

# General Radio EXPERIMENTER

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ELECTRICAL MEASUREMENTS AND THEIR INDUSTRIAL APPLICATIONS®

## STANDARDIZED TERMINALS AND CONNECTORS

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● SINCE THE EARLY DAYS OF RADIO the name of General Radio has been identified with high quality standard parts. The TYPE 274 Banana Plug, originally designed as an improvement over earlier European types, has become universally accepted, with its companion jacks and jack-top binding posts; and it is interesting to note that, even in European countries where other dimensions are estab-

lished in the metric system, the General Radio binding-post spacing of  $\frac{3}{4}$ " has been adopted as standard.

The virtues of versatility and standardized dimensions in terminal and connecting systems are important both to the individual experimenter and to the manufacturer. In the laboratory, substantial savings in time can be realized by the use of terminals that can be easily connected together in different manners and configurations. In production, substantial savings in stocking, quantity purchasing, and standardized assembly can be realized by using parts that are adaptable to many uses and that are designed to follow a simple, standardized system of dimensions.

The General Radio TYPES 274, 874, 838, and 938 Terminals and Connectors have been carefully worked out to meet these requirements.

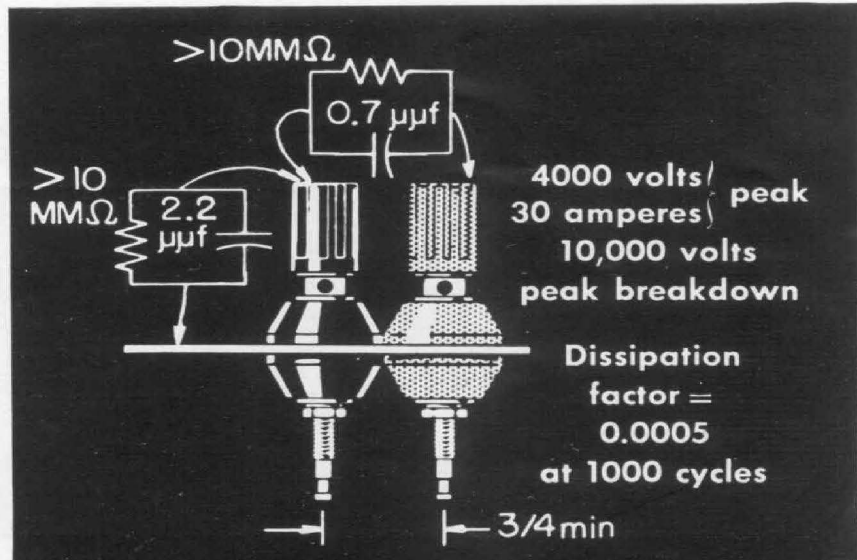


Figure 1. Electrical characteristics of a pair of Type 938 Binding Posts.

High quality materials are used throughout, excellent electrical characteristics have been achieved, harmonious appearance has been combined with functional correctness, and mechanical details have been so planned that versatility and simplicity are outstanding. The result of a continuing program of refinement and standardization has been the development of an integrated line of so-called electronic hardware that, it is believed, will meet all the connector needs of the electronic laboratory and the manufacturer of electronic laboratory equipment.

**PART I—TERMINALS**

**Type 874 Coaxial Connector**

The TYPE 874 Coaxial Connector has been previously described in detail,<sup>1</sup> and its adaptability demonstrated by its use in the extensive line of TYPE 874 Coaxial Elements.<sup>2</sup> Its main features are that any connector will plug into any other, no male and female versions being required, and that its tubular center conductor will accept any TYPE 274 Banana Plug or TYPE 838-B Alligator Clip. The cable connector, when mounted in a collet, becomes a panel connector. As such it becomes a general-purpose quick-connect-and-disconnect coaxial connector accepting any other TYPE 874 Connector or a TYPE 274-DB1 or TYPE 274-DB2 Insulated Single Plug. Its diameter is so chosen that a TYPE 938-P Grounded Jack-Top-Type Binding Post

