COMMERCIAL RADIO

JUNE
1935

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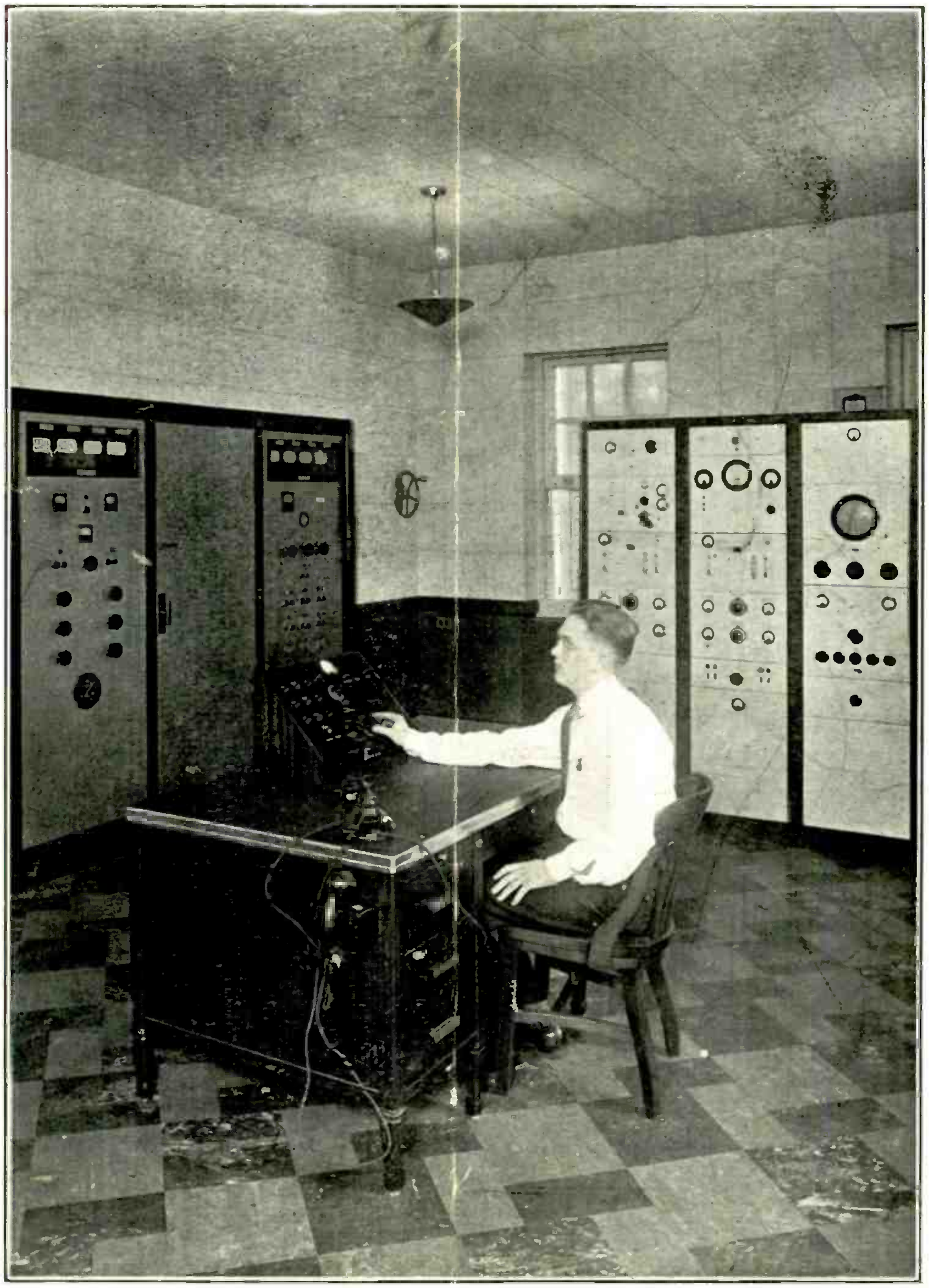

Constant Frequency Monitor

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A MONTHLY JOURNAL DEVOTED TO THE COMMERCIAL RADIO & ALLIED FIELD

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RCA Manufacturing Company, Inc.
Camden New Jersey

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ATLANTA	144 Walton Street, N. W.
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VOLUME IV NO. 8

TELEVISION keeps threatèningly bobbing its head, but regardless of the speed of development, it will not be ahead of the public demand or anticipation.

The recent intimations to RCA stockholders at their meeting by David Sarnoff, and other public announcements by the same author are the official words of that corporation's continued efforts in the direction of television.

Later announcement is that starting April 1st next year the American Telephone & Telegraph will have placed and be ready for experimentation of their new "coaxial" cable between Philadelphia and New York which is the hope for the 1,000,000 cycle frequency line transmission required for distance transmission of television. This will be the first long distance actual test for the line transmission that will answer the distribution problems of television.

