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FM RADIO-ELECTRONICS

MARCH 1943

U. S. SIGNAL CORPS INSPECTOR

Radio-Electronic Products Directory

THE JOURNAL OF WARTIME RADIO-ELECTRONIC DEVELOPMENT, ENGINEERING & MANUFACTURING ★ Edited by M. B. Sleeper ★

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For the big job they've got to do, they deserve the finest tools that American skill and ingenuity can contrive. We at Simpson are proud and glad to give our best . . . to match their fight with work . . . to produce Simpson Instruments in unprecedented numbers . . . and to wish them Godspeed with every working hour.

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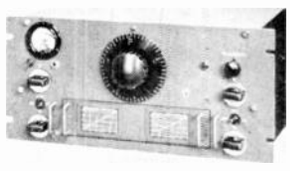
Simpson

INSTRUMENTS THAT STAY ACCURATE

Buy War Bonds and Stamps for Victory

OFFICIAL
U. S. NAVY
PHOTOGRAPH

WHEELHOUSE OF A PC BOAT



Just as the wheelhouse is the nerve center of the swift little PC boats, so radio is the nerve system that links the Navy's ships together.

Like the ships, like the men who man them, the Navy's radio equipment can take it.

NATIONAL COMPANY, INC.
Malden, Mass.

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Where a stock item can do the job, by all means standardize. (The UTC catalogue covers over four hundred types.) *But*, the ideal transformer for a specific job doesn't just happen...it's designed. For example, after extensive development, UTC reduced the weight of an important aircraft item over 90%. *Let UTC design a unit to your specific problem.*

There is no substitute for engineering skill

UNITED TRANSFORMER CO.

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FM RADIO-ELECTRONICS

COMBINED WITH: APPLIED ELECTRONIC ENGINEERING

VOL. 3 | MARCH, 1943 | NO. 4

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The publishers will be pleased to receive articles, particularly those well illustrated with photos and drawings, concerning radio-electronic developments. Manuscripts should be sent to the publication office, at New York City. Contributions will be neither acknowledged nor returned unless accompanied by adequate postage, packing, and directions, nor will FM Magazine be responsible for their safe handling in its office or in transit.

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THIS MONTH'S COVER

The coöperative spirit which characterizes Signal Corps and Navy inspectors has gradually broken down antagonism on the part of radio manufacturers toward the idea of such supervision. Indirectly, their presence has resulted in showing up weak spots in factory organizations, and in the elimination of deadwood in engineering and production departments. This month's cover shows Signal Corps inspector E. P. Mayer at work in a final inspection cage at the Hammarlund Manufacturing Company.

for the DURATION—

if you delay now, you may have to wait until the War is *over!*

If you aren't a subscriber to FM RADIO-ELECTRONICS, or if your subscription has expired, act NOW while we are still able to accept subscriptions.

The WPB has already put a limitation on our paper supply. One and probably two further reductions are projected for this year. We are now making plans for meeting this situation.

This means putting a limit on subscriptions — refusing subscriptions when that limit is reached. Exactly when that will be, we don't know but we have been told to expect it.

When the time comes, we shall be able to accept new subscriptions only if expirations aren't renewed. And if your subscription isn't renewed promptly, it will be allotted to someone else.

It will also mean that we can print no extra copies, in order to have back numbers available. So, if you lend your copies and don't get them back, we shan't be able to fill in the missing numbers in your files.

If you have been getting copies at your office, we suggest that you have them sent to your home. They have such a strange way of disappearing from desks and tables.

Don't delay. We shan't have advance warning of further paper restrictions, so we won't be able to warn you. Use the subscription blank bound into this issue. Note the saving on group subscriptions.

P.S. The rate to men in the Armed Forces is $1.50 per year.

FM RADIO-ELECTRONICS

WHAT'S NEW THIS MONTH

AS YOU probably noticed on the front cover, there is a change in the sub-title. We'd prefer not to have a sub-title, for *FM* is an excellent name by itself because it is so easy to say and to remember.

However, the title of a magazine must properly describe its contents and indicate its class of readers. During the last three years, developments in electronic tubes contributed enormously to the advance of the radio art, and radio engineers have, in turn, combined radio and electronic development for many new services. Thus, the combined fields of radio and electronics are now understood to have a broad implication which embraces all future growth, while radio has come to have a limited significance.

At its inception, this publication was devoted to the presentation of new ideas for the design, engineering, manufacture, installation and operation of radio equipment. Since editorial scope has been broadened with the progress of what has become the radio-electronic art, it was necessary to indicate that growth by a change in the title.

A year ago, "Applied Electronics" was decided upon as an appropriate sub-title. As a matter of courtesy, the publishers of "Electronics" were advised of this proposed change. They objected, on the ground that they alone were privileged to used the word "electronic" with an "s." Without conceding any such proprietorship, since no one can stem the tide of its use, the sub-title "Applied Electronics" was abandoned, and our esteemed contemporary was advised: "I specifically want to avoid the use of a title which would give anyone the impression that I am trying to encroach upon the rights of another publisher."

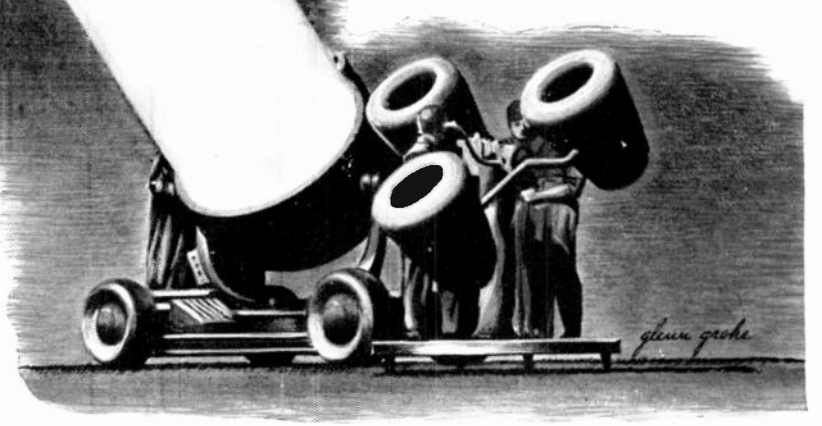
Subsequently, the sub-title Radio-Electronic Engineering & Design was adopted. While that was adequately descriptive, it had a disadvantage. For purposes of writing or conversation, neither the name and modifying sub-title, nor any shortened form of the two, could be used together.

Thus it has come about that the abbreviated RADIO-ELECTRONICS has now come into use. We hope that this will cause offense to no one. We feel sure that it will not give rise to any justifiable complaint. It is still our intent to avoid encroachment upon the rights of any other publisher.

M. B. SLEEPER, *Editor.*

LISTEN AND BEHOLD ANEW

★ The world and most that we know about it is the gift of our eyes and ears. Listen, and Behold, are the earliest admonitions for knowledge. Could any mission be higher, then, than that of expanding the scope of human sight and hearing? Even when the means is modest, as an incandescent lamp, or fluorescent lamps and equipment, or radio and electronic tubes? Everyday things these, of critical value now, that we work upon here at Sylvania. Yet they are keys to whole new worlds of boon and blessing. Already flaring in the vacuum tubes are prophetic miracles, from television to aircraft landing beams, from making germ structure visible to killing bacteria by light, from measuring ocean depths to penetrating fog and storm. Small wonder we approach our work humbly. Or that we set for ourselves the highest standards known.



SYLVANIA

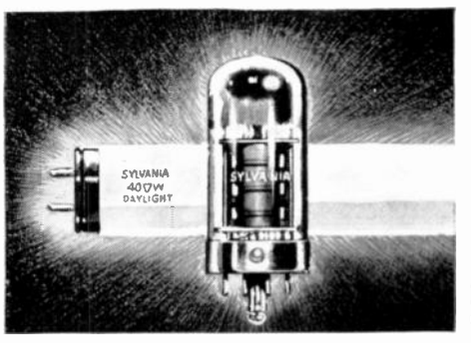
ELECTRIC PRODUCTS INC.

formerly Hygrade Sylvania Corporation

Emporium, Pa.

Established 1901 . . . Makers of Incandescent Lamps, Fluorescent Lamps, Fixtures and Accessories, Radio Tubes and Electronic Devices

NAME TO REMEMBER. You may find the Sylvania name and mark on radio tubes, incandescent lamps and fluorescent lamps and equipment already in your service. It is a name to remember—to hold in mind and seek out when time comes to make necessary replacements. If you then find it less easy than formerly to locate Sylvania Tubes and Lamps—just remember that war needs must come first. We are doing all we can to fill-civilian needs in view of wartime necessities that must be met.



HT-4B

HERE is that high-powered rig you have always wanted to own . . . one that you can depend upon for peak operating efficiency. Hallicrafters have built into the HT-4B the resultant experience from years of engineering research.

Model HT-4B delivers a carrier output of 325 watts on phone and 450 watts on CW. The preamplifier supplied with the transmitter can be mounted conveniently at the operating position, controlling volume, keying and standby . . . once adjusted to any band the rig may be operated remotely.

When, once again, we are permitted to sell communications equipment for civilian use — your HT-4B will be waiting for you.

hallicrafters

CHICAGO, U. S. A.

World's largest exclusive manufacturer of short wave radio communications equipment.

THE WAR-BORN WORD FOR POST-WAR MAGIC

"ELECTRONICS"

DURING World War I a new word, connoting great mystery, strange power, and associated with the quick acquisition of wealth, came into wide public use. It was the word RADIO. To be sure, *wireless* was in general use before the turn of the century. The dictionary defines both as communication by electric waves without the use of interconnecting wires. The greatest difference between the two is that one had the effect of producing a pleasant psychological reaction, and the other didn't.

Now, by some unexplained oddity, World War 2 is giving us a repeat performance, but this time the word is ELECTRONICS. The difference is only that it has the attributes of deeper mystery, greater power, and is becoming associated with the quicker acquisition of still more wealth, waiting only for release upon the return of Peace.

The Most Misunderstood Word ★ Right now, *electronics* is the most misunderstood and misused word in our language. Lacking definition in the public mind, it inspires the uninformed to endow it with meaning drawn from their own imaginations.

Here, as a case in point, is the description of a radio transceiver of small dimensions, quoted from a widely-circulated publication: "Many secret devices have been developed which must await the end of the war before being revealed and adapted to civilian uses. As an example, there is the walky-talky set used in field observation work, which consists only of a small box containing electronic devices with a transmitter, and is understood to be capable of broadcasting on different wavelengths for a distance of over a mile."

That's what happens when the word *electronics* gets into the description of a gadget that any radio amateur can put together from a cigar box, some small batteries, a tube, and some hardware out of his junk box!

What the Dictionary Says ★ Few people know that any definition has been established for the word, but it's in the current edition of the Merriam-Webster dictionary: "*electronics*, that branch of physics which treats of the emission, behavior, and effects of electrons, esp. in vacuum tubes, photoelectric cells, and the like." To the popular mind, such a definition merely confirms the mysterious, potential powers of *electronics*. But here is a definition, given in a circular distributed by a brokerage house, which really opens the flood gates of the imagination: "Electronics is that branch of science and technology which deals with the behavior of electrons in their passage through gas and/or vacuum tubes. Applied electronics, of course, is the development of practical uses for the phenomena observed and discovered. As to an electron itself, its true nature is unknown. Some scientists regard it as pure electricity. Others describe it as the natural elementary quality of negative electricity, or a particle of matter carrying an electric charge. Its size is infinitesimal and it takes 30 billion, billion, billions of electrons to weigh one ounce. The fact that electrons are so small enhances their usefulness, in that it takes only a very minute amount of energy to control their movements."

"Electronic Device" ★ A definition greatly needed, but still lacking, is that of *electronic device*. A moment's consideration makes it clear that since *electronic* is defined as "of or pertaining to an electron or electrons," an *electronic device* must be one in which some electronic action takes place.

Thus, logically, the term *electronic device* can be used in referring to various types of vacuum and gas tubes, and photoelectric cells.

It is, therefore, manifestly incorrect to attribute to an electronic device or to electrons the ability to perform any mechanical work, since electron tubes have no moving parts.

Yet non-technical writers, who are building up the popular conception of electronics, constantly refer to electronic devices as the means by which work is done. Here is an example: "The electronic devices do many things better, cheaper, and quicker than old mechanical arrangements and they perform many industrial jobs which cannot be done in other ways."

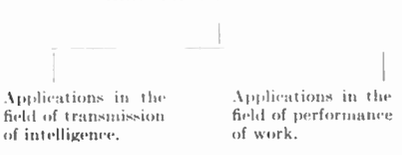
Substitute *devices controlled by electron tubes* in that sentence for *electronic devices*, and a clear conception is given because the misstatement is corrected.

The invention, the novelty, and the improvement lies in the use of devices which are controlled by electron tubes, or in new tubes which make possible new devices. But no one has ever watched a tube (or electronic device) do anything more than stand silent and immobile in its socket.

No Such Animal ★ An ultra-violet ray tube is an electronic device which kills bacteria; a cathode ray tube is an electronic device which makes a television picture; and a thyratron is an electronic device which controls the speed of a motor or the brilliance of electric lights.

But who ever saw an *electronic device* count automobiles, push out brown beans, or open doors? *Those jobs are done by pawls pushing number wheels, by magnets activating plungers, or by compressed air in cylinders forcing out pistons, under the control of electronic devices.*

Radio-Electronics and Industrial-Electronics ★ The electronics industry, carrying on research, development, and manufacture of tubes (electronic devices), is concerned with applications divided into two groups. These are the parent radio-electronics field, concerned with the transmission of intelligence[1]; and the new industrial-electronics field, concerned with performing work. This can be expressed diagramatically in this manner:



Or, to express the relations of the industries involved in the manufacture of tubes and tube-controlled equipment:

The line of demarkation between radio-electronics and industrial-electronics is drawn from another angle by W. A. Ready, president of the National Company, Inc., referring to the need for a new army of maintenance men to install, operate, and maintain industrial-electronics equipment: "These men will be . . . as distinct from radio men as pattern makers are distinct from cabinet makers. The principles and the tools will be the same, but the jobs will be very different. It will be a good profession, busy, profitable, and interesting."

Thus new uses for what were originally radio tubes, plus the development of new tubes for still other uses, have grown to the point of creating two distinct and entirely unrelated fields of application,

(CONTINUED ON PAGE 43)

[1] Telephone engineers may object to the use of the word *radio* as a generic term for the transmission of intelligence. However, the development of radio and wire transmission have become so integrated that the awkwardness of introducing a third division seems hardly justified.

REVISED ARMY-NAVY TUBE LIST

This A-N Tube List Supersedes the Previously Published List Dated September 28, 1942

A CAREFUL STUDY of the tubes shown in the accompanying A-N Preferred List may save designers much time, for both the Army and the Navy are tightening down on the use of non-listed tubes.

Following is the complete text of the joint Army-Navy announcement:

March 2, 1943

TO THOSE CONCERNED WITH THE DESIGN AND MANUFACTURE OF ARMY OR NAVY EQUIPMENT UTILIZING VACUUM TUBES

1. The following Army-Navy Preferred List of Vacuum Tubes sets up a group of unclassified general purpose tubes selected jointly by the Signal Corps and the Bureau of Ships. The purpose of this list is to effect an eventual reduction in the variety of tubes used in service equipment.

2. IT IS MANDATORY THAT ALL UNCLASSIFIED TUBES TO BE USED IN ALL FUTURE DESIGNS OF NEW EQUIPMENTS UNDER THE JURISDICTION OF THE SIGNAL CORPS LABORATORIES OR THE RADIO AND SOUND BRANCH OF THE BUREAU OF SHIPS BE CHOSEN FROM THIS LIST. EXCEPTIONS TO THIS RULE ARE HEREINAFTER NOTED.

3. The term "new equipments," as mentioned in Paragraph 2 above, is taken to include:

a. Equipments basically new in electrical design, with no similar prototypes.

b. Equipments having a similar prototype but completely redesigned as to electrical characteristics.

c. New test equipment for operational field use.

4. The term "new equipments," as mentioned in Paragraph 2 above, *does not* include:

a. Equipments either basically new or redesigned, that are likely to be manufactured in very small quantity, such as laboratory measuring instruments.

b. Equipments that are solely mechanical redesigns of existing prototypes.

c. Equipments that are reorders without change of existing models.

d. Equipments in the design stage before the effective date of adoption of this Preferred List.

NOTE: The foregoing statements in Paragraphs 3 and 4 above are explanatory in nature and are not intended to be all-inclusive.

5. In the event that it is believed that a tube other than one of those included in this Preferred List should be used in the design of new equipments for either the Signal Corps or Navy, specific approval of the Service concerned must be obtained. Such approval, when Signal Corps equipment is concerned, is to be requested from the Signal Corps Laboratory concerned with such equipment; the said Laboratory will then make known its recommendations in the matter to the Office of the Chief Signal Officer where the final decision will be made and returned to the laboratory for transmittal to the party requesting the exception. When Navy equipment is concerned, the request for exception shall be addressed to the Bureau of Ships, Navy Department.

6. The publication of this list is in no way intended to hamper or restrict development work in the field of vacuum tubes or vacuum tube applications.

7. This list is to take effect immediately.

Office of the Chief Signal Officer, Headquarters, Services of Supply, War Department.

Chief of the Bureau of Ships, Navy Department.

ARMY–NAVY PREFERRED LIST OF VACUUM TUBES

MARCH 1, 1943

RECEIVING

Filament Volts	Diodes	Diode Triodes	Triodes	Twin Triodes	Pentodes: Remote	Pentodes: Sharp	Rectifiers	Converters	Power	Indicators
1.4	1A3	1LH4	1G4GT	3A5 1291	1T4	1L4 1LN5 1S5		1LC6 1R5	3A4 3Q4 3Q5GT 1299	991
5.0							5U4G 5Y3GT			
6.3	6H6* 9006	6SQ7* 6SR7*	2C22 2C26 6C4 6J5* 1201 9002	6J6 6SL7GT 6SN7GT	6AG5 6AK5 6SG7* 6SK7* 9003	6AC7* 6AG7* 6SH7* 6SJ7* 9001	6X5GT 1005	6SA7*	6B4G 6G6G 6L6G 6N7GT 6V6GT 6Y6G	6E5
12.6	12H6*	12SQT* 12SR7*	1265GT	12SL7GT 12SN7GT	12SG7* 12SK7*	12SH7* 12SJ7*		12SA7*	12A6*	1629

TRANSMITTING

Triodes	Triodes	Twin Triodes	Pentodes	Rectifiers: Vacuum	Rectifiers: Gas	Grid Cont. Rectifiers
304TH	807	815	2E22	2Y2	4B25	394-A
801-A	813	829	803	3B24	83	884
811	814	832	837	5R4GY	866A	2050
826	1625			73R	872A	C1B
833-A				371A		C5B
838				705A		
1626				836		
8005				1616		
8025				8020		

MISCELLANEOUS

Voltage Reg.	Prototubes	Cathode Ray
VR- 90-30	918	2API
VR-105-30	927	3BPI
VR-150-30		5CPI
		9EPI

* Where direct interchangeability is assured "GT" and "L" counterparts of the preferred metal tubes may be used.

AIRCRAFT RADIO APPARATUS DESIGN

Mechanical and Electrical Details of the Bendix RTA-1B Communications Unit, Part 1

BY R. B. EDWARDS*

AIRCRAFT radio apparatus design might be described as the radio engineer's delight, for no restriction is put upon the designer's ingenuity in using the best he can find in materials and methods to assure absolute dependability. In other words, it is an axiom of aircraft radio design that the best there is is not good enough if something can be found that is still better.

The only limiting factor is weight, and even that is not necessarily a limitation on performance. With this wide latitude, the engineer's skill as a designer shows up in his ability to take advantage of such precision production methods as will achieve a well-proportioned balance between the quality of the equipment and its cost.

The foregoing might be considered as the overall specifications for the Bendix radio telephone transmitter and receiver shown in the accompanying illustrations.

* Project Engineer, Bendix Radio, Division of Bendix Aviation Corporation, Baltimore, Md.

[1] Also known as A. R. Inc. 5088.

[2] See diagram which will be published in part 2 of this article.

Design of Aircraft Radio Apparatus

SOME of the finest examples of radio apparatus design are to be found among equipment for aircraft communications service.

It is with particular pleasure, therefore, that we present Mr. R. B. Edwards' article. Very complete data is included on the electrical characteristics and the mechanical construction, permitting close comparison with other types of receivers and low-power transmitters. Both the text and the illustrations deserve careful study by radio designers and engineers.

Requirements for Army and Navy aircraft radio equipment have given a tremendous impetus to what is becoming a highly specialized division of communications apparatus design. Continued progress in this field can be expected as a part of the peacetime expansion of air transportation for, as commercial flights become longer, the need for dependable communications will become still greater.

General Description ★ The Model RTA-1B equipment is designed to provide reliable, long-range, two-way telephone communications between aircraft and ground stations or other aircraft, while in flight. The equipment operates in the frequency range of 2.5 to 13.0 mc., on any of ten fixed crystal-controlled channels specified by the purchaser.

This unit [1] was designed to fill the needs of our domestic airlines. Many people contributed their ideas toward its design. These include communications men from United Airlines, Eastern Airlines, Transcontinental and Western Airlines, and Aeronautical Radio, Incorporated, as well as engineers in the Bendix Radio engineering departments. The Bendix engineers, of course, are responsible for the production design of the RTA-1 units. Aeronautical Radio, Incorporated, acted as the coördinating medium between the airlines and Bendix Radio during the production design of this equipment, now widely used for domestic transport planes as well as some foreign airlines.

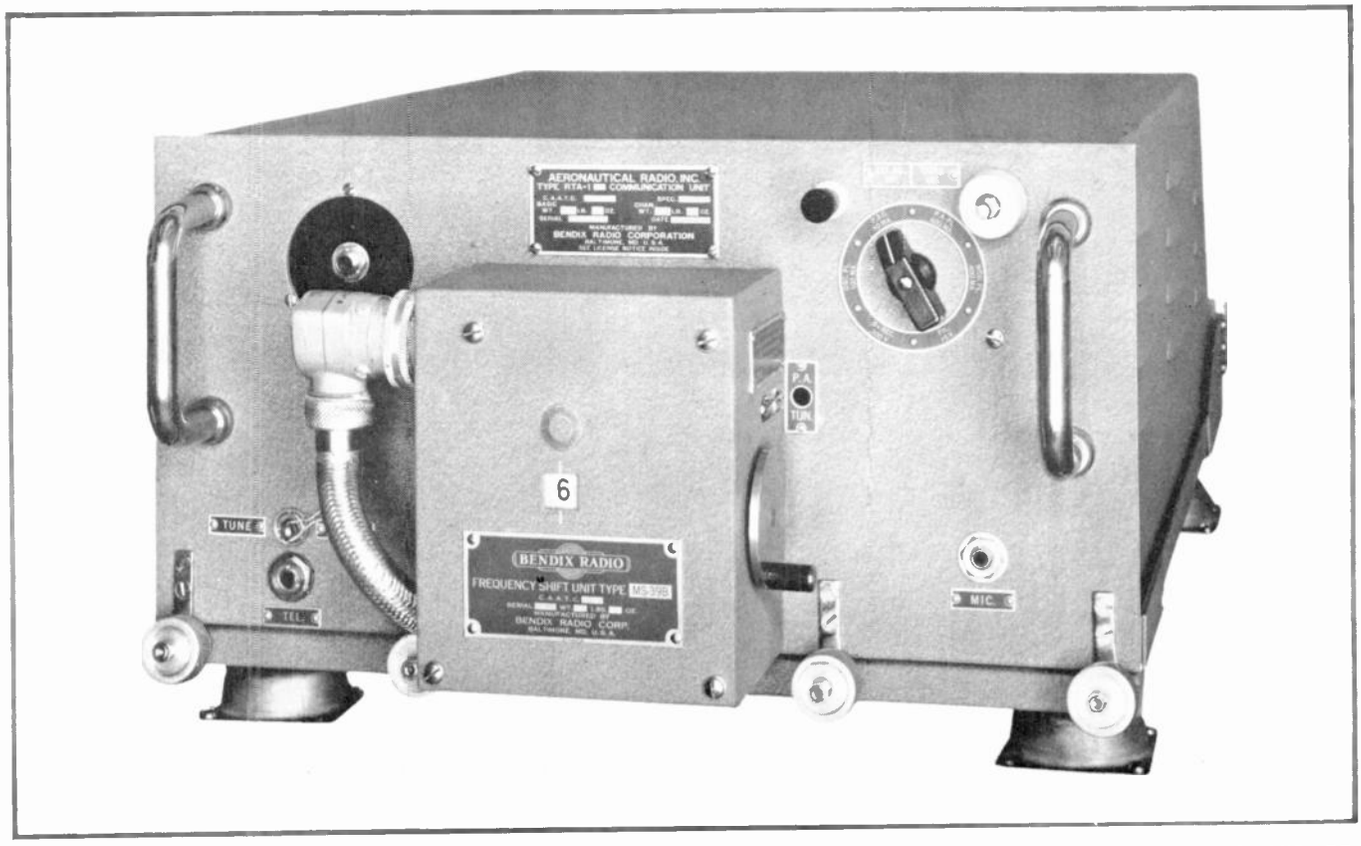


FIG. 1. THIS 10-CHANNEL 50-WATT TRANSMITTER AND RECEIVER WEIGHS 68.5 LBS., INCLUDING THE TRANSMITTING AND RECEIVING DYNAMOTORS, YET NO DETAIL HAS BEEN OMITTED THAT WOULD CONTRIBUTE TO DEPENDABILITY OF OPERATION

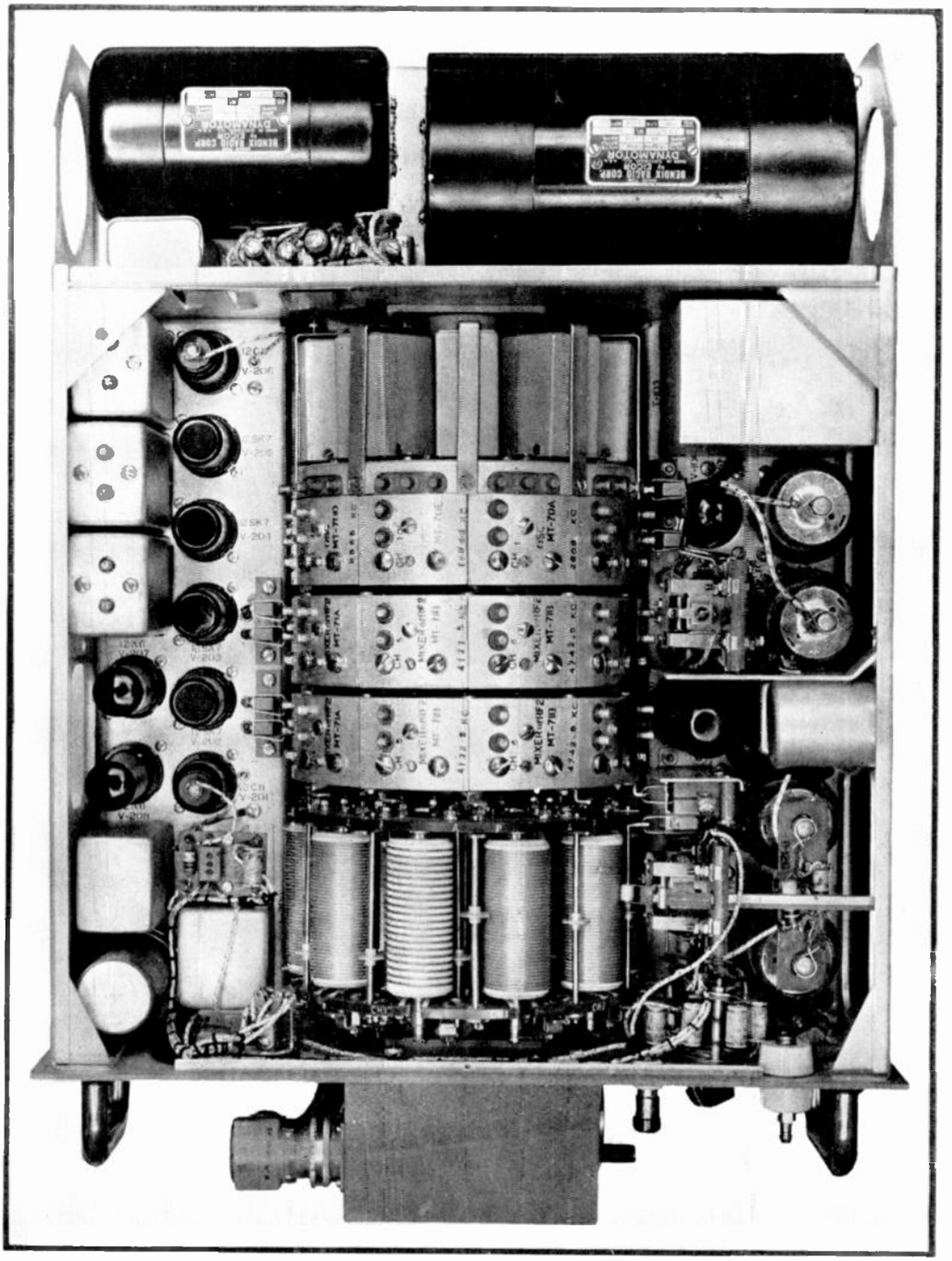


FIG. 2. TOP VIEW, SHOWING THE RECEIVER SECTION AT THE LEFT, TRANSMITTER SECTION AT THE RIGHT, AND THE TURRET

Transmitter, receiver, and power supply are contained in one case, the front of which is shown in Fig. 1. Either 12 or 24 volts can be used as a power supply without modifying the equipment, as will be explained subsequently.