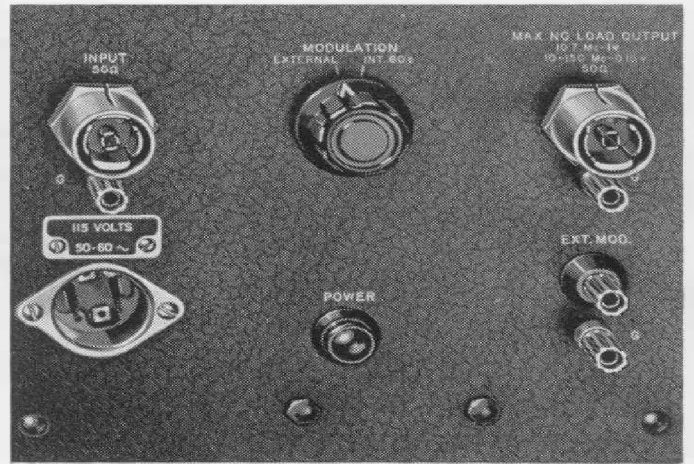


Figure 2. The Type 938-P Binding Post Assembly and the Type 874-P Panel Connector can be mounted as shown here on the Type 1023-A Amplitude Modulator to permit connection by either coaxial connector or double banana plug.

can be mounted adjacent to it at a spacing of 3/4". Since its height is the same as that of the binding post, a TYPE 274-MB Double Plug can then be plugged into the combination if the complete shielding of a coaxial cable is not required. Its bright-alloy-plated finish matches that of other terminals of all types.

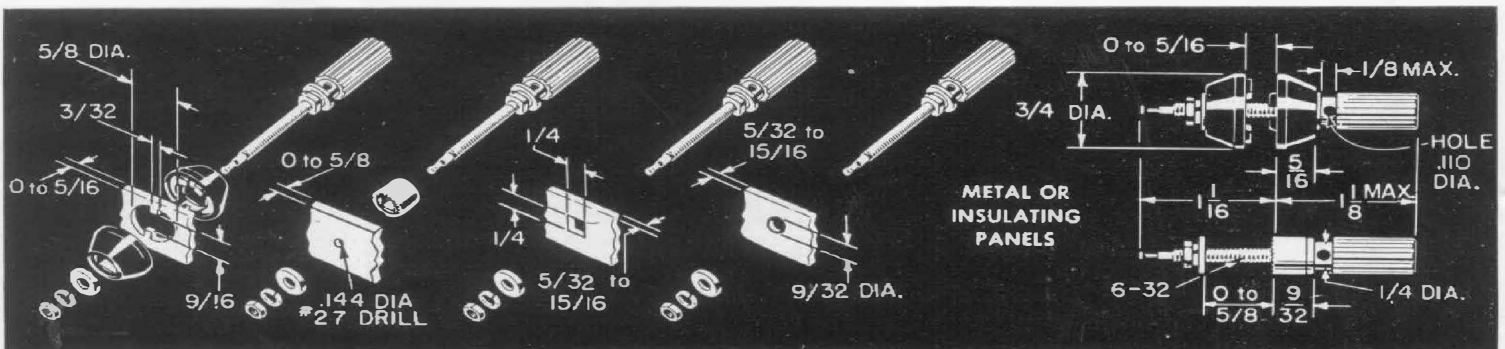
**Type 938 Binding Post**

The TYPE 938 Binding Post comes in three versions: the metal top TYPE 938-A, the black insulated top TYPE 938-C, and the red insulated top TYPE 938-D. A completely new design in all details,

1W. R. Thurston, "A Radically New Coaxial Connector for the Laboratory," *General Radio Experimenter*, XXIII, 5, October, 1948.

2W. R. Thurston, "Simple, Complete Coaxial Measuring Equipment for the U-H-F Range," *General Radio Experimenter*, XXIV, 8, January, 1950.

Figure 3. Mechanical details of the Type 938 Binding Posts and Binding Post Assemblies. Locking keys in 5/8-inch mounting hole can be omitted if locking feature is not wanted.



