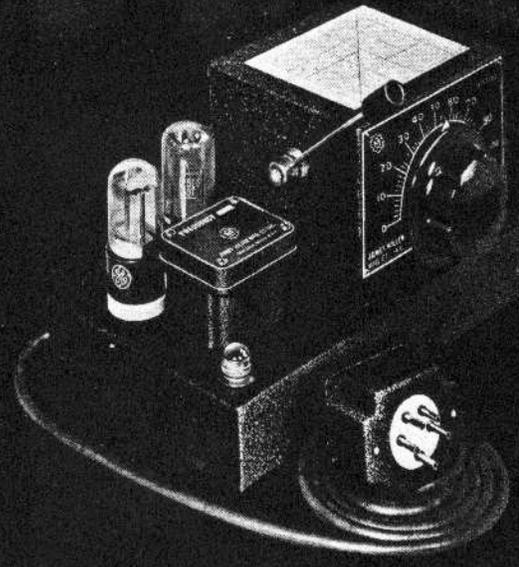


90800



90700

Amateur Band

TRANSMITTER ACCESSORIES

50-Watt Transmitter — Exciter
 USES 6L6 AND 807
Compact relay rack mounting

A Tri-tet circuit, which is used to obtain harmonic output, is reduced to the simple tetrode circuit for oscillator output at the crystal fundamental by short-circuiting the cathode tank circuit. Sufficient oscillator output at the fourth harmonic of the crystal frequency is obtainable to drive the 807, which may be operated as either a straight amplifier or frequency doubler, making it possible to obtain an output of 25 to 50 watts or more in four bands from a single crystal of properly-chosen frequency.

The entire unit is designed to operate from a single 250-ma. supply delivering up to 750 volts, the maximum voltage at which the 807 is designed to operate. A fixed bias of 45 volts is required for the 807 and the two heaters together consume 1.8 amperes at 6.3 volts. A single milliammeter with a scale of 200 ma. may be switched to read the plate current of either stage.

Because it is possible to double or quadruple frequency in the plate circuit of the oscillator and to double frequency in the plate circuit of the 807 as well, there are several possible combinations of coils and crystals which will produce the same output frequency.

90800, less tubes, but including one set of coils. *Net Price*

Additional coils, per set of three. *Net Price*

(In ordering state band in which crystal operates and band in which output is desired)

Variarm — ECO

A GOOD ECO AT A LOW PRICE

LOW DRIFT — Less than 0.06% from cold start
 Most drift in first 10 minutes.

VIBRATION IMMUNE — Shock mounted oscillator section; sturdy construction.

NO HAND CAPACITY

CHIRPLESS KEYING — Constant load on power supply.

GOOD BAND SPREAD — 100 dial divisions from 3500 to 3650 kc. "Variarm" vernier tuning.

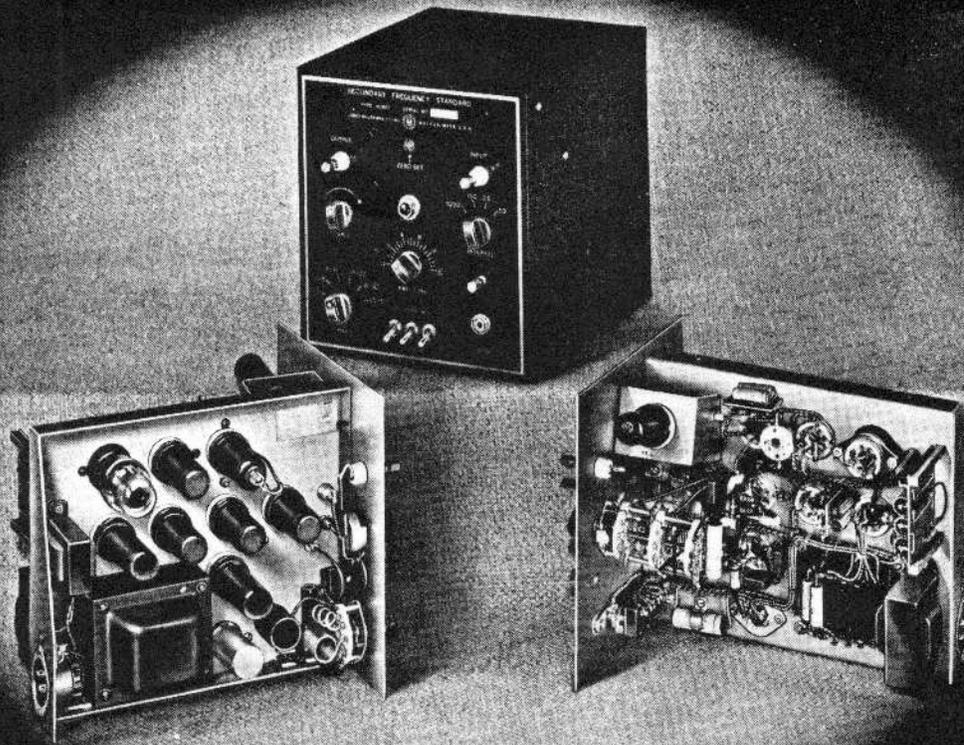
COMPLETE — Vibrationless power supply, three tubes, output coupling units.

