the GENERAL RADIO Experimenter

Since 1915 – Manufacturers of Electronic Apparatus for Science and Industry

VOLUME 32 No. 6 NOVEMBER, 1957

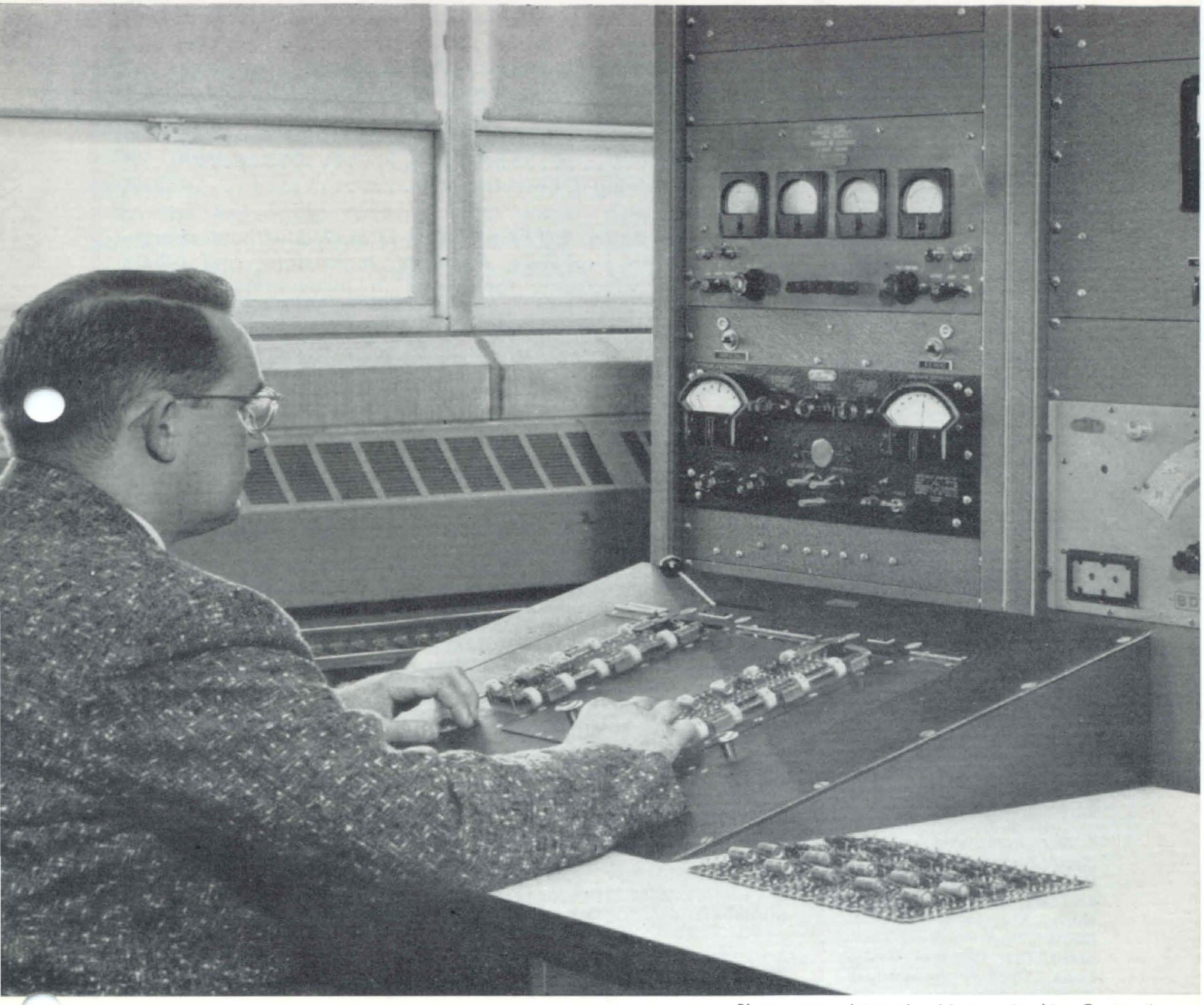

Photo courtesy International Business Machines Corporation

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Emergency Power Supply
Automatic Printed-Circuit Tester

the GENERAL RADIO Experimenter

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The General Radio EXPERIMENTER is mailed without charge each month to engineers, scientists, technicians, and others interested in electronic techniques in measurement. When sending requests for subscriptions and address-change notices, please supply the following information: name, company address, type of business company is engaged in, and title or position of individual.