England, Germany, Japan, and even here in the United States some transmission of disc scanning principle of television is "on the air" everyday. At the Camden RCA-Victor works Zworykin and his staff are continuing their efforts. At the West Coast offices and the Philco Philadelphia plant Farnsworth and his staff are each day recording some slight advances.

It is such an extensive study that little can be accomplished by small individual experimenters for want of funds, but an actual fact if it were not for this the public would be kept better informed of the day to day progress. It does appear a "large shop" proposition.

COMMERCIAL RADIO

(FORMERLY "C Q")

The Only Magazine in America Devoted Entirely to the Commercial Radio Man

Contents for June, 1935

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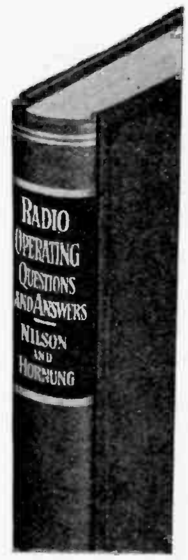

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A Constant Frequency Monitor That Stays Put

By ROY H. McCONNELL

WE about fourteen months ago designed and built a constant frequency motor which I believe will be of interest to anyone interested in the building of a frequency motor that is really accurate. The circuit diagram is shown in Figure 1, with which also is given data regarding parts used in construction of the unit. The monitor has been tested for long periods of time in direct comparison with a constant frequency monitor which is a commercial product which was approved by the Bureau of Standards for the Federal Radio Commission. We have found the monitor to be just as accurate as the commercial job. It will measure beats as low as one per second which I believe you will agree is getting down pretty fine. The photos give complete data for the construction of the frame and dimensions of the temperature chamber, inner oven or rather heat attenuating box which holds the crystal and locations of the heaters.

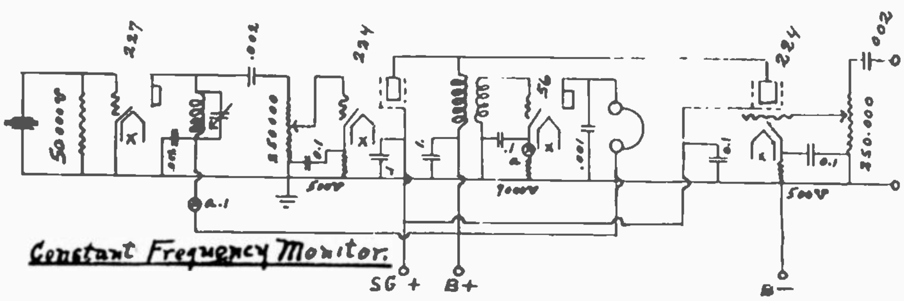


Fig. 1. is the diagram of the monitor. The value of the various parts are given in the drawing.

a.1. is an 0-15 Millammeter

a. is an 0-1½ Millammeter.

X. Filament leads all connect to the 2½ volt transformer mounted on the left hand side of the monitor frame. A 30 ohm resistor is shunted across the 2½ volt leads with the center tap grounded.

The screen grid voltage is 65, the plate voltage 120.

The oscillator and detector coils were salvaged from an Atwater Kent model 20 radio. The secondary was removed from the oscillator coil. The detector coil was not changed in any way.

I would advise strict adherence to the specifications of the various parts of the monitor if you want to be sure of having a job that will function as it should without any monkey business and some rebuilding. We spent considerable time and effort before arriving at a design that was satisfactory. This is particularly necessary regarding the temperature oven. We built several before we hit on a combination that worked and really stayed put. To start with we imagined that all that was necessary to have an accurate temperature oven was to build a well insulated box and put a good heater unit in it and a mercury thermostat. Well it didn't work out that way, we had equivalent of six inches of wood insulation in our first oven and used four Ohmspun heater units and an Amsco mercury thermostat, and lo and behold, the blamed thing would vary as much as two degrees centigrade, this was discouraging to say the least, and we immediately began to have more respect for the men who designed and built the frequency monitors which received approval of the Federal Radio Commision. Then as one of our Bohemian friends says "what to do is the next thing." Well we got our heads together and had a conference, with the results that we built a new temperature oven much smaller than the first, put the heater units just two of them on each side of the inner crystal oven and put the thermoregulator in a holder fastened against the inner oven and between the heating unit, this did the job beautifully. The heat stays on about 45 seconds and off 75 and the temperature is so even that we cannot detect any change on the thermometer. That took care of the heat problem.

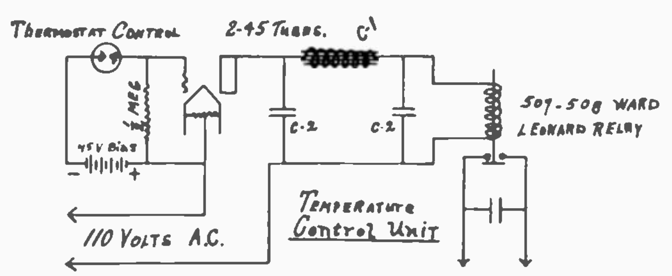


Fig. 2 is a diagram of the heat control unit. The resistor across the filaments is a 30 ohm center tapped.

