

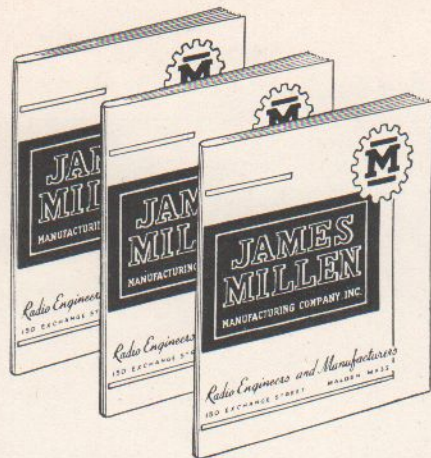
JAMES MILLEN

MANUFACTURING COMPANY, INC.

Radio Engineers and Manufacturers



ELECTRONIC LABORATORY EQUIPMENT 1946-1947



MILLEN RADIO PRODUCTS are divided, for cataloging purposes, into three groups, covered by three separate catalogs:

- I. Component Parts
- II. Communication Receivers and Transmitters
- III. Laboratory and Measurement Equipment

THIS CATALOG describes and lists those of our standard laboratory instruments and special products, not normally carried in stock by our franchised distributors. Our distributors carry in stock our complete line of component parts and amateur receivers and transmitters, but due to the engineering correspondence generally required in connection with the merchandising of laboratory equipment, these instruments are normally sold through our district offices or from the main sales office at the factory. Any of our distributors, however, will, upon request, be happy to place your order on the factory and thus secure for you any of the items in this catalog, although they do not normally carry them in stock.

THE PRICES IN THIS CATALOG are strictly net for the eastern part of Continental U.S.A. (Prices on some items are slightly higher west of the Rockies and approximately 60% higher, because of customs duties, etc., in Canada.) All discounts have already been deducted for your convenience. The code numbers used are all that it is necessary to give in placing an order. They fully describe each item and also are selected so as to count as only "one word" when sent by telegraph. Most combinations of letters and numerals generally used for this purpose normally count as three words.

OUR DOMESTIC DISTRICT SALES OFFICES are maintained in all principal cities where full information about our products and policies may be promptly obtained by telephone or mail. A full list of these offices is tabulated on the back cover of this catalog.

OUR EXPORT SALES OFFICE is located in New York City at 9 Rockefeller Plaza, under the direction of Mr. C. Lohman Janik, whose many years of experience in handling export sales and the shipment of radio and electrical apparatus enables us to handle export shipments quickly and efficiently, with a minimum of expense and delay to our customers, in all parts of the world. The central location of our export office in New York City enables us not only to give quick replies to our foreign correspondents, but also to offer the facilities of our office and the services of its staff to our many friends and customers from other countries who normally visit this country through the great port of New York.

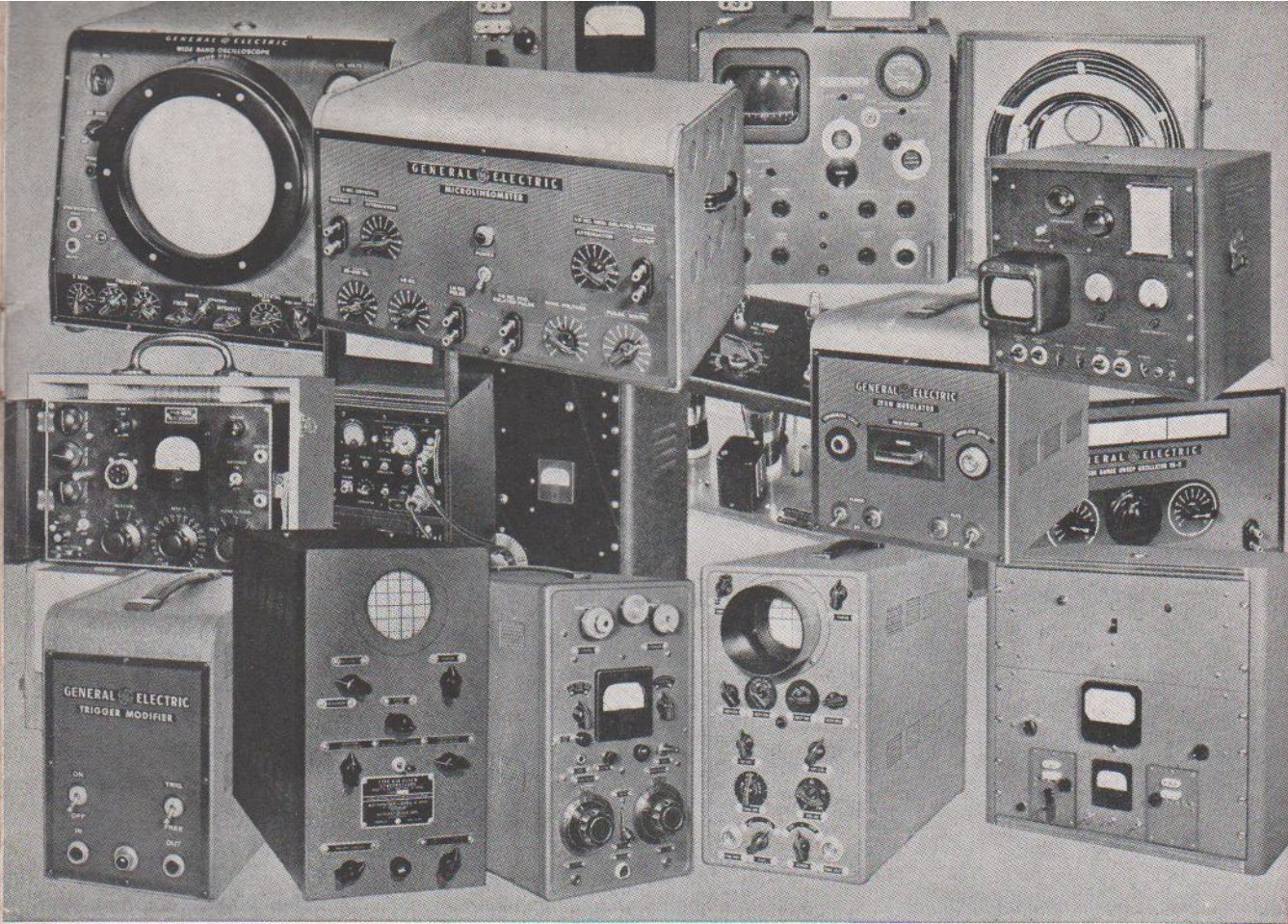
GOVERNMENT AND COMMERCIAL APPARATUS. In addition to our standard line of catalog items distributed through our foreign and domestic dealers, we operate a special design and contract manufacturing department where we specialize in the development and manufacture of component parts and complete Transmitters, Receivers, Amplifiers, Control Units, etc., for the different government departments and such commercial communication equipment manufacturers as the General Electric Company, the Western Electric Company, the Radio Corporation of America, the Federal Telegraph Company, and many others. We are very much interested in receiving inquiries from commercial equipment manufacturers for this department.

