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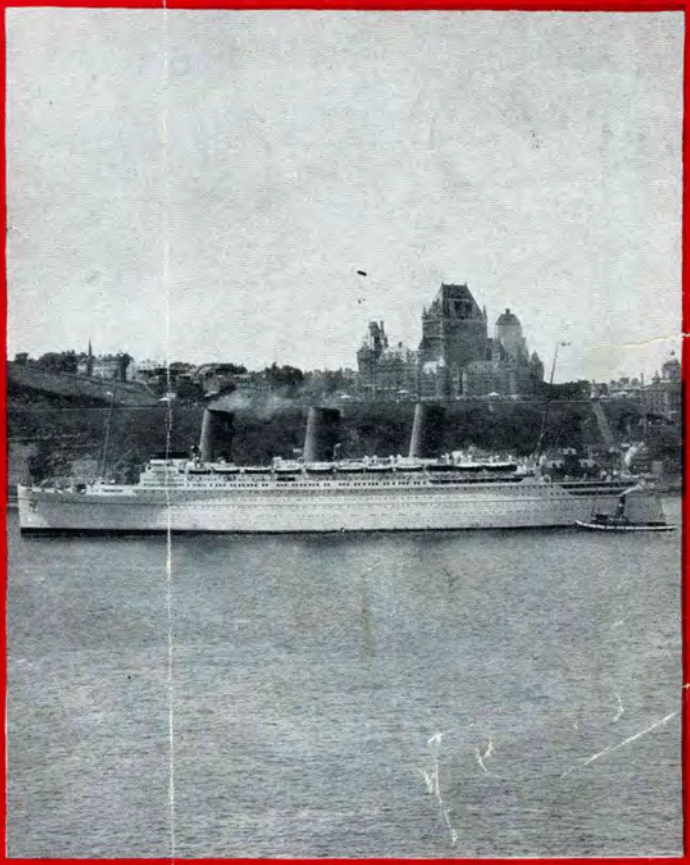

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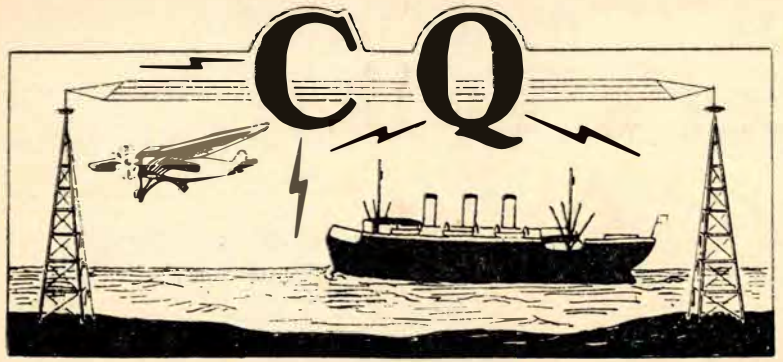

THE COMMERCIAL RADIO MAGAZINE

The ONLY Magazine in America Devoted Entirely to the Commercial Radio Man.

Published Monthly by CQ Magazine Company, 112 West 13th Street, New York, N. Y. Yearly subscription rate $1.50 in U. S. and Canada; $2.00 foreign. Make all checks, drafts and money orders payable to the Company. Single Copies, 15 cents.

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

VOL. II **MAY, 1933** **NO. 9**

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OPERATOR "J"

By STEPHEN KOVACS

Vice-President A. R. T. A., Member of V. W. O. A. and Institute of Radio Engineers

When we consider resistances in series the total resistance of the circuit is equal to the sum of the resistances, but when the resistances are in parallel we find that we must operate with **Conductances,** that is, adding the conductances of the parallel branches. Conductance is

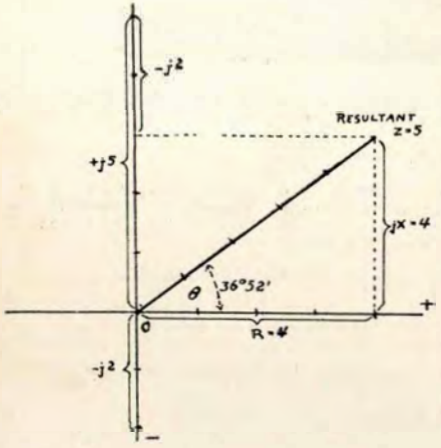

DIAGRAM 1.

the reciprocal of resistance therefore the total resistance of the resistances in parallel is equal to the reciprocal of the total conductance.

Using G for conductance and R for resistance, their mathematical relation is expressed; $R = 1/G$ and $G = 1/R$.

Then if we have R_1 and R_2 the conductance of R_1, that is $G_1 = 1/R_1$ and $G_2 = 1/R_2$ and the total conductance $G = G_1 + G_2 = 1/R_1 + 1/R_2$, therefore the total resistance is equal to the reciprocal of this; that is:

$$R = \frac{1}{1/R_1 + 1/R_2}$$

In A.C. circuits we have impedances to deal with, which are made up of resistances and reactance (inductive and capacitive reactances). In series we operate with impedances, and in parallel groups we operate with the reciprocal of the impedance, **Admittance,** and the reciprocal of reactance, **Susceptance.** The similarity of solving D.C. and A.C. circuits ends here, this is because impedances and admittances cannot be added in the simple manner resistances are handled.

Supposing we have an A.C. circuit which contains only resistance, the resistance would offer an opposition to current flow without affecting the current-voltage relation, but if we assume a circuit containing capacity alone we find that the current would lead the voltage by 90°, this is evident when we consider that at the beginning of the cycle the capacity is entirely discharged and offers no resistance to the current so that at this point the current is maximum while the voltage is just beginning to build up from zero. As the capacity is getting charged it offers more and more opposition to the current flow and its rate is decreasing, while the voltage is building up reaching maximum when the capacity is completely charged and current flow is minimum. However, there is always some resistance present in the circuit, so that at the beginning of the cycle when the voltage is minimum the current cannot be maximum, and will reach maximum only when the voltage is built up to some certain point where it can overcome the opposition of the resistance. This means that the current can never lead the voltage by the full 90°, that is, the resistance has a tendency to keep the current and voltage in phase, therefore it is evident that the effects of the capacity reactance and the resistance are 90° apart.

Again assuming that we have an A.C. circuit which contains only inductance we find that the current will lag the voltage by 90°, because when the voltage is building up in the inductance the magnetic lines of force expand from the middle of the inductance cutting the inductance itself and setting up an E.M.F. which is exactly equal and opposite to the E.M.F. generating it, so the voltage is built up to maximum, but no current is flowing, but when the voltage begins to decrease the magnetic lines of force collapse back toward the center of the conduct-

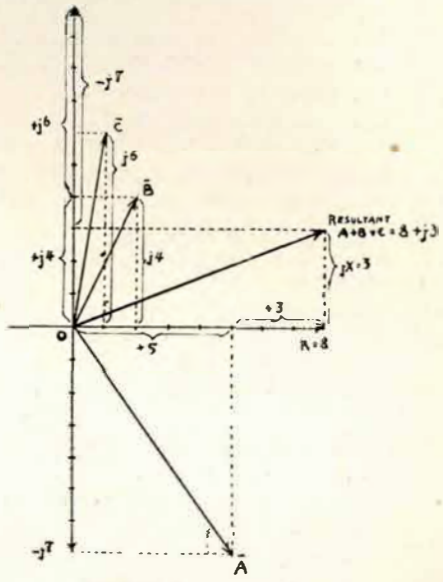

DIAGRAM 2.

or and the E.M.F. thus generated is in the same direction as the generating E.M.F., and therefore current begins to flow when the voltage begins to drop from maximum. In other words the current lags the voltage by 90 degrees. In summing up; we have the Capacity reactance X_c causing the current to lead by 90°, the Inductive Reactance X_L causing the current to lag by 90°, that is, the effects of the capacitive and inductive reactances are exactly 180° while the resistance R, tends to keep the current in step with the voltage and therefore its effect is 90° from either capacitive or inductive reactance.

This is shown graphically on diagram 1. The resistance lies along the horizontal axis (abscissa), towards the right from the origin O, while the reactances lie along the ordinate; the inductive reactance above the origin and the capacitive reactance X_c below the origin. On this diagram we have an inductive reactance X_L of 5 Ohms, a capacitive reactance X_c of 2 Ohms and a resistance of 4 ohms given; they make up the impedance Z. To find the total impedance; we know that X_L is exactly opposite to X_c since $X_L = 5$ and $X_c = 2$ then $X = 5 - 2 = 3$ Ohms and X_L predominating. then we have only the inductive reactance of 3 Ohms and the resistance R of 4 ohms to deal with, as marked on diagram 1 by X and R. We observe that R and X form the two arms and Z the hypotenous of a right triangle, therefore $Z = \sqrt{R^2 + X^2}$;

in this particular case; $Z = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5$ Ohms, and $\tan \ominus = X / R = 3/4$ which is the tangent of angle 36° 52'. It is evident that Z cannot be expressed by giving its magnitude only; but it is necessary to give the angle it makes with the horizontal axis, or by resolving it to X and R, therefore impedance is a **complex quantity.** Admittance is also a complex quantity. When complex quantities are added, subtracted, multiplied or divided they are handled as **vectors.** Currents and voltages are **vector quantities** and are also handled as such. They are usually expressed giving their magnitudes and the angle the make with the reference axis (horizontal) in a positive (counterclockwise) direction.

Vectors may be added, subtracted, multiplied and divided by the used of trigonometric formulæ, but when more than two vectors are handled this method becomes extremely cumbersome and impractical. A far simpler method is the **vector algebra.**

In this paper we will refer these complex quantities to **rectangular coordinate axes** as shown in diagram 1 resolving the complex quantities to their components along the horizontal and vertical axes. Thus the impedance in diagram 1 will be expressed $Z = R + X$, or in this particular case $Z = 4 + j3$. The operator **"j"** is used to indicate that the component 3 is along the vertical axis, that is the vector 3 is revolved 90° in a positive direction from the axis of reference. The horizontal axis is called the **"axis of reals"** and the vertical is called the **"axis of imaginaries."** Although the values along the vertical axis are just as real values as are those on the axis of reals, it is called the axis of imaginaries because of the mathe-

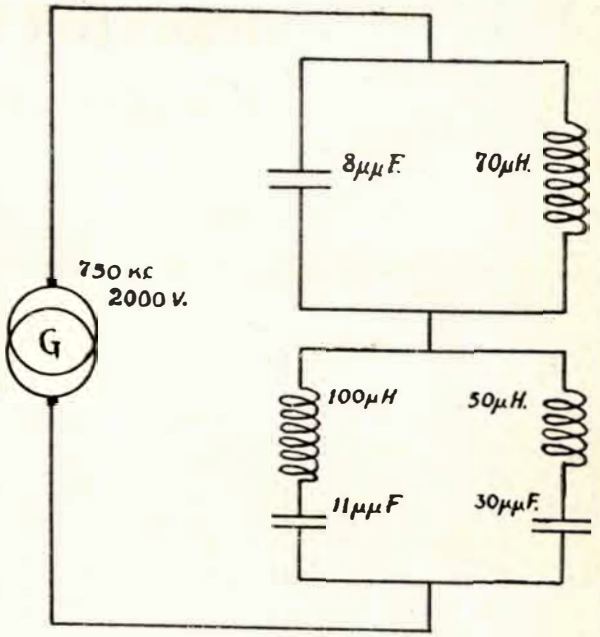

DIAGRAM 3.

matical significance of the operator "j". Operator "j" is equal to the square root of minus one ($\sqrt{-1}$) which is an imaginary quantity, however, $j^2 = -1$.

If we now consider the rectangular coordinate axes on diagram 1, the values along the axis of reals, to the right from the origin are positive and to the left negative. Then multiplying a positive value on the axis of reals by —1, it will become a negative value and will lie along the axis to the left of the origin. This means we revolved the vector around the origin (0) 180°, but $-1 = j^2 = \sqrt{-1}\ \sqrt{-1}$, so that we operated on it twice with **j.** If we operate on the vector by j once only, we then revolve it only 90°, and the vector which is operated on but once by j will lie along the vertical axis above the origin. Operating on the vector three times by j; $j^3 = \sqrt{-1}\ \sqrt{-1}\ \sqrt{-1} = -1\sqrt{-1} = -j$, we then revolved the vector 270° and it will lie along the axis of imaginaries below the origin.

With this effect of operator j in mind, we may express the impedance $\overline{Z} = R + jX$ (the short line above the letter indicates that it is a vector or complex quantity). Had we the impedance and the angle $\ominus$ given, we could simply resolve it to its components; $R = Z\ (\text{Cos}\ \ominus)$, $X = Z\ (\text{Sin}\ \ominus)$, and $\overline{Z} = Z\ (\text{Cos}\ \ominus + j\text{Sin}\ \ominus)$.

For a simple example in adding vectors. Given A, B and C complex quantities. $\overline{A} = 5 - j7$, $\overline{B} = 2 + j4$ and $\overline{C} = 1 + 6$; then $\overline{A} + \overline{B} + \overline{C}$

(Continued on Page 25)

Lady "Op's"?-Goody!

By RED STALLWORTH

Newspaper item: GIRL SEEKS POSITION AS RADIO OPERATOR. . . . . .

The SS. STEEL VENTILATOR is well at sea., Buenos Aires bound, with Oscar Glutch as chief and Miss Agatha Hockwald, of Brooklyn, as his junior. Miss Hockwald has the watch as Glutch ambles into the shack. Her face is flushed with excitement.

"Oh Mr. Glutch! I was just in communication with Palm Beach, Florida, and he had the loveliest note I ever heard. I mean, it was simply gorgeous," cooed Miss Hockwald.

"Yes, yes, that's very nice, Miss Hockwald, but did you get the time-tick?"

"Oh dear! I forgot all about it—but I'll bet that WOE operator is a nice fellow," says Agatha, dismissing time-ticks altogether. "He certainly was sweet to me; told me GM, 73 and everything."

"I wouldn't fool around with those coast station operators, Miss Hockwald," warns the chief. "You can never tell whether one of those fellows has, at one time or another, been a Fuller Brush Man. Now take all those married ops at WCC—"

Hearing WSL calling, Miss Hockwald interrupts. "Oh heavens! There's WSL calling me on long-wave. Will you be a nice boy and start that nasty old arc for me? Oh thanks."

After Miss Hockwald has obtained many repetitions she hands the chief a message that greatly resembles a returned income-tax report —whatever they look like. He takes a look at it, shakes his head and announces that he's going to turn in; for Miss Hockwald to call him after the stocks.

"Very good, Mr. Glutch. But please don't use any more of my toothpaste; I only have enough to last me to Rio." The chief struggles with himself, spats and shoves off muttering. . . . .

Little Agatha has been copying the nightly press just long enough to be able to make a terrible mess of it. She has American T & T quoted at 75⅝ and Radio leading the field with 108⅛ and she yelled "wise guy" when Brooklyn Can was transmitted.

Coming to the resting place, she removes the phones from her matted tresses and goes in to call Glutch. The latter, having had a few shots of Greek Cognac before retiring, is in a bit of a fog as he opens his blood shot eyes.

"Mr. Glutch, Mr. Glutch. It's time to get up. Come on now. I relieve you on time and there's no reason why you shouldn't do the same for me. Mr. Glutch!"

He makes a slight move, opens and closes his yap like a cow chewing up a clothes line. He doesn't say anything, having heard her when she first came in and turned on the light.

"Oh goodness gracious, I wish you would get up; I've got to wash out a pair of stockings for tomorrow. You know I only have one pair that hasn't a run in them. Mr. Glutch, are you going to get up or not?" At this time she gets a good look at his face and begins to giggle uproariously. "Oh but you certainly look lousy. You've been drinking again, haven't you? Ha ha, what a mug."