C-2. are 300 volt I. MFD Condensers.

The choke is the prilary of an old trickle charger.

The 2-45 tubes are used in parallel.

The condenser across the relay contacts may be anything from 1/10 to ¼ MFD.

The circuit is given in Fig. 2 for the heat control unit. It is the most satisfactory unit of this kind we have ever had anything to do with and we have used several kinds. It is simple and easily constructed and has given us uninterrupted service for over eighteen months with no trouble at all. We are now using three of these units and like them fine.

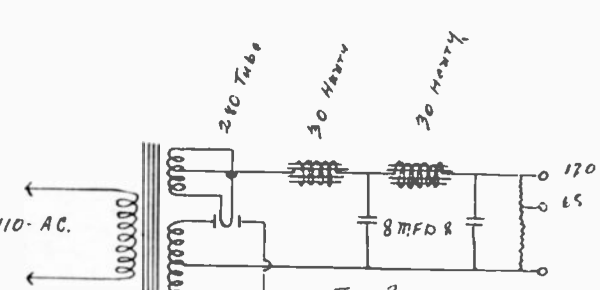
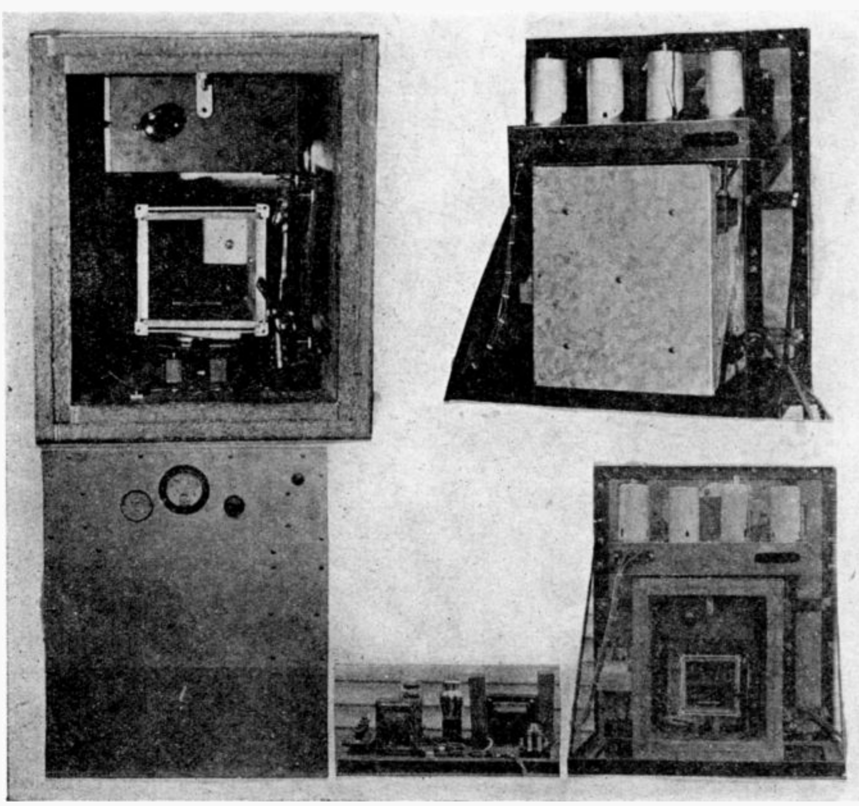


Fig. 3. is the circuit for the power pack for the monitor. There is nothing unusual about it and as you will note the voltage is rather low but seems to make for stability and gives us plenty of power. The crystal used is an X Cut operating at 46 degrees centigrade. The holder is a standard holder with no tension on the top plate. As you will notice in the photos the monitor is completely shielded and we are showing in the photo how the leads are brought from the temperature oven to the crystal stage. In operation the monitor is very stable and has no body capacity effect. I feel sure that any one building a monitor of this type will be highly pleased with the results it will give. Ours is giving us splendid service and satisfaction.

Upper left—The photo shows the construction of the temperature oven. The inner and outer boxes are made of 16 gauge galvanized steel with an inch of celotex between them for insulation. The photo shows how the celotex is put in. The cover of the box fits inside the front of the oven and is bolted to the steel cover with stove bolts. The dimensions of the oven are, height 10 inches, width 8 inches, depth 7 inches. These are inside measurements. The heat attenuation box is made of aluminum and is 4¼ inches outside diameter. It is made from a standard 6 inch aluminum box which we cut down to 4¾ inches, and is lined with ⅜ inch cedar wood. The copper box above the heat attenuating chamber contains the oscillator coil and tuning condenser for same, its dimensions are 3 x 3 x 6.