OUR PRODUCTS ARE GUARANTEED in accordance with the terms of the standard uniform guarantee of the Radio Manufacturers Association, in which organization we hold membership.

PATENTS. Our products are manufactured under many patents and patent applications of our own as well as licenses from the principal patent pools. See special labels attached to products. Trade marks Reg. U. S. Pat. Office.

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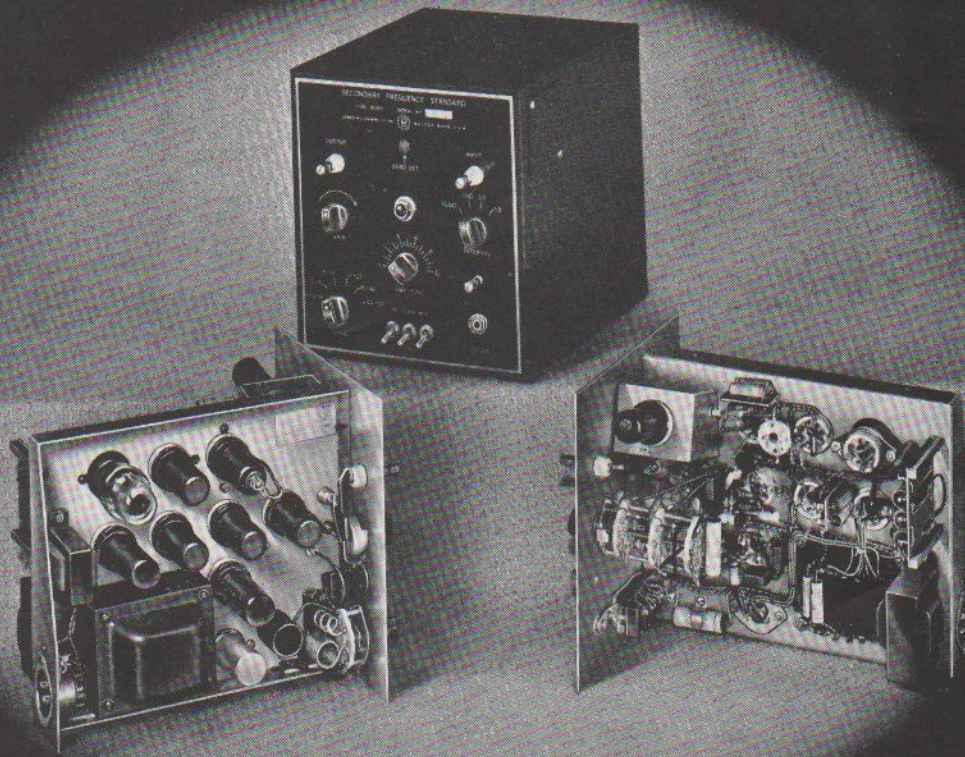
Special Products

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.





Secondary Frequency Standard

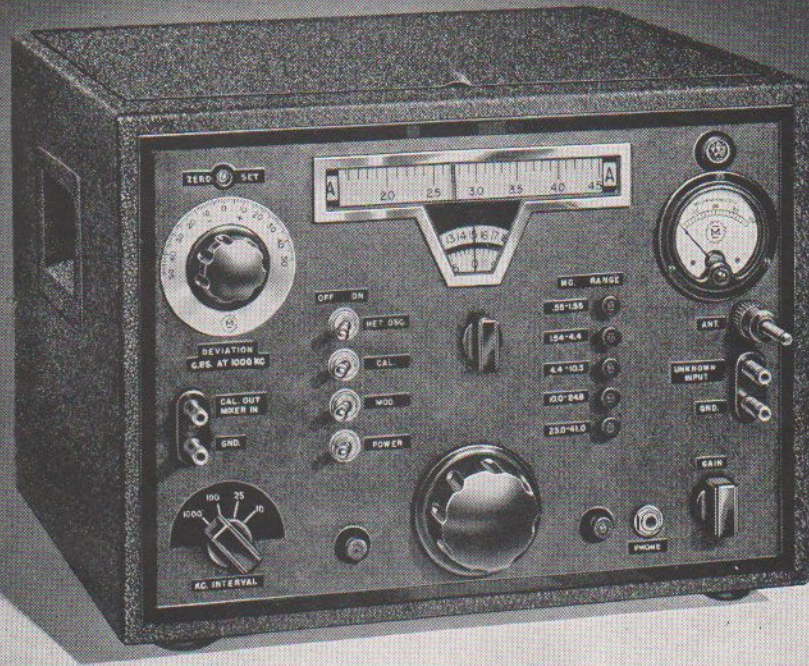
A Precision Frequency Standard for both Laboratory and production uses. Designed around the GE G-18 and G-51 crystal, so as to have a frequency temperature coefficient of less than 1 cycle/Mc/C°. The crystal is sealed in Helium in a standard metal tube envelope. Adjustable output provided at intervals of 10, 25, 100, and 1000 KC with magnitude useful to 50 MC. Harmonic amplifier with tuned plate circuit and panel range switch. 900 cycle modulator, with panel control switch. Panel plate supply control switch. In addition to Oscillators, Multi-vibrators, Modulators, and Amplifiers, a built-in Detector with 'phone jack and gain control on the panel is incorporated. Easily adjusted to WWV. Self-contained AC power supply with VR 150-30

voltage regulator. Used in quantity by Signal Corps, Navy, FCC, British and all large government prime contractors such as GE, RCA, Western Electric, Sperry, Westinghouse, etc. Cabinet size 9" x 9⁵/₈" x 10¹/₂", weight 20 lbs. Compact, dependable, stable, trouble-free.