Glutch, tiring of this nonsense, gives her a toothless leer and lets go a burst of healthy oaths that sends her flying back to the shack in wild retreat. Whereupon the chief falls back into a stupor.

In the shack, Agatha powders her nose, takes another look at her ticket which gives her courage, and races in to call the chief again. She gives him another good call and this time the boy comes to with a start. "Say, Miss Hockwald," he yells, "if you don't get the devil out of here I'm gonna smack ya one. Get back in there until I get dressed—and say, did you sew that patch on my pants?"

The good ship STEEL VENTILATOR arrives BA. Miss Hockwald rushes in to the chief. "Oh goody! I'll bet this is a nice place to take photographs and send postcards from. Just wait until Mazie learns that I'm down in the Argentine. I guess she'll burn up all right. Are you going ashore, Mr. Glutch?"

"Yes," says Glutch between his teeth. "I thought I'd run over for a while. Why?"

"Oh. I was just wondering what you did ashore—I mean, do you go to the movies and things like that? Are you going sight-seeing?"

Oscar has stood about all of this that he is capable of and he screams: "Listen you, I'm going over and get cock-eyed, and if that powder-puff of yours is in my shaving mug when I get back I'm going to drop you over the side!"

I'm Going To Sea Again

I have looked for my fun and I've found it,
From Eastport clear down to the line,
Though I've snapped off a hundred doll babies,
Only four of the lot were real fine.

One was an angel from Mobile,
One was a savage from Brest,
And one was a golden skinned Chino,
But the last one I met was the best.

I'm not much of a hand with the ladies,
Far from a shiek I'll admit,
But in most every clime, I've had a good time,
Though I usually paid well for it.

I quitted a Shipping Board tanker
In Mobile the day of the strike,
And grabbed off a staid rebel flopper,
For beauty I'd not seen the like.

High-brow and haughty but generous,
Almost a Dutchess she were,
But she ditched me at last, when she learned of my past,
And I learned about women from her.

Then I signed on an Isthmian Madhouse,
With rails for the port of Hongkong,
And I got me an amber skinned heathen,
You can get them out there for a song.

Fragile and gentle and dainty,
Doll in a teacup she were,
But I woke up one day, and gone was my pay,
And I learned about women from her.

Then I returned to the East Coast,
And made a short trip to that France,
Where I spotted this "come get me savage"
And decided to take one more chance.

Dark hair'd, brown eyed with red lips,
More like a hop dream she were,
But though quite a dear, her habits were queer,
And I learned about women from her.

Then I shipped on a Shepard Line freighter,
From New York to Port Aberdeen,
Where I met the last pretty lady,
The snappiest ever I've seen.

Torrid, restless and thirsty,
A judge of good whiskey she were,
So I'll make one more trip, in any old ship,
To find out some more about her.

RADIO AUTO ALARM

Modern Aid To Navigation

By J. C. COLLETON
Submarine Signal Company

The newspapers are running many articles lately on this development so we give a little information which we think you readers are entitled to.

The radio auto alarm is a device which keeps guard duty for distress calls on 500 K.C. when the operator is asleep, working on some other frequency or performing duties other than guarding 500 K.C.

There are two general classes of auto alarm systems. Both operate upon receipt of the International distress alarm signal consisting of twelve-four second dashes separated by one second spaces, the new system being made further selective in superposing an interruption on the note of the signal of 27 times a second.

The older system which is extensively used abroad contains a selector which consists of a series of relays connected to a timing switch or time delayed relay. The timing devices measure the length of the dash and space and operates standard relays which hold closed if the signal selected is of the correct duration. Should the signal be of incorrect time as would be the case in receiving regular traffic signals, the relays and timing devices reset and stand ready for another signal. If the timing of the signal is correct a relay circuit closes at the end of the third four second dash and rings a bell in the operator's quarters, captain's cabin, and flashes a red light on the bridge. According to the law of averages, any device working on this principle will be actuated frequently by traffic signals on 500 K.C. Since this frequency is commonly used as an international calling frequency there is every opportunity for false alarms when two or three stations are calling simultaneously. Since the one second space is a measured part of the distress auto alarm signal, receipt of distress calls is readily prevented by interference filling this space.

The older system relies upon the operator on the distressed ship sending out the four second dashes separated by a one second space. In times of disaster the operator is inclined to be nervous and may not form the required signal with sufficient accuracy to set off the auto alarm on nearby ships.

The new system is designed fully appreciating the natural defects of the older system. An automatic sender which provides the proper signal for the older system as well as the new is considered desirable, according to the British Board of Trade. The automatic sender which is part of the new system is so designed that it forms the automatic distress alarm signal simultaneously for both systems with a high degree of precision.

It is a well known fact among radio operators that a weak signal of different pitch from the interference can be copied even though the interference is of much greater intensity. An auto alarm based upon the principle of frequency discrimination is fundamentally foolproof. The second auto alarm system is designed to select a twenty-seven cycle signal to the exclusion of all others. This frequency is high enough to exceed frequency attained in speed key transmission, yet is low enough to permit use of a keying relay to create the modulation. This feature enables it to be used on all types of radio transmitters whether it is arc, spark, or CW.

This auto alarm system requires an automatic sender, that is, a device to key the radio transmitter twenty-seven times a second. This is done by connecting a quick operating relay on to a tuned vibrator. The vibrator maintains the frequency and the relay opens and closes the keying circuit of the transmitter. Thirty amperes have been successfully interrupted twenty-seven times a second without serious arcing at the relay contacts. The radio signal sent out has a peculiar flutter which resolves into a major 27 cycle component.

The receiving apparatus consists of a band pass receiver of high sensitivity which feeds a special detector and linear amplifier. The amplifier connects to a small vibrating reed which is tuned to 27 cycles and selects only the particular fluttering signal. The reed is designed so that it requires four seconds to build up sufficient amplitude to close a pair of contacts which operate the signal bells and flashing light. This time delay is sufficient insurance against impacts from the ship's transmitter and static bursts which occur at irregular intervals. False alarms are thereby prevented and heavy interference does not prevent its response to a distress call sent by the automatic sender.

BOOK REVIEW

"Modern Communication," published by Houghton Mifflin Company, New York, is a book of 182 pages constituting the seven papers delivered in the form of lectures. Social Aspects is covered by Arthur W. Page; Research in the Communication Field by H. D. Arnold; Research in Speech and Hearing by the well known authority Harvey Fletcher; Transoceanic Radio Telephony, by Ralph Bown; Talking Motion Pictures and other by-products by John E. Otterson; Fundamental Research, by Frank B. Jewett; and Picture Transmission and Television, by Herbert E. Ives. The book is written so anyone can understand it, and the publishers have performed a wonderful service to anyone interested in these diverse fields by putting under one cover these lectures delivered before the Lowell Institute of Boston, by the representatives from the Bell Laboratories, American Telephone & Telegraph Co., and the Electrical Research Products, Inc.

NEW DELEGATES WANTED

There are appointments open for delegates at Port Arthur, Texas; Galveston, Texas; Lake Charles, Louisiana, and all cities inland where there are sufficient broadcast stations to warrant same. Anyone desiring these appointments kindly communicate with the Association.

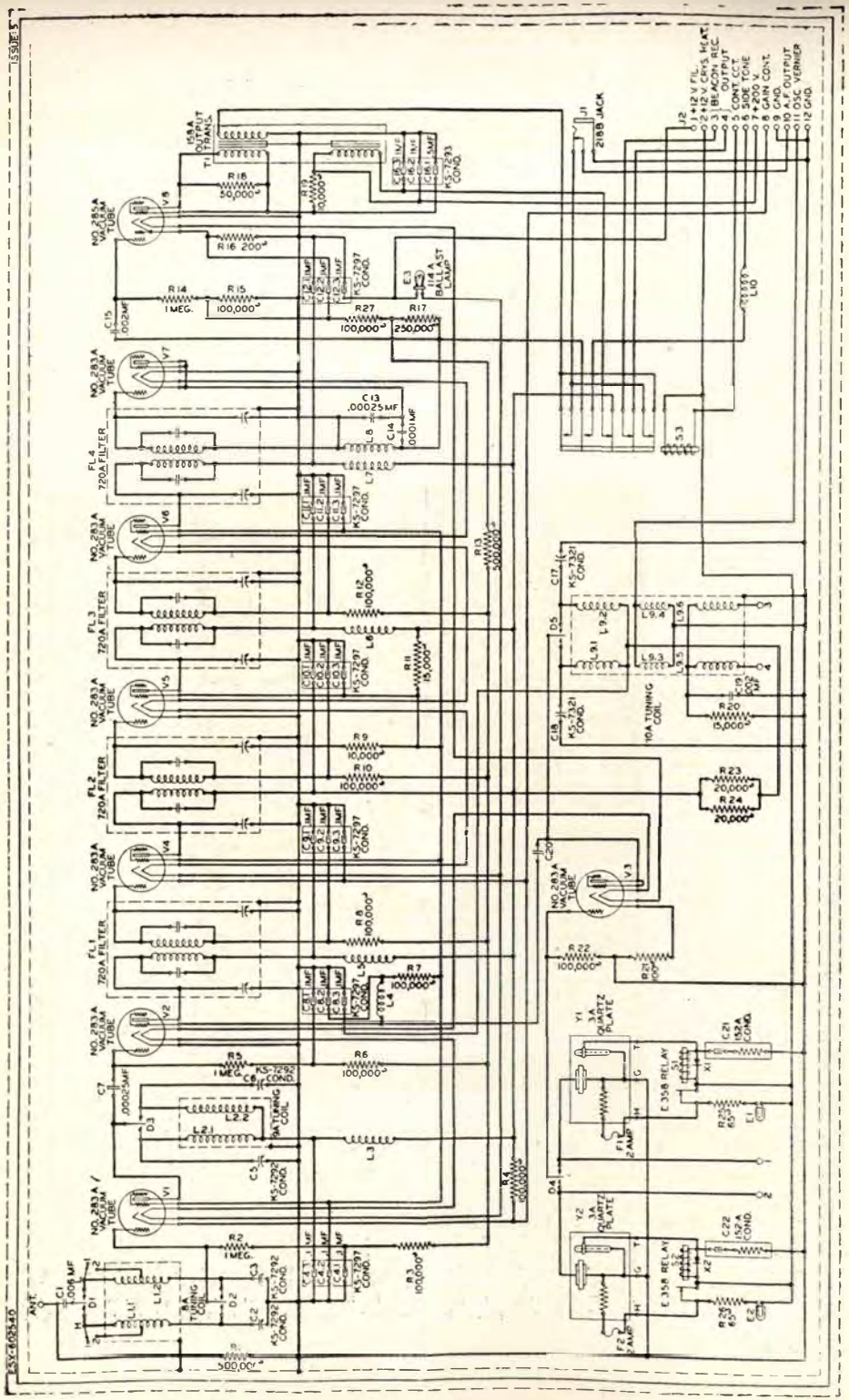

Fig. 1—Simplified schematic of the 12A receiver

A CRYSTAL CONTROL SUPERHETERODYNE RECEIVER

By H. B. FISCHER

Member of Technical Staff, Bell Telephone Laboratories

Several years' experience with airplane radio telephone apparatus indicated, among other things, that there was need for greater selectivity in the receiver, and that the changes between night and day frequencies should be easy to make during a flight. Because of the limited width of the frequency band available for aviation telephone communication and of the large number of operating companies desiring frequency allocations, it has been necessary to assign channels with a frequency separation of only about one-tenth per cent. Since this is only one or two-tenths of the separation of broadcast channels, the difficulty in selecting the channel desired without interference from the adjacent ones is evident. The requirement of being able to change frequencies while in flight arises because the ground station must be able to be in continual communication with a group of planes, some of which may be just beginning a flight and others about to terminate one. At transition periods between day and night conditions, a plane about to end a flight may be set for one frequency and a plane beginning a flight, at another. Without the ability to change frequency at a definite time while in the air, ready communication with the ground necessarily becomes handicapped.

In the development of the Western Electric 12A receiver, which is a part of the new aviation radio equipment, these two requirements have been fully and satisfactorily met. Certain other improvements which a study of past experience indicated to be desirable have also been made. In spite of these many improvements, the new receiver will weigh no more than the 9B receiver formerly used for this service.

A schematic of the receiver is shown in Figure 1. To obtain the required degree of selectivity and sensitivity, a superheterodyne circuit is employed. From left to right in the diagram, there is one stage of tuned radio-frequency amplification, a first detector or modulator, three stages of intermediate frequency amplification at 385 kc, a detector and automatic volume control tube, and one stage of audio frequency amplification. A separate tuned circuit for each frequency is employed for the radio frequency stage and for the oscillator. Operation of a shifting mechanism selects the proper circuits for the frequency desired, the circuits having been properly tuned while the plane was on the ground.

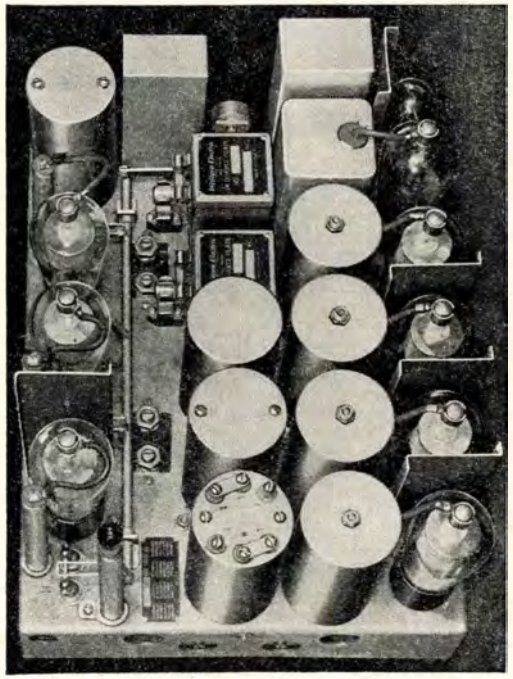

Fig. 2—Tuned transformers in cylindrical cans are placed adjacent to the tubes with which they are associated

In any radio receiver the usable sensitivity is limited by the tube and circuit noises. When this limit has been reached, sensitivity to still weaker signals is obtainable only by increasing the voltage input. For a given field strength, the voltage induced in a given antenna is fixed, but the voltage across a tuned circuit in series with the antenna can be much greater. Antennas ordinarily used for airplanes have a comparatively low resistance, and so lend themselves to the series tuning which is employed in this receiver with excellent effect.

Western Electric quartz plates are employed for controlling the frequency of the beating oscillator, thus insuring the correct frequency for satisfactory operation under all conditions and without attention on the part of the operator. Two oscillators are provided, and the one required is selected by the operation of the same control that selects the proper tuned circuits.

Under some operating conditions the high degree of frequency stability and freedom from attention on the part of the operator provided by the quartz plates may not be required. The 12A receiver has therefore been designed so that in such cases a tuning unit, either the 8A or 8B, may be used in place of the quartz plates. These are plug-in tuned circuits whose constants are much more

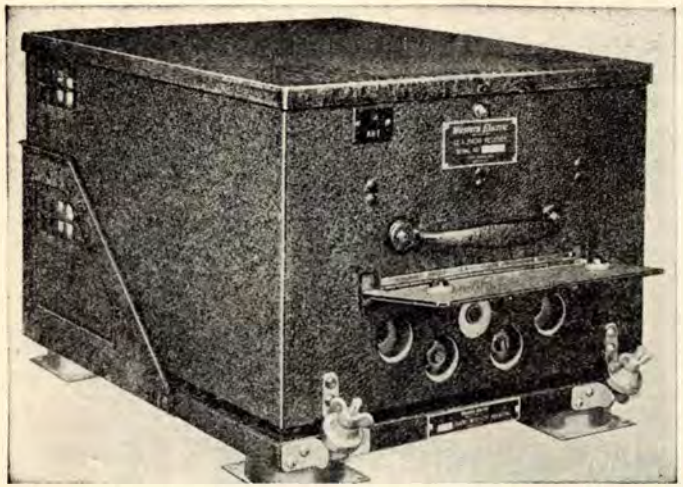

Fig. 3—The 12A receiver showing door on front and the shock proof base on which it mounts.

stable than are those of ordinary tuned circuits. The coil is wound on an isolantite form, and the adjustable condenser has a thermostatic metal plate to reduce variations due to temperature changes. The units are mounted in moisture proof aluminum cans to avoid changes in the oscillator frequency caused by changes in humidity.