The heaters are standard Ohmspun drawing ¼ amper, of which two are used, mounted one on each side of the heat attenuating chamber as shown in the photo. The Amsco mercury thermostat is mounted between the heater unit and the heat attenuator. The device shown under the heat attenuating box is a bymetallic thermostat and is installed as a safety precaution; it is set at about three degrees higher than the mercury thermostat and will open in case anything should go wrong with the relay in the mercury thermostat circuit and it should fail to function. In other words it is a safety valve. This was installed because of a sad experience we had with a commercial oven in which the relay stuck and burned up the lay out and just about ruined everything in it. The oscillator coil was taken out of an Atwater Kent model 20 receiver and is tuned by a Hammarlund 14 plate midget condenser, capacity 100 Mmf.

Upper right—This photo shows the monitor back view with the cover on the heater oven. The frame is made of ¾ inch angle iron and is 21 inches high, 18 inches wide, and is 12 inches deep at the base. It is of welded construction. The photo shows the details of same. The method of bringing the leads from the crystal and oscillator inductance are clearly shown in the photo. The tubing carrying the wires is ¼ inch copper and the cover on side of the heater oven is also copper. The connections are under the cover and are soldered and taped. The chassis pan upon which the apparatus is mounted is 13½ x 7 x 2 inches, the sides being copper and the top and bottom electralloy. The leads to the B-Supply are shown on the left hand side of the chassis pan. The leads to the heat control unit are shown on the bottom right hand side of the heater oven.



Lower left—This photo shows the front of the monitor. The panels are 7 x 18 electralloy. The left hand meter is an 0 to 15 millammeter, the center meter an 0 to 1½ millammeter; the control on the right controls the signal input to the detector circuit in the upper right hand corner is the binding post to which the antenna is connected. We use about 10 feet of wire stretched across the back of the transmitter room. The thermometer is shown in the center upper part of the lower panel; have always intended to get an angle thermometer but have never done it yet.

Lower center—This is a photo of the heat control unit used on the monitor. It was constructed entirely from the junk box with the exception of the relay and tubes. The filament transformer came from a defunct midget set; the choke is the primary of a trickle charger that had long since become obsolete. The binding posts were once part of a Willard B Supply.

Lower right—This is another back view of the monitor. On the lower left hand side is shown the filament heating transformer which furnishes the filament current for the tubes. Between the two right hand tube shields can be seen the knob which controls the output from the crystal oscillator. A good view of the Ohmspun heater units and the crystal and holder is shown. The detector coil is a coil taken from an Atwater Kent model 20 receivers just as it is. It is mounted back of the two center tube shields and shielded with a copper can size 3¼ x 3¼ x 3½.

"IN BALTIMORE"

By WM. D. KELLY, WFBR

WPFH is the Police Radio in Baltimore. The main xmtr is a RCA UT 4199 and is operating on 2414 kc with a ¼ wave T type antenna.

There are 44 cars and one police boat with a receiver.

The following members constitute the staff:

Chief-Lt. Wm. E. Taylor
Charles E. A. Linn, Operator
George J. Haslup, Operator
Joseph J. Recker, Operator
Ernest E. Oliphant (Service & Relief)
Sgt. Ferdinand I. Kammer (Relief Op)
John Quincy Adams (Service & Re-
F. Russell Dunlap (Service & Relief)
Karl Zeuch (Dispatcher & Relief)

The Aux xmtr was built in the radio shop of Lt. Taylor from frame up. This aux is giving as good avc as the main xmtr.

* * *

At WCAO there's talk of a new transmitter, but no matter what all the transmitter salesmen say, the Chief Engineer Jimmy Schultz says they haven't bought one yet. However, Jimmy is building some new studio and master control mixers.

And, between times, Jimmy Schultz is working on his ham station. He is putting in a lot of new stuff in that xmtr and says that it will be on the air soon.

Jones at WCAO has a net profit of .50c on this chain letter business. Jones and Lynch are running a ham station between them and claim good dx on 20 meter phone.

Basford (WCAO) is trying to get enuf do re me from the Mrs. to increase his xmtr output. Well —

* * *

Dows at WFBR, one of the boys, Clem Holloway, stepped off the end of the dock and went and got married the other day.

Paul Ruckert, WFBR control, has been looking over all kinds of maps and dope about good vacation places.

Wm. Q. Ranft, WFBR's chief, is sporting a new Chevrolet.

* * *

George Porter Houston, chief WCBM, is still talking about having to get up 4 A. M. to make a frequency run on the "Intercity" network. (Old ABC)

Snyder, WCBM control room, has worn hole in the rug keeping time to the music with his foot.

Ed Laker is still in the "Sound Reenforcing" biz.

Kries has just put W3DYN on the air and reports dx using an inside antenna.

Craig Brown is in Baltimore on his vacation and honeymoon. Craig spends most of his time in South America with the Pan American Grace Airways. All the gang wishes him "Happy Landings".