GENERAL RADIO COMPANY

275 Massachusetts Avenue, Cambridge 39, Mass.

Telephone: TRowbridge 6-4400

NEW YORK: Broad Avenue at Linden, Ridgefield, New Jersey
Telephone — N. Y., WOrth 4-2722
N. J., WHitney 3-3140

CHICAGO: 6605 West North Avenue, Oak Park, Illinois
Telephone — VIllage 8-9400

PHILADELPHIA: 1150 York Road, Abington, Pennsylvania
Telephone — HAncock 4-7419

WASHINGTON: 8055 13th St., Silver Spring, Maryland
Telephone — JUniper 5-1088

LOS ANGELES: 1000 North Seward St., Los Angeles 38, Calif.
Telephone — HOllywood 9-6201

SAN FRANCISCO: 1182 Los Altos Ave., Los Altos, Calif.
Telephone — WHitecliff 8-8233

CANADA: 99 Floral Parkway, Toronto 15, Ontario
Telephone — CHerry 6-2171

REPAIR SERVICES

EAST COAST: General Radio Co., Service Dept., 275 Massachusetts Ave., Cambridge 39, Mass.
Telephone — TRowbridge 6-4400

MIDWEST: General Radio Co., Service Dept., 6605 West North Ave., Oak Park, Illinois
Telephone — VIllage 8-9400

WEST COAST: Western Instrument Co., 826 North Victory Boulevard, Burbank, Calif.
Telephone — VIctoria 9-3013

CANADA: Bayly Engineering, Ltd., First St., Ajax, Ontario
Telephone — Toronto EMpire 8-6866

COVER

The automatic printed-circuit tester, developed by International Business Machines Corporation, is shown here in operation at IBM's Kingston, New York, plant. The General Radio Type 1605-A Impedance Comparator, an integral part of the tester, is shown in the left-hand rack just above the inclined panel.

AUTOMATIC TESTING OF PRINTED-CIRCUIT COMPONENTS FOR THE IBM SAGE COMPUTER

The testing of component values on printed-circuit cards at the Kingston, New York, plant of IBM's Military Products Division is carried out by a completely automatic tester. This test system, devised by IBM engineers, is one of the most interesting of the many existing automatic test systems in which the General Radio TYPE 1605-A Impedance Comparator is used. The cover photograph shows the tester in operation.

In the Automatic Tester, each component is sequenced individually through its appropriate test by means of internal punched-card programming. The components on the printed-circuit card being tested are compared either with those on a precision-built master card or with built-in standards of resistance and capacitance. Each component is tested statically in order to locate components near end-of-life which might easily pass undetected through a functional test. When a component fails to fall within the prescribed limits an error indication occurs.

The automatic tester consists of measuring equipment, a program unit, card fixtures, a stepping switch, and error-detection circuits. The measuring equipment consists of two bridges, a peak detection circuit, and a General Radio Impedance Comparator, TYPE 1605-A.

The program unit is a modified IBM drum-type reader which uses standard IBM punched cards to indicate which tests are to be used for a particular component, while at the same time setting the limits within which the component value should fall. Flexibility of programming allows more than 500 different printed-circuit cards to be tested merely by use of the appropriate program cards. Two drums, each containing a punched card, are used to program the sequence of tests.

There are two printed-circuit card fixtures, one for the card to be tested and one for the master card. In the operation of the tester, the operator needs only to insert the cards into the fixtures and start the tests. The rest is automatic. The stepping switch completes circuits from the component to be tested to the appropriate measuring equipment for each step of the program sequence.

Within the 1-second test cycle for each individual component, the sequencing is accomplished by a series of pulses which perform the functions of stepping, program reading, test selecting, test pulsing, and resetting. The error-detection circuit is designed to turn off the pulse generator in the event of a component's failure to pass the test.

Components in series or in parallel combinations can be tested easily since the tester can take advantage of all terminals on printed-circuit cards. The components which can be tested by this automatic tester are resistors from 10 ohms to 20 megohms, with 1.1 percent accuracy; capacitors from 100 micromicrofarads, with 2 percent accuracy; inductances and impedance magnitudes from 2 ohms to 2 megohms, with 2 percent accuracy; IBM-type W, Y, and Z diodes for opens, shorts, and back resistance; and transformers for turns ratio, coupling, shorts, and opens.

Designed to check one component per

second, the tester is capable of checking the most complicated printed-circuit card in 36 seconds, a considerable improvement over manual testing techniques.