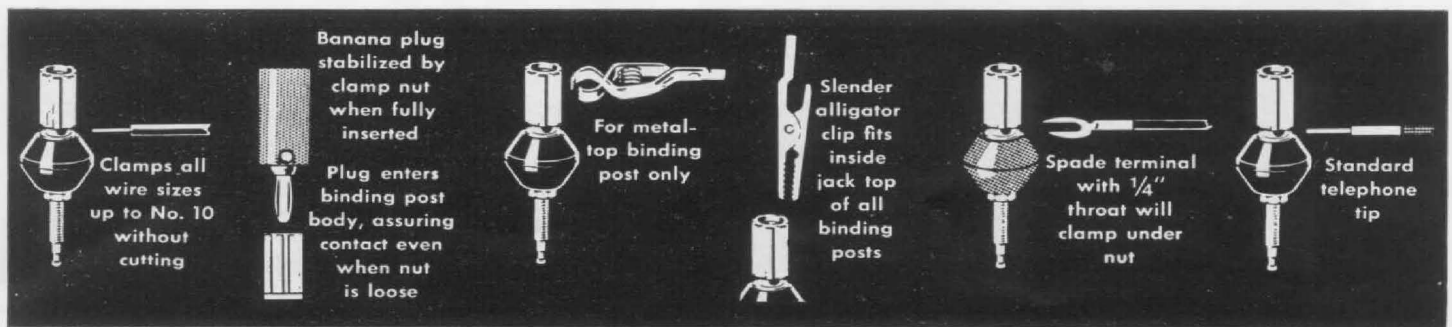


Figure 4. Six methods of connection that show the versatility of the Type 938 Binding Post.

these binding posts represent a substantial improvement over the older TYPE 138 Binding Posts which they replace.

The jack-top feature of the older binding posts is retained, but the hole into which the banana plug enters is in the body rather than in the top. If the top is not tightened down, there is therefore no danger of erratic contact caused by loose fit in the threads.

Back-of-panel connections to the binding post are soldered directly to a turret turned down on the mounting stud so that there is no danger of erratic contact from loosening up of nuts holding a soldering terminal.

The tops, fluted to resemble the Type KN knobs, are easily tightened and loosened with the fingers. At the end where the banana plug enters, they are chamfered to give a firm seat for the shoulder of the plug and to prevent rocking. At the end where a connecting wire enters the cross hole, they are contoured to produce a firm grip *without a shearing action*. This contour, combined with the proper choice of cross-hole size and location in the body, makes the binding post satisfactory for wire sizes from AWG No. 40 to No. 10, and for standard telephone tips. The body diameter is so chosen that a spade terminal with  $\frac{1}{4}$ " throat will clamp securely between top and body. The top

diameter is so chosen that a standard battery clip will fit the metal-top TYPE 938-A, and TYPE 838-B Alligator Clips will clip into the banana-plug holes on all three types, insulated and uninsulated. To prevent accidental loss, all tops are captive.

Insulation throughout is polystyrene to assure highest quality electrical behavior. Dielectric constant and dissipation factor are low, leakage resistance is high, and the effects of moisture are minimized. The insulated binding-post tops have polystyrene sleeves cemented over bright-alloy-plated threaded brass inserts. TYPE 938-BB Black Insulators and TYPE 938-BR Red Insulators furnish universal insulating mounting means with a single interchangeable piece. This piece, a polystyrene cone of pleasing proportions, is recessed to reduce capacitance and increase leakage path, and has shoulder contours at top and bottom that yield a high degree of versatility. At the top end, the hole is square to accommodate the square anti-rotational shoulder of the TYPE 938 Binding Posts; the dimensions of the square are so chosen that TYPE 274 and TYPE 938 Jacks fit snugly within it; and the square hole is slightly recessed within a round hole of the proper diameter to center the older TYPE 138 Binding Posts. At the bottom end, the locating shoulder is so recessed that, where two pieces are

rotated 90° from each other, the shoulders nest within each other and the mounting surfaces can be brought together to touch. As a result, a pair of cones can be mounted on any thickness of panel from zero to 5/16". On thin panels, the nesting of the locating flanges locks the two pieces so that they cannot rotate with respect to each other, and four openings are left in the nested locating shoulders that can be used to engage a tab in the panel hole to prevent rotation of the assembly. On thick panels the pieces can be keyed individually to the panel-hole tab.

