general usable.

Selector Plug 1261-P3 — Provides proper voltages for TYPE 720-A Heterodyne-Frequency Meter.

Selector Plug 1261-P4 — Provides proper voltages for TYPE 1231-A Audio Amplifier and Null Detector. On Null Detector use, the plate supply regulation causes the meter to overshoot somewhat upon rapidly approaching a null.

Selector Plug 1261-P5 — To be wired by customer to meet his own requirements.

Hum and Noise Level—Sufficiently low, when operated from 60-cycle supply line, to assure satisfactory operation of instruments listed under conditions specified.

Input Voltage: 105–125 volts, 40 to 60 cycles.

Input Power: Less than 8 watts at 115 volts, 60 cycles.

Tube: One TYPE 6H6 is supplied.

Batteries: Two Burgess No. 2 uni-cells which are floated across the output of the Filament Supply are furnished.

Terminals: A four-terminal output socket fits the plug on the battery cable of the TYPE 759-B, TYPE 761-A, TYPE 720-A, and TYPE 1231-A.

Dimensions: (Length) 10 x (width) 2¼ x (depth) 5 inches.

Net Weight: 7¼ pounds (less power cord).

Type		*Code Word*	*Price*
1261-A	Power Supply	NUTTY	$55.00

When ordering, specify type of selector plug desired. See list above in specifications.

PARTS AND ACCESSORIES

Type	Name	Price
119-A	R-F Choke	$1.50
119-B	R-F Choke	2.00
138-A	Binding Post	*Discontinued*
138-B	Switch Contact	.10
	Package of 10	.40
	Package of 100	2.25
138-C	Switch Contact	.10
	Package of 10	.50
	Package of 100	3.20
138-D	Switch Contact	*Discontinued*
138-Q	Switch Stop	.10
	Package of 10	.40
	Package of 100	2.25
138-UL	Binding Post Assembly	.50
	Package of 10	4.00
138-V, VD, X	Binding Posts	.25
	Package of 10	1.35
	Package of 100	12.00
202-A, B	Switches	*Discontinued*
202-Y, Z	Switch Knobs	*Discontinued*
274-D	Insulated Plug	.25
	Package of 10	2.25
274-J	Jack	.10
	Package of 10	.55
	Package of 100	3.50
	1000–1,999 per M	33.25
	2000–19,999 per M	31.50
	20,000–49,999 per M	31.15
	50,000 and over per M	30.65
274-K, L	Binding Post Assemblies	*Discontinued*
274-M	Double Plug	.50
	Package of 10	3.50
274-ML	Double Plug	*Discontinued*
274-NC	Shielded Conductor	1.50
274-ND	Shielded Plug	1.50
274-NE	Shielded Plug and Cable	4.00
274-P	Plug	.12
	Package of 10	.90
	Package of 100	6.25
	1000–1,999 per M	59.40
	2000–19,999 per M	56.25
	20,000–49,999 per M	55.65
	50,000 and over per M	54.70
274-RJ	Four-Gang Jack Base	*Discontinued*
274-SB	Short Circuit Plug	.65
274-U	Plug	.15
	Package of 10	1.00
	Package of 100	8.00
274-X	Plug	.10
	Package of 10	.60
	Package of 100	4.25
	1000–1,999 per M	40.40
	2000–19,999 per M	38.25
	20,000–49,999 per M	37.90
	50,000 and over per M	37.20
274-Y	Panel Terminal Insulator Assembly (per pair)	.20
	10 pairs	1.35
274-Z	Panel Terminal Insulator Assembly (per pair)	$ .30
	10 pairs	2.10
318-B, C	Dial Plates	.35
339-A	Switch	2.50
339-B	Switch	2.00
480-A, B	Relay Racks	*Discontinued*
519-A	Dial Lens	1.75
520-A	Dial Lock	.75
522-A	Dial Plate	.35
637-A	Fluted Knob	.30
	Package of 10	2.10
637-B, G, H	Fluted Knobs	.35
	Package of 10	2.35
637-J	Fluted Knob	.40
	Package of 10	2.75
637-K	Fluted Knob	.45
	Package of 10	3.25
637-P, Q, R, S	Fluted Knobs	.50
	Package of 10	3.75
641	Audio-Frequency Transformers	*Discontinued*
666-A	Variable Transformer	*Discontinued*
674-C	Jumbo Plug	.25
	Package of 10	1.50
674-D	Insulated Jumbo Plug	.50
	Package of 10	4.00
674-J	Jumbo Jack	.30
	Package of 10	1.65
674-P	Jumbo Plug	.30
	Package of 10	1.75
677-U, Y	Coil Forms	*Discontinued*
677-P1	Spacer	*Discontinued*
678-P, J	Bases	*Discontinued*
701-A, K	Direct-Drive Dials	1.25
702-A, B, F, G	Friction-Drive Dials	1.75
703-A, B, F, G	Friction-Drive Dials	2.00
703-K, L	Friction-Drive Dials	2.50
704-C, D	Precision Dials	6.00
705-A, F	Friction-Drive Dials	1.75
706-C, D	Precision Dials	6.50
710-A, B, F, G	Direct-Drive Dials	1.25
712-A, F	Direct-Drive Dials	1.25
717-A, B, F, G	Direct-Drive Dials	1.50
717-K, L	Direct-Drive Dials	2.00
741	Transformers	*Discontinued*
774-E	Cable Plug	1.50
774-F	Plug Connector	1.00
774-G	Panel Plug	1.00
774-M	Cable Jack	1.50
774-N	Jack Connector	1.00
774-P	Panel Jack	1.00
774-R1, R2	Coaxial Patch Cords	4.00
774-X	Insertion Unit	4.50
774-YB	Terminal Unit	3.50

