September, 1933

CQ

COMMERCIAL RADIO

20 CENTS

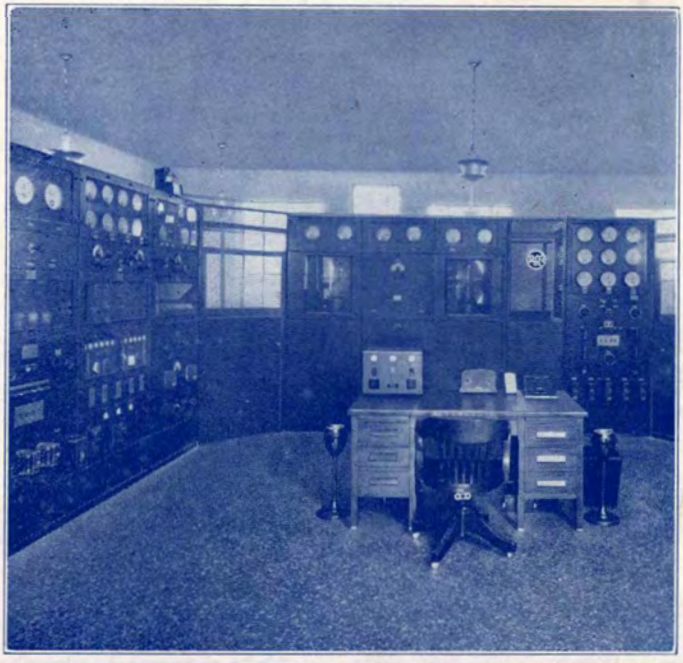
IN THIS ISSUE:

MEASURING ANTENNA RESISTANCE

USE OF STANDARD FREQUENCY TRANSMITTING

LEAGUE OF NATIONS WIRELESS STATION

STATION WHDH FISHERMEN'S FRIEND



CQ COMMERCIAL RADIO

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JAMES J. DELANEY, Editor L. D. McGEADY, Bus. Mgr.

VOL. III SEPTEMBER, 1933 NO. 1

AS WE LOOK BACK

The reader will notice that this issue of our book is Volume III, No. 1. In other words, as there are twelve issues to a volume this is the 25th issue published.

Just to touch the high points of the previous volume, there were articles published on up-to-date broadcast transmitters, the latest in the way of ship telegraph installations, and a complete description of the ship radio-telephone installations.

Some spendid technical articles that both register the progress in their individual field of radio, as well as enlighten the reader of this book on what is transpiring in the different fields, were published. The very latest radio apparatus developed for use in air service were completely described, short wave radio work, and the purely experimental advances in radio came in for their own. Radio fiction, organization activities, and reviews of what was actually happening all contributed to make up our efforts.

No "bunk," or "hooey." Conjecture, we have firmly believed was out of place. Personal enthusiasm has often had to take a back seat when faced with stern realism. However, we feel as we look back, that we have given our readers an honest expression as contained in the articles themselves, of the many authors' ideas of what were the real progresses in our particular field of radio.

There is we think, no journalism that quite compares with that journalism that weighs its printed matter by the yardstick of permanent value, and we fondly hope that our readers are in accord with us that every attempt has been made in this direction.

THE EDITORS

CONTENTS:

FINAL STORY ON "CITIES SERVICE PETROL"

The following is a brief account of the explosion and sinking of the Cities Service oil tanker SS "Cities Service Petrol" on July 14, 1933, about 100 miles off the North Carolina coast.

At 9:30 A. M. July 14th while enroute from Port Arthur, Tex. to New York, N. Y., with a cargo of crude oil, a terrific explosion rocked the ship. The radio room was practically wrecked, the aerial, lead-in wires and lead-in insulator were all torn away and presumably blown overboard by the explosion, the transmitter was twisted and bent, the receiver thrown off the table, the lights went out in the radio room, and the current to the transmitter went off probably on account of the cables carrying the current from the engine room dynamo to the radio room having been blown apart in the tween decks where the explosion occurred or melted by the fire which started immediately.

The radio operator was on watch at the time of the explosion but except for being badly shaken up was uninjured, and after picking up a life preserver made his way as soon as possible up to the boat deck where the master was directing the launching of the two remaining seaworthy lifeboats.

Captain F. L. Sears asked the operator if there was any chance of being able to send a distress message out, and the operator said it was impossible, all the radio apparatus having been put out of commission by the explosion so that it was impossible to either send or receive signals.

The Captain then ordered the crew into the lifeboats and everybody except one man, a wiper who was killed by the explosion managed to get into the lifeboats safely, although one or two men were pretty badly burned. The lifeboats then pulled away from the blazing ship, and rowed or drifted around in the choppy sea for several hours, when Captain Sears decided to go alongside the "Petrol" again, as he thought there was a possibility of the fire burning itself out.

When the lifeboat came alongside the ship, the captain and six or seven men clambered up ropes hanging over the bow of the ship and reached the main deck. But the sea having got much rougher, great difficulty was experienced in keeping the lifeboat from being dashed against the ship side and smashed by the heavy seas, the captain therefore ordered the lifeboat to stand off from the ship and only to come back and pick him and the remaining men on board off when he signalled.

The fire on the "Petrol" had by now gained so much headway that it was visible for many miles, and shortly after dusk after the lifeboats had been pulling around for several more hours, the lights of two vessels coming in our direction were visible.

The ship closest to the lifeboat containing ten men, including the 2nd officer and the radio operator made signals in answer to the S. O. S. signals sent from the lifeboat by a flashlight, and soon was able to pick up the men from the lifeboat, when it was learned that the rescueing ship was the SS "Trimountain."

The other lifeboat containing about nineteen men was unable to get close up to the Trimountain on account of the heavy sea and being on the weather side, but succeeded in getting picked up by the other ship which had seen the blaze, and which turned out to be the SS "Gulfgem."

The Gulfgem then sent a lifeboat with volunteers over to the Petrol to bring off the remaining men on board there, and succeeded in saving all except Captain Sears, who refused to leave the doomed vessel, and remained on her till she exploded again and sank immediately at about 11:00 P. M. about ten or fifteen minutes after the last man was safely taken off.

The "Trimountain" with ten survivors and the "Gulfgem" with twenty-six aboard then proceeded to Charleston, S. C., where all were sent ashore and later brought up to New York by bus.

N. R. A.

The uppermost question of the moment is "Where does the radio operator fit in on the NRA? Nothing has as yet been decided. It is probable that the ship man will come under the general classification of other marine employees on boats. The land, and airway station man under the same classification as telegraph operators. The broadcast station operator under still another classification, more easily identified.

Meetings have been held at Washington by the different interests concerned. As yet no final code has been approved by the Government authorities.

* * * Q-R-U * * *

By DONALD MYERS

It's QRU in the morning,
And QRU at night,
While QRU during "AS three"
Is the neopyte's delight.
When signals far are rambling in—
A thousand miles or two—
And a shattered distance record
Would bring a thrill to you,
A Fiend from Below, with unholy glee,
Opens her up—right abeam, by Gee—
(Stuttering with great persistency.)
And with long preamble addressing you,
Winds up with a QRU.
Killing a signal—'twas clear as a bell—
With a rusty spark, as rough as hell.
QSA———QRK?———QRU?—
So help me, what I long to do,
(In view of these circumstances)
Is written in the Book of Rules
As Penal Happenstances.
So repressing deadly wishes, I
Make answer short and snappy,
As the one and only thing to do,
To keep the beggar happy
Is give him the old. tried and true
Abbreviation, "QRU."

THE LEAGUE OF NATIONS' WIRELESS CENTER

By S. NATALE DI LORENZO

Not long ago the N.Y. Times in New York announced a newsbeat by catching a broadcast over the air and having its radio operators work overtime picking this up. It was claimed that the edition of the Times was on sale in Washington, D. C., for members of the State Department before they arrived at their desks to receive officially cabled dispatches, and before other newspapers received officially issued copies released by the State Department.

Here is a description of the station that transmitted the message. Some months ago we described the N. Y. Times receiving Station that did the receiving.

The important role played by the League of Nations in world politics is well known. It is at the same time the role of intermediary of arbitrator, of mediator, and in a word, the organizer of peace.

Obviously, in order to play this part the League of Nations must conserve both its liberty of action and its autonomy. It can readily be seen that it can only succeed if it ensures, by its own means all the necessary communications with the different adherent nations.

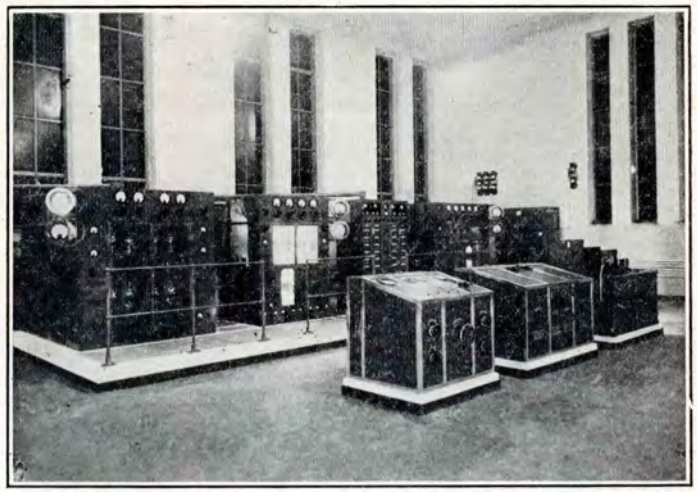
It is extremely delicate to envisage, in order to ensure communications in the event of a conflict, the use of any other wireless station than that belonging to the League itself. It would be necessary, in effect, that that station be able to get in contact with a nation, not only absolutely a stranger to the conflict, but also completely devoid of any commercial or economic relations with the belligerents.

Even were these special conditions fulfilled, there would still subsist the additional drawbacks, inherent and inevetable in an exploitation of the kind, such as loss of time and heavy expenditures.

In the event of a European conflagration only the autonomous holding of means of communications would ensure the League of Nations freedom of action.

In the earliest plans for the League, immediately following the World War, all this was obvious and steps were immediately taken to include plans for an independent wireless station with power sufficient to encircle the globe.

Although under discussion for many years it was only in September, 1929, that the Assembly of the League of Nations resolved to begin the actual erection of the wireless station. Since the project would be of equally great importance to all members, a committee of international experts prepared specifications for the station.



Marconi Short-Wave Transmitter at the League of Nations Wireless Station. Switch gear permits use of any of four waves selected between 14 and 100 meters.

It was decided that the installation of the League of Nations Wireless Centre should consist of transmitters covering both the short waves and the medium waves. The transmitters should be capable of being used both for telegraphic and telephonic communications. Receivers covering practically all present used frequencies were to be supplied. Aerials both directive and semi-directive were to be erected. The power supply would be ensured by the local electric power station or by means of an autonomous generating plant, the object being to ensure for the wireless centre complete immunity and independence.

The League Assembly decided to accept the project submitted by the Swiss government, which provided that the League of Nations bear the cost of the two short wave transmitters, while the Radio-Suisse, Limited Company for Wireless Telegraphy and Telephony, would be called upon to provide the medium wave transmitter, a certain number of receivers, the technical equipment of a central telegraph office at Geneva, as well as the land and buildings necessary for the transmitting and receiving stations.

In choosing the location for the Wireless Centre is was natural to place it as near as practicable to the very seat of the League of Nations. This, in addition to the advantages thus obviously enjoyed, also placed the wireless stations at the position most free of the danger of coercion and seizure in all of Europe.

The actual location of the transmitter is at Prangins, a beautiful spot on the lake close to Nyon, about eight miles from Geneva. The receiving position is at Colovrex, on a plateau in the lower hills of the Jura, back of Geneva. Both positions are connected by subterranean cables for automatic working with the operating office in the League Secretariat and with two auxiliary offices—one in the palatial hall where the Assembly meets and another in the Disarmament Conference building next to the League Secretariat on the Quai Wilson. They are also connected with the Swiss Post Office's main telegraph office in Geneva.

The League's Sunday broadcasting program, which goes out in English, French and Spanish, on two short wave lengths, originates in an office of the League Secretariat where a microphone has been installed.

The League of Nations Wireless Centre was erected at a cost of nearly four million gold francs, of which 2,500,000 was borne by the League and about 1,500,000 by Radio-Suisse. In normal times it is the Radio-Suisse in collaboration with the League's transit and communication section, which operates the station, while in times of emergency, such as during the recent Shanghai crisis and the Chinese-Japanese dispute in Manchuria, the League has complete control. Orders to stop hostilities and other urgent negotiations can thus have priority, thereby keeping the League Council in direct communication with danger spots.

In normal times the station is in constant use for the exchange of telegraphic messages between the League Secretariat and delegations at various conferences at Geneva, and also with the greatest possible number of extra-European governments, either directly or by means of retransmission. Apart from this, the plant can be employed for transmitting circular messages from the League Secretariat to member States, thereby ensuring a nearer connection between the League Secretariat and extra-European countries.

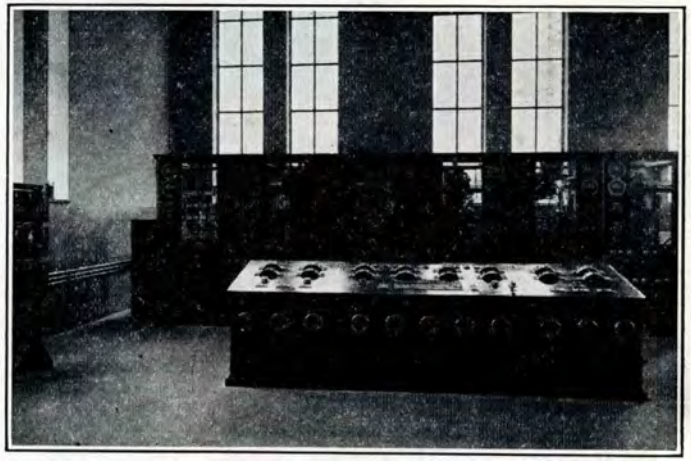
Experiments in radiotelephony are being carried out which, it is hoped, will result in closer contact between the work of the League and public opinion throughout the world.

As was to be expected, the equipment of the League station is international in character; components having been supplied by the leading wireless manufacturers in countries which are members of the League.

Britain's contribution is a short-wave transmitter with feeder and aerial systems and also telephone terminal gear supplied by the Marconi Wireless Telegraph Company, Limited. The Marconi Company also erected for the Radio-Suisse a medium-wave transmitter. The Societe Francaise Radio-Electrique have installed a short-wave transmitter and the Telefunken Company of Germany are responsible for receivers and transmitting and receiving aerials, connected with their own type of feeder. Holland has provided Philips valves and most of the electrical power machinery is of Swiss manufacture.

The transmitting station at Prangins, therefore, consists of two short-wave transmitters belonging to the League of Nations, and a medium-wave transmitter, provided by the Radio-Suisse.

The French short-wave transmitter supplied by the Societe Francaise Radio-Electrique is of a new type recently perfected and combining all the latest improvements of modern technique in relation to the production of short Hertzian waves. Making use of a piezo-electric quartz crystal it is characterized by rigorously stable frequency of transmission a high efficiency, and extreme facility of working. Speeds in excess of 200 words per minute have been established. This transmitter has a wave range from 14 to 40 metres and is at present working on three waves in the neighborhood of 15, 18, and 35 metres. The first called the day wave, the second the twilight or evening wave, and the third the night wave. When the transmitter is working in telegraphy on pure continuous waves the primary oscillating circuit has a power of 20 kilowatts and when operating in telephony its power is 8 kilowatts. Moreover, the construction of the penultimate stage enables the power to be quite easily doubled. The Societe also supplied three highly accurate frequency-metres covering all the frequencies at use at the Centre.



The Societe-Francaise Radio-Suisse Transmitter at the League of Nations Station.

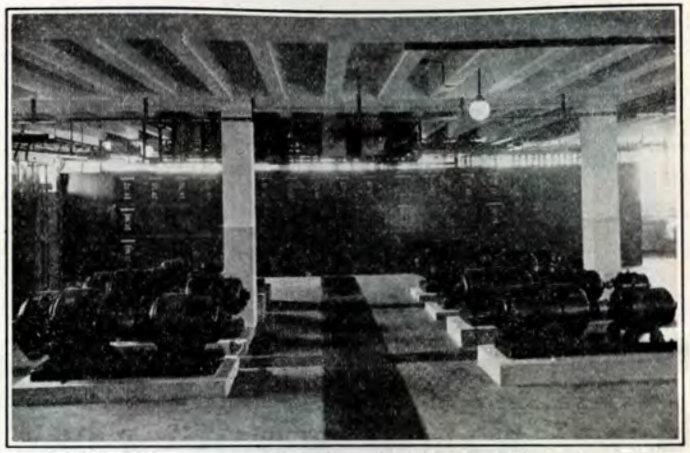
The medium-wave transmitter supplied by the Radio-Suisse has an aerial power of fifty-kilowatts and can work on any wave between 3,000 and 5,000 metres By means of this transmitter communications with any point in Europe can readily be established.