The advantages of using individual insulating mounting cones for each binding post, as contrasted to the older TYPES 274-Y and 274-Z Double Insulators, are largely in versatility and simplification of stocking. Since each assembly is complete in itself, binding posts can be located anywhere on a panel at center-line separations equal to or greater than 3/4". The problems of single binding posts, clusters of binding

posts, or binding posts at non-standard separations can therefore be solved without special parts.<sup>3</sup> For grounded binding posts, however, the TYPE 938-F Spacer has been found a useful supplement to the insulating cones. This spacer, made of bright-alloy-plated brass, has a square center hole to fit the square anti-rotational shoulder of the TYPE 938 Binding Posts, and a flat knurl on the bottom to prevent rotation of the assembly when mounted on a panel. Two advantages accrue from the use of a binding post mounted on this spacer for a ground terminal. From an electrical standpoint, the short, direct connection to the panel furnishes a low-inductance ground; from a production standpoint, the assembly operation of connecting a wire to the binding post and to some ground point is eliminated.

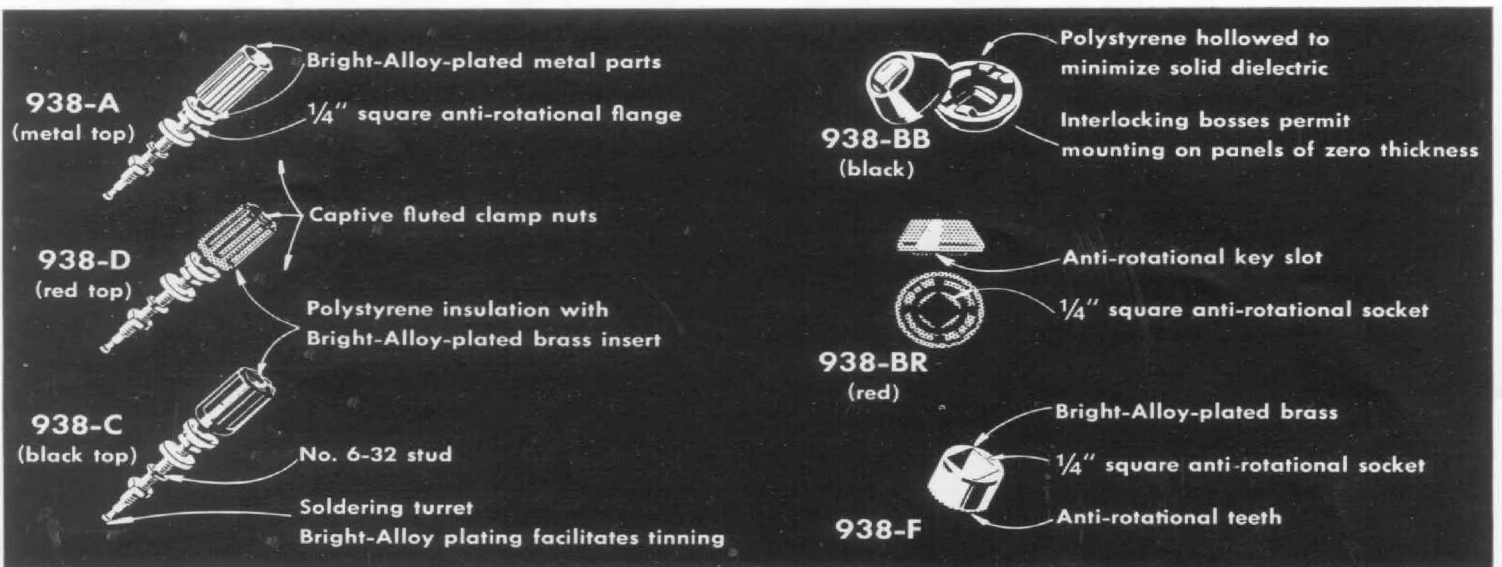
For convenience in ordering, five complete binding-post assemblies are listed. These are:

TYPE 938-W: TYPE 938-A (metal top) + TYPE 938-BB (pair of black insulating cones)

TYPE 938-R: TYPE 938-A (metal top) + TYPE 938-BR (pair of red insulating cones)

<sup>3</sup>For applications where equipment is already designed to use the older TYPE 274-Y or TYPE 274-Z Panel Terminal Insulators, the TYPE 938-Z Replacement Binding Post Insulator can be directly substituted. This insulator, moulded of black polystyrene, has the same outside dimensions and mounts in the same holes as the older insulators, and it will accept either TYPE 938 or 138 Binding Posts or TYPE 938 Jacks. See price table on page 5.