EDITOR'S NOTE:

For the information in the above article we are indebted to the Kingston, New York Plant, International Business Machines Corporation.

THE TYPE P-583 EMERGENCY POWER SUPPLY

FOR

THE TYPE 1100-AP PRIMARY FREQUENCY STANDARD

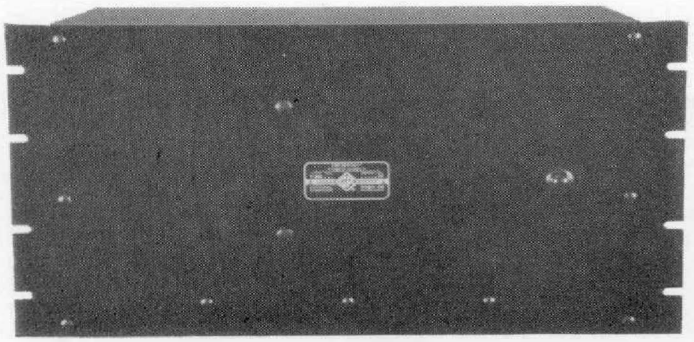
Continuity of service is an important consideration in many applications of the TYPE 1100-AP Primary Frequency Standard. This is particularly true of those installations where timekeeping is the primary function of the standard, as in astronomical observatories. To assure this continuity, an emergency power supply furnishing auxiliary a-c power in the event of line failure is needed. One such supply, using a battery-operated dynamotor has been described previously.[1]

Because rotating machines are relatively slow in starting, a vibrator-type inverter, which starts much more rapidly, is used in the new TYPE P-583 Emergency Power Supply. The inverter operates from a 32-volt storage battery, which is maintained on trickle-charge.[2] *The output of the emergency supply is at 115 volts, 60 cycles.* A transformer is provided in the emergency supply so that the frequency standard can be operated at 115 volts from either 115-volt or 230-volt power service. The service frequency can be either 50 or 60 cycles. Figure 2 is an elementary circuit schematic.

Upon failure of the 115/230 volt, 50-60 cycle a-c power supply, the relays in the TYPE P-583 Emergency Power Supply operate (1) to connect the vibrator type inverter to the battery and (2) to transfer the power input terminals of the frequency standard to the output of the inverter. This changeover is accomplished so rapidly that, if the frequency standard is in normal operating condition, no interruption in operation of the TYPE 1103-A Syncronometer occurs.

If the 1 kc synchronous motor of the TYPE 1103-A Syncronometer is not in average mechanical condition,[3] addition of capacitors to the power supply filter will insure continuous operation during the changeover. To provide this margin of safety, additional capacitors are provided, with directions for installation.

Figure 1. Panel view of the Emergency Power Supply, which is designed for relay-rack mounting.



[1] "Emergency Power Equipment for Frequency Standards," *General Radio Experimenter*, 25, 11, April, 1951.

[2] Battery and charging equipment are not included with the Type P-583 Emergency Power Supply, but must be furnished by the user.

[3] A simple coasting test will indicate the condition of the Syncronometer, as outlined in the operating instructions for the Emergency Power Supply.

If the TYPE P-583 Emergency Power Supply is purchased with a TYPE 1100-AP Primary Frequency Standard, these capacitors are installed at the factory.

On resumption of the 115/230 volt, 50-60 cycle a-c supply, the relays of the TYPE 583 Emergency Power Supply operate (1) to disconnect the inverter from the battery and (2) to connect the power input terminals of the frequency standard to the output of the 115/230 volt line transformer.

In order to assure reasonably uniform "pickup" and "dropout," voltages for the operation of the relays, a tapped transformer is provided. The tap connection should be made to the tap corresponding to the average line voltage at the location of the standard.

Terminals are provided at the rear of the unit for connection of (1) the 32-volt battery, (2) the 115/230-volt 50-60 cycle a-c power line, and (3) the power connection to the frequency standard. A transformer is provided within the unit for changing from 115 to 230-volt service. *The frequency standard is operated at 115-volt supply at all times.* When the power system is 60 cycles, the frequency of the supply to the standard is the same on both normal and emergency supplies. If the power system is 50 cycles, the standard operates on 50 cycles on normal supply and 60 cycles on emergency supply. This change in supply frequency causes no difficulty.

The TYPE P-583 Emergency Power Supply is not limited in its applications solely to the General Radio Frequency Standard. It can operate any 115-volt, 60-cycle equipment within its continuous power rating of 180 watts.