Ten frequencies are available for transmitting, and ten different frequencies for receiving, provided by the use of separate, pretuned crystal-controlled circuits. These are selected in pairs[2] from a remote control, or manually at the unit. The channel number can be seen in the small window of the remote control cover, Fig. 1, with the manual control crank on the side of the cover.

The same remote control panel also contains headphone and microphone jacks for dual reception and transmission. Audio and RF gain controls can also be used at the remote panel, if desired. In addition, a dual audio control system can be employed, but only one RF control is available. As a rule, the airlines design control panels to suit their individual needs.

Four types of mounting bases are available for this equipment. One is equipped with Lord shock absorbers. The other three are designed to fit mounting racks provided in aircraft. Each of the four types is equipped with two Cannon rectangular receptacles which engage the plugs mounted at the rear of the communications unit, as illustrated in Fig. 4. These handle all the power and control circuits.

The inter-wiring of the transmitter and receiver circuits is designed to provide an interphone system between pilots, using the dual transmitter microphones.

This can be accomplished when the transmitter filament switch is OFF and the circuit master switch is ON, since the interphone audio circuits are operated by the receiver dynamotor which functions as long as the master switch is ON.

The type MS-39B frequency shift unit, shown on the front of the equipment, Fig. 1, selects the transmitting and receiving frequencies by rotating the turret, Figs. 2 and 3, on which the crystals and inductors for each channel are mounted. Thus, in a single operation, both transmitter and receiver are switched to any one of the ten pre-set channels.

The time required for shifting to the most remote position is 6 seconds when

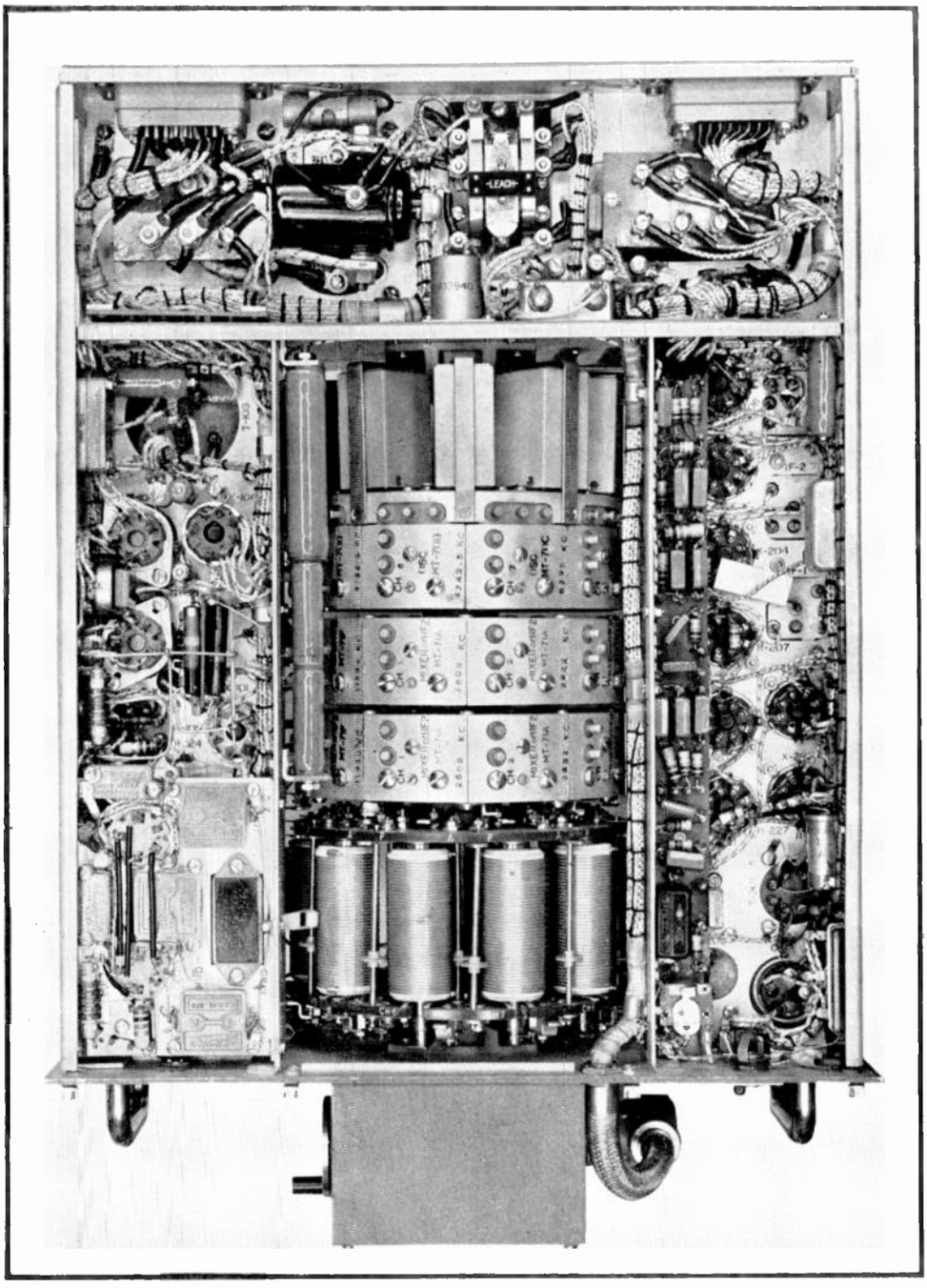


FIG. 3. BOTTOM VIEW SHOWS HOW, BY THE TUNING TURRET DESIGN, EVERY INCH OF SPACE IS UTILIZED EFFECTIVELY

the equipment is operating in an ambient temperature of + 20° C.

In case of failure, the control unit can be operated by a hand crank, located at the side, as shown in Fig. 1.

A muting relay circuit eliminates the audio clicks set up while the channel selecting mechanism is in operation.

The audio circuits of the transmitter and receiver are interconnected so that the sidetone is heard in the receiver outputs when the transmitter is modulated. Maximum receiver sidetone output is 200 milliwatts into 500 ohms when the transmitter is modulated 100%. The maximum amplitude of the sidetone signal can be adjusted by means of a screwdriver adjustment at the side of the cabinet.

There is a meter jack on the front panel, connected to a multi-point switch. These can be seen in Fig. 1 at the upper left and right, respectively. Connections are made through the switch so that the following currents and voltages can be measured:

PA plate current
Modulator plate current
PA grid current
Transmitter oscillator plate current
Transmitter filament voltage, at the tube socket
Receiver B+ supply voltage

Meter range shunts are proportioned to give normal readings at approximately half-scale indications on a meter of 0–1 milliampere range.

The meter jack is carried on an insulating plate which is, in turn, mounted in a 2-in. meter hole. When it is specified, a meter is mounted on the panel, thus eliminating the use of the jack, plug, and separate meter.

As for the performance characteristics, these are set forth briefly in the following data:

Transmitter Characteristics ★ The transmitter section employs a crystal-controlled oscillator circuit operating on any of ten fixed channels specified by the purchaser, within the 2.5 to 13.0 mc. band.

Power output is 50 watts at 100% modulation. Power measurements for rating purposes are made with a dummy load of 20 ohms resistance and 400-mmf. capacitance at an input voltage of 12.5 or 25 volts to the transmitter dynamotor.

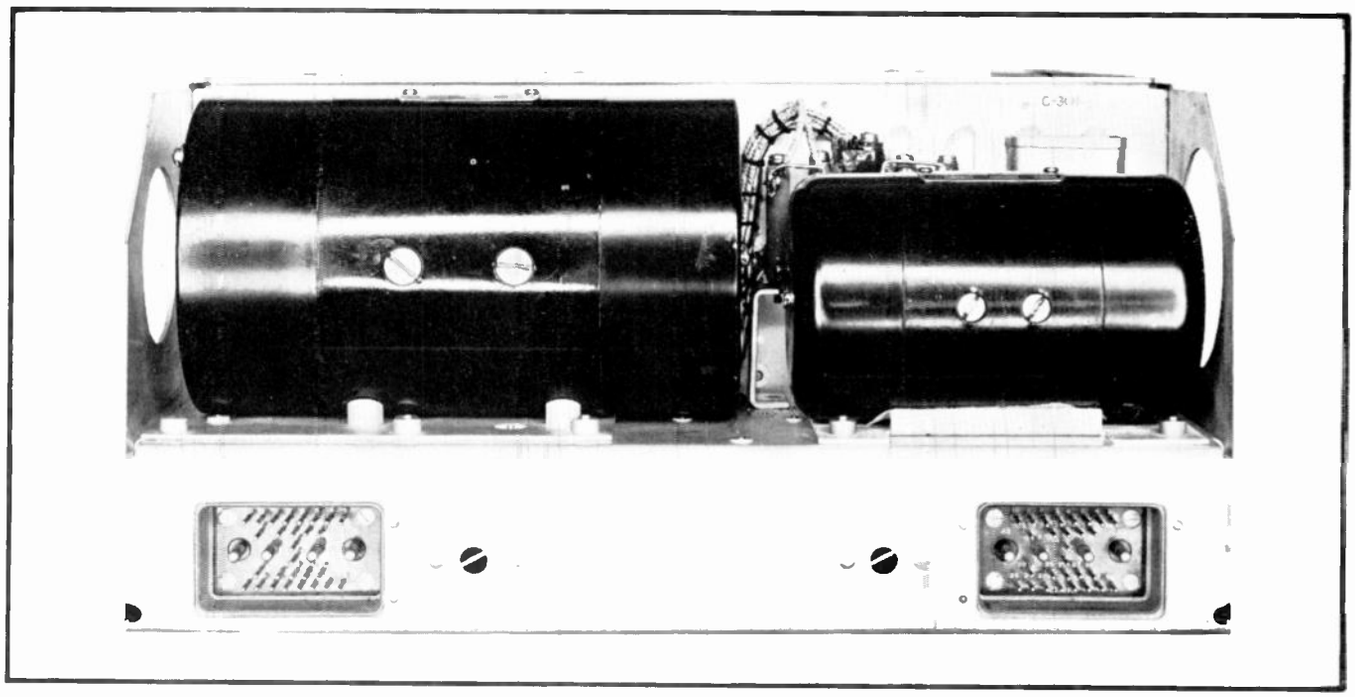


FIG. 4. DYNAMOTORS, MOUNTED AT THE REAR, ARE OUTSIDE THE CABINET SECTION CONTAINING THE RADIO TUNING CIRCUITS

Audio-input impedance for the carbon microphone is 100 ohms. Sufficient gain is provided to fully modulate the transmitter with an input of 0.4 volt. Direct current supply is provided for the microphone.

The overall frequency response is ± 3 db from 500 to 3,000 cycles and cuts off beyond these limits. Response at 100 cycles is down at least 20 db from the 1,000-cycle value. This audio response eliminates much of the undesirable noise that would be heard otherwise.

Harmonic distortion, measured at 1,000 cycles, is 10% maximum at 95% modulation. High-level modulation is applied to the Class C final RF amplifiers.

Receiver Characteristics ★ The receiver section employs a superheterodyne circuit with a crystal-controlled heterodyne oscillator and operates on any of ten fixed channels specified by the purchaser in the 2.5 to 13.0-mc. band.

The overall selectivity is:

Frequency	*Band Width at 60 db*	*Band Width at 5 db*
2.5 mc.	Not more than 20 kc.	Not less than 4.5 kc.
13.0 mc.	Not more than 24 kc.	Not less than 4.5 kc.

Attenuation of images and all other undesired frequencies is in excess of 60 db for receiver frequencies up to 10.0 mc., and not less than 50 db above 10.0 mc.

The sensitivity is such that an input of 2 microvolts modulated 30% at 400 cycles will produce an output of 50 milliwatts at a signal-to-noise ratio of 4 to 1.

An automatic volume control holds the output within 6 db for an input variation from 2 microvolts to 0.1 volt. The receiver does not block at RF inputs up to 10 volts.

Two independent audio channels each supply 300 milliwatts to a 500-ohm resistive load. Maximum harmonic distortion at 1,000 cycles and full-rated output is 15%. Cross talk between channels is down at least 50 db for all frequencies audible in the headphones. The overall audio response is ± 3 db from 300 to 2,500 cycles.

Power Supply ★ Operating from 12 to 14 volts, when the transmitter switch is off, the receiver on, and the transmitter tube heaters in low position, the input current is 8.2 amps. at 14 volts. With the transmitter on, at 100% modulation, the input current is 39.0 amperes at 12.5 volts.

Operating from 24 to 28 volts, when the transmitter switch is off, the receiver on, and the transmitter tube heaters in low position, the input current is 4.8 amps. at 28 volts. With the transmitter on, at 100% modulation, the input current is 20.5 amps. at 25 volts.

It is assumed that the input voltage drops when the transmitter is turned on.

The circuit design of this equipment is such that either 12-volt or 24-volt operation is possible without making any changes whatever in the unit. The power supply compartment in the rear section, Fig. 4, carries a dual-voltage transmitting dynamotor and a dual-voltage receiving dynamotor.

Each dynamotor has two 12- to 14-volt armatures. The receiver dynamotor has one 12- to 14-volt field, and the transmitter dynamotor has two 12- to 14-volt fields.

The armature connections, with their individual fields, are brought out separately to the rectangular plugs at the rear of the unit.

At the input, the motor elements of each dynamotor are connected in parallel for 12- to 14-volt operation, or in series for 24- to 28-volt operation. All changes are made in the wiring of the aircraft, without any alteration of the radio equipment. Filament and relay circuits are wired in such a manner that correct voltages are always applied to the heaters and coils.

If, for any reason, it is necessary or desirable to replace the dual-voltage dynamotors with single-voltage units for 12 to 14 volts or 24 to 28 volts, this can be done readily, for the dynamotors and their terminal boards are mounted individually.

When using single-voltage units, no harm can be done to the radio or to the aircraft if the wrong supply voltage is applied accidentally.

If 12- to 14-volt dynamotor equipment is used inadvertently in a plane having a 24- to 28-volt supply, the result will be no operation. Conversely, if 24- to 28-volt dynamotor equipment is connected to a 12- to 14-volt supply, the dynamotors will run at reduced speed, but no damage will result.

Transmit-Receive Switch ★ When the microphone switch is pressed to talk, four relays perform the following operations:

A. The transmitter dynamotor is then turned on.
B. The antenna circuit is transferred from receiver to transmitter.
C. The crystal oscillator output is transferred from the receiver mixer tube to the grid of the final transmitter amplifier.
D. Voltage from the receiver B+ supply to the RF and IF tubes is cut off, and the receiver dynamotor B+ is applied to the transmitter speech amplifier.

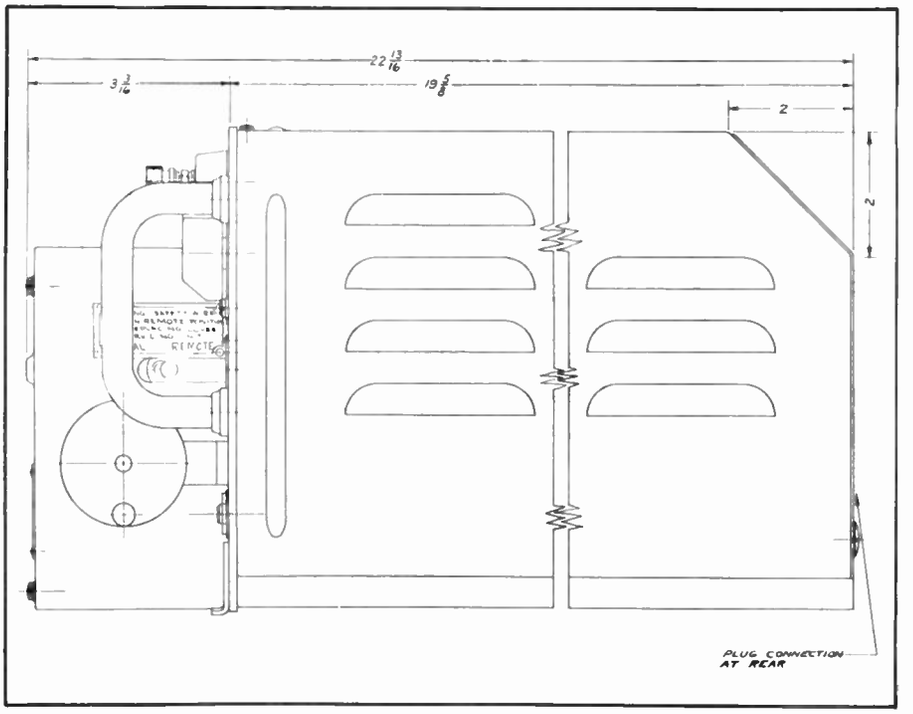


FIG. 5. SIDE VIEW OF THE COMPLETE UNIT, EXCEPT FOR THE MOUNTING BASE. NOTE THAT THE DRAWING HAS BEEN FORESHORTENED. DIMENSIONS SHOW DEPTH

E. The crystal oscillator is changed from Pierce to Miller circuit (when the crystal frequency is the same as the operating frequency).

F. Connections are changed from the receiver crystal to the transmitter crystal.

When the microphone button is released, operations A to F are reversed. In addition, all transmitter operation is cut off to prevent the coasting of the transmitter dynamotor from causing interference in the receiver during the interval before the armature comes to rest.

Vacuum Tubes ★ There are 6 tubes in the transmitter, and 8 in the receiver. Following are the type numbers:

Transmitter —	
Four	807
One	6L6
One	6V6
Receiver —	
Two	12C8
Three	12SK7
One	12SA7
Two	12A6

EDITOR'S NOTE. — *Part 2 of this article will present details of the mechanical and electrical design of this aircraft radio unit.*

RECENT ARMY-NAVY "E" AWARDS

More and more "E" awards are being won by manufacturers of radio-electronics equipment, materials, and components. The latest additions to an already imposing list are:

Colonial Radio Corporation
Buffalo, N. Y.
Corning Glass Works
Corning, N. Y.
Farnsworth Television & Radio Corp.
Marion, Ind.
Formica Insulation Company
Cincinnati, O.
C. O. Jelliff Manufacturing Corp.
Southport, Conn.
Fred M. Link
New York City
P. R. Mallory & Company, Inc.
Indianapolis, Ind.
Republic Steel Corporation
Cleveland, O.
Solar Manufacturing Corporation
Bayonne, N. J.
Sprague Specialties Company
North Adams, Mass.
Wincharger Corporation
Sioux City, Iowa

These names, added to the previous recipients of the "E" award, add up to an impressive record of achievement for the radio industry.

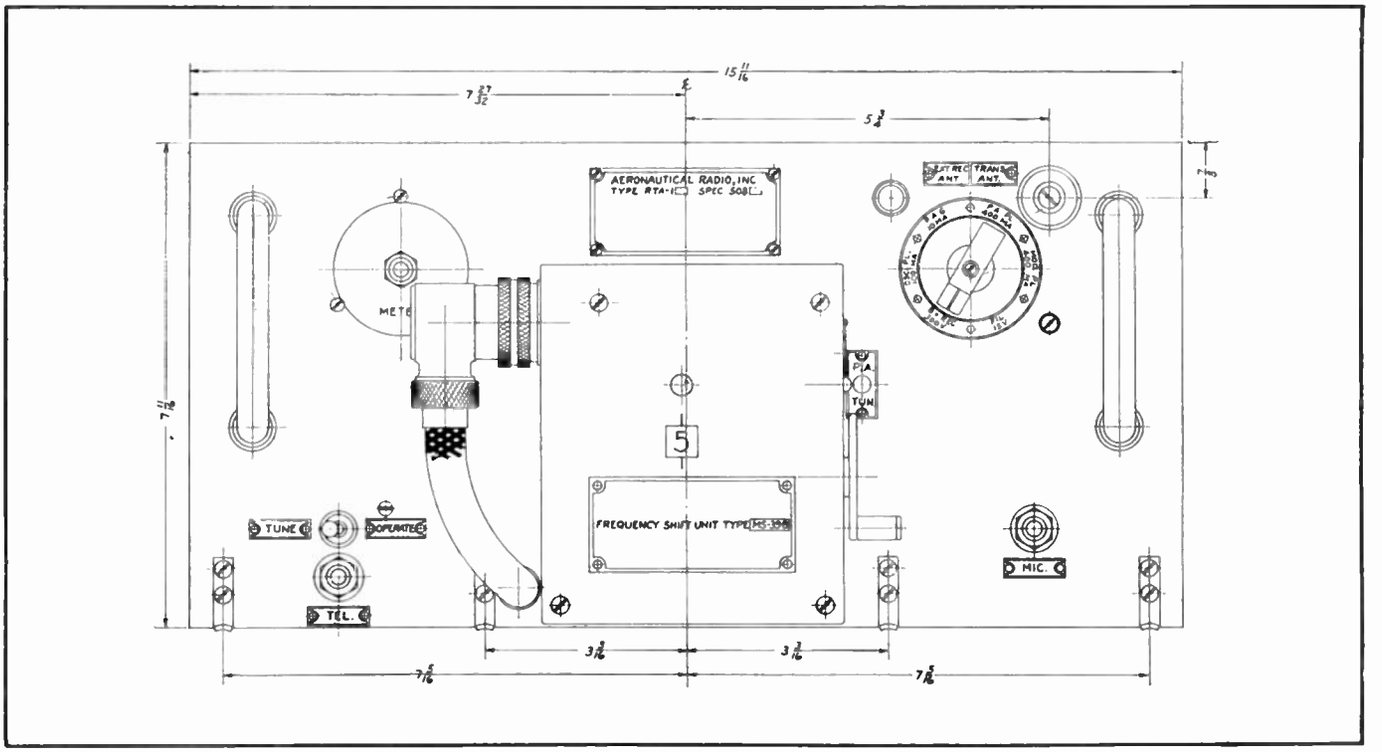


FIG. 6. FOLLOWING GENERALLY ACCEPTED PRACTICE IN THE DESIGN OF AIRCRAFT EQUIPMENT, THIS UNIT IS NARROWER THAN IT IS DEEP. THE PURPOSE IS TO CONSERVE MOUNTING SPACE, SINCE EQUIPMENT IS USUALLY CROWDED CLOSELY TOGETHER

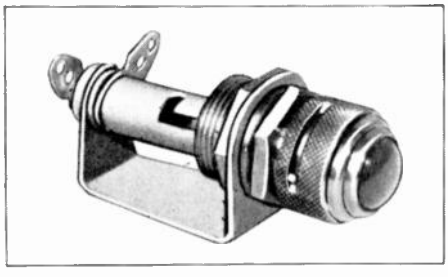
SPOT NEWS NOTES

Items and comments, personal and otherwise, about manufacturing, broadcasting, communications, and television activities

Ernest R. Breech: President of Bendix Aviation Corporation: "Through a startling development during this war, these hazards of blind flying, day or night, have been conquered. These developments are so broad in the scope of their application for military purposes that I cannot hint to you how this has been accomplished. I can tell you that it is no longer experimental and I can give you positive assurance that after the war fog, even at night, will join the long list of weather hazards conquered by Man in his desire to fly. Man's genius has added another great invention to the long list of engineering advances that now assures the airline pilot, regardless of actual weather conditions, a ceiling and visibility unlimited."

Profits: Reports from 722 U. S. broadcasting stations show that 478 made a profit on 1942 operations of more than $2,500 each. Of the remaining 244 stations, 139 were in the red, while 105 showed profits of less than $2,500 each. Reports have not yet been received from 180 stations.

More FM for New York: Municipal station W39NY is running trial programs from 2 to 5 P.M. and 7 to 8:15 P.M., preparatory for full-time schedule. Antenna is on the Municipal Building, 540 ft. above City Hall Park.



THIS PILOT LIGHT NEEDS NO RHEOSTAT

Adjustable Pilot Light: The accompanying illustration shows a pilot light equipped with a shutter by which illumination can be varied from zero to full brilliance, thus eliminating rheostat control. Produced by Gothard Manufacturing Company, 1300 N. 9th Street, Chicago, these pilot lights are furnished with red, green, amber, blue, opal, or polarized lenses.

Record-a-Rule: Walter Widlar, of WGAR, Cleveland, asks us to inform our readers that there is no charge for the Record-a-Rule, as long as the station's supply lasts. This device, giving an accurate measure of playing time of records and transcriptions, was described last month in FM Radio-Electronics. Mr. Widlar reports that many letters and telegrams were received from broadcast stations, asking how Record-a-Rule can be obtained. Answer is: just ask Walter Widlar at WGAR.

HALLICRAFTERS' BILL HALLIGAN AND S. W. EQUIPMENT DISTRIBUTOR BOB HENRY

Bob Henry: One of the Country's largest distributors of short-wave communications equipment, Bob Henry has now been appointed to the Radio Procurement Division of the Bureau of Ships. The photograph above was taken during a recent visit with Bill Halligan, Hallicrafters president.

Answers: To start new employees on the right foot, and to familiarize them with Company policies and practices, Stromberg-Carlson now gives each newcomer a copy of YOU AND YOUR JOB. This 48-page pocket-size book eliminates misunderstandings that might otherwise arise concerning such matters as working hours, pay day, Union membership and working conditions in the plant. Succeeding pages are devoted to the new employee's relations with his fellow workers and with the Company organization. This kind of information might well be supplied to men and women at other plants. Executives who would like to have a copy of the Stromberg-Carlson book should address Dr. Ray H. Manson, vice president.

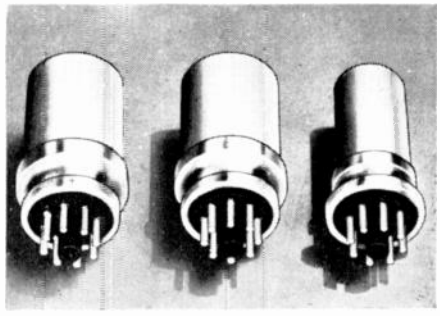
Wanted: U. S. Signal Corps is still in the market for used equipment suitable for training school purposes. The items needed are:

Transmitters — Hallicrafter and Collins
Receivers — Hallicrafter, Hammarlund, Howard, National, RME
Meters — Precision AC and DC types
Components — Mica and paper condensers, resistors, insulators
Laboratory Equipment — Oscilloscopes, AF and RF signal generators, test instruments

If you have such items in perfect condition, send a description with name of the manufacturer and model number to: Capt. James C. Short, Philadelphia Signal Corps Procurement District, Wissahickon Avenue, Philadelphia. The purchase price will be set by a Signal Corps inspector.

New Buying Guide: The 1943 catalog issued by Allied Radio Corporation, 833 W. Jackson Blvd., Chicago, includes many new items required for radio-electronics and industrial electronics research and production. Included also are standard components, materials, supplies, and tools, as well as public address and intercommunication equipment. A copy will be sent without charge, on request.

No Suspensions: While the FCC will consider individual broadcast station applications to suspend operation during the War, Chairman Fly has announced the rejection of a proposal to permit stations to close down for the duration and still retain their licenses. However, it has been provided that stations may operate for as little as six hours per day. Applications to suspend by KAST, Astoria, Ore., and WPID, Petersburg, Va., were denied.



DRY ELECTROLYTICS FOR QUICK REPLACEMENT

Plug-in Dry Electrolytics: Sprague Specialty Company, North Adams, Mass., is in production on plug-in type dry electrolytic condensers. Small, light, and rugged, these units are particularly suited for the elimination of low-frequency ripples, at 2 to 100 cycles.

(CONTINUED ON PAGE 35)

NEWS PICTURE

For the last six months, FM "schoolcasts" have been used as an adjunct to public school education in San Francisco. Miss Pauline Ryder, principal of the Emerson School where these photographs were taken, describes the results as an unqualified success. Most popular are Dwight Newton's current events programs, with which classroom activities are coördinated. Other schoolcasts are on history, science, economics, and geography. The transmitter is a G.E. installation at the Samuel Gompers Trade School. Eighty G.E. classroom receivers are now in use.

FM EMERGENCY EQUIPMENT

Part 1. General Electric Receivers for FM Patrol Car and Main Station Installations

FIG. 1. 6-VOLT MOBILE RECEIVER. A SIMILAR SET, OPERATING ON AC, IS USED FOR MAIN STATIONS

IN ORDER to meet the various requirements of FM emergency communications service, the G.E. receiver shown in the accompanying illustrations is furnished in four different models, all of which use the same basic chassis. These are:

1. 6-volt mobile receiver with vibrator power supply, as shown in the larger view in Fig. 3.

2. 6-volt mobile receiver with dynamotor power supply, as shown in Fig. 4.

3. AC-operated main station receiver mounted in the standard case shown in Fig. 1.

4. AC-operated main station receiver for rack mounting on a standard 19-in. panel, with the tubes in a horizontal position and accessible from the front of the panel.

Description of Circuits ★ The basic circuit of these FM receivers is designed to operate at any point in the 30 to 40-mc. band. A single crystal oscillator provides both the high and low-frequency conversion voltages in a double superheterodyne circuit.

Highly effective noise rejection is obtained by having almost complete limiting at less than 1. microvolt (absolute) of signal input. At this input, the receiver band width is approximately 30 kc.

The following description of the circuits and their operation is based on the diagram in Fig. 5:

All high-frequency tuning is accomplished by inductive means, through the use of compressed, powdered iron cores. This method of tuning was chosen because of its high degree of stability and its simplicity of construction.

The first tube, V111, is a radio frequency amplifier whose function is to amplify the received signal before conversion to the intermediate frequency. Its input circuit consists of an inductively tuned transformer, capacitatively coupled to the control grid.