Figure 5. Basic parts of the Type 938 Binding Post.





TYPE 938-WB: TYPE 938-C (black insulating top) + TYPE 938-BB (pair of black insulating cones)

TYPE 938-WR: TYPE 938-D (red insulating top) + TYPE 938-BR (pair of red insulating cones)

TYPE 938-P: TYPE 938-A (metal top) + TYPE 938-F (metal spacer)

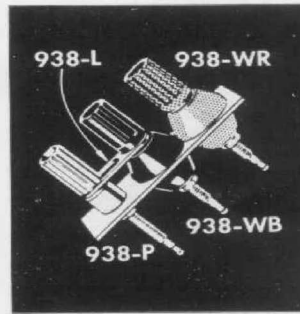


Figure 6. Typical binding post assemblies.

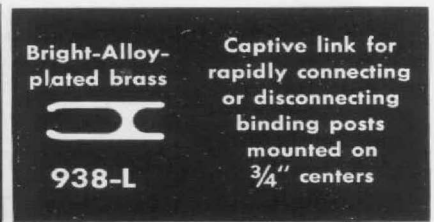


Figure 7. Shorting link is useful in connecting one post of a pair to a third, grounded, post as shown in Figure 6.

**PART II**

which discusses connectors will appear in the July issue.

**BASIC PARTS**

Type	See Figure§	Code Word	Unit Prices† 10*-99	100-999	1000-1999	2000-9999	10,000 up
938-A	5	STANPARASP	\$0.30	\$0.26	\$0.24	\$0.23	\$0.22
938-C	5	STANPARAWL	0.40	0.34	0.32	0.30	0.29
938-D	5	STANPARARM	0.40	0.34	0.32	0.30	0.29
938-BB	5	STANPARAUK	0.125	0.11	0.105	0.10	0.095
938-BR	5	STANPARATE	0.125	0.11	0.105	0.10	0.095
938-F	5	STANPARBON	0.025	0.02	0.02	0.02	0.02
938-L	7	STANPARBET	0.10	0.09	0.085	—	—

**ASSEMBLIES**

938-P	Metal top, 938-F Spacer . . . . .	6	STANPARDOT	\$0.325	\$0.28	\$0.26	\$0.25	\$0.24
938-W	Metal top, black ins.	not shown	STANPARANT	0.425	0.37	0.35	0.33	0.31
938-R	Metal top, red ins.	not shown	STANPARGIG	0.425	0.37	0.35	0.33	0.31
938-WB	Black top and ins. . . . .	6	STANPARBAN	0.525	0.45	0.425	0.40	0.38
938-WR	Red top and ins. . . . .	6	STANPARCUB	0.525	0.45	0.425	0.40	0.38

\*Minimum quantity sold.

†Net prices. No further quantity discounts.

§For the convenience of the user, all binding posts and assemblies are supplied unassembled.

**TYPE 938-Z REPLACEMENT BINDING POST INSULATOR**

The TYPE 938-Z Insulators fit the TYPE 938 Binding Posts, as well as the obsolete TYPE 138 Binding Posts. Since, in addition to the above, the TYPE 938-Z Insulators mount in the same (1/2" diameter) holes, they serve as replacements for the TYPES 274-Y and 274-Z Insulators or to mount TYPE 938 Binding Posts in place of TYPE 138 Binding Posts.

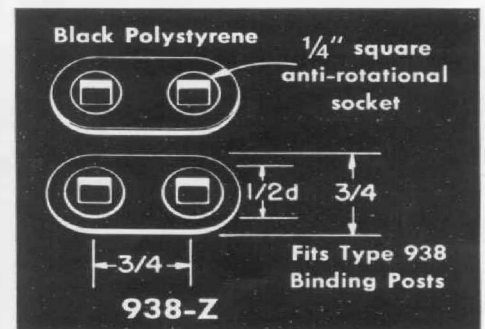


Figure 8. Flat insulators shown here are available for applications where present designs require them.