Great Britain, through the Marconi Company, supplied one of the short-wave transmitters with feeder and aerials systems. Unlike the French transmitter which operates on selected waves within its band, the British transmitter, making use of the Marconi-Franklin Constant Frequency Drive for stability control, can operate on any wavelength between 14 and 100 metres.

This system, permitting great flexibility, also ensures great stability of frequency over its entire tuning range. Change of wavelength can be completed in a few minutes. Telephony as well as pure continous wave or note modulated telegraphy can be used; the change being effected by switching which also provides for a change in the depth of modulation, should such be desired. Modulation is by choke control. The Marconi transmitter is designed to give an output to the feeder system on telegraphy of 20 kilowatts on the shortest wavelength and correspondingly greater output on the longer wavelengths.

The high tension or plate power supply is taken from Direct Current generators with an output of 60 kilowatts at 6,000 to 10,000 volts. Current for the main filaments is derived from 20 to 30 volt Direct Current generators driven by Alternating motors, while separate motor generators are used for the anode and filament supplies to the master oscillator units, and all grid bias is obtained from rectifier-potentiometer equipments off Alternating Current supply.

The aerial system at the Centre consists of three groups of beam-aerials. The first group, making use of the Marconi system, comprises two parts, one of which is directed toward South America the other toward the Far East, each side being composed of two complete sets of aerials; one for day and one for night working. The second aerial group using the Telefunken system is directed toward Central America and can be shifted in the direction of Australia and the West Indies. This group is also divided into a night and day array. The third aerial, designed for one wavelength only, is directed toward South America and can be shifted toward British India.



The Power Supply Room for The Transmitters at The League of Nations Wireless Station.

In addition to these three groups of beam aerials the station possesses three semi-directional aerials. All the aerial systems are connected by feeder to a commutator box convenient to the transmitters and so arranged that either the Marconi or the S.F.R. transmitter can be used on any of the aerial systems appropriate to the wavelength.

The station has been in constant use for world wide telegraphy since the opening of the Disarmament Conference at Geneva in February 1932, with satisfactory results. The efficiency of the station and the value for quick and complete dissemination of information were strikingly illustrated recently when the League's 15,000 word report on the Chino-Japanese dispute in Manchuria was broadcast to the entire world. Acknowledgement of splendid reception were received at the Centre on this ten hour world wide broadcast from Washington, New York, Shanghai, Nagoya, Rio de Janeiro, and Buenos Aires.

The telephony service has also been employed and speeches have been successfully transmitted to America for rebroadcasting.

Sir Eric Drummond, Secretary General of the League, remarking on the League's Wireless Centre, said:

"We can hardly estimate the change that may be made in international relations if people in various parts of the world become accustomed not only to the thoughts but even to the actual voices of the statesmen of other countries."

PAST, OR FUTURE?

A contemporary publication states among other things that the 1914 strike of Commercial operators was lost due to the fact that "rank greenhorns" were shipped West from Eastern radio schools to take the operators' places on post. Even though the said students could not copy five words a minute, they were treated to the finest.

Frankly, we would rather look forward than backward, and with due thought, may we remind each other that the West now has everything considered school for school turning out "operators?"

A FISH STORY FROM FRANCE

A French correspondent at La Rochelle, France, suggests that the radio operators' pay on fishing boats be determined by the catch.

He suggests that the operator be guaranteed a salary of 900 frances, (for the trip evidently), and that a rate of 6% be given to the radio operator as his pay on the entire catch above 80,000 francs. Of course below the 80,000 franc catch he would be covered by his guarantee.

MEASURING ANTENNA RESISTANCE

By L. F. JONES
Transmitter Engineer RCA-Victor Company

The measurement of antenna resistance is one of the commonest causes of sleepless nights and headaches to the radio engineer. It is a measurement that is not easy to make accurately due to the many unsuspected sources of error. Yet it is one of the most important steps in adjusting a radio transmitter. Antenna resistance must generally be known before a transmission line can be terminated properly, and it must always be known to ascertain the power output of the station.

Definition

If the impedance between an antenna terminal and ground is measured at the operating frequency, it will be found to consist of an inductive or capacitive reactance plus a resistive component. The resistive component is known as the antenna resistance and is the value which, when multiplied by the square of the current flowing into the antenna terminal, is the measure of the power supplied to the antenna. Although the antenna resistance consists of several

different resistances including radiation resistance, conductor resistance, ground resistance, eddy current resistance, it was specified as being measured between "antenna terminal" (antenna lead) and ground and therefore did not include the resistance of the permanent equipment connected into the antenna circuit for tuning and coupling purposes

The IRE Standards Committee states that such equipment resistance should be included but the Federal Radio Commission, being interested in only the power actually delivered to the antenna, has stated upon inquiry that the resistance of the coupling and tuning equipment must not be included. Anyway the question is generally of small importance because well designed coupling and tuning equipment usually has less than one ohm resistance at broadcast frequencies.

The power ratings of all RCA transmitters are based on the measurement of power delivered to the antenna terminal, when efficient transmission lines are available. A 1 KW transmitter, for instance, must deliver 1 KW to the antenna over and above any losses in the antenna tuning equipment.

Procedure

There are a number of ways of measuring antenna resistance. The most customary and probably the most convenient way is that shown in Figure 1.

An oscillator is used to induce a voltage in a small pickup coil "L." A variable resistance, a meter and a tuning condenser are connected in series with the antenna. A loading coil may be connected in place of "C" or in series with "C" if one is required to tune the antenna to resonance. A wavemeter is used for adjusting the oscillator to the desired frequencies.

With the oscillator adjusted to the frequency at which a measurement is desired, the resistance should be set at zero and the antenna is tuned to resonance as indicated by the meter "M." The coupling between the oscillator and "L" should be adjusted to give a convenient deflection on the meter. The resistance should then be increased until the current indicated by the meter is exactly half of the former value, whereupon the inserted resistance "R" is equal to the antenna resistance plus the resistance of "L," "M," "C" and the connections thereto. The total resistance of these last items, known as the "equipment resistance," is generally known in advance. It must be subtracted from the value of "R" obtained the remainder being the desired antenna resistance.

If the equipment resistance is not known it may be determined by disconnecting the antenna from the circuit and by connecting the upper side of "C" to ground through a high quality impedance "Z" The impedance "Z" must be of high quality so that it will not add an appreciable new resistance to the circuit (usually one of the coils or condensers supplied as part of the permanent antenna equipment will suffice), and it should be of approximately the same reactance as offered by the antenna so that the setting of "C" will not have to be appreciably changed. The resistance "R" should then be set at zero and a convenient deflection should again be secured on the meter having first tuned the circuit to resonance by slightly shifting "C." Again the value of "R" should be increased until the current is reduced to half whereupon the value of "R" is equal to the desired "equipment resistance."

Precautions

In making the measurements it is essential that the following precautions be carefully observed.

1. The oscillator should have large reserve power so that only very loose coupling to the antenna is required. If this condition is not met, the adjusting of "R" will appreciably affect the loading of the oscillator and will thereby affect

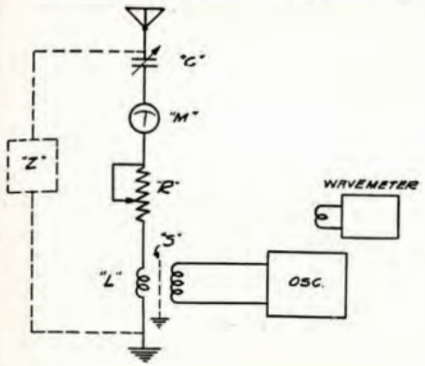


FIG. 1.

its output. If the meter "M" has a maximum scale of approximately 100 milliamperes it is best to use an oscillator of 50 or 100 watts power. Smaller oscillatorrs may be used if more sensitive meters are used at "M."

2. Or a small oscillator may be used with tight coupling to the antenna if a radio frequency ammeter is connected in series with the oscillator's output coil. By means of this meter any variations in the oscillator's output can be allowed for, or the output can be held constant by a rheostat in the oscillator's circuit.

3. It is important that the voltage induced in the antenna circuit by the oscillator be induced at one point only, and that this point be adjacent to ground. The oscillator should therefore be so arranged and connected that it will not radiate large amounts of energy which may be picked up by the antenna or by other parts of the test circuit. Every effort should be made to induce a voltage only in the pickup coil "L." It is inadvisable to attempt to use the main transmitter in place of the auxiliary oscillator.

4. Any tank circuits such as the one in the line termination equipment or transmitter should be short circuited or open circuited so as not to effect the measurements.

5. Just before each measurement it should be made certain that the antenna circuit is tuned to exact resonance.

6. The resistance must be of a type presenting negligible inductance or capacitance at the frequency being used. A special decade box is made which is suitable for this purpose.

7. The meter "M" must of course be of the thermocouple type and should preferably have a full scale reading between 25 and 125 milliamperes depending on the oscillator power available. Weston thermogalvanometers rated at 115 milliamperes full scale have been found very suitable. They have a current squared scale, so a reduction in current of one half necessitates a reduction in scale reading to one quarter.

8. The use of the electrostatic shield "S" is desirable though not essential.

9. The antenna resistance should be measured not only at the operating frequency but also at four or five frequencies each side so that a curve of antenna resistance versus frequency can be drawn. The slope and smoothness of such a curve are useful in prophesying the accuracy of the measurements.

10. Whenever the resistance measured at the operating frequency seems unreasonable, the resistance at the fundamental frequency should be measured. An antenna's fundamental frequency is its resonant frequency when connected directly to ground. If condenser "C" is removed and if the pickup coil "L" contains only several turns (neglected), the antenna fundamental may be measured without further change in the circuit of Figure 1. In this case the oscillator is of course to be tuned to the antenna's resonant frequency instead of tuning the antenna to the oscillator's frequency. If the resistance at the fundamental is not between 15 and 30 ohms, the design of the antenna and ground systems should be looked upon with suspicion.

The method described above is correct for measuring true antenna resistance. The resistance so obtained, when multiplied by the square of the antenna current as measured by a meter in series with the antenna lead, will correctly indicate the power output. However, in practice it is customary to locate the meter in the ground lead as shown in Figure 2. In this case the by-passing effects of the distributed capacity "Q" and of other miscellaneous capacities will cause the actual current at the meter to differ somewhat from the true antenna current as measured at "P." Therefore an "effective" antenna resistance somewhat different from the true resistance must generally be used when the antenna current is measured in the ground lead. To find this effective resistance two methods may be employed of which the first is to be preferred.

Effective Resistance

(A) The antenna ammeter may first be inserted at "P" and then in series with the ground lead, noting the two currents. Since the watts or I^2R are the same for both points and since the R for the upper point is known, the effective

(Continued on Page 33)

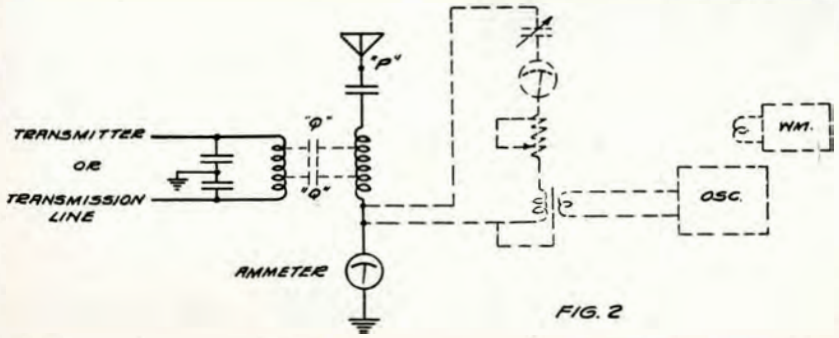


FIG. 2

PIONEER WIRELESS OPERATORS

By DR. LEE DE FOREST

Old Timers enjoy Dr. de Forest's series—new comers will want to know what obstacles had to be overcome. A correct appreciation demands that you follow "Pioneer Radio Operators," which started in this book in May 1931, and this is the twentieth installment.

Due to its already condensed and detailed form it is impossible to run a synopsis of what has gone before. Every radio man is grateful to the author for the fine efforts he has put on record through this series of articles.

"My mail still assumes prodigious proportions at times. I am constantly re-filling fountain pen, constantly buying supplies of stamps. Despite these deep and blinding sands, the scrub cactii and scant vegetation around me, this wretched hamlet and its dwellers, I find scenes of appealing beauty in sky and water."

At last the lot of Leyden jars arrived, substituting for the plate-glass in oil, which was forever breaking down when the spark gap was widened for higher voltages. An additional transmitting helix, also, to enable us to try longer wave-lengths and higher r. f. potentials. An air-blast on the improved spark gap, to give better quenching (altho we didn't then know it by that name).

And then the endless testing, changing of adjustments on helix and condenser, ding-dong, "D, D, D"—all through the night—sending and listening on schedule—much utilization of Western Union.

It was useless to attempt communication by **daylight**—static was absolutely continuous except late at night. Frequently I tried and retried every form of "static eliminator" circuit I had ever devised, with indifferent results, so terrific was the disturbance around Pensacola; especially where all the cloud-framed horizon was pink and lurid from the continual glowing flashes of heat lightning, with never a growl of thunder.

And when without either antenna, earth, or tuner connecetion to the electrolytic receiver I could still hear a constant grinding in the head-phones I would resignedly lay down the "cans" and call upon the name of the Lord in prayer! That, my friends, was **static,** as we knew it away back in 1905, before Prof. Pupin, and other northern theorists began to patent "eliminators." Had these savants ever summered in Pensacola, Florida, they could have saved their patent fees.

Remember—we had no aid of wave-meter, nor even a hot-wire meter in those crude days of Wireless in the Raw. Consequently only by dint of "anchor spark gap" readings, and groaning of the transformer, or length of blue brush discharge, and by constant monitoring reports from South West Pass Station could we guess which was the best, or the most promising frequency, or correct length of a spark gap. We easily calculated our wave-lengths, but that solved no problems.

We simply, doggedly tried every degree of coupling for each separate wave length, and varied the spark gap and transformer primary inductance for every individual setting of antenna inductance and capacity, keeping systematic records of each as we progressed. On schedule times, and these during only a few hours of the late night, for the reasons stated

And thus the torrid, soul-trying weeks wore away.

Until on September 3, five weeks after I ran the fever quarantine, as I was coming back to the wireless station, after a dawn-light cup of coffee—I saw Iradell standing in the door of the shack waving a yellow blank above his head. "They've got us; they've got us!" he feebly shouted. Mutely I grasped his hand and blinked blindly at the rising sun.

Again my Diary: "Sept. 3. At last the triumpth has come. I have achieved the long-sought end. Key West now hears this station. Another difficulty overcome, one more problem solved. In a few days I will be leaving this region now infested with the Fever. Yet I shall not go without regrets. There are memories to cherish.

"The day vanishing behind descending stars, nebulae paving the sky with misty light, as the moon the sea; the dark waters aglitter with phosphorescence with a myriad of earth-born stars; each wave a shimmer with moonbeams when there was no moon. And in tranquil dawns I have heard again the sweet singing of the mocking bird, as in childhood's southern paradise.

"All of these things I will leave behind in the busy life of the Cities of the North."

Just what it was we did to finally drive that hole through the atmospheric wall to Key West we never exactly knew. All factors finally helped—the perfect ground, the improved antenna, the perfected attuning of the primary to the antenna circuit, the reduced losses in the circuits; but most important, doubtless, we finally found a wave-length for which the sky wave (undreamed of at that period), or the shore-skirting wave, did not interfere with the ground-wave, or direct-traveling wave.

I could never convince myself that the peculiar geography of that West Florida coast line played no part in that strangely puzzling phenomenon.

Suffice it that so long as PN stayed on that lucky wave-length she never thereafter failed to raise K. W.—(the gods of static permitting, always).

Now-a-days with undamped transmitters, with audion amplifiers and t. r. f. no end, such difficulties are swept aside too quickly even to be noted. But in 1905 they "sure were hell."—And I doubt not that today a careful radio survey between Pensacola and Key West might reveal some quite unusual and extremely interesting interference phenomena.