The Rice-Variarm was described in detail in a comprehensive article by Henry E. Rice, Jr., in *QST*. The Millen commercial models are:

No. 90700 has fundamental oscillator frequency range of from 3500 to 3650 Kc. "Convenient-to-change" taps on amplifier and link coils provide for output on 80 or 40. Complete with G.E. tubes, ready to use. *Net Price*

No. 90701 is the same as No. 90700 except fundamental oscillator frequency range of from 1750 to 2000 Kc., providing for output on 160 or 80. Complete with G.E. tubes, ready to use. *Net Price*





Secondary Frequency Standard

The No. 90505 Secondary Frequency Standard is a precision frequency standard for both laboratory and production uses. The frequencies of the output signals are controlled by a crystal whose maximum frequency drift with temperature is less than one cycle per megacycle per degree centigrade change in temperature.

The 90505 may be zero-set against WWV (United States Bureau of Standards primary standard frequency signals) or against any other primary standard.

It is used in many types of calibration and in frequency checking 10 KC, 25 KC, 100 KC, or at every 1000 KC point from 10 KC to 50 MC. In conjunction with an external oscillator any frequency in the range of 10 KC to 50 MC. can be measured. The No. 90505 may be used for convenient and precise measurement of transmitter and signal generator frequency when used in conjunction with audio oscillators and audio-frequency meters or oscilloscopes for checking the calibration of the receivers.

The 90505 Secondary Frequency Standard contains a mixer so that signals connected to the input terminals can be mixed with the output of the Frequency Standard to determine the frequency of the input signal.

The Secondary Frequency Standard consists of a 6K8 1000 KC crystal oscillator and buffer, a 6SN7-GT

100 KC multivibrator, a 6SN7-GT 25 KC and 10 KC multivibrator, a 6SJ7 mixer, a 6J5 audio oscillator for the modulation, a 6V6 harmonic amplifier with band-switching tuned plate circuit, a VR-150-30 voltage regulator and a 5Y3-GT or 5W4 rectifier.

This compact, convenient, precise, and dependable Secondary Frequency Standard is used in quantity by G.E., RCA, Western Electric, Sperry, Westinghouse, Signal Corps, Navy, F.C.C., various crystal grinding laboratories and many broadcast stations.

Power Supply:

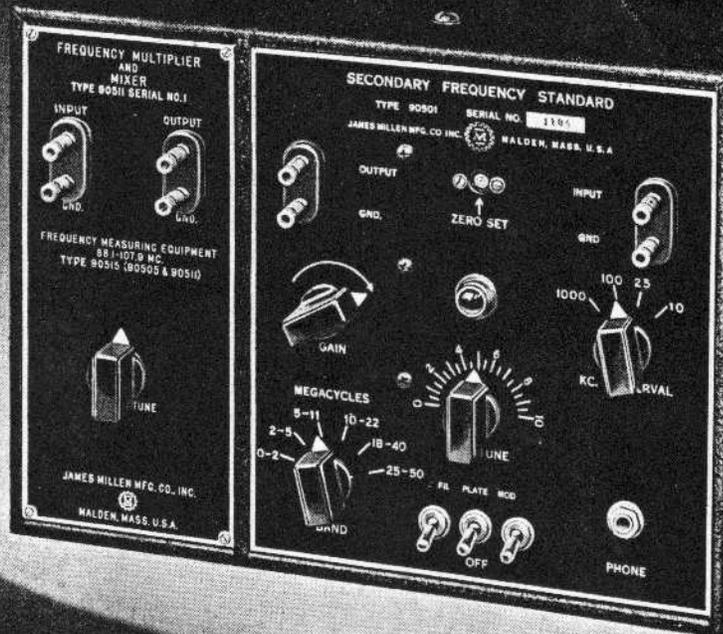
105-125 volts 60 cycles
Power consumption 44 watts
Fuse size 1½ ampere
Other models available

Physical Dimensions:

Height 9½ inches
Width 9 inches
Depth 10½ inches
Weight 20 pounds

Code	Description	Net Price
90505	Secondary Frequency Standard complete with low-drift 1000 KC crystal and all tubes. 105-125 volt 60 cycle power supply.	
90507	Secondary Frequency Standard complete with low-drift 1000 KC crystal and all tubes. 220 volt 50/60 cycle power supply.	