Type	Code Word	Price† per pair					
		5*-99	100-999	1000-1999	2000-9999	10,000 up	
938-Z	Insulator . . . . .	STANPARHOD	\$0.175	\$0.165	\$0.155	\$0.145	\$0.14

\*Minimum quantity sold.

†Net prices. No further quantity discounts.

## TWELVE TONS OF SALT AND AN IMPEDANCE BRIDGE DETECT LEAK IN PIPE LINE

A new raw-water intake line for the City of Wyandotte, Michigan, installed last year, consisted of 1700 feet of 42-inch concrete pipe laid in a trench 12 feet deep, below the bottom of the Detroit River. Before the trench was filled to cover the pipe, tests showed a leakage of only one gallon per minute, which was negligible compared to the leakage allowed by the specifications.

During the process of backfilling, a constant head of approximately 20 feet was maintained in the pipe. After about 800 feet of the work had been completed, a leak developed, so serious that two pumps, delivering 60,000 gallons per hour, were unable to fill the 12-inch riser pipe used as a test head.

To repair the leak, it was first necessary to locate it. Pumping tests indicated that the leak was in the covered portion of the pipe.

The method chosen to locate the leak consisted of pumping into the pipe water containing known concentrations of

various substances and using detection apparatus in boats on the river. Among the materials used were activated carbon, fluoresceine dye, chlorine, ping-pong balls, and oranges. None of these gave positive results.

Finally, through the cooperation of the Pennsylvania Salt Manufacturing Company, a brine solution was tried, and a conductivity measurement of the river water was used as an indicator. The detector consisted of a test cell that could be immersed in the water and a General Radio TYPE 650-A Impedance Bridge to measure the cell resistance. Calibration tests on the cell were made with various concentrations of salt in solution as well as measurements of the normal river water resistance as a function of the distance from shore.

Some twelve tons of salt were used in the test. Brine solution was pumped into the line, and the boat crew moved out from shore over the pipe line. The normal resistance of river water varied from 1,000 ohms at a point 25 feet from shore to 4,500 ohms 2,000 feet out. As the boat moved along, the galvanometer was kept at zero by changing the setting of the main resistance dial to balance the progressive change in water resistance.

The leak was located in a very short time and was evidenced by a sudden pronounced deflection of the galvanometer. Repeated tests each located the leak at the same spot, about 650 feet off shore. Excavation proved the leak to be at this spot and repairs were quickly made.

View of the Type 650-A Impedance Bridge.





The TYPE 650-A Impedance Bridge was selected for this job because it is completely self-contained, direct reading, and has more than adequate accuracy for the measurements.

The single resistance dial with logarithmic scale made it easy to monitor the change in normal resistance of the

river water, so that pronounced deflection of the galvanometer could be obtained at the point of the leak.

The foregoing was abstracted from an article entitled "Leak Detection on Sub-Aqueous Raw-Water Intake Line," by George Hazey, Chief Operator, Filtration Plant, Wyandotte, Michigan, appearing in *Water and Sewage Works* for September, 1951.

## PULSED SIGNALS IN NOISE

There are many occasions in the design, development, and manufacturing test of large electronic systems where a source of pulsed signals in noise is practically a necessity. Oftentimes a complete high-gain pulse-receiving amplifier is tied up to supply such signals where such complexity is hardly desirable.

For some applications at the Sperry Gyroscope Company, Great Neck, New York, this problem has been solved by use of the General Radio TYPE 1390-A Random Noise Generator in conjunction with simple auxiliary circuitry. The system is indicated in Figure 1 with appropriate waveforms in Figure 2.

The purpose of the detector is to transform the bi-polar random noise from the generator, Figure 2A, to unipolar, or video, noise, Figure 2B. The signal mixing tube is one in which the output is

inversely proportional to the sum of its two inputs. Thus a mixer output of variable signal-to-noise ratio can be obtained by varying either the output of the 1390-A, Figure 2A, or the output of the pulse generator, Figure 2C, or both.