The amplified signal is coupled into the control grid of the first converter tube V112 by means of the double-tuned circuit L6 and L7 and the coupling condenser C106. A high-frequency oscillator voltage is applied to the same grid through the coupling condenser C105. An IF voltage, whose frequency is the difference between the signal frequency and the 6th harmonic of the crystal-controlled oscillator voltage applied to the control grid, appears in the plate circuit of the mixer tube V112.

The high-frequency IF voltage, which is between 4.6 and 6.4 mc., depending on the operating frequency, is impressed on the control grid of the first IF amplifier tube V113 through the tuned coupling transformer L8, L9. The amplified output voltage is transferred to the control grid of the second converter tube V114 through the tuned coupling transformer L10, L11.

A single crystal-controlled oscillator is used to provide oscillator voltages for both the first and second converters. Oscillator voltage at the fundamental frequency of the crystal is coupled from the oscillator choke L2 to the control grid of the second converter V114 through the condenser C118. The sixth harmonic of the crystal frequency is inductively tuned in the plate circuit of oscillator tube V123 by L1 and its associated condenser C143. This sixth harmonic is applied to the control grid of the first converter tube V112 through the coupling condenser C105.

The low IF voltage, whose frequency is the difference between the first IF and the crystal oscillator frequencies, is about 455 kc., and appears in the plate circuit of the second converter tube V114.

This low IF voltage is impressed on the control grid of the low IF amplifier tube V115 through the inductively-tuned transformer L12, L13. The plate circuit of the low IF tube is inductively tuned by the powdered-iron core choke L3, and its associated condenser C101. The low IF transformers are of a special design which provides the necessary band width required for the reception of FM signals.

The amplified low IF voltage is coupled to the first limiter tube V116 through condenser C124. The cascade limiter circuit consists of two choke-and-resistance-coupled tubes V116 and V117 in series.

Each limiter operates at zero initial bias and low plate voltage. Both grid circuits are designed for self-biasing by the use of capacity-resistance networks. The values of these networks are so chosen as to provide maximum noise quieting. The plate circuits are designed so that the negative signal swings are all beyond plate current cutoff, and positive signal peaks are cut off by plate current saturation. Control of volume is accomplished by varying the screen voltage of the second limiter tube V117, the control itself being located in the control unit.

The limited IF voltage is fed to the discriminator tube V118 through coupling transformer T2. The secondary of this transformer is center-tapped, and opposite ends of the winding are connected to separate diode plates.

Between the cathodes of V118 there are two resistors R118 and R120, of equal value. As the frequency varies from the mid IF, the DC voltage across R118 and R120 changes in magnitude and polarity, depending upon the direction of the swing. This change in DC voltage is actually the

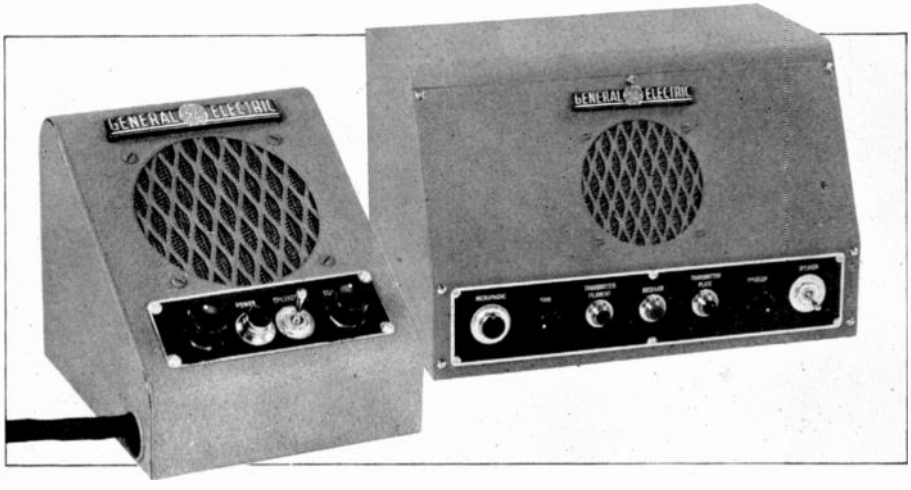


FIG. 2. ONE-WAY AND TWO-WAY MAIN STATION SPEAKER AND CONTROL UNITS

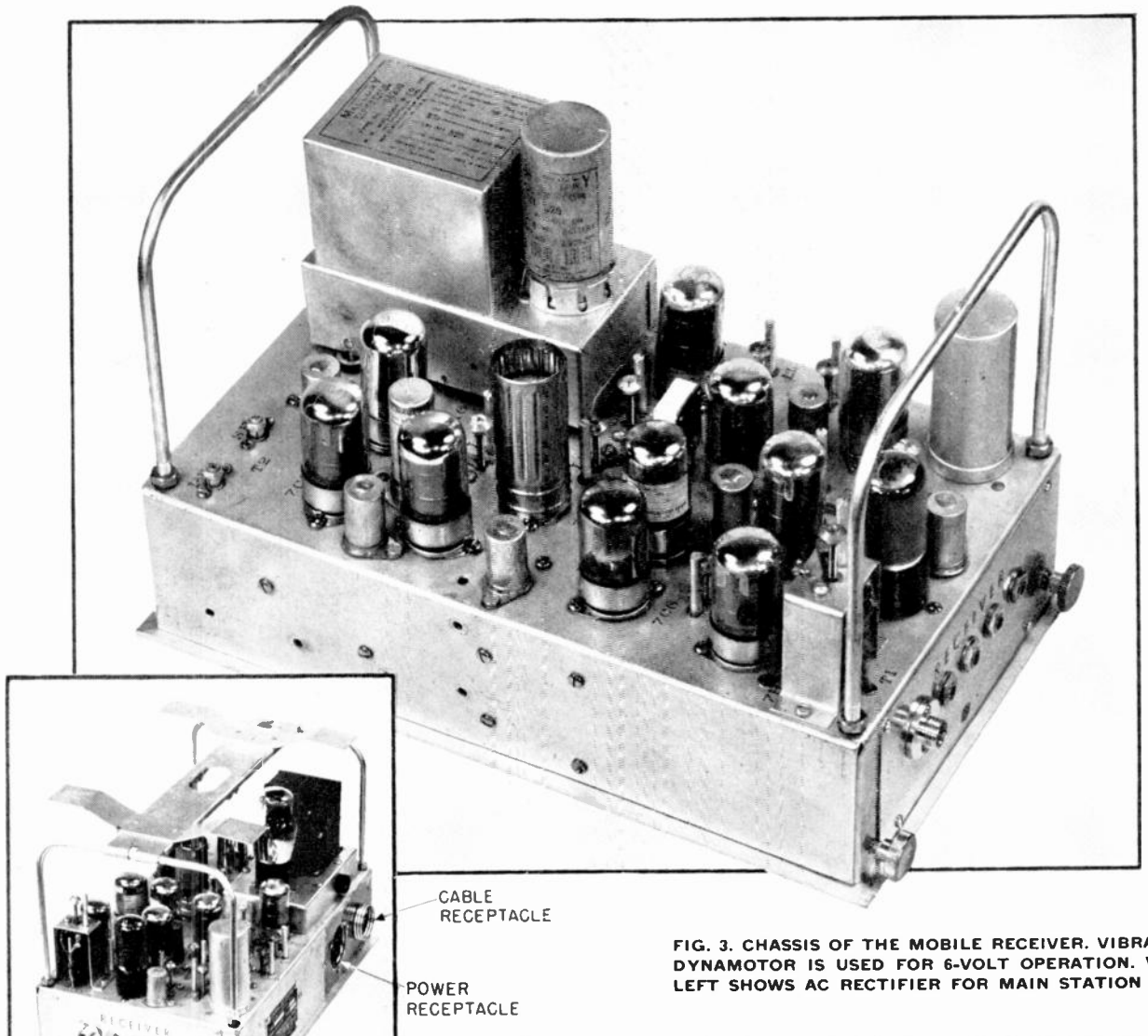


FIG. 3. CHASSIS OF THE MOBILE RECEIVER. VIBRATOR OR DYNAMOTOR IS USED FOR 6-VOLT OPERATION. VIEW AT LEFT SHOWS AC RECTIFIER FOR MAIN STATION SERVICE

audio modulation which is taken off and fed through the capacity-resistance network R119, C135, and C139 to the first audio amplifier tube V120.

The squelch amplifier tube V119 is operated by amplitude noise voltage appearing at the grid of the first limiter tube V116. This noise voltage is first amplified by the triode section of V119, and then rectified by the diode section. The resultant DC voltage is used to bias-off the triode section of the first audio amplifier V120. In the presence of a frequency-modulated signal, rectified DC at the grid of the first limiter tube V116 biases-off the noise amplifier tube V119, thus removing the DC voltage applied to the first audio amplifier tube, and rendering this tube inoperative.

The audio voltage appearing in the plate circuit of the audio amplifier tube V120 is coupled to the power output tube V121 through the network C138 and R121, and is in turn coupled to the loudspeaker through the output transformer T3.

Electrical Noise Interference ★ The elimination of interference caused by automobile ignition systems requires somewhat different treatment in different makes of cars, and even in cars of the same make. However, one of the following remedies, or combinations of them, will stop interference unless it is caused by some obvious defect in the ignition system.

A. As soon as the equipment is installed in the car, check the reception to determine if any interference is present. This should be done when the engine is not running, by turning the receiver on, with the volume set for normal listening level.

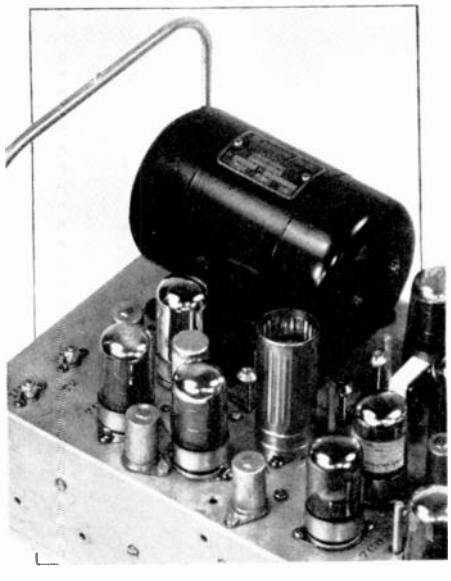
Impress a weak signal from a transmitter or signal generator on the receiver, and adjust the signal to the point where the background noise in the receiver is quite weak.

Then start the motor and note the increase in the noise level.

B. First of all, spark plug suppressors should be installed on all the plugs.

C. Next, a distributor-type suppressor, designed for the high-tension lead between the spark coil and the distributor, should be installed. For Ford cars, a special high-resistance brush can be obtained which serves this purpose.

FIG. 4. DETAIL OF RECEIVER SHOWING 6-VOLT DYNAMOTOR POWER SUPPLY



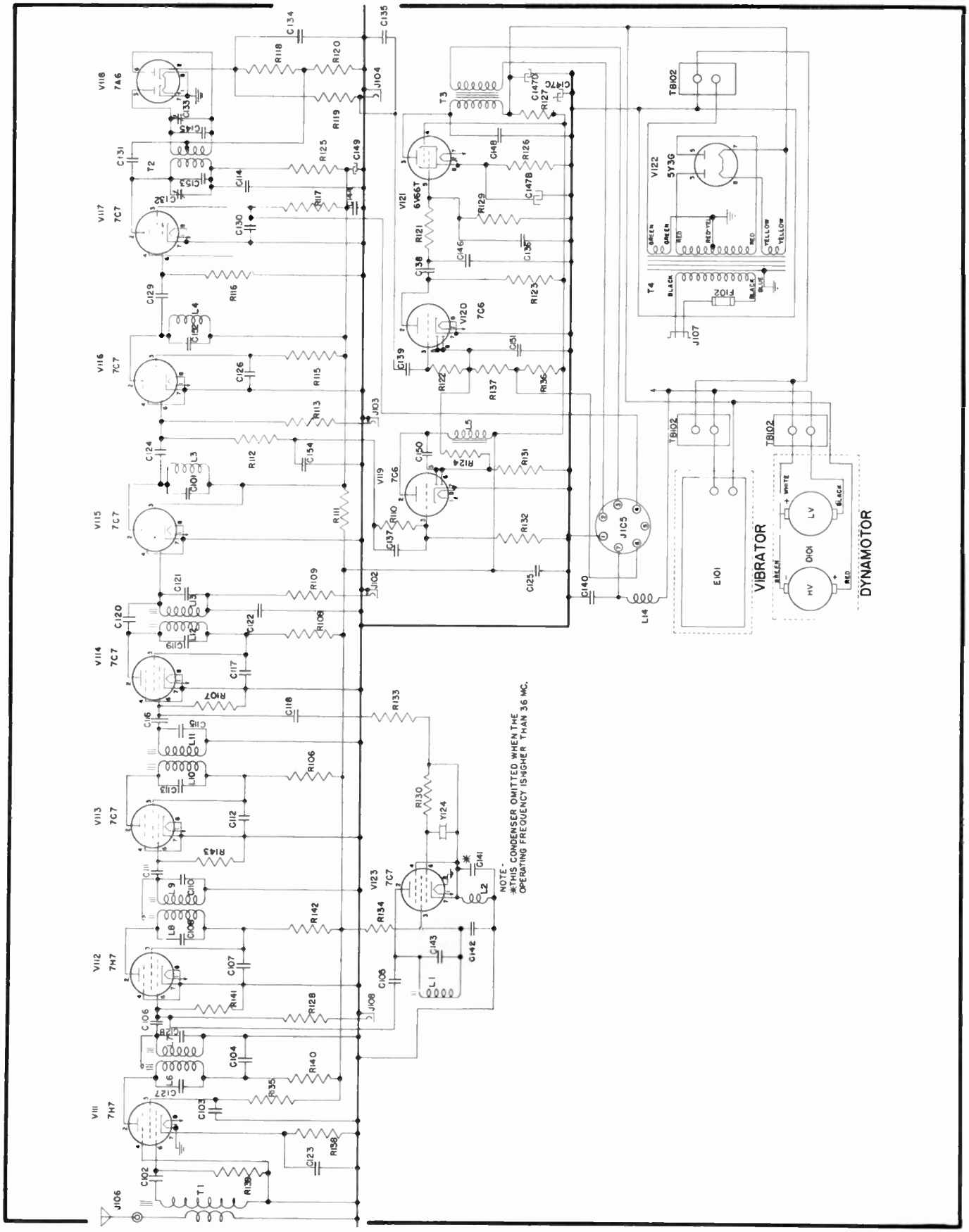


FIG. 5. SCHEMATIC OF THE G.E. MOBILE EMERGENCY FM RECEIVER, SHOWING ARRANGEMENT OF ALTERNATE POWER SUPPLIES

D. In all probability, some interference noise will still remain. If so, automobile-type condensers should be tried on the various parts listed below:

1. Generator
2. Generator voltage regulator
3. Low-voltage distributor terminal
4. Electric-type water temperature gauge at the motor block
5. Electric-type oil pressure gauge at the motor block
6. Electric-type gasoline gauge at tank

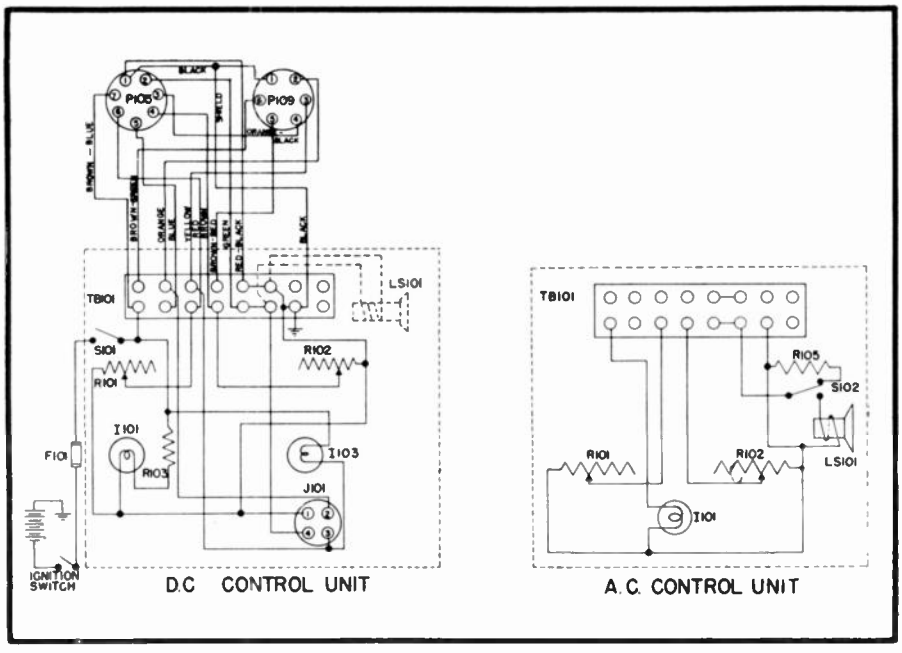


FIG. 6. SCHEMATIC DIAGRAMS OF THE AC- AND DC-OPERATED CONTROL UNITS

These are points where trouble is most often located. This is a case where the trial-and-error method is the best to use.

E. Sometimes it is necessary to bond various parts of the car to eliminate points where differences of potential exist. A single bond may turn the trick, or it may be found that bonds must be applied at several points. The most common are:

1. Choke and gas control rods should be bonded to the bulkhead.
2. The steering column, brake cable, and gear-shift rod (with steering-column gear shifting) should be bonded to the bulkhead.
3. Spark-plug cable conduits should be bonded to the engine block at least two points.
4. The engine hood should be bonded to the body of the car near the point of hinging.
5. In extreme cases, one or more bonds between the exhaust pipe and car frame may help to eliminate the last race of noise.

Circuit Data ★ The following circuit data gives further information on the circuit diagrams in Figs. 5 and 6.

TUBES

V111 RF amplifier, 7H7
V112 1st converter, 7H7
V113 High-frequency IF amplifier, 7C7
V114 2nd converter, 7C7
V115 Low-frequency IF amplifier, 7C7
V116 1st limiter, 7C7
V117 2nd limiter, 7C7
V118 Discriminator, 7A6
V119 Squelch amplifier, 7C6
V120 1st audio amplifier, 7C6
V121 Output amplier, 6V6GT
V122 Rectifier, 5Y3-G (for AC operation)
V123 Oscillator, 7C7

CONDENSERS

C101 Plate tuning, 47 mmf. ceramic [1]
C102 Coupling, 100 mmf. mica
C103 Screen by-pass, .0022 mfd. mica
C104 Plate supply by-pass, .0022 mfd. mica
C105 Coupling, 2.2 mmf. ceramic [2]
C106 Coupling, 100 mmf. ceramic
C107 Screen by-pass, .0047 mfd. mica
C108 Plate tuning, 15 mmf. ceramic [3]
C110 Grid tuning, 15 mmf. ceramic [3]
C111 Coupling, 47 mmf. ceramic
C112 Screen by-pass, .02 mfd. metal case
C113 Plate tuning, 15 mmf. ceramic [3]
C114 Plate by-pass, 470 mmf. mica
C115 Grid tuning, 15 mmf. ceramic [3]
C116 Coupling, 47 mmf. ceramic
C117 Screen by-pass, .02 mfd. metal case
C118 Coupling, 2.2 mmf. ceramic [2]
C119 Plate tuning, 22 mmf. ceramic [1]
C120 Coupling, 2.2 mmf. ceramic [2]
C121 Grid tuning, 22 mmf. ceramic [1]
C122 Grid by-pass, 47 mmf. ceramic
C123 Cathode by-pass, 220 mmf. mica
C124 Coupling, 47 mmf. ceramic
C125 B+ filter, .05 mfd. metal case
C126 Screen by-pass, 220 mmf. mica
C127 Plate tuning, 15 mmf. ceramic [3]
C128 Grid tuning, 3.3 mmf. ceramic [2]
C129 Coupling, 22 mmf. mica
C130 Screen by-pass, .02 mfd. metal case
C131 Coupling, 47 mmf. ceramic [1]
C132 Tuning, 4 to 50 mmf. air trimmer
C133 Tuning, 4 to 50 mmf. air trimmer
C134 Cathode by-pass, 470 mmf. mica
C135 By-pass, 270 mmf. mica
C136 Grid by-pass, .0012 mfd. mica
C137 Coupling, .001 mfd. mica
C138 Coupling, .0047 mfd. mica
C139 Coupling, .0012 mfd. mica
C140 By-pass, .0047 mfd. mica
C141 Tuning, 15 mmf. ceramic [3]
C142 Screen by-pass, .0022 mfd. mica
C143 Tuning, 8 mmf. ceramic [1]
C144 By-pass, .02 mfd. metal case
C145 Tuning, 22 mmf. ceramic [1]
C146 By-pass, 470 mmf. mica
C147b Cathode by-pass, 20 mfd. 25 volts dry electrolytic
C147c Filter, 15 mfd. 450 volts dry electrolytic
C147d Filter, 30 mfd. 450 volts dry electrolytic
C148 By-pass, .02 mfd. metal case
C149 Filter, 10 mfd. 450 volts dry electrolytic
C150 Coupling, 100 mmf. mica
C151 By-pass, .1 mfd metal case
C152 Plate tuning, 100 mmf. ceramic
C153 Plate tuning, 22 mmf. ceramic [1]
C154 By-pass 47 mmf. mica

INDUCTANCES

L1 Crystal oscillator coil
L2 Crystal oscillator choke
L3 Low-frequency IF plate coil
L4 1st limiter plate coil
L5 Squelch choke
L6 RF coil, primary
L7 RF coil, secondary
L8 1st high-frequency IF coil, primary
L9 1st high-frequency IF coil, secondary
L10 2nd high-frequency IF coil, primary
L11 2nd high-frequency IF coil, secondary
L12 Low-frequency IF coil, primary
L13 Low-frequency IF coil, secondary
L14 "A" choke

TRANSFORMERS

T1 Antenna transformer
T2 Discriminator transformer
T3 Output transformer
T4 Power transformer

[1] 10%, zero temperature coefficient.
[2] 20%, zero temperature coefficient.
[3] 5%, zero temperature coefficient.

(CONTINUED ON PAGE 37)

NOTES ON MODERN APPARATUS DESIGN

Part 2. Suggestions to Help Designers and Engineers Get the Right Answer the First Time

BY M. B. SLEEPER

37. Mounting Ceramic Parts ★ If a ceramic part, such as a resistor, is clamped in place with screws and nuts, washers of resilient material must be interposed so as to prevent the metal from crushing and cracking the ceramic. Even though the ceramic material is not damaged when it is mounted, direct contact with metal may cause a fracture under vibration in service.

Lead washers were recommended until that material was replaced by phenolic washers or, if the part runs hot, asbestos washers.

38. Mounting Tubular Resistors ★ The most careful consideration must be given to the mounting of resistors which carry enough current to undergo a substantial temperature rise. It is particularly important to mount them above the chassis. Underneath, where there is little or no circulation of air, they may raise the temperature of other parts, such as condensers, enough to alter their electrical characteristics, and even to cause failures.

Generally, it is better to mount a resistor horizontally rather than vertically. The reason is that the cooling is more uniform in the horizontal position. A resistor mounted vertically may run cool at the bottom and excessively hot at the top.

Resistors should be mounted between angle brackets — never held down on the chassis by a clamp around the middle.

39. Cabinet Ventilation ★ It is essential to provide adequate ventilation for cabinets, particularly on small transmitters where power tubes run at relatively high temperatures. Temperature checks should be made on any preliminary model to determine if the temperature within the cabinet exceeds intended operating temperatures of the other components. Sometimes this is a serious problem, calling for experimentation in the location and number of ventilating louvres in the cabinet. Circulation of air around the cabinet cannot be counted upon, for in so many instances receivers and small transmitters are installed in confined spaces.

Many receivers which are equipped with dynamotors are now designed with the dynamotor outside the enclosure surrounding the receiver components. The receiving circuits and dynamotor are carried on a common chassis, but the cover over the receiver does not contain the dynamotor. Thus the temperature rise within the dynamotor does not affect the circuit components.

40. Phenolic Coil Forms ★ Short sections of phenolic rod used as coil forms should be coated with a suitable varnish and baked for at least one hour at moderate temperature before winding. Another hour should elapse after they are removed from the baking oven to permit the forms to cool. The varnish protects the phenolic forms from shrinking in very dry climates, and swelling under extreme humidity. Kauri No. 74 varnish or its equivalent should be used.

41. Screws in Phenolic Material ★ Screws threaded into phenolic material, such as those used to hold terminal lugs on coil forms, are very apt to work loose, particularly under the influence of dry climate. It is becoming standard practice to dip each screw in Glyptol before it is threaded into the phenolic material. Lockwashers are of little value when interposed between metal and phenolic materials.

42. Service in the Tropics ★ Jungle warfare has introduced some special do's and don't's for radio designers. For example, leather straps go to pieces quickly, and what is left of them is consumed by insects. Canvas can be treated chemically to give satisfactory service, however. Inorganic insulation on hook-up wires, such as Vinylite, does not interest the bugs, nor tend to support plant life. The same thing is true of Bakelite varnish, probably because of its formaldehyde content. Copper sulphate paints are used for their resistance to plant and animal life.

43. Safetying ★ More and more attention is being given to safetying mounting screws and nuts on radio equipment for aircraft use. That is, holes are drilled in fillister-head screws or through the threaded ends of screws, and wires inserted so that they can be passed around adjacent fixed parts, thus preventing the screws from coming loose.

The purpose is to keep any mounted device from working free from its fastenings. A free object in a plane may not only become damaged from tossing about, but may damage other equipment, injure the occupants, or even jam the operating controls of the plane.

Safetying nuts and bolts has been standard practice for aircraft designers for many years, but its application to radio equipment has received little attention until recently. Now, safetying measures are being written into some specifications.

44. Standard for Rough Treatment ★ It is almost impossible for a radio engineer to appreciate the rough treatment that his equipment will undergo in military service, unless he has had an opportunity to find out from first-hand experience. This is not due to lack of consideration on the part of those who install, use, and service the equipment, but to the inevitable exigencies of battle conditions.

This can best be pictured in words by borrowing an expression from the men who fly and maintain the Navy's planes on the aircraft carriers. They say: "It's a good landing if the pilot can walk away from his ship." Paraphrasing this, the radio designer might say: "It's a good design if it will stand up in service on carrier-based airplanes."

Power Supplies ★ There are a few notes concerning power supplies which, if observed, may help to reduce the number of points which will be indicated for alterations when a first model is submitted for test. To experienced designers, they may appear obvious, yet they are frequently overlooked by engineers whose attention is focused on performance rather than on mechanical design. These are indicated in Fig. 2.

A. Filter Chokes ★ In all probability, the filter choke in this unit could have been designed for mounting under the chassis. If that was not practical, the height of the case could have been reduced so that the top would not have been higher than the top of the dynamotor. The reason for this is to keep the overall dimensions of the power unit as small as possible.

B. Filter Condensers ★ In this experimental model, the tallest component is the 4-mfd. oil-filled filter condenser. Like the choke coil, this condenser should not exceed the height of the dynamotor. Any one of several other types are substantially lower than this one.

C. Dynamotor Mounting ★ This dynamotor is shock-mounted with screws passing through rubber grommets which have been forced half way into the holes in the brackets. Although this method has been used widely, it is no longer looked upon with favor. The trouble is that the rubber grommets deteriorate, and soon the dynamotor is rattling around on loose screws.

If shock-mounting is not required, it is better to fasten the dynamotor brackets

securely on the chassis. If shock-mounting is necessary, rubber grommets are not adequate. In that case, the best practice is to mount the dynamotor directly on the chassis, and then use Lord or equivalent shock-absorbers for the entire unit.

D. Chassis Cover ★ When a cover over the power supply is needed, it should be held by slide fasteners or some other quick-detachable means. This unit was fitted with a cover held by four machine screws — one on each side — threaded into Boots nuts. The use of any screws which must be completely removed is ill-advised because they are too easy to lose, and may be too difficult to replace. Further, the use of a screwdriver is necessary in order to remove the cover. Finally, it is quite likely that one or more of the screws would be found inaccessible.

A better method would be to arrange the fastenings for the cover in such a way that it could be removed by loosening two slide fasteners or screws with large thumb nuts, both located on the side where the cable connectors are inserted.

E. Connectors and Fuse ★ As a rule, shelves on which equipment is mounted are so crowded that the long dimensions should be the depth, rather than the width. Therefore, it would have been better practice, in the absence of controlling specifications, to put the connectors and the fuse on a short side of the chassis. That would have brought the lesser dimension to the front, thus conserving space on the instrument shelf.

F. Mounting Base ★ On the unit illustrated in Fig. 2, no provision was made for fastening it down. This is necessary on all mobile equipment, and is generally desirable on apparatus intended for fixed-station use. In the former case, a mounting base is required, from which the power supply chassis can be removed quickly, without the use of tools.

Similarly, a shock-mounting for the power supply should be so designed that it can be fastened down permanently, and the chassis disengaged from it in a matter of seconds. This is more fully discussed in Section 25.

The reason for this is that, when any piece of equipment fails, it is removed and replaced with another at the earliest possible moment. Then the defective apparatus is taken to a service shop where the necessary facilities for repair and recalibration are available.

Summary ★ These notes cover only the high spots and some of the recurrent features of modern apparatus design. They are presented as overall time-savers. In certain specific instances they do not apply, and no attempt has been made to cover exceptions to the general rules.

When it is necessary to choose between a method that might be good enough and one which is covered in these notes, the wise designer will abandon the former and follow the latter on the theory that, with requirements being made more and more exacting, good-enough practices are sure to be rejected.