SPECIFICATIONS

Input: 115/230 volts, 50-60 cycles from power line: 32 volts, 7 amperes, from battery.

Output: 115 volts, 60 cycles, 180 watts continuous.

Accessories Required: 32-volt battery, 120 ampere-hour capacity.

Dimensions: Panel, (length) 19 x (height) 10½ inches; depth behind panel, 13 inches.

Price and delivery will be quoted on request.

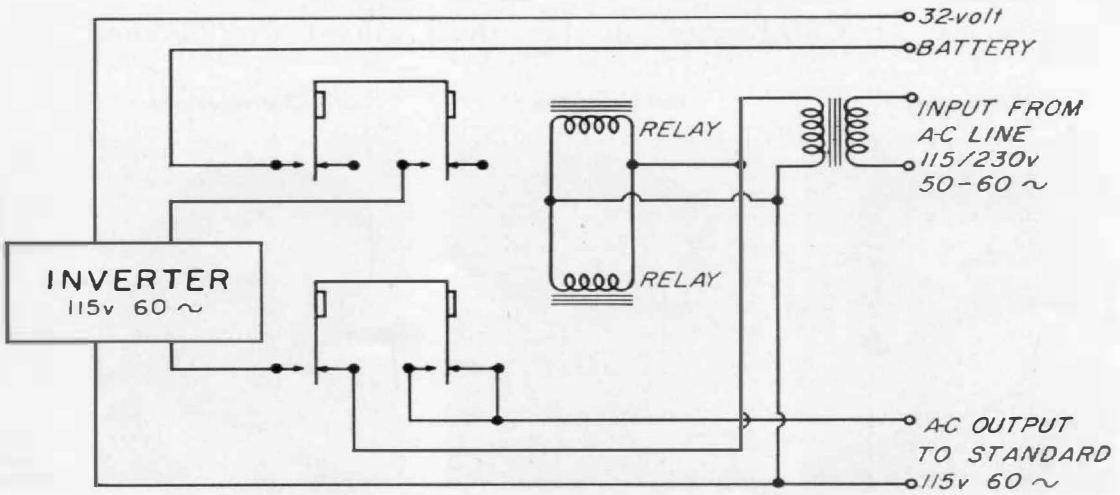


Figure 2. Elementary schematic of the Emergency Power Supply.

DISTRICT OFFICE PERSONNEL

Life in General Radio's rapidly expanding Sales Engineering Department is seldom a static existence. Our sales engineer starts his career at the main office in Cambridge with a training course that includes experience in all the operating departments of the company, with special emphasis on both development and sales engineering. Later, he will probably move out to one of the seven district offices — New York, Philadelphia, Washington, Chicago, Los Angeles, San Francisco, or Toronto. Further progress may entail transfer to another office, an office manager's post, or eventually, return to Cambridge with increased responsibility and scope for his talents.

1957 has seen a number of transfers among our sales engineering personnel:

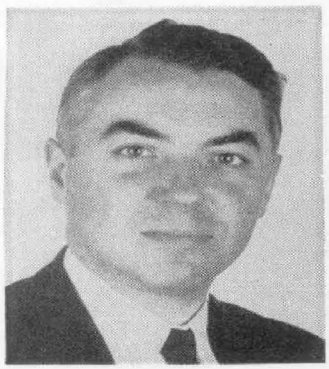
Fred Ireland, for many years manager of our Los Angeles office, returns to the main office at Cambridge as Exhibits Manager, where he will plan and supervise our rapidly expanding program of trade show exhibits and traveling shows. His new job will take him frequently to all parts of the country. Mr. Ireland came to General Radio in 1934, after receiving his A.B. degree in physics from Harvard. After three years in instrument development and sales engineering at Cambridge, he became manager of the New York office. In 1940 he was made manager of the Los Angeles office.

William R. (Bill) Saylor, former manager of our Washington office at Silver Spring, Maryland, is now manager of our Los Angeles office, replacing Mr. Ireland. Mr. Saylor, who received his S.B. and S.M. degrees from the Massachusetts Institute of Technology in 1937, came to General Radio in 1943, after three years in industry and three years in teaching. He became Manager of the Washington office in 1954.