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Code	Description	Net Price
90505	115 volt 60 cycle AC operated. Secondary Frequency Standard complete with GE Crystal and all tubes	
90507	220 volt 50/60 cycle AC operated. Secondary Frequency Standard complete with GE Crystal and all tubes	





Frequency Determination Unit

The Model 90640 Frequency Determination Meter is a complete instrument for frequency measurements between 550 kc and 41 megacycles, requiring no external equipment. Former frequency measuring procedure necessitates the use of some combination of secondary frequency standard, heterodyne frequency meter and a general coverage receiver. The 90640 Frequency Determination Meter incorporates such portions of these various devices as may be necessary to form a complete unit equipment. This device is versatile, in that it is adapted to rapid rough frequency determination checks, as well as precision measurements. Frequency accuracy up to approximately 0.5% can be obtained by means of direct dial reading. Accuracies up to 0.001% can be obtained by means of a calibration chart and the self-contained crystal calibrator. This single instrument offers both time saving on measurements where accuracy is not of prime importance and, at the same time, the precision of a secondary frequency standard, where such is required.

The No. 90640 Frequency Determination Meter incorporates the selectivity and sensitivity of two tuned RF stages at the frequency of the signal to be measured, together with the multivibrators, modulators and low

drift crystal oscillator (less than one cycle per megacycle per degree centigrade) desirable in a secondary frequency standard. A crystal zero set, deviation calibration, zero beat indicator and direct calibrated dial add to the versatility of the instrument. Ease of use has been given due consideration, resulting in motor driven dial and motor driven band changing. The 90640 Frequency Determination Meter incorporates the following tubes:

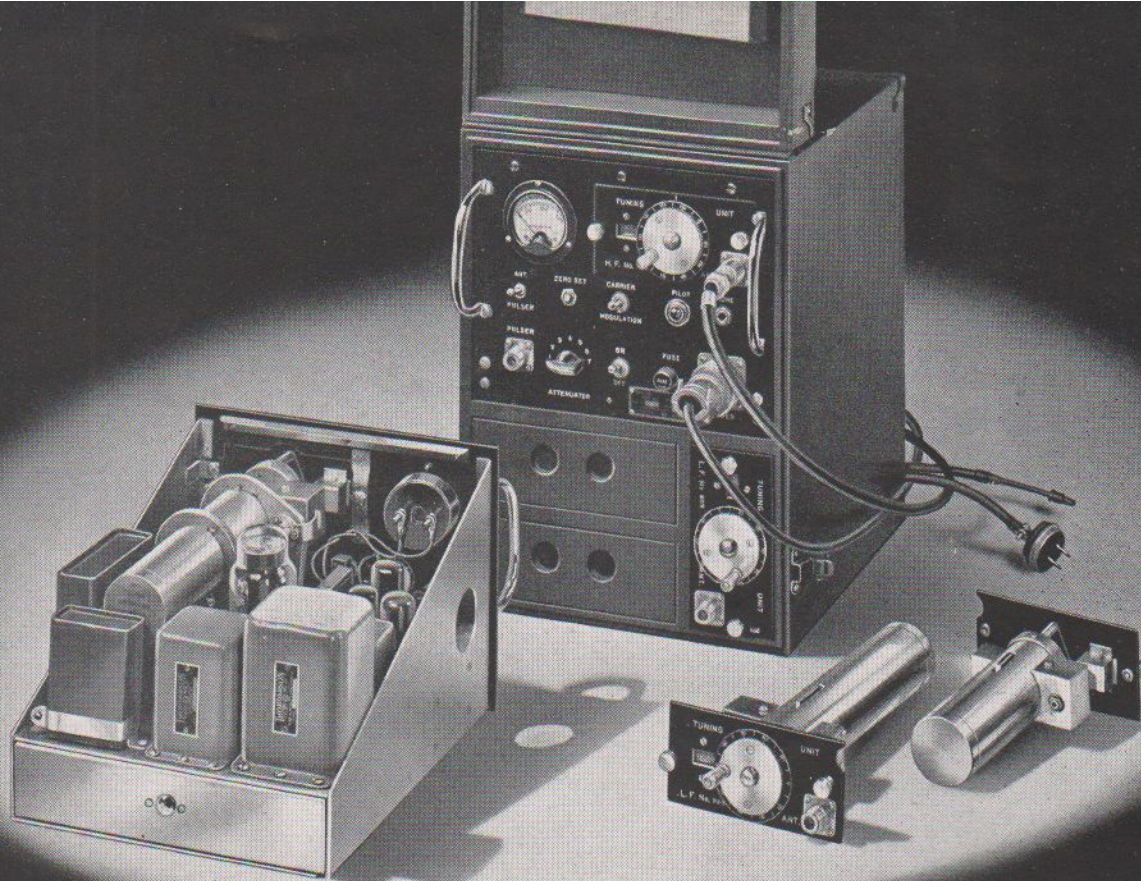
6J5 Heterodyne Oscillator	6K8 Crystal Oscillator
6L7 Mixer	6SN7-GT 100 kc Multivibrator
6AK5 R-F Amplifier	6SN7-GT 25-10 kc Multivibrator
6J5 Modulator	VR-150 Voltage Regulator
6J5 Audio Amplifier	5Y3-G Rectifier

The standard 90640 covers a frequency range of 550 kc to 41 megacycles, in five bands. Special models can be custom built for other frequency ranges or specialized applications.

Cabinet size: 14" x 12½" x 9⅝"
Weight: 47 lbs.

No. 90640 Frequency Determination Meter, complete with tubes and crystal, 115 volt, 60 cycles, A.C.
Net Price..... \$





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.