COLON, ON THE COAST OF ADVENTURE

By WINFIELD M. THOMPSON
Field Agent, Panama Pacific Line

ALONG THE OLD WATERFRONT AT COLON

In the foreground are the ruins of one of the piers of gold rush days, and the uprights of a side wheel steamer's engine. Pier and ship were burned many years ago. The new docks at Cristobal join the shore line at the extreme right of the picture.

As guardian of the Northern gate at the Panama Canal, Colon has an important place among the world's specialized ports. In origin akin to Suez and Port Said, but larger and more vital than either, Colon like them lives on transportation. The construction of the Panama Railroad, in the fifties, brought it into prominence. The digging of the Panama Canal maintained it for more than three decades, and the Canal's completion assured its future.

Standing at the busiest crossroads of world trade routes—ships make more than 6000 transits of the Panama Canal each year—Colon is an important transfer point for steamship passengers, Steamer lanes from every sea merge here for the transit of the Canal southward, or here assume their separate directions as the ships come through from the Pacific.

At Colon you may leave a ship that has brought you from California, Australia, the Orient, the West Coast of South America or Europe, and board one that will take you to the Dutch East Indies, the North or East coasts of South America, or in fact to any chosen part of the world. It is only a question of waiting awhile at Colon for your next ship to come along.

As a near neighbor to the Panama Canal's great commissary base at Cristobal and to U. S. Army and Navy bases where many men are enrolled for duty; as a port for cruise ships in the Caribbean that do not make the transit of the Canal, and as a permanent port of call for the Panama Pacific and the lesser intercoastal lines Colon reaps steady revenue from varied sources.

Colon lacks the historical background of Panama City and its climate is not so dry as that on the Pacific side of the Isthmus, facts that the Colon citizen admits cheerfully; but there is much in Colon to engage the attention of the visitor with imaganation and an open mind—not the least item being the comforts and good services of the Hotel Washington, of which the landlord is your Uncle Sam.

When the Town Was Aspinwall

The traveler of mature years associates Colon with the name of Aspinwall, given it when the American engineers came down from New York to start work on the Panama Railroad, in honor of William H. Aspinwall, one of the builders of the line.

Gold in the gulches of California was the touchstone that raised a modern city here out of the primal slime of a tropic swamp. Gold seekers came by steamer from New York to the mouth of the Chagres River, seven miles West, and landed there to make the trans-Isthmian journey by way of the river and the old Cruces trail over the mountains to Panama City. There is no anchorage off the Chagres, and the steamers perforce came to Limon Bay for shelter. Here they could lie off Aspinwall in security, except in northern blows. At such times they steamed to Puerto Bello, 20 miles east, where there is a protected harbor.

The Battle of the Names

With the coming of the liners, the gold rush travel across the Isthmus and the building of the railroad, Aspinwall quickly took on the feverish activity of a boom town. Piers and warehouses were built, and the streets by the waterside were lined with shops, saloons and boarding houses, run by men who had come hither from many parts of the earth.

The government of Colombia, to which country Panama then belonged, watched the development of Aspinwall with an eye to revenue, and taxed the American railroad builders and their trading compatriots with joyous vigor. But they did not accept the name Aspinwall preferring to call the place Colon, in honor of the Great Discoverer.

For some years there was a passive battle of names between the Americans at the Isthmus and the Colombian government over the name Aspinwall. This finally was settled in 1891 by the Colombians refusing to deliver mail addressed to Aspinwall. Thence on, Colon was Colon only, and Aspinwall disappeared from bills of lading and gazetteers.

When the French came, in 1881, they completed the tribute to Columbus by naming the territory at the entrance of their Canal, Christophe. With the coming of the Americans, in 1904, this became Cristobal, and so it is today—a triangle of American territory that is physically part of Colon. The Canal Zone line, for convenience, runs along the city's water front, but back of the docks at Cristobal.

Thus, the flag of Panama flies on one side of the line, and the American flag on the other; and political fictions are maintained, with the solemn actuality of a customs house or octroi station at the line.

Mosquitoes Carried Death

During the five years the Panama Railroad was under construction (1850-55) the world heard many grisly tales of Aspinwall and the Isthmus.

Doleful ballads were written about the deadly Chagres fever of which men died over night. Also calculated to give Aspinwall a bad name were tales of men fighting to board the New York steamers and escape the horrors that beset them on the railroad job. It was said that every tie in the road cost a human life. After the panic was over, and the road finished, doctors declared nearly as many men died of homesickness and fear as of fever.

Certainly hosts perished for want of ordinary sanitary precautions. The malaria and yellow fever-carrying mosquitoes were then unknown to science and the swamps of the Isthmus and the clear waters of the Chagres received much undeserved blame. When the American sanitary experts of the Panama Canal staff had learned by experiments the character of these fever-carrying insects, and had banished them from the Canal Zone—thus writing a marvelous chapter in the history of human progress—Colon

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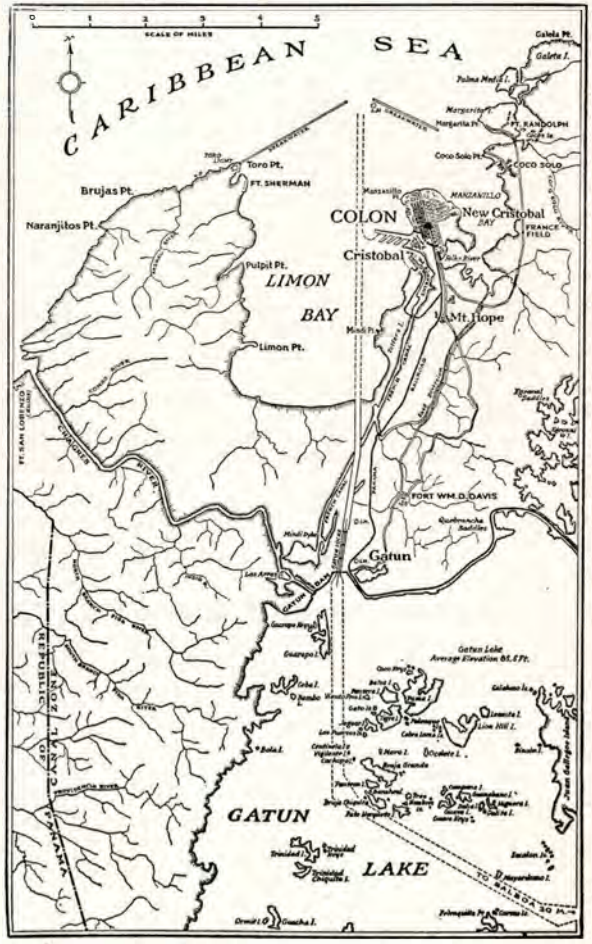

Panama Canal, Limon Bay and Colon. Official Map

HUMOR FROM BRITAIN

HINTS TO SHIPBUILDERS

Firstly, never make the initial error of regarding the operator as anything but subhuman. Remember that on no account should he be provided with a wardrobe, more than two drawers, the smaller the better, nor more than one port. Indeed this latter is a ridiculous luxury, the idle perpetuation of an aberrant precedent. At any rate it is essential that this one port shall be so placed as to admit the very minimum of light on to the desk whereat the operator performs his alleged duties.

It is perhaps hardly necessary to mention that as many bogey funnels, ventilator shafts, steering gear rods, flush pipes from the Master's W. C., or any other impedimenta that occasion or ingenuity may suggest should be passed through the operator's quarters. Advantage should be taken of the fact that it will usually be found possible to contrive that the only possible space for the motor-alternator is immediately over the Master's head when he is in bed. This will occasion the Master but little inconvenience, he will see to that, but it will have the desired effect of tending to make the operator's life almost as miserable as it deserves to be. Should however it not be convenient to place the wireless house near the Master's accommodation then a site in the fiddley structure is highly recommended. A little ingenuity will ensure that the ash-hoist passes conveniently near and a study of animal's hours of watch together with a word to the Chief Engineer as regards times of dumping ashes will work wonders. N.B.—We would emphasise the times 0048 and 1248 G.M.T.

Naturally only one door will be provided but a little thought upon the position of this item mayhap will be profitable especially should the vessel be engaged in a regular trade. A study of the prevailing winds upon this route will generally elicit which side is likely to be the usual weather side of the ship. One need not say more. Should however there be little or no choice in this matter then a door opening forward should meet the case.

Of course one is limited in these degenerate radical days, the good old custom of berthing the operator with galley boy has unfortunately fallen into abeyance. Sic transit. Even so there remain many opportunities for the enterprising builder and an efficient Marine Superintendent (square-rigged of course) should be allowed the full scope of his prejudices.—(From The Signal London, Eng.)

Important News—"Watch Your Step"

It is the patriotic, if not the bounden and legal duty of all licensees of radio broadcasting stations to deny their facilities to advertisers who are disposed to defy, ignore, or modify the codes established by the NRA, Commissioner Harold A. Lafount declared in a public statement.

Mr. Lafount's observations were based on experiences gained on his recent inspection trip of 107 radio stations in 11 Western and Pacific Coast states.

Mr. Lafount said "Under the Radio Act the Commission has no right of censorship. However, the Commission has the right to take into consideration the kind of programs broadcast when licensees apply for renewals.

"In the present crucial time, when the Government is making a determined effort to restore prosperity and to provide employment for vast groups, by establishing codes for industry, tending to provide more jobs, by reducing working hours and advancing wage scales, it is questionable, in my individual opinion, if the Commission should ignore such protests as the one filed by the delegation mentioned.

"Of course, when the people are fully informed concerning the NRA drive, its import, and the philosophy back of it, listeners will ignore appeals for business based on price-cutting. In fact, such appeals will be considered unfair, unpatriotic and un-American.

"During the World War those who refused to do their part were labeled 'Slackers'—a term of contempt. Those who refuse to aid the Government in this critical time in its war against depression should be placed in the same category. So far they have been dubbed 'Chislers' but to my mind that is too mild a term.

"The success of the recovery drive, it is generally conceded depends on team work on the part of the whole nation—the buyers as well as the producers. Many are called upon to make sacrifices for the common good and those who refuse to play the game deserve, and undoubtedly will receive, the odium of all true Americans.

"It is to be hoped that radio stations, using valuable facilities loaned to them temporarily by the Government, will not unwittingly be placed in an embarrassing position because of the good or lack of patriotism on the part of a few unscrupulous advertisers."

Hats Off to Ray Dickens

How a jammed retractable landing gear on a scheduled passenger plane in flight was rectified by the transmission of special operating instructions to the pilot through a Depeartment of Commerce airways radio station with the result that the aircraft was brought safely to earth without damage, was described in a letter received by the Aeronautics Branch of the Department from Frank Erickson, operations manager of Varney Air Service, Ltd., Alameda, Calif.

Pilot Fred Hammer, in preparing to land his transport plane at the San Francisco Bay Airdrome, Alameda, found his landing gear jammed in its recesses in the lower wings. His plane was equipped with a radio receiving set but no transmitter, so he released a note setting forth the situation. Although he could with good luck, have landed the plane with the wheels tucked up in the wings without injury to its occupants, such an operation would have resulted in damage to the propeller and the underpart of the aircraft, and considerable shaking up to the passengeres.

The operations manager received the note telephoned to the Department of Commerce airways radio station on the edge of the Oakland Airport several miles away, and appealed to Operator Raymond E. Dickens to relay special instructions to the pilot as to the operation of the hydraulic landing gear. The request came at a time when he was due to make the regular broadcast of weather reports. The pilot received the instructions by radio and was able to drop the wheels into position for a normal landing.

"He showed unusual initiative," wrote Mr. Erickson of the radio operator, "in realizing that in the emergency he was justified in interrupting the regular weather schedule and we appreciate the fact that such men are in charge of the work." Mr. Erickson said that Operator Dickens' co-operation "was only a striking example of the extent to which we depend upon the Department radio."

The 13A—A Radio Receiver for Diversified Uses

By H. T. BUDENBOM

Member of Technical Staff Bell Telephone Laboratories

A recent request from the Tropical Radio Telegraph Company for radio telephone equipment to supplement their telegraph links with the Caribbean countries, calling for apparatus somewhat wider in scope than existing equipment, has hastened the development of the most recent addition to the Western Electric line of radio receivers. It is known as the 13A. Like the 11A aviation ground station receiver, the new model is a sensitive superheterodyne, operating from the usual 110 to 120 volt supply system at any frequency from 50 to 60 cycles. It incorporates continuously variable tuning, and covers the frequency range from 2.2 to 25 megacycles. This range includes all the frequencies above the broadcast band now used commercially for medium and long range radio communication, except a narrow band—from 1.5 to 2.2 megacycles—just above the highest broadcast assignment.

The purchaser of a 13A radio receiver acquires a suitable number of individual panels mounted in a seven-foot cabinet. The number of panels supplied will in most cases be less than the total number available but will be adequate to render the particular service desired. By suitable choice of units either telephone or telegraph facilities or both are available at any frequency within the total range combination of panels ordered so that the customer may add to his receiver at any time.

The units available and their functions are indicated in Figue 1. In general there may be: one or more antenna tuning units or an antenna tuning panel, depending on the number, type, and disposition of antennas employed; an antenna patching panel to permit the radio frequency panels to be connected to the different antennas as required for directional reception; one, two, or three radio frequency amplifiers, depending on the frequencies to be received; an intermediate frequency amplifier and detector; and an audio-frequency amplifier, which incorporates the power supply. In addition, a heterodyne oscillator panel is available for continuous-wave telegraph reception. Of these all but the antenna tuning units are mounted in a metal cabinet.

Three radio frequency amplifiers are provided to cover the entire frequency range. These are known as 83 type amplifiers with letters suffixed to the type number to indicate the frequency range. Thus the 83A covers the band from 12 to 25 megacycles, the 83B from 6 to 13.2, and the 83C, from 2.2 to 6.2. All three are of similar design, and feature single control gang tuning of three tuned circuits ahead of the amplifier stage, two tuned circuits between amplifier and modulator stages, and the beating oscillator. The six condenseers operated from the single control are shown in Figure 2 which shows the rear of the panel with lid removed. When three tuned circuits ahead of the amplifier are not required for adequate selectivity, one or more may be cut out by a strap and bus arrangement. A slow motion condenser drive, with a 2700 division double dial, provides an average frequency increment of only about 5 kilocycles per division, even for the highest frequency amplifier. All the radio frequency amplifiers terminate in inter-

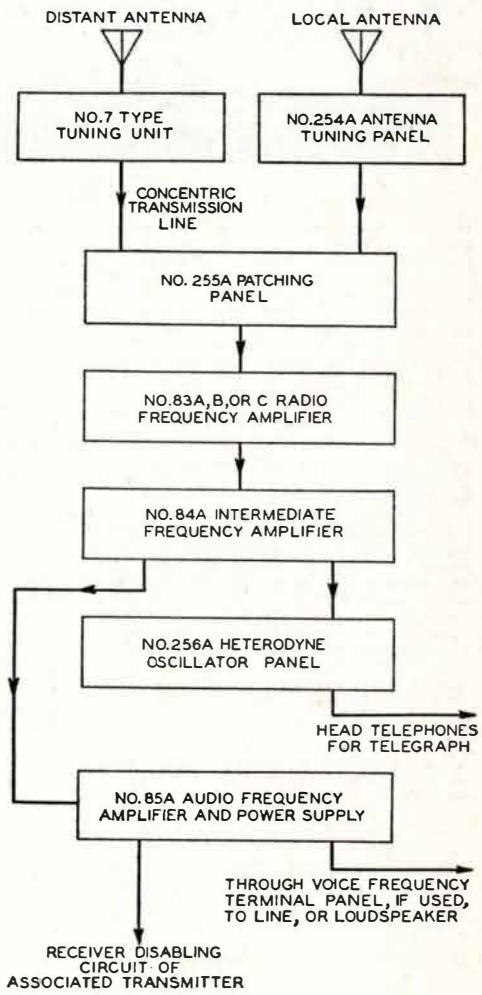

Fig. 1 Block schematic of the various units comprising the 13A radio receiver

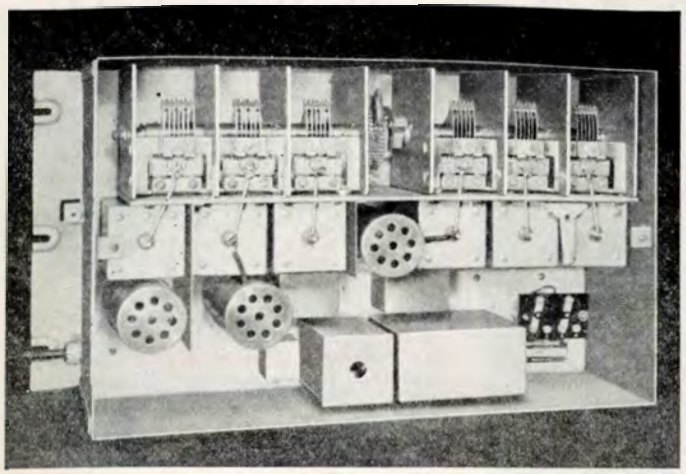

Fig. 2—Rear view of 83B amplifier with rear lid removed

densers of which are ganged, is different for each of these frequency ranges. Also this arrangement makes it possible to monitor simultaneously on three channels, one in each radio frequency range, as well as permitting a much more rapid change from one frequency to another.