NOTES AND COMMENTS

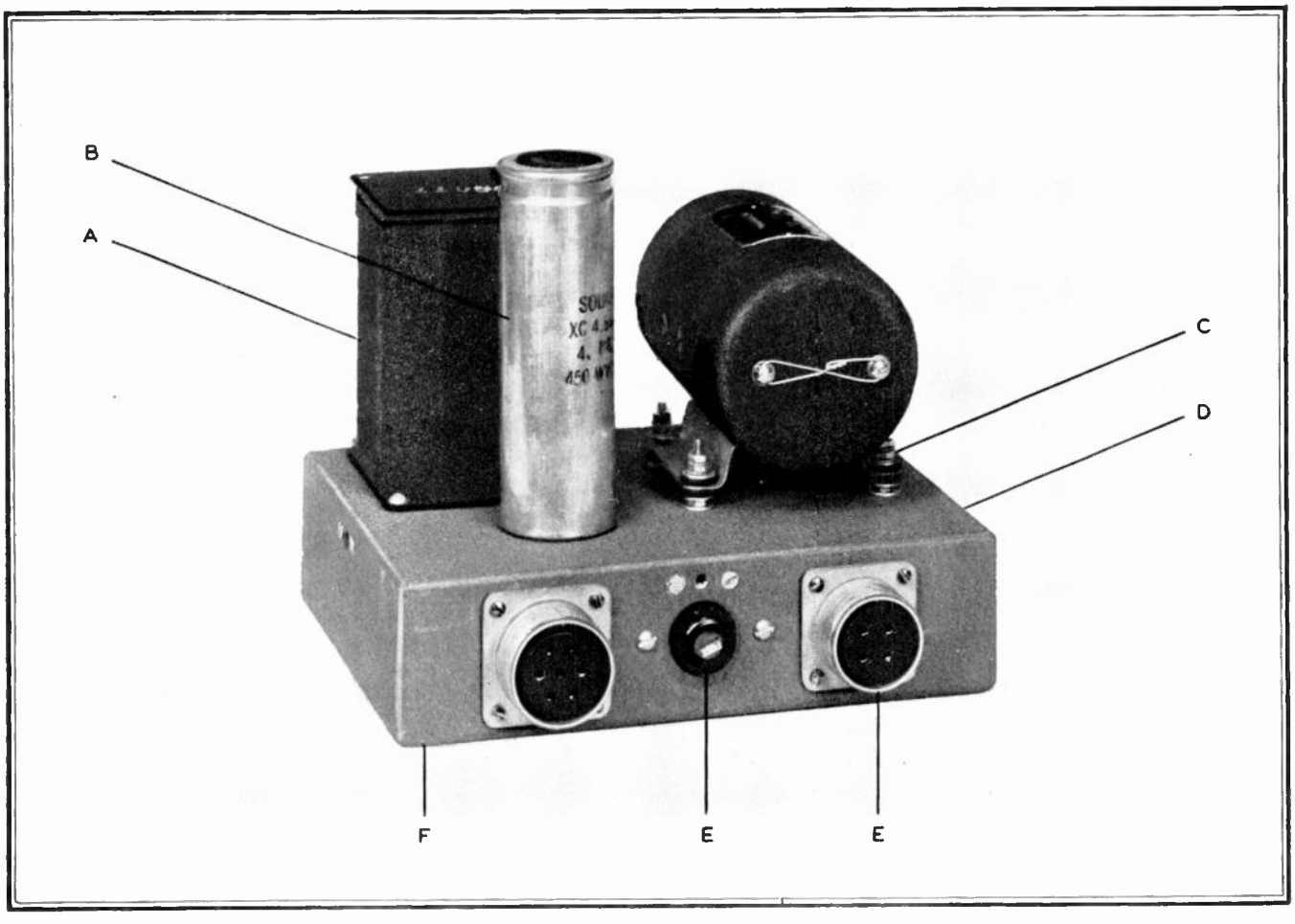
Part 1 of NOTES ON MODERN APPARATUS DESIGN brought two letters from which we quote the following:

To the Editor:

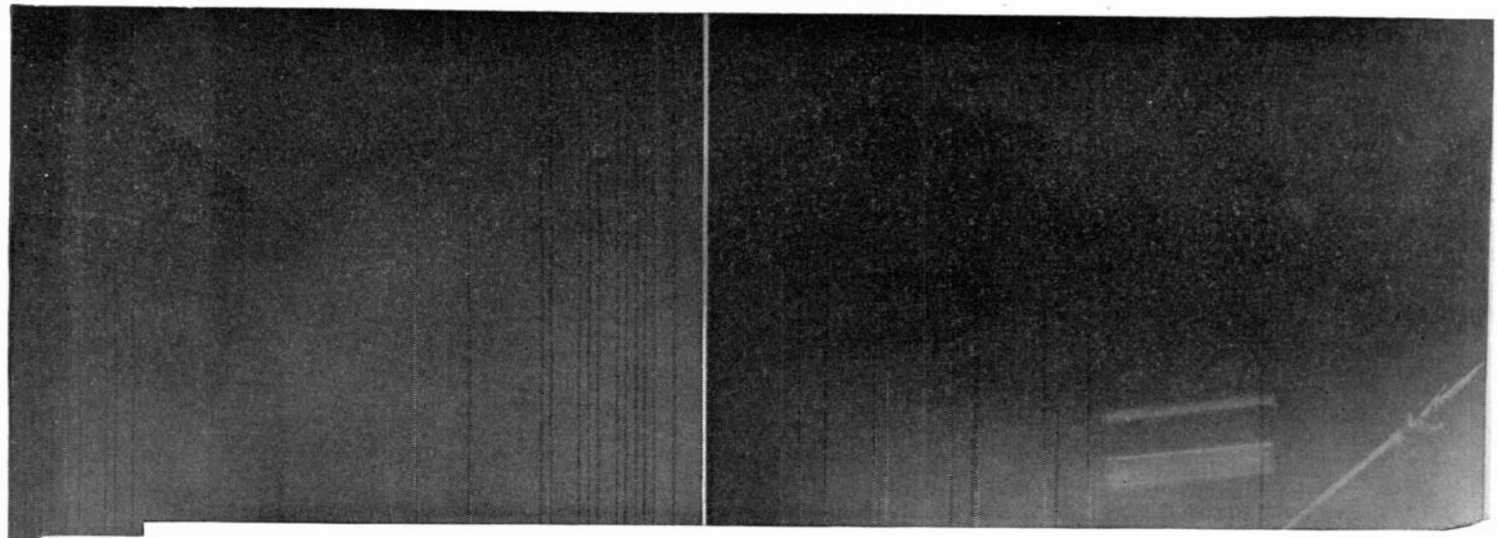
In your February issue, the article "Notes on Modern Apparatus Design" suggested the use of spot welding for fastening a small shield to the chassis of a receiver. If the shield and chassis are of steel, this could be done, although I believe it would be better practice to make it removable by securing it with screws, lock washers, and nuts.

However, if the shield and chassis are of aluminum, the former method would not be practical, for there are only a few spot welding machines in the Country which are capable of doing work of this

(CONTINUED ON PAGE 43)



POWER SUPPLY DESIGNS HAVE GONE THROUGH MANY CHANGES AND REFINEMENTS SINCE THIS EXPERIMENTAL MODEL WAS BUILT



G-E TELEVISION APPARATUS + G-E PROGRAMMING EXPERIENCE =

WITHIN the limits of all-out war production, General Electric television broadcast equipment is undergoing rigid testing at G.E.'s own proving-ground television station, WRGB, at Schenectady.

Flexibility of equipment is constantly being analyzed. New television programming arts and skill are being developed. Three times weekly live talent shows — such as boxing matches, menu planning, style shows, and operettas with full orchestral accompaniment — are being televised.

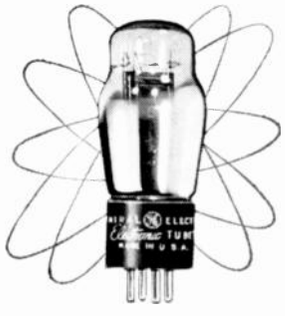
YOUR FUTURE TELEVISION SYSTEM

Techniques in staging, lighting, and make-up are being tried. Carefully checked results provide a vast fund of practical experience for you to draw upon when television is again available. Development of television at WRGB is greatly helped by a co-operative home television audience organized to criticize the programs.

And the G-E post-war television receiver for the home will come out of the same vast fund of television experience. It will be a receiver that will get the most out of the most recent discoveries and developments in television broadcasting.

G-E television broadcast equipment, program experience and receivers are working together for your future television success. We are experimenting so you won't have to.

General Electric cordially invites you when in Schenectady to visit Station WRGB for a preview of your future television system. . . . Radio, Television, and Electronics Department, General Electric Company, Schenectady, New York.



LEADER IN RADIO, TELEVISION, AND ELECTRONICS

GENERAL ELECTRIC

160-82-6312

TELEVISION 23

March 1943

MICA-DIELECTRIC CONDENSERS

PART 3—A.S.A. STANDARDS OF NOVEMBER 12, 1942*

FULL-SIZE drawings of standard molded cases for potted mica condensers are given on the following pages, and one-half scale drawings of ceramic cases for mica condensers.

Part 1, published in the January issue, described the standard specifications in detail. Part 2, which appeared in the February issue, showed full-size drawings of the molded mica condensers, and listed the standard capacities and characteristics.

The data on ceramic-case types appearing in this issue is complete except for the omission of series CM90 and CM95. These are the largest types, for which there is limited application. They are rated at 3,000 and 35,000 peak working voltage respectively. Data on them can be obtained from the American Standards Association, 29 West 39th Street, New York City.

Two tables shown below are reprinted from Part 1 for the readers' convenience. The first shows the designation letter for capacity tolerance, and the second is the designation letter for Q, temperature coefficient, and capacity drift.

The complete type designation, which serves as a detailed description, is indicated below each illustration on the following pages.

CAPACITY TOLERANCE (See Type Designation)

Designation letter	Tolerance
G	± 2 per cent
J	± 5 per cent
K	± 10 per cent
M	± 20 per cent

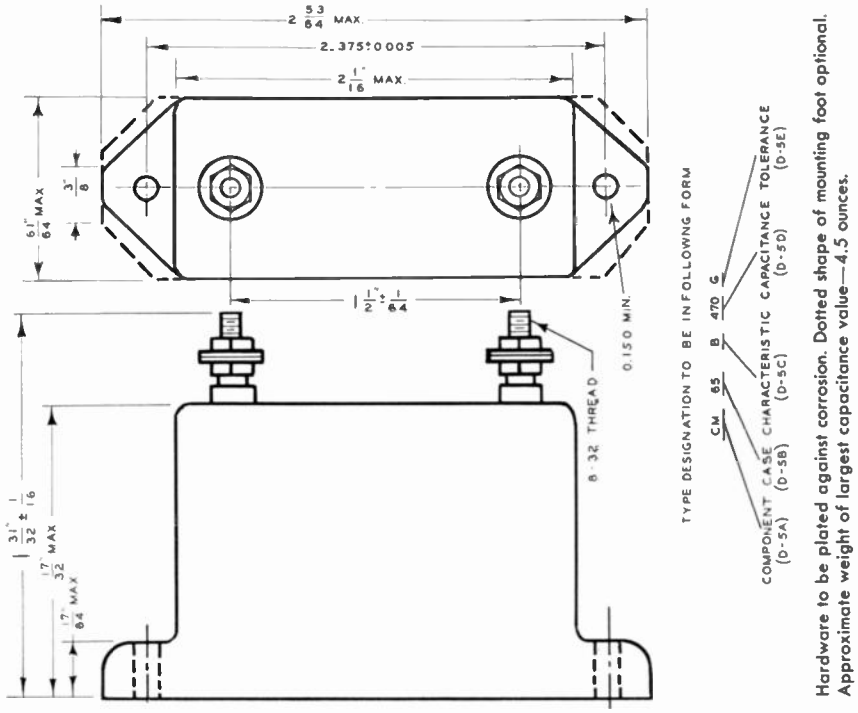
CHARACTERISTIC (See Type Designation)

Characteristic	Q	Temperature Coefficient Parts/Million/deg. C	Maximum Capacitance Drift (F-6)
A	Not specified	Not specified	Not specified
B	[As specified	Not specified	Not specified
C	in D-5c (1)]	−200 to +200	0.5 per cent
D	"	−100 to +100	0.2 per cent
E	"	0 to +100	0.05 per cent
F	"	0 to + 50	0.025 per cent
G	"	0 to − 50	0.025 per cent

*See Part 1, January 1943 issue for complete description of this Standard. Further information can be obtained from American Standards Association, 29 West 39 St., New York City.

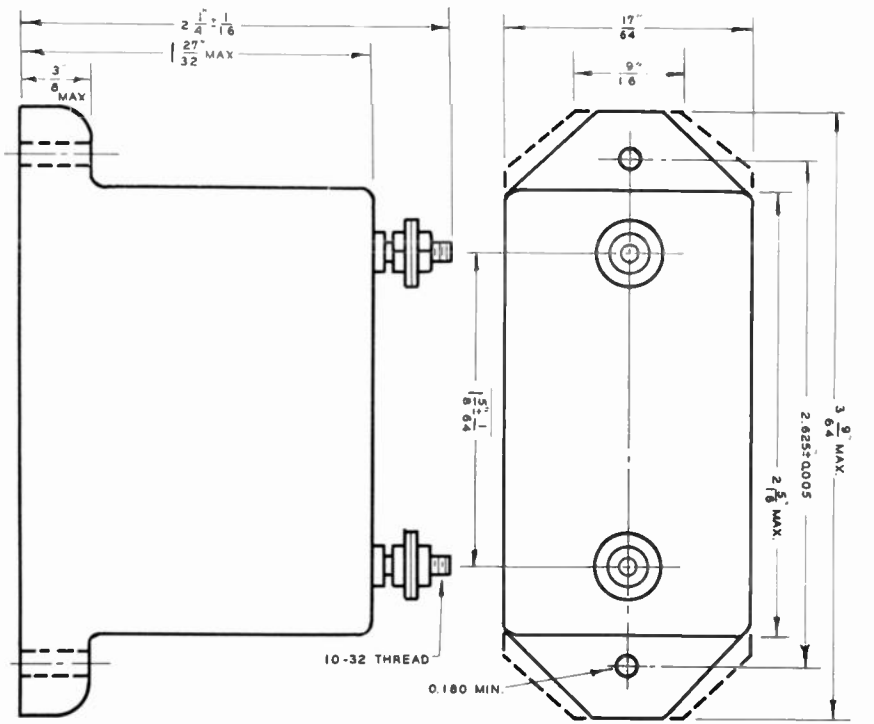
Type Designation†	Cap μμf	*Peak Wkg Vtge	*Characteristics Available at ±2%(G)	±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM65-682-	6800	2000	BCDEF	BCDEF	10	7.5	4.3	2.0
CM65-752-	7500	2000	BCDEF	BCDEF	10	8.2	4.7	2.2
CM65-822-	8200	1500	BCDEF	BCDEF	10	8.2	4.7	2.2
CM65-912-	9100	1500	BCDEF	BCDEF	10	8.2	5.1	2.4
CM65-103-	10000	1000	BCDEF	BCDEF	10	9.1	5.1	2.4
CM65-113-	11000	1000	BCDEF	BCDEF	11	10	5.6	2.7
CM65-123-	12000	1000	BCDEF	BCDEF	11	10	6.2	3.0
CM65-133-	13000	1000	BCDEF	BCDEF	11	11	6.8	3.0
CM65-153-	15000	1000	BCDEF	BCDEF	11	11	6.8	3.3
CM65-163-	16000	1000	BCDEF	BCDEF	11	11	6.8	3.3
CM65-183-	18000	1000	BCDEF	BCDEF	11	11	7.5	3.3
CM65-203-	20000	1000	BCDEF	BCDEF	11	11	7.5	3.6
CM65-223-	22000	1000	BCDEF	BCDEF	11	11	7.5	3.6
CM65-243-	24000	1000	BCDE	BCDE	11	11	7.5	3.6
CM65-273-	27000	500	BCDE	BCDE	11	11	7.5	3.9
CM65-303-	30000	500	BCDE	BCDE	11	11	8.2	3.9
CM65-333-	33000	500	BCDE	BCDE	11	11	8.2	4.3
CM65-363-	36000	500	BCDE	BCDE	11	11	8.2	4.3
CM65-393-	39000	500	BCDE	BCDE	11	11	8.2	4.3
CM65-433-	43000	500	BCDE	BCDE	11	11	9.1	4.7
CM65-473-	47000	250	BCDE	BCDE	11	11	9.1	4.7
CM65-513-	51000	250	BCDE	BCDE	11	11	9.1	4.7
CM65-563-	56000	250	BCDE	BCDE	11	11	9.1	4.7
CM65-623-	62000	250	BCDE	BCDE	11	11	9.1	5.1
CM65-683-	68000	250	BCDE	BCDE	11	11	9.1	5.1
CM65-753-	75000	250	BCDE	BCDE	11	11	9.1	5.1
CM65-823-	82000	250	BCDE	BCDE	11	11	9.1	5.1
CM65-913-	91000	250	BCDE	BCDE	11	11	9.1	5.6
CM65-104-	100000	250	BCDE	BCDE	11	11	9.1	5.6

† Complete type designation will include additional letter symbols as shown in sketch.
* Characteristics D, E, and F require 50 °C reduction in current rating.
Characteristic G requires 50% reduction in voltage and current ratings.



Hardware to be plated against corrosion. Dotted shape of mounting foot optional.
Approximate weight of largest capacitance value—4.5 ounces.

Type Designation†	Cap μμf	*Peak Wkg Vtge	*Characteristics Available at ±2%(G)	±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM65-470-	47	3000	BCDEFG	BCDEFG	1.2	0.51	0.15	0.051
CM65-510-	51	3000	BCDEFG	BCDEFG	1.3	0.51	0.18	0.056
CM65-560-	56	3000	BCDEFG	BCDEFG	1.3	0.56	0.20	0.056
CM65-620-	62	3000	BCDEFG	BCDEFG	1.5	0.62	0.22	0.068
CM65-680-	68	3000	BCDEFG	BCDEFG	1.5	0.62	0.24	0.075
CM65-750-	75	3000	BCDEFG	BCDEFG	1.5	0.62	0.27	0.082
CM65-820-	82	3000	BCDEFG	BCDEFG	1.6	0.68	0.27	0.082
CM65-910-	91	3000	BCDEFG	BCDEFG	1.6	0.68	0.33	0.091
CM65-101-	100	3000	BCDEFG	BCDEFG	1.8	0.75	0.33	0.10
CM65-111-	110	3000	BCDEFG	BCDEFG	1.8	0.82	0.36	0.12
CM65-121-	120	3000	BCDEFG	BCDEFG	2.0	0.91	0.39	0.15
CM65-131-	130	3000	BCDEFG	BCDEFG	2.0	0.91	0.43	0.16
CM65-151-	150	3000	BCDEFG	BCDEFG	2.2	1.0	0.47	0.18
CM65-161-	160	3000	BCDEFG	BCDEFG	2.2	1.1	0.51	0.20
CM65-181-	180	3000	BCDEFG	BCDEFG	2.4	1.1	0.56	0.22
CM65-201-	200	3000	BCDEFG	BCDEFG	2.4	1.2	0.62	0.24
CM65-221-	220	3000	BCDEFG	BCDEFG	2.7	1.3	0.62	0.27
CM65-241-	240	3000	BCDEFG	BCDEFG	2.7	1.3	0.68	0.30
CM65-271-	270	3000	BCDEFG	BCDEFG	3.0	1.5	0.75	0.30
CM65-301-	300	3000	BCDEFG	BCDEFG	3.0	1.5	0.75	0.36
CM65-331-	330	3000	BCDEFG	BCDEFG	3.0	1.6	0.82	0.36
CM65-361-	360	3000	BCDEFG	BCDEFG	3.3	1.6	0.91	0.39
CM65-391-	390	3000	BCDEFG	BCDEFG	3.3	1.8	0.91	0.43
CM65-431-	430	3000	BCDEFG	BCDEFG	3.6	1.8	1.0	0.47
CM65-471-	470	3000	BCDEFG	BCDEFG	3.6	2.0	1.1	0.47
CM65-511-	510	3000	BCDEFG	BCDEFG	3.6	2.0	1.1	0.51
CM65-561-	560	3000	BCDEFG	BCDEFG	3.9	2.2	1.2	0.51
CM65-621-	620	3000	BCDEFG	BCDEFG	3.9	2.4	1.2	0.56
CM65-681-	680	3000	BCDEFG	BCDEFG	4.3	2.4	1.3	0.62
CM65-751-	750	3000	BCDEFG	BCDEFG	4.3	2.7	1.3	0.62
CM65-821-	820	3000	BCDEFG	BCDEFG	4.3	2.7	1.5	0.68
CM65-911-	910	3000	BCDEFG	BCDEFG	4.7	3.0	1.5	0.68
CM65-102-	1000	3000	BCDEFG	BCDEFG	4.7	3.0	1.6	0.75
CM65-112-	1100	3000	BCDEF	BCDEF	5.1	3.3	1.6	0.82
CM65-122-	1200	3000	BCDEF	BCDEF	5.1	3.3	1.8	0.82
CM65-132-	1300	3000	BCDEF	BCDEF	5.6	3.6	1.8	0.91
CM65-152-	1500	3000	BCDEF	BCDEF	5.6	3.9	2.0	0.91
CM65-162-	1600	3000	BCDEF	BCDEF	5.6	3.9	2.0	1.0
CM65-182-	1800	3000	BCDEF	BCDEF	6.2	4.3	2.2	1.1
CM65-202-	2000	3000	BCDEF	BCDEF	6.2	4.3	2.4	1.1
CM65-222-	2200	3000	BCDEF	BCDEF	6.8	4.7	2.4	1.2
CM65-242-	2400	3000	BCDEF	BCDEF	6.8	4.7	2.7	1.2
CM65-272-	2700	2000	BCDEF	BCDEF	6.8	5.1	2.7	1.3
CM65-302-	3000	2000	BCDEF	BCDEF	7.5	5.1	3.0	1.3
CM65-332-	3300	2000	BCDEF	BCDEF	7.5	5.6	3.0	1.5
CM65-362-	3600	2000	BCDEF	BCDEF	7.5	5.6	3.3	1.5
CM65-392-	3900	2000	BCDEF	BCDEF	8.2	6.2	3.3	1.6
CM65-432-	4300	2000	BCDEF	BCDEF	8.2	6.2	3.6	1.6
CM65-472-	4700	2000	BCDEF	BCDEF	8.2	6.8	3.6	1.8
CM65-512-	5100	2000	BCDEF	BCDEF	8.2	6.8	3.6	1.8
CM65-562-	5600	2000	BCDEF	BCDEF	9.1	7.5	3.9	2.0
CM65-622-	6200	2000	BCDEF	BCDEF	9.1	7.5	4.3	2.0



TYPE DESIGNATION TO BE IN FOLLOWING FORM

CM 70 B 470 G

COMPONENT (D-5A) · CASE (D-5B) · CHARACTERISTIC (D-5C) · CAPACITANCE (D 5D) · TOLERANCE (D-5E)

Hardware to be plated against corrosion. Dotted shape of mounting foot optional.
Approximate weight of largest capacitance value—6.6 ounces.

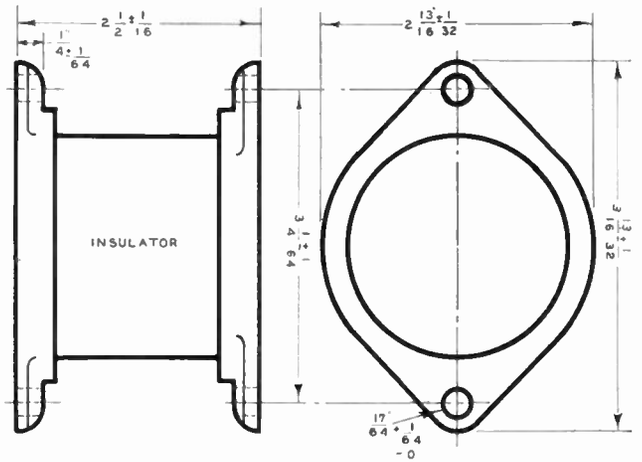
Type Designation†	Cap μμf	*Peak Wkg Vtge	*Characteristics Available at ±2%(G)	±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM70-470-	47	5000	BCDEFG	BCDEFG	1.5	0.62	0.20	0.062
CM70-510-	51	5000	BCDEFG	BCDEFG	1.6	0.68	0.22	0.062
CM70-560-	56	5000	BCDEFG	BCDEFG	1.8	0.75	0.27	0.068
CM70-620-	62	5000	BCDEFG	BCDEFG	1.8	0.82	0.30	0.075
CM70-680-	68	5000	BCDEFG	BCDEFG	2.0	0.91	0.33	0.075
CM70-750-	75	5000	BCDEFG	BCDEFG	2.0	1.0	0.36	0.082
CM70-820-	82	5000	BCDEFG	BCDEFG	2.2	1.1	0.39	0.091
CM70-910-	91	5000	BCDEFG	BCDEFG	2.4	1.2	0.43	0.10
CM70-101-	100	5000	BCDEFG	BCDEFG	2.4	1.2	0.47	0.10
CM70-111-	110	5000	BCDEFG	BCDEFG	2.7	1.3	0.51	0.15
CM70-121-	120	5000	BCDEFG	BCDEFG	2.7	1.5	0.56	0.18
CM70-131-	130	5000	BCDEFG	BCDEFG	3.0	1.6	0.62	0.22

Type Designation†	Cap μμf	*Peak Wkg Vtge	*Characteristics Available at ±2%(G)	±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM70-151-	150	5000	BCDEFG	BCDEFG	3.3	1.8	0.68	0.24
CM70-161-	160	5000	BCDEFG	BCDEFG	3.3	1.8	0.75	0.27
CM70-181-	180	5000	BCDEFG	BCDEFG	3.3	2.0	0.82	0.30
CM70-201-	200	5000	BCDEFG	BCDEFG	3.6	2.0	0.82	0.33
CM70-221-	220	5000	BCDEFG	BCDEFG	3.6	2.2	0.91	0.39
CM70-241-	240	5000	BCDEFG	BCDEFG	3.6	2.4	1.0	0.43
CM70-271-	270	5000	BCDEFG	BCDEFG	3.9	2.4	1.1	0.47
CM70-301-	300	5000	BCDEFG	BCDEFG	3.9	2.7	1.1	0.51
CM70-331-	330	5000	BCDEFG	BCDEFG	4.3	2.7	1.2	0.51
CM70-361-	360	5000	BCDEFG	BCDEFG	4.3	2.7	1.3	0.56
CM70-391-	390	5000	BCDEFG	BCDEFG	4.3	2.7	1.3	0.62
CM70-431-	430	5000	BCDEFG	BCDEFG	4.7	3.0	1.5	0.68
CM70-471-	470	5000	BCDEFG	BCDEFG	4.7	3.3	1.5	0.68
CM70-511-	510	5000	BCDEFG	BCDEFG	4.7	3.3	1.6	0.75
CM70-561-	560	5000	BCDEFG	BCDEFG	5.1	3.6	1.8	0.82
CM70-621-	620	5000	BCDEFG	BCDEFG	5.1	3.6	1.8	0.82
CM70-681-	680	5000	BCDEFG	BCDEFG	5.1	3.6	2.0	0.91
CM70-751-	750	5000	BCDEFG	BCDEFG	5.6	3.9	2.2	0.91
CM70-821-	820	5000	BCDEFG	BCDEFG	5.6	3.9	2.4	1.0
CM70-911-	910	5000	BCDEFG	BCDEFG	5.6	4.3	2.4	1.1
CM70-102-	1000	5000	BCDEFG	BCDEFG	6.2	4.3	2.4	1.2
CM70-112-	1100	5000	BCDEFG	BCDEFG	6.2	4.7	2.7	1.2
CM70-122-	1200	5000	BCDEFG	BCDEFG	6.2	4.7	2.7	1.3
CM70-132-	1300	5000	BCDEFG	BCDEFG	6.8	5.1	3.0	1.3
CM70-152-	1500	5000	BCDEFG	BCDEFG	6.8	5.1	3.3	1.5
CM70-162-	1600	5000	BCDEFG	BCDEFG	6.8	5.6	3.6	1.5
CM70-182-	1800	5000	BCDEFG	BCDEFG	7.5	5.6	3.6	1.6
CM70-202-	2000	5000	BCDEFG	BCDEFG	7.5	6.2	3.6	1.8
CM70-222-	2200	5000	BCDEFG	BCDEFG	7.5	6.2	3.9	2.0
CM70-242-	2400	5000	BCDEFG	BCDEFG	8.2	6.2	4.3	2.0
CM70-272-	2700	3000	BCDEFG	BCDEFG	8.2	6.8	4.3	2.2
CM70-302-	3000	3000	BCDEFG	BCDEFG	8.2	6.8	4.7	2.2
CM70-332-	3300	3000	BCDEFG	BCDEFG	8.2	6.8	4.7	2.4
CM70-362-	3600	3000	BCDEFG	BCDEFG	8.2	7.5	5.1	2.4
CM70-392-	3900	3000	BCDEFG	BCDEFG	9.1	7.5	5.6	2.7
CM70-432-	4300	3000	BCDEFG	BCDEFG	9.1	7.5	5.6	2.7
CM70-472-	4700	3000	BCDEFG	BCDEFG	9.1	8.2	6.2	3.0
CM70-512-	5100	3000	BCDEFG	BCDEFG	9.1	8.2	6.2	3.0
CM70-562-	5600	3000	BCDEFG	BCDEFG	9.1	9.1	6.2	3.3
CM70-622-	6200	3000	BCDEFG	BCDEFG	10	9.1	6.8	3.6
CM70-682-	6800	3000	BCDEFG	BCDEFG	10	9.1	6.8	3.6
CM70-752-	7500	3000	BCDEFG	BCDEFG	10	9.1	6.8	3.9
CM70-822-	8200	2000	BCDEF	BCDEF	10	10	7.5	3.9
CM70-912-	9100	2000	BCDEF	BCDEF	11	10	8.2	4.3
CM70-103-	10000	2000	BCDEF	BCDEF	11	11	8.2	4.3
CM70-113-	11000	2000	BCDEF	BCDEF	11	11	8.2	4.7
CM70-123-	12000	2000	BCDEF	BCDEF	11	11	9.1	4.7
CM70-133-	13000	2000	BCDEF	BCDEF	12	12	9.1	5.1
CM70-153-	15000	2000	BCDEF	BCDEF	12	12	10	5.1
CM70-163-	16000	2000	BCDEF	BCDEF	12	12	10	5.6
CM70-183-	18000	2000	BCDEF	BCDEF	12	13	10	5.6
CM70-203-	20000	2000	BCDEF	BCDEF	13	13	11	6.2
CM70-223-	22000	2000	BCDEF	BCDEF	13	13	11	6.2