These precautions, together with the careful design of the oscillator circuit, minimize frequency variations caused by changes in the supply voltage and provide a high degree of frequency stability. Small variations do occur, however, and a vernier condenser is required to compensate for the frequency drift. To avoid the use of a mechanical drive for the vernier when the receiver is controlled from a remote point, the vernier condenser is located at the operating point and connected to the set through a shielded radio-frequency transmission line of low impedance.

To obtain the high degree of selectivity required, three intermediate-frequency amplifier tubes with four double tuned transformers are employed. Each such double tuned transformer comprises a filter section and, mounted in an aluminum shield, is placed next to the amplifier tube, as may be seen in Figure 2. The fourth tuned transformer is connected to the detector which operates as a two-element rectifier and not only supplies signal output, but furnishes voltage for the automatic volume control system as well.

All but the audio frequency tube are the recently developed Western Electric 283A tubes, which have variable mu and high gain. The detector and oscillator are operated as two and three element tubes respectively by connecting certain electrodes together. By this arrangement the number of different types of tubes is reduced. For the audio frequency stage a 285A tube is employed. This is a pentode capable of delivering a sufficiently high output for the satisfactory operation of several pairs of headphones. When the receiver is used as part of an airplane system, this tube also acts as the amplifier for the side tone circuit when the transmitter is operated. A relay in the receiver makes the necessary change in connections when the button on the microphone is pushed.

Automatic gain control, widely used with present-day broadcast receivers, is even more important with airplane receivers, since in addition to the usual fading due to variation in the transmission path, there is a large change in signal strength due to the travel of the plane. With the system employed in the 12A receiver there is a barely noticeable change in audio output with a variation in signal input of 10,000 to 1. Even with this wide range in automatic control, however, a certain amount of manual control is desirable. An input in excess of half a volt is too great to be properly handled by the automatic control, and since voltage of this magnitude may be applied when the plane is flying close to the transmitter, a manual control is provided near the

(Continued on Page 23)

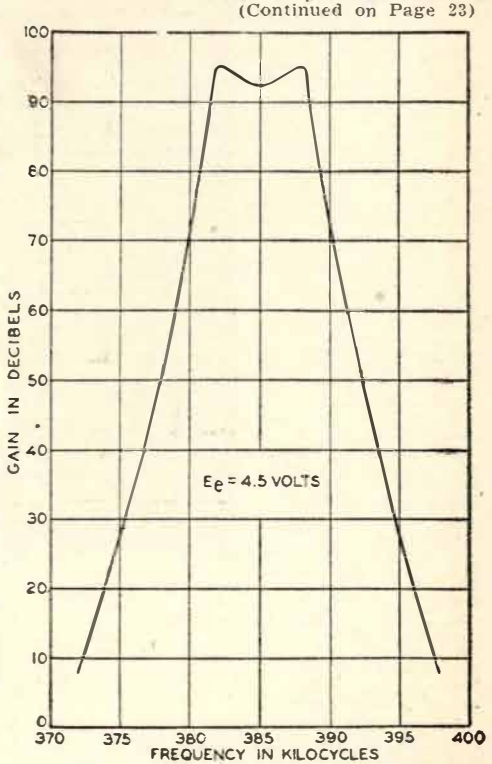

Fig. 4—Selectivity of 12A receiver

ENGINEERING THE COMMERCIAL SHORT WAVE RECEIVER

By JAMES MILLEN*

There was a time—and it is not very long past—when the efficiency of a commercial type radio receiver might be roughly judged by the complicity and number of controls. It is necessary to follow a tenuous thread of memory back to the old days of the Marconi 101 and 112 tuners to prove this. Even the present day equipment, operating on the long wave ship channels, presents an array of dials and controls compared to which the broadcast receiver of a decade ago, with its trimmers and individually tuned circuits, was simplicity itself.

A multiplicity of long wave controls, in the hands of the expert operator, contributes a delicacy of adjustment resulting in peak efficiency at all tuning points. The interaction of the controls is reduced to a minimum, and where apparent, is automatically compensated by the experienced operator. As a matter of fact, such interaction can be discounted as negligible. It appears as slight variations in capacity and inductance which affect, almost inappreciably, the resonance of the low frequency circuits.

However, a degree of interaction which would be negligible at 700 meters may be sufficient to complicate and slow down the process of tuning at 70 meters and below. Inspection of the familiar equation for resonance—

$$F = \frac{1}{2\pi\sqrt{LC}}$$

—will demonstrate this, and differentiation of F in respect to L or C will make the matter even more clear.

Most operators are acquainted with the fact that a given variation in inductance or capacity will cause a much greater frequency shift on the high frequencies than on the low. For instance, a capacity shift of 1 mmf in a typical circuit tuned to 300 kc, or 1000 meters, will cause a frequency variation of only 300 cycles, while a similar change in capacity at 10,000 kc, or 30 meters, will throw the circuit 200,000 cycles off resonance! These considerations indicate the importance of control elimination both from the point of view of interaction and the general criticalness of tuning which would definitely tend to lower the copying efficiency of the operator himself. In engineering a commercial short-wave receiver, this means a single tuning control for at least two tuned circuits—the minimum contributing adequate amplification and selectivity—and the elimination of the highly interactive regeneration control for the adjustment of volume.

It is obvious, in consideration of the above figures, that the attainment of these ideals is further complicated by the very factors that recommend their achievement! It is a fairly simple matter to design a single control receiver operating from 600 to 2000 meters—but an engineering feat of no meager degree to accomplish the same thing on a receiver covering the short commercial bands! It is up to the manufacturer to eliminate the human operating element as far as possible, and to incorporate into his design much of the preciseness and efficiency heretofore contributed by the operator himself.

In addition to consideration of simplicity and electrical efficiency, the manufacturer and his engineering department are faced with other requisites in a receiver which can be wholeheartedly recommended for commercial services. The receiver must encompass the widely divergent frequency bands employed in traffic and broadcast work. This predicates a band change mechanism combining mechanical convenience with the highest electrical efficiency—eliminating switching arrangements, which introduce considerable losses, as well as back of panel plug-in coils. Body capacity effects, to controls, phone cords or cabinet, must be reduced to an imperceptible minimum. High quality output is essential in anticipation of rebroadcast services. It should be possible to secure adequate band spreading over any of the short wave spectra. The dial should be so designed as to take full

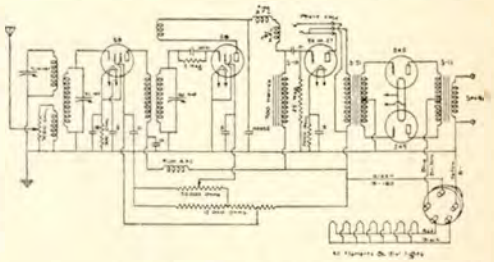

Figure 1—Wiring diagram of the National 58C Communications Type Short-Wave Receiver

advantage of the logging simplicity contributed by single control tuning. Mechanical and electrical ruggedness are of course essential, and such parts which, beyond the manufacturer's control, may break down with time and service, should be so located that they can be readily tested and replaced by the operator. The receiver should be readily adaptable to either desk or rack-and-panel mounting.

It is possible to achieve these desired qualifications in both tuned radio-frequency and superheterodyne designs. While the short-wave super undoubtedly represents a closer approach to the ideal commercial short-wave receiver, the t-r-f job has many commercial applications. It is used as a standby receiver on a second channel. It is of particular utility in aircraft, where weight is a serious consideration, and in marine installations where the greater portion of traffic is handled on long waves.

The design of such a tuned radio-frequency receiver has contributed much to the development of the tuned circuits in the commercial superheterodyne, and is therefore logically in line for first consideration. Such a set is the

*The National Co., Malden, Mass

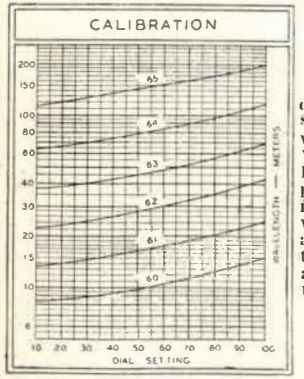

Fig. 2—Tuning curves of the standard short-wave coils used with the 58C. Band spread coils provide a 5 to 2 frequency spread, while other coils are available extending the range as high as 2000 meters.

National 58C Communications Type diagrammed in Figure 1.

An unusually high degree of radio-frequency efficiency has been attained through the use of the type 58 pentodes in the r-f and detector circuits. The high amplification factor, trans-conductance and, above all, the high plate impedance, enable the designer to achieve a degree of sensitivity and selectivity, through proper coil design, that has heretofore been little more than an experimental ideal. The coils are wound on special R-39 material which retains its low loss characteristics even after indefinite exposure to salt sea air. These coils can be so designed as to provide a band spread ratio of about 2:5. For instance, where a normal coil would cover from 2400 kc to 4400 kc, with full rotation of the dial, a band spread coil can be designed to cover any desired spectrum 800 kc wide, within this band, with similar full rotation. In other words, in the neighborhood of eighty meters, the band spread coil will confine the entire tuning range to 800 kc where an ordinary coil would encompass 2000 kc.

The wiring of the radio frequency circuits is so standardized as to introduce a definite and determined amount of inductance and capacity—the same in every receiver. The coils are carefully checked against standards, the result being the correct amount of lumped capacity and inductance in every circuit, at all frequencies to permit single control tuning of the radio frequency and detector circuits.

The two condensers of the gang are electrically isolated as far as any connection through the common shaft is concerned. This is a precaution which cannot be overlooked in the design of the commercial short-wave receiver where every possibility of uncontrolled coupling must be eliminated. It might seem, off hand, that the coupling affected through those portions of the tuned circuits which happen to be common in parts of the conventional ganged condenser frame should be of a negligible magnitude. True, the paths are very short. However, an inch or so represents an appreciable part of the total conductor length at frequencies above 15 megacycles (20 meters) and is sufficient to cause instability and circuit interlocking. To overcome this trouble, a special tuning condenser was developed, in which both rotors are entirely insulated from the condenser frame and from each other. This design makes it possible to isolate completely the input and output circuits of the radio frequency stage, supplementing the usual shields, and resulting in a perfectly stable system even at the highest frequencies to which the receiver will tune.

The Volume Control

It has heretofore been considered that the simple regeneration control in the detector circuit provided adequate overall volume control—even in commercial short-wave receivers. Such an arrangement, however, introduces undesired circuit interaction, as well as resulting in several forms of distortion and general inelasticity of operation. With such an arrangement, the radio-frequency tube is necessarily operating at maximum amplification at all times, resulting in overload, and sometimes blocking, of both that tube and the detector, on strong signals. Backing up the regeneration control to reduce signal strength results in detuning (as well as additional distortion due to the fact that the detector tube is then being operated with decreased plate or screen voltages). The obvious solution is to employ a second control operating at the input to the r-f stage.

Figure 3—Behind the scenes—showing general construction and shielding. Vulnerable parts are arranged beneath the sub-base to facilitate inspection, test and replacement.

Under actual reception conditions this ad-

(Continued on Page 24)

"Salt Sprays"

Was you there Charlie? . . . No? Well I was . . . . . At 326 Broadway, the latter part of October 1929, awaiting an assignment. Having turned one down that day (yes, you could do it in those days), I had just decided it would be best for me to heave up anchor and set sail for Philly, my home port, when Christie poked his head into the Static Room and inquired if anyone would like to "go back to the Vaterland." "Barkis was willing," so I grabbed the first train for Savannah, from which port the "Georgian" was sailing the following day for London and Hamburg. I arrived just in time to make a pierhead jump.

When signing the Articles, I was surprised to learn that I would have an assistant operator, a young Englishman, who was to leave at London. After I had everything shipshape in the shack, I got Sears to spill his story.

He had only made one trip to sea before joining the "Georgian," that being as junior on a small passenger ship running from London to Cape Town. It being his first trip, he had his hands full trying to make the antique 1 KW spark, that passed as a transmitter, say "uncle." Upon his return to London, he was transferred to the "Georgian," the American operator, also a first tripper, having been sent to a hospital suffering from stomach trouble, attributed to his efforts in trying to drink the City of London dry during the few days that the vessel remained there. The Marconi people sent an inspector along with Sears to check up on the equipment, a converted P-8, and to instruct him on its operation. After a half hour spent in snooping about the transmitter and gazing at it from all angles, he happened to glance behind the control panel and exclaimed, "By jove, the bally ol' thing's a valve transmitter!" With this brilliant bit of information, he departed.

Two days out of the Channel, a French fisherman, homeward-bound from the Grand Banks, hailed the "Georgian," signalled her position and requested that they radio it in to Ushant (FFU), France. It was then that Sears discovered his set was not perkin'. For three days he searched for the trouble without any success. On the 4th day the saloon messboy, "Speedy," informed the captain that he had taken a course in wireless, and WAS SURE he could get the set to work. The Old Man told him to do his stuff. Speedy and Sears immediately went into a huddle and the net result of 24 hours of physical, not to mention mental, labor was a radio shack strewn waist-deep with discarded circuit diagrams and enough wire to lay a trans-Atlantic cable. At noon the same day Speedy donned a coat lined with brass buttons, secured from some unknown source, and nonchalantly seated himself at the saloon table. The Chief Engineer, who was seated at the head of the table, choked on his food and finally managed to gasp out, "What the hell are you doing here?" Before replying Speedy helped himself to a liberal portion of corn beef and cabbage, while the Chief gazed at him in amazement. "Well, as you know, the Captain has given me permission to assist Mr. Sears in repairing the radio transmitter, and as Assistant Radio Operator, I am entitled to eat in the saloon." "You ornery son-of-a-seacook," sputtered the chief. "You;" and words failing him he reached for the catsup bottle. Exit Speedy. By this time Sears found that he had another piece of trouble on his hands, i. e., an open circuit in Speedy's upper-region and in order to rid himself of it politely suggested that he remove himself from the radio shack and go back to wrestling pots and pans.

A day's run from Wilmington, N. C., the Skipper handed in his arrival message. With this to inspire him, Sears finally located his trouble—a broken pigtail connection on the secondary wave-changing switch.

Do You Remember?

By G. J. F.

Perhaps some of you Old Timers remember "3PW" (Philadelphia School of Wireless), which was located at Broad and Cherry Streets. If you do, you will remember "Smitty". . . . .Smitty and "3PW" were synonymous.

Theory was his line—when he stuck to it—,but he had a better line of verbal and practical jokes that made him popular with his students.

One hour is a long time to be bombarded with a descriptive volley of Molecular Action, or to be gassed by a detailed account of Types of Lead Acid Cells and Construction Thereof; and a half hour of this was about all most of the fellows could stand. Heads would begin to nod sleepily; some would gaze abstractedly out of the window, deeply engrossed in a contemplative observation of the stellar construction; others would stealthily produce limberger or liverwurst sandwiches and drowsily munch on them.

At these signs of indolence, Smitty would drop theory, for the time being, and relate tales of his experiences when an operator at sea, most of which had a Baron Munchausen tenor, alternating with a few racy jokes.