Electron Mechanics Of The Cathode Ray Tube

By BERNARD EPHRAIM

THE growing popularity that has been given to the cathode-ray tube, since the advent of television, can be attributed to the remarkable advances of technical applied science research. The vast amount of engineering and the exhaustive efforts investigators have given to the study would take volumes to record. In this short discourse, it is the purpose to clarify some of the more important phenomena that have heretofore been slightly confusing to the experimentalist.

In 1869, the electrical research worker, Hittorf, discovered the phenomenon now known as cathode rays whilst conducting experiments pertaining to the conduction of electricity through highly rarefied gases: It is of scientific interest to note the successive changes in phenomenon leading up to a cathode-ray discharge.

Cathode-ray Discharge in a Gas Filled Tube

Ocular evidence of an elementary nature concerning cathode rays has its genesis in the lowly spark-gap, one time used as part of the apparatus necessary for radio transmission. This visual phenomena is seen in the form of an electrical discharge bridging the intervening gap of the electrodes when the difference in applied potential has been sufficiently raised. The size and shape of the electrodes together with their distance of separation are the main factors determining the potential applied to the gap to insure discharge. The spark occurs in a series of mauve colored flame which is characteristic of air, and if another gas were substituted, a different color would, in general, be obtained.

The successive changes in the appearance of the phenomena when the electrodes are placed inside of a glass tube, which is slowly being evacuated, leads up to what is known as a cathode-ray discharge. At low vacuum, the first visible discharge broadens and fills the whole tube. At slightly higher vacuum, a dark space manifests itself near the cathode of the tube, which space gradually extends toward the anode; also there appears a narrow greyish region very close to the cathode. With further exhaustion this greyish region moves away from the cathode leaving a second dark space, and on the surface of the cathode a blue luminous layer now appears. This surface is called the cathode layer. Referring to Figure 1, the first dark space F is called the Faraday dark space, the second, the Crooke's dark space, and the greyish region between N is called the negative glow. What is left of the mauve discharge P is called the positive column, the latter is frequently striated as shown in the Figure. With continued exhaustion of the tube, the positive column continues to shorten and finally disappears. Next, the Faraday dark space disappears, and finally the negative glow reaches the anode of the tube; when this condition is reached, the phenomenon is called a **cathode-ray discharge.**

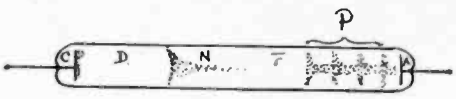


Fig. 1

Showing the Essential Characteristics of an Electric Discharge in a Vacuum Tube.

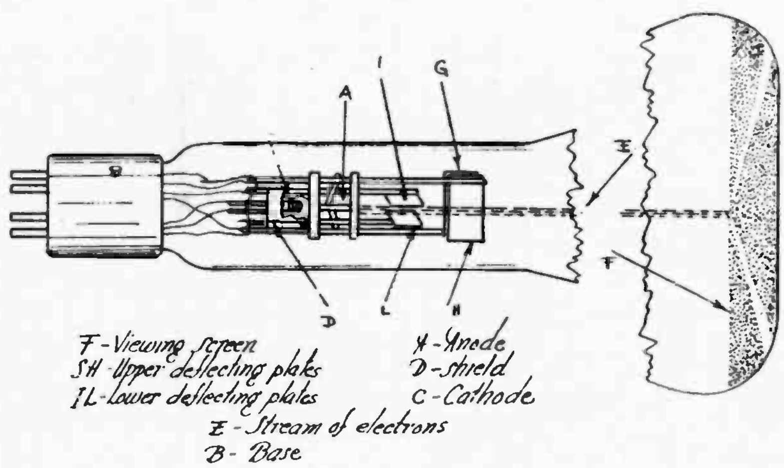


Fig. 2

Elements of a Cathode Ray Tube

Explanation of Appearance of Discharge

The explanation of the cathode-ray discharge is as follows: If there is much gas, perhaps the number of positive ions moving on the cathode produce appreciable intensity or space charge of positive electricity, the electrons, because of their high speed, being yanked out in 1/1000th the time which the positive ions require to cross. The layer of positive electricity occurring in the middle of the tube disturbs the normal drop in potential from the anode down to the cathode and extends the positive electricity of the anode well down the tube. This leads to what is known as the cathode dark space, which is a space in which, perhaps, 80 per cent. of the potential drop of the tube is concentrated. From the cathode to the edge of this space charge the electrons are very rapidly accelerated and produce the ionization accompanied by the emission of light in the body of the tube. The blueish layer at the cathode

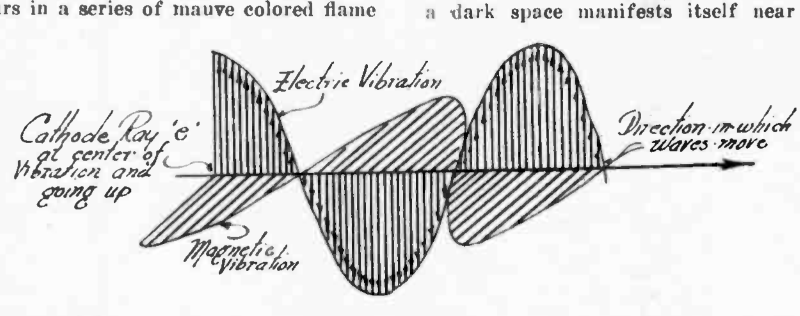


Fig. 3

Showing Relation between Electric and Magnetic Vibrations in an Electric Wave.

doubtless has to do with the conditions resulting from the bombardment of the cathode by positive ions and the neutralization of those ions taking place at that point. This layer will vary in color depending upon the nature of the gas occluded in the metal.