Type Designation†	Cap μμf	Peak Wkg Vtge	*Characteristics Available at ±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM75-910J	91	6000	BCDEF	2.7	1.8	0.91	0.27
CM75-101J	100	6000	BCDEF	3.0	2.0	0.91	0.30
CM75-111J	110	6000	BCDEF	3.0	2.2	1.0	0.30
CM75-121J	120	6000	BCDEF	3.3	2.2	1.0	0.33
CM75-131J	130	6000	BCDEF	3.3	2.4	1.1	0.36
CM75-151J	150	6000	BCDEF	3.6	2.4	1.2	0.39
CM75-161J	160	6000	BCDEF	3.9	2.7	1.3	0.43
CM75-181J	180	6000	BCDEF	4.3	3.0	1.5	0.47
CM75-201J	200	6000	BCDEF	4.3	3.0	1.5	0.51
CM75-221J	220	6000	BCDEF	4.7	3.3	1.6	0.56
CM75-241J	240	6000	BCDEF	4.7	3.6	1.8	0.62
CM75-271J	270	6000	BCDEF	5.1	3.6	2.0	0.62
CM75-301J	300	6000	BCDEF	5.1	3.9	2.0	0.6
CM75-331J	330	6000	BCDEF	5.6	4.3	2.2	0.75
CM75-361J	360	6000	BCDEF	6.2	4.3	2.4	0.75
CM75-391J	390	6000	BCDEF	6.2	4.7	2.7	0.82
CM75-431J	430	6000	BCDEF	6.8	4.7	2.7	0.82
CM75-471J	470	6000	BCDEF	6.8	5.1	3.0	0.91
CM75-511J	510	6000	BCDEF	6.8	5.1	3.0	1.0
CM75-561J	560	6000	BCDEF	7.5	5.6	3.3	1.1
CM75-621J	620	6000	BCDEF	8.2	6.2	3.6	1.2
CM75-681J	680	6000	BCDEF	8.2	6.2	3.9	1.3
CM75-751J	750	6000	BCDEF	8.2	6.8	3.9	1.5
CM75-821J	820	6000	BCDEF	9.1	6.8	4.3	1.5
CM75-911J	910	6000	BCDEF	9.1	7.5	4.7	1.6
CM75-102J	1000	6000	BCDEF	10	7.5	5.1	1.8
CM75-112J	1100	6000	BCDEF	10	8.2	5.1	2.0
CM75-122J	1200	6000	BCDEF	11	8.2	5.6	2.2
CM75-132J	1300	6000	BCDEF	11	9.1	6.2	2.2
CM75-152J	1500	6000	BCDEF	12	9.1	6.2	2.4
CM75-162J	1600	6000	BCDEF	12	10	6.8	2.7
CM75-182J	1800	6000	BCDEF	13	11	7.5	3.0
CM75-202J	2000	6000	BCDEF	13	11	7.5	3.3
CM75-222J	2200	6000	BCDEF	13	12	8.2	3.6
CM75-242J	2400	6000	BCDEF	15	13	9.1	3.9
CM75-272J	2700	6000	BCDEF	15	13	9.1	3.9
CM75-302J	3000	6000	BCDEF	15	13	9.1	4.3
CM75-332J	3300	6000	BCDEF	15	15	10	4.7
CM75-362J	3600	6000	BCDEF	16	15	11	5.1
CM75-392J	3900	6000	BCDEF	16	15	11	5.6
CM75-432J	4300	6000	BCDEF	16	15	11	5.6
CM75-472J	4700	6000	BCDEF	16	16	12	6.2
CM75-512J	5100	4000	BCDEF	16	16	12	6.2
CM75-562J	5600	4000	BCDEF	16	18	13	6.8
CM75-622J	6200	4000	BCDEF	16	18	13	7.5
CM75-682J	6800	4000	BCDEF	16	18	13	7.5
CM75-752J	7500	4000	BCDEF	18	18	13	7.5
CM75-822J	8200	4000	BCDEF	18	20	15	8.2
CM75-912J	9100	4000	BCDEF	18	20	15	8.2
CM75-103J	10000	4000	BCDEF	18	20	15	9.1
CM75-113J	11000	4000	BCDEF	18	20	15	9.1
CM75-123J	12000	3000	BCDEF	18	20	16	9.1
CM75-133J	13000	3000	BCDEF	18	20	16	10

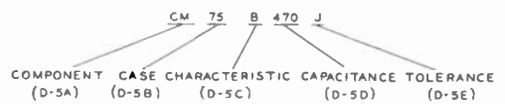
CM70–243–	24000	1500	BCDEF	BCDEF	13	15	12	6.8
CM70–273–	27000	1500	BCDEF	BCDEF	13	15	12	6.8
CM70–303–	30000	1500	BCDEF	BCDEF	13	15	12	6.8
CM70–333–	33000	1500	BCDEF	BCDEF	13	15	13	7.5
CM70–363–	36000	1500	BCDEF	BCDEF	13	16	13	7.5
CM70–393–	39000	1500	BCDEF	BCDEF	15	16	13	7.5
CM70–433–	43000	1500	BCDEF	BCDEF	15	16	13	7.5
CM70–473–	47000	1500	BCDE	BCDE	15	16	13	7.5
CM70–513–	51000	1500	BCDE	BCDE	15	16	15	7.5
CM70–563–	56000	1000	BCDE	BCDE	15	16	15	8.2
CM70–623–	62000	1000	BCDE	BCDE	15	18	15	8.2
CM70–683–	68000	1000	BCDE	BCDE	15	18	15	8.2
CM70–753–	75000	1000	BCDE	BCDE	15	18	15	8.2
CM70–823–	82000	500	BCDE	BCDE	15	18	15	8.2
CM70–913–	91000	500	BCDE	BCDE	15	18	15	8.2
CM70–104–	100000	500	BCDE	BCDE	15	18	15	8.2

† Complete type designation includes additional letter symbol as shown in sketch.
* Characteristics D, E, and F require 50% reduction in current rating.
Characteristic G requires 50% reduction in voltage and current ratings.



TYPE DESIGNATION TO BE IN FOLLOWING FORM

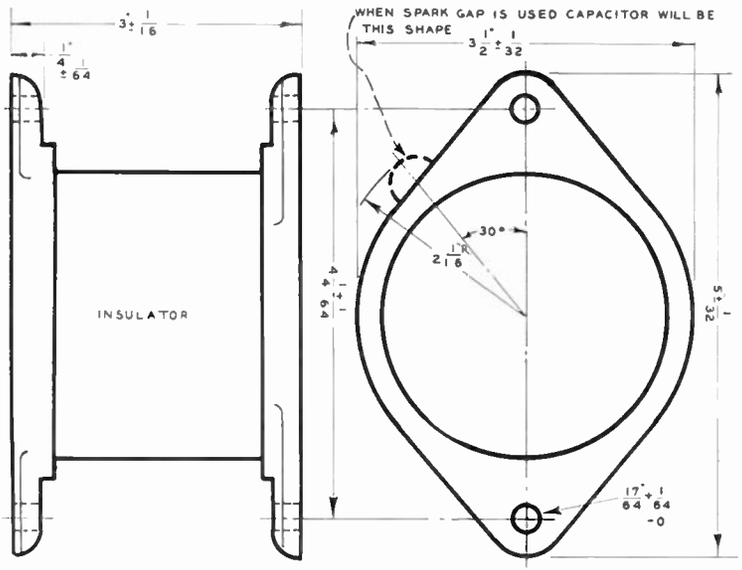
One-half size



Approximate weight of largest capacitance value—1½ pounds.

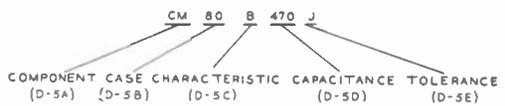
Type Designation†	Cap μμf	Peak Wkg Vtge	*Characteristics Available at ±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM75–470J	47	6000	BCDEF	2.0	1.2	0.51	0.16
CM75–510J	51	6000	BCDEF	2.0	1.3	0.56	0.18
CM75–560J	56	6000	BCDEF	2.2	1.3	0.56	0.18
CM75–620J	62	6000	BCDEF	2.2	1.5	0.62	0.20
CM75–680J	68	6000	BCDEF	2.4	1.5	0.68	0.22
CM75–750J	75	6000	BCDEF	2.4	1.6	0.68	0.22
CM75–820J	82	6000	BCDEF	2.7	1.8	0.75	0.24
CM75–153J	15000	3000	BCDEF	18	20	16	10
CM75–163J	16000	3000	BCDEF	18	20	16	10
CM75–183J	18000	2000	BCDEF	18	20	16	11
CM75–203J	20000	2000	BCDEF	18	22	18	11
CM75–223J	22000	2000	BCDEF	18	22	18	11
CM75–243J	24000	2000	BCDEF	18	22	18	12
CM75–273J	27000	2000	BCDEF	18	22	18	12
CM75–303J	30000	1500	BCDEF	18	22	18	12
CM75–333J	33000	1500	BCDEF	18	22	20	13
CM75–363J	36000	1500	BCDEF	18	22	20	13
CM75–393J	39000	1500	BCDEF	18	22	20	13
CM75–433J	43000	1500	BCDEF	18	22	22	13
CM75–473J	47000	1500	BCDEF	18	22	22	15
CM75–513J	51000	1500	BCDEF	18	22	22	15
CM75–563J	56000	1500	BCDEF	18	22	22	15
CM75–623J	62000	1500	BCDEF	18	22	22	16
CM75–683J	68000	1500	BCDEF	18	22	22	16
CM75–753J	75000	1000	BCDEF	18	22	22	16
CM75–823J	82000	1000	BCDEF	18	22	22	16
CM75–913J	91000	1000	BCDEF	18	22	22	16
CM75–104J	100000	1000	BCDEF	18	22	22	18

† Complete type designation includes additional letter symbol as shown in sketch.
* Characteristics D, E, and F require 50% reduction in current rating.



TYPE DESIGNATION TO BE IN FOLLOWING FORM

One-half size

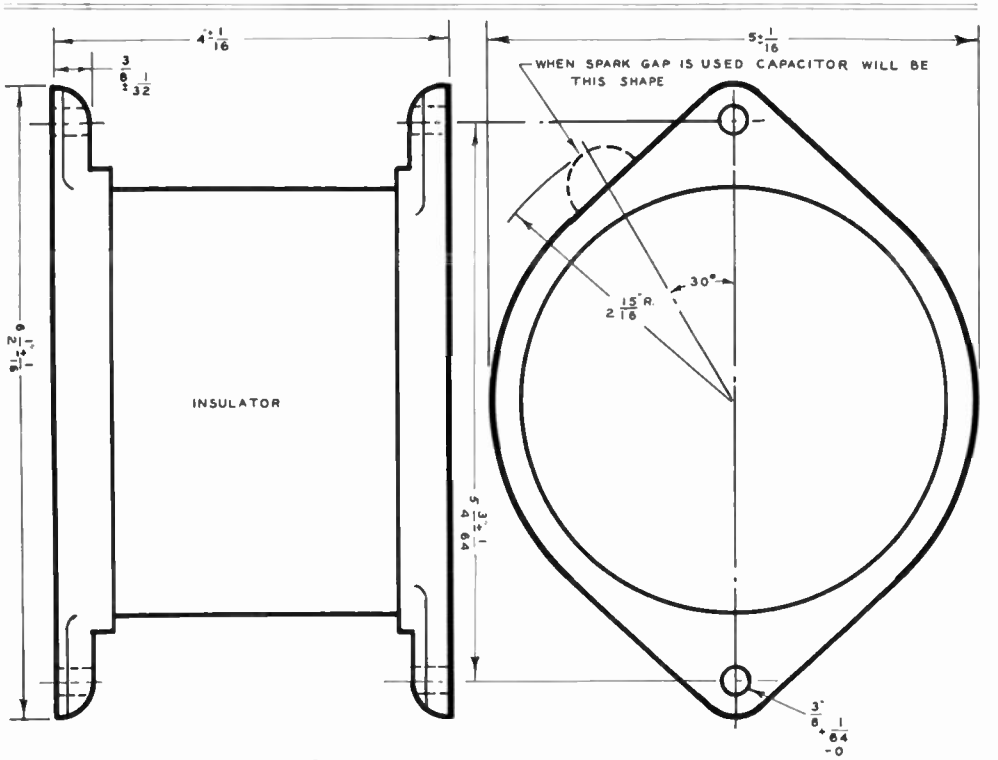


Approximate weight of largest capacitance value—2 pounds.

Type Designation†	Cap μμf	Peak Wkg Vtge	*Characteristics Available at ±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM80-470J	47	10000	BCDEF	2.7	2.0	0.91	0.27
CM80-510J	51	10000	BCDEF	2.7	2.0	1.0	0.30
CM80-560J	56	10000	BCDEF	3.0	2.2	1.0	0.30
CM80-620J	62	10000	BCDEF	3.3	2.2	1.1	0.33
CM80-680J	68	10000	BCDEF	3.3	2.4	1.2	0.33
CM80-750J	75	10000	BCDEF	3.6	2.4	1.2	0.36
CM80-820J	82	10000	BCDEF	3.6	2.7	1.3	0.39
CM80-910J	91	10000	BCDEF	3.9	2.7	1.5	0.43
CM80-101J	100	10000	BCDEF	4.3	3.0	1.5	0.47
CM80-111J	110	10000	BCDEF	4.3	3.0	1.6	0.51
CM80-121J	120	10000	BCDEF	4.7	3.3	1.6	0.56
CM80-131J	130	10000	BCDEF	4.7	3.6	1.8	0.62
CM80-151J	150	10000	BCDEF	5.1	3.6	1.8	0.62
CM80-161J	160	10000	BCDEF	5.1	3.9	2.0	0.75
CM80-181J	180	10000	BCDEF	5.6	4.3	2.2	0.82
CM80-201J	200	10000	BCDEF	6.2	4.3	2.4	0.82
CM80-221J	220	10000	BCDEF	6.2	4.7	2.4	0.91
CM80-241J	240	10000	BCDEF	6.8	5.1	2.7	1.0
CM80-271J	270	10000	BCDEF	6.8	5.1	2.7	1.0
CM80-301J	300	10000	BCDEF	7.5	5.6	3.0	1.1
CM80-331J	330	10000	BCDEF	7.5	5.6	3.0	1.2
CM80-361J	360	10000	BCDEF	8.2	6.2	3.6	1.2
CM80-391J	390	10000	BCDEF	8.2	6.2	3.6	1.3
CM80-431J	430	10000	BCDEF	9.1	6.2	3.6	1.3
CM80-471J	470	10000	BCDEF	9.1	6.8	3.9	1.5
CM80-511J	510	10000	BCDEF	9.1	6.8	3.9	1.6
CM80-561J	560	10000	BCDEF	10	7.5	4.3	1.6
CM80-621J	620	10000	BCDEF	11	8.2	4.7	1.8
CM80-681J	680	10000	BCDEF	11	8.2	4.7	1.8
CM80-751J	750	10000	BCDEF	11	8.2	5.1	2.0
CM80-821J	820	10000	BCDEF	12	9.1	5.1	2.2
CM80-911J	910	10000	BCDEF	12	9.1	5.6	2.2
CM80-102J	1000	10000	BCDEF	12	10	6.2	2.4
CM80-112J	1100	10000	BCDEF	13	10	6.2	2.7
CM80-122J	1200	10000	BCDEF	15	11	6.8	2.7
CM80-132J	1300	10000	BCDEF	15	11	6.8	2.7
CM80-152J	1500	10000	BCDEF	15	12	7.5	3.0
CM80-162J	1600	10000	BCDEF	16	12	7.5	3.3
CM80-182J	1800	10000	BCDEF	16	13	8.2	3.6
CM80-202J	2000	10000	BCDEF	16	13	8.2	3.6
CM80-222J	2200	8000	BCDEF	18	13	9.1	3.9
CM80-242J	2400	8000	BCDEF	18	15	10	4.3
CM80-272J	2700	8000	BCDEF	18	15	10	4.3
CM80-302J	3000	8000	BCDEF	18	16	10	4.7
CM80-332J	3300	8000	BCDEF	20	16	11	4.7
CM80-362J	3600	8000	BCDEF	20	18	11	5.1
CM80-392J	3900	8000	BCDEF	20	18	12	5.6
CM80-432J	4300	8000	BCDEF	20	18	12	5.6
CM80-472J	4700	6000	BCDEF	20	20	13	6.2
CM80-512J	5100	6000	BCDEF	20	20	13	6.2
CM80-562J	5600	5000	BCDEF	20	20	13	6.8
CM80-622J	6200	5000	BCDEF	20	22	15	6.8
CM80-682J	6800	5000	BCDEF	20	22	15	7.5
CM80-752J	7500	5000	BCDEF	20	22	15	7.5
CM80-822J	8200	5000	BCDEF	20	24	16	8.2
CM80-912J	9100	5000	BCDEF	20	24	16	8.2
CM80-103J	10000	5000	BCDEF	20	24	18	9.1
CM80-113J	11000	5000	BCDEF	20	27	18	9.1
CM80-123J	12000	4000	BCDEF	20	27	8	10
CM80-133J	13000	4000	BCDEF	20	27	20	10
CM80-153J	15000	4000	BCDEF	20	27	20	11
CM80-163J	16000	4000	BCDEF	20	27	20	11
CM80-183J	18000	3000	BCDEF	20	30	20	12
CM80-203J	20000	3000	BCDEF	20	30	22	13
CM80-223J	22000	3000	BCDEF	20	30	22	13
CM80-243J	24000	3000	BCDEF	20	33	24	13
CM80-273J	27000	3000	BCDEF	20	33	24	13
CM80-303J	30000	2000	BCDEF	20	33	24	15
CM80-333J	33000	2000	BCDEF	20	33	24	15
CM80-363J	36000	2000	BCDEF	20	33	27	16
CM80-393J	39000	2000	BCDEF	20	36	27	16
CM80-433J	43000	2000	BCDEF	20	36	27	16
CM80-473J	47000	2000	BCDEF	20	36	27	18
CM80-513J	51000	2000	BCDEF	20	36	30	18
CM80-563J	56000	2000	BCDEF	20	36	30	18
CM80-623J	62000	2000	BCDEF	20	39	30	18
CM80-683J	68000	2000	BCDEF	20	39	33	20
CM80-753J	75000	1500	BCDEF	20	39	33	20
CM80-823J	82000	1500	BCDEF	20	39	33	20
CM80-913J	91000	1500	BCDEF	20	39	33	20
CM80-104J	100000	1500	BCDEF	20	39	36	20

† Complete type designation will include additional symbol as shown in sketch.
* Characteristics D, E, and F require 50°C reduction in current rating.

Type Designation†	Cap μμf	Peak Wkg Vtge	*Characteristics Available at ±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM85-151J	150	20000	BCDEF	8.2	4.7	2.0	0.82
CM85-161J	160	20000	BCDEF	8.2	5.1	2.2	0.91
CM85-181J	180	20000	BCDEF	9.1	5.1	2.4	1.0
CM85-201J	200	20000	BCDEF	9.1	5.6	2.7	1.1
CM85-221J	220	20000	BCDEF	9.1	6.2	3.0	1.2
CM85-241J	240	20000	BCDEF	10	6.2	3.6	1.3
CM85-271J	270	20000	BCDEF	10	6.8	3.6	1.5
CM85-301J	300	20000	BCDEF	10	6.8	3.9	1.6
CM85-331J	330	20000	BCDEF	11	7.5	3.9	1.6
CM85-361J	360	20000	BCDEF	11	7.5	3.9	1.8
CM85-391J	390	20000	BCDEF	11	8.2	4.3	2.0
CM85-431J	430	20000	BCDEF	12	8.2	4.7	2.2
CM85-471J	470	20000	BCDEF	12	9.1	4.7	2.2
CM85-511J	510	20000	BCDEF	12	9.1	5.1	2.4
CM85-561J	560	20000	BCDEF	13	10	5.6	2.7



One-half size

TYPE DESIGNATION TO BE IN FOLLOWING FORM

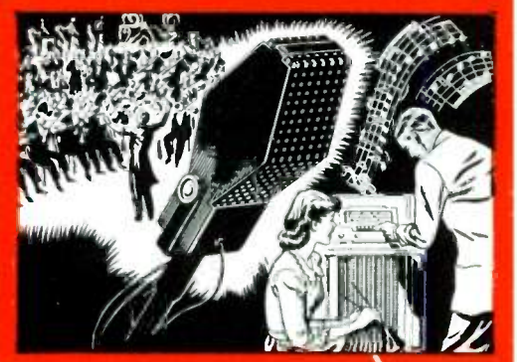
CM 85 B 470 J

COMPONENT (D-5A)	CASE (D-5B)	CHARACTERISTIC (D-5C)	CAPACITANCE (D-5D)	TOLERANCE (D-5E)

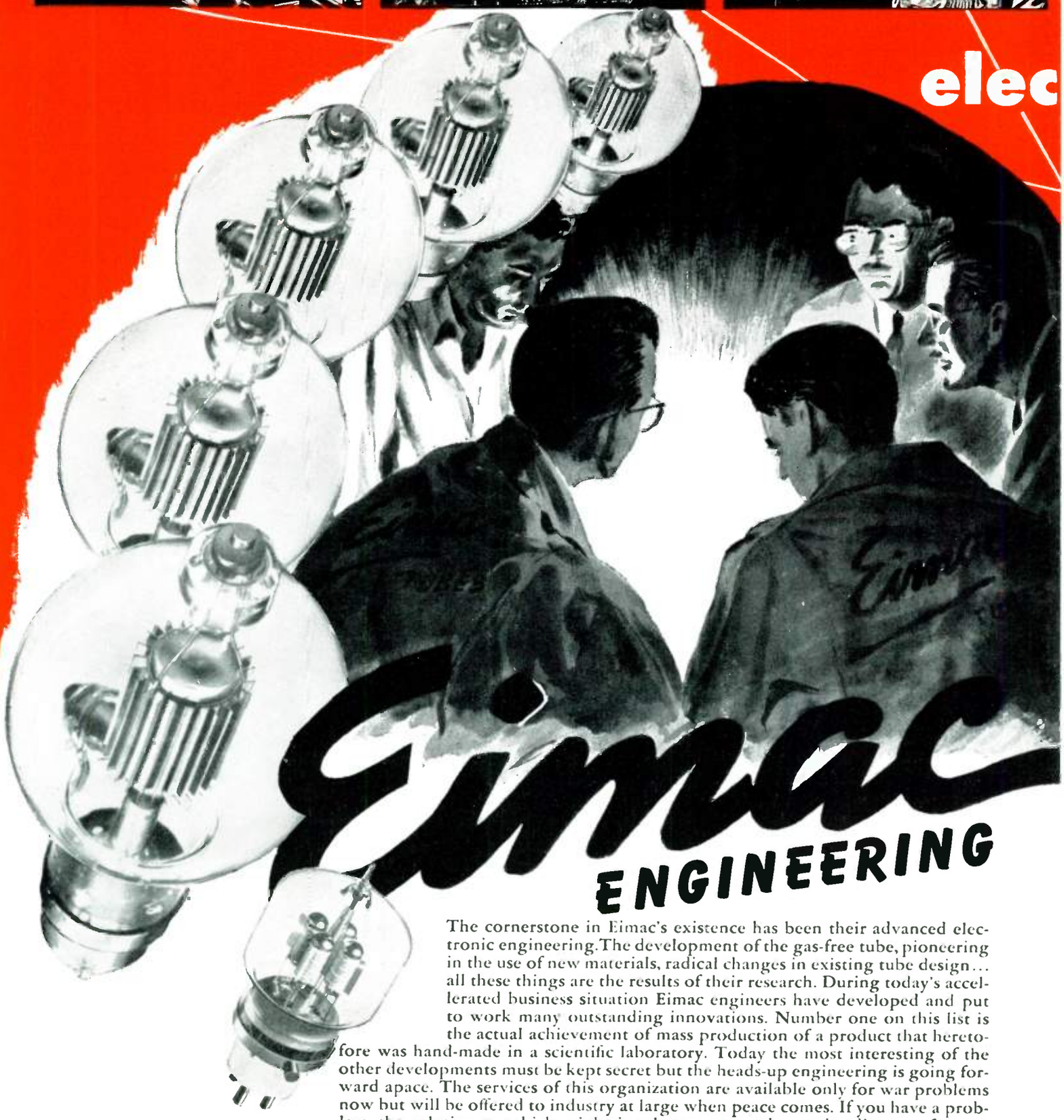
Approximate weight of largest capacitance value—5½ pounds.

Type Designation†	Cap μμf	Peak Wkg Vtge	*Characteristics Available at ±5%(J)	*Rated Currents in Amperes at 3 Mc	1 Mc	0.3 Mc	0.1 Mc
CM85-470J	47	20000	BCDEF	5.1	2.2	0.47	0.12
CM85-510J	51	20000	BCDEF	5.1	2.4	0.51	0.15
CM85-560J	56	20000	BCDEF	5.6	2.4	0.56	0.18
CM85-620J	62	20000	BCDEF	5.6	2.7	0.68	0.20
CM85-680J	68	20000	BCDEF	5.6	2.7	0.75	0.24
CM85-750J	75	20000	BCDEF	6.2	3.0	0.91	0.27
CM85-820J	82	20000	BCDEF	6.2	3.0	1.0	0.33
CM85-910J	91	20000	BCDEF	6.8	3.3	1.1	0.39
CM85-101J	100	20000	BCDEF	6.8	3.6	1.3	0.47
CM85-111J	110	20000	BCDEF	7.5	3.9	1.5	0.51
CM85-121J	120	20000	BCDEF	7.5	4.3	1.6	0.62
CM85-131J	130	20000	BCDEF	7.5	4.3	1.8	0.68
CM85-621J	620	20000	BCDEF	13	11	6.2	2.7
CM85-681J	680	20000	BCDEF	13	11	6.2	2.7
CM85-751J	750	20000	BCDEF	13	12	6.8	3.0
CM85-821J	820	20000	BCDEF	15	12	6.8	3.3
CM85-911J	910	20000	BCDEF	15	13	7.5	3.6
CM85-102J	1000	20000	BCDEF	15	13	7.5	3.6
CM85-112J	1100	20000	BCDEF	16	15	8.2	3.9
CM85-122J	1200	15000	BCDEF	16	15	8.2	4.3
CM85-132J	1300	15000	BCDEF	16	15	9.1	4.3
CM85-152J	1500	15000	BCDEF	16	16	9.1	4.7
CM85-162J	1600	15000	BCDEF	18	18	10	4.7
CM85-182J	1800	15000	BCDEF	18	18	11	5.1
CM85-202J	2000	15000	BCDEF	18	20	11	5.6
CM85-222J	2200	12000	BCDEF	20	20	12	5.6
CM85-242J	2400	12000	BCDEF	20	22	13	6.2
CM85-272J	2700	12000	BCDEF	20	22	13	6.2
CM85-302J	3000	12000	BCDEF	20	24	13	6.8
CM85-332J	3300	12000	BCDEF	22	24	15	6.8
CM85-362J	3600	12000	BCDEF	22	24	15	7.5
CM85-392J	3900	12000	BCDEF	22	27	16	7.5
CM85-432J	4300	12000	BCDEF	22	27	16	8.2
CM85-472J	4700	10000	BCDEF	22	27	18	8.2
CM85-512J	5100	10000	BCDEF	24	30	18	9.1
CM85-562J	5600	10000	BCDEF	24	33	20	9.1
CM85-622J	6200	10000	BCDEF	24	33	20	10
CM85-682J	6800	10000	BCDEF	24	33	20	10
CM85-752J	7500	10000	BCDEF	24	36	22	11
CM85-822J	8200	10000	BCDEF	24	36	22	11
CM85-912J	9100	8000	BCDEF	24	39	24	12
CM85-103J	10000	8000	BCDEF	24	39	24	12
CM85-113J	11000	8000	BCDEF	24	39	27	13
CM85-123J	12000	5000	BCDEF	24	43	27	13
CM85-133J	13000	5000	BCDEF	24	43	27	13
CM85-153J	15000	5000	BCDEF	24	43	27	15
CM85-163J	16000	5000	BCDEF	24	47	30	15
CM85-183J	18000	5000	BCDEF	24	47	30	16
CM85-203J	20000	5000	BCDEF	24	47	30	18
CM85-223J	22000	5000	BCDEF	24	47	30	18
CM85-243J	24000	5000	BCDEF	24	51	33	18
CM85 273J	27000	3000	BCDEF	24	51	33	18
CM85-303J	30000	3000	BCDEF	24	51	33	20
CM85-333J	33000	3000	BCDEF	24	51	33	20
CM85-363J	36000	3000	BCDEF	24	51	36	22
CM85-393J	39000	3000	BCDEF	24	51	36	22
CM85-433J	43000	3000	BCDEF	24	51	36	22
CM85-473J	47000	3000	BCDEF	24	51	36	22
CM85-513J	51000	3000	BCDEF	24	51	36	24
CM85-563J	56000	3000	BCDEF	24	51	36	24
CM85-623J	62000	3000	BCDEF	24	51	39	24
CM85-683J	68000	3000	BCDEF	24	51	39	24
CM85-753J	75000	2000	BCDEF	24	51	39	24
CM85-823J	82000	2000	BCDEF	24	51	39	24
CM85-913J	91000	2000	BCDEF	24	51	39	24
CM85-104J	100000	2000	BCDEF	24	51	39	24

† Complete type designation will include additional symbol as shown in sketch.
* Characteristics D, E, and F require 50% reduction in current rating.



elec



Eimac

ENGINEERING

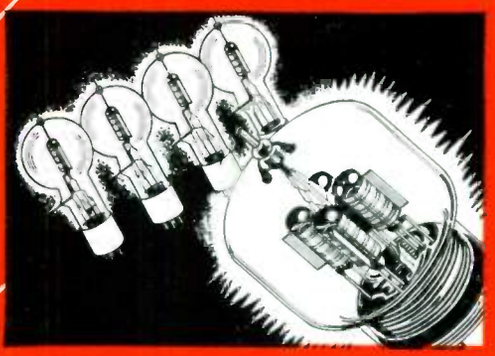
The cornerstone in Eimac's existence has been their advanced electronic engineering. The development of the gas-free tube, pioneering in the use of new materials, radical changes in existing tube design... all these things are the results of their research. During today's accelerated business situation Eimac engineers have developed and put to work many outstanding innovations. Number one on this list is the actual achievement of mass production of a product that heretofore was hand-made in a scientific laboratory. Today the most interesting of the other developments must be kept secret but the heads-up engineering is going forward apace. The services of this organization are available only for war problems now but will be offered to industry at large when peace comes. If you have a problem, the solution to which might involve vacuum tubes, write direct to factory.