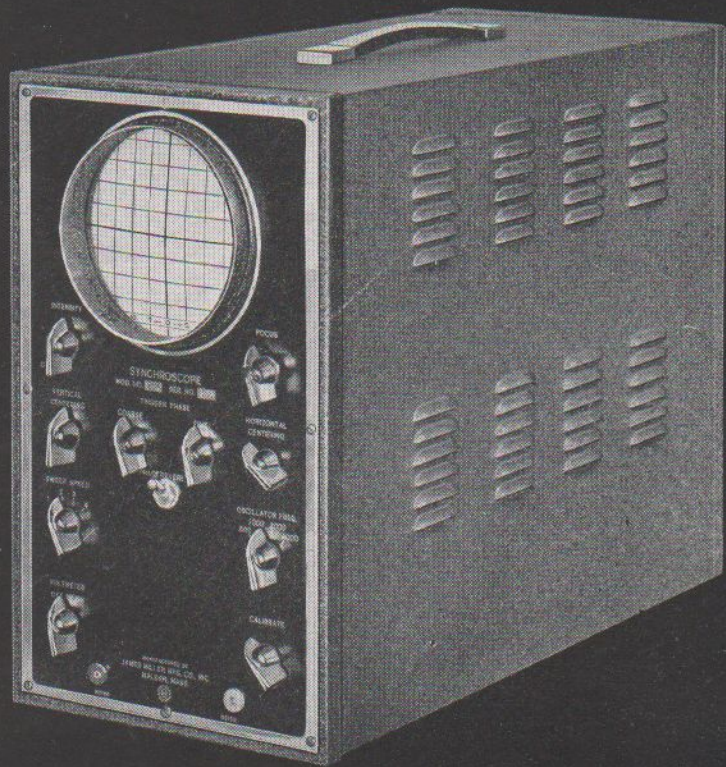
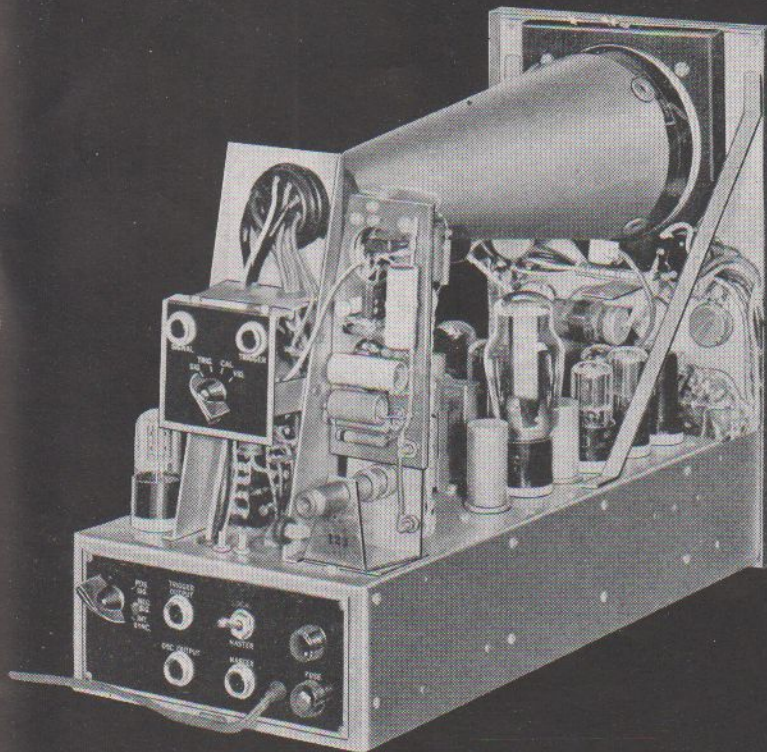
The 90630 is supplied in a mahogany carrying case complete with two cavity tuning units, complete calibration tables of one megacycle calibration points, from 200 to 700 megacycles, a probe antenna, a power cable, one spare 1N21B crystal detector, and sufficient instructions and precautions for the proper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





Synchrosopes

The Millen P-4 Synchroscope is a very compact synchroscope, designed in co-operation with the M.I.T. Radiation Laboratory, for intermittent laboratory use. It has a built-in triggering circuit, which operates at any of four repetition rates; and with a synchronized sweep with any of four sweep speeds. The sweep circuit in the P-4 Synchroscope may be synchronized to an external positive or negative triggering pulse. The internal trigger in the sweep circuit may be driven by an external audio oscillator, at any frequency between 370 cycles and 5000 cycles per second. The internal trigger pulse and the sweep generator are synchronized by means of a local oscillator or an external sine wave source. The frequency of this oscillator may be set to 500, 1000, 2000 or 4000 cycles per second, by the OSC. FREQ. switch on the front panel. The oscillator output, after amplification, is available at the OSC. OUTPUT jack on the rear of the Synchroscope. These frequencies are within $\pm 10\%$ of the specified frequencies. The sweep speed may be selected by the SWEEP SPEED switch on the front panel. Sweep speeds are approximately: No. 1, 0.5 microseconds per inch, No. 2, 2 microseconds per inch, No. 3, 6 microseconds per inch and No. 4, 25 microseconds per inch. Any of these sweep speeds may be used at any of the oscillator repetition rates.

The calibration of the two fastest sweep speeds may be checked by an internal calibrator, by switching the input switch on the rear, to CAL.

A phase shifting circuit is incorporated for shifting the phase between the internal trigger pulse and the horizontal sweep. The phase shift may be controlled by the COARSE and FINE TRIGGER PHASE controls on the front panel. Phase may be reversed by the PHASE REVERSING switch on the front panel.

The vertical sensitivity of the Synchroscope may be calibrated with a D.C. voltmeter, plugged into the METER jacks on the front panel.

The A.C. power switch is ganged with the INTENSITY control. The INTENSITY, FOCUS, VERTICAL CENTERING and HORIZONTAL CENTERING perform the same functions in the P-4 Synchroscope as in a standard oscilloscope.

An intensifying pulse is generated in the unit, and applied to the control grid of the cathode ray tube, to intensify the forward trace of the sweep, and blank out the return trace.

The sweep circuit consists of a multivibrator, whose natural frequency is approximately 370 cycles per second; a triode, which is cut off by the negative output of the multivibrator, permitting a condenser to discharge through a pentode.

The repetition rate of the multivibrator is determined internally when the synchronizing switch on the rear of the Synchroscope is switched to INT. SYNC., or from one plate or the other of the phase inverter, when the synchronizing switch is turned either to POS. SIG. or NEG. SIG., when the synchronized sweep is being driven by an external trigger pulse, plugged into the TRIGGER jack on the rear.