Cause of Ray Discharge

The cathode-ray discharge will pass through any highly evacuated tube in which there is still enough gas to enable the mechanism to begin which possesses internal conducting electrodes (preferably of a non-metallic nature). When the electrodes are subject to high elec-

The free electrons are repelled by the cathode or negative pole, and if the vacuum is sufficient, pass through the greater portion of the length of the tube without serious loss of energy. They therefore have velocities which at maximum are equivalent to the potential drop across the tube, but in general are somewhat less due to the loss of energy to ionization of neutral atoms on the way. On the other hand, the positive ions accelerated in the high field move toward the cathode and impinge thereon with considerable energy. Of the positive ions impinging, a certain fraction, from 10 to 1/10th per cent, succeed in knock-

in sufficient numbers to maintain the supply of electrons. The cathodic electrons move in straight lines under the influence of the field and are accelerated so that many of them on reaching the anode, or positive electrode, have an energy corresponding to the potential across the tube. These straight beams of electrons are called cathode-rays.

Today electrical manufacturers do not bother with a gas-filled tube for obtaining cathode rays. The modern cathode ray tube has a cathode of an incandescent filament or an indirect heater which emits electrons and accelerates them to the anode in the best possible

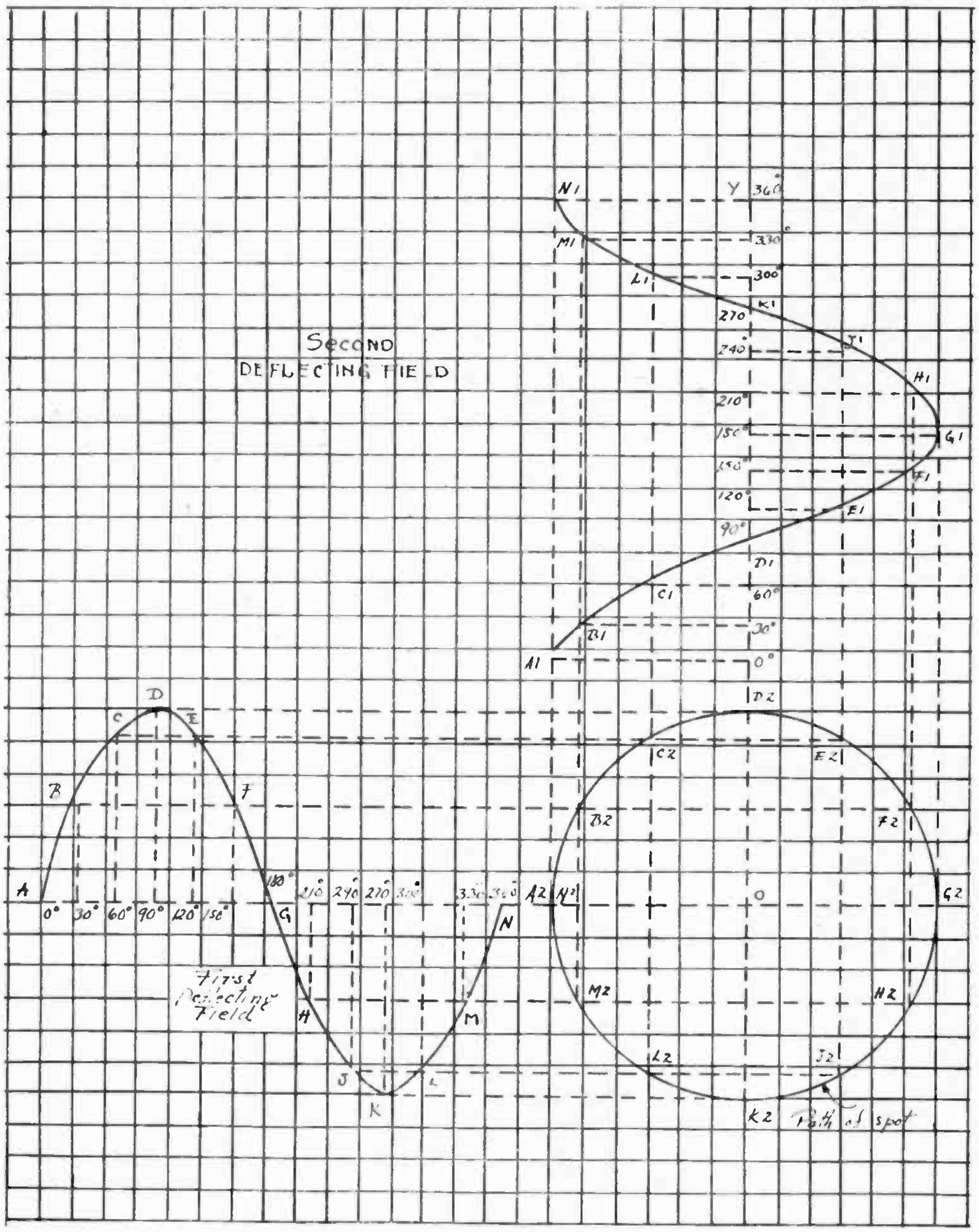


FIG. 4

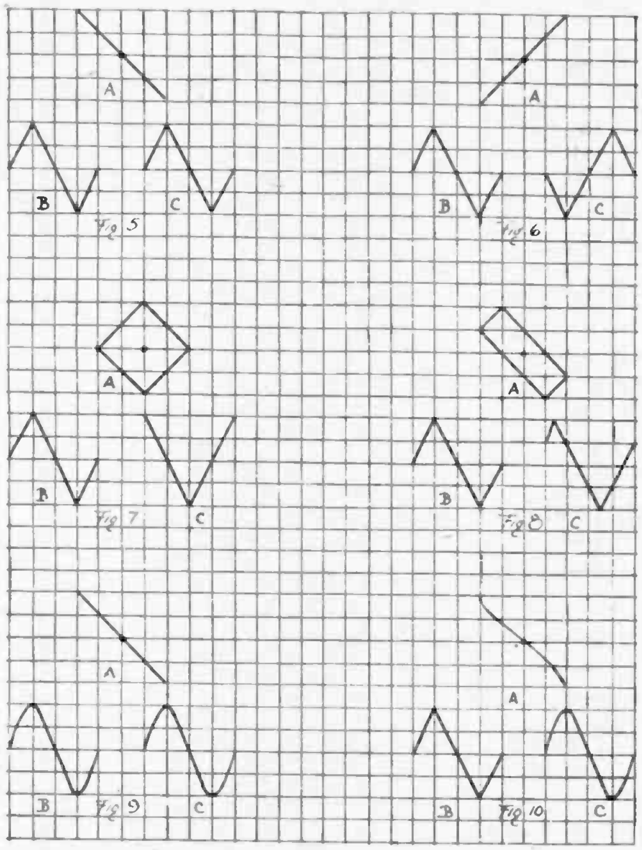
tric stress by the application of some thousands of volts potential difference, the few ions existing in the residual gas due to outside causes gain enough energy in the high electric field to crash through many neutral molecules, tearing out electrons from these molecules and filling the space between the electrodes with positive ions and free electrons.