In the intermediate frequency amplifier, known as the 84A, is obtained the greater portion of the radio gain and the closeup selectivity. This amplifier has three stages coupled by eight tuned circuits, including the one terminating the radio frequency amplifier, and an almost linear diode detector. Shunt capacity coupling is used in the filter circuits, which has permitted a band width changing feature to be incorporated. By operating the band width switch on the front of the panel, the received band may be narrowed, a feature of considerable value for both telegraph and telephone reception in the presence of severe interference. Both automatic and manual gain control are provided, and the time constant of the automatic control may be easily altered in the field.

The use of a 256A (heterodyne oscillator) panel adapts the receiver to continuous wave telegraph reception as already noted. It provides for slowing down the time constant of the automatic gain control circuit for telegraph reception, and also for peaking the audio-frequency characteristic to improve telegraph selectivity. In telephone reception this panel may be used to keep the radio receiver at approximately zero beat frequency with the distant carrier, without disturbing the conversing subscribers.

Two stages of audio frequency amplification are obtained from the 85A amplifier which also furnishes the power supply. Both input and output impedances are 600 ohms, and the final

mediate frequency output circuits, which step down to a very low impedance, and the outputs of all the radio frequency amplifiers employed are connected in series with the input circuit of the intermediate frequency amplifier.

Inductances of the coils of the 83A amplifier are given their factory adjustment in a novel manner. The coils are of copper tubing supported only at their ends and under slight tension. The inductance is changed by increasing or decreasing this tension, which slightly pulls out the turns or allows them to come closer together.

A variable-mu pentode is used for the modulator and the voltage of the beating oscillator is supplied to the suppressor grid as shown in Figure 3. This type of modulation lightens the output requirement of the beating oscillator and results in improved stability without re-radiation difficulties. The five tuned radio frequency circuits and the variable-mu modulator tube, provide outstanding selectivity against cross talk from a strong unwanted signal, such as those from the local transmitter where constant-carrier transmission is used. Unusually small frequency and antenna distance separations are thus feasible with this receiver.

The provision of a complete radio frequency panel for each frequency range admittedly adds to the cost of the receiver compared to a plug-in coil or selector switch arrangement. Together with the feature of connecting the outputs of the radio frequency amplifier in series with the input of the intermediate frequency amplifier, however, it eliminates series contacts in the low impedance circuits which would be present with plug-in coils, and which would be very undesirable in the corrosive atmosphere of the tropics or on shipboard. Furthermore, it facilitates the use of ganged condensers, since the frequency ratio of the beating oscillator and signal circuits, the con-

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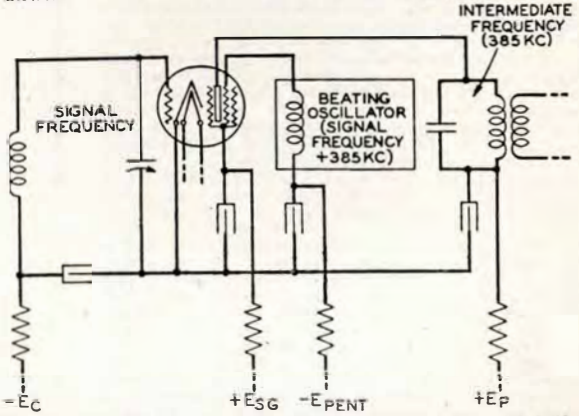


Fig. 3—Simplified schematic of suppressor grid modulation circuit

Station WHDH—Fishermen's Friend

The fishing industry not alone in our own United States, but all over the World, has for many years been a close friend of the radio operator. This industry, one of man's oldest endeavors to take food from the sources supplied by mother nature, is found wherever there is water in any quantity. The method of catch may differ by the degree of civilization but the fish has become a main source of supply.

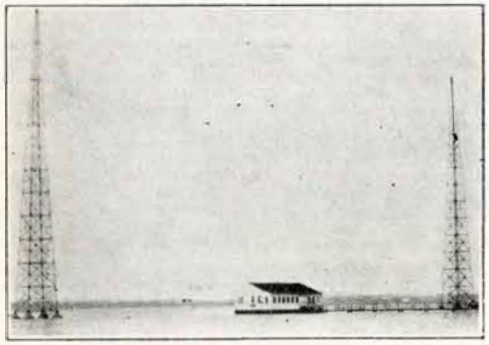
Boston is the largest fishing port in the world. It is estimated that more than five thousand men and four hundred and forty-six vessels of five tons or more capacity are employed in the New England fishing industry.

The principal fishing banks and their distance from Boston are:

George's Bank—180 miles
Brown's Bank—200 miles
Le Havre Bank—300 miles
Emerald Bank—400 miles
Western Bank—500 miles
St. Peter's Bank—800 miles
Grand Bank of N. F.—960 miles

This industry is estimated to have produced for Boston and Gloucester approximately $15,000,000 for the 1930, when there was invested in floating equipment devoted to this field between $20,000,000 and $25,000,000.

While only the larger of these boats are equipped with commercial radio transmitting and receiving apparatus, and carry a commercial licensed radio operator, more than 90% of them are equipped with broadcast receiving radio sets on which they depend for both news from the mainland as well as entertainment when the day's work is finished while out at sea.



The radio broadcast station WHDH with studios at Boston, and transmitter at Gloucester is the fisherman's friend. Many years back Mr. Ralph G. Matheson founded Station WEPS at Gloucester for the special purpose of rendering service to fishermen at sea. He and his father, John J. Matheson, now own the majority common stock of Station WHDH, which was first licensed in 1929 to operate with 1 KW power, on 830 kc, frequency. In 1931 they were authorized to move the transmitter to Saugus, Mass., which is about eight miles outside of Boston.

A little over 5.3 per cent. of the total time that WHDH is on the air is devoted exclusively to fisherman's programs, and of course it is supposed that the other 95 per cent. of the time is of interest to all men on the boats as well as to others who may listen in. The station is not in any way affiliated with any chain stations. It is claimed that the station has a net worth of $54,660.71. Recently the station applied for unlimited time on the air but the Examiner, George H. Hill, for the Radio Commission recommended that this be denied, in his report submitted August 12th.

Storm warnings, weather forecast, time signals, arrival of fishing vessels market prices of fish and emergency messages concerning illnesses, deaths, etc., are some of the services rendered by this station to the fishermen while at sea. No similar services is rendered by any other broadcasting station.

Good luck to Station WHDH, and to its Manager Ralph G. Matheson. It is hoped that it will long continue in its good work and that every radio operator in the fishing banks will give it every support in his power.

Interesting Activities

Twenty-three weather stations were notified to close August 1, by the Department of Agriculture, under which the Weather Bureau operates. The Weather Bureau will have two hundred cities with observers hereafter.

* * *

Maps showing wind direction and velocity at various levels up to 13,000 feet, and in some cases higher are now issued at important terminals on the Federal Airway System twice daily, the Aeronautic Branch announced. These maps are sent over the teletype system, the operator having available blank maps merely inserts arrows showing direction and velocity on one map as it comes over the teletypewriter, first on one map for a given height, then as they follow on the five other blank maps in the same fashion for the other five heights.

* * *

There are 68 autogiro aircraft with Department of Commerce licenses. Twenty four pilots are licensed exclusively on this type of machine, ranging in age from 17 to 54 years. However any licensed pilot is privileged to fly these craft for pleasure without special license or authorization. By passing a test given on this type of aircraft an airplane pilot holding a license of limited commercial or transport grade may fly autogiros for hire.

* * *

Using twelve month averages of 1926 as 100, the U. S. Department of Labor report as follows on shipbuilding employment:

	1932	1933
April	91.1	53.2
May	87.0	57.0
June	83.9	57.5
July	76.2	62.7

On aircraft equipment, using same base as above:

	1932	1933
April	214.3	206.4
May	208.3	244.8
June	196.6	251.2
July	180.5	251.4

WLW Going for Water

Joseph L. Chambers, technical supervisor in charge of constructing the new plant for the 500,000 watt transmitter of WLW, announced that the cooling system will require 1,000,000 gallons of water daily.

The publicity boys immediately got busy on this figure and announced that this is enough water to supply the wants of more than 6,600 average families. WLW it will be remembered is the new Crosley station at Cincinnati, expected to be ready next February.

USES OF TRANSMISSIONS OF STANDARD RADIO FREQUENCIES

This article gives methods of frequency measurement for utilizing the standard frequencies transmitted by radio by the National Bureau of Standards. It is in parts.

Part 1 gives methods of using the 5000-kc transmissions for the calibration of standard oscillators in simple cases, where the frequencies have such numerical values as to be readily checked directlyin terms of the transmissions.

Part 2 gives specific information for the use of the transmissions to check with great accuracy the frequency standard used in any broadcasting station (e.g., the monitor required by F.R.C. Rule 145). The discussion is divided into three sections, A, B, and C, progressing in difficulty of measurement. Section A deals with two frequencies, 1000 and 1250 kc. which could readily be measured as explained in Section B. Very little apparatus is required for measurements required when a station standard is used which differs from the assigned frequency by 500 or 1000 cycles per second. Section B gives the method of measurement when an auxiliary generator is required. The method described in this Section applies when the frequency in kilocycles is a multiple of 50. Section C gives the method of measurement for any broadcast frequency (multiples of ten).

The Standard Frequency Transmissions.—The Bureau of Standards transmits standard frequencies from its station WWV, Washington, D. C., every Tuesday. The transmissions are on 5000 kilocycles, and are given continuously for two hours during the day and two hours at night. (The hours may be obtained on request from the Bureau of Standards.) The transmissions can be heard and utilized by stations equipped for continuous-wave reception throughout the United States, although not with certainty in some places. The accuracy of the frequency is at all times better than one cycle in five million.

The transmissions consist mainly of continuous, unkeyed carrier frequency, giving a continuous whistle in the phones when received with an oscillatory receiving set. For the first five minutes the general call (CQ de WWV) and announcement of the frequency are transmitted. The frequency and the call letters of the station (WWV) are given every ten minutes thereafter.

Part 1. Checking Standard Oscillators

A. Method of Measurement

While the standard frequency transmissions may be used for many standardization purposes, the most common use is to determine accurately the frequency of a piezo oscillator. The apparatus necessary is (1) the piezo oscillator, (2) a continuously variable radio-frequency generator which is approximately calibrated (3) a variable audio-frequency generator, and (4) a radio receiving set. A frequency meter of resonance type is also useful but is not essential.

> *"You can lead a horse to water, but you cannot make him drink," —The Department of Commerce can and does make available a Standard Radio Frequency. They go farther and tell how to utilize this service. We are happy to familiarize our readers with this service, and recommend that you not only read, but study this material until memorized.*

The fundamental frequency of a piezo oscillator is fixed by the dimensions of the quartz plate used. The vacuum tube circuit arrangement in which the quartz plate is connected gives numerous harmonics for each fundamental frequency. The radio-frequency generator, which is continuously variable, can be adjusted to any frequency, and likewise gives a series of harmonics for each fundamental frequency to which it is adjusted. If the frequency of the radio-frequency generator is varied over a wide range, beat notes are produced at a number of settings of the generator by the interaction of various harmonics of the fundamental frequency of the piezo oscillator with a harmonic of the fundamental frequency of the generator. The beat notes may be heard in a pair of telephones suitably connected to the generator or to the piezo oscillator. Any frequency present in the piezo oscillator can beat with a corresponding frequency present in the radio-frequency generator at a number of frequencies which have a simple relation to the fundamental frequency of the piezo oscillator. Providing the harmonic relationship is known, measurements can be made at a great number of frequencies in terms of a single standard frequency.

If f is the fundamental frequency of the piezo oscillator which is being used and F' the fundamental frequency of the auxiliary generator which gives zero beat, then

$$af = bF$$

where a and b are integers (1, 2, 3, 4, etc.)

The procedure is simplest when the ratio of 5000 kc to the nominal frequency of the piezo oscillatior to be standardized is a fairly small integer, less than 100. For instance, secondary standards whose fundamental frequencies are 50, 100, 200, 500, or 1000 kc can be measured very simply in terms of the 5000-kc transmissions and these secondary standards may be advantageously used in turn to calibrate other apparatus. It is, however, possible to use the 5000-kc signals to establish accurately any desired frequency.

Fig. 1

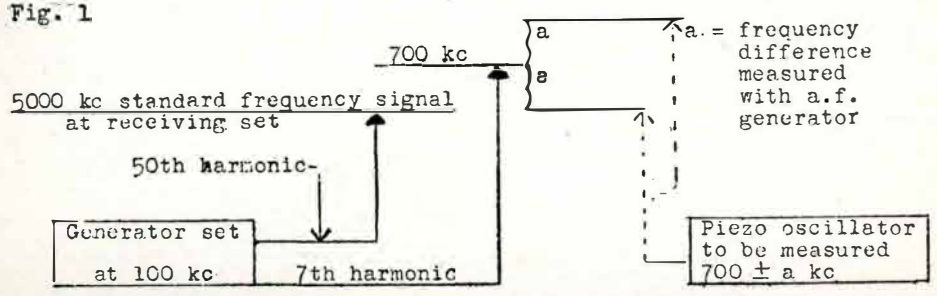
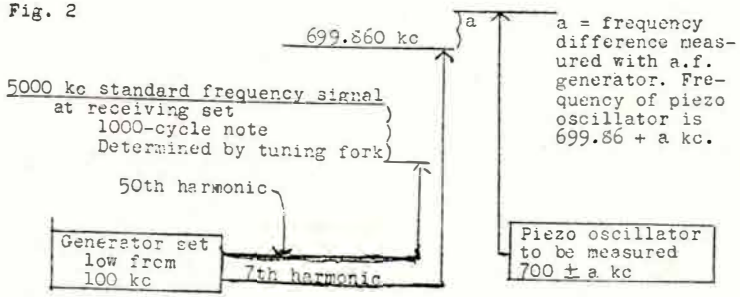


Fig. 2



B. Examples of Measurement Method

Suppose it is required to measure the frequency of a piezo oscillator, the approximate frequency of which is 700 kc, in terms of the 5000-kc standard frequency signals.

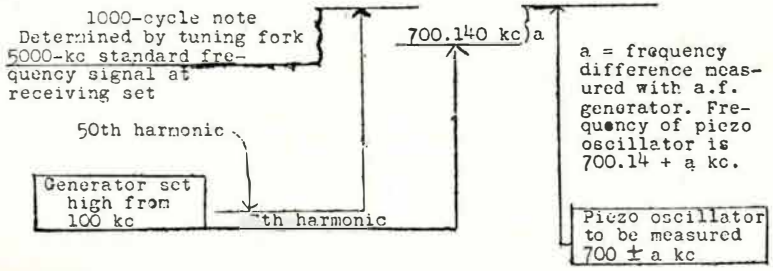
If the radio-frequency generator is set at 100 kc, the 50th harmonic (5000 kc) will beat with the 5000-kc transmission, and the 7th harmonic (700 kc) will beat with the fundamental of the piezo oscillator.

The 5000-kc standard frequency signal is received first and identified with the receiving set in the generating condition. The radio-frequency generator is then turned on and adjusted to near 100 kc. This should give a beat note with the frequency generated by the receiving set. The regeneration of the receiving set is then reduced until the set just stops generating. A beat note should then be heard which will in general be of less intensity than that previously heard. This is the beat between the 50th harmonic of the radio-frequency generator and the frequency of the incoming wave. This beat note should be reduced to zero frequency by adjusting the radio-frequency generator. For most precise work this adjustment should be made by using a beat frequency indicator or other means of indicating exact zero beat. A simpler and equally accurate substitute is to bring in a tuning fork as described below. However, for a simple discussion of the steps involved in the measurement, it will be assumed that an accurate zero-beat setting is obtained.

The radio-frequency generator is therefore precisely adjusted so that it has a frequency of 100 kc. Without changing its adjustment, couple the piezo oscillator to it loosely. A beat note should be heard in the telephones in the output of the piezo oscillator unless the frequency given by the piezo oscillator is an exact multiple of 100 kc. Suppose, for example, it is 700.520 kc. In this case a beat of 520 cycles per second will be heard. To determine the value of this note, the audio-frequency generator must be used.