The four sweep speeds are the specified values within $\pm 20\%$. The actual sweep speeds are calibrated at 1000 cycles per second repetition rate and averaged over the first three inches of sweep, when the first three inches are centered on the face of the cathode ray tube. Although the sweep is quite linear, it is not entirely linear, so that the sweep speed measured over a small portion of the face of the tube is not exactly the average sweep speed. An internal sweep calibrator signal may be applied to a vertical plate of the cathode ray tube, by turning the input switch to CAL. The frequency of the calibrating signal is 2 megacycles per second, so that the time interval between the crests of the sine waves is 0.50 microseconds.

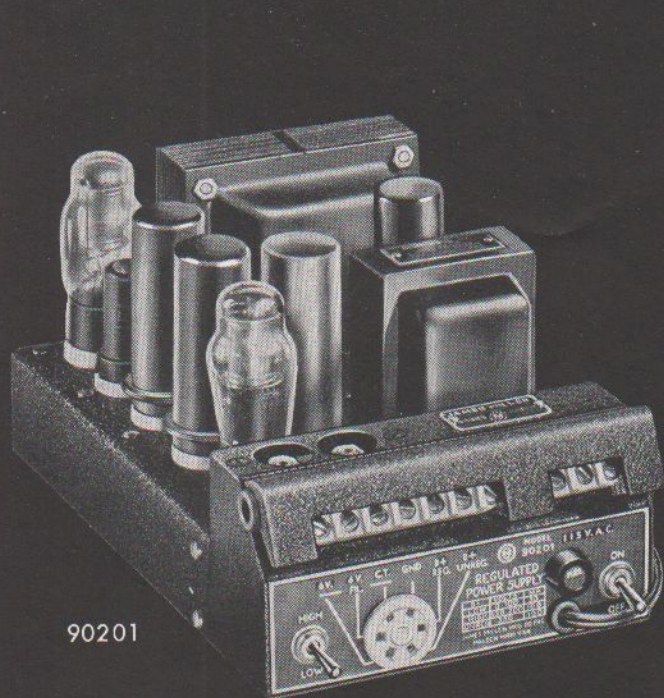
Carrying Case $14\frac{3}{4}'' \times 8\frac{3}{4}'' \times 20\frac{3}{4}''$

Weight 42 lbs.

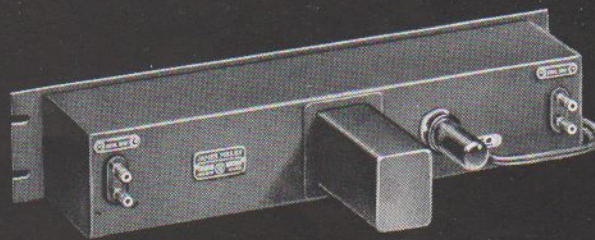
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Code	Description	Net Price
P4	115 Volt 60 Cycle Synchroscope, complete with tubes	
P4E	115 Volt 60 Cycle Synchroscope plus Detector and Video Amplifier, complete with tubes	





90201



90202



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 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 $5\frac{7}{8}$ ". The weight is 15 lbs. The outputs are:

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 \$

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.

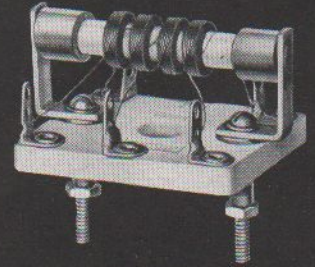
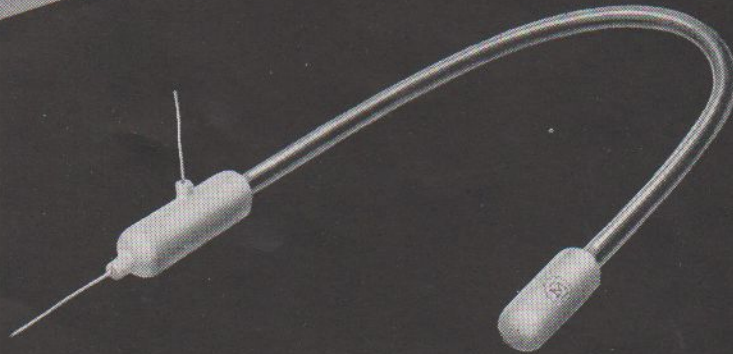
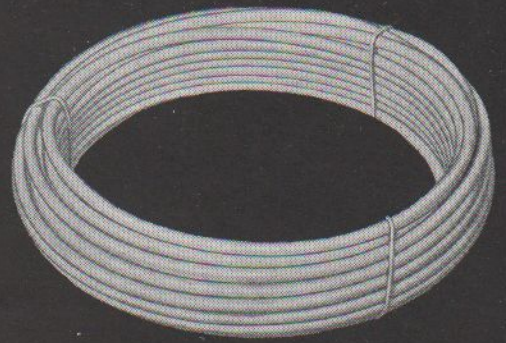
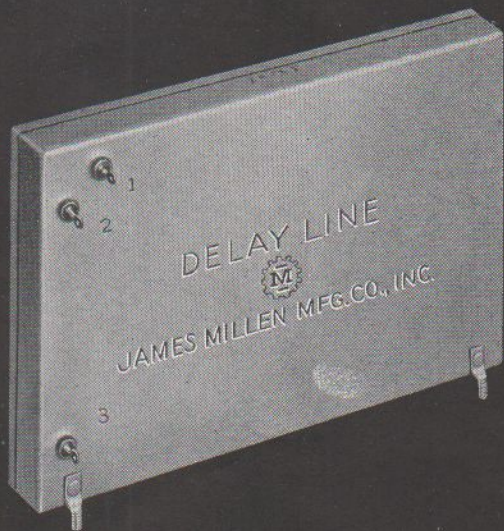
Here again the research engineer is freed of the drudgery of such time consuming mechanical construction as mounting the cathode ray tube, providing proper and adequate magnetic shielding, building the high voltage power supply, providing proper safety features, etc., and other such details of the basic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

No. 90902: Two inch oscilloscope complete with tubes for 115 V 60 cycle AC input \$

No. 90903: Three inch oscilloscope complete with tubes for 115 V 60 cycle AC input \$

No. 90905: Five inch oscilloscope complete with tubes for 115 V 60 cycle input \$





Delay Lines

In pulse formation work and pulse delay measurement, one of the essential components is a circuit, with an inherent delay characteristic. In earlier work, such time delay units were designed around lumped capacitors and inductances. For some applications, this is still the preferred method, both from a functional as well as an economic point of view. In pulse generating devices, for time measurements, however, a lumped type delay line will not always produce the optimum pulse shape, and markedly superior results are obtained from a line of the continuous delay or distributed constants type. Such a line was an exclusive war-time development of the research laboratory of the General Electric Company. During the war, we were the manufacturers of this continuous delay line for the General Electric Company, who, in turn, furnished it to all radar and gun director manufacturers. We are now merchandisers as well as manufacturers of this new type line.