90515

Frequency Calibration Unit

Carrier frequency stability requirements for FM broadcast and station monitors, as set forth by FCC, are very rigid. Since most FM stations will be located where frequency monitoring services are not readily available, it is desirable that trained station technical personnel have some means of checking carrier frequency, against the Government standard station WWV. The procedure employed in making such measurements must be of sufficient accuracy to assure compliance with the FCC requirements. Many methods for checking frequency have been successfully used but the majority of these require expensive equipment. A relatively simple and inexpensive procedure, employing comparison of the transmitter carrier frequency with WWV and accurate to a maximum error in the order of 50 cycles at carrier frequency, is possible by using the special No. 90511 multiplier-crystal mixer unit, together with a secondary frequency standard No. 90505. The combination of these two units comprises the No. 90515 frequency calibration unit. This combination is used in conjunction with a standard communication receiver which is tuned to the 5, 10 or 15 megacycle WWV transmission. The equipment can then be adjusted so as to obtain a beat with WWV, whose carrier frequency at any instant is accurate to better than one part in ten million. The secondary frequency standard, when compared with the signal from WWV, is accurate to three parts in ten million. This accuracy can be maintained for more than sufficient time to make the necessary measurements. The total overall error, including error in WWV,

secondary frequency standard error and measurement error will result in a total possible error of less than 50 cycles at the carrier frequency.

The No. 90511 multiplier unit consists of two double-function 6J6 tubes, both of which are used as double multipliers to obtain an output of 81 megacycles. This output is mixed with the transmitter signal by means of a 1N34 germanium crystal. Tuning of the multiplier stages is fixed, whereas tuning of the mixer stage is brought out to the front of the panel. The entire unit is mounted in a cabinet $9\frac{1}{2}$ " high x 13" wide and $10\frac{1}{2}$ " deep, the left side of which includes the 90511 multiplier unit, the right side the 90505. The 90511 is sold in the large cabinet so that it is possible for any one already having a 90505 to install it in the cabinet, making it a complete unit. The 90515 is furnished complete with the multiplier unit and secondary frequency standard.