TYPE 774 COAXIAL TERMINALS

At high and ultra-high frequencies, the interconnection of the various elements in a measuring system is best accomplished by means of coaxial lines. To obtain maximum benefit from coaxial lines, however, proper terminal equipment is necessary, and for convenience plug-and-jack units are desirable.

TYPE 774 Coaxial Terminals are concentric plug-and-jack units intended for use with coaxial lines. They are used in a number of General Radio instruments, among them the TYPE 821-A Twin-T, the TYPE 916-A Radio-Frequency Bridge, and the TYPE 804-B U-H-F Signal Generator.

In order to reduce impedance mismatch with any line having a different characteristic impedance, TYPE 774 Coaxial Terminals have been made with short internal conductors and with low capacitance. In order to provide as continuous an external shield as possible, lugs have been provided for four connections to the outer shell from the cable sheath at points uniformly distributed around the circumference.

The solid dielectric is polystyrene, which has both a low dielectric constant and a low power factor.

A plug unit and a jack unit are available for mounting on panels, and a similar pair of units for terminating coaxial cables. The plug connector and the jack connector make it possible to join two cables having identical terminations, that is, two plugs or two jacks.

SPECIFICATIONS

Capacitance: For many applications the capacitance of these units is the factor to be considered in determining their suitability. The capacitance for each TYPE 774 Unit is given in the description on the next page. In addition to the total capacitance there is given, for many units, a figure called "insertion capacitance," which is the capacitance added to a circuit when that particular unit is plugged in. This is lower than the total capacitance because of the overlapping when a plug unit is plugged into a jack.

Materials: Metallic parts are of nickel-plated brass; insulation is polystyrene.

Cable: The cable consists of a standard beryllium-copper conductor, separated from a braided tinned-copper shield by Anhydrex A insulation, with an over-all covering of abrasion-resistant rubber. The nominal characteristic impedance is 72 ohms ±10%; the nominal capacitance is 26 $\mu\mu$f per foot; and the power factor is 2% or less at 1000 cycles.

Dimensions: All drawings are approximately ½ scale.