Distributed constants or continuous delay line is furnished in three forms:

1. Bulk line
2. Flexible completed units
3. Cased completed units

The bulk line has an impedance of approximately 1100 ohms and a delay constant of approximately .6 u sec/ft. It

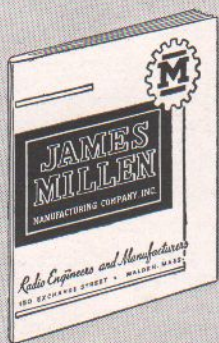
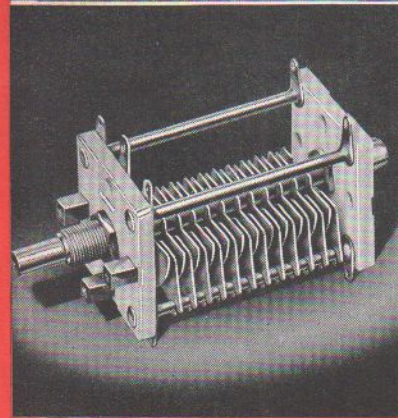
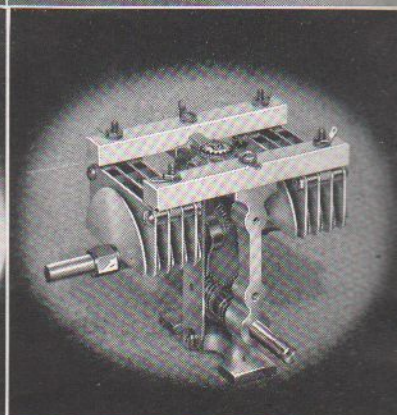
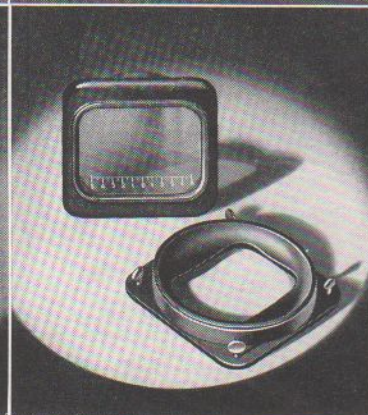
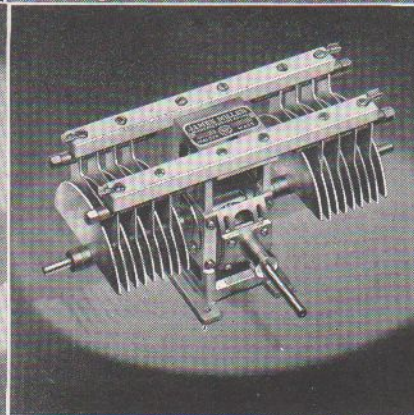
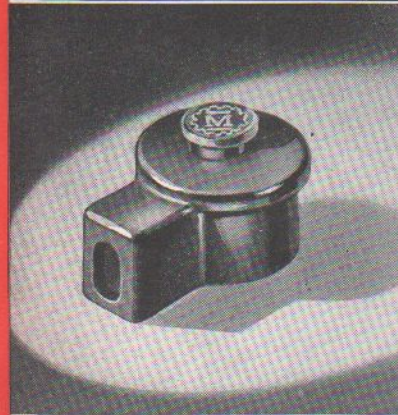
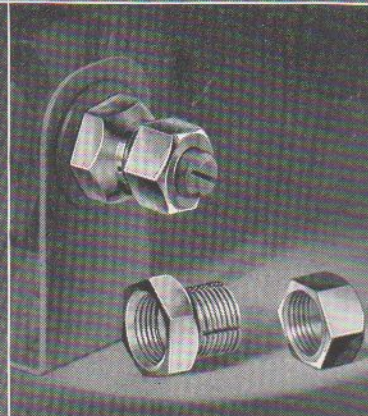
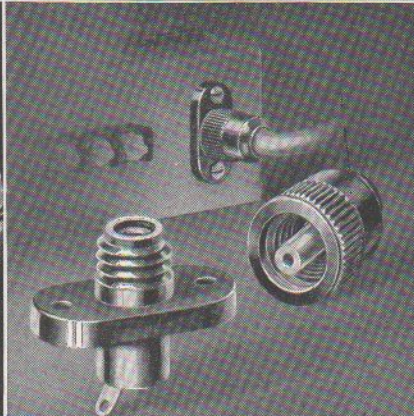
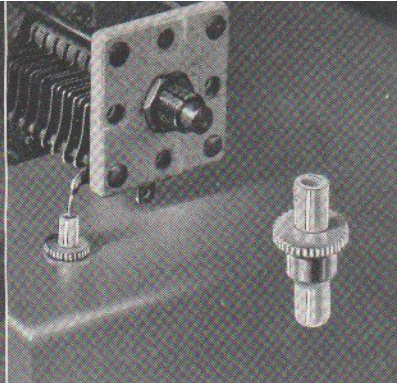
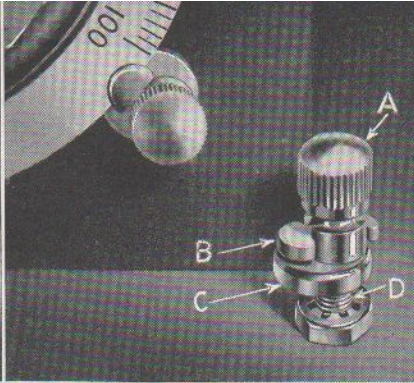
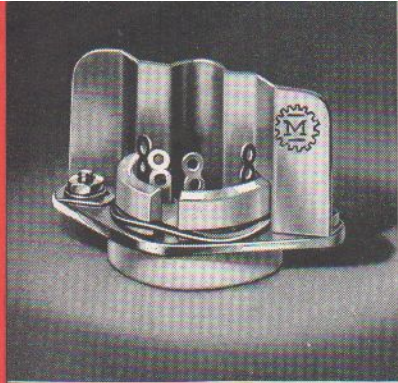
can also be furnished on special order with 400 ohm impedance. It is approximately $\frac{5}{16}$ " diameter and is furnished in random lengths of from 50 to 100 feet each. It is priced "by the foot." In handling, care must be used not to coil bulk line around a diameter of less than 6".