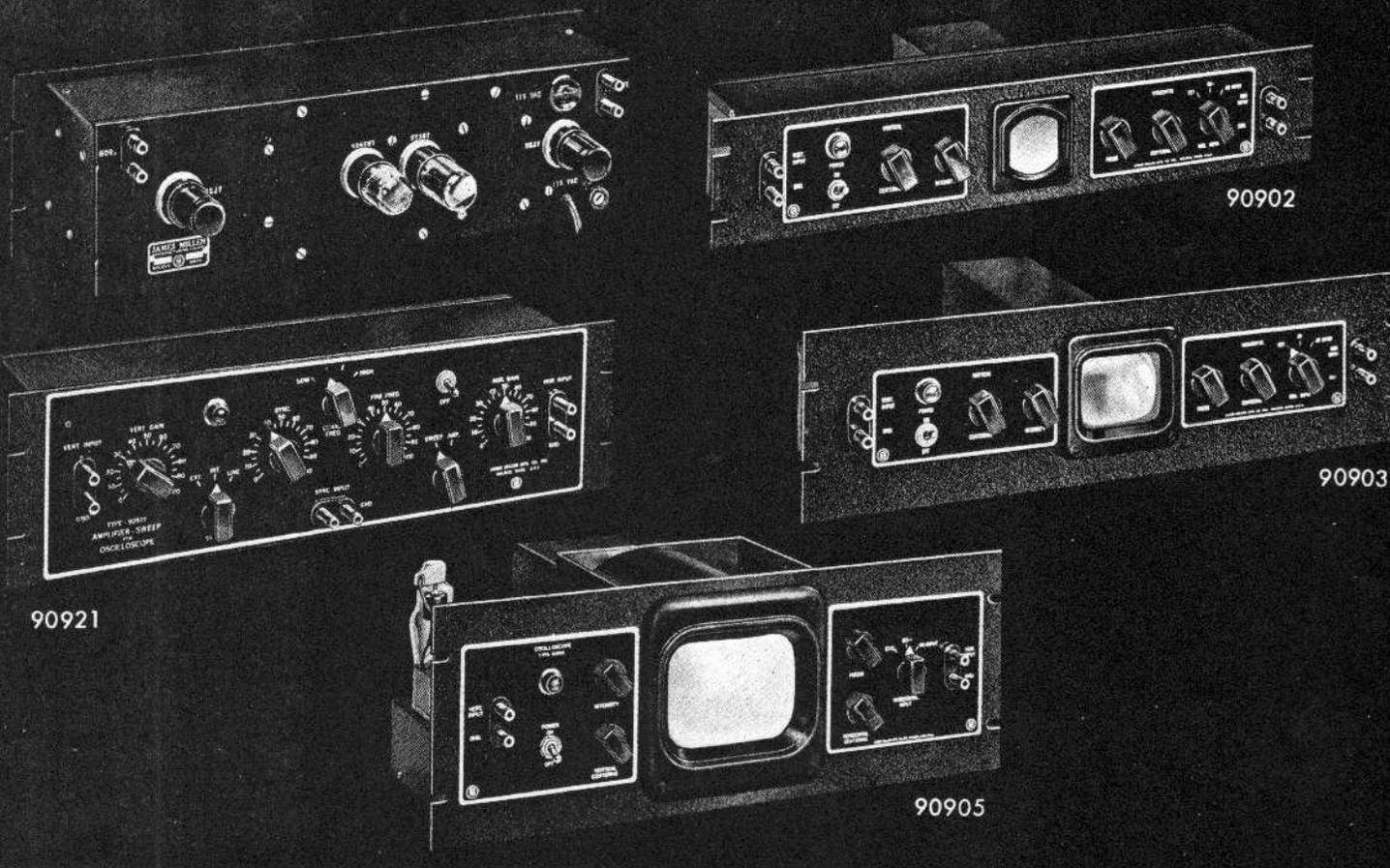
Cabinet Size:..... $9\frac{1}{2}$ " high
 13 " wide
 $10\frac{1}{2}$ " deep

Weight:..... 32 lbs.

No. 90511 Multiplier unit, less 90505 frequency standard but with cabinet for mounting frequency standard, with tubes.....\$

No. 90515 Complete combination multiplier and frequency standard unit, comprising 90511 and 90505, complete with tubes and crystal, 115 volt 60 cycle AC....\$





Basic Units

Herewith is presented a group of units designed for either of two purposes. That is, general laboratory and experimental use in their normal form as complete self contained portable equipments of their respective types, or else as basic unit components for actual permanent incorporation into more involved specialized complete equipments. The group includes such items as oscilloscopes, power units, IF strips, video amplifiers, filters, and delay lines, etc.

THE OSCILLOSCOPES

The 90902, etc., series oscilloscopes in their packaged form are entirely adequate for many laboratory as well as industrial and communication uses. As a transmitter modulation monitor, no additional equipment or accessories are required. The well known trapezoidal monitoring patterns are secured by feeding some modulated carrier voltage from a pick up loop directly to the vertical plates of the cathode ray tube and some audio modulating voltage to the vertical plates.

By the addition of such units as sweeps, pulse generators, amplifiers, servo sweeps, etc., all of which can be conveniently and neatly constructed on companion rack panels, the original basic scope unit can be expanded to serve any conceivable application.

Here again the research engineer is freed of the drudgery of such time consuming mechanical construction as mounting the cathode ray tube, providing proper and adequate magnetic shielding, building the high voltage power supply, providing proper safety features, etc., and other such details of the basic scope before being able to proceed with his specialized work. Available in several models, as follows:

No. 90902: Two inch oscilloscope less tubes, 115 V 60 cycle AC supply.....	\$
No. 90903: Three inch oscilloscope less tubes, 115 V 60 cycle AC supply.....	\$
No. 90905: Five inch oscilloscope less tubes, 115 V 60 cycle supply.....	\$

THE AMPLIFIER-SWEEP

The Millen 90921 Amplifier-Sweep is an accessory which may be used with any basic oscilloscope. It contains a 6SJ7 amplifier for the signal voltages to be applied to the oscilloscope vertical deflection plates, a 6SJ7 amplifier for the horizontal deflection signal, a sawtooth sweep generator whose output may be applied to the horizontal amplifier, and an internal power supply. The response of each amplifier is flat within 2 db from 15 cycles to 125 kilocycles. The gain of each amplifier is approximately 30 db. Maximum undistorted output from each amplifier is "hard" tube oscillator to generate a linear sweep covering 15 cycles to 40 kilocycles in four overlapping ranges. The 90921 was designed especially for use with the Millen 90902, 90903 and 90905 basic oscilloscopes.