The frequency of the beat note and the frequency of the audio-frequency generator may be compared by using single phone units from each source and rapidly interchanging them at the ear. If sufficient intensity is available from the two sources then the two audio frequencies will combine and beats may be heard by the ear when the audio-frequency generator is closely adjusted. For exact zero beat the frequency of the adjustable audio-frequency generator gives the difference in frequency between the

Fig. 3.



7th harmonic (700 kc) of the generator adjusted to 100 kc and the fundamental of the piezo oscillator.

Fig. 1 gives a diagrammatic representation of the frequencies used. It is necessary to determine whether the piezo oscillator is higher or lower than 700 kc. This can be done by varying the frequency of the radio-frequency generator. If increasing the frequency of this generator results in decreasing the beat note, then the piezo oscillator is higher than the reference frequency, that is, the audio frequency is to be added to 700 kc. If the reverse is true, then the audio frequency is to be subtracted.

C. Use of Audio-Frequency Note in Measurement

A change in the method described above which does not require a beat indicator, is to adjust the radio-frequency generator to have a known frequency difference with the incoming wave by means of matching with that of a tuning fork of known frequency such as 1000 cycles per second. This method is more complicated in calculation because a record must be made of four factors (1) as to whether the radio-frequency generator was adjusted higher or lower than zero beat, (2) the frequency difference, (3) the harmonic relation between the standard signal and the radio-frequency generator; and (4) the harmonic relation between the radio-frequency generator and the piezo oscillator. The harmonic relations, however, come in to any method of measurement of this kind. The measurements involving the use of the tuning fork for adjusting the generator to give a beat note 1000 cycles per second below the 5000-kc signal would be made as follows, and are shown diagrammatically in Fig. 2. Set generator from approximate zero beat at 100 kc to 99.98 kc. The 50th harmonic is 99.98 x 50 = 4999.0 kc (beats with 5000 kc in receiver which is not oscillating and gives a 1000-cycle note). The 7th harmonic of the generator (99.98 x 7 = 699.86 kc) may now be heard beating in the telephones of the piezo oscillator which is known to be approximately 700 kc. If this value were exactly 700 kc, a note of 700,000 — 699.860 kc or 140 cycles would be heard. However, the beat note produced is matched with a corresponding note from the audio-frequency generator. If the piezo oscillator had the frequency of 700.520 kc as assumed previously, the audio-frequency note measured would have been 700.520 — 699.860 = 0.660 kc or 660 cycles per second.

Whether to add or subtract the audio-frequency note of 660 cycles to the known frequency of 699.860 kc would be decided as follows when the radio-frequency generator was set lower than the standard frequency signal. If lowering the frequency of the radio-frequency generator increases the beat note (660 cycles in this case), add the beat note frequency, or if increasing the frequency of the radio-frequency generator decreases the beat note, add the beat note frequency.

The measurement could also be made by adjusting the generator to 100.020 kc using the thousand-cycle tuning fork, as in Fig. 3. The 50th harmonic is 100.020 x 50 = 5001 kc which beats with the standard frequency signal of 5000 kc and produces a 1000-cycle note. A certain audio-frequency note is produced in the telephones of the piezo oscillator, which is matched with a similar note from the audio-frequency oscillator as before. If lowering the frequency of the radio-frequency generator reduces the audio-frequency note heard, subtract it from the known frequency of 700.140 kc, or if increasing the frequency of the radio-frequency generator increases the audio note, subtract it. The audio-frequency note heard with a piezo oscillator having the assumed frequency would be 380 cycles, hence 700.140 + 0.380 = 700.520 kc.

The methods described above are capable of giving very accurate values of frequency if properly carried out. A much simpler procedure by which less accurate values may be obtained is to calibrate a frequency meter in terms of the standard frequency signals and then measure the piezo oscillator by means of the frequency meter.

(See part two of this article in next issue)

A. R. T. A. NEWS

We are pleased to announce that the Radio Operators in the Newtex S.S. Line are 100 per cent. Association at present. This is the first and only 100 per cent. A. R. T. A. Line.

There are two Broadcast Stations which now are 100 per cent. A. R. T. A. The men at these two stations have asked that we not make public their station until later.

Willard Kirchhoff is now on the Jefferson Meyers.

Willard Bliss is relieving on the Tachira.

Irving Finver is on the Yorba Linda.

Steve Kovacs went on the F. Q. Barstow.

W. D. Thomas, M. Welte, and John Walter are on the Washington.

Boston Notes

Local No. 1, A. R. T. A.

A fall from the dock to the deck of his vessel, the trawler Illinois, resulted in a compound fracture of the leg and the temporary retirement of Brother Carl Potter of 50 Haskell St., North Cambridge. Carl was taken to the Boston City Hospital in a serious condition. Late reports from his home indicate he is recovering at a satisfactory pace.

* * *

While Carl Potter is on the sick list his job on the trawler Illinois is being competently cared for by Harold ("Scottie") Stanley. Scottie, since his, Honduran banana canoe, Virginia, tied up a few months ago has been a valuable utility man around the R.M.C.A.

* * *

Harry R. Chetham, whom everybody in radio knows, has been appointed broadcast delegate for Local Number 1. Harry still retains his position as chief operator of WPEH, Somerville Police Department, despite the fierce competition of recent months, and will devote his extra energy, of which he has an abundance, to lining up the police, airways, and broadcast operators in the New England district.

* * *

One of our newer members, George Steele, recently hung up his license in the radio shack of the trawler Winthrop. George comes from a long line of fisher folk His brother Fred, a graduate of the Massachusetts Nautical Schoolship, is an engineer on the Winthrop and his father, Capt. John Steele, is skipper of the William J. O'Brien and one of the high-line fishermen out of Boston.

* * *

Brother Charlie Murray is spending an enjoyable summer on the Yacht Vanda. If Charlie's prayers that his yacht go south for the winter are answered, Boston's swanky temples of mirth and merriment, notably the Theatrical Club, will be missing a most distinguished patron.

* * *

Ralph O'Brien, after a few week's vacation at his home in Winterport, Maine, is back cleaning spark gaps on the Sewalls Point of the Mystic collier fleet.

THIRD REPORT OF LIAISON COMMITTEE ON AERONAUTIC RADIO RESEARCH

As explained last month, a Committee of eleven able members was designated with eight alternates. The Committee worked earnestly to complete this report on Aeronautic Radio Research. It is in short an actual summary of what has been accomplished, and what should soon be in this important branch of radio. Technical papers, books, magazines, and actual "inside" records were scanned. It is yours for the reading.

(Continued from last Month)

The transmitter is quartz crystal controlled, and means are provided for rapid shift between three frequencies one for day, one for night, and one for use on the national calling frequency of 3,105 kilocycles. The number of apparatus units making up the system has been greatly reduced and the maintenance of the apparatus has been facilitated by the provision of mountings for the principal apparatus units from which they are quickly detachable. Equipment is manufactured in two types, one with a 2-dynamotor power unit for 12-volt storage battery operation, and one for use with a new combination double-voltage generator and dynamotor unit which is gear-connected to the airplane engine. The use of this latter type of power unit makes possible a considerable reduction in the weight of the power apparatus which the airplane must carry.

A 400-watt telephone and telegraph transmitter was designed and a number supplied to the Department of Commerce. This transmitter embodies the same type of high efficiency audio system, self-contained rectifiers, etc., as the 2-kilowatt set under (A) above. The maximum plate supply voltage for this set is 1,250 volts.

For commercial aircraft plane-to-ground communication, in addition to the 10-watt telephone and telegraph transmitting set which is described elsewhere, a 60-watt CW telegraph transmitting set was developed and a number have been furnished to the trade. This equipment is at 60 to 75 watts CW telegraph output, and by means of plug-in coils covers a frequency range of 3,500 to 6,000 kilocycles. The transmitter and dynamotor weigh approximately 15 pounds each. Power supply is from the 12-volt airplane battery. A 20-watt telephone and telegraph transmitting set for 2,900 to 6,000 kilocycles has also become available.

In the military field, the Navy Department has continued its development work on radio equipment, with a view to obtaining more efficient equipment with a greater distance range per pound of weight with a corresponding decrease in bulk. Communication efficiency has been exceedingly high in all units attached to the fleet and the apparatus now in use is considered by the Navy to be very satisfactory. An advanced design of spotting set was manufactured for the Navy. Transmitting and receiving equipment for the airship Macon were manufactured. An experimental 100-watt telephone transmitting set having the feature of dial calling was designed and built. By means of the dial, automatic calling of any one of a number of airplanes is possible without it being necessary for the operator to know the telegraph code.

The reduction of the band width occupied in airplane telephony is an urgent problem which requires future attention. According to the Federal Radio Commission Rules and Regulations the normal width of the communication band for commercial telephony is 6 kilocycles. The process of modulating a carrier wave by a multifrequency wave in actual practice results in the production of two series of side frequencies or side bands, one series on either side of the carrier. The voice frequency range ordinarily considered necessary for commercial telephony is from about 200 to about 3,000 cycles. It has been found, due to overmodulation, non-stabilized circuits, generation of spurious frequencies, intermodulation between various side-band frequencies and other troubles, in certain types of commercial aircraft and ground transmitters that the total band width occupied is in excess of the limits set by the above figures.

As frequency assignments by the Federal Radio Commission are based upon a 6-kilocycle band width it is necessary that the transmitter and receiver design take this into full account and that they shall be so designed that these spurious emissions are minimized, and there shall be incorporated therein filters or other devices which will exclude nonessential frequencies so that full use may be made of the available channels. Some success has been attained in correcting overmodulation in ground transmitters by the use of a constant-level input amplifier which holds the output of the microphone to just the proper level to accomplish full modulation of the carrier. Under present conditions it has been found that even with selective receivers a separation of 30 kilocycles is necessary between different aeronautical chains if interfering cross talk is to be avoided.

C. HIGHER FREQUENCIES

Work is continuing actively in industrial research and development organizations on the application of frequencies above 30,000 kilocycles to aviation service. Tests indicate that frequencies of the order of 30,000 to 100,000 kilocycles (10 to 3 meters wave length) may be used for two-way communication plane-to-ground, with certain limitations, in much the same manner as the frequencies in the 3,000 to 6,000 kilocycle range are now being used. To utilize these high frequencies, however, it is necessary to overcome a number of technical difficulties in both transmitter and receiver design. Work is continuing with that end in view.

One company has been actively studying the possibilities of these higher frequencies, some of their work being done from the Empire State building in New York City. While this work has not been directed primarily to aviation applications, some of the data taken involve transmission between this station and an airplane in flight and have provided further indications of the value of these frequencies.

Laboratory work by a manufacturer on a transmitter and receiver unit, working at a wave length of 9 centimeters, shows considerable promise for line-of-sight or directional communication. The magneto-static type of oscillator is

employed. Communication with modulated light beams also shows some promise for aeronautic purposes.

III. NAVIGATION

A. DIRECTION FINDERS

Some fundamental work has been done on the characteristics of directional airplane antennas at frequencies above 1,500 kilocycles, with special attention to the influence of the receiving airplane's height above, and distance from, the transmitter. This work is primarily guided by the idea of reducing or eliminating the separation between the frequencies useful for purposes of guidance and those commonly associated with aircraft-to-ground communication. Here again, the basic principle is that of apparatus simplification. Design data, largely of an engineering nature, have been collected on the structure and characteristics of loop antennas, both fixed and rotatable, along the specific lines of correlation of the antenna characteristics with the structural features of different types of aircraft. Refinements have been made in the design of radio receivers adapted for operation with directional receiving antennas.

A simple direction finder of automatic type for use on airplanes at broadcast and lower frequencies was developed by the aeronautics branch. It gives a visual indication of the direction of any radio station whose signals are received. It is a small compact unit, making use of an ordinary commercial receiving set with a converter unit added. There are no moving parts other than a single rotatable loop antenna, the design being adapted to the rigorous requirements of airplane service. When the loop antenna is set with its plane perpendicular to the direction of the station received, the zero center indicating instrument reads "on course." For other orientations of the loop antenna the instrument needle deflects, informing the pilot not only of the line of direction but also whether the station received is ahead or to the rear. The direction finder may be used as a homing device or as a position finder by the aid of cross bearings on two or more ground stations.

The Navy Department has carried on research work in the further development of direction finders. Present Navy equipment consisting of fixed wing-loop antennas, Bellini-Tosi apparatus, and rotatable loop antennas have proved very satisfactory and are continually used. It is now possible, with the more efficient radio receivers available, to obtain equipment of this type for much less weight and bulk than formerly.

Direction finding on the ground is used as a regular aid to air transport operation southward from the United States. Thorough success has been obtained in the use of a direction-finder installation operating on about 700 kilocycles, over flat country and water. An installation was made at another point for taking bearings over very mountainous country. Operations on 700 and 1,700 kilocycles were compared. On account of the signal-static ratio, operation on 1,700 kilocycles was superior, a distance range of 300 miles being obtained on that frequency as compared with a distance range of 100 miles on 700 kilocycles under the same operating conditions. On the 1,700-kilocycle frequency, however, there were rapid shifts of direction in the wintertime, beginning one half hour before sunset and occurring throughout the night. The shifts were worse at sunrise and sunset and also were particularly severe over the coast line. The effects were a maximum at distances between 50 and 100 miles, and decreased with increase of distance beyond [illegible] miles.

A ground direction finder using 1,708 kilocycles was installed at Tampico, Mexico, for use in navigating the route between Mexico City and Tampico. A range of mountains 10,400 feet high is crossed approximately 150 miles from Tampico. This mountain range rises from sea level 30 miles from the airport and at 67 miles has reached a height of 4,000 feet. As the mountain range is higher each side of the route, and considerable blind flying is done, it is essential that the aircraft fly a direct course, hence the use of a direction finder. Consistent results have been obtained when the airplanes fly approximately 1,000 feet above the mountain range. Bearings become very erratic when the airplane is behind the mountain range going into Mexico City. The route between Tampico and Brownsville follows the coast line for approximately 200 miles and when aircraft are flying below 2,500 feet bearings are very erratic. Between 2,500 and 5,000 feet the bearings become steady, with slight variations at times. These results follow well-known propagation characteristics for water and land.

B. RANGE BEACONS

The principal limitation upon the successful functioning of the radio range beacons heretofore has been the existence of serious fluctuations of indicated course at night. This has been overcome as the result of research work by the Aeronautics Branch.

The fluctuations were found to be especially great in mountainous country. They were of the same magnitude for the aural and the visual type beacons. Tests were made which proved that the effects were caused by the presence of horizontally polarized components in the transmitted wave. These components are produced by horizontal portions of the transmitting loop antennas at the beacon station. It appeared that the only remedy was to eliminate the transmission of the horizontally polarized waves by replacing the transmitting loop antennas by a type of transmitting antenna system which radiates no horizontal components. Many expedients were tried, and a new antenna system, which has been termed the transmission-line antenna system (or T-L antenna), was evolved.

It comprises 4 vertical antennas placed at the corners of a square, 2 antennas on diagonal corners of the square working together in place of 1 of the loop antennas of the earlier beacon antenna system. The significant element of the system is the particular means employed to confine the radiation to the vertical antenna. For this, transmission lines are used as feeders for the vertical antennas, these lines being so terminated that there is no radiation from them. The superior results obtained with the T-L system were due to a number of special features, such as complete shielding of all parts of the transmitting apparatus and phase control of the antenna currents, but principally to the use of transmission lines to feed the power from the goniometer to each of the vertical antennas.

This antenna system is successful in reducing night effects to a negligible amount. Using loop antennas for transmission, average course fluctuation of plus or minus 30° are obtained beyond about 30 miles from the range-beacon station over mountainous terrain. These variations are so great as to render the beacon course useless. With the new antenna system the fluctuations are reduced below 3° throughout the entire useful distance range (more than 100 miles). These variations are wholly negligible in the use of the beacon signals, being so small that pilots consider the variations to be completely eliminated.

An advantage of the T-L antenna is that it simplifies the problem of adjusting the 4 beacon courses to the arbitrary angles required by the airways radiating from it. This is done by adjusting the phases of the currents in the 4 vertical antennas. Special studies were made to assume the synchronizing of these phases and avoiding changes after adjustments were once made. Another advantage of the T-L antenna is its special adaptability to the combined radio-telephone and range-beacon transmitter mentioned in section IIA, and the improved radio-telephone transmission resulting.

Installations of these antenna systems are being made at 46 range-beacon stations. The 4 vertical antennas are insulated, self-supporting, steel towers 125 feet high. These towers are in most cases located on the corners of a square measuring about 420 feet on a side. The transmission lines supplying them are lead-covered cable, buried underground.