But his favorite joke was to assemble the class around the 2 K. W. Federal arc set and warm it up, explaining each operation as he went along. Then he would open the arc chamber, after it had cooled off, and describe its intricate inner-works, allowing just enough time for air to mix with the hydrogen gas. When closing the chamber, he would give it a liberal shot of "alky."

The next step was to select a beginner and confer upon him the honor of exhibiting, to the assembled class, his skill in starting the arc. The unsuspecting victim would timidly seat himself in the operating chair, in the same manner that a condemned convict seats himself on the "hot stove." If he became stage-struck, Smitty and some of the older students, "in the know," would benignantly lean across his shoulder and coach him along, step by step, until the arc was ready to be struck; then cautiously step back, with a final warning to be sure and strike the arc hard. At this critical moment, the rest of the beginners would crowd closer to the arc chamber with bated breaths.

After a few nervous passes at the carbon holder, our victim would grit his teeth, close his eyes and slam the holder in as hard as possible; per instructions, as a good pupil should.

WHAM! BANG! Up would fly the upper chamber, belching forth flame and gas in every direction. Chairs and slow-footed students were bowled over in the mad scramble for the doorway; and in a few seconds the classroom would be practically deserted, except for Smitty and his conspirators.

Are you a regular subscriber? If not, why not send $1.50 immediately and get CQ regularly?

SOME NOTES ON PLATE OUTPUT CIRCUITS OF TUBE TRANSMITTERS

By E. H. RIETZKE

President, Capitol Radio Engineering Institute, Member, The Institute of Radio Engineers

Probably no other single adjustment in a transmitter has as great an effect on the operating efficiency and output of the tube as has the adjustment of the plate tap—and probably no other adjustment is made as a rule with such a vague idea of what should happen and what adjustment should be considered correct.

Diagram 1 shows schematically the conventional plate tank circuit, LC, the power supply, and some source of grid excitation voltage, E_g. The plate tap P is also shown as being variable.

Now in every practical transmitter the tank circuit LC has two principal functions. First, it acts as a series resonant circuit in which a comparatively high circulating current is built up for coupling an antenna, exciting a following amplifier grid, or exciting the grid of the same tube if the tube is acting as an oscillator with either a crystal or a tuned LC grid circuit. As a series circuit the R.F. current in ammeter A is limited entirely by the R.F. resistance of the circuit, LC being adjusted to resonance or very close to resonance. (In the case of an oscillator the plate tank circuit is adjusted to a frequency slightly higher than the operating frequency in order that the circuit may act as an inductance to provide the correct phase relation for the feed back through the tube.) Since the greatest percentage of the R.F. resistance is in the inductance at normal frequencies with well designed circuit appartus, as the tuning tap T is moved toward ground and the tuning capacity increased in proportion the circuit resistance will usually be decreased with a corresponding increase in the circuit current as indicated by A.

Second, the plate tank circuit acts as a **parallel** circuit connected between the plate and filament thus providing the high load impedance into which the tube must operate. While the series resonant circuit resistance may be 6 or 8 ohms, its total parallel impedance should usually be in the order of several thousand ohms. This is the characteristic of all resonant parallel circuits consisting of inductance in one branch and capacity in the other. Theoretically if the plate P is connected at point x and circuit LC contains absolutely zero resistance the impedance between x and y at resonance will be infinite. This condition is of course impossible as both the condenser and the inductance contain certain resistance losses.

If the resistance of both branches is definitely known the exact impedance of the parallel circuit at the resonant frequency can be calculated. However the individual resistances are difficult to measure and usually only the total circuit resistance is measured, the assumption then being, with a well designed condenser and excepting at the very high frequencies, that most of the circuit resistance is in the inductive branch. With this assumption the parallel impedance between x and y is equal approximately to, $Z=L/CR$, L and C being in microhenries and microfarads, R and Z in ohms. By knowing the effective R.F. resistance per turn of the type of inductance to be used, it is comparatively easy to design the coil and condenser combination to provide the approximate desired parallel impedance.

However in most cases where the transmitter must be adjustable over a band of frequencies such an exact design is neither entirely practical nor desirable. Thus the plate tap P is usually made adjustable. If P is connected at x, then $Z=L/CR$. If P is connected at y, $Z=0$. If P is connected exactly halfway between x and y, $Z=L/2CR$. In other words the parallel impedance between tap P and ground will be in direct relation to its position on the coil L.

A tube, or any other power generating device, will deliver the greatest amount of power into an impedance equal to the internal generator impedance, in this case the plate-filament tube impedance. If the load impedance is made less than the tube impedance the power output falls off rapidly; if the load impedance is made greater than the tube impedance the power output falls off but not so rapidly. Thus with all other adjustments kept correct as tap P is moved down the coil L the R.F. current in A will increase until the point of optimum impedance is reached and then decrease rapidly.

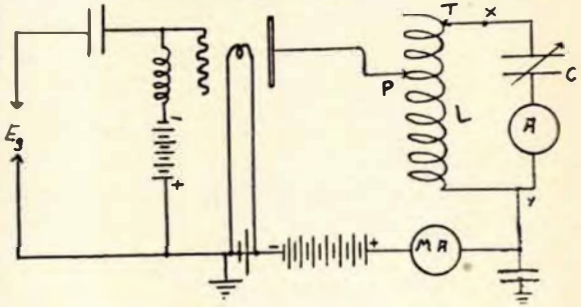

Diagram 1

The D.C. plate current milliammeter M.A. must now be considered. Assume the tube is worked with a comparatively high grid bias so that with no excitation very little plate current flows, the usual condition with telegraph transmitters and with the Class B amplifier in a broadcast transmitter. The impedance of the tube and the load impedance are in series. The generated A.C. voltage in the plate circuit is equal to μE_g. With high load impedance this voltage can force only a small current through the tube and plate circuit, thus with a high load

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RADIOTELEGRAPH OPERATOR LICENSES

(Due to continued demands from our readers we are publishing again the license regulations which went into effect July 1, 1932, only eliminating such paragraphs as apply to amateur licenses and at the end note amendments with dates.)

1. **Commercial Extra First Class**—To be eligible for examination, an applicant for this class of license must hold a radiotelegraph operator first class license and must have been actually engaged as an operator at stations open to public correspondence for at least 18 months during the two years previous to his application and must not have been penalized for violation of any radio act, treaty or regulation binding on the United States. Applicants must pass code tests in transmission and reception at a speed of not less than 30 words per minute in Continental Morse Code and 25 words per minute in American Morse Code, five characters to the word. The questions in this examination will cover the same subjects required for radiotelegraph and radiotelephone class of operator license, but considerably wider in scope.

Holders of license of this class are authorized to act as chief operator at any licensed radiotelegraph or radiotelephone station except amateur.

2. **Radiotelegraph Operator First Class**—To be eligible for examination, an applicant for this class of license must have been actually engaged as an operator at ship or coastal stations open to public correspondence for at least 12 months. Applicants for this class of license must pass code tests in transmission and reception at a speed of at least 20 words per minute in Continental Morse Code, code groups, and 25 words per minute in Continental Morse Code, plain language (5 characters to the word).

   The practical and theoretical examination shall consist of comprehensive questions under the following headings:
   (a) Diagram of radio installation: Applicants are required to draw a complete wiring diagram of a modern marine radio installation as used aboard American vessels. The applicant may be required to draw either a spark, arc, or vacuum tube transmitter (with radiotelephone attachment).
   (b) Theory, adjustment, operation, and care of modern radiotelegraph and radiotelephone transmitting apparatus.
   (c) Receiving apparatus.
   (d) General principles of electricity.
   (e) Operation and care of storage batteries.
   (f) Power supply apparatus.
   (g) International regulations governing radio communication and the United States Radio Laws and Regulations.

Holders of this class of license are authorized to act as operator at any licensed radiotelegraph station except amateur, or to act as chief operator on a vessel in the first class engaged in international service.

3. **Radiotelegraph Operator Second Class**—Applicants for this class of license must pass code tests in transmission and reception at a speed of not less than 16 words per minute in Continental Morse Code, code groups, and 20 words per minute in Continental Morse Code, plain language (5 characters to the word). The practical and theoretical examination will cover the same subjects as Radiotelegraph Operator First Class license.

Holders of this class of license are authorized to act as operator at any licensed radiotelegraph station except amateur, or as chief operator on a vessel in the first class engaged in international service. They will be authorized to act as chief operator on a vessel in the second class after license is endorsed certifying to six months or more satisfactory service as an operator at radiotelegraph stations open to public correspondence.

4. **Radiotelegraph Operator Third Class**—Applicants for this class of license must pass a code test in transmission and reception at a speed of not less than 15 words per minute in Continental Morse Code, plain language (5 characters to the word) and a practical and theoretical examination consisting of comprehensive questions on the care and operation of vacuum tube apparatus and radio communication laws and regulations.

Holders of this class license will be authorized to operate any radiotelegraph station except amateur and stations open to international mobile public correspondence.

5. Holders of radiotelegraph operator licenses of the first, second, and third classes may qualify to operate radiotelephone stations by passing the regular radiotelephone operator examination of the class desired and having their licenses so endorsed.

6. Radiotelegraph operator first, second and third class license examinations will include questions relative to the theory and operation of radiotelephone apparatus in order that the holders of these classes of licenses may operate radiotelephone apparatus employed in mobile and point-to-point service.

RADIOTELEPHONE OPERATOR LICENSES

No code test is required for these classes of licenses.

7. **Radiotelephone First Class**—Applicants for this class of license must pass a theoretical examination covering the following:
   (a) Diagram of modern broadcast installation.
   (b) Theory, adjustment, operation, and care of modern radiotelephone transmitters.
   (c) Receivers.
   (d) General principles of electricity.
   (e) Operation and care of storage batteries.
   (f) Power supply apparatus.
   (g) Radio communication laws and regulations.

Holders of this class of license are authorized to act as operator at any licensed radio station except stations licensed for radiotelegraph service.

8. **Radiotelephone Operator Second Class**—Applicants for this class of license must pass an examination similar to that required for radiotelephone operator first class, but not so comprehensive in scope.

Holders of this class of license are authorized to act as operator at any licensed radio station except broadcast and stations licensed for radiotelegraph service.

9. **Radiotelephone Operator Third Class**—Applicants for this class of license will be required to pass an examination covering the laws and regulations governing radio com-

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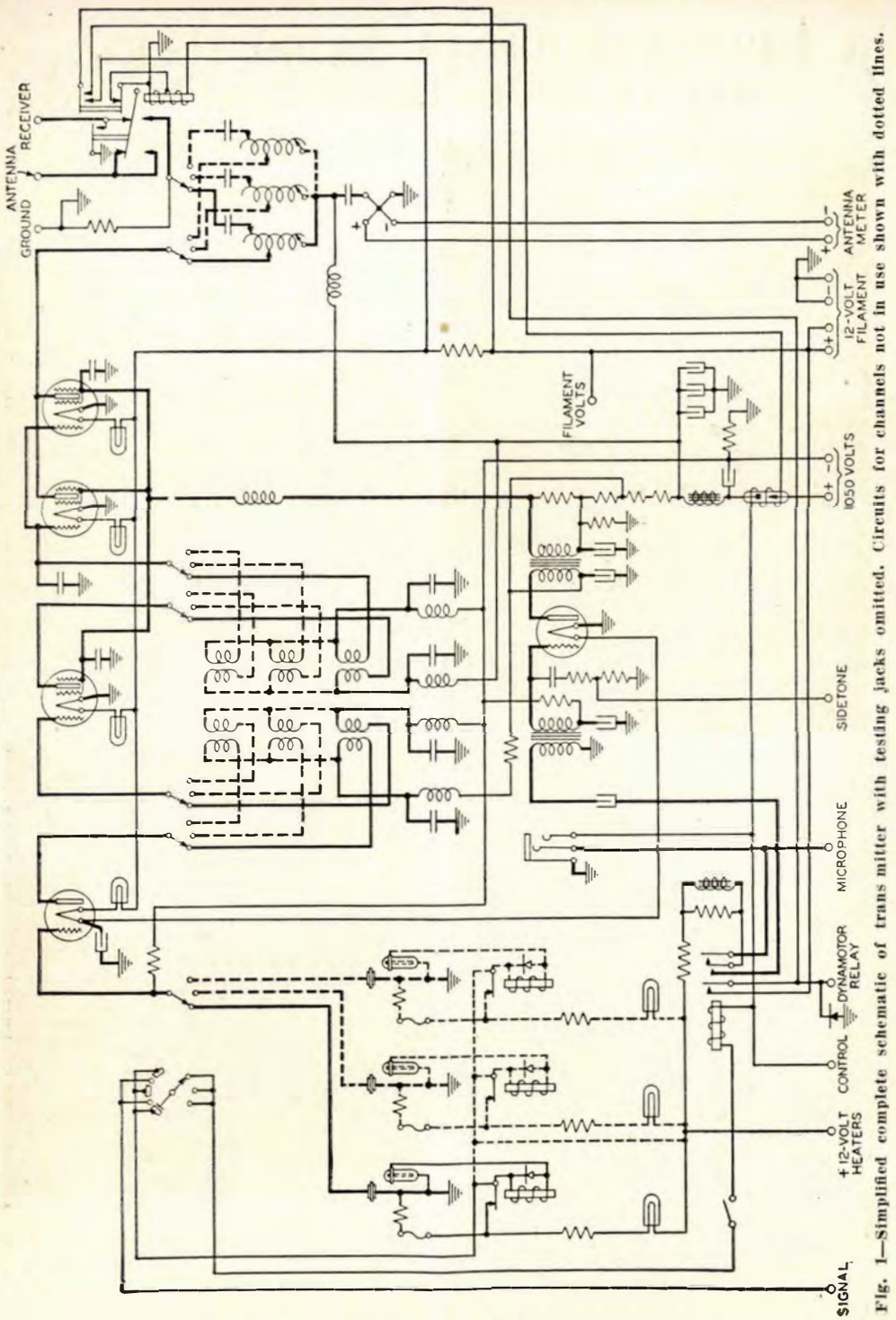

Fig. 1—Simplified complete schematic of transmitter with testing jacks omitted. Circuits for channels not in use shown with dotted lines.

A THREE-FREQUENCY RADIO TELEPHONE TRANSMITTER FOR AIRPLANES

By W. C. TINUS

Member of Technical Staff, Bell Telephone Laboratories

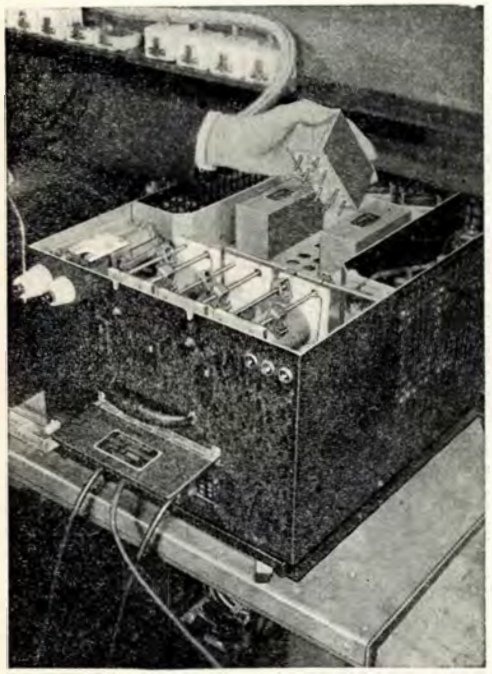

Fig. 2—The 13A radio telephone transmitter with cover removed showing one of the plug-in transformer units being inserted.