Power Supply

105-125 volts — 60 cycles
Power consumption — 32 watts
Fuse size — 1 ampere

Physical Dimensions

Height..... 5 1/4 inches
Width..... 19 inches
Depth (overall including tubes)..... 8 3/4 inches
Weight..... 13 pounds

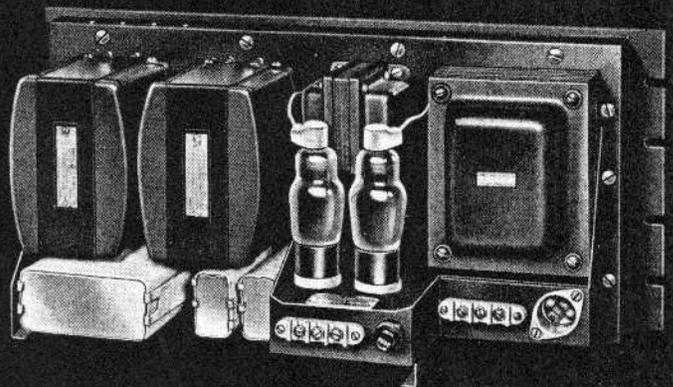
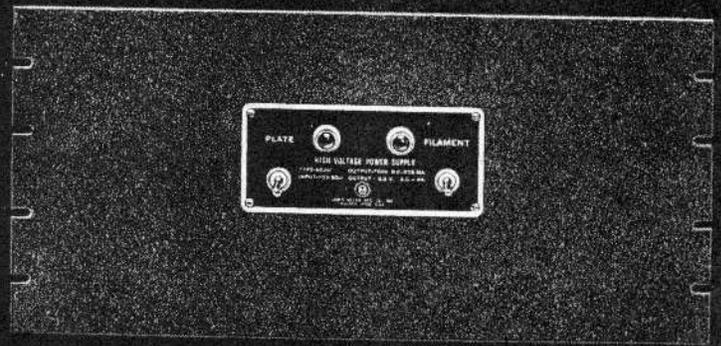
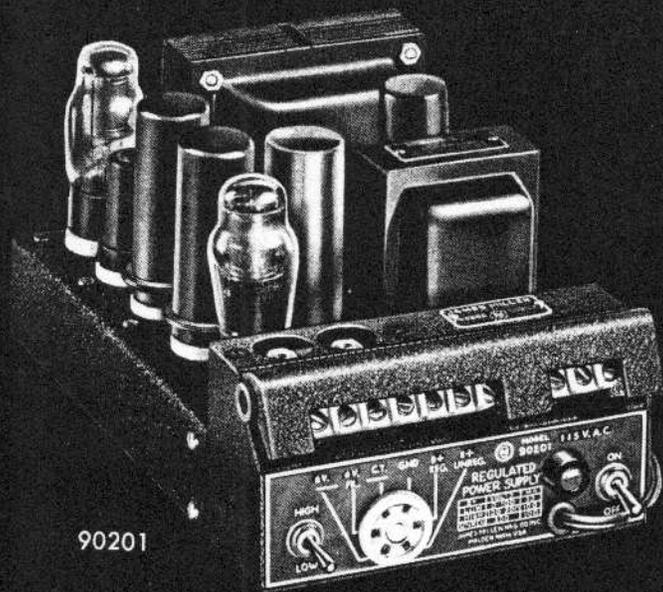
The 90921 Amplifier-Sweep is designed to mount in a Standard rack panel

Tube Complement

1-6SJ7 — Vertical Amplifier
1-6SJ7 — Horizontal Amplifier
1-6SN7-GT — Sweep Generator
1-5Y3-GT — Rectifier

Gain of each amplifier — approximately 30 db
Frequency Response — Flat within 2 db — 15 cycles to 125 kilocycles
Sweep Frequencies — 15 cycles to 40 kilocycles
Maximum D.C. to amplifier input — 400 volts
Maximum undistorted amplifier output — approximately 70 volts peak to peak
No. 90921 Amplifier-Sweep less tubes..... \$





Basic Power Supplies

Herewith is presented the first in a group of universal power supplies for general laboratory and experimental use, as well as incorporation in the assembly of complete amateur and commercial transmitters. The No. 90281 described herewith is also suitable for use with our basic No. 90800 universal exciter unit.