A limitation upon the radio range beacons which has not yet been overcome is the existence in certain places of bent and multiple courses. These phenomena have been found only in mountainous regions. Studies by the Aeronautics Branch indicate that they are due at least in part to reflections from mountainsides. They are the same whether loop antennas or T-L antennas are used at the beacon transmitting station. The anomalies remain fixed in position, not changing with time. Studies have been carried on principally in the vicinity of Los Angeles where the largest anomalies have been found. Tests in this vicinity have covered such points as the following: Variation in severity of multiple-course effects with respect to height of airplane; variation in severity with respect to location of the range-beacon station's position in regard to surrounding mountain ranges.

It was found that the multiple-course effect was essentially the same at all altitudes, but there was some evidence that at the lower altitudes they are possibly not quite so severe. The location of the range-beacon station in valleys, flat country, or on high plateaus seemed to produce no appreciable change in severity of the multiple courses. Moving a portable range-beacon around several miles at a time also seemed to have no effect, it apparently being impossible to reduce these multiple-course effects by moving the range-beacon to any position in a given region. In all cases observed, except one, the multiple courses were within a fairly narrow zone. This exception was found when flying the Saugus range-beacon, evidence of a course being detected 26° off the main course. This course was very sharp and so ragged that it could not be followed.

A simultaneous aural and visual radio range beacon has been developed. Tests were carried on at College Park, Md., and Harrisburg, Pa., by the Aeronautics Branch. The transmitter provides both types of beacon signals simultaneously, so that either type of indication or both may be utilized at will. The receiving equipment required on the airplane comprises the regular medium-frequency receiving set, the regular headphones and visual indicator, and a very simple filter unit. The filter unit relieves the pilot from hearing the continuous tones associated with the visual signal. The system requires no added attention or manipulation by the pilot.

Pilots using the radio range beacons sometimes feel a lack of certainty as to which quadrant they are in, but this feeling diminishes as they accumulate experience. However, a positive system of quadrant identification has been devised by the Aeronautics Branch, applicable to the visual type beacon using the T-L antenna system. By adjusting the radiation pattern of the antennas to cardioids rather than circles, and using brief dot signals, all ambiguity of position is eliminated. This work is still in a research stage.

IV. LANDING AIDS

Research on this subject has been materially advanced since the second report of the committee. A complete system of radio aids for blind landing was developed by the Aeronautics Branch in research extending over the past 4 years, and has recently been demonstrated to the public in a series of completely blind landings under practical operating conditions.

This system gives position in all three dimensions—lateral, longitudinal, and vertical—which is the information that the pilot must have to make a landing. Lateral position is given by a runway localizing beacon, longitudinal position by marker beacons, and vertical position by a landing beam.

Work on this research project was divided into three stages, the first of which consisted of fundamental experiments and research to develop the basic component parts of the system, including the runway localizing beacon, marker beacons, landing beam, and suitable radio receiving and indicating apparatus for use in the air. The second stage consisted of the practical development of these component parts, fitting them together to form a complete system and finally demonstrating the practicability of the system through the medium of an extensive series of hooded landings, conducted by the Aeronautics Branch at its experimental flying field at College Park, Md. The third stage of the development, which involves the testing of the complete system experimentally under the conditions obtaining at a commercial airport, is under way at the Newark (N.J.) Municipal Airport where the city of Newark has cooperated in the installation of the system.

The work at the Newark airport includes fog landings as well as hooded landings. The former are of course, more representative of operating conditions. While the Newark installation is not for service use in air-passenger operations, it affords an opportunity for cooperative experimentation with air-transport operators.

This system of landing aids is so designed as to require a minimum of special equipment on the airplane and to provide maximum convenience to the pilot. It is an airport system, all of the radio-transmitting equipment being located on the ground at an airport. The lateral localizing of the runway is given by a small radio range beacon of visual type operating on a frequency in the neighborhood of 300 kilocycles. The vertical direction is provided by a landing-beam transmitter operating on about 100,000 kilocycles; this gives a radio beam which is directive in the vertical plane, and marks out a line of equal received intensity in space which is tangent to the ground and suitably curved for the operation of landing. Longtitudinal position is furnished by two marker beacons—low-power radio transmitters which give the pilot special signals, one of which he hears as he passes over a point 2,000 feet before the edge of the landing field is reached and the other is heard at the edge of the field.

The pilot hears the marker-beacon signals in his headphones. The indications from the runway-localizing beacon and the landing beam are received on a single instrument with two pointers. One pointer is vertical and tells him his position laterally, and the other is horizontal and tells him his position in the vertical

plane. By so operating the airplane controls as to keep the two pointers crossed at right angles, like the cross hairs of a gun sight, the pilot keeps the plane on the proper path of landing. When he hears the second marker beacon signal he levels off and lands. The airplane equipment includes a distance indicator and other auxiliary aids.

Many auxiliary problems have been worked out, such as the coordinating of two-way telephone communication with the other radio devices, and the provision of a monitoring arrangement for the tests of the system. Experiments have also been made to adapt the equipment for use with all wind directions. The runway localizing beacon has been successfully operated in a pit below ground level, thus permitting its use in the center of a landing area. The experience at Newark, however, indicates that in practice it may not be necessary to provide service throughout 360°. In the Newark installation the runway-localizing beacon and landing-beam transmitter are located northeast of the field, northeast being the direction of the prevailing winds during times of low visibility. Both of these transmitters are capable of serving any direction throughout a 45° sector, which is sufficient to care for the wind conditions.

A. RUNWAY LOCALIZERS

The increased reliability of the radio range beacons and the general adoption of two gyroscopic instruments, the artificial horizon and the directional gyro, by transport operators, is resulting in an increased amount of instrument flying under conditions of low visibility. Commercial air transport has begun the installation of 15-watt range beacon transmitters for use as runway localizers at a number of airports. These installations use 12-foot loop antennas fed by a transmission line. The installation permits of voice communication with the pilot by merely pressing the microphone button which transfers the input from the aural signal unit to the microphone and the output from the loop antennas to the standard antenna.

The installation has been tested as a source of power for a buried 6-foot crossed-loop antenna system to supply a runway-localizing beacon with success. It has also been tried as an airport-localizing beacon, with larger loop antennas above the ground, to aid in locating the airport when it is off the route marked by the airways range beacons. In tests, distance range as great as 15 miles have been obtained for voice signals, as great as 18 miles for the airport-localizing-beacon signals, and as great as 6 miles for the runway localizer. This installation is made up of apparatus that is commercially available.

B. HEIGHT INDICATION

For a system of landing aids at an airport, an alternative to the landing beam previously described is an audio-frequency induction system. Such a system, using a set of concentric cables carrying audiofrequency currents has been tried out by the Army.

The Army has also experimented with a sonic altimeter developed by a manufacturing company. In this device a sound pulse is transmitted from the airplane at intervals, and height above ground is indicated by the elapsed time when the echo returns to the airplane. This method gives absolute height above ground, or distance from a mountain side, independent of any auxiliary equipment on the ground.

Engineers of a manufacturing company have made successful flights with an improved sonic altimeter designed especially for low-altitude use, as for landing purposes, rather than for use during cruising conditions. An entirely new design of sound-producing mechanism is employed which obviates the use of a pressure storage tank supplied from the motor cylinder. Reception of the echo is secured by the use of a magnetophone type of pick-up with a 3-stage amplifier, thus permittng the use of standard radio headphones.

C. DISTANCE INDICATION

In a system of landing aids, a necessary element is a means of informing the pilot of his distance from the point at which he is to set the airplane on the ground. Marker beacons, consisting of low-power radio transmitters, meet this need. In the complete airport system previously described, they utilize a frequency of 10,000 kilocycles or lower, and an antenna about 2 feet high and 3,000 feet long. An alternative type of marker beacon developed for the same purpose by the Army uses a frequency of about 100,000 kilocycles and an antenna consisting of an array of doublet antennas a quarter wave length apart.

V. AUXILIARY PROBLEMS

A. ANTENNAS

Hitherto it has been considered essential that the receiving antenna on an airplane be completely nondirectional, primarily to reduce night effects and also to prevent large errors in direction indication when flying at an angle to the course in close proximity to the beacon station. The T-L antenna system developed for use at radio-range-beacon stations eliminates both types of errors without restricting the receiving antennas used aboard the aircraft to any specific type. It now becomes desirable to use a directional rather than a nondirectional receiving antenna on the airplanes. This gives several advantageous features of operation, such as superior localizing effect over a radio-range-beacon station. An antenna inclined at an angle of 45° from the fuselage back and up to the vertical fin has been found very satisfactory. Using it, there is a sudden surge of signal just after passing over the beacon, which aids considerably in localizing the station. The same effect may be obtained with the usual vertical pole antenna by adding a flat-top element from the top of the pole antenna back to the vertical fin.

A second advantage inherent in the inclined receiving antenna occurs in connection with its use on runway localizing beacons for landing purposes. Such beacons use small loop transmitting antennas; since the useful distance range is only about 10 miles, the question of night effects is not involved. The inclination of the receiving antenna introduces a directional effect which is observed when flying at an angle to the course. Upon turning into the course, an effective moving of the course toward the airplane is obtained. The reverse is true when turning away from the course. The net result is to eliminate weaving of the airplane about the course and thus to permit more accurate flying of the course.

With great speeds the aerodynamic drag of airplane antennas presents appreciable objections. Even the supporting mast must be curtailed. This problem merits considerable study.

(Continued on Page 27)

BROADCAST STATION NEWS

Mac Kenzie Reid of WOR is a canny Scot, now working on his second million. Buying himself a new home now.

C. Phelan is doing time at WEAF. Old timers will remember him for his four years with Independent Wireless.

It's claimed at WABC that Bradley Libbey is suffering from an inferiority complex, and is trying to cover it up with a superiority complex. What say, Brad?

Jack Norton at WABC has the best out known, his final is "Leaving here O.K."

The WABC champion 3.2 man is Harry Zietlinger. "More beer better or worse," is his demand.

W. D. McQueen at WEAF is an old naval op. Six years at sea, and two at NAI at Phila. will identify him to his friends.

Edward J. Content, Asst. Chief Eng. at WOR has a bad habit of saying, "Say, let me show you what I just did"—the answer is, "So, what?"

WABC's champion of better times for ops is Harry Spears with his, "Let's walk out."

Martin Stearns, at WABC is "Old pappy" to the boys. Trying to get rid of weight is his hobby.

Look out for Gifford Campbell, "On the arm" is his motto, and "Wait until next week," when it comes to paying back, to the other men at WOR.

T. G. Hahn at WEAF sports a record for you. Five years with old Marconi Co., two years marine with Independent Wireless and another six years ashore for Independent. WST, WSH, WSA and WCG were his.

Jim Swenson at WABC has an awful crush on the 18th floor reception girl at his station. Hope she don't read this and suggest a closer affiliation with Jim. Not bad, not bad, say we after looking said dame over.

Bob Trago, they claim thinks NAR should be RAT the boys claim. Why should it be that way at WABC, Bob?

Vic Pallero another WABC boy broke his toe, but hobbled about on the job just the same. Our sympathy, Vic.

Ray O'Neil WOR, went and did the double act. We hope it is something else than 5 KW bottles soon Ray.

Lots of you boys must know H. E. Meyer at WEAF. He was two years with Independent Wireless, and four years with Westinghouse station. A good fellow they say.

Dick Stewart at WABC claims he will go goofy if he does not get out of the studios. Look up, Dick, look up.

McCartney, Protzman, Livingood, Guilette, Berger, Wilson and Hatfield are the bottle boys at WABC. Just the babies of the happy Columbia family.

WOR has an Ex-Sea Captain on its staff in the person of Al Nilson. Hope you're not all at sea with your radio Al.

L. L. Lane is at WEAF. Spent a couple of years with Army Signal Supplies, one year at Naval Sonic Development, and two years as a Naval radio op. Now in Control room.

Tommy Thompson in Control room at WABC only has 120 hours to go for an air transport ticket. That is if he passes the mark when he does get it.

Walter Voss at WOR can give you some dope on getting to the World Fair cheap. An old telegraph boy, and knows the side door pullman game. Married, but still remembers.

Irving Reis is the "Lend me a Dime till pay day" boy at WABC.

Andy Poole is Night Super at WOR. A little man, but lots of stuff in his head.

Any of you fellows remember A. Horwath at WEAF. An old naval op for six years.

Sanford Helt is now at WKBF. Was formerly with WODX Mobile, Ala. How's things at Indianapolis, San?

Paul Reveal, ex marine is Asst. Supervisor Night Control at WOR and doing a good job of it.

Howard Chinn is in control room at WABC. His other part is double-chinn.

William Pearson at WABC is a broker, always broke.

Say here is one for you. Take a tip from Ralph Schlegel at WOR and get a side line. His is going to the dogs, he raises thorough bred dogs.

Bill Lodge at WABC is studying up on his technical. Go to it, Bill, you can't tell when they will appreciate it.

W. D. Van Etten at WOR denies he ever made that personal phone call. "It was company business, and I won't pay." says W. D.

Boy has WEAF got them. Here's another E. Gundrum. Naval radio for four years, but likes his new racket plenty.

J. R. Poppele, Chief Engineer, is WOR's great philosopher. No wonder after all the years he has been in broadcasting, he's daddy of them all.

Roy Briean of WABC has them all guessing. Lawyer or fibber, who knows.

Here is a boy that is up and doing, Harry Miller at WOR. Never sets still a minute. Someone will have to put a paper weight on him.

Paul Laporte is the Indian of WABC. Not a trouble man, just inherited it.

H. L. Hadden, Day Supervisor at WOR, is going to pieces. He's taken up the saxophone now, and you should hear him play.

Joe Travis is the lady-killer of WABC. "They recognize brains," says Joe.

Have you fellows got one. Bob Ward, Maintenance Engineer, at WOR can't seem to fix that alarm clock so as to get in early.

Everyone at the station wants to know where Frank Evans hangs out at WABC. They never can find him.

Poor Cyrus Samuelson at WOR, born an apprentice and thinks if it keeps up he will always be one.

Vernon Gamble at WABC wants to know if you have any telephone numbers of blondes not in use. If so put them in circulation says he, give him the number.

Next time your stuck ring Charles Kibling at WOR, the author of 1001 alibi's.

Waiting to hear from Gamblin, Singer, Rehberger, or Robinson at the Kearney, N. J. transmitter of WOR. More next time.

The 13A—A Radio Receiver for Diversified Uses

(Continued from Page 16)

stage is push-pull, which increases the stability. This amplifier may be used separately from the receiver if desired. To attenuate any disturbances or undesired signals appearing in the power supply, filters (719 A, B, and C) are available as optional equipment.

Two types of antenna tuning elements are available: the 7 type antenna tuning units for coupling distant antennas, and the 254A panel for coupling local antennas. Both are suitable for either balanced or unbalanced antennas. The tuning units are adapted to out of doors location. The tuning units and radio frequency amplifiers include means whereby the operator may, in effect, move the tuning meter on the receiver to the remotely located tuning unit and thus make the required antenna tuning adjustments with the aid of another man or of an order wire.

All of the amplifier units that, in various combinations, form the 13A receiver, employ the new dished type of panel. This construction, provides effective shielding and at the same time gives a rigid construction while employing relatively thin and easily fabricated material. In general all wiring and small components are placed on the front of the panel, where they are readily accessible for maintenance, and all large components are mounted on the rear of the panel. Metal covers form the flush front of the cabinet as shown in Figure 2, and when removed, give access to apparatus mounted on the front of individual panels, as shown in Figure 4. Studs, spot welded to the rear of the front covers pass through rectangular holes in the side lips of the panel and are drawn up from the rear, as may be gathered from inspection of the left side of the panels, Figures 2 and 4. The normal telephone selectivity is over 60 db when ten kilocycles off tune, and telegraph selectivity, about 50 db when five kilocycles off tune. The automatic gain control has a range of about 60 db for a 6 db change in output, which is ample for ordinary conditions.

Relays are provided in both the 83 and 85 type amplifiers which enable the receiver to be used in cut-carrier transmission systems. Operated through the control circuit in the local transmitter, they disable the receiver when the transmitter comes on, and restore it when transmission ceases. The action is rapid enough to restore the receiver by the time the distant talker replies. This arrangemnt allows the receiver to be operated at the same frequency as the transmitter while located in the same room with it and with antennas closely adjacent.

The back of the panel is completely enclosed by the rear cover and lid.