Operating experience with airplane radio telephone equipment during the last few years has served to emphasize the need for facilities permitting rapid change of the operating frequency. The large increase in night flying has made general the use by each transport company of at least two frequencies: one best suited to day conditions and one, to night. It is apparent that the transition from day to night frequency will result in confusion unless all stations on the system, including planes in flight, can change frequency simultaneously. In a new airplane transmitter which has been developed, therefore provision is made for changing the frequency by operating a simple manual control. This allows the pilot to change from day to night frequency or vice versa at a preestablished time. No technical skill is required for this procedure as it involves no tuning operations whatever.

Besides this feature, the new transmitter—known as the 13A—incorporates a third frequency channel which may be selected by the same control that changes from day to night frequencies. This arrangement contributes greatly to safety because all Department of Commerce stations keep constant watch on 3105 kc, which frequency is not assigned to any transport company. By being able to transmit on 3105 kc, therefore, an airplane pilot can communicate at any time with a Department of Commerce station to ask for weather reports or other information or to request assistance in emergencies. These government stations reply on the weather broadcast frequency so the pilot can have two way communication with them at any time without requiring an additional channel in his high-frequency receiver. These outstanding improvements, as well as others in the control and maintenance features, arise from certain novel refinements in both the electrical circuits and in the mechanical design.

The radio frequency circuits consist of a crystal controlled oscillator, and two stages of amplification employing screen grid tubes. The use of these four-element tubes—especially designed for this service by H. E. Mendenhall—eliminates the delicate and troublesome neutralizing adjustment, which is very advantageous in portable apparatus.

Of considerable interest are the coupling transformers used between the oscillator and amplifier, and between the two amplifier stages. These are radio frequency transformers which in conjunction with the tube and wiring capacities form band pass filters. The two transformers for each of the three frequency channels are built as a single plug-in and many

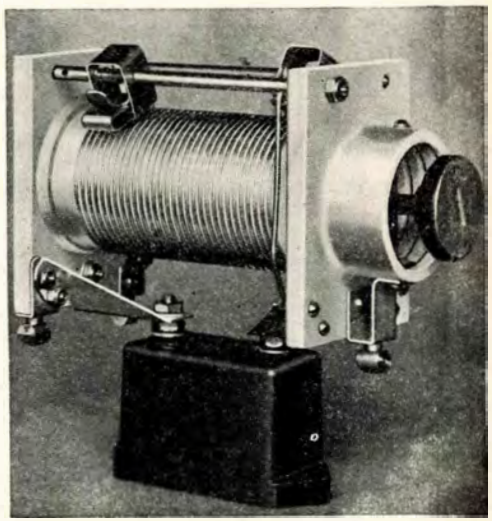

Fig. 3—A combination of coil and mica condenser forming the antenna coupling circuit is built as a single plug-in unit.

Fig. 4—The new ballast lamp, employing a two contact Ediswan base, is of unusually small size.

be seen in Figure 2. This arrangement not only eliminates tuning controls but results in a rugged and compact design. Such units are available for a number of bands varying from 550 to 800 kc in width and so located that one transformer covers practically all the aviation night frequencies and another the day frequencies. Transformers suited to other bands than those used for aircraft communication are also available. R. C. Newhouse was largely responsible for their development.

The crystals are also arranged in plug-in units, and may be seen behind the transformers in the photograph. The crystal is connected in the grid circuit of the oscillator tube, and operates at one-half of the desired output frequency. The primary of the transformer coupling the oscillator to the first amplifier presents a high inductive reactance to the plate of the oscillator at the crystal frequency, which is necessary to produce oscillations. The second harmonic of the crystal frequency is passed by this transformer and drives the first amplifier at output frequency. Similarly the other transformer passes the output frequency and drives the second amplifier.

Coupling between the second amplifier and the antenna is secured by a simple tuned circuit which must be adjusted in the field to tune various antennas of widely different characteristics. There are also three of these circuits which, consisting of a coil and a fixed mica condenser, are built in the form of a plug-in unit as shown in Figure 3 and in the front of the transmitter in Figure 2. A continuous winding of bare tinned copper is wound on an isolantite form, and clips on slide rods can be set on any turn. When clamped in place they make good contact directly with the winding itself. Fine tuning is done by a small inductance wound on the inside of the coil form at the low potential end of the coil. This contact is adjusted with a screwdriver which may be inserted through a small door in the front of the transmitter.

Three-point switches are employed to select the desired crystal, pair of interstage transformers, and antenna coupling units, and all the switches are mechanically connected together and operated by a single control. An interlocking switch is also connected to the same control which prevents application of high voltage to the transmitter except when the switches are centered on one or another of the three channels. This switch also lights a lamp in the control unit near the pilot when the switches are off position.

A novel system of modulation is used in the new transmitter which permits deep modulation of the fifty watt carrier with only about one watt of audio-frequency power. This feature is directly responsible for the very satisfactory overall efficiency. The audio amplifier—like the oscillator a 205D tube—is employed to modulate the screen bias of both of the radio frequency amplifier stages. The overall characteristic of these two modulating amplifiers in cascade is nearly linear up to substantially complete modulation. With maximum modulation, the largest harmonic in the rectified output is less than 10% of the fundamental. The low frequencies are purposely attenuated by a series condenser in the input circuit to reduce the amplitude of airplane noise picked up by the microphone.

A schematic circuit of the complete transmitter is shown in Figure 1. A thermocouple in the radio-frequency ground circuit is employed to operate an antenna ammeter near the pilot, who can therefore note whether the current is normal and whether it modulates when he speaks into the microphone—a positive assurance that his transmitting equipment is working properly. All grid and plate circuits are equipped with jacks (not shown on the diagram) accessible through a door on the front of the transmitter, which facilitate the location of trouble and routine checking by the maintenance men. An antenna relay, employed to switch the antenna

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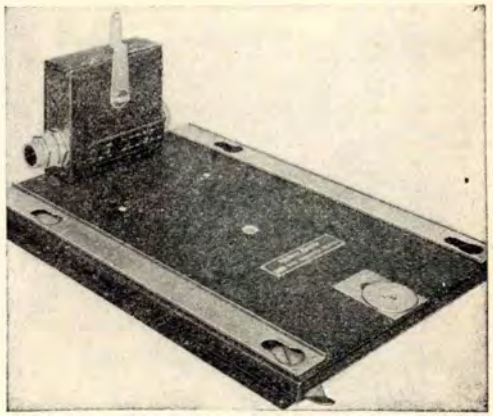

Fig. 5—Separable transmitter mounting which allows the transmitter to be readily removed or replaced as desired.

BROADCAST STATION NEWS

John J. Cunnie, the "Mayor of Newtown Square," is doing overtime re-arranging the English language while he is working for WCAU to make it more expressive. Lest we forget, Newtown Square is where WCAU transmitter is located.

Harold G. Peery, Engineer of all Don Lee, Inc. stations including KHJ, is working overtime these days improving circuits and equipment. Good luck, Harry, the boys say you are a good "chief."

James A. Nassau, in broadcasting for ever so long, is doing his stuff at WLIT under his brother Joe who is "best man" at the station. The older boys will remember Joe was formerly with WOO, the Wanamaker Philadelphia station from its opening to its demise. There's two boys for you.

Rollo Kimball and Jay Wright, KSL, out where the salt begins, like their 50,000 watter. Well who wouldn't?

Say, you fellows, what do you know, they say Ed. Turner at WIP never shows a "hobby." Well, yes, sure he is a married man.

Joe Chambers, the "big shot" at WLW, helped set one of the new tower bases for the 831 ft. tower. And, RCA got the contract to erect the station equipment. 400,000 smackers they say it will set the boss back for the new 500,000 watter. Well 100,000 watt tubes at $1,600 each soon run into money, boys. Eight months more and maybe we'll hear 500,000 wats.

Don C. Good is at KMTR, sometimes known as the land of the quake. Extra work says Good putting them in shape after the rumbles.

Say, Stanley G. Coker has moved up to Chief Engineer at KFUL. Good luck, Stan, take it easy.

Get this. Fred Moore at WCAU, ex-Navy 12 years, has taken to literature, the "better" class.

Harry Lubcke is the television boy at W6XS and W6AO, Los Angeles. "Some day" says Harry, and then a long deep breath.

Martin Oebbecke, WLIT, the "World's Worst Ham" at 3BMD, got Canada. Come on, Boys, write him and say you got his station and give him a new thrill if it's better than 600 miles.

Ralph Stevenson, Willis E. Groves, and Eugene Pack at KSL spent their time on ski getting to the transmitter which is 50,000 watter at Saltair, Utah, this last winter. The snow was "awful" deep they say.

James Tisdale at WIP is a boy who likes to go places in a Ford. Who ever heard of going places in a Ford, better stick to the old "ham" set, Jim.

Barkley Schroeder is the Publicity Director of the weekly Crosley Radio News. He gives everybody a write up but the ops. Well here goes. Robert E. Grow is one of them, now you name the others.

W. Walter Tison has six years to his credit at WFLA-WSUN. He created, designed, installed and operated the station. Pretty good for one boy. What two years in the navy and a stretch with the merchant marine will do for a man. He even has his brother Boykin Tison on his staff, and another Navy man, Joe Mitchell, as chief op.

Al Gegenbach WCAU is almost ready for the fatal step. The girl comes first says Al. . . that is after WCAU.

Then there is James Hart WCAU formerly WOO. What a man, nine children, all his own when the Mrs. goes downtown.

And, another queer one from WCAU, Allan R. Muncey, Lieut. Naval Reserve, ex-Navy, who spends all his time hanging around the Navy Yard. What's the dope, Allan, ready to sign up if she grabs you?

E. G. (Ernie) Underwood is Chief Op. at KHJ. Goes way back, fact is was a Naval Radio Officer during the World War.

John Schantz, WLIT Philadelphia, is an old sea dog. Seven years on the high seas, and six at his station.

E. T. Darlington, Lee Kline, and C. Colman all of WFI are ex-ship boys. The first two have had eight years each at WFI, and Colman who is 3QT at home has had six.

J. E. Peterson, control room WIP, is an old "boy" after our own heart. Bed time stories, and Uncle W-I-P are his hobbies. Frank Pfaff, the other control, can have the banquets says Peters.

Raymond Lloyd, WIP, ex-ship with a first class license and a first class thirst says this 3.2 "ain't what it used to be." Come out of it, Ray, remember you didn't always play golf either.

Tom Herrin and Rollie Johnson are both gentlemen of the younger generation doing time at WFLA.

John G. Leitch, technical supervisor of WCAU is the same man who was formerly radio inspector for the 3rd District. Left four years ago and joined up with the station, that is now a model in up to date broadcast stations.

Joseph Morrow also of WCAU is W3ALA at home anytime you want to say "hello," and Edward R. Johnston is master of the control room during the daylight hours. He likes golf. Funny how these control room boys go for the game.

Bob Murray of KHJ gave the "eye-witness" account of the quake over Columbia, and shares honors as monitoring engineer of the station with Ray Lithgow who was formerly a talkie installation expert before that game went "sour."

Richard Delp, 10 years at WFI, and looking for another 10 is 3ZM after hours to you boys.

Harold Higgins, ex-ship and beer dog of WIP, thinks golf is good when things are slow.

Le Roy Anspach, a good operator at WCAU, loves music. Fact is he teaches it too.

And, you all know Edward A. Carrol, former United Fruit op, who is doing time at WCAU. Say Ed, just had an addition to his family on April 22d, her name is Ann Patricia, and both

(Continued on Page 25)

CORRESPONDENCE SECTION

Dear Editor:

There are a lot of operators at sea who will not have seen the enclosed clipping taken from the New York Herald, Sunday, April 2d. Suggest you publish it in "CQ" as it is in the cause of a good work.

73,

H. J. K.

News of the Freight Ships

To the New York Herald Tribune:

May I add my bit to the expression of gratitude so aptly phrased in the letter to your column by A. F. Halsey under the heading of "563 Miles East Sandy Hook."

No such complete news is ever given a sailor's wife as that received from your marine news, and so it is that I repeat, "God bless you for the reports of freight ships at sea. Please continue them." R. ANDERSEN

Union City, N. J., March 23, 1933.

* * *

To the New York Herald Tribune:

I was so interested in reading A. F. Halsey's letter in your paper today about radio positions. As a captain's wife they are a part of my daily life and usually the first page to which I turn. In fact, it was from them that I learned to read the paper backward! On a vacation I am never happy till I get my Herald Tribune and find where "my" ship is, or at which port.

I am certainly most grateful for the service, because by it we not only know they are safe on that day but it is possible to send mail with some certainty of its being received on time. When they are away months at a time these helps are especially appreciated. Ever since the war I have been following them, and I, too, thank you and hope they may continue.

MRS. JOSEPH F. JOHNSON

Chester, N. Y., March 23, 1933.

* * *

To the New York Herald Tribune:

We, too, have a loved one crossing the seas in a freight ship, and every member of our family subscribes heartily to the sentiments expressed in the letter by A. F. Halsey. All of us join in his prayer for your newspaper.

Ever since our young brother became a merchant marine officer, seven of us, in widely separated sections of New England, have bought or have had sent to us the daily and Sunday Herald Tribune. During one vacation period our sister rode six miles on horseback daily in order to get the shipping news. The radio reports have been of inestimable comfort to all of us.

If ship owners and ship masters could only understand fully what these reports mean to those of us whose loved ones are counted among those who go down to the sea in ships they would make it mandatory upon each ship's radio operator to report her position daily. That your newspaper is glad to print these reports I feel sure, because I have seen the marine news page with its wireless reports grow for the past twelve years. When this space was out recently we were shrouded in gloom.

This is the first time that I have ever written to a newspaper upon any subject, but Mr. Halsey's letter touched us deeply. P. J. S.

Worcester, Mass., March 25, 1933.

MICROPHONE RESISTANCE IN CIRCUITS

By E. E. GRIFFIN,

Chief Engineer, Universal Microphone Co.

There has always been more or less mystery and confusion as to the resistance of microphones and microphone buttons. Yet there is nothing especially complicated or magical about it all.

In some cases the DC resistance is practically the same as the AC impedance, while in others it is entirely different.

Take the case of a microphone button in series with a 1½ volt dry cell. Considering the DC resistance of the microphone as 200 ohms, we will have a current of 7½ milliamperes flowing in this circuit.

This value of 200 ohms DC resistance is also its approximate AC resistance or impedance. The alternating current impedance of a carbon microphone is not always its apparent talking resistance, but rather the ratio of the power absorbed by it to the square of the current flowing through it.

The general assumption is that AC resistance of a carbon microphone is about 80% of its apparent talking resistance.

In the case of a two button microphone, an entirely different condition takes place. We have one source of current, a single dry cell, and the two buttons of the microphone are in parallel. Thus the microphone presents a parallel circuit, each leg of which being 200 ohms the total overall resistance is 100 ohms, and thus with 1½ volts of battery in the circuit a total current of 15 mils will flow.

Its actual DC resistance, as far as battery supply is concerned, will be 100 ohms. Its AC impedance, however, as connected to the primary of the microphone transformer is entirely different since the two buttons in relation to the transformer are connected in series, thus presenting some 350 to 400 ohms AC impedance.

In regard to the transformer, the microphone is now considered an acoustically driven AC generator, with an impedance of approximately 400 ohms, and thus the transformer in order to efficiently match this value must have a primary winding of approximately 400 ohms effective impedance, and must be provided with a center tap to take care of the microphone's DC exciting current.

Each of these transformers has an extremely low resistance, with comparatively high AC impedance, which insures flat frequency characteristics from well below 30 cycles to well over 12,000 cycles.

Veteran Wireless Operators Association News

(Note: All communications to the V. W. O. A. should be addressed to WILLIAM J. McGONIGLE, SEC'Y, 140 VANDERBILT AVE., BROOKLYN, N. Y.)

Radio Communications Silent

On Memorial Day, May 30th, 1933, the entire radio communication system of the country, government as well as commercial, will be silent for one minute, immediately following the noon time signal, E. S. T. on the East coast and P. S. T. on the West coast, in tribute to our fellow radiomen who have made the supreme sacrifice in the line of duty.