Although the simple addition of a video pulse and video noise, Figure 2D, is not mathematically identical to the noisy signal from a typical radar receiver which it attempts to simulate, this scheme is satisfactory for measurements where only relative data are required, such as production testing.

We are indebted to Robert Crane, Project Engineer, and Dudley Lesser, Test Methods Engineer, of the Sperry Gyroscope Company for permission to publish the foregoing note on the use of the TYPE 1390-A Random Noise Generator.

— EDITOR

Figure 1.

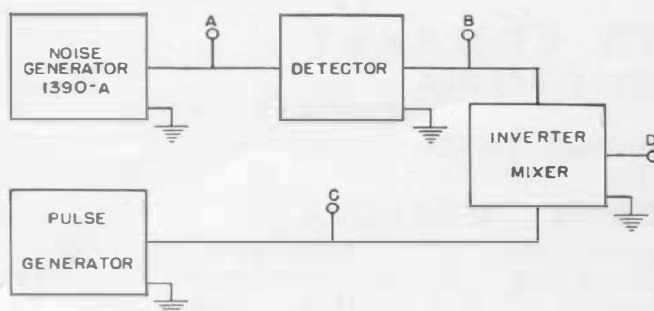
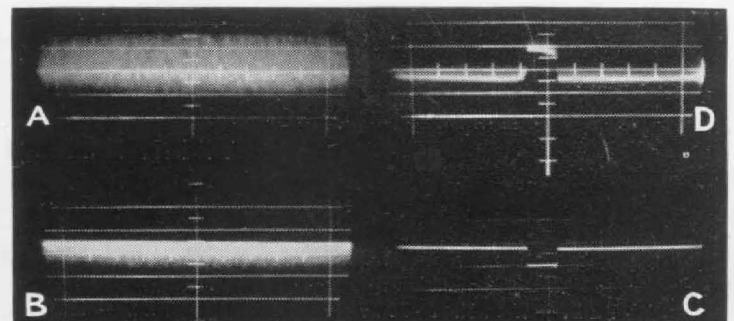


Figure 2.





## MISCELLANY

**SPEAKERS:** Harold B. Richmond, Chairman of the Board, participated in the Electronics Panel at Research Day, sponsored by the Boston Chamber of Commerce April 18, 1952; Frank D. Lewis, Engineer, spoke at the Boston Section, I.R.E., March 27, 1952, on "A TV Station Monitor for Channels 2 to 83"; and on February 27, W. M. Ihde of our Chicago office addressed the Student Section, I.R.E., at Valparaiso Technical Institute, Indiana, on "Loudness—Its Meaning and Its Measurement."

**VISITORS:** We have welcomed recently at our Cambridge plant the following visitors from foreign countries: Paul Fabricant and Marius Berlin of Radiophon, Paris, exclusive distributors of General Radio products in France and the French Colonies; Dr. B. Hirschfeld, Director, and Dr. A. Morato, Chief Engineer, of Industria & Comercio de Radio Invictus, Sao Paulo, Brazil, accompanied by R. C. Auriema of Ad. Auriema, New York, our distributors for Latin America; Rev. Pierre Gouin, S. J., from Addis Ababa, Ethiopia, and Rev. Alfonso de la Mora, S. J., from Mexico City, both at present studying at Weston College.

### A. S. T. M. 50th ANNIVERSARY

The American Society for Testing Materials is holding its 50th Anniversary Meeting and 10th exhibit of testing apparatus and laboratory supplies in New York at the Hotels Statler and New Yorker June 23 through 27. All who are interested in materials testing and associated equipment are cordially invited to attend the exhibit. The General Radio Company in Booth No. 19 will have on display equipment for the measurement of dielectric properties, of insulation resistance, of sound and noise, and of stresses on photo-elastic models. For those interested only in the exhibit, there is no entrance fee.

### SUMMER CLOSING

**VACATION**—During the weeks starting July 28 and August 4 most of our employees will be vacationing. Manufacturing departments will be closed and other departments will be manned by a skeleton staff. Every effort will be made to take care of urgent business, but repairs cannot be made, except in hardship cases. Our Service Department requests that shipments of material to be repaired be either scheduled to reach us well before this vacation period or delayed until afterward.

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