THE REGULATED POWER UNITS

The 90200 series of Regulated Power Supplies is a specific example of such basic components. One use for which these power supplies have been designed is to serve as compact easy to use universal type of general purpose laboratory instruments for temporary or permanent table top use. The high voltage output is obtained either through a five prong connector plug or from a barrier type terminal strip protected by a hinged safety cover. Convenient switches, AC cord, and fuse receptacle combined with compactness contribute to ease of use.

The second application for which this series of Regulated Power Supply units has been designed is as a "DC Package" for directly mounting in a permanent place in the larger chassis of any special equipment being constructed. Then the designer and builder of such an apparatus may concentrate his abilities and time upon that part of his project to which he alone can best contribute without the necessity of devoting effort and time to a power source that can better be purchased in ready to use form.

The power units are fastened to an equipment chassis by means of four $\frac{1}{4}$ -20 machine screws into heavy tapped corner plates welded securely to the underside of the power unit. Required chassis space: $7\frac{1}{8}$ " x 11", and overall height of $5\frac{1}{8}$ ".

Regulated voltages: 4 to 115 at 30 mA. and 100 to 200 at 85 mA.

Unregulated voltages: 240 volts at 150 mA., 6.3 AC volts at 2 amps. C.T.

The tubes required are: 5T4-1, 6L6-2, 6SJ7-1, VR75-1, VR105-1.

No. 90201 Regulated Power Unit, complete with tubes for 115 V 60 cycle input..... \$

Shipping weight: 15 lbs.

THE HIGH VOLTAGE POWER UNITS

The No. 90281 high voltage power supply has a d.c. output of 700 volts, with maximum current of 235 ma. In addition, AC filament power of 6.3 volts at 4 amperes is also available so that this power supply is an ideal unit for use with transmitters, such as the Millen No. 90800, as well as general laboratory purposes.

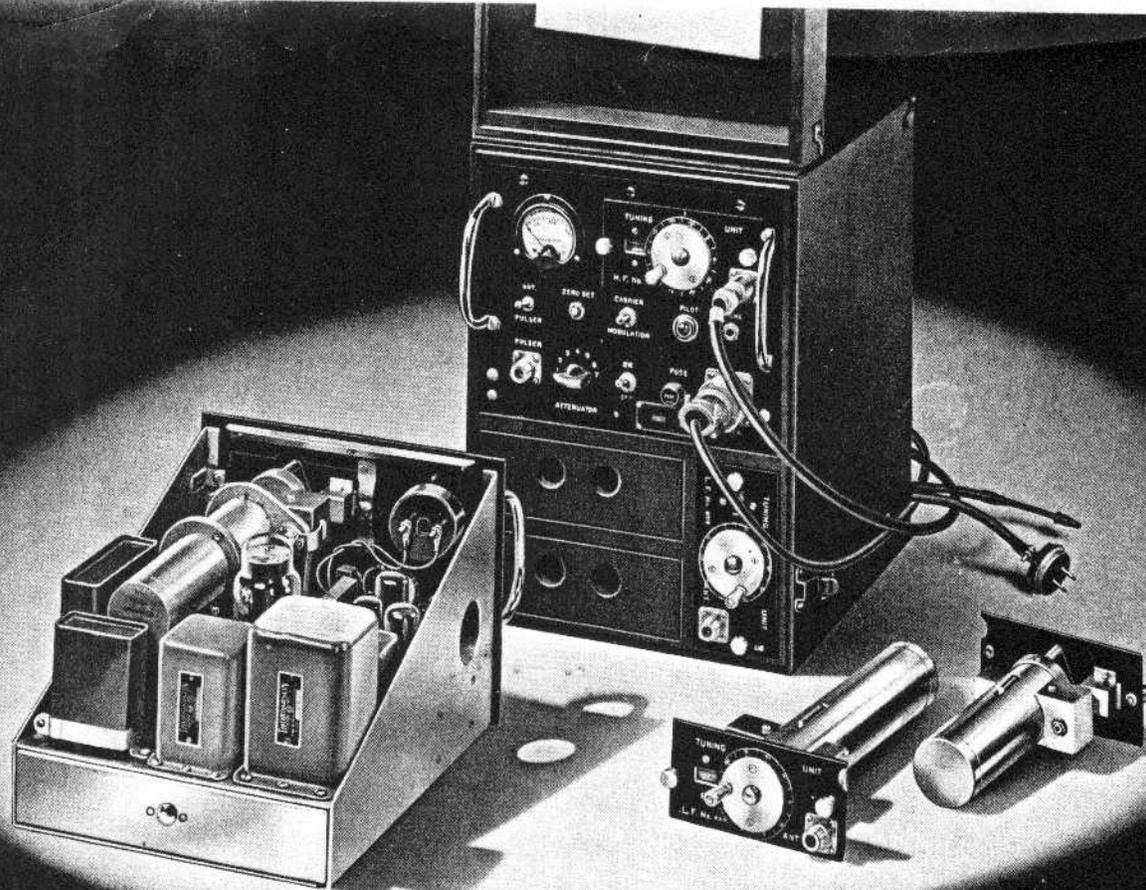
The power supply uses two No. 816 rectifiers and has a two section II filter with 10 henry General Electric chokes and a 2-2-10 mfd. bank of 1000 volt General Electric Pyranol capacitors. For convenience of operation, a dual AC input terminal arrangement is provided. First, there is the conventional AC cord and connector; second, there is, in parallel with this connector, a terminal block with extra connections for independent switching of rectifier filament and plate transformers.