The Veteran Wireless Operators Association has sponsored the one minute silent period, this and last year. The observance of the silent period has been made possible by the hearty cooperation of the following officials representing the radio communication organizations mentioned: Captain S. C. Hooper, director of Naval Communications, for the U. S. Navy; L. C. Covell, assistant commandant, for the U. S. Coast Guard; W. E. Beakes, vice president, for Tropical Radio; A. J. Costigan, traffic superintendent, for Radiomarine Corporation; A. Y. Tuel, vice president, for Mackay Radio; Paul Trautwein, president, for Mariners Radio Service; J. W. Swanson, vice president, for Southern Radio; R. H. Frey, radio supervisor, for A. H. Bull & Co.; and W. R. Pfizer, secretary, Panama Railroad Company.

We express to them our heartfelt appreciation of their participation in the tribute to the heroic radiomen who stayed at the "KEY" to the last.

We urge all radio operators to cooperate in the observance of the one minute silent period on Memorial Day. Radio operators aboard foreign vessels that are in American waters at the time, will, we believe, observe the tribute should they be requested to by American radio stations.

Memorial Day Services

On Memorial Day, at approximately noon, local time, services will be held at the Wireless Operators Association monument in Battery Park, New York, under the auspices of the Veteran Wireless Operators Association. A wreath will be placed on the monument by Fred Muller, the president. A short prayer will be read by a local clergyman. Tentative arrangements have been made for the broadcasting of the services by a local station. The public, and especially all members of the radio operating fraternity, are invited to attend.

"Stag" Dinner-Smoker

The semi-annual stag dinner-smoker of this association will be held this year at 6 P. M. on May 18th, 1933, at Paul's Restaurant, 90 Lafayette street, New York City. A beef-steak dinner will be served, accompanied by plenty of "real" 3.2 brew. Paul is the type of host who will not allow his guests to be neglected so far as food and the above mentioned brew are concerned. All radio operators and their friends are cordially invited to be with us on the 18th. We assure you a splendid dinner and entertainment. Attend, and be convinced. Meet old friends; make new ones! Tickets: $2.00. Obtainable from secretary at above address.

In Memoriam

We mourn the loss to the radio art of Colonel Samuel Reber, life member of this association and for many years general foreign representative of the Radio Corporation of America; Paul Bowen, a real veteran radio operator; the Radio Staff of the "Akron", Robert W. Copeland, CRM.; Herschel L. Morlen, RM1c, and Douglas C. Slayton, RM3c.

Have You Heard?

That: George Clark will represent the VWOA at the Century of Progress Exposition in Chicago which opens June 1st, 1933. He will be glad to welcome you at our booth. Drop up to see him. . . . Charles E. Pearce, who does most of the Association printing, is a member of the 20 year group. Still has a "live" ticket, too. . . . Ray Meyers is improving rapidly. And why not? A Miss "Charming" has charge of Ward 17 in the Philadelphia Naval Hospital. Ray expects to be at the dinner-smoker on the 18th. . . . VWOA news items appear regularly in column QRD? in Radio News Magazine. . . . John Christianson of the Netcong Transatlantic Radio staff joins. Started radio operating in the Navy in 1911. . . . George P. Smith, who runs the concessions at Bear Mountain Park, N. Y., invites radiomen up to see the place. How about getting a party together and making a trip up there this summer? Ye Sec'y will be glad to hear from all interested. All welcome. . . . Fred Muller for the nth time buys ticket number 1 for the dinner-smoker. . . . C. S. Anderson wrote the excellent biography of George Clark appearing in the May issue of the Bulletin. Thanks CS. . . . The 1932 and 1933 Year Books will be mailed you upon receipt of $.50 by the Secretary. These books contain an account of the activities of the VWOA during the past few years. An excellent buy! . . . An article "Sparks to the Rescue" will appear in the July issue of Popular Mechanics. . . . Radio staff of broadcasting station KFOX at Long Beach are to be commended for the excellent work performed by them during the recent earthquake which wrought havoc in and around Long Beach. They kept KFOX on the air despite the fact that the roof of the building and a side wall had caved in. We salute them. Heroes all! . . . This Association is, to a large degree, responsible for the admission of "Doc" Forsythe to Sailors' Snug Harbor. Fred Muller president, represented the association in the negotiations. "Doc" is the first radioman to be admitted to Snug Harbor. Congrats, Doc, and many happy days. . . . Joseph Israels II remits for dinner ticket. . . . There are, among our members, many versatile entertainers. They will demonstrate their talents at our dinner-smoker. Don't fail to see and hear them. . . . An old pal is looking for Jim Russell. . . . V. P. Villandre, of the Radiomarine office at 75 Varick street, will take your membership dues or sell you a ticket to the dinner. Thanks, Vic, for cooperation. . . . Remittances for tickets should be mailed the secretary at the above address.

V. W. O. A. DINNER-SMOKER, 6 P. M. MAY 18TH, 1933, AT PAUL'S RESTAURANT, 90 LAFAYETTE STREET, NEW YORK CITY.

IT WILL BE OUR PLEASURE TO GREET YOU AT PAUL'S ON THE 18TH!

American Radio Telegraphists Association News

All communications for The American Radio Telegraphists Association should be addressed to Hoyt S. Haddock, President of the Association, 20 Irving Place, New York City.

Authorized representatives are as follows:
Boston, Richard J. Golden; Charles W. Marsh.
Baltimore, Christopher Kelley, 650 West Fayette Street.
Miami, D. W. Scott, P. O. Box 2254
New Orleans, Forrest H. Flanders, Y. M. C. A., Box 314, 936 St. Charles at Lee Circle
Great Lakes, Arthur H. Freitag
Port Arthur, (Gulf representative).
Baytown, Texas, Ralph E. Knudsen
Beaumont, Clyde B. Trevey
Seattle, Rollie B. Weiss
San Francisco, Oliver Treadway
Los Angeles, M. L. Schaefer

Hoyt S. Haddock

Gentlemen, we are pleased to introduce to those not already acquainted, the likeness of Mr. Hoyt S. Haddock, who on May 5th will celebrate his 26th birthday. A little over six feet tall, blond, and married (the Mrs. is with him to prove it), he has been sailing for the last seven years out of the Gulf and the Eastern Division, with an occasional land station assignment. He has been for a long time the Gulf representative of the A. R. T. A., and has assumed his new duties of President of the Organization. Congratulations, Hoyt, and many good wishes.

MESSAGE OF THE PRESIDENT

I wish to sincerely thank all who so heartily supported me and earnestly worked for me in our recent election. I feel that if frankness, sincerity, and diligent effort are what you desire, you will never regret at any time your choice.

My program is centered largely along four lines, namely:

1. One hundred per cent. membership of all Commercial Operators.
2. Substantial funds in the treasury.
3. A complete, comprehensive, monthly report of the progress and affairs of the association.
4. To place a fund of helpful, enlightening material before the membership that is necessary for efficiency in the operating profession.

To those who do not know me, I wish to say that I am always open to suggestions of all kinds. I think that all who know me will feel free to come to me with both complaints and ideas, and I wish everyone to take this attitude, although I am hoping that it will be mostly for co-operation and suggestions that you come.

Remember, Operators, this is your organization and it is up to you to put it over. Co-operation, brotherly spirit and determination will do it and so far you have shown that you are capable of this, so continue it and you have my assurance that you will receive my every effort and diligence.

Dear Brother:

Listed below are the names of members who polled the five highest number of votes, respectively, in the recent election. You will note that I polled the highest number both as president and as vice president. This necessitated selecting Brother Richard J. Golden as vice president as he polled the second highest number for that office.

President	Vice President
Hoyt S. Haddock	Hoyt S. Haddock
Stephen Kovacs	Richard J. Golden
Kenneth Peterson	Alexander Vadas
Reinhardt Foege	Reinhardt Foege
Richard Golden	George K. Fitzsimmons

I have now taken over the duties of my office, and it is my sincere wish that each and every member of the Association will co-operate with me in every possible way.

Trusting that I will be able to have the pleasure of knowing every member personally in the very near future and assuring you that I am looking forward to a happy friendship with you, I remain,

Respectfully,
HOYT S. HADDOCK, President

New York Notes

After a quiet winter on his farm at Rochester, N. Y. our wrecking master, Freddie Gritzner, has again sailed on the Salvor for another try at Neptune's gold.

Joe Welch is back on the W. M. Rockefeller.

A. R. T. A. Notes

James W. Moore was assigned to the Joseph Seep of Standard Oil.

Charles Lambert sailed on the Gypsum Queen to run between Havana and Houston. The boys are betting Charlie will not be able to stand the good Havana cigars and will go back to his "twofors."

Kenneth Peterson is back in New York taking his Stanshipco vacation.

George Orgera remains chief of the Excambion. Julius Bamberg sailed as his assistant.

Steven Kovacs also on Stanship vacation.

George E. Fitzsimmons has a free week while the George Washington is being drydocked. Charlie Porter took a trip to Boston for the week.

Vernon Minzey took out the Vamar, he sure will like his stockfisk now.

Lester Jordan is spending Stanship vacation around Nawiearns.

Willard Bliss is now at Marine Hospital, Staten Island, where he expects to spend a month.

James Tasker dropped in for a visit before sailing for the West Coast again.

J. Flaherty sailed again for Stanship after a siege of illness.

Harry Schlesinger (Trader Corn) took another trip to South Africa on The West Isleta. He promised faithfully that he complete his book "Hunting Blind Tigers in South Africa" by the end of this 3½ months voyage. He vouches for the fact that they do not drink between 6 A. M. and 6:30 A. M. down there.

Goldweitz (Bronx Express) took assignment on The Texas Banker.

John Kennedy still kicking milk bottles at the Lynmore.

Hal Sudborough is fleet clerk at Patuxent (Stanship) and still known as Sparks.

Anton B. Anderson took his vacation owing to W. C. Teagle tying up.

Dr. Forsyth's eyes are getting better now. Doc holds the distinction of being the first radio operator to be admitted to Sailors Snug Harbor. Next. .?.

Alex Vadas is enjoying yachting on the Mascotte at Bahamas.

Gulf Notes

Robert Ubaldo sends greetings to his many friends and expresses his desire that all his friends join the A. R. T. A. Ubaldo is at present making the SS Virginia, Texas Co., his home.

D. F. O'Brien wants to know the whereabouts of his friend, O. P. Simons, from whom he has heard nothing for some time.

John Hemley, formerly with WBAP, Fort Worth, and WAFF, Dallas, is now an operator aboard the SS Maine.

In 1924 Mr. Barrett was serving as Junior under Edward C. Caffery on the SS Henry R. Mallory. Mr. Caffery would be very glad to hear from him or anyone who knows him.

J. E. Bridges, formerly employed at XEPN, is back in Fort Worth after the closing of the Mexican station. J. E. has hopes that Mr. W. E. Branch will reopen XEPN.

May, 1933

A CRYSTAL CONTROL SUPER-HETERODYNE RECEIVER

(Continued from Page 10)

operator's position, where it may be adjusted as required. Under normal conditions no adjustment is necessary during flight. A variable level control, also, is provided to allow the operator to adjust the headset volume to a comfortable value.

The power required for the heaters of the vacuum tubes is 3.2 amperes at 12 volts. A ballast lamp in the heater supply circuit provides adequate regulation for applied voltages from 11.5 to 14.5 volts. When the quartz plates are employed for frequency control, an additional intermittent drain of 2.4 amperes is required at the same voltage. For the plates and screens some 40 milliamperes is required at 200 volts, which is furnished by a small dynamotor operated from the battery.

To secure rigidity and still allow easy access to the various parts of the circuit, the apparatus is mounted on a dished aluminum chassis, as may be seen in Figure 2. The radio-frequency tuning coils, the intermediate frequency filters, the quartz crystal frequency controls, the filter system for the power supply, the various relays, and all vacuum tubes are mounted on the upper or flush surface of this chassis, while the radio-frequency tuning condensers, the high frequency choke coils, and the associated by-pass condensers are mounted underneath on the dished side of the chassis. An aluminum box surrounds the chassis and apparatus to provide mechanical protection and overall shielding. A removable top gives access to the tubes and frequency controls, and a small hinged door on the front gives access to the antenna tuning condensers and the indicator lamps of the crystal heater, as shown in Figure 3.

The complete receiver is placed on a base which has rubber shock proofing to protect the receiver from vibration normally found in an airplane. This mounting is permanently installed in the plane and to it is run the power supply cable, the leads of which terminate in a multicontact receptacle to which a plug on the receiver makes contact when the receiver is placed in the mounting. The frequency changing mechanism is also part of the mounting and connects to the receiver through a coupling. This arrangement permits the receiver to be readily removed for repair or replacement without disturbing the permanent wiring.

One of the outstanding characteristics of this receiver is its high value of selectivity. The response from an interfering signal only ten kilocycles from the desired one is about 1/1000 of that due to the desired signal. A selectivity curve is shown in Figure 4. Although the receivers used for this service at the ground stations have similar selectivity, it far surpasses anything previously attained in airplane sets.

The sensitivity obtained in the three stages of intermediate-frequency amplification and one of radio-frequency is very high. An input of one microvolt at the antenna gives an output of over twelve milliwatts, which is more than sufficient for headphone reception. Such high sensitivity is not required for normal operation, but it insures a sufficient reserve of amplification to give satisfactory reception under abnormal conditions. The outstanding performance of this receiver, together with its simplicity of operation, should be of considerable value in increasing the reliability of aviation communication.

ENGINEERING THE COMMERCIAL SHORT WAVE RECEIVER

(Continued from Page 12)

ditional control contributes several other advantages. The detector can always be operated on that portion of its characteristic at which best rectification is possible, with an ensuing improvement in tone quality and sensitivity. The receiver may also be operated in a condition of maximum selectivity by setting the regeneration control close to point of oscillation and controlling volume altogether at the r-f input, a highly important consideration under today's traffic conditions.

It will be observed in Figure 1 that the volume control is across the antenna and ground, while the regeneration adjustment varies the screen grid potential of the detector tube. The actual feedback is effected through a tickler with fixed coupling. The small variable condenser across the coil coupled to both the antenna primary and the grid circuit of the r-f tube acts as a compensator for the varied loading effects of different antennas.

The radio-frequency filter in the detector circuit is the result of a careful study of r-f isolation. The informed operator will appreciate the difficulties encountered when excessive r-f is permitted to invade the audio frequency circuits. The most noticeable characteristic of such a condition is the presence of hand capacity effects on all parts of the a-f system, including the headphones or loudspeaker leads, as well as the metal cabinet. Another symptom is the exasperating fringe howl as the detector approaches oscillation. A "sticky" regeneration control—an apparently excessive amount of lost motion—is directly traceable, in many instances, to inadequate filtering in the detector output circuit.

The use of a detector tube having a high plate impedance such as the '56, precludes the employment of a fairly large bypass condenser—the usual solution of the problem. Such a condenser would necessarily attenuate the higher frequencies, resulting in muffled tone quality and even unintelligibility of speech, and limit the tone selectivity in copying cw. The matter resolves itself into the familiar high radio-frequency problem of efficient r-f choke design. The inductance of the choke used is only 2.5 millihenries, but, what is more important, the distributed capacity has been lowered to only 1 mmf by means of pancake design.

The output of the detector tube is coupled to the audio amplifier through a 700 henry impedance, providing excellent gain in the first audio stage, a coupling system which contributes still further to the smooth operation of the regeneration control, and at the same time maintains perfect quality.