EITEL-McCULLOUGH, INC. · SAN BRUNO, CALIFORNIA

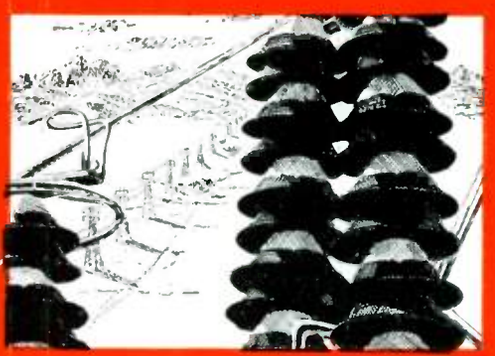
tronic telesis*

*** Progress conciously planned and produced by intelligently directed effort.**

– Century Dictionary and Cyclopedia



Eimac Tubes in the Ground Stations of the Major Airlines. The economy, stamina and superior performance capabilities of Eimac tubes helped make the operation of complex multi-frequency transmitters practical for aircraft ground stations. Eimac 450T tubes are in use by practically every major airline today.



Eimac Tubes in Instrument Landing Equipment. Airline pilots no longer need fly "by the seat of their pants" for blind landing equipment is in regular service. There are several of these systems in existence which use Eimac tubes.

Eimac Tubes and Frequency Modulation. Close cooperation between Eimac and the leading engineers throughout the world has made Eimac first choice in the important new development in radio. FM and Eimac tubes have been close companions from the very start of Major Armstrong's experiments.

Eimac Tubes in Police Radio Communications. Where dependability, stamina and superior performance are extremely vital you'll find Eimac tubes every time. Police radio engineers from Connecticut to California are loud in their praise of the service of Eimac tubes.

Eimac Engineered the Vacuum Condenser. Small, compact tank circuits made possible with the Eimac vacuum condensers helped increase the efficiency of many types of radio transmitters. Since plate spacing is determined by mechanical rather than voltage limitations, actual plate area is reduced to the very minimum.

Eimac Developed the Vacuum Relay. Over two years ago Eimac developed this single pole double throw vacuum relay. It handles 20,000 volts of RF potential without internal breakdown. Air pressure and humidity have no effect on it. Actually flashover will occur across outside terminals first even though contact spacing is but .015". A tribute to Eimac engineering.

Eimac Developed the Multi-Unit Tube. Triode units so nearly perfect that two or more can be placed in a single envelope. Power capabilities are determined by multiplying the capabilities of the single triode unit by the number of units employed in the tube. A revolutionary vacuum tube typical of Eimac's engineering leadership.

Power Transmission with Vacuum Tubes? In the days to come many new uses for Eimac tubes will be announced. The use of vacuum tubes for power transmission may be one of them. Of one thing you can be sure, Eimac engineering and development will be in the forefront.

Eimac Tubes have gone to War. With almost machine gun rapidity, Eimac tubes have been adopted by one after another of the peacetime services. Naturally Eimac was among the first to be drafted into war. The important job they are accomplishing today must remain secret for the duration. When the shooting is over, you'll find out why the armed services turned to Eimac so quickly.

Coveted Army-Navy "E" award for high achievement in production for war.

Export Agents: FRAZAR & HANSEN (formerly Frazar & Co., Ltd.)

301 Clay St., San Francisco, California, U.S.A.

WRH

RADIO-ELECTRONIC PRODUCTS DIRECTORY

The Radio Engineers' & Purchasing Agents' Guide to Essential Materials, Components, and Equipment

★ Indicates advertiser in this issue of Radio-Electronic Engineering

ANTENNAS, Mobile Whip & Collapsible

Birnbach Radio Co., 145 Hudson St., N. Y. C.
Brach Mfg. Corp., L. S., Newark, N. J.
Camburn Elec. Co., 484 Broome St., N. Y. C.
Galvin Mfg. Corp., Chicago, Ill.
★ Link, F. M., 125 W. 17th St., N. Y. C.
Premax Products, 4214 Highland Ave., Niagara Falls, N. Y.
★ Radio Eng. Labs., Inc., L. I. City, N. Y.
★ Snyder Mfg. Co., Noble & Darien Sts., Phila.
Technical Appliance Co., 516 W. 34 St., N. Y. C.
Ward Products Corp., 1523 E. 45 St., Cleveland, O.

ANTENNAS, Transmitting

Blaw-Knox Co., Pittsburgh, Pa.
Lehigh Structural Steel Co., 17 Battery Pl., N. Y. C.
★ Lingo & Son, John E., Camden, N. J.
Truscon Steel Co., Youngstown, O.
Wincharger Corp., Sioux City, Iowa

BEADS, Insulating

American Lava Corp., Chattanooga, Tenn.
Dunn, Inc., Struthers, 1321 Cherry, Phila., Pa
Star Porcelain Co., Trenton, N. J.
Steward Mfg. Co., Chattanooga, Tenn.

BOLTS, NUTS & SCREWS, Machine

American Screw Co., Providence, R. I.
Bristol Co., The Waterbury, Conn.
Central Screw Co., 3519 Shields Av., Chicago
Chandler Prods. Corp., Cleveland, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
Harper Co., H. M., 2609 Fletcher, Chicago
International Screw Co., Detroit
Lamson & Sessions Co., Cleveland, O.
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Ohio Nut & Bolt Co., Berea, Ohio
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., 198 Varick, N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Progressive Mfg. Co., Torrington, Conn.
Republic Steel Corp., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof, Inc., 2501 N. Keeler, Chicago
Southington Hardware Mfg. Co., The, Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

BOOKS on Radio & Electronics

MacMillan Co., 60 Fifth Ave., N. Y. C.
McGraw-Hill Book Co., 330 W. 42 St., N. Y. C.
Radio Technical Pub. Co., 45 Astor Pl., N. Y. C.
Rider, John F., 404 Fourth Ave., N. Y. C.
Ronald Press Co., 15 E. 26 St., N. Y. C.
Van Nostrand Co., D., 250 Fourth Ave., N. Y. C.
Wiley & Sons, John, 440 Fourth Ave., N. Y. C.

CABLE, Coaxial

American Phenolic Corp., 1830 S. 54 Av., Chicago
Anaconda Wire & Cable Co., 25 B'way, N. Y. C.
Andrew Co., Victor J., 363 E. 75 St., Chicago
Belden Mfg. Co., 4673 W. Van Buren, Chicago
Boston Insulated Wire & Cable Co., Boston
Communications Prods. Co., Jersey City, N. J.
Cornish Wire Co., 15 Park Row, N. Y. C.
Doolittle Radio, Inc., 7521 S. Loomis Blvd., Chicago
General Cable Corp., 420 Lexington, N. Y. C.
General Insulated Wire Corp., 53 Park Pl., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Simplex Wire & Cable Corp., Cambridge, Mass.

CABLE, Coaxial, Solid Dielectric

American Phenolic Corp., 1830 S. 54 Ave., Chicago
Federal Tel. & Radio Corp., E. Newark, N. J.
Simplex Wire & Cable Corp., Cambridge, Mass.

CABLE, Microphone, Speaker & Battery

Alden Prods, Co., Brockton, Mass.
Anaconda Wire & Cable Co., 25 Broadway, N. Y. C.
Belden Mfg. Co., 4633 W. Van Buren, Chicago
Boston Insulated Wire & Cable Co., Dorchester, Mass.
Gavett Mfg. Co., Brookfield, Mass.
Holyoke Wire & Cable Corp., Holyoke, Mass.

CASTINGS, Die

Aluminum Co. of America, Pittsburgh, Pa.
American Brass Co., Waterbury, Conn.
Dow Chemical Co., Dow metal Div., Midland, Mich.

CERAMICS, Bushings, Washers, Special Shapes

Akron Porcelain Co., Akron, O.
American Lava Corp., Chattanooga, Tenn.
Centralab, Div. of Globe-Union Inc., Milwaukee, Wis.
Electronic Mechanics, Inc., Paterson, N. J.
Gen'l Ceramics & Steatite Corp., Keasbey, N. J.
Isolantite, Inc., Belleville, N. J.
Lapp Insulator Co., Leroy, N. Y.
Louthan Mfg. Co., E. Liverpool, O.
Star Porcelain Co., Trenton, N. J.
Steward Mfg. Co., Chattanooga, Tenn.
Victor Insulator Co., Victor, N. Y.

CHOKES, RF

Aladdin Radio Industries, 501 W. 35th, Chicago
Alden Prods. Co., Brockton, Mass.
American Communications Corp., 306 B'way, N. Y. C.
Barker & Williamson, Upper Darby, Pa
Coto-Coil Co., Providence, R. I.
D-X Radio Prods. Co., 1575 Milwaukee, Chicago
General Winding Co., 420 W. 45 St., N. Y. C.
Guthman & Co., Edwin, 400 S. Peoria, Chicago
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Lectrohm, Inc., Cicero, Ill.
★ Meissner Mfg. Co., Mt. Carmel, Ill.
Miller Co., J. W., Los Angeles, Cal.
Muter Co., 1255 S. Michigan, Chicago
★ National Co., Malden, Mass.
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago
Radex Corp., 1328 Elston Av., Chicago
Sickles Co., F. W., Chicopee, Mass.
Teleradio Eng. Corp., 484 Broome St., N. Y. C.
Triumph Mfg. Co., 4017 W. Lake St., Chicago

CLIPS, Connector

Mueller Electric Co., Cleveland, O.

CLIPS & MOUNTINGS, Fuse

Alden Prods. Co., Brockton, Mass.
Dante Elec. Mfg. Co., Bantam, Conn.
Ilsco Copper Tube & Prods., Inc., Station M., Cincinnati
Jefferson Elec. Co., Bellwood, Ill.
Jones, Howard B., 2300 Wabansia, Chicago
Littlefuse, Inc., 4753 Ravenswood, Chicago
Patton MacGuyer Co., Providence, R. I.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Stewart Stamping Co., 621 E. 216 St., Bronx, N. Y.
Zierick Mfg. Co., 385 Girard Ave., Bronx, N. Y. C.

CLOTH, Insulating

Acme Wire Co., New Haven, Conn.
Brand & Co., Wm., 276-4th Av., N. Y. C.
Endurette Corp. of Amer., Cliffwood, N. J.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Irvington Varnish & Insulating Co., Irvington, N. J.
Mica Insulator Co., 196 Varick, N. Y. C.

CONDENSERS, Fixed

Aerovox Corp., New Bedford, Mass.
American Condenser Corp., 2508 S. Michigan, Chicago
Art Radio Corp., 115 Liberty, N. Y. C.
Atlas Condenser Prods. Co., 548 Westchester Av., N. Y. C.
Automatic Winding Co., East Newark, N. J.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
Centralab, Milwaukee, Wis.
Condenser Corp. of America, South Plainfield, N. J.
Condenser Prods. Co., 1375 N. Branch, Chicago
Cornell-Dubilier Elec. Corp., S. Plainfield, N. J.
Cosmic Radio Co., 699 E. 135th St., N. Y. C.
Crowley & Co., Henry L., W. Orange, N. J.
Deutschmann Corp., Tobe, Canton, Mass
Dumont Elec. Co., 34 Hubert St., N. Y. C.
Electro-Motive Mfg. Co., Willimantic, Conn
Erie Resistor Corp., Erie, Pa.
Fast & Co., John E., 3123 N. Crawford, Chicago
General Radio Co., Cambridge, Mass.
Girard-Hopkins, Oakland, Calif.
H. R. S. Prods., 5707 W. Lake St., Chicago
Illinois Cond. Co., 1160 Howe St., Chicago
Industrial Cond. Corp., 1725 W. North Av., Chicago
Insuline Corp. of America, Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Kellogg Switchb'd & Supply Co., 6650 Cicero, Chicago
Mallory & Co., P. R., Indianapolis, Ind.
Micamold Radio Corp., Brooklyn, N. Y.
Muter Co., 1255 S. Michigan, Chicago
Potter Co., 1950 Sheridan Rd., N. Chicago
RCA Mfg. Co., Camden, N. J.
Sangamo Elec. Co., Springfield, Ill.
Solar Mfg. Corp., Bayonne, N. J.
Sprague Specialties Co., N. Adams, Mass.
Teleradio Engineering Corp., 484 Broome St., N. Y. C.

CONDENSERS, Gas-filled

Lapp Insulator Co., Inc., Leroy, N. Y.

CONDENSERS, High-Voltage Vacuum

Centralab, Milwaukee, Wis.
★ Eitel-McCullough, Inc., San Bruno, Calif.
Erie Resistor Corp., Erie, Pa.
★ General Electric Co., Schenectady, N. Y.

CONDENSERS, Small Ceramic Tubular

Centralab; Div. of Globe-Union, Inc., Milwaukee, Wis.
Erie Resistor Corp., Erie, Pa.

CONDENSERS, Tubular Ceramic Trasmitting

Aerovox Corp., New Bedford, Mass.
Cornell-Dubilier, S. Plainfield, N. J.
RCA Mfg. Co., Inc., Camden, N. J.
Sangamo Electric Co., Springfield, Ill.
Solar Mfg. Corp., Bayonne, N. J.

CONDENSERS, Variable Receiver Tuning

Alden Prods. Co., Brockton, Mass.
American Steel Package Co., Defiance Ohio
Barker & Williamson, Ardmore, Pa.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
General Instrument Corp., Elizabeth, N. J.
Hammarlund Mfg. Co., 424 W. 33rd St., N. Y. C.
Insuline Corp. of Amer., L. I. City, N. Y.
Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., Malden, Mass
National Co., Malden, Mass.
Oak Mfg. Co., 1267 Clybourn Ave., Chicago
Radio Condenser Co., Camden, N. J.
Rauland Corp., Chicago, Ill.

CONDENSERS, Variable Transmitter Tuning

Barker & Williamson, Upper Darby, Pa.
Bud Radio, Cleveland, O.
Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Insuline Corp. of Amer., L. I. City, N. Y.
Johnson, E. F., Waseca, Minn.
Millen Mfg. Co., James, Malden, Mass.
★ National Co., Malden, Mass.
Radio Condenser Co., Camden, N. J.

CONDENSERS, Variable Trimmer

Alden Prods Co., Brockton, Mass
American Steel Package Co., Defiance, O.
Bud Radio, Inc., Cleveland, O.
Cardwell Mfg. Corp., Allen, Brooklyn, N. Y.
Centralab, Milwaukee, Wis.
Fade Radio & Elec. Corp., Long Island City, N. Y.
General Radio Co., Cambridge, Mass.
Guthman, Inc., E. I., 400 S. Peoria, Chicago
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Insuline Corp. of America, Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
★ Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., James, Malden, Mass.
Miller Co., J. W., Los Angeles, Cal.
Muter Co., 1255 S. Michigan Av., Chicago
★ National Co., Malden, Mass.
Potter Co., 1950 Sheridan Rd., N. Chicago
Sickles Co., F. W., Chicopee, Mass.
Solar Mfg. Corp., Bayonne, N. J.
Teleradio Eng. Corp., 484 Broome, N. Y. C.

CONNECTORS, Cable

Aero Electric Corp., Los Angeles, Calif.
Alden Prods., Brockton, Mass.
Amer. Microphone Co., 1915 S. Western Av., Los Angeles
Amer. Phenolic Corp., 1830 S. 54th St., Chicago
American Radio Hardware Co., 476 B'way, N. Y. C.
Andrew, Victor J., 6429 S. Lavergne Av., Chicago
Astatic Corp., Youngstown, O.
Atlas Sound Corp., 1442 39th St., Brooklyn, N. Y.
Birnbach Radio, 145 Hudson St., N. Y. C.
Breeze Mfg. Corp., Newark, N. J.
Brush Development Co., Cleveland, O.
Bud Radio, Cleveland, Ohio
Cannon Elec. Development, 3209 Humboldt, Los Angeles
Eby, Inc., Hugh H., Philadelphia
Electro Voice Mfg. Co., South Bend, Indiana
Franklin Mfg. Corp., 175 Varick St., N. Y. C.
General Radio Co., Cambridge, Mass.
Harwood Co., 747 N. Highland Ave., Los Angeles
Insuline Corp. of Amer., L. I. City, N. Y.
Jones, Howard B., 2300 Wabansia, Chicago
Mallory & Co., P. R., Indianapolis, Ind.
Monowatt Electric Co., Providence, R. I.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
Selectar Mfg. Co., Long Island City, N. Y.

CONTACT POINTS

Callite Tungsten Corp., Union City, N. J.
Mallory & Co., Inc., P. R., Indianapolis, Ind.

COUPLINGS, flexible

Cardwell Mfg. Corp., Allen D., Brooklyn, N. Y.
Johnson Co., E. F., Waseca, Minn.
Millen Mfg. Co., James, Malden, Mass.
★ National Co., Inc., Malden, Mass.

CRYSTAL GRINDING EQUIPMENT

Felker Mfg. Co., Torrance, Calif.

Additions This Month

27 NEW MANUFACTURERS' NAMES

This Directory is revised every month, so as to assure engineers and purchasing agents of up-to-date information. We shall be pleased to receive suggestions as to company names which should be added, and hard-to-find items which should be listed in this Directory.


THIS IS A FIGHTING SPEAKER!
. . . it is not a figment of the drawing board or the future dream of a designer. This new Jensen speech reproducer is now on active duty with the armed forces.
It is only one of the many newly developed Jensen speech reproducers...products of Jensen's laboratories and factory.
Jensen continues to make a full line of sound reproducers of all types for qualified users.
Jensen
RADIO MANUFACTURING CO., 6601 S. LARAMIE AVENUE, CHICAGO

CRYSTALS, Quartz

Bausch & Lomb Optical Co., Rochester, N. Y.
Billey Elec. Co., Erie, Penna.
Burnett, Wm. W. L., San Diego, Cal.
Collins Radio Co., Cedar Rapids, Iowa
Crystal Research Labs., Hartford, Conn.
Electronic Research Corp., 800 W. Washington Blvd., Chicago
Federal Engineering Co., 37 Murray St., N. Y. C.
General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Harvey-Wells Communications, Southbridge, Mass.
Hipower Crystal Co., 2035 W. Charleston, Chicago
Hunt & Sons, G. C., Carlisle, Pa.
Jefferson, Inc., Ray, Westport, L. I., N. Y.
Kaar Engineering Co., Palo Alto, Cal.
Meck Industries, John, Plymouth, Ind.
Miller, August E., North Bergen, N. J.
Peterson Radio, Council Bluffs, Iowa
Precision Piezo Service, Baton Rouge, La.
Premier Crystal Labs., 63 Park Row, N. Y. C.
RCA Mfg. Co., Camden, N. J.
Scientific Radio Service, Hyattsville, Md.
Standard Piezo Co., Carlisle, Pa.
Valpey Crystals, Hollston, Mass.
Zeiss, Inc., Carl, 485 Fifth Av., N. Y. C.

DIALS, Instrument

Crowe Nameplate Co., 3701 Ravenswood Ave., Chicago
General Radio Co., Cambridge, Mass.
Gits Molding Corp., 4600 Huron St., Chicago
★ National Co., Inc., Malden, Mass.
Rogan Bros., 2003 S. Michigan Ave., Chicago

DISCS, Recording

Advance Recording Products Co., Long Island City, N. Y.
Allied Recording Products Co., Long Island City, N. Y.
Audio Devices, Inc., 1600 B'way, N. Y. C.
Federal Recorder Co., Elkhart, Ind.
Gould-Moody Co., 395 B'way, N. Y. C.
Presto Recording Corp., 242 W. 55 St., N. Y. C.
RCA Mfg. Co., Camden, N. J.

FASTENERS, Separable

Camloc Fastener Co., 420 Lexington Ave., N. Y. C.
Shakeproof, Inc., 2501 N. Keeler Ave., Chicago

FELT

American Felt Co., Inc., Glenville, Conn.
Western Felt Works, 4031 Ogden Ave., Chicago

FIBRE, Vulcanized

Brandywine Fibre Prods. Co., Wilmington, Del.
Continental-Diamond Fibre Co., Newark, Del.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Mica Insulator Co., 196 Varick, N. Y. C.
Nat'l Vulcanized Fibre Co., Wilmington, Del.
Taylor Fibre Co., Norristown, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

FILTERS, Electrical Noise

Avia Products Co., 737 N. Highland Ave., Los Angeles
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Tobe Deutschmann Corp., Canton, Mass.

FINISHES, Metal

Alrose Chemical Co., Providence, R. I.
Aluminum Co. of America, Pittsburgh, Pa.
Ault & Wiborg Corp., 75 Varick, N. Y. C.
Hilo Varnish Corp., Brooklyn, N. Y.
Maas & Waldstein Co., Newark, N. J.
New Wrinkle, Inc., Dayton, O.

FREQUENCY METERS

★ Browning Labs., Inc., Winchester, Mass.
General Radio Co., Cambridge, Mass.
Lavoie Laboratories, Long Branch, N. J.
★ Link, F. M., 125 W. 17 St., N. Y. C.
Measurements Corporation, Boonton, N. J.

FREQUENCY STANDARDS, Primary

General Radio Co., Cambridge, Mass.

FREQUENCY STANDARDS, Quartz Secondary

Millen Mfg. Co., Inc., Malden, Mass.

FUSES, Enclosed

Dante Elec. Mfg. Co., Bantam, Conn.
Jefferson Elec. Co., Bellwood, Ill.
Littlefuse, Inc., 4753 Ravenswood Av., Chicago

GEARS & PINIONS, Metal

Continental-Diamond Fibre Co., Newark, Del.
Gear Specialties, Inc., 2650 W. Medill, Chicago
Perkins Machine & Gear Co., Springfield, Mass.
Thompson Clock Co., H. C., Bristol, Conn.

GEARS & PINIONS, Non-Metallic

Brandywine Fibre Prods. Co., Wilmington, Del.
Formica Insulation Co., Cincinnati, O.
Gear Specialties, Inc., 2650 W. Medill, Chicago
★ General Electric Co., Pittsfield, Mass.
Mica Insulator Co., 196 Varick St., N. Y. C.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., Springfield, Mass.
Richardson Co., Melrose Park, Chicago
Synthane Corp., Oaks, Pa.
Taylor Fibre Co., Norristown, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

GENERATORS, Gas Engine Driven

Kato Engineering Co., Mankato, Minn.
Pioneer Gen-E-Motor, 5841 W. Dickens Ave., Chicago, Ill.

GENERATORS, Hand Driven

Carter Motor Co., 1608 Milwaukee, Chicago

GENERATORS, Standard Signal

Boonton Radio Corp., Boonton, N. J.
Ferris Instrument Co., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Measurements Corp., Boonton, N. J.

GENERATORS, Wind-Driven, Aircraft

General Armature Corp., Lock Haven, Pa.

HEADPHONES

Brush Development Co., Cleveland, O.
Conn. Tel. & Electric Co., Meriden, Conn.
Carrier Microphone Co., Inglewood, Cal.
Cannon Co., C. F., Springwater, N. Y.
Carron Mfg. Co., 415 S. Aberdeen, Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
Connecticut Tel. & Elec. Co., Meriden, Conn.
Elec. Industries Mfg. Co., Red Bank, N. J.
Kellogg Switchboard & Supply Co., 6650 S. Cicero Av., Chicago
Murdock Mfg. Co., Chelsea, Mass.
Telephonics Corp., 350 W. 31 St., N.Y.C.
Trimm Radio Mfg. Co., 1770 W. Berteau, Chicago
Universal Microphone Co., Inglewood, Cal.

HORNS, Outdoor

Graybar Elect. Co., Lexington Ave. at 43 St., N. Y. C.
Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago
Operadio Mfg. Co., St. Charles, Ill.
Oxford-Tartak Radio Corp., 915 W. Van Buren St., Chicago
Racon Electric Co., 52 E. 19 St., N. Y. C.
RCA Mfg. Co., Camden, N. J.
University Laboratories, 225 Varick St., N. Y. C.

INSTRUMENTS, Radio Laboratory

Ballantine Laboratories, Inc., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Hewlett Packard Co., Palo Alto, Calif.
Measurements Corporation, Boonton, N. J.

INSULATORS: Ceramic Stand-off, Lead-in, Rod Types

American Lava Corp., Chattanooga, Tenn.
Corning Glass Works, Corning, N. Y.
Electronic Mechanics, Inc., Clifton, N. J.
Isolantite, Inc., Belleville, N. S.
Johnson Co., E. F., Waseca, Minn.
Lapp Insulator Co., Inc., Leroy, N. Y.
Locke Insulator Co., Baltimore, Md.
Millen Mfg. Co., Malden, Mass.
National Co., Inc., Malden, Mass.

IRON CORES, Powdered

Crowley & Co., Henry L., West Orange, N. J.
Gibson Elec. Co., Pittsburgh, Pa.
Mallory & Co., P. R., Indianapolis, Ind.
Stackpole Carbon Co., St. Marys, Pa.
Western Electric Co., 195 Broadway, N. Y. C.
Wilson Co., H. A., Newark, N. J.

IRONS, Soldering

Acme Electric Heating Co., 1217 Washington St., Boston
Amer. Electrical Heater Co., 6110 Cass Ave., Detroit
Electric Soldering Iron Co., Deep River, Conn.
General Electric Co., Schenectady, N. Y.
Hexacon Electric Co., Roselle Park, N. J.
Vasco Electrical Mfg. Co., 4116 Avalon Blvd., Los Angeles
Vulcan Electric Co., Lynn, Mass.

JACKS, Telephone

Alden Prods. Co., Brockton, Mass.
Amer. Molded Prods. Co., 1753 N. Honore St., Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
Guardian Elec. Mfg. Co., 1627 W. Walnut St., Chicago
Insuline Corp. of Amer., Long Island City, N. Y.
Johnson, E. F., Waseca, Minn.
Jones, Howard B., 2300 Wabansia Ave., Chicago
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Mangold Radio Pts. & Stamping Co., 6300 Shelbourne St., Philadelphia
Molded Insulation Co., Germantown, Pa.

KEYS, Telegraph

Amer. Radio Hardware Co., Inc., 476 Broadway, N. Y. C.
Bunnell & Co., J. H., 215 Fulton St., N. Y. C.
Mossman, Inc., Donald P., 6133 N. Northwest Hy., Chicago
Signal Electric Mfg. Co., Menominee, Mich.
Telephonics Corp., 350 W. 31 St., N. Y. C.

KNOBS, Radio & Instrument

Alden Prods. Co., Brockton, Mass.
American Insulator Corp., New Freedom, Pa.
Chicago Molded Prods. Corp., 1025 N. Kolmar, Chicago
General Radio Co., Cambridge, Mass.
Gits Molding Corp., 4600 Huron St., Chicago
Imperial Molded Prods. Corp., 2921 W. Harrison, Chicago
Kurtz Kasch, Inc., Dayton, O.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Millen Mfg. Co., James, Malden, Mass.
★ Nat'l Co., Inc., Malden, Mass.
Radio City Products Co., 127 W. 26 St., N. Y. C.
Rogan Bros., 2001 S. Michigan, Chicago

LABELS, Removable

Avery Adhesives, 451 3rd St., Los Angeles

LABELS, Stick-to-Metal

Ever Ready Label Corp., E. 25th St., N. Y. C.

LABORATORIES, Electronic Research

★ Browning Labs., Inc., Winchester, Mass.

LUGS, Soldering

Burndy Engineering Co., 459 E. 133rd St., N. Y. C.
Cinch Mfg. Corp., W. Van Buren St., Chicago
Dante Elec. Mfg. Co., Bantam, Conn.
Ideal Commutator Dresser Co., Sycamore, Ill.
Isco Copper Tube & Prods., Inc., Station M, Cincinnati
Krueger & Hudepohl, Third & Vine, Cincinnati, O.
Patton-MacGuyer Co., 17 Virginia Av., Providence, R. I.
Sherman Mfg. Co., Battle Creek, Mich.
Thomas & Betts Co., Elizabeth, N. J.
Zierick Mfg. Co., 385 Girard Ave., Bronx, N. Y. C.