ing out more electrons from the cathode. The process goes on, the emission of electrons from the cathode increasing until a self - maintaining mechanism is established. Under these conditions a certain number of electrons are liberated from the cathode, which in turn succeed in ionizing enough of the residual gas so that the positive ions reach the cathode

vacuum. The currents obtained in this way are much greater, more uniform in intensity, and finally all electrons have acquired sensibly the potential across the tube.

The Modern Cathode-ray Tube

A sketch of a modern cathode-ray tube is shown in Figure 2. The device func-



tions as follows: A filament heats a tube called a cathode, and negatively charged particles of electricity are emitted in all directions. These electrons are attracted by a positively charged plate called an anode. This anode has a perforation in its center and a stream of electrons shoots out through this opening and impinges upon a chemically treated surface (willemite or calcium tungstate) called a screen, which is at the top end of the tube. Electrons striking this surface produce a glow or fluorescense which varies in turn with the intensity of the element controlling the flow of electrons. A negatively charged cylinder concentrates the electrons emitted by the filament so that practically all pass through the small hole in the anode. The percentage of electrons passing through the hole in the anode depends upon the size of the hole, the field between the cathode and the anode, the shape of the surrounding electrodes, electrical conditions about the anode, and other factors dependent upon the temperature of the anode which are too numerous to mention. Possibly the fraction passing the hole can vary from one-ten millionth or less to possibly one per cent of the electrons. The energy given to the electron to pass to the chemically treated surface can only be approximated by direct experiment; however, the electrons gain their energy from the electrical accelerating field.