A.C. or D.C. Operation

The fundamental design of the 58C receiver permits several modifications for battery, a.c. and combination operation. For complete direct current operation, the '34 type tubes are substituted for the '56s. The 58C may also be operated from an a-c heater source with the "B" potentials supplied by high voltage batteries. However general convenience and reliability recommend an alternating current source for all potentials. Excellent regulation and humless reception are secured through the design of adequate filter and rectifying circuits. Despite the increasing tendence toward unitary design, the 58C is constructed for use with a separate power pack. Single unit construction necessitates a large amount of shielding in the r-f and detector circuits, and to be effective against low frequency induction should be of a ferrous metal and of far greater extent and thickness than that which amply fulfills the r-f isolation requirements — thus increasing the radio-frequency losses. Shielding, at best, is a costly pound of cure which tends to offset the increased performance attained through the use of low-loss insulation and design. These considerations strongly recommend the use of the separate unit with the high-frequency receiver, limiting all shielding to the radio-frequency fields.

Operating Conveniences

Inspection of the accompanying photographs will indicate the mechanical layout and still further attention to the requirements of the commercial operator. The r-f and detector plug-in coils are inserted from the front of panel by the convenient handles. The coil forms and receptacles are grooved so that the coils automatically and without "fishing" assume the correct position in reference to the prongs. It is thus possible to shift wave bands with almost the rapidity and ease of a switching arrangement without any sacrifice in the electrical efficiency of the receiver.

The dial is provided with a micrometer adjustment and the scale is checked against a Vernier section. The 270 degree dial is etched with 150 divisions which, by means of the vernier feature can be read to 1/10th of one division or slightly less than 11 minutes of arc! Logging of a highly precise nature, such as is desirable in commercial work, is thus facilitated.

The secondary controls, from left to right, are the antenna compensator, r-f volume control and regeneration control.

While this receiver is designed primarily for short-wave reception, its utility to the professional operator can be still further extended by means of standard coils which permit operation as high as 2000 meters.

WHAT NEXT?

The ship radio operators on the Cunard Liner "Franconia," and the Hamburg-American Liner "Reliance" recently were called into service to carry on by radio interchange of results in a bridge match on one side under direction of Shepard Barclay, and on the other by Leonard R. Gracy of Bridge Headquarters, Inc., while the boats are traveling between New York and Havana.

AIRWAY NOTES

M. B. Andrews is chief operator at the American Airways Station KGUB. He installed Southern Transcontinental Route, radio system.

J. G. Morris is second operator assisting him. Morris is a former railroad, telegraph, and ship operator, but for the last two years is in the airways, and likes it plenty. Goes fishing on time off as well as hunting everything with wing or hoof.

M. H. Griffith, formerly of the U. S. Navy, has been assigned to KCT. He is with the Airways Division, Department of Commerce.

Jack H. Cooper is now in charge at landing field, Sidney, Neb. He is ex-Navy man.

E. W. McGinnis, formerly at Airway Div., Dept. of Commerce, Big Springs, Tex., is back in the Navy on the USS Utah, filling up time for retirement.

Ship News

R. C. Wardell is on the US Coast Guard Ossipee.

H. J. Baine, on the SS City of Newport News, got a little extra work when his boat got hit recently.

E. Stromen is signed up on the SS Harboe Jensen.

Ernest J. Vogt is still on the SS Haiti, but finds time to keep his amateur W2BDP going too.

Howard C. Wagar, formerly on the SS L. J. Drake, is now on the W. H. Libby of Standard Shipping.

John F. Taylor is on the SS President Pierce. No longer on the SS President Hoover.

Ernest Gannett is on the SS William A. McKenney.

Ernest J. Vogt, formerly SS Carillo, is now on the SS Haiti, of the Columbia Lines.

G. H. Stetka has been transferred to the USS Luzon on the Yangtze Patrol, Asiatic Station.

Howard C. Wagar is now operator on the SS "L. J. Drake."

Howell H. Jones, of the USS John D. Edwards, has been transferred to Naval Radio Receiving Station at Los Banos, Philippine Islands.

R. D. Lagle, formerly on Aircraft Carrier, USS Saratoga is now assigned to the USS Utah.

Henry Jenkins, formerly radio operator on Lightship at Portland, Oregon, has been transferred to an Assistant Keeper at Arlington, Oregon.

G. C. Kleinsorge, formerly on the USS Whitney, has been transferred to the USS Raleigh.

Rex L. Munger, who sailed out of New York for six years, is now connected with the Lew-Bonn Radio Company, at St. Paul, Minnesota, and would like to hear from some of the old boys.

The Gulf Radio School, at New Orleans, have moved to new quarters in the same city.

BROADCAST STATION NEWS

(Continued from Page 19)

"Skeets" who is the Mrs. and the baby are doing swell.

Hudson Lyon and Bruce Piersall share Control room honors at KHJ. Bruce is an ex-sea and Hudson was with the Navy as radioman during the war.

I. H. Strassman is engineer and a big shot at WIP. A good man in a good job the boys say.

Edward Beeler of WCAU made a discovery recently. A new speed copy pinched him. He thought he had been taken in by all of them, but here sure enough was a new one doing it.

Samuel Sabaroff, WCAU op., helps support all the radio magazines. He reads them all and looks for more.

But, Charles Miller, Chief Op of WCAU, claims the best amateur set in the 3rd District. You "hams" try him out some day and see how he works it. Distance is no item for Charlie.

Hank Geist and George Lewis of WCAU are the Stokowski ops. Geist is regularly assigned to him, but loves to pound "jazz" on the piano himself. Poor George who with Mr. Leitch supervised the installation of the station gets plenty of work trying to get apparatus right for Stokowski. "What a life," says George to his friends and on the quiet.

OPERATOR "J"

(Continued from Page 5)

$= (5 - j7) + (2 + j4) + (1 + j6) = (5 + 2 + 1) + (-j7 + j4 + j6) = 8 + j3$ Resultant.

This problem and its solution are shown graphically on diagram 2.

As we are to operate with admittances, the reciprocals of impedances, when solving parallel circuits, we will next consider the **reciprocals of rectangular vectors.**

We have the impedance given: $Z = R + jX$, its reciprocal is the admittance Y, that is $Y = 1/Z$ therefore

$$Y = \frac{1}{Z} = \frac{1}{R + jX}$$

In order to remove the radical from the denominator we multiply the numerator and denominator by $R - jX$, and simplify.

$$\frac{1}{R + jX} \cdot \frac{R - jX}{R - jX} = \frac{R - jX}{R^2 - jXR - jXR - (j^2X^2)}$$

$$= \frac{R - jX}{R^2 - (j^2X^2)} \qquad \text{But } j^2 = -1$$

Therefore

$$\frac{R - jX}{R^2 - (j^2X^2)} = \frac{R - jX}{R^2 - (-1X^2)} = \frac{R - jX}{R^2 + X^2}$$

$$= \frac{R}{R^2 + X^2} - j\frac{X}{R^2 + X^2} \qquad \text{Q. E. D.}$$

The formula $Y = \frac{R}{R^2 + X^2} - j\frac{X}{R^2 + X^2}$

is worthwhile well remembering.

It will be noted that in this formula "j" is preceded by a minus sign. Had the impedance been given as $Z = R - jX$, then in the above formula for admittance (Y) operator "j" would be preceded by a plus sign. This rule is clearly stated in the following: **"Capacitive reactance is negative, therefore a minus sign is placed before X_C. Inductive reactance is positive and X_L is preceded by a plus sign. Conversely, Capacitive susceptance is positive and B_C is preceded by a plus sign. Inductive susceptance is negative and a minus sign is placed before B_L."**

Diagram 3 shows an A.C. circuit in series-parallel combination. It is required to find the total impedance of the circuit, the current delivered by the generator and the voltage and current phase relation.

In the upper parallel combination's right branch we have an inductance (L) of 70μH and a 20 Ohm resistance (R).

The inductive reactance $X_L = 2\pi FL$, where $2\pi = 6.28$, F = frequency (750 KC's) and L = inductance (.00007 H); Then $X_L = 6.28 \times 750000 \times .00007 = 330$ Ohms

Impedance $\overline{Z} = 20 + j330$

Admittance $\overline{Y} = 1/Z =$

$$\frac{20}{20^2 + 330^2} - j\frac{330}{20^2 + 330^2} = .0001826 - j.003019$$

In the left branch of the upper combination we have a capacity (C) of 8$\mu\mu$ Farad

(.000000000008) and a resistance of 40 Ohms. Then

$$X_c = \frac{1}{2\pi FC} = \frac{1}{6.28 \times 750000 \times .000000000008} = 265 \text{ Ohms}$$

Impedance $\overline{Z''} = 40 - j265$

$$\overline{Y''} = \frac{40}{40 + 265} + \frac{265}{40 + 265} = .0005569 + j.00369$$

The total admittance of the upper combination then: $\overline{Y'} + \overline{Y''} = (.0001826 - j.003019) + (.0005569 + j.00369) = .0007395 + j.000671 = \overline{Y_1}$ and

$$\overline{Z_a} = 1/Y_a = \frac{1}{.0007395 + j.000671} = \frac{.0007395}{.0007395^2 + j.000671^2} - j\frac{.000671}{.0007395^2 + j.000671^2}$$

$= 741.6 - j672$

In the lower combination's right branch we have 50μHenry inductance, 30$\mu\mu$ Farad capacity and 100 Ohms resistance, then its inductive reactance $X_L = 6.28 \times 750000 \times .00005 = 236$ Ohms.

The capacity reactance

$$X_c = \frac{1}{6.28 \times 750000 \times .000000000003} = 708 \text{ Ohms}$$

Then $\overline{Z_1} = 100 + j(236 - 708) = 100 - j472$

and $\overline{Y_1} = 1Z_1 = .0004296 + j.002028$

In the left branch of the lower combination we have 100μH inductance, 11$\mu\mu$F capacity and 200 Ohms of resistance, then $X_L = 6.28 \times 750000 \times .0001 = 471$ Ohms

and $X_c = \frac{1}{6.28 \times 750000 \times .000000000011} = 193$ Ohms

Then $\overline{Z_2} = 200 + (471 - 193) = 200 + 278$

and $\overline{Y_2} = 1/Z_2 = .001705 - j.002371$

Therefore the total admittance of the lower combination:

$\overline{Y_1} + \overline{Y_2} = (.0004296 + j.002028) + (.001705 - j.002371) = .0021346 - j.000343 = \overline{Y_b}$

and $Z_b = 1/Y_b = 456.7 + j73.42$; Therefore the total impedance of the whole circuit: $\overline{Z} = \overline{Z_a} + \overline{Z_b} = (741.6 - j672) + (456.7 + j73.42) = 1198.3 - j599.58$

$Z = \sqrt{1198.3^2 - j599.48^2} = 1340$ Ohms Impedance and since the capacitive reactance predominates the current will lead the voltage by an angle whose Tan = 599.48/1198.3 = .5 and therefore the angle of lead is 26°34'.

The voltage across the circuit is given 2000 V. then the current I = 2000/1340 = 1.49 Amperes.

It will repay the reader should he go to the trouble of finding the current and voltage in each part of the circuit, because their distribution is very peculiar. For instance, while the voltage across the whole circuit is 2000 volts, across the upper combination we find its magnitude 1500 Volts and across the lower combination its magnitude is 680 Volts, however, it must be borne in mind that these voltages are vector quantities and they have directions as well as magnitudes and therefore must be added as vectors.

Some Notes on Plate Output Circuits of Tube Transmitters

(Continued from Page 14)

impedance the current in M.A. is low. As the plate tap P is moved down the coil the current in both M.A. and A increase up to the point of optimum impedance. As the tap P is moved still further down the coil the D.C. plate current of M.A. increases, the R.F. current in A decreases and the plate of the tube rapidly heats up because, due to the low generating efficiency with the reduced load impedance the percentage of the total power that is dissipated on the plate of the tube is greatly increased.

In an amplifier as shown the improper adjustment of the plate tap will seldom have any other bad effect than a decrease in power output, an increase in plate current if too few plate turns are used, or both. In an oscillator however an incorrect number of plate turns can make the oscillating circuit very unstable. In most oscillator circuits the operating bias is obtained from a grid leak, the bias thus being effective only while the circuit is oscillating and the grid excited. In such a circuit if oscillations cease the bias is instantly removed and the plate current rises sharply. If the tube was being worked near its maximum power rating when oscillating, the sudden increase of plate current may damage the tube.

Normally in such an oscillator circuit, (assume in Diagram 1 E_g represents a tuned grid circuit and the bias battery is replaced by a grid leak), as the plate tap P is placed well up the coil L oscillations will be very stable but not strong. As the plate tap is moved down toward ground, one turn at a time, both the R.F. current as indicated by A and the plate current as indicated by M.A. increase. However a point will be reached where, while maximum current can be obtained in A, oscillations will not be stable. The effect of coupling to the plate circuit, or any other adjustment may make oscillations stop. If used for telegraphy the circuit may oscillate on one closing of the key and fail to start on another closing. Obviously the transmitter cannot be operated in such a condition. The remedy is to increase the plate turns by one or more until oscillations are stable and the maximum R.F. power is obtained with the plate current within permissible limits.

If the oscillator is crystal controlled and employs a grid leak bias the conditions are substantially as described above, except that a crystal oscillator should never be used with a plate voltage that could cause damage to the tube if oscillations cease. Crystal controlled oscillators are often operated with a battery bias as shown in Diagram 1, in that case E_g in the diagram represents the crystal. With such an arrangement the oscillator can be biased practically to the cut off point. With sufficient plate turns closing the plate circuit starts the oscillations and good output can be obtained. Now as the plate turns are decreased toward the optimum value the power output increases. With more than sufficient plate turns the plate tuning is not critical. With a decrease of plate turns the output increases and the plate tuning becomes more critical until a point is reached where oscillations break as the tank circuit is tuned through resonance. However when oscillations break the plate current drops to zero instead of rising sharply.

It may or may not be possible to start oscillations under this condition by tuning the tank circuit near resonance. For stable operation the plate turns should be increased until the maximum output can be obtained with a stable oscillating circuit.

In any tube transmitting circuit the satisfactory operation of the tube is largely a function of the load circuit adjustment and the most important load adjustment is the plate tap. In making this adjustment the factors of stable operation and efficiency must be considered as fully as that of obtaining maximum output.

Radiotelegraph Operator Licenses

(Continued from Page 15)

munication and the general procedure of handling radiotelephone traffic between mobile and fixed points in aeronautical or marine harbor service.

This class of license will be valid for the operation of mobile radiotelephone stations equipped for operation on a single frequency and with apparatus so constructed as to prohibit any change in adjustment by operators.

AMATEUR OPERATOR LICENSES

The operation of an amateur station will be permitted only by the holder of an Amateur Operator license.

10. **Amateur Extra First Class**—To be eligible for examination for this class of license, an applicant must have had at least two years' service as a licensed amateur radiotelegraph operator and must not have been penalized for violation of any radio act, treaty or regulation binding on the United States. The applicant must pass code tests in transmission and reception at a speed not less than 16 words per minute in Continental Morse Code, code groups, and 20 words per minute in Continental Morse Code, plain language (5 characters to the word), and a theoretical examination relating to amateur apparatus, both telegraph and telephone, and international regulations and acts of Congress affecting amateur stations and operators.

This license is valid for the operation of any licensed amateur radio station.

The amateur extra first class license examination will be sufficiently wide in scope to authorize the holder of this class of license the unlimited radiotelephone privileges set forth in paragraph 377 of the Federal Radio Commission's Rules and Regulations.

11. **Amateur First Class**—Applicants for this class of license must pass a code test in transmission and reception at a speed of not less than 10 words per minute in Continental Morse Code (5 characters to the word), and an examination similar to that given for Amateur Extra First Class license but not so comprehensive in scope.

This license is valid only for the operation of licensed amateur radio stations not utilizing special phone privileges as set forth in paragraph 377 of the Rules and Regulations of the Federal Radio Commission.