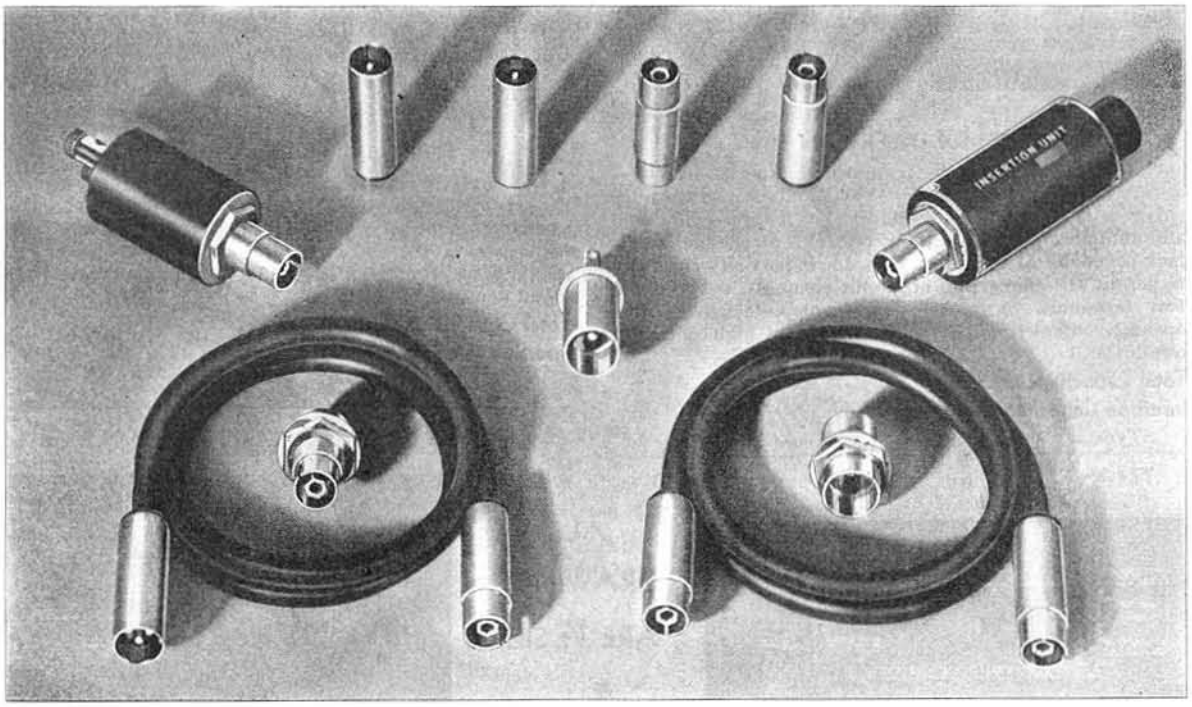
Net Weight: See descriptions on next page.

PATCH CORDS

The TYPE 774-R Patch Cords consist of a 3-foot section of concentric-shielded cable (see specifications above) terminated in TYPE 774 Coaxial Cable Terminals.

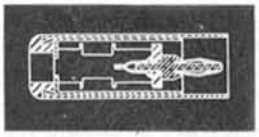
The TYPE 774-R1 has a TYPE 774-M Cable Jack at one end and a TYPE 774-E Cable Plug at the other. The TYPE 774-R2 has a TYPE 774-M Cable Jack at each end.

Type	*Description*	*Net Weight*	*Code Word*	*Price*
774-R1	Patch Cord	5 oz.	ACCESSORIM	$4.00
774-R2	Patch Cord	5 oz.	ACCESSORAT	4.00



TYPE 774-E CABLE PLUG

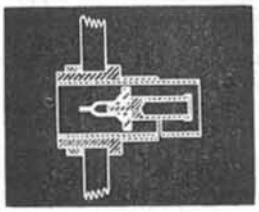
This is a plug connector unit for use with concentric shielded cables (5/16 inch or less in diameter). The connection of the inner conductor is made by means of a TYPE 274 Plug, while the outer sleeve fits snugly around the split sleeves of the jack terminals or connectors. Four soldering lugs are provided for connecting to the shield of a concentric cable, as is a lug for the inner conductor.



Total Capacitance: 2.5 μμf.
Insertion Capacitance: 1.4 μμf.
Net Weight: 1½ oz.
Code Word: ACCESSOEYE
Price: $1.50

TYPE 774-P PANEL JACK

A metal stud, supported by a polystyrene strip, is mounted concentrically with the outer shell, and is recessed to receive the TYPE 774 Plug of the plug connector units. The outer conductor is a split sleeve which grounds to the panel on which the jack is mounted. In conjunction with the sleeve of a cable plug or connector unit it very effectively shields the high lead connection.

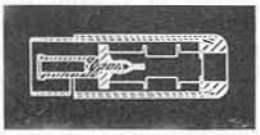


Total Capacitance: 2.8 μμf.
Insertion Capacitance: 1.7 μμf.
Net Weight: 1¾ oz.
Code Word: ACCESSOPOD
Price: $1.00

TYPE 774-M CABLE JACK

This is the jack unit for connecting a concentric cable to a TYPE 774-G Panel Plug. Similar in construction to the cable plug, a recessed stud takes the TYPE 274 Plug, while a split sleeve fits into the outer sleeve of the plug terminals.