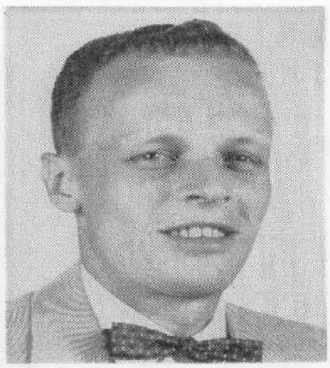
C. William (Bill) Harrison takes over the Washington office, after two years as a sales engineer at the Cambridge office and two years in the New York office. Mr. Harrison received his B.S. in Electrical Engineering from Northwestern University in 1946. He spent the years 1946 and 1951–52 in the U. S. Navy with the rank of lieutenant and was with the General Electric Company from 1948 to 1951. He came to General Radio in 1953.

Leo J. Chamberlain goes from Cambridge to replace Mr. Harrison at the New York office. Mr. Chamberlain received his B.S.E.E. degree from Cornell University in 1953. After serving two years in the U. S. Navy (Lt., j.g.), he joined the General Radio Sales Engi-

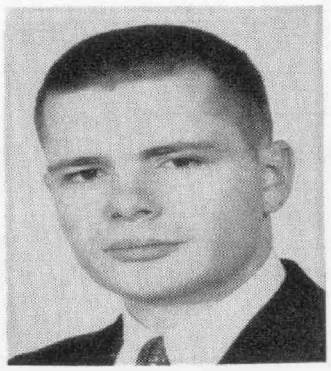
Bill Saylor



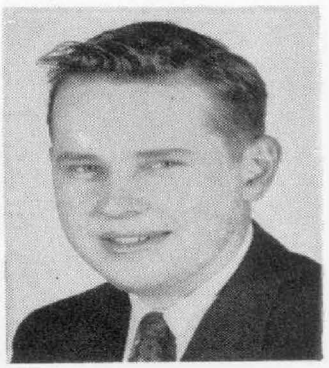
Bill Harrison



Leo Chamberlain



Peter Bishop



Fred Ireland

neering group in 1955. He has toured extensively in the Eastern States with General Radio's traveling exhibits and is the principal author of *GR—An Engineer's Company*, which describes sales engineering opportunities at General Radio. He has also been active in the affairs of the Boston Section, Institute of Radio Engineers, and has conducted a monthly column in the section publication, *The Reflector*.

Peter Bishop, recent Cambridge sales engineering trainee, also goes to the New York office. Mr. Bishop received his S.B. degree in Electrical Engineering from the Massachusetts Institute of Technology in 1954. After two years as a lieutenant in the U. S. Army Signal Corps, he joined the General Radio organization in 1956. For the past few months at Cambridge he has been engaged in development work on a transadmittance meter.

NEW TELEPHONE NUMBERS FOR GENERAL RADIO TORONTO OFFICE

For the convenience of our Canadian customers we have increased the telephone facilities at our Toronto office. Three lines are now available. This change has also necessitated a change in the telephone number. New numbers are:

CHerry 6-2171, 2172, 2173.

TECHNICAL TRAINING OBSERVATOUR

Ad. Auriema, Inc., General Radio's distributor for Latin America, Spain, and Portugal, has instituted an "Observatour" to give their agents and staffs throughout the world first-hand information on United States manufacturers' newest techniques in production, merchandising, and managing.

The first Observatour held several years ago was general in scope but stressed sales and management. During September 1957 the second tour stressed production methods and engineering developments. In the course of the tour the group traveled approximately 6800 miles and visited 23 manufacturing plants in 19 major cities in the United States from coast to coast.

General Radio was happy to play host to a group of these engineers who are responsible for selling GR products in their respective countries. They were escorted by Mr. N. Lampert of Ad. Auriema's New York Office and spent one and a half days at our Cambridge and Concord plants.

Although the limited time would not permit complete tours of every part of the company, lectures and demonstrations were set up to acquaint the group with details of General Radio's products and manufacturing processes. Round-

General Radio Vice-President D. B. Sinclair details engineering developments to the Observatour visitors: Mr. ATILO CASSIET, from Buenos Aires; Mr. ANDRES LARA SAENZ, from Madrid; Mr. N. LAMPERT, Ad. Auriema, Inc.; Mr. JORGE NASSAR, from Medellin, Colombia. General Radio's Export Manager, S. W. DeBlois, is at the far right.

table discussions were also arranged so that specific problems could be resolved.

The Observatour has certainly proved to be a wonderful means of keeping manufacturers and their export distributors better acquainted and more aware of each other's problems. General Radio has always been pleased to have representatives of its export distributors or any of their customers visit Cambridge at any time to obtain first-hand information. And of course such an invitation is not limited to export customers! A little advance notice of any forthcoming visit will naturally facilitate arrangements to have any specific problems covered.

General Radio Company

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