The front panel carries the filament and plate toggle switches and their associated pilot lamps, for use when the remote switching system is not employed. The panel is standard $8\frac{3}{4}$ " x 19" rack mounting.

No. 90281 — High Voltage Power Supply, 115 V 60 W, less tubes..... \$

Shipping weight: 60 lbs.





Ultra High Frequency Calibrator

The 90630 cavity-type frequency calibrator covers the frequency range of 200 to 700 megacycles with a maximum calibration error of not over 0.25%. The range of 200 to 700 megacycles is covered by two plug-in cavity-type tuning units which may be interchanged by loosening two thumb screws on the front of the calibrator panel. The calibrator may be used on harmonics up to 1500 megacycles at somewhat reduced sensitivity.

The calibrator consists of an accurately calibrated cavity-type tuning unit, a crystal detector, a two-stage video amplifier, and a peak-reading vacuum tube voltmeter.

The video amplifier of the calibrator is provided with a seven-step attenuator and a separate input and crystal detector for measuring the voltage of pulsed or modulated radio-frequency signals without going through the cavity tuning unit. The calibrator will respond to any signal modulated with a negative pulse whose repetition rate is between 250 cycles per second and 3200 cycles per second and whose pulse width is 2 microseconds or greater.

The equipment is provided with a phone jack so that the modulation on the signal may be orally monitored.

The 90630 may be used as a relative power output indicator, a modulation monitor, or an untuned receiver with a crystal detector and a peak reading vacuum tube voltmeter, as well as a frequency calibrator.

The frequency calibrator may be used with or without the video amplifier. When it is desired to use the frequency calibrator on an unmodulated radio-frequency carrier, the rectified voltage across the detector crystal in the cavity tuning unit is applied directly to the meter on the panel of the calibrator.

The sensitivity of the equipment used as a receiver without the tuning unit is approximately 20 millivolts. The overall sensitivity

of the equipment with tuning unit is approximately 100 millivolts r.m.s. for a 30 microampere deflection on a 500 microampere meter on the calibrator at 200 megacycles. This sensitivity increases from 200 to 400 megacycles, and the overall sensitivity from 400 to 700 megacycles is approximately 20 millivolts r.m.s. for a deflection of 30 microamperes on the 500 microampere meter on the panel of the calibrator.

Connectors on the panel of the frequency calibrator are type N connectors.