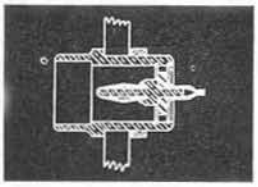
Total Capacitance: 2.8 μμf.
Insertion Capacitance: 1.7 μμf.
Net Weight: 1½ oz.
Code Word: ACCESSOMUD
Price: $1.50



TYPE 774-G PANEL PLUG

This unit consists of a TYPE 274 Plug mounted axially in the center of a brass shell. The plug is supported on a polystyrene insulating strip which serves to isolate it from the outer conductor. The assembly requires a ¾-inch mounting hole and may be mounted on any panel thickness up to ½ inch. The entire plug assembly is finished with a nickel plate. A tinned soldering terminal is provided for the central plug, while the outer conductor grounds to the metal panel.

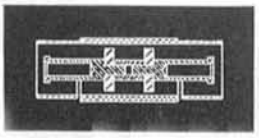
Total Capacitance: 2.4 μμf.
Insertion Capacitance: 1.3 μμf.
Net Weight: 1¾ oz.
Code Word: ACCESSOGOD
Price: $1.00



CONCENTRIC CONNECTORS

To obtain maximum flexibility with the cable and panel terminals described above, it is desirable to have adapters available to connect between two terminals of the same kind. The TYPE 774-F Plug Connector and TYPE 774-N Jack Connector are two-way units designed for this purpose. The plug connector has a plug terminal at either end and may thus be used to connect a jack-terminated cable to a panel jack, or to connect two cable jacks together. In a similar manner the jack connector makes possible connection of two plug-type terminals.

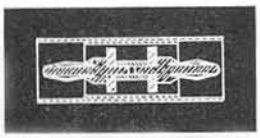
TYPE 774-N JACK CONNECTOR



Total Capacitance: 4.2 μμf.
Insertion Capacitance: 2.0 μμf
Net Weight: 1 oz.
Code Word: ACCESSONUT
Price: $1.00

TYPE 774-F PLUG CONNECTOR

Total Capacitance: 3.6 μμf.
Insertion Capacitance: 1.3 μμf.
Net Weight: 1 oz.
Code Word: ACCESSOFIG
Price: $1.00

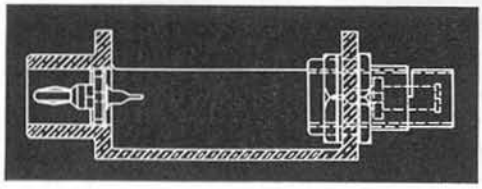


TYPE 774-X INSERTION UNIT

This unit is designed for housing dummy antennas, impedance-matching networks, attenuators, and similar circuits. It consists essentially of a hollow cylindrical aluminum casting with a plug connector at one end and a jack connector at the other. One side is partially cut away to permit the connection of circuit elements between the two terminals. A nickel-silver nameplate covers this opening, completing the shielding of the high potential terminals.

Total Capacitance: 6.0 μμf.
Insertion Capacitance: 4.9 μμf.

Type	*Net Weight*	*Code Word*	*Price*
774-X	4½ oz.	ACCESSOXEB	$4.50

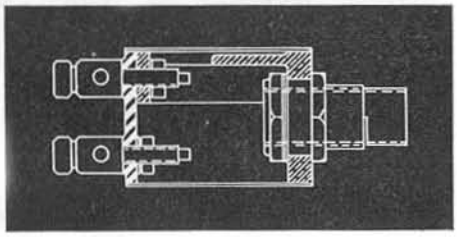


TYPE 774-YB TERMINAL UNIT

This unit provides a shielded housing for terminating resistors, at the same time making the output of a coaxial system available at a pair of ¾-inch spaced binding posts. As shown in the accompanying sketch, it consists of a coaxial jack, a pair of TYPE 138-V Binding Posts, and a metal housing.

Total Capacitance: 5.1 μμf.
Insertion Capacitance: 4.0 μμf.

Type	*Net Weight*	*Code Word*	*Price*
774-YB	4 oz.	ACCESSOYAM	$3.50



ALL DRAWINGS ARE ½ SIZE

TYPE 274-M DOUBLE PLUG

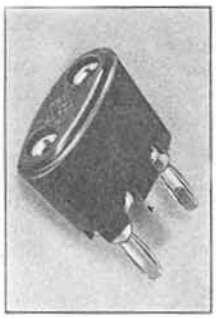
The popular TYPE 274-M Double Plug, which fits the terminals on General Radio instruments has been redesigned to improve both its appearance and its electrical characteristics. It is so shaped that it can be easily gripped by the fingers, and a dot is molded into the surface to indicate polarity.

Jack Spacing: ¾ inch on centers.