Holders of this class of license, after at least one year's experience as a licensed operator at an amateur station, may be accorded unlimited phone privileges as indicated in Paragraph 377 of the Rules and Regulations of the Federal Radio Commission after passing the supplemental examination and having their license so endorsed.

12. **Temporary Amateur Operator Class**—Application for this class of license will be accepted only from applicants residing more than 100 miles from examining point, which may be the district headquarters, a suboffice, or a city visited by an examining officer. The applicant must submit a sworn statement attesting to his ability to transmit and receive at a speed of not less than 10 words per minute in Continental Morse Code, and complete a questionnaire pertaining to the operation of an amateur radio installation.

Applications for examination for unlimited amateur phone privilege will not be accepted from holders of Temporary Amateur Class Operator license. Applicants for this examination must appear personally before an examining officer and pass a written examination.

Passing Mark For All Examinations

13. The percentage that must be obtained as a passing mark in each examination is 75 out of a possible 100. No credit will be given for experience in the examination for any class of license.

Execution of Oath of Secrecy

14. Licenses are not valid until the oath of secrecy has been executed and the signature of the issuing officer affixed thereto.

All examinations, including the code test, must be written in long hand by the applicant.

Renewals

15. **Renewals (a) Commercial Operator Extra First Class**—These licenses may be renewed without examination provided the record shows 12 months' satisfactory service at stations which the applicant is authorized to operate, at least six months of which must have been during the last 12 months of the license period.

Provided further that the holders of these licenses employed as radio inspectors, radio instructors, or in similar occupations requiring exceptional qualifications, where the duties require the testing or demonstrating, or otherwise using commercial radio apparatus and the telegraph codes, may be issued renewals of their licenses without examination, provided such employment has covered a period of 18 months out of the two-year license period. Where the applicant has not regularly used the telegraph codes, he will be given the code examination as for an original license, and if he has used only one code, he will be examined in the code not used.

(b) Other renewals: Renewal licenses may be issued to holders of other classes (except amateur) without examination, provided the operator has had three months' satisfactory service during the last six months of the license term.

One year's satisfactory service out of two years of the license term may be accepted for renewal at the discretion of the examining officer.

(c) No credit will be allowed for service unless it appears that such service was obtained under conditions that required the employment of a licensed operator.

(d) Holders of radiotelegraph licenses endorsed for operation of radiotelephone stations whose service has been wholly at radiotelephone stations will be required to pass the code test for the class of license held, and failing this, will be issued a radiotelephone operator's license as a renewal of the class in which he previously qualified.

In cases where it is impossible for the applicant to appear for the code examination when making application for renewal, he will be issued a radiotelephone operator's license as above. However, in such cases the applicant may appear for code examination within three months after the date of the issuance of the radiotelephone license and be issued a license of the class formerly held, provided he passes the code examination. Failing to appear or failing to pass the code test during the three months period, the applicant forfeits this privilege.

(e) Renewals or new licenses may be issued a reasonable length of time prior to the expiration of existing licenses but must bear the exact date of issue, which must correspond with the date on Form 756 forwarded to the Federal Radio Commission. Operators who fail to apply for renewal of their licenses on or prior to the date of expiration must be re-examined.

(f) If, because of circumstances over which the applicant has no control, an operator is unable to apply for renewal of license on or prior to the date of expiration, an affidavit may be submitted to the Federal Radio Commission through the supervisor of radio or examining officer, attesting to the facts. After consideration by the Federal Radio Commission, advice will be forwarded to the supervisor of radio or examining officer in regard to the issuance of a renewal of the license.

(g) Service records must be completed and signed only by masters, employers or the duly authorized agents of either.

(h) Any improper alteration of the service record or the forgery of the master's or employer's signatures, or any attempt to obtain a license by fraudulent means, or by attempting to impersonate another, or copying or divulging questions used in examinations, will constitute a violation of the regulations for which the operator may suffer suspension of license or debarment from further examination for a period not exceeding two years at the discretion of the licensing authority.

16. **Duplicate Licenses**—Any operator applying for a duplicate license to replace an original which has been lost, mutilated, or destroyed, will be required to submit an affidavit to the Federal Radio Commission through a supervisor of radio or examining officer, attesting to the facts regarding the manner in which the original was lost. The Federal Radio Commission will consider the facts in the case and advise the supervisor of radio or examining officer in regard to the issuance of a duplicate license. Duplicates will be issued under the same serial number and date as the original, and will be marked "duplicate" in red on the face of the license.

17. **Reexamination**—No applicant who fails to qualify will be reexamined within three months from date of the previous examination. However, when an applicant for the radiotelegraph operator first class or second class license fails in the code examination, he may be reexamined the same day for any other class of license desired.

License Endorsements

18. **Radiotelegraph Class licenses to be valid for the operation of radiophone stations will be endorsed as follows:** The holder of this license has qualified by examination for additional authority to operate any radiophone station. (If radiophone examination taken by applicant is for second class radiotelephone operator's license, endorsement should be followed by "except broadcast".)

Date .....Examining Officer .....

* * *

September 7, 1932

In the absence of further instructions to the contrary, temporary amateur operators' licenses shall not be restricted to specific amateur station locations. Therefore, temporary amateur operators may operate amateur stations in accordance with the rules governing amateur first class operator licenses.

* * *

September 30, 1932

The holders of radiotelephone second or third class licenses will not be granted this privilege and must obtain the unlimited phone privileges in accordance with paragraph 3 of Section 11.

The holders of radiotelegraph second class licenses (or the old commercial licenses) who can show a total of one year or more service at stations open to public correspondence during their operating career (and who obtained a percentage of 75 or higher in the commercial second class license examination) may obtain a radiotelegraph first class license upon proof of this service and passing a code test for the radiotelegraph first class examination without being required to retake the theoretical examination.

* * *

October 14, 1932

Operators who have operated at more than three stations in the aviation service and who apply for renewal of licenses may indicate service on the reverse of their licenses by giving the name of the aviation chain or company where employed in lieu of listing the call letters of all stations. When this is done, the employer shall sign the license opposite the service entry, indicating whether or not the service performed is considered satisfactory.

When the service has been at three or less stations in the aviation service, it will be necessary that the call letters as well as the station locations and signatures of employers be obtained.

This regulation applies only to endorsements for stations in the aviation service.

* * *

November 10, 1932

Reference is made to Section 12 of the Rules and Regulations Governing the Issuance of Radio Operators Licenses which states, in part:

"Application for this class of license (temporary amateur class) will be accepted only from applicants residing more than **100 miles** from examining point, which may be the district headquarters, a suboffice, or a city visited by an examining officer. . ."

For the purpose of determining the distance an applicant resides from an examining point, examining officers have been directed to com-

pute distance on the basis of airline mileage rather than railroad or highway mileage.

* * *

November 26, 1932

Prior to July 1, 1932 a special class of license was issued covering operation of stations in the aviation service. This license was known as "Radiotelephone Operator, Aeronautical Class" and was temporarily replaced, effective July 1, 1932, by the Radiotelephone second class license (valid only for telephone operation of stations in the aviation service). In this connection, the Commission on November 26, 1932, adopted an order continuing the radiotelephone second class operator's license, bearing the endorsement "Valid only for telephone operation of stations licensed in the aviation service," for an indefinite period of time.

Applicants for this class of license are required to make a passing mark in both radio and meteorological subjects. The minimum requirements are:

(1) A passing mark of 15%, out of a possible 20%, in meteorological questions; and
(2) A passing mark of 60%, out of a possible 80%, in radio making a total of 75%.

* * *

December 12, 1932

In reference to the issuance or renewal operator licenses, as the regulations governing the issuance of radio operator licenses adopted July 1, 1932 eliminated the commercial third class operator license, holders of these licenses which are submitted for renewal shall be issued radiotelephone third class licenses without further examination.

* * *

January 6, 1933

For the time being, and until the Commission can consider a revision of the rules and regulations governing the issuance of radio operator licenses, the following temporary rules shall apply:

1. Any person holding a valid radio operator's license of any class issued by the Commission may operate any station licensed for, and operating on frequencies above 40,000 kilocycles provided in the case of amateur operators such operation shall be in conformity with Rule 363.
2. Inasmuch as the requirements for other classes of radio operator's licenses are greater in scope than for the radiotelephone third class operator's license, such operators, except amateur, may operate any station licensed for frequencies below 40,000 kilocycles for which a third class radiotelephone operator's license is valid.

* * *

February 7, 1933

Section 9 of the Rules and Regulations Governing the Issuance of Radio Operators Licenses has been broadened to permit the holder of a radiotelephone third class operator's license to operate stations using type A-3 emission which are licensed to use a maximum power of 50 watts; and also to operate any class of station licensed for, and operating on, frequencies above 40,000 kilocycles using any type of emission.

The second paragraph of Section 9 has also been modified to permit the holder of a radiotelephone third class license to operate stations licensed to use a maximum power of 50 watts utilizing more than one frequency when the change in frequency is accomplished by mechanical means in such manner that the operator is not required to make any change in the electrical adjustment of the equipment.

* * *

February 13, 1933

Under date of February 3, 1933, the Federal Radio Commission issued the following order:

"That Section 15 of the Rules and Regulations Governing the Issuance of Radio Operators' Licenses, except amateur, be suspended until July 1, 1934, insofar as it requires employment service or examination as a condition precedent to obtaining a renewal of the same class of license."

* * *

March 10, 1933

The regulations governing the issuance of radio operator licenses adopted July 1, 1932 abolished the commercial classes of licenses (except the commercial extra first) and instituted the radiotelegraph and radiotelephone classes, providing for the renewal of commercial classes as follows:

Commercial extra first class
Commercial first class
Commercial second class
Commercial third class
Commercial extra first class
Radiotelegraph first class
Radiotelegraph second class
Radiotelephone third class

The commercial first and second class licenses are valid for the operation of broadcast and other radiotelephone stations until expiration.

The radiotelegraph class license does not grant to the holder the same privileges and rights as were formerly granted to the holders of commercial class licenses. In order to obtain a radiotelephone endorsement the holders of commercial class licenses must have had satisfactory service at radiotelephone stations. In this respect, the use of the phrase "same class of license," as contained in the Commission's Order of February 3, 1933, has caused confusion. The intention of the Commission is that renewal licenses shall be issued in accordance with the present regulations except that no service is required under a commercial class license to obtain a renewal as a radiotelegraph class license.

The radiotelephone endorsement is not considered as "the same class of license" but as a new class of license and an applicant shall be required to take the examination for the radiotelephone endorsement desired or to show the equivalent service at radiotelephone stations.

The Commission's Order is not retroactive and does not permit the renewal of licenses which expired prior to February 3, 1933.

* * *

March 15, 1933

The following shall supersede, effective April 1, 1933, the 1st paragraph of Section 18 of the Rules and Regulations Governing the Issuance of Radio Operators Licenses.

Where the holder of a radiotelegraph class license has qualified for a radiotelephone class license, his radiotelegraph license shall be endorsed as follows:

Radiotelephone First Class

"The holder of this license has qualified for the radiotelephone first class license and is authorized to operate any licensed radiotelephone station.
Date ..... Examining Officer ....."

Radiotelephone Second Class

"The holder of this license has qualified for the radiotelephone second class license and is authorized to operate any licensed radiotelephone station for which this class of license is made valid.
Date ..... Examining Officer ....."

Radiotelephone Third Class

"The holder of this license has qualified for the radiotelephone third class license and is authorized to operate any licensed radiotelephone station for which this class of license is made valid.
Date ..... Examining Officer ....."

Radiotelephone Second Class

(Valid only for telephone operation of stations in the aviation service.)

"The holder of this license has qualified for the radiotelephone second class (valid only for telephone operation of stations in the aviation service) license.
Date ..... Examining Officer ....."

The commercial extra first class license does not require any endorsement to be valid for radiotelephone operation.

* * *

March 30, 1933

Section 3 of the Rules and Regulations Governing the Issuance of Radio Operator's Licenses states, in paragraph 2, that the holder of a radiotelegraph second class license is not authorized to act as chief operator on a vessel in the second class until his license is endorsed certifying to six months or more satisfactory service as an operator at radiotelegraph stations open to public correspondence.

It is not mandatory for the holder of a radiotelegraph second class license to have his license endorsed by the Commission to authorize him to act as chief operator on a vessel of the second class; the service record on the reverse side of the license, when attesting to six months or more satisfactory service and certified by the operator's employer, will suffice.

However, upon renewal it becomes desirable for the renewal license to indicate in some manner that the holder is entitled to act as chief operator on a vessel of the second class (if he is so entitled because of service gained under his previous license) since this information would not otherwise be readily available. Therefore, such renewal radiotelegraph second class licenses shall have inserted in the space provided on the license form 758 after "Special Endorsement," the following endorsement:

"Authority is granted the holder on this license to act as chief operator on a vessel of the second class.
(Date _____ (Signature) _____
Examining Officer"

Although as previously stated, the service record will suffice to entitle the holder of a radiotelegraph second class license to act as chief operator on a vessel of the second class, he may, in addition, have his license endorsed by the Commission as quoted above at any time he so desires upon making proper application on form 756.

A THREE-FREQUENCY RADIO TELEPHONE TRANSMITTER FOR AIRPLANES

(Continued from Page 18)

between the transmitter and receiver, is made part of the transmitter to reduce the number of component parts of the system. The development of miniature ballast lamps by the group under J. R. Wilson has made it possible to use a lamp in each filament branch. The small size of these lamps may be judged from Figure 4.

Operation of the equipment requires the transmitter to stop immediately when the microphone button is released and to produce no noise in an adjacent receiver of very high gain. This was greatly facilitated by the development in co-operation with V. L. Ronci, of a high vacuum relay which opens the 1050 volt plate supply. This relay is very small and light and is entirely safe to use where gasoline fumes may be present.

In the mechanical design of the transmitter, for which P. S. March was responsible, several novel features are incorporated. A separate mounting is designed for permanent installation in the airplane. An upright section at the rear of the mounting, shown in Figure 5, carries a multiple contact jack terminating all connections to the transmitter except the antenna, and a coupling to connect to the switches that select the frequency channel. All wiring is run to this mounting in either flexible or rigid conduit. A lever projecting from the front operates a cam which, when the transmitter is placed on the mounting, slides it back into contact with the receptacle and the frequency changing switch.

The box containing the transmitter itself is of sheet duralumin, and not only supports the apparatus but provides the necessary shielding. It is divided into two irregularly shaped compartments by interior partitions. Part of the outer casing is perforated and the space between the inner partition and the perforated section of the outer case forms a ventilated compartment into which is placed only the heat dissipating apparatus, such as the vacuum tubes, ballast lamps, resistances, and crystals. All other apparatus and wiring is completely enclosed for protection against dust and moisture. A new type of vitreous enamel resistor with rear connections was developed to keep the wiring out of the ventilated compartment.

The 13A radio transmitter is an excellent example of the great improvement that can be made in apparatus by a careful study of the most desirable form of the various component parts and their relative locations based on an intimate knowledge of service conditions. Even without a radical change in fundamental performance, the new transmitter is so superior to the old in many respects that it is expected to receive an enthusiastic reception from air transport operators.

An 8C Western Electric amplifier, with its inherent poor characteristics below 100 cycles and above 4,000, can be easily modified into a flat amplifier with good characteristics from 35 to 10,000 cycles, we are advised by Phil Lasky of KDYL. Ask your nearest Western Electric or Graybar office for dope on "Conversion of 8C Amplifier PER RA-67 Accordance with RCP-No. 1."

Although it may be a little late for "All American" and "All Star" selections, the Static Room has selected what it considers to be an unbeatable radio staff, one any captain would simply love to have aboard his vessel:

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1st Assistant, Abraham Goldweitz
2nd Assistant, Simon Golden
3rd Assistant, Joseph Gately

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