LUGS, Solderless

Aircraft Marine Prod., Inc., Elizabeth, N. J.
Burndy Eng. Co., 107 Eastern Blvd., N. Y. C.

MACHINES, Impregnating

Stokes Machine Co., F. J., Phila., Pa.

MACHINES, Numbering

Altair Machinery Corp., 55 VanDam, N. Y. C.
Numberall Stamp & Tool Co., Huguenot Park, Staten Island, N. Y.

MACHINES, Riveting

Chicago Rivet & Machine Co., Bellwood, Illinois
★ Wiedeman Machine Co., Phila., Pa.

MACHINES, Screwdriving

Detroit Power Screwdriver Co., Detroit, Mich.
Stanley Tool Div. of the Stanley Works, New Britain, Conn.

MAGNETS, Permanent

★ General Elec. Co., Schenectady, N. Y.
Thomas & Skinner Steel Prod. Co., Indianapolis, Ind.

MARKERS, Wire Identification

Brand & Co., Wm., 276 4th Ave., N. Y. C.

METAL, Thermostatic

Baker & Co., 113 Astor, Newark, N. J.
C. S. Brainin Co., 20 VanDam, N. Y. C.
Callite Tungsten Corp., Union City, N. J.
Chace Co., W. M., Detroit, Mich.
Metals & Controls Corp., Attleboro, Mass.
Wilson Co., H. A., 105 Chestnut, Newark, N. J.

METERS, Ammeters, Voltmeters, Small Panel

Cambridge Inst. Co., Grand Central Terminal, N. Y. C.
De Jur-Amsco Corp., Shelton, Conn.
★ General Electric Co., Bridgeport, Conn.
Hickok Elec. Inst. Co., Cleveland, O.
Hoyt Elec. Inst. Works, Boston, Mass.
Readrite Meter Works, Bluffton, O.
Roller-Smith Co., Bethlehem, Pa.
★ Simpson Elec. Co., 5218 W. Kinzie, Chicago
Triplett Elec. Inst. Co., Bluffton, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Weston Elec. Inst. Corp., Newark, N. J.
Wheelco Inst. Co., 847 W. Harrison St., Chicago

METERS, Q

Boonton Radio Corp., Boonton, N. J.

METERS, Vacuum Tube Volt

Ballantine Laboratories, Inc., Boonton, N. J.
Ferris Instrument Corp., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Hewlett-Packard Co., Palo Alto, Calif.
Measurements Corp., Boonton, N. J.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.

METERS, Vibrating Reed

Biddle, James G., 1211 Arch St., Philadelphia
Triplett Elec. Inst. Co., Bluffton, O.

MICA

Brand & Co., Wm., 276 Fourth Av., N. Y. C.
Insulation Mfgrs. Corp., 565 W. Wash. Blvd., Chicago
Macallen Co., Boston, Mass.
Mica Insulator Corp., 196 Varick, N. Y. C.
New England Mica Co., Waltham, Mass.
Richardson Co., Melrose Park, Chicago

MICROPHONES

Amer. Microphone Co., 1015 Western Av., Los Angeles
Amperite Co., 561 B'way, N. Y. C.
Astatic Corp., Youngstown, O.
Brush Development Co., Cleveland, O.
Carrier Microphone Co., Inglewood, Cal.
Elect. Industries Mfg. Co., Red Bank, N. J.
Electro Voice Mfg. Co., South Bend, Ind.
Kellogg Switchboard & Supply Co., 6650 S. Cicero, Chicago
Radio Speakers, Inc., 221 E. Cullerton, Chicago
Philmore Mfg. Co., 113 University Pl., N. Y. C.
Permoflux Corp., 4916 W. Grand Av., Chicago
Rowe Industries, Inc., Toledo, O.
Shure Bros., 225 W. Huron St., Chicago
Telephonics Corp., 350 W. 31 St., N. Y. C.
Turner Co., Cedar Rapids, Ia.
Universal Microphone Co., Inglewood, Cal.

MONITORS, Frequency

★ General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
RCA Mfg. Co., Camden, N. J.

MOTOR-GENERATORS, Dynamotors, Rotary Converters

Alliance Mfg. Co., Alliance, O.
Air-Way Mfg. Co., Toledo, O.
Bendix, Red Bank, N. J.
Black & Decker Mfg. Co., Towson, Md.
Bodine Elec. Co., 2262 W. Ohio, Chicago
★ Carter Motor Co., 1608 Milwaukee, Chicago
Clements Mfg. Co., Chicago, Ill.
Continental Electric Co., Newark, N. J.
Delco Appliance, Rochester, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Dormeyer Co., Chicago, Ill.
Eclipse Aviation, Bendix, N. J.
Elcor, Inc., 1060 W. Adams, Chicago
Electric Motors Corp., Racine, Wis.
Electric Specialty Co., Stamford, Conn.
Electrolux Corp., Old Greenwich, Conn.
Eureka Vacuum Cleaner, Detroit, Mich.
General Armature Corp., Lock Haven, Pa.
★ General Electric Co., Schenectady, N. Y.
Jannette Mfg. Co., 558 W. Monroe, Chicago
Knapp-Monarch, St. Louis, Mo.
Leland Electric Co., Dayton, O.
Ohio Electric Co., 74 Trinity Pl., N. Y. C.
Pioneer Gen-E-Motor, 5841 W. Dickens Av., Chicago
Redmond Co., A. G., Owosso, Mich.
Russell Co., Chicago, Ill.
Webster Co., Chicago, Ill.
Westinghouse Elect. Mfg. Co., Lima, O.
Wincharger Corp., Sioux City, Iowa

MOUNTINGS, Shock Absorbing

Lord Mfg. Co., Erie, Pa.
Pierce-Roberts Co., Trenton, N. J.
U. S. Rubber Co., 1230-6th Ave., N. Y. C.

MYCALEX

★ General Electric Co., Schenectady, N. Y.
Mycalex Corp. of Amer., Clifton, N. J.

NICKEL, Sheet, Rod, Tubes

Eagle Metals Co., Seattle, Wash.
Pacific Metals Co., Ltd., San Francisco, Calif.
Steel Sales Corp., 129 S. Jefferson St., Chicago
Tull Metal & Supply Co., J. M., Atlanta, Ga.

SPOT NEWS

(CONTINUED FROM PAGE 14)

"E" Award: To F. M. Link, in recognition of their accomplishments in engineering and manufacture of FM communications and other special equipment for the various branches of the U. S. Army and Navy, and for the allied governments.

Harry Boyd Brown: Predicts that television, as one of the greatest of all post-war industries, will easily reach a volume of $1,000,000,000 a year. Philco Corporation has consistently asserted the greatest confidence in the future of television for home entertainment.

Substitute for Decals: Since a limitation was put on the use of decalcomanias by WPB, self-adhesive stickers have been found to be a successful substitute for labels and notices to be applied on metal, glass, plastic, or painted surfaces. Deliveries are faster, too. These stickers are manufactured by Avery Adhesives, Los Angeles.

Purchase Priority Plan: RCA has announced a post-war purchase plan under which theatre owners attain preferred positions on a "priority purchase" list for new and replacement equipment when production is resumed. By weekly or monthly deposits, the theatre owner can build up an interest-bearing reserve for his estimated post-war needs. It appears that this plan could well be extended to broadcast stations, too.

Second Plant: Opened by Clarostat Mfg. Company, Brooklyn, N. Y., to be devoted exclusively to assembling parts and windings fabricated in plant No. 1. Executive and engineering offices will continue at 285 North 6th Street.

W55M: The Milwaukee Journal's FM transmitter schedule has been shifted from 10 A.M. to 10 P.M., to noon to midnight, in response to the requests of evening listeners.

Frequency Classifications: The FCC has reclassified the useful radio spectrum into 7 bands:

	10 kc.	to 30 kc.	Very Low	(VLF)
Above	30 kc.	to 300 kc.	Low	(LF)
"	300 kc.	to 3 mc.	Medium	(MF)
"	3 mc.	to 30 mc.	High	(HF)
"	30 mc.	to 300 mc.	Very High	(VHF)
"	300 mc.	to 3000 mc.	Ultra High	(UHF)
"	3000 mc.	to 30000 mc.	Super High	(SHF)

Thread-Cutting Screws: To enable engineers and production managers to test the advantages of thread-cutting screws, Shakeproof, Inc., 2501 N. Keeler Avenue, Chicago, is offering a demonstration kit of samples which will be sent upon request.

Surprising: A lengthy interview with Major Armstrong, published in the *New York Times* recently, did not contain a single

(CONTINUED ON PAGE 41)

Whitehead Metal Prod. Co., 303 W. 10th St., N. Y. C.
Williams and Co., Inc., Pittsburgh, Pa.

NUTS, Self-locking

Boots Aircraft Nut Corp., New Canaan, Conn.
Elastic Stop Nut Corp., Union, N. J.
Palnut Co., Inc., Irvington, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

OSCILLOSCOPES, Cathode Ray

Du Mont Laboratories, Inc., Allen B., Passaic, N. J.
General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Millen Mfg. Co., Malden, Mass.
RCA Mfg. Co., Inc., Camden, N. J.

OVENS, Industrial & Laboratory

★ General Elec. Co., Schenectady, N. Y.
Trent Co., Harold E., Philadelphia

PILOT LIGHTS

Alden Prods. Co., Brockton, Mass.
Amer. Radio Hardware Co., Inc., 467 B'way, N. Y. C.
Dial Light Co. of America, 90 West, N. Y. C.
Drake Mfg. Co., 1713 W. Hubbard, Chicago
General Control Co., Cambridge, Mass.
★ General Elec. Co., Lamp Dept., Nela Specialty Div., Hoboken, N. J.
Gothard Mfg. Co., Springfield, Ill.
Herzog Miniature Lamp Works, 12-19 Jackson Av., Long Island City, N. Y.
Kirkland Co., H. R., Morristown, N. J.
Mallory & Co., P. R., Indianapolis, Ind.
Rothard Mfg. Co., N. 9th Ave., Springfield, Ill.
Signal Indicator Corp., 140 Cedar St., N. Y. C.
Sylvania Elec. Prod. Co., Emporium, Pa.

PHOSPHOR BRONZE

American Brass Co., Waterbury, Conn.
Bunting Brass & Bronze Co., Toledo, O.
Driver-Harris Co., Harrison, N. J.
Phosphor Bronze Smelting Co., Philadelphia
Revere Copper & Brass, 230 Park Av., N. Y. C.
Seymour Mfg. Co., Seymour, Conn.

PLASTICS, Extruded

Blum & Co., Inc., Julius, 532 W. 22 St., N. Y. C.
Brand & Co., Wm., 276 Fourth Ave., N. Y. C.
Extruded Plastics, Inc., Norwalk, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.

PLASTIC, Sheet for Name Plates

Mica Insulator Co., 200 Varick St., N. Y. C.

PLASTICS, Injection Molded

Tech-Art Plastics, 41-01 36th Ave., Long Island City, N. Y.

PLASTICS, Laminated or Molded

Acadia Synthetic Prods., 4031 Ogden Av., Chicago
Alden Prods. Co., Brockton, Mass.
American Cyanamid Co., 30 Rockefeller Plaza, N. Y. C.
American Insulator Corp., New Freedom, Pa.
American Molded Prods. Co., 1753 N. Honore, Chicago
Auburn Button Works, Auburn, N. Y.
Barber-Colman Co., Rockford, Ill.
Brandywine Fibre Prods. Co., Wilmington, Del.
Catalin Corp., 1 Park Av., N. Y. C.
Celanese Celluloid Corp., 180 Madison Av., N. Y. C.
Chicago Molded Prods. Corp., 1024 N. Kolmar, Chicago
Continental-Diamond Fibre Co., Newark, Del.
Dow Chemical Co., Midland, Mich.
Durez Plastics & Chemicals, Inc., N. Tonawanda, N. Y.
Extruded Plastics, Inc., Norwalk, Conn.
Formica Insulation Co., Cincinnati, O.
★ General Electric Co., Plastics Dept., Pittsfield, Mass.
General Industries Co., Elyria, O.
Gits Molding Corp., 1600 Huron St., Chicago
Imperial Molded Prods. Co., 2921 W. Harrison, Chicago
Industrial Molded Prods. Co., 2035 Charleston, Chicago
Kurz-Kasch, Inc., Dayton, O.
Macallen Co., Boston, Mass.
Mica Insulator Co., 196 Varick, N. Y. C.
Monsanto Chemical Co., Springfield, Mass.
National Vulcanized Fibre Co., Wilmington, Del.
Northern Industrial Chemical Co., Boston, Mass.
Printloid Corp., 93 Mercer St., N. Y. C.
★ Radio City Products Co., 127 W. 26 St., N. Y. C.
Richardson Co., Melrose Park, Chicago
Rogan Bros., 180 N. Wacker Dr., Chicago
Rohm & Haas Co., Philadelphia
Stokes Rubber Co., Joseph, Trenton, N. J.
Surprenant Elec. Ins. Co., Boston
Synthane Corp., Oaks, Pa.
Taylor Fibre Co., Norristown, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

PLASTICS, Transparent

Celanese Celluloid Corp., 180 Madison Ave., N. Y. C.
du Pont de Nemours & Co., E. I., Arlington, N. J.
Printloid Corp., 93 Mercer St., N. Y. C.
Rohm & Haas Co., Washington Sq., Philadelphia

PLATING, Metal on Molded Parts

Metaplast Corp., 205 W. 19 St., N. Y. C.

PLUGS (Banana), Spring Type

Birnbach Radio Co., 145 Hudson St., N. Y. C.
Eastman Kodak Co., Rochester, N. Y.

PLUGS & JACKS, Spring Type

Eby, Inc., Hugh H., Philadelphia, Pa.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Ucinite Co., Newtonville, Mass.

PLUGS, Telephone Type

Alden Prods. Co., Brockton, Mass.
American Molded Prods. Co., 1753 N. Honore, Chicago
Chicago Tel. Supply Co., Elkhart, Ind.
Guardian Elec. Mfg. Co., 1627 W. Walnut, Chicago
Insuline Corp. of Amer., Long Island City, N. Y.
Johnson Co., E. F., Waseca, Minn.
Jones, Howard B., 2300 Wabansia Av., Chicago
Mallory & Co., Inc., P. R., Indianapolis, Ind.

PLYWOOD, Metal Faced

Haskelite Mfg. Corp., 208 W. Washington St., Chicago

PRESSES, PLASTIC MOLDING

Kux Machine Co., 3930 W. Harrison, Chicago

PRESSES, Stamping

Stokes Machine Co., F. J., Philadelphia
Watson-Stillman Corp., The, Roselle Park, N. J.
★ Wiedeman Machine Co., Phila., Pa.

RECTIFIERS, Current

Benwood Linze Co., St. Louis, Mo.
Continental Elec. Co., 903 Merchandise Mart, Chicago
Electronics Labs., Indianapolis, Ind.
Fansteel Metallurgical Corp., N. Chicago, Ill.
★ General Electric Co., Bridgeport, Conn.
International Tel. & Radio Mfg. Corp., E. Newark, N. J.
Mallory & Co., P. R., Indianapolis, Ind.
Nothelfer Winding Labs., Trenton, N. J.
United Cinephone Corp., Torrington, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

RECTIFIERS Instrument & Relay

Selenium Corp. of Amer., 1800 W. Pico Blvd., Los Angeles

REGULATORS, Temperature

Allen-Bradley Co., Milwaukee, Wis.
Dunn, Inc., Struthers, 1321 Cherry, Philadelphia
Fenwal Inc., Ashland, Mass.
★ General Electric Co., Schenectady, N. Y.
Mercoid Corp., 4217 Belmont, Chicago
Minneapolis-Honeywell Regulator, Minneapolis, Minn.
Spencer Thermostat Co., Attleboro, Mass.

REGULATORS, Voltage

Acme Elec. & Mfg. Co., Cuba, N. Y.
Amperite Co., 561 Broadway, N. Y. C.
Ferranti Elec., Inc., 30 Rockefeller Plaza, N. Y. C.
★ General Elec. Co., Schenectady, N. Y.
H-B Elec. Co., Philadelphia
Sola Electric Co., 2525 Clybourn Av., Chicago
★ United Transformer Corp., 150 Varick St., N. Y. C.

RELAYS, Small Switching

Allied Control Co., Inc., 223 Fulton St., N. Y. C.
Amperite Co., 561 Broadway, N. Y. C.
G-M Laboratories, Inc., 1313 N. Knox Ave., Chicago
Guardian Electric, W. Walnut St., Chicago
Potter & Brumfield Co., Princeton, Ind.
Sigma Instruments, Inc., 76 Freeport St., Boston, Mass.
Struthers Dunn, Inc., 1326 Cherry St., Philadelphia
Ward Leonard Elec. Co., Mt. Vernon, N. Y.

RELAYS, Small Telephone Type

Amer. Automatic Elect. Sales Co., 1033 W. Van Buren St., Chicago
Clare & Co., C. P., 4719 W. Sunnyside Ave., Chicago
Guardian Electric Co., 1625 W. Walnut St., Chicago
Wick Organ Co., Highland, Ill.

RELAYS, Time Delay

Amperite Co., 561 Broadway, N. Y. C.
Haydon Mfg. Co., Inc., Forestville, Conn.
Industrial Timer Corp., Newark, N. J.
Sangamo Elect. Co., Springfield, Ill.

RELAY TESTERS, Vibration

Kurman Electric Co., Inc., 3030 Northern Blvd., L. I. City, N. Y.

FM EMERGENCY EQUIPMENT

(CONTINUED FROM PAGE 19)

RESISTORS

R101 Volume control, 50,000 ohms carbon
R102 Squelch control, 20,000 ohms carbon
R103 Bleeder, 18 ohms carbon
R104 Dropping, 50 ohms wire-wound
R105 Speaker cutout, 5 ohms carbon
R106 Plate filter, 68,000 ohms carbon
R107 Grid leak, .47 meg. carbon
R108 Plate filter, 27,000 ohms carbon
R109 Grid leak, .18 meg. carbon
R110 Voltage divider, .47 meg. carbon
R111 Dropping, 22,000 ohms carbon
R112 Grid, .22 meg. carbon
R113 Grid leak, .27 meg. carbon
R115 Screen, 33,000 ohms carbon
R116 Grid leak, .1 meg. carbon
R117 Screen, 47,000 ohms carbon
R118 Discriminator load, .11 meg. carbon
R119 Audio de-emphasis, .22 meg. carbon
R120 Discriminator load, .11 meg. carbon
R121 Grid de-emphasis, 82,000 ohms carbon
R122 Grid leak, 5.6 meg. carbon
R123 Plate, .22 meg. carbon
R124 Voltage divider, 2.2 meg. carbon
R125 Voltage dropping, 33,000 ohms carbon
R126 Cathode bias, 270 ohms carbon
R127 B+ filter, 1,000 ohms wire-wound
R128 Metering, .1 meg. carbon
R129 Grid leak, .47 meg. carbon
R130 Grid leak, .1 meg. carbon
R131 Voltage divider, 1. meg. carbon
R132 Voltage divider, .22 meg. carbon
R133 Grid injection, 10,000 ohms carbon
R134 B+, 2,200 ohms carbon
R135 Screen, 47,000 ohms carbon
R136 Voltage divider, 68,000 ohms carbon
R137 Voltage divider, 2.7 meg. carbon
R138 Cathode bias, 150 ohms carbon
R139 Grid leak, 2.2 meg. carbon
R140 Plate, 2,200 ohms carbon
R141 Grid leak, 3.9 ohms carbon
R142 Plate & screen, 2,700 ohms carbon
R143 Grid leak, 47,000 ohms carbon

Location of Trouble ★ Service operations on this equipment have been reduced to a simple routine by which almost any fault can be located which develops in service.

1. No Crystal Oscillator Voltage

a. Check for crystal oscillator voltage with a voltmeter of 5,000 to 20,000 ohms per volt across R130.

b. Check V123 tube (7C7) in tube tester.

c. Check for plate voltage.

d. Check inductances L1, L2 and capacitor C143 for open or short circuits.

e. Check C141. It is omitted at crystal frequencies above 5,078 kc., but it must be used at crystal frequencies below 5,078 kc.

2. Low Mixer Current at J108

a. Coils L1 and L7 out of tune. Reset to paint dab and tune L1, L6, and L7 for maximum meter deflection.

b. Check tubes V112 and V123 in tester.

c. Check inductances L1, L2, and L7 and capacitors C142, C143, C105, and C106 for open or short circuits.

d. Check plate and screen voltages on V123 (7C7) oscillator tube.

3. Low Sensitivity

a. Check external antenna circuit. In 2-way installation, check antenna circuit between jacks J106 and J107 on transmitter chassis.

b. Check all tuning alignment.

c. Check all tubes in tester.

d. Check all plate and screen voltages.

4. No Plate Voltage

a. Check fuse F102

b. Check rectifier tube V122 in tester.

c. Check transformer T104. Remove V122 (5Y3G) from socket. Voltage between socket pins No. 3 and No. 5 should be approximately 430 volts AC.

d. Check condenser C147 and resistor R127.

e. Check fuse in control unit.

f. Check dynamotor or vibrator for polarity connections.

g. Check control cable for open 6-volt lead.

h. Look for defective vibrator.

5. Loudspeaker Dead

a. Check tubes V120, V118, and V121 in tester.

b. Check voice coil ground lead, pin No. 3 on J105. In 1-way installations it should be grounded through dummy plug. In 2-way installations, it should be grounded through K101.

c. Check the cable.

RESISTORS, Fixed

Acme Elec. Heating Co., Boston, Mass.
★ Aerovox Corp., New Bedford, Mass.
Allen-Bradley Co., Milwaukee, Wis.
Atlas Resistor Co., 423 Broome St., N. Y. C.
Centralab, Milwaukee, Wisconsin
Clarostat Mfg. Co., Brooklyn, N. Y.
Cont'l Carbon, Inc., Cleveland, O.
Daven Co., 158 Summit St., Newark, N. J.
Dixon Crucible Co., Jersey City, N. J.
Erie Resistor Corp., Erie, Pa.
Globar Div. Carborundum Co., Niagara Falls, N. Y.
Hardwick, Hindle, Inc., Newark, N. J.
Instrument Resistors Co., Little Falls, N. J.
Intern'l Resistance Co., Philadelphia
Lectrohm, Inc., Cicero, Ill.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Ohmite Mfg. Co., 4835 W. Flournoy, Chicago
Sensitive Research Inst. Corp., 4545 Bronx Blvd., N. Y. C.
Shalleross Mfg. Co., Collingdale, Pa.
Sprague Specialties Co., N. Adams, Mass.
Stackpole Carbon Co., St. Marys, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
White Dental Mfg. Co., 10 E. 40th St., N. Y. C.
Wirt Co., Germantown, Pa.

RESISTORS, Fixed Precision

Instrument Resistors, Inc., Little Falls, N. J.
Intern'l Resistance Co., Philadelphia
Ohmite Mfg. Co., 4835 Flournoy St., Chicago

RESISTORS, Flexible

Clarostat Mfg. Co., Inc., Brooklyn, N. Y.

RESISTORS, Variable

★ Aerovox Corp., New Bedford, Mass.
Allen-Bradley Co., Milwaukee, Wis.
Amer. Instrument Co., Silver Spring, Md.
Atlas Resistor Co., N. Y. C.
Centralab, Milwaukee, Wis.
Chicago Tel. Supply Co., Elkhart, Ind.
Cinema Eng. Co., Burbank, Cal.
Clarostat Mfg. Co., Brooklyn, N. Y.
Cutler-Hammer, Inc., Milwaukee, Wis.
DeJur Amsco Corp., Shelton, Conn.
Electro Motive Mfg. Co., Willimantic, Conn.
General Radio Co., Cambridge, Mass.
G-M Labs., Inc., Chicago, Ill.
Hardwick, Hindle, Inc., Newark, N. J.
Instrument Resistors, Inc., Little Falls, N. J.
Intern'l Resistance Co., Philadelphia
Lectrohm, Inc., 5125 W. 25 St., Cicero, Ill.
Mallory & Co., P. R., Indianapolis, Ind.
Ohio Carbon Co., Cleveland, Ohio
Ohmite Mfg. Co., 4835 W. Flournoy St., Chicago
Shalleross Mfg. Co., Collingdale, Pa.
Stackpole Carbon Co., St. Marys, Pa.
Utah Radio Prods. Co., 820 Orleans St., Chicago
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Wirt Co., Germantown, Pa.

RESISTORS, Variable, Ceramic Base

Hardwick, Hindle, Inc., Newark, N. J.
Lectrohm, Inc., 5125 W. 25 St., Cicero, Ill.
Ohmite Mfg. Co., 4835 Flournoy St., Chicago

RIVETS, Plain

Central Screw Co., 3519 Shields Av., Chicago
Progressive Mfg. Co., Torrington, Conn.
Republic Steel Corp., Cleveland, O.

SCREW MACHINE Parts, Non-Metallic

Continental-Diamond Fibre Co., Newark, Del.

SCREWS, Recessed Head

American Screw Co., Providence, R. I.
Bristol Co., The, Waterbury, Conn.
Chandler Prods. Co., Cleveland, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
International Screw Co., Detroit, Mich.
Lamson & Sessions, Cleveland, O.
National Screw & Mfg. Co., Cleveland, O.
New England Screw Co., Keene, N. H.
Parker Co., Charles, The, Meriden, Conn.
Parker-Kalon Corp., 198 Varick, N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof, Inc., 2501 N. Keeler Av., Chicago
Southington Hardw. Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping

American Screw Co., Providence, R. I.
Central Screw Co., 3519 Shields Av., Chicago
Continental Screw Co., New Bedford, Mass.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
Parker-Kalon Corp., 198 Varick, N. Y. C.
Shakeproof, Inc., 2501 N. Keeler, Chicago

SCREWS, Set and Cap

Allen Mfg. Co., Hartford, Conn.
Federal Screw Prod. Co., 224 W. Huron St., Chicago
Parker-Kalon Corp., 198 Varick, N. Y. C.
Republic Steel Corp., Cleveland, O.
Shakeproof, Inc., 2501 N. Keeler Av., Chicago

SCREWS, Hollow & Socket Head

Allen Mfg. Co., Hartford, Conn.
Central Screw Co., 3519 Shields, Chicago
Federal Screw Prod. Co., 224 W. Huron St., Chicago
Parker-Kalon, 198 Varick, N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.

SELENIUM

Federal Tel. & Radio Corp., S. Newark, N. J.
Benwood Linze Co., St. Louis, Mo.
Selenium Corp. of Amer., 1800 W. Pico Blvd., Los Angeles

SHAFTING, Flexible

Breeze Corps., Inc., Newark, N. J.
Mall Tool Co., 7708 S. Chicago Ave., Chicago
Steward Mfg. Corp., 4311 Ravenswood Ave., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.
White Dental Mfg. Co., 10 E. 48 St., N. Y. C.

SHEETS, Electrical

American Rolling Mill Co., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Follansbee Steel Corp., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Newport Rolling Mill Co., Newport, Ky.
Republic Steel Corp., Cleveland, O.
Ryerson & Son, Inc., Jos. T., Chicago

SHIELDS, Tube

★ Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y.

SOCKETS, Tube

Aladdin Radio Industries, 501 W. 35th St., Chicago
Alden Prods. Co., Brockton, Mass.
Amer. Phenolic Corp., 1830 S. 54th Av., Chicago
Amer. Radio Hardware Co., 476 B'way, N. Y. C.
Birnbach Radio Co., 145 Hudson, N. Y. C.
Bud Radio, Inc., Cleveland, O.
Cinch Mfg. Co., 2335 W. Van Buren St., Chicago
Cont'l-Diamond Fibre Co., Newark, Del.
Eagle Elec. Mfg. Co., Brooklyn, N. Y.
Eby, Inc., H. H., Philadelphia
Federal Screw Prods. Co., 26 S. Jefferson, Chicago
Franklin Mfg. Corp., 175 Varick, N. Y. C.
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
Johnson Co., E. F., Waseca, Minn.
Jones, Howard B., 2300 Wabansia, Chicago
Micarta Fabricators, Inc., 4619 Ravenswood, Chicago
Millen Mfg. Co., James, Malden, Mass.
Miller Co., J. W., Los Angeles, Cal.
★ Nat'l Co., Malden, Mass.
Remler Co., San Francisco, Cal.

SOCKETS, Tube, Ceramic Base

Johnson Co., E. F., Waseca, Minn.
★ National Co., Inc., Malden, Mass.

SOLDER, Self-fluxing

Garden City Laboratory, 2744 W. 37th Pl., Chicago
★ General Elec. Co., Bridgeport, Conn.
Kester Solder Co., 4209 Wrightwood Av., Chicago
Ruby Chemical Co., Columbus, O.

SOLDER POTS

Lectrohm, Inc., Cicero, Ill.

SPEAKERS, Cabinet Mounting

Cinaudagraph Speakers, Inc., 3911 S. Michigan Ave., Chicago
Jensen Radio Mfg. Co., 6601 S. Laramie St., Chicago
Rola Co., Inc., 2530 Superior Ave., Cleveland, O.
Utah Radio Prod. Co., 842 Orleans St., Chicago

SPEAKERS, Outdoor Type

Jensen Radio Mfg. Co., 6601 S. Laramie St., Chicago
University Labs., 225 Varick St., N. Y. C.