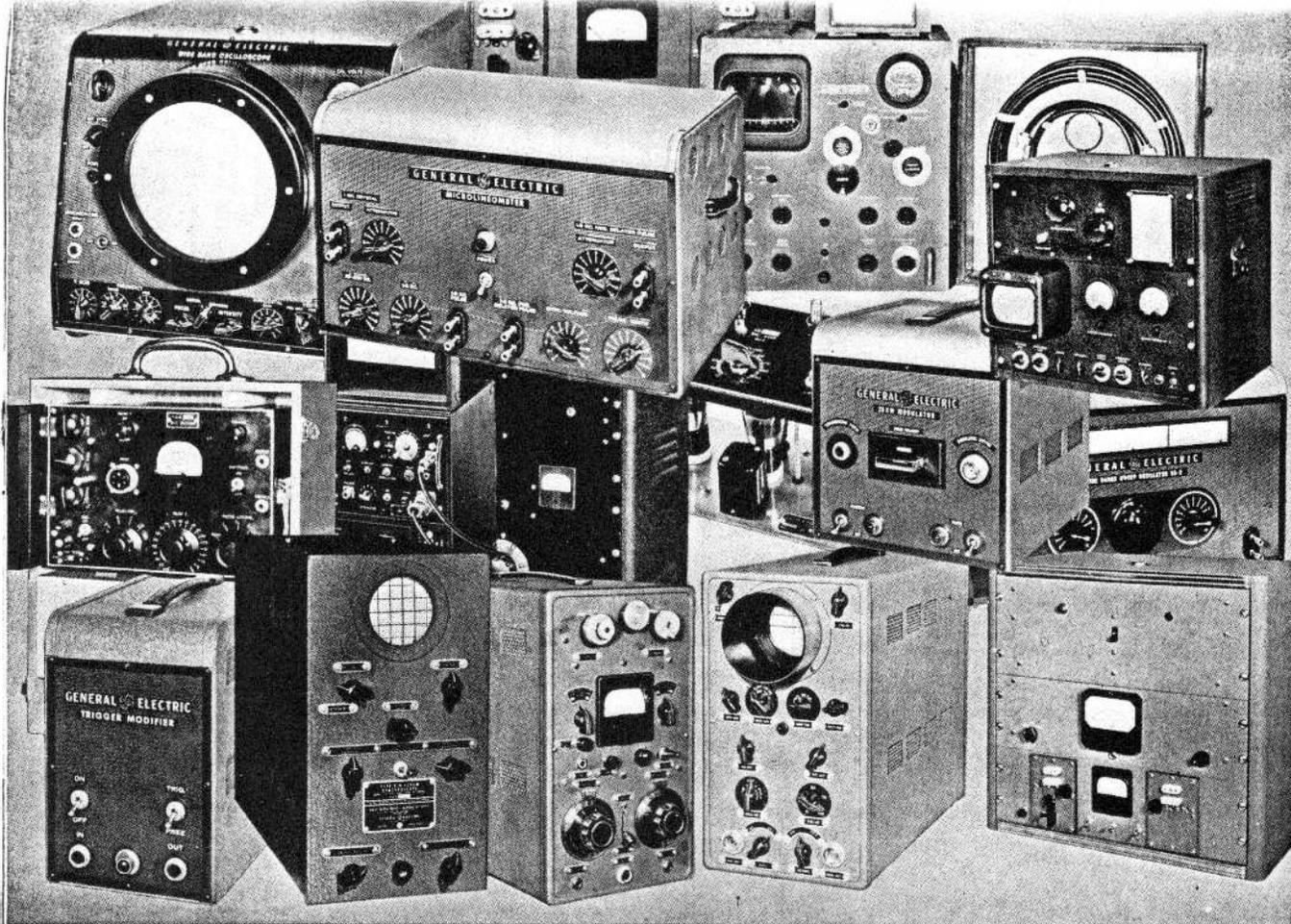
The 90630 is supplied in a mahogany carrying case complete with two cavity tuning units, complete calibration tables of one megacycle calibration points, from 200 to 700 megacycles, a probe antenna, a power cable, one spare 1N21B crystal detector, and sufficient instructions and precautions for the proper operation of the equipment.

Carrying Case 15" x 11½" x 15¼"
Weight 51½ lbs.

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Code	Description	Net Price
90630	115 Volt 60 cycle or 400-1200 cycle (state which) Frequency Calibrator complete with extra cavity, tubes, cables and carrying case.....	





Special Products

Our special products division is prepared to promptly make, in small or medium quantities, to customers' specifications, all types of electronic equipment, whether it be for communication, industrial control, medical, nuclear physics, or other such fields. We are prepared to work from prototypes, circuits, or final performance specifications, and to furnish mechanical design, styling and other such engineering services, including the design and manufacture of any special components that may be required, including variable capacitors, dials, cavities, etc.

Illustrated herewith are a few units of varied types, recently produced for the radio industry. Some are test units for the customer's own use, while others were styled and manufac-

tured for the customer to "resell" as part of his own line of standard merchandise. In this latter respect, we can be of particular aid to those large companies whose particular abilities lie generally in large production but require, from a sales angle, small runs of complicated items to round out their lines. We can, on a much shorter time basis and at a much lower cost, handle the production of such items for them. We are primarily interested in short run, highly specialized equipment, in which we can use our abilities for ingenious mechanical design, plus the flexible production facilities at our command. We are not interested in large quantities of low priced units, such as private brand broadcast receivers and components thereof.