The flexible complete lines are furnished in values of from 0.1 u sec. to 3.5 u sec. The terminals are No. 18 tinned leads, extended through the molded end caps. This form of line is particularly useful in applications where space is at a premium, as the line can be worked into a harness cable or tucked around the edges of the chassis, in otherwise waste space.

The cased lines are mounted in hermetically sealed steel containers with sperti "metal to glass" terminals. Case size, terminal arrangement, mounting feet, etc., furnished to customer's requirements. Lines of this type can be furnished in values up to 8 u sec. or more and with multiple sections, in a single case.

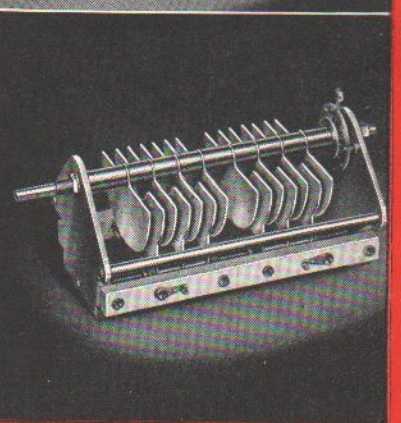
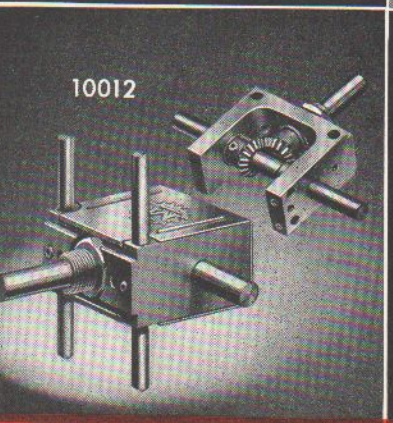
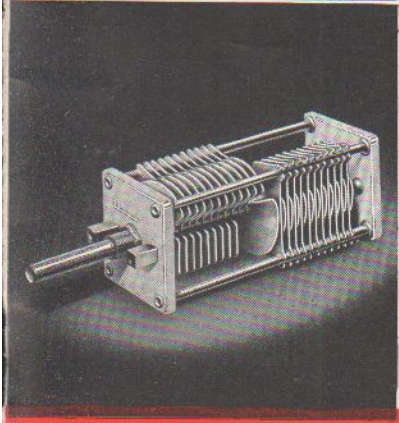
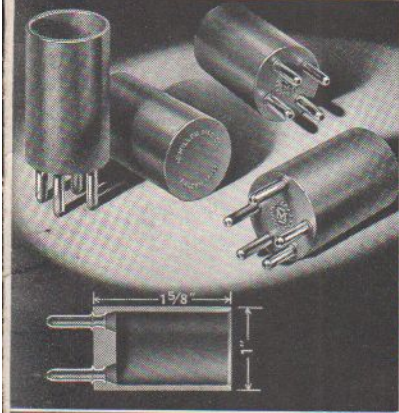
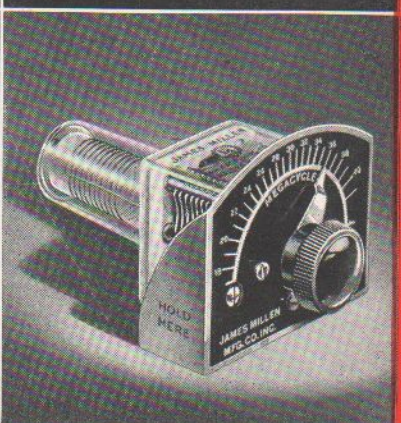
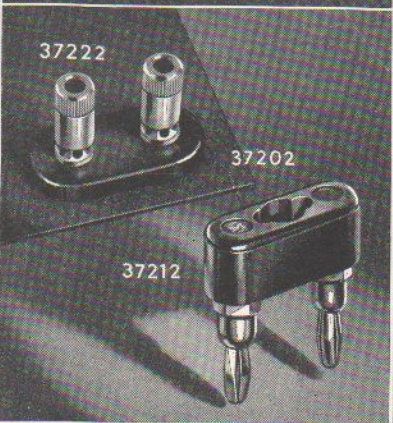
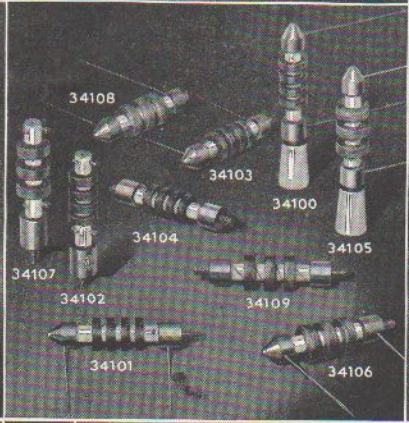
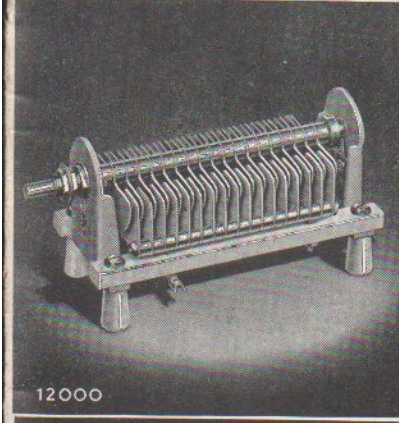
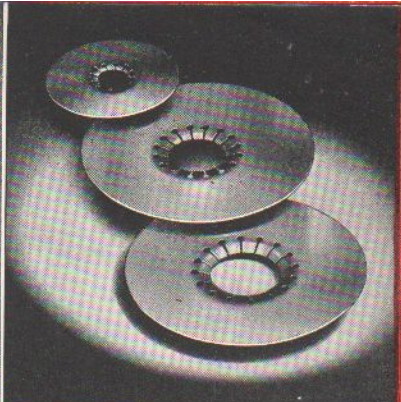
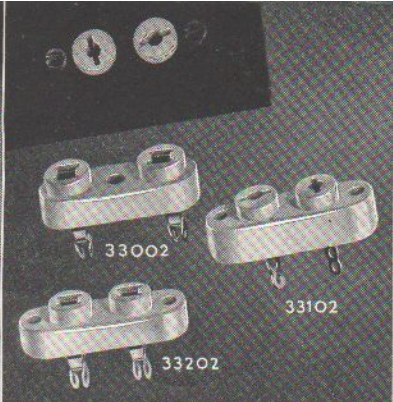
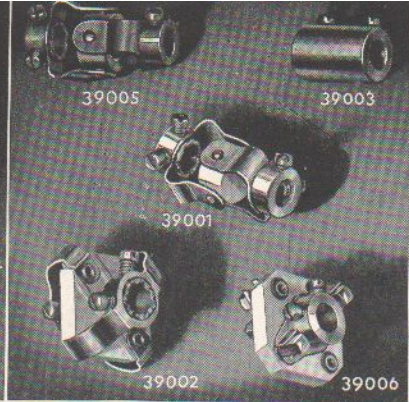
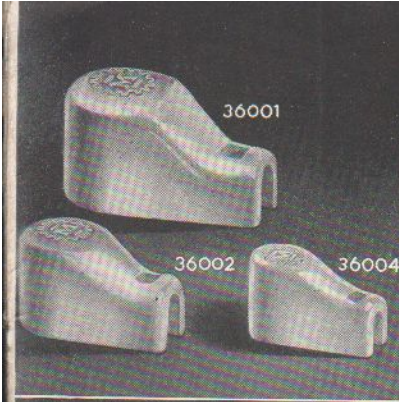
Due to the special nature of delay line applications, we list no standard units, but solicit correspondence regarding your exact requirements. This also applies to lumped line units. Illustrated herewith are typical samples of all styles.