SPRINGS

Accurate Spring Mfg. Co., 3817 W. Lake, Chicago
American Spring & Mfg. Corp., Holly, Mich.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
Barnes Co., Wallace, Bristol, Conn.
Cuyahoga Spring Co., Cleveland, O.
Gibson Co., Wm. D., 1800 Clybourn Av., Chicago
Hubbard Spring Co., M. D. Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.

You can send any man a magazine if you pay the postage. You may even sell him a subscription if you talk hard enough. But only if the contents serves his needs and interests will he ever read it.

Today, in the radio-electronic industry, it seems that the more important the man, the taller the pile of unread magazines in his office. How, then, does FM Radio-Electronics continue to hold No. 1 place in the attention of the men who count in this industry? . . . It is probably because FM is edited with an intimate knowledge of their interests that they have such a keen interest in its contents. And this probably explains the fact that the contents of an article or advertisement is more certain to be seen by the men who count in this industry if it appears in FM. . . . While there are several other papers in this field, none duplicates the distinctive character, contents, reader interest, or advertising effectiveness of FM Radio-Electronics.

March 1943

Instrument Specialties Co., Little Falls, N. Y.
Muehlhausen Spring Corp., Logansport, Ind.
Peck Spring Co., Plainville, Conn.
Raymond Mfg. Co., Corry, Pa.

STAMPINGS, Metal

★ Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y.
Insuline Corp. of Amer., Long Island City, N. Y.

SUPPRESSORS, Parasitic

Ohmite Mfg. Co., 4835 Flournoy St., Chicago

SWITCHES, Aircraft Push

Square D Co., Kollsman Inst. Div., Elmhurst, N. Y.

SWITCHES, Key

Audio Development Co., Minneapolis, Minn.
Chicago Tel. Supply Co., Elkhart, Ind.
General Control Co., Cambridge, Mass.
Mossman, Inc., Donald P., 6133 N. Northwest Hy., Chicago

SWITCHES, Micro

Micro Switch Corp., Freeport, Ill.

SWITCHES, Rotary Gang, Bakelite Wafer

Mallory & Co., Inc., P. R., Indianapolis, Ind.
Stackpole Carbon Co., St. Marys, Pa.

SWITCHES, Rotary Gang, Ceramic Wafer

Oak Mfg. Co., 1267 Clybourn Ave., Chicago
Ohmite Mfg. Co., 4835 Flournoy St., Chicago
Shalleross Mfg. Co., Collingsdale, Pa.

SWITCHES, Time Delay

Haydon Mfg. Co., Inc., Forestville, Conn.
Industrial Timer Corp., 115 Edison Pl., Newark, N. J.
Sangamo Elect. Co., Springfield, Ill.

TERMINAL STRIPS

Cinch Mfg. Corp., W. Van Buren St., Chicago
Curtis Devel. & Mfg. Co., N. Crawford Ave., Chicago
Franklin Mfg. Corp., 175 Variek St., N. Y. C.
Jones, Howard B., 2300 Wabansia Ave., Chicago

TEST CHAMBERS, Temperature, Humidity, Altitude

Kold-Hold Mfg. Co., 446 N. Grand Ave., Lansing, Mich.
Mobile Refrigeration, Inc., 630 5th Ave., N. Y. C.
Tenney Engineering, Inc., Montclair, N. J.

TRACING PAPERS

Keuffel & Esser, Hoboken, N. J.

TRANSFORMERS, Constant-Voltage Power

Dongan Elec. Co., 74 Trinity Pl., N. Y. C.
Raytheon Mfg. Co., Waltham, Mass.
Sola Electric Co., 2525 Clybourn Ave., Chicago

TRANSFORMERS, IF, RF

Aladdin Radio Industries, 501 W. 35th St., Chicago
Amer. Transformer Co., Newark, N. J.
Automatic Windings Co., E. Passaic, N. J.
★ Browning Labs., Inc., Winchester, Mass.
Caron Mfg. Co., 415 S. Aberdeen, Chicago
D-X Radio Prods. Co., 1575 Milwaukee, Chicago
Gen'l Winding Co., 420 W. 45 St., N. Y. C.
Greyhound Equip. Co., 1720 Church Ave., Brooklyn, N. Y.
Guthman & Co., 400 S. Peoria St., Chicago
Hammarlund Mfg. Co., 424 W. 33 St., N. Y. C.
★ Meissner Mfg. Co., Mt. Carmel, Ill.
Millen Mfg. Co., James, Malden, Mass.
Miller Co., J. W., Los Angeles, Cal.
★ Nat'l Co., Malden, Mass.
Sickles Co., F. W., Springfield, Mass.
Super Elect. Prod. Corp., Jersey City, N. J.
Teleradio Eng. Corp., 484 Broome St., N. Y. C.
Triumph Mfg. Co., 4017 W. Lake, Chicago

TRANSFORMERS, Receiver Audio & Power

Acme Elec. & Mfg. Co., Cuba, N. Y.
Amer. Transformer Co., Newark, N. J.
Amplifier Co. of Amer., 17 W. 20th St., N. Y. C.
Audio Devel. Co., N. Minneapolis, Minn.
Chicago Transformer Corp., 3501 Addison St., Chicago
Chmaudagraph Speakers, Inc., 3929 S. Michigan, Chicago
Dongan Elec. Co., 74 Trinity Pl., N. Y. C.
Electronic Trans. Co., 515 W. 29 St., N. Y. C.
Ferranti Elec., Inc., 30 Rockefeller Plaza, N. Y. C.
Freed Trans. Co., 72 Spring St., N. Y. C.
Gen'l Radio Co., Cambridge, Mass.
General Trans. Corp., 1250 W. Van Buren, Chicago
Halldorson Co., 4500 Ravenswood, Chicago
Jefferson Elec. Co., Bellwood, Ill.
Kenyon Transformer Co., 840 Barry St., N. Y. C.
Magnetic Windings Co., Easton, Pa.
Newark Transformer Co., Newark, N. J.
New York Transformer Co., 51 W. 3rd, N. Y. C.
Norwalk Transformer Corp., S. Norwalk, Conn.
Raytheon Mfg. Co., Waltham, Mass.
Standard Transformer Corp., 1500 N. Halsted, Chicago
Super Elect. Prod. Co., Jersey City, N. J.
Superior Elec. Co., Bristol, Conn.
Thermador Elect. & Mfg. Co., Riverside Dr., Los Angeles
Thordarson Elec. Mfg. Co., 500 W. Huron, Chicago
Utah Radio Prods. Co., 820 Orleans St., Chicago
★ United Transformer Co., 150 Variek St., N. Y. C.

TUBE MANUFACTURING MACHINES

Hilton Eng. Labs., Redwood City, Calif.
Elsler Eng. Co., 7518 13th St., Newark, N. J.

TUBES, Cathode Ray

★ Dumont Labs., Allen B., Passaic, N. J.
Farnsworth Tele. & Radio Corp., Ft. Wayne, Ind.
★ General Elec. Co., Schenectady, N. Y.
Nat'l Union Radio Corp., Newark, N. J.
RCA Mfg. Co., Camden, N. J.
★ Sylvania Elec Prod., Inc., Emporium

TUBES, Current Regulating

Amperite Co., 561 Broadway, N. Y. C.
Champion Radio Works, Danvers, Mass.
Hytron Corp. & Hytronic Labs., Salem, Mass.
RCA Mfg. Co., Camden, N. J.
★ Sylvania Elec. Prod., Inc., Emporium, Pa.

TUBES, Photo-Electric

Bradley Labs., New Haven, Conn.
Cont'l Elec. Co., Geneva, Ill.
De Jur-Amsco Corp., Shelton, Conn.
De Vry, Herman A., 1111 W. Center, Chicago
Electronic Laboratory, Los Angeles, Cal.
Emby Prods. Co., Los Angeles, Cal.
★ General Elec. Co., Schenectady, N. Y.
General Scientific Corp., 4829 S. Kedzie Av., Chicago
G-M Labs., 4313 N. Knox Av., Chicago
Leeds & Northrup Co., Philadelphia
Nat'l Union Radio Corp., Newark, N. J.
Photobell Corp., 123 Liberty St., N. Y. C.
RCA Mfg. Co., Camden, N. J.
Rehtron Corp., 2159 Magnolia Av., Chicago
Rhamstine, J., Detroit, Mich.
Westinghouse Lamp Div., Bloomfield, N. J.
Weston Elec. Inst. Corp., Newark, N. J.

TUBES, Receiving

★ General Electric Co., Schenectady, N. Y.
Hytron Corp., Salem, Mass.
Ken-Rad Tube & Lamp Corp., Owensboro, Ky.
Nat'l Union Radio Corp., Newark, N. J.
Raytheon Prod. Corp., 420 Lexington Av., N. Y. C.
RCA Mfg. Co., Camden, N. J.
★ Sylvania Elect. Prod., Inc., Emporium, Pa.
Tung-Sol Lamp Works, Newark, N. J.

TUBES, Transmitting

Amperex Electronic Prods., Brooklyn, N. Y.
Eitel-McCullough, Inc., San Bruno, Cal.
Federal Telegraph Co., Newark, N. J.
★ General Elec. Co., Schenectady, N. Y.
Heintz & Kaufman, S. San Francisco, Cal.
Hytron Corp., Salem, Mass.
Nat'l Union Radio Corp., Newark, N. J.
Raytheon Prod. Corp., 420 Lexington Av., N. Y. C.
RCA Mfg. Co., Camden, N. J.
Taylor Tubes, Inc., 2341 Wabansia, Chicago
United Electronics Co., Newark, N. J.
Westinghouse Lamp Div., Bloomfield, N. J.

TUBES, Voltage-Regulating

Amperite Co., 561 Broadway, N. Y. C.
Hygrade Sylvania Corp., Salem, Mass.
Hytron Corp., Salem, Mass.
RCA Mfg. Co., Camden, N. J.

TUBING, Laminated Phenolic

Brandywine Fibre Prods. Co., Wilmington, Del.
Formica Insulation Co., Cincinnati, O.
★ General Electric Co., Pittsfield, Mass.
Insulation Mfgrs. Corp., 565 W. Washington Blvd., Chicago
Mica Insulator Co., 196 Variek, N. Y. C.
Nat'l Vulcanized Fibre Co., Wilmington, Del.
Richardson Co., Melrose Park, Chicago
Synthane Corp., Oaks, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wilmington Fibre Specialty Co., Wilmington, Del.

TUBING & SLEEVING, Varnished Cambric, Glass-Fibre, Spaghetti

Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., Wm., 276 Fourth Av., N. Y. C.
Endurette Corp. of Amer., Cliffwood, N. J.
★ General Elec. Co., Bridgeport, Conn.
Insulation Mfgrs. Corp., 565 W. Washington Blvd. Chicago
Irvington Var. & Ins. Co., Irvington, N. J.
Mica Insulator Co., 196 Variek St., N. Y. C.

VARNISHES, Insulating, Air-Drying

John C. Dolph Co., Newark, N. J.
Irvington Var. & Ins. Co., Irvington, N. J.
Stille-Young Corp., 2300 N. Ashland Ave., Chicago
Zophar Mills, Inc., 112 26 St., Bklyn., N. Y.

VARNISHES, Insulating, Baking

John C. Dolph Co., Newark, N. J.
Irvington Var. & Ins. Co., Irvington N. J.
Stille-Young Corp., 2300 N. Ashland Ave., Chicago
Zophar Mills, Inc., 112 26 St., Bklyn., N. Y.

VIBRATION TEST EQUIPMENT

Vibration Specialty Co., 1536 Winter St., Philadelphia

VIBRATORS, Power Supply

Amer. Telev. & Radio Co., St. Paul, Minn.
Electronic Labs., Indianapolis, Ind.
Mallory & Co., Inc., P. R., Indianapolis, Ind.
Turner Co., Cedar Rapids, Ia.

VOLTMETERS, Vacuum Tube

Ballantine Laboratories, Inc., Boonton, N. J.
General Radio Co., Cambridge, Mass.
Hewlett Packard Co., Palo Alto, Calif.
Measurements Corp., Boonton, N. J.

WAXES & COMPOUNDS, Insulating

Western Elec. Co., 195 Broadway, N. Y. C.
Zophar Mills, Inc., 112 26 St., Bklyn., N. Y.

WIRE, Bare

American Steel & Wire Co., Cleveland, O.
Anaconda Wire & Cable Co., 25 Broadway, N. Y. C.
Ansonia Elec. Co., Ansonia, Conn.
Belden Mfg. Co., 4633 W. Van Buren, Chicago
★ General Elec. Co., Bridgeport, Conn.
Phosphor Bronze Smelting Co., Philadelphia
Rea Magnet Wire Co., Fort Wayne, Ind.
Roebling's Sons Co., John, Trenton, N. J.

IF YOU ARE NOT ALREADY A SUBSCRIBER TO *FM* RADIO-ELECTRONICS, BE SURE TO READ THE IMPORTANT ANNOUNCEMENT ON PAGE 4

SPOT NEWS

(CONTINUED FROM PAGE 35)

reference to frequency modulation. It seems hardly possible that this subject was not mentioned in the course of the interviewer's discussion with the Major. However, the Times has been consistently cold toward FM, in spite of the fact that there are more FM stations in New York than in any other city.

Transmitting Tubes: New RCA Guide for Transmitting Tubes, containing 72 pages of circuit designs and technical data, is now available from the Commercial Engineering Section, RCA, Harrison, N. J.

ON NATIONAL QUARTZ CRYSTAL COMMITTEE

John M. Ziegler: Of Crystal Products Company, Kansas City, Mo., has been appointed to the National Quartz Crystal Industries Advisory Committee. Formerly a member of the RCA Research Laboratory for crystals, Mr. Ziegler taught the first Piezo electrical applications courses at the University of Kansas.

FM Police Radio: Eleven cities and towns in Connecticut have obtained General Electric FM police radio equipment through the WPB's police radio pool. These are Bridgeport, Darien, Trumbull, Groton, Westport, Bristol, New London, Fairfield, Plymouth, Meriden, and Stratford.

Audio Transformers: A new bulletin issued by Acme Electric & Mfg. Company, Cuba, N. Y., lists standard audio, driver, interstage, and microphone transformers for aircraft and mobile radio apparatus.

Dr. Grant C. Hector: Appointed Director of Engineering at National Union Radio Corporation. He leaves the U. S. Office of Scientific Research and Development to take up the direction of electronic tube research at National Union's Newark and Lansdale, Pa., plants.

(CONTINUED ON PAGE 43)

WIRE, Hookup

Gavitt Mfg. Co., Brookfield, Mass.
Lenz Electrical Mfg. Co., 1751 N. Western Ave., Chicago
Rockbestos Prod. Corp., New Haven, Conn.

WIRE, Magnet

Acme Wire Co., New Haven, Conn.
American Steel & Wire Co., Cleveland, O.
Anaconda Wire & Cable Co., 25 Broadway, N. Y. C.
Ansonia Elec. Co., Ansonia, Conn.
Belden Mfg. Co., 4633 W. Van Buren, Chicago
Electric Auto-Lite Co., The, Port Huron, Mich.
★ General Elec. Co., Bridgeport, Conn.
Holyoke Wire & Cable Corp., Holyoke, Mass.
Hudson Wire Co., Winsted, Conn.
Rea Magnet Wire Co., Fort Wayne, Indiana
Rockbestos Prods. Corp., New Haven, Conn.
Roebling's Sons Co., John, Trenton, N. J.
Wheeler Insulated Wire Co., Bridgeport, Conn.

WOOD, Laminated & Impregnated

Camfield Mfg. Co., Grand Haven, Mich.
Formica Insulation Co., Cincinnati, O.

IMPORTANT BOOKS

Principles of Aeronautical Radio Engineering: by P. C. Sandretto. 414 pages, 223 illustrations, 6 by 9 ins., cloth binding. Published by McGraw-Hill Book Company, New York City. Price $3.50

As superintendent of the Communications Laboratory of United Air Lines, P. C. Sandretto is thoroughly qualified to write on the subject of aeronautical radio engineering. His book comes at a particularly appropriate time, filling the need for such an addition to radio literature, and emphasizes the growth of this particular section of radio-electronic engineering to a position of major importance.

The text is an admirable combination of theory and practice, calculated to be highly useful to engineers now engaged in the design of aircraft radio equipment for military service. Although, as the author points out, the text is primarily concerned with continental commercial airline operation, the basic principles underlie the theory and practice of equipment for military applications.

Chapters are grouped in four parts covering general considerations, avigation, communications, and accessories, with an appendix on mechanical requirements for aircraft radio equipment.

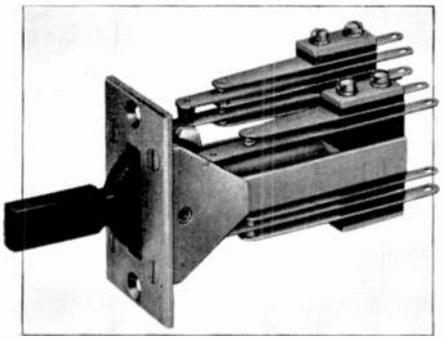
Part 2 covers the subjects of the radio range, the ultra-high-frequency radio range, aircraft direction finders, markers, instrument landing, absolute altimeters, and direction finding from ground stations.

Chapters in Part 3 are devoted to medium-high-frequency communication, and ultra-high-frequency communication. These include aircraft and ground station equipment. Microwave applications are only referred to briefly.

In the fourth part, practical problems of application are discussed under the chapter headings of aircraft power supply systems and considerations in aeronautical radio systems design. Among the subjects covered is that of alternating current systems and variable-frequency alternating current systems, both of which are now receiving much attention from aircraft and radio engineers.

SPOT NEWS

(CONTINUED FROM PAGE 41)



KEY SWITCH HANDLES MANY CIRCUITS

Key Switch: A new key switch is being produced by Donald P. Mossman, Inc., 6133 N. Northwest Highway, Chicago. As the illustration shows, one or two sets of contacts can be mounted above and below the frame, with as many as six contacts in each pile. This, with locking or non-locking key positions, makes possible an almost unlimited number of circuit arrangements. Maximum rating of contacts is 5 amps., 110 volts AC, non-inductive.

FM Reinstatements: Requests for reinstatements of FM applications have been received by the FCC from:

Ashland Broadcasting Co., Ashland, Ky.
Debs Memorial Radio Fund, Inc., N. Y. C.
Central N. Y. Broadcasting Corp., Syracuse, N. Y.
Radio Voice of N. H., Inc., Manchester
Piedmont Pub. Co., Winston-Salem, N. C.
WBNX Broadcasting Co., Inc., N. Y. C.
Greater N. Y. Broadcasting Corp., N. Y. C.
Courier-Journal Co., Louisville, Ky.
News Syndicate Co., Inc., N. Y. C.
N. J. Broadcasting Corp., West Orange, N. J.
Oak Park Realty & Am. Co., Chicago
Outlet Co., Providence, R. I.
Hawley Broadcasting Co., Reading, Pa.
Don Lee System, Berkeley, Calif.
WMCA, Incorporated, N. Y. C.
St. Louis University, St. Louis, Mo.

It is expected that practically all the other applications which were dropped when broadcast station construction was frozen will be revived.

NOTES ON MODERN APPARATUS DESIGN

(CONTINUED FROM PAGE 21)

kind on thin aluminum sheet. These machines were developed by the aircraft companies and, due to their present needs, it is not likely that such machines are available to the radio industry.

The development of welding equipment capable of doing perfect work on light aluminum sheet, on a production basis, would be a great service to radio manufacturers who are called upon to fabricate chassis and cabinets from this material.

Yours very truly,
BURT L. ZIMET, *Project Engineer,*
Freed Radio Corporation,
New York City

To the Editor:

We have read with a great deal of interest your February issue. Under the title "Notes on Modern Apparatus Design" you make a recommendation that condensers and resistors should be impregnated with wax, and we thoroughly agree with you. However, you state that Superla wax should be used. We, and probably other manufacturers, have been supplying a number of waxes for this purpose. Your statement puts us on the defensive with our customers inasmuch as your opinion is highly valued, and instead of helping our customers, we start with a controversy.

We believe it would have been more fair to all the suppliers of waxes if you had recommended the use of Superla wax or other equivalent waterproofing wax.

Very truly yours,
A. SAUNDERS, *Technical Director,*
Zophar Mills, Inc.,
Brooklyn, N. Y.

WAR-BORN WORD FOR POST-WAR MAGIC

(CONTINUED FROM PAGE 7)

namely, radio-electronics and industrial-electronics.

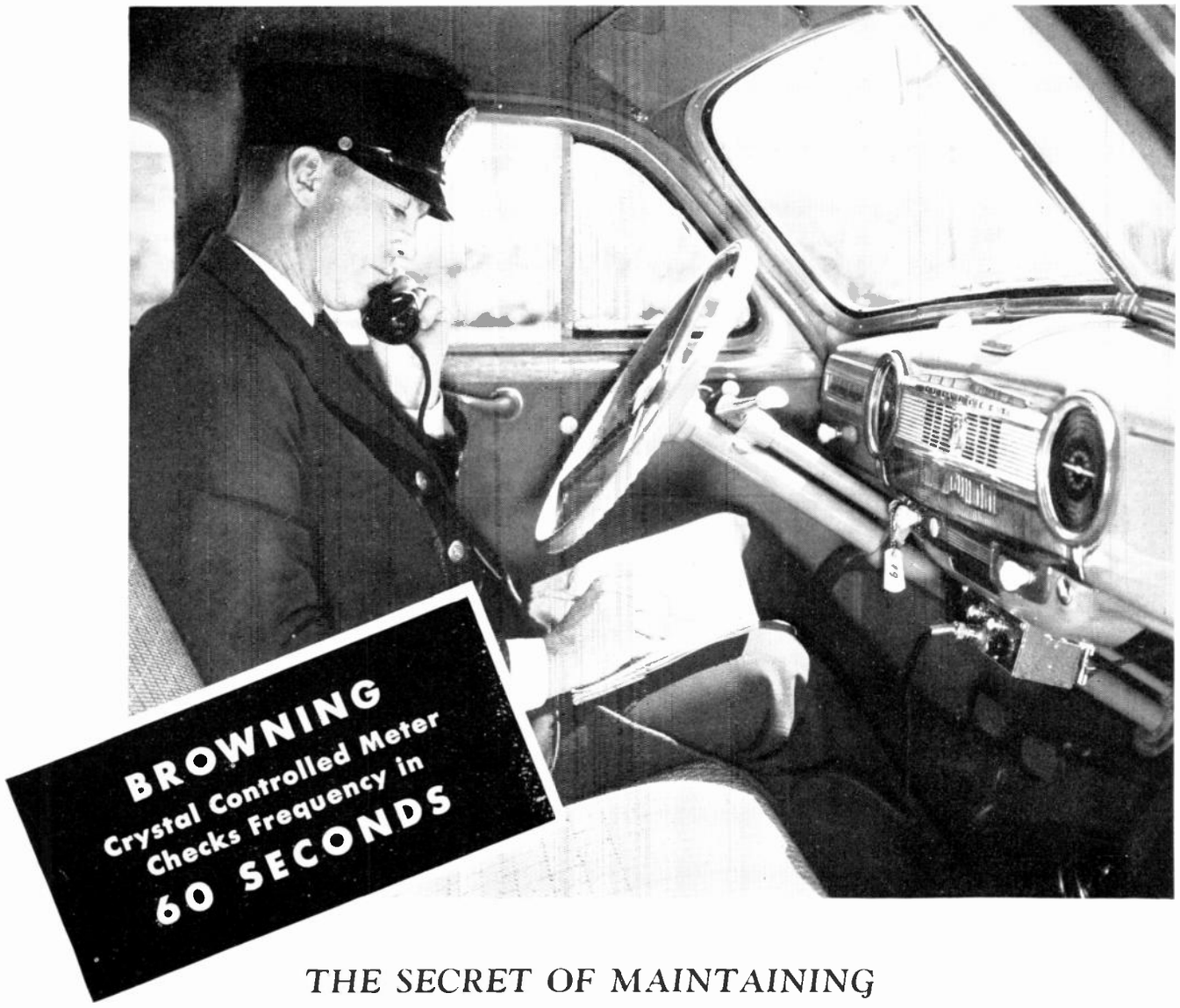
While radio-electronics is now and will be in the future the larger field of application as measured by dollar-volume of sales, the field of industrial-electronics, firmly rooted by its contributions to wartime production, is destined to expand enormously in the post-war period.

Looking Ahead ★ To avoid the confusion which is already evident in both advertising and semi-technical literature, it is necessary that engineers undertake to make clear to those responsible for sales promotion and company management the correct use of the words *electronics, electronic device, radio-electronics* and *industrial-electronics.*

In one way or another, further developments of electron tubes and their applications will soon enter into every business and every home, and draw upon every company bank account and every personal pocketbook. Many new companies will be financed by public offerings of their securities.

The active coöperation of our engineers is needed to head off the popular misconception of terms thus coming into general use. Without it, the confusion already in evidence will become hopelessly confounded.

M. B. SLEEPER.



THE SECRET OF MAINTAINING

100% RELIABILITY

THE range of dependable communication may be cut 25% or more by off-frequency transmission. Experience shows this to be the most common cause of failures to get messages through.

There are two reasons for this. First, off-frequency operation results in weak signals. Second, weak signals result in poor noise suppression. This is true of both AM and FM equipment.

Particularly in the spring, dampness and temperature changes from warm days to chilly nights cause radio equipment to drift away from the assigned frequency.

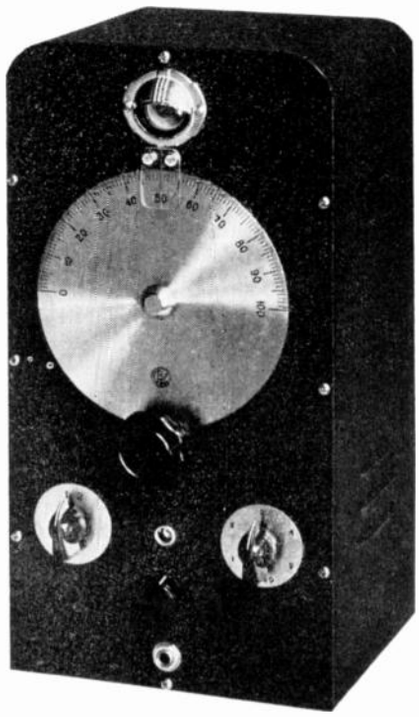
The only remedy is to check each car installation at least once a week. With a BROWNING crystal-controlled frequency meter, this takes only 60 seconds! — one minute and the job is done with absolute precision.

That is why the BROWNING frequency meter has come into almost universal use by police, fire, and public utility radio supervisors. Available for prompt delivery.

The Browning Frequency Meter, illustrated here, is used as standard equipment for police and public utility emergency radio systems throughout the USA. It provides the greater precision now required by the FCC for all emergency transmitters.

Suitable for both FM and AM, the Browning Meter is built with one to four bands, for any frequencies between 1.5 and 60 mc. Prices:

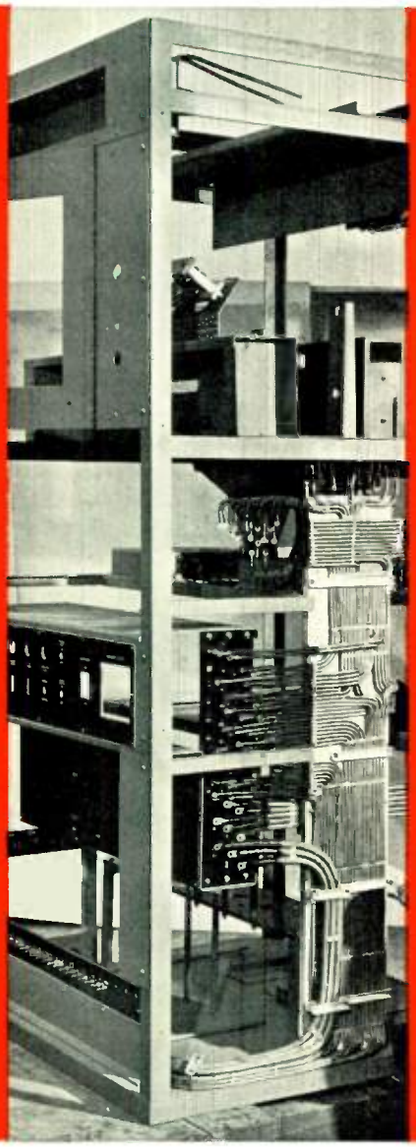
1 Band	$125	4 Bands	$165
2 Bands	145	4 Bands	185



BROWNING LABORATORIES, INC.

WINCHESTER • MASSACHUSETTS

instruments, electron tubes, communications and broadcast equipment, apparatus design, manufacturing methods



Glimpse of Things to Come

REL is crowding years of normal, peacetime progress into every month of wartime effort. That's why, if we could use our present designs and methods of construction to build you a broadcast installation now, you'd say: "I never expected there could be so many improvements over prewar equipment!"

We're looking forward to the day when we can show you just what we mean by this, and what it will mean in lower costs and improved service to your radio audience. It will be an easy matter to apply our present military designs to broadcast installations the minute restrictions are lifted. And we're rearing to go!

To help hasten that day, we're putting all we've got into building still better equipment and still more of it for the military services. Meanwhile, are you, too, making your plans to place orders quickly for replacing your prewar equipment as soon as you get the green light?

When that time comes, we'll show you why we say today — *Look to REL for peacetime leadership.*

REL

RADIO ENGINEERING LABS., Inc.
Long Island City New York

Sales Offices:
5334 Hollywood Blvd., Hollywood, California
2040 Grand River Ave. W., Detroit, Michigan
310 Fifteenth St., Denver, Colorado

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A glance at the map shows how great is the responsibility put upon the State Police organization. To meet it with the fast action which wartime emergencies demand, 2-way communication with the fleet of 150 State Police patrol cars is required.

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