Standard overall sensitivity of the 13A receiver is one microvolt, or better, which, considering circuit noise and other interference, is about the maximum ordinarily usable. This sensitivity is maintained with good uniformity over the tuning range of each panel. Eight microvolts input modulated 30 per cent is sufficient for a 20 db signal-to-noise ratio. Maximum audio output is about 23 db above six milliwatts. Normal telephone fidelity is 3 db down at 100 and 3000 cycles; the upper value is cut to 6 db at 1750 cycles by operation of the band width switch. By field changes requiring perhaps five minutes, this fidelity may be improved to 6 db down at 35 and 4500 cycles. Telegraph fidelity with the peaking circuit is down 20 db at 200 and 2000 cycles referred to the 800 cycle peak.

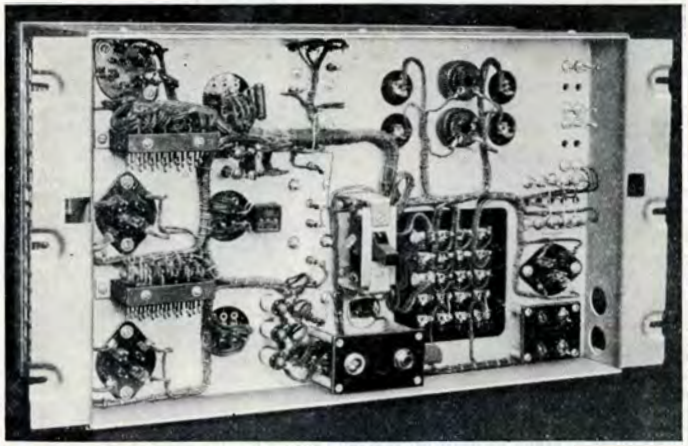


Fig. 4—Front of 85A amplifier panel with front cover removed

Careful scrutiny has been given the component parts of the receiver to insure their stability under the extremes of temperature and humidity which may be found in tropical countries, or on shipboard. Every effort has been made to insure satisfactory life and performance over an atmospheric temperature range of at least from —40° to + 120° F., accompanied by humidities up to 85%. Adequate precautions against the corrosive effects of salt air have also been taken.

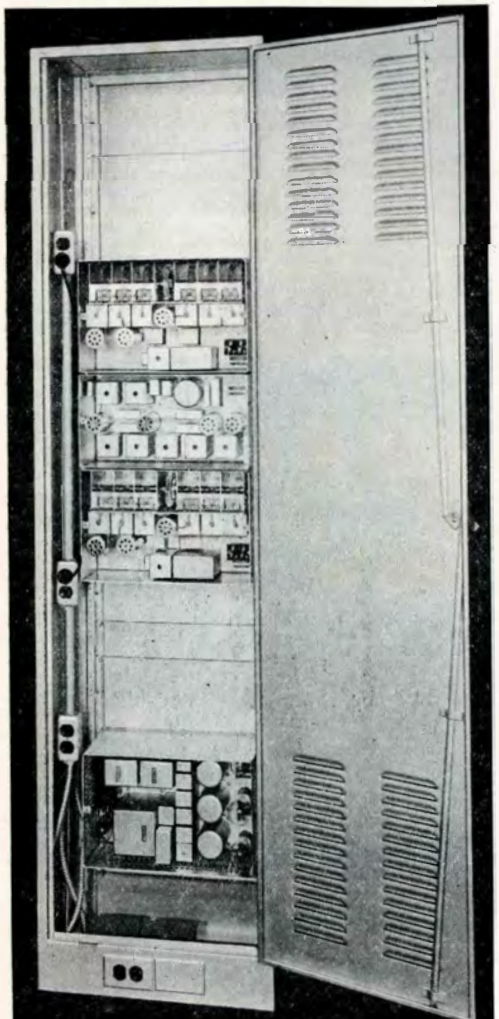


Fig. 5—Rear of 13A receiver cabinet for Tropical Radio with door open, and rear lids of units removed

Third Report of Liaison Committee on Aeronautic Radio Research

(Continued from Page 24)

As the result of increased flying operations through icing conditions, the icing of airplane antennas presents a serious problem requiring immediate solution. The seriousness of antenna icing is indicated by the fact that wires have iced up to 3 inches in diameter by actual measurement on the ground after landing. Icing results in (1) vibration of wires and mast with breakage for this reason, (2) breakage of wires as the result of sheer load of ice, (3) great drag of wires reducing speed of plane, and (4) loss of distance range of radio reception. Heating of wires by means of the generator-storage battery combination has been tried with little success in the air although ground tests were successful. The use of a rubber-covered antenna wire has been found to help some, by maintaining the insulation, but it is not a solution. The difficulty of vibration is greatly increased if bracing is applied to an antenna mast at one third or one half the distance from its point of support. In the operation of seaplanes the effect of salt spray is similar to the effect of ice, and it was necessary to cover the insulators by special compounds to prevent shorting out of the radio signals. It is recommended that research agencies equipped for such work interest themselves in the early solution of this problem.

Radio Towers Need Painting?

A leading paint research expert says that it takes only three dollars worth of paint to preserve a ton of fabricated steel such as used in radio towers, which is worth about $50.00.

While the Department of Commerce demands that all radio towers in the immediate vicinity of airports be painted, and the Radio Commissions master monitoring station uprights at Grand Rapids, Neb., are kept scrupulously clean and painted, there are many others so paint experts claim that need painting badly.

NATIONAL ELECTRICAL AND RADIO SHOW

The Electrical Association of New York is sponsoring a National Electrical and Radio Exposition, at Madison Square Garden, New York City, from September 20th to 30th inclusive.

Many of the larger radio firms are going to exhibit at this Show their new models for the coming season.

Among some of the novel attractions announced by the promoters of the exhibition are the exhibits which will be arranged by the signal corps of the Army to show the important part played in tactics of modern warfare by radio and electricity. This will be arranged under the direction of the Second Army Corps Commander.

Chief Engineer, Thomas Rochester, of the New York City Police Department will be in charge of an exhibit showing the complete workings of the short wave radio system which is used by the department.

The usual broadcasting studios so popular at these exhibitions will be there, and several local stations will arrange for programs originating in the show. Each of eleven days has been designated to some special purpose, with the first, or opening day designated "N.R.A. Blue Eagle Day."

Colon, on the Coast of Adventure

(Continued from Page 13)

and the Isthmus ceased to merit their evil reputation.

Although in Colon the weather is always hot and humid, tourists in these times find themselves in as good health there as anywhere else, while white men of various races live there year after year and do business as effectively as they would in any other tropical country.

IT STANDS FOR A WOMAN'S PRIDE
In the inscription on this statue of Columbus, given to Colon in 1866 by Empress Eugenia of France, the donor used her maiden name, and made no mention of her consort, Napoleon III.

Capital of a Shadowy Coast

Though Colon is rated as a business and shipping city, when properly classified it is the capital of the Coast of Adventure. Its contacts with white men date from Columbus, who in 1503 found shelter in Limon Bay and here spent Christmas, on his last voyage. Sir Francis Drake looked shoreward here when dying; and not far Eastward they dressed him in his armor to die like the fighter he was, and buried him at sea, off Puerto Bello, to the roll of drums, the wail of brass and the thunder of minute guns.

Early voyagers to Limon Bay found the site of Colon a marshy island, with the natives living in trees. Let us take the testimony of Columbus, who having run into bad weather, found shelter in what undoubtedly was Limon Bay. He wrote in his journal:

"It was like a great bay, where we rested three days, and going ashore, saw the inhabitants dwell upon the tops of trees, like birds laying sticks across from bough to bough, and building huts upon them rather than houses . . . for fear of the griffins that are in that country."

The griffin, one should know, was an horrific animal of the ancient Greeks, with the beak and wings of an eagle, and the body and legs of a lion. Columbus does not say that he ever saw one.

In the three centuries after Columbus, many adventurous white men came into the bay of Limon, and more than one furtive craft cast anchor for a time off Toro Point, to issue forth when the hour arrived for action, under the black banner of the corsair. Here the ships of Morgan's buccaneers made their rendevous for the attack on Fort San Lorenzo, at the mouth of the Chagres, which cleared the way for their march on Old Panama.

Where Clouds Have Birth

An indelible first impression of Colon is to be received in early morning, as your ship from the North slips silently in the grey half light through a gap in two long stone breakwaters into the broad, glassy waters of Limon Bay. On the right will be the bright eye of Point Toro light, at the top of a tall and slim white crayon rising from the greenish-black base of jungle-clad shores.

On the left will lie Colon, first visible as white triangles and cubes of buildings embedded in foliage.

As the dawn spreads its pink color wash over the dim sky ahead, wisps and scarves of fleecy mist will appear on dark and distant mountain slopes, where every hollow seems filled with downy cotton. Soon, when the tropic day shall have banished the last shadows of the night the sun will gather them into legions of pearly clouds, and marshall them on a field of the purest blue. From the land beyond Toro Point will come off a pungent odor, the unmistakable smell of vegetation, from steaming swamps where millions of roots lie steeping in tepid water; from the mangrove bush along the ooze of the shores; from flowering trees and shrubs in the green uplands—a blend of odors that is the concentrated, typical essence of the tropics.

PROMENADING ON BROADWAY
The wood awning, or roof, over the wide sidewalk, is typical of Colon. Here toward evening one meets slim brown girls, out for a stroll, who walk with a grace that might be envied by the fairest of their white sisters

Your ship will slow down to berth at a long modern pier. White men in linen suits, black roustabouts, trucks, motor cars, piles of freight—here will be the familiar symbols of a busy port, breaking the spell of the tropic dawn, and introducing to you the realities of Colon.

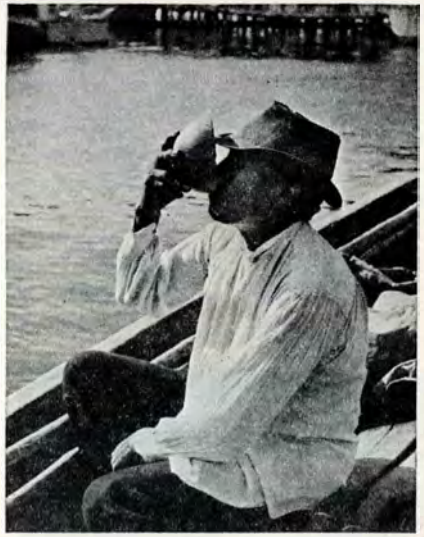
One Cruises About Colon

From the pier a modern motor car will take you through the vacant morning streets to the Washington Hotel, where the cool shower bath, the rising trade wind coming through the open windows, and the tiled cleanliness of your bedroom floor make you feel that tropical travel is not without its compensations.

Later you may begin your explorations of Colon by a leisurely drive around the town in an ancient caramata, or one-horse victoria, driven by a soft voiced West Indian negro, with a strong English form of speech. "I'm from Barbados, marster," said Felix, our caramata man. "Yes 'arf my life I was there, marster; 'arf my life."

In the Cristobal section are many shipping offices, banks, and all the equipment of a port. Near the old foreshore of the town runs the Panama railroad, coming to a dead end at the passenger station, with a stone freight shed beyond bearing on its front the date 1856. Back of the rails is the front street, lined with shops, kept for the greater part by Hindoo merchants. They deal in tinsel, and live on the trusting tourist.

Within the city in orderly array are right angled streets, wide and open to the sun, except for fixed wood awnings over the broad sidewalks. Through the centre of the town—once the outskirts—is a fine new avenue, with a parked centre, known as Broadway. Beyond it lies a modern residential section, New Cristobal, with bungalows, villas and apartment houses, all in the latest style.



AN INDIAN FROM SAN BLAS GULF
He wears his shirt outside and is not fussy about his hat, but he is a first-class sailor man, and comes up on the open sea, from his home 70 miles away, in a boat shaped from a trunk of a silk cotton tree.

A Statue With a Story

In the centre of Broadway, toward the bay end of the street, is a locally famous statue to Columbus. It represents the Admiral of the Indies pointing out to a shrinking Indian maiden the glories of European civilization. Old visitors to Colon have seen the statue often, and in different places. It stood first in the French reservation —now Cristobal—near the entrance of the French canal, before Count de Lesseps' house. When the Hotel Washington was built the statue was removed to a prominent spot on the hotel lawn, between the house and the sea wall. Here it stood until about two years ago, when the people of Colon, exercising their right of ownership, moved it to its present appropriate site.

At first glance there is nothing particularly striking about the statue, which is a fair example of the sculptor's art of the last century. Study of the lettering on the base suddenly opens a chapter of romance. It is as follows:

HE'S A LIBERAL SCOT

Andy Johnston, Scotch manager of the Stranger's Club. There is a local tradition that he once gave away a bottle of liquor. Be that as it may, he has made the club the social centre of that section of the Isthmus of Panama.

Al Immortal
Descubridor del Nuevo Mundo
Donada a la Ciudad de
Colon
Par Eugenia de Montijo
Emperatriz de los Franceses
MDCCC
LXVI

"To the immortal discoverer of the New World . . . given to the City of Colon," conventional phrases. But, "By Eugenia de Montijo Empress of the French, 1866."

These last few words open a broad and intriguing field of speculation. Why did Eugenia choose here to employ her maiden name, with the Spanish form, Eugenia? Why no mention of her consort, the Emperor Napoleon III? Why such a gift to a then obscure Isthmian city, long before the French had embarked on their ambitious and ill-fated attempt to join the Atlantic and Pacific by a Panama canal?

Monument to a Woman's Pride

Search of the many biographies of Eugenia fails to provide specific answers to these questions. None of the biographers mentions the statue. But between the lines one may read the fact that this is a memorial to the wounded pride of a woman.

The use of Eugenia's maiden name on this statue points to a crisis in the life of the beautiful young Spaniard whom Napoleon III had married for her beauty. She had devoted herself to her new station, but had been unable to correct the irregular habits of her older husband, whose indiscretions had led to a complete severance of the couple's conjugal relations. In 1866 Eugenie was a wife in name only, though still an Empress—a fact that she subtly conveyed to posterity when she approved the wording for this statue of Columbus.

Why, we ask, should such a gift have been made? At that time Ferdinand de Lesseps was bringing to a successful conclusion the building of the Suez Canal, and was already dreaming of the conquest of the Isthmus of Panama. As yet his new plans had not been matured or confided to the public. De Lesseps was a favorite cousin of Eugenie, and there is little doubt that he had conveyed to her his ambitions for Panama, long before the completion of his work at Suez. If his plans for Panama were to take definite shape, concessions must be secured from the government of Colombia, which then held the Province of Panama. What could be more adroit in the way of political spade work in preparation for negotiations than such an appropriate and poetical gift from the beautiful Empress of the French to the people of Colon?

The statue was set up at Colon in 1868, one year before the Suez Canal was completed and opened with great eclat by Eugenie, as representative of the French people.

Down by the Old Wharves

On the bay front, not far from the railroad station, one may see the remains of some of the earlier wharves of Colon, where the New York steamers landed their passengers for the rail trip to Panama City. Sticking out of the tide are blackened iron pillars and the uprights of a steamer's engine—attesting the destruction of pier and ship by fire, many years ago.

One smells old legend in these ruins of ship and pier. The steamers that tied up here were of the side wheel type, and from 1000 to 2000 tons register. Fast for their size, they made the run from New York in little more than a week.

Most passengers landed at Colon hurried away to Panama by the first available train, to catch a ship for California. The rail fare was $25 for a ride of 36 miles. Little wonder the railroad paid fabulous dividends in its first years, or that its officials lived like rajahs.

With the Little Traders

At various points along the old waterfront of Colon one comes upon reminders of earlier days and ways. The Indian from the San Blas gulf still comes up to town, a good seventy miles on the open sea, in a boat shaped from the trunk of a single silk cotton wood tree, and moors his craft beside the smart launches of local yachtsmen.

One of the remaining old piers is a landing place for the little trading schooners that come under sail from distant bays and islets, bringing cocoanuts. Their crews are brown men. It is pleasant to loaf about the dim shed and watch these children of nature at work and play. At twilight comes rest from the labor of handling cargo, and with it skylarking on the pier, with informal wrestling matches and perhaps a snatch of cumbe with some sloe-eyed damsel who has come down from the town for a little visit.

Interesting and capable sailormen handle these little traders; types that would arrest attention anywhere. To see a tawny young skipper, with kinky hair, blue eyes and a cockey accent, excites no comment here. There are plenty of such offspring of white fathers up and down the coast of Darien.

Diversion, Polite and Otherwise

As evening approaches, it is in order to drop in at the Stranger's Club for the cocktail hour. Here local fashion may be assembled on the balcony overlooking the bay, the young women all slimness and polite undress. Tables are low lighted. The sea gently laps the stone wall under the club house, and the day's dying trade wind comes faintly off the water. From the adjacent bar comes a steady hum of men's voices, and an occasional laugh.