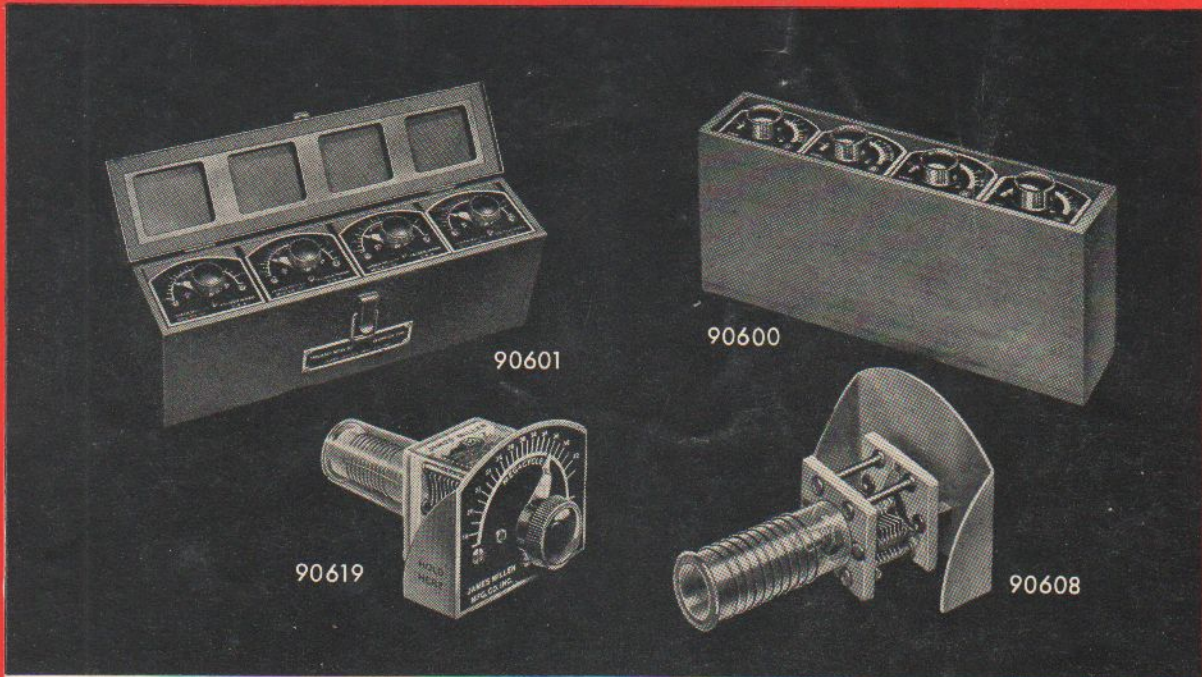




Herewith are illustrated just a few of the many exclusive Millen "Designed for Application" line of MODERN PARTS for MODERN CIRCUITS, which are fully listed and described in our general component parts catalog. A copy is available either through your distributor or direct from any of our district offices, or the factory.







Midget Absorption Frequency Meters

Many amateurs and experimenters do not realize that one of the most useful "tools" of the commercial transmitter designer is a series of very small absorption type frequency meters. These handy instruments can be poked into small shield compartments, coil cans, corners of chassis, etc., to check harmonics; parasitics; oscillator-doubler, etc., tank tuning; and a host of other such applications. Quickly enables the design engineer to find out what is really "going on" in a circuit.

Types 90605 thru 90609 are extremely small and designed primarily for engineering laboratory use

where they will be handled with reasonable care. The most useful combination being the group of four under code No. 90600 and covering the total range of from 3.0 to 140 megacycles. When purchased in sets of four under code No. 90601 a convenient carrying and storage case is included. Series 90601 are slightly larger and very much more rugged. They are further protected by a contour fitting transparent polystyrene case to protect against damage and dirt. This latter series is designed primarily for field use and are not quite as convenient for laboratory use as the 90605 thru 90608 types. All types have dials directly calibrated in frequency.

Code	Description	Net Price
90604	Range 160 to 210 mc.	\$
90605	Range 3.0 to 10 mc.	
90606	Range 9.0 to 23 mc.	
90607	Range 23 to 60 mc.	
90608	Range 50 to 140 mc.	
90609	Range 130 to 170 mc.	
90610	Range 105 to 150 mc.	
90619	Range 350 to 1000 kc.	
90600	Complete set of 90605 thru 90608, in case	
90601	Complete set Field type Frequency Meters in metal carrying case 1.5 to 40 mc.	

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