Power Factor: 0.07% at 1000 cycles.

Leakage Resistance: Greater than 10^8 megohms.

Direct Capacitance: 1 $\mu\mu$f, approximately.



Type 274-M Double Plug

Code Word: STANPARBUG

Unit Price	$0.50
Package of 10	3.50

TYPE 138-UL BINDING POST ASSEMBLY

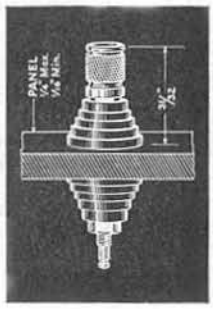
The TYPE 138-UL consists of a brass binding post (with top) and two hollow conical insulators, molded of polystyrene. It is designed for mounting on panels from 1/16 inch to ¼ inch thick through a 11/16-inch hole. With this mounting hole the spacing between panel and stud exceeds ¼ inch, insuring a very low capacitance; at the same time the power factor is extremely low, since the only solid dielectric is low-loss polystyrene. The d-c leakage resistance of the polystyrene is greater than 100 megamegohms, and the effect of surface leakage has been minimized by using a stepped conical insulator, which increases the length of the leakage path.

The shank is threaded to take a knurled top, is drilled to take a connector lead, and to receive the TYPE 274 Plug.

Type 138-UL Binding Post Assembly

Code Word: STANPARULE

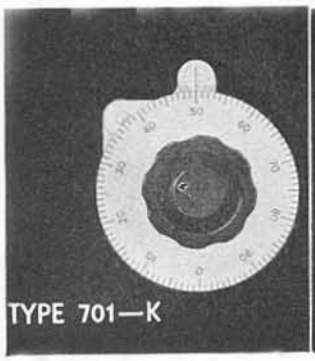
Unit Price	$0.50
Package of 10	4.00

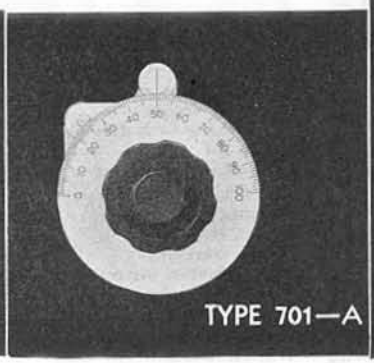


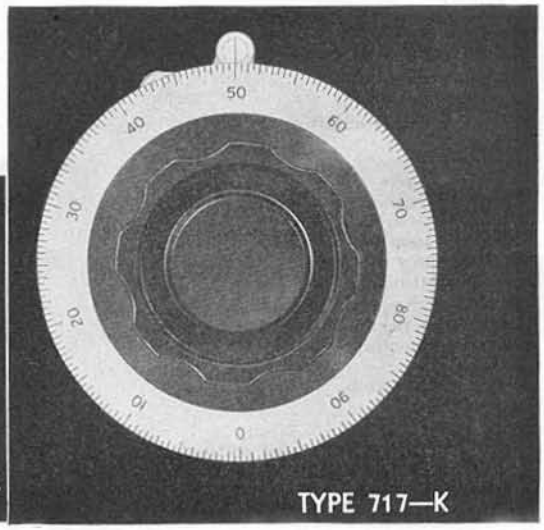
DIALS

The TYPE 717 Direct-Drive Dials and TYPE 703 Friction-Drive Dials are now available with 360° scales.

A 2-inch diameter dial is available with either 180° or 360° scale.







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

Type	Shaft Diameter	Dial: Arc	Dial: Divisions	Friction-Drive Ratio	Net Weight	Code Word	Price
703-K	¼ in.	360°	200†	1:5	8 oz.	DIHOP	$2.50
703-L	⅜ in.	360°	200†	1:5	8 oz.	DIHIP	2.50

● 4-INCH DIAMETER — TYPE 717 DIRECT-DRIVE DIALS

717-K	¼ in.	360°	200†	.....	5 oz.	DIHUG	$2.00
717-L	⅜ in.	360°	200†	.....	5 oz.	DIKEG	2.00

● 2-INCH DIAMETER — TYPE 701 DIRECT-DRIVE DIALS

701-A	¼ in.	180°	100	.....	2 oz.	DILAF	$1.25
701-K	¼ in.	360°	100	.....	2 oz.	DILUX	1.25

*PATENT NOTICE. See Note 17, page vi.

†Numbered 0 to 100, with half-division points indicated.

INDEX BY TYPE NUMBER

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