Exotic, thinks the visitor; yet strangely lonely after all, when one looks out across the empty bay in the gathering twilight, and sees a rusty old tramp steamer pushing warily up the channel to the Canal entrance. No cocktails for the men on that old iron pot's cramped bridge; but what would they not give for a night ashore among the bright lights of Colon, that now are twinkling in a long sparkling line along the water front and up the straight side streets?

Take a walk and come about nine o'clock to Tenth and Bolivar streets, which is the center of the town's night life (and day life, too, for that matter). As yet the curtain has not gone up for the night's show. In a garish cabaret upstairs the hostesses, fragile blondes in the main, wearing modish long dresses, very low at the neck—are gathered in knots waiting for the band to strike up and the night's first customers to appear. There is a good dance floor, and a full bill of food and drink offerings. Should one eat a hearty meal here, he would pay a mighty check, for Colon is not a place for cheap food.

One observes an orderly air in the cabaret, that is run by a man who drinks plain soda and keeps a yacht. The girls are chiefly Americans, brought down from New York on contract and under bond. They are filling a business engagement, and conduct themselves accordingly. The tourist here for a night sometimes is surprised at the adroit coolness with which his hostess repels his advances, while still urging him to be good to himself in the matter of drinks. After the night's work is over she goes back to her hotel room, and when her contract is up she goes back home.

Bright Lights That Grow Dim

Out on the street there rises a discord of music, some distant, some nearer at hand; the twang of banjoes, the rattle of hard pianos, the raucous blare of uncontrolled radios suddenly turned on, spilling into the night air the hideousness of discordant native song. In the street a sweeper silently pads around with brush and shovel. He is a Hindoo, wearing his caste turban. Beside a pillar a negro mendicant is

patiently picking a mandolin, unheard above the street din. American sailors and marines in uniform march noisily by, each with a girl hanging to his arm.

Peddlers cry their wares; drivers of autos and horse carriages solicit business. Parties hire cars for a ride, and derive much satisfaction from the lavish decorations of the vehicle. It may be a Packard or a Lincoln, but its manfacturers would scarcely recognize it, with its white seat covers, pale blue body with red and white stripes, nickel plated horns and bugles, plates of automobile clubs, and what not. "The more stuff they hang on a car the better business they do," said my host of an evening.

All night the district of the white lights does business. In some of the cabarets, lithe honey-colored wenches dance with snake-like movements, lewd and unabashed. In the lower priced places much beer flows.

But there is such a thing as too much beer, and too much nocturnal joy, even in Colon. If by chance you drive in the rain of the early morning through empty Bolivar Street, en route to a pier, you may see in the half light of dawn a cabaret open to the street, with a single bartender wearily wiping sour beer from a great semicircular bar while the only customers left, a sailor and his girl, are leaning against the hand rail, she drooping beside him with an arm about his neck, and both asleep on their feet.

Around the corner, over the rusty old sheet iron buildings that were part of the French canal plant, the sun comes up through a haze of powdered gold between rain clouds; a ship leaves her anchorage and moves off toward the Gatun Locks, and the day begins for Colon.

Radio Manufacturers Active

The Radio Manufacturers Association, with Earle Whitehorne as Campaign Director have launched a Radio Progress Week campaign which will be carried on by radio dealers, servicemen, manufacturers, and others in the industry between the dates of October 2-7. Posters for dealers' windows, letter seal stickers, newspaper advertising material for local campaigns, are some of the material furnished. This material may be had by anyone in the radio business by addressing, Radio Manufacturers Association, 330 West 42nd St., New York City.

Press Wireless Requests Rejected

The Federal Radio Commission on July 28th, turned down the requests of the Press Wireless, Inc., for radiotelephone press service stations at Hicksville, N. Y., Chicago, Ill., and San Francisco, Cal., and construction permits for special experimental station at Elgin, Ill., and a license for operation of a multiple address radiotelephone station at Chicago.

In reviewing this the Commission justly calls attention to the fact that in April, 1931, permits were granted for the construction of 19 stations for point to point telegraph stations. Since then the applicant abandoned seven of the permits, and only two of the stations authorized have been completed.

Newly painted bottoms in the Bay State Fishing Company's shipyard indicate there will be additions to the fishing fleet shortly. And by the time this is in print the Mystic Steamship Company will have put back into service several of its tied up collier fleet.

* * *

After a lengthy leave of absence necessitated by illness in his family, Ray Downing is back to work on the trawler Ocean.

Measuring Antenna Resistance

(Continued from Page 10)

R for the lower or ground lead point can be readily calculated.

(B) The circuit of Figure 1 may be used in the manner depicted by the dotted lines of Figure 2. The tank of Figure 2 should be short circuited but otherwise left the same as in normal operation, the transmission lines if any being connected as usual. Thus the effects of electrostatic capacities are taken into effect. This method is slightly in error because the resistance of the permanent antenna coupling coil and series condenser and also certain other errors enter in, thus method (A) is preferred.

Conclusion

Measurements made in accordance with the procedures outlined above should be consistent and accurate within several percent. Common values of antenna resistance are 20-25 ohms case the antenna is operating at its fundamental when the antenna is wavelength long (in which frequency), 35-70 ohms when 3-8 wavelength long, 250-500 ohms when 1-2 wavelength long, and 100-150 ohms when 5-8 wavelength long. If the effective length of the antenna in wavelengths is not known it can be found by determining the fundamental frequency (as explained above for finding the resistance at the fundamental). Then multiply ¼ by the ratio of operating frequency to fundamental frequency; the result is the effective length expressed in wavelengths.

Sometimes it is desired to operate a broadcast station at a lower plate efficiency than specified by the Federal Radio Commission. This desire may be based on the lower distortion frequently obtainable at lower efficiencies particularly in Class B radio amplifiers, or on other considerations. For operation at a lower efficiency the output power is measured by the "direct" method, necessitating the forwarding to the Commission of complete data in affidavit form regarding the antenna resistance. In such case the procedure outlined above for measuring resistance is acceptable and should be used. Report No. 3043 of the Commission should be referred to for information on the required accuracies of the instruments and on the exact form in which the data must be presented.

Fast Working and Enthusiastic Commissioner

The Federal Radio Commission recently announced that between July 1 and August 7, Commissioner Harold A. Lafount, who was appointed from the Fifth Zone, which is the Western and Pacific States, in eleven States, covered 36 Cities "Conferred with 107 broadcasters, 69 licensed operators, 44 program directors, officers of 12 amateur organizations and with 34 individuals who were contemplating filing applications for permits to construct and operate broadcasting stations." Along with this he held conferences with several manufacturers and distributors of radio equipment and local officials of radio communication companies, inspected a number of transmitting plants, visited 9 police radio stations, conferred with representatives of Teachers' and Parents' Organizations, numerous listeners, Welfare Organizations, Chambers of Commerce, Commercial Clubs, Breakfast Clubs, and Advertising Agencies.

He returned, "loud in his praise of the equipment used," "enthusiastic over the work being accomplished by police radio stations," and "more enthusiastic than ever before over the American radio system." Who could ask for more?

International Brotherhood of Electrical Workers

Address all communications for International Brotherhood of Electrical Workers, Radio Division, to: Mr. Thomas R. McLean, Special Representative, International Brotherhood of Electrical Workers, 1200 Fifteenth St., N. W., Washington, D. C.

The three Police Department Radio Stations in Chicago have recognized the Radio Division of the I.B.E.W. an dare paying union wages.

We are grateful to those who sent in their names with authorization to represent them at the forthcoming Broadcasting Code hearing. Some time in the near future you will be glad to have the backing of this powerful Brotherhood. We are in Radio Division to stay—and grow.

If by the time your CQ reaches you the Broadcasters have presented their Code at least you will know that you had the backing of the best and most experienced Labor-legal talent procurable in this wide United States.

Regardless of what you hear to the contrary all the best and biggest labor organizations are affiliated with the American Federation of Labor—United we stand—divided we don't eat!

To those of you who have as yet been backward in this matter of having your case represented let me say but one thing—you are a millstone around your brother operator's neck, so get along. Hand your copy of CQ around and you'll help circulate an increasingly popular little magazine; also spread the news that a radio operators A. F. of L. union has been doing things for the broadcasting operator for **seven years.**

Only the gloom of old man depression has stood in the way of our growth but now we see daylight again. Let's get going and sign up a few more employers thanking our lucky stars and our farsighted President Roosevelt for making progress possible under NIRA.

The I.B.E.W. has been in existence since 1891 and has been affiliated with the American Federation of Labor since that time. It is capable of working out the radio man's problems and pledges its facilities, resources and experience to that end. Your support is needed to bring about a full realization of your rights under NIRA.

The second and fourth Thursdays of every month have been set as the meeting nights of radio men in New York City. The place is the Union Church, 233 West 48th Street; the time, midnight.

At their last meeting the New York members appointed a committee to prepare a set of working rules along the lines of the rules in force in St. Louis and Chicago.

The response to last month's appeal for news among I.B.E.W. radio men was most gratifying. We heard from members in Buffalo, Detroit, Akron, Lincoln, Houston, St. Louis, Kansas City, Chicago, Fort Worth and many others. That's the right spirit! We need a lot more like that.

We cannot emphasize too strongly the necessity of radio men throughout the nation availing themselves of their privileges granted to them under the National Industrial Recovery Act. If ever there was a time to think about organization, that time is now! And there never was a better time than the present to do something about it.

Most of us remember the unpleasant experience we had with the URTA. Some of us have had distasteful relations with other organizations started and carried on for the personal gain of the organizers. The I.B.E.W. is not interested primarily in your dollars. We need your moral support now more than anything else.

Your name and address on a postcard authorizing the I.B.E.W. Radio Division to represent you at the hearing of the Broadcaster's Code is a step in the right direction. No other expense is involved.

W. J. Keller of KMOX, St. Louis, is doing fine work through his articles in the Electrical Workers Journal. We expect to see him break into CQ not later than next month's issue.

Jersey City, N. J., may have only two broadcasting stations, but it is the second city in the U. S. to recognize I.B.E.W. radio men one hundred percent.

James J. McCafferty formerly of the Columbia Broadcasting System has gone back to WMCA as Chief Operator. Another former Columbia engineer to join this up and coming station is Gunard C. Hagberg.

Radio station WCFL with transmitter on Navy Pier and extensive studios in Furniture Mart Building was the first Broadcasting Station in Chicago to recognize our organization and to pay union scale of wages, which is $60.00 per 48 hour week. This wage scale is also in effect in all radio stations in St. Louis.

We are warning all broadcasting operators against the evils of the company union idea which has been going around lately. The idea being to have a committee of operators meet with their own employers for the purpose of settling difficulties and improving working conditions. Oh yeah! ask too much and lose your job! We've been through the mill ourselves.

The treatment given the airway operators ought to be a good lesson to unorganized operators.

V. W. O. A. NOTES

A Few New Members

Hoyt S. Haddock, President of the American Radio Telegraphists Association, joins as an Associate member. He was formerly on the staff of WPA down Texas way.

Edward Hamel, who has radio operated for Radiomarine, Mackay and Tropical since 1928, becomes an Associate member.

Oscar Oehmen, who received Commercial License No. 249 on April 10, 1912, the first year of issue, joins as a Veteran and automatically becomes a member of our 21 year group. He is now on the mail boat, President.

Irving L. Kaufman signs up as a Veteran and a member of the 15 year group. His operating assignments include the SS Presidents Hayes, Monroe, Taft, McKinley, Johnson, and Hoover.

Benjamin G. Tempest joins as a Veteran member. His assignments include 9 years on Morgan Line Ships, Shipping Board Ships for a short spell and some few months with the A. T. & T. Company.

BARGAINS

New Low Prices
ARMY AND NAVY
RADIO SURPLUS

Just bought 70 of these from U. S. Navy and you can have them at ¼ of Navy's cost. Our price $25.00

New Westinghouse Generators

Used either as Generator or Dynomotor
Fil. Volts 6.9. Plate Volts 400-500
Fil. Amp 3.75 Fill M. A. 250
Complete with filter 9-16" shaft, 3" long, weight 30 lbs.

NEW—Edison Storage Battery Type BB-1, 10 volt, 37 amp., contains 7 cells. Complete in steel portable case $15.00

Holtzer - Cabot "Mike," Utah type, carbon granular transmitter. As illustrated. $1.00

Voltmeters, D.C. portable new Weston model 45, 3 scale 0-3-15-150 guaranteed ¼ of 1% accurate $40.00
Ammeters, D.C., portable, new weston model 45, 3 scale 0-1, 5-15-150 with 3 scale external shunt and leads ¼ of 1% accurate $30.00

Condensers, Mica, op. volts 12,-500 cap. .004
Dubilier, new $7.50
Dublier, used 5.00
Wireless spec., new 5.00
Wireless spec., used 2.50
Condenser, Dubilier, mica, volts 40,000, cap. .0012-.001-.0008 or .003 .....$10.00
Condenser, Dubilier, mica, op. volts 8,500, cap. .004 ....$5.00
Condensers. Dubilier, mica, op. volts 8,500, capacity .0004 mfd. $5.00
Condensers, Murdock .002 mfd. 5000 volt $1.00

U. S. Navy Oxidised Brass Masthead Lights (clear) 15 inches high overall, 12 pounds. $7.50 each

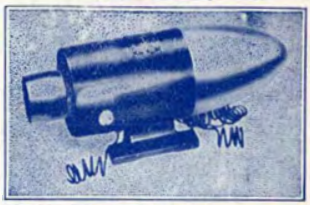
EDISON STORAGE BATTERIES

ALL TYPES
1.2 VOLTS PER CELL

A-4	Amps. 175.	Per cell	$3.50
A-6	Amps. 225.	Per cell	4.00
A-8	Amps. 300.	Per cell	5.00
B-4	Amps. 90.	Per cell	3.50
M-8	Amps. 11	Per cell	1.00
L-40	Amps. 25.	Per cell	1.50
J-3	Amps. 37.	Per cell	3.00

NEW LOW PRICE

Dynamotor 32/350 volt, ball bearing, 80 mills. Special $9.00. Per pair $15.00
Western Electric Switchboard C.W 928. Control board for Dynamotor System C.W. 927. Consists of starting switches, fuses, 0-50-500 volt voltmeter with switches for testing main lines and output. Also contains complete filter system. Very special $8.00



Navy Aircraft Dynamotor, Gen. Elec. new, 24/1000 volts, 1 amp., extended shaft with pulley, can be driven by motor, or propeller, giving 24 volts output for filament and 1000 volts for plate or driven by its own input of 24 volts. Value $250.00. Our special price $50.00

MOTOR GENERATORS

120 d.c., 110 or 220 a.c., 500 cycle, 250 watt $30.00
120 d.c., 110 or 220 a.c., 500 cycle 500 watt .....$40 to $75.00
120 d.c., 110 or 220 a.c., 500 cycle, 1 kw. .....$75 to $100.00
120 d.c., 110 or 220 a.c., 500 cycle 2 kw .....$50 to $150.00
120 d.c., 110 or 220 a.c., 500 cycle, 5 kw .....$95 to $250.00
120 d.c., to 20 d.c., 2 kw ..$60.00
120 d.c. to 400 d.c. 2 kw ..$45.00
120 d.c. to 600 d.c. 2 kw ..$65.00

GENERATORS

110 volt a.c. 900 cycle self-excited 200 watts $10.00
165 volt a.c. 600 cycle, self-excited 250 watts $15.00
110 volt a.c. 500 cycle, self-excited 250 watts $25.00
1500 volt d.c. 660 mills, 1 kw. Esco 1750 r.p.m. $45.00
240 volt 500 cycle, self-excited 2500 r.p.m. 250 watt, (also hand drive) $25.00
120 volt d.c. 5 kw 60.00
120 volt d.c. 20 kw 115.00
600 volt d.c. 2 kw 45.00
220 volt a.c. 500 cycle 1 kw 45.00
220 volt a.c. 500 cycle 2 kw. 60.00
12 volt d.c. 60 amp 15.00
12 volt d.c. 33 amp. 7.50

DYNAMOTORS

24-750 volt Gen. Electric 200 mills $27.50
24-1000 Gen. Elec. 1000mills 50.00
24-1500 Gen. Elec. 2½ kw. output $95.00
12-350 volt 80 mills 18.00
12-750 volt 200 mills 30.00
32-350 volt 80 mills 9.00
32-300 volt 60 mills 7.50
Dynamotor Armatures. General Electric triple commutators, d.c. 24/1500 volt $12.50

Largest Radio Electric Supply House in U. S. on Army Navy Surplus. Postage and deposit of 20 per cent. required on C. O. D. orders. No orders shipped for less than $1.00.—WE DO NOT ISSUE CATALOGS.

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