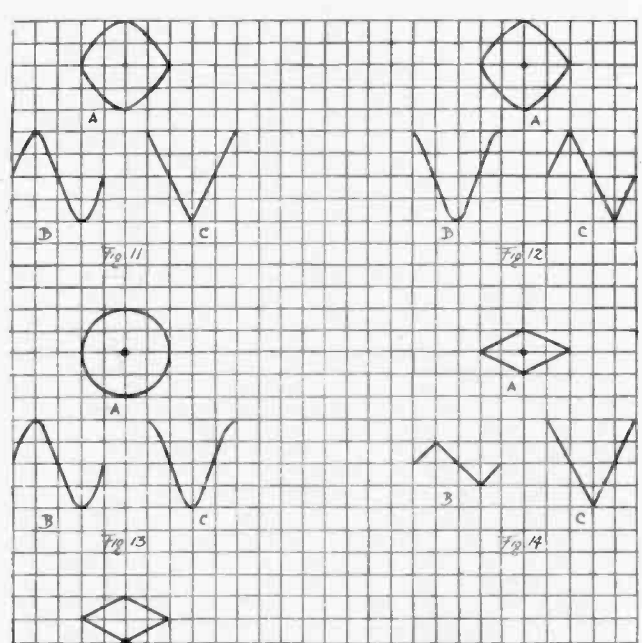
Phenomenon of Fluorescence

The phenomenon of fluorescence may be best explained with the introduction of atomistic ideas and yet not be beyond the comprehension of those not thoroughly conversant with electron mechanics. The explanation is: Electrons striking the fluorescent material at the screen-end of the tube expel electrons from that material. In the course of return of these electrons to their parent atoms, light is emitted. The cathode-ray in striking the end of the tube gradually spends its energy ionizing atoms. They ultimately end with zero velocity and are picked up by some positive ion or else slide along the glass wals of the envelope to one of the electrodes and escape. Most of the cathode rays penetrate the screen and are ultimately absorbed. A few are reflected with loss of energy. The rays that were not absorbed or reflected are scattered obliquely and go forth with lesser energy, that is, with the same frequency but of decreased magnitude, similar to that of scattered quanta. The energy that must be expended to cause fluorescence is at present unknown to the writer. Fluorescence is caused by an electron with as little energy as possible, perhaps one or two volts. However, IT IS INVISIBLE. To SEE fluorescence, enough energy must be liberated per unit volume so that the volume of density of light emitted causes a visual effect on the eye of the observer. Taking into consideration the not altogether improbable assumption, many investigators are inclined to believe that when an observer's eye is dark adapted he could just see the density of ionization in a gas in which there are one thousand million ions per cubic centimeter emitting light. In other words, the energy of electrons must be such that in the region in which the cathode-ray strikes, it must be sufficient to give a thousand million ions per cubic centimeter or more. The fluoresent material gets rid of the energy in the form of light.

Scanning or Deflecting Rays

The scanning of cathode rays upon the fluorescent screen is done by deflecting

(Continued on Page 13)



Variable Condenser Breakdown Voltages

By RAYMOND L. MOOREHOUSE

Engineer, The Allen D. Cardwell Mfg. Co.

THERE is an increasing tendency on the part of variable condenser purchasers, both professional and amateur, to demand condensers with certain voltage breakdown ratings. This has led to many mis-ratings, with the result that even experienced experimenters and amateurs are confused by the contradictory figures. The trouble is that most of these ratings are calculated on the basis of air separation between the plates, and many of them do not take into consideration such important factors as plate thickness and shape, operating frequency and also the ratio of inductance to capacitance in the actual transmitter circuit.

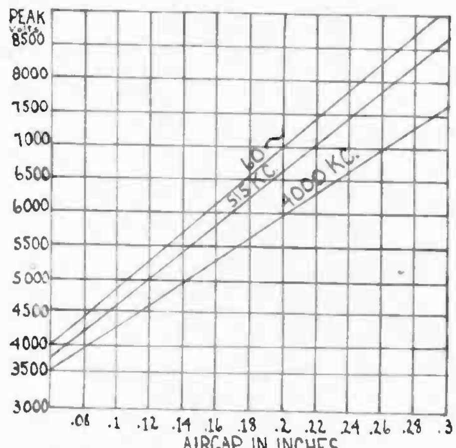


Fig 1. BREAKDOWN OF AIR CONDENSERS.

In this connection, prospective users of high-voltage condensers should be interested in the curves shown in Fig. 1. These represent the average of hundreds of individual tests made on stock condensers of various types and sizes by members of the writer's organization and also by independent testing laboratories. They reveal some pertinent facts that apply to all variable air condensers, regardless of make.

All the tested condensers had polished plates with rounded edges. The use of square edge plates in condensers intended for high-voltage applications is altogether unthinkable, as square-edge plates reduce the flashover voltage as much as 20%. This figure is not a mere guess, but is based on actual measurements.

The curves are correct for plate thicknesses from about .025 to .062 inch. Thinner plates reduce the rating by 8% or more, a fact that is not generally appreciated. Figure 2 explains why this is so. The thinner the plate, the more nearly does it approach a sharp point, and of course corona and jumpover effects take place much more readily from points than from rounded surfaces. The comparative bluntness of plate B, as measured against plate A, reduces the sparking tendency considerably. The plate thicknesses have been exaggerated a little to show the general idea.

It will be seen that there is a 15% difference between the breakdown voltages of the same air gap when the condenser is used first on 515 kc. and then on 4000 kc. The first frequency is regarded as average for the broadcast channels, and the second for the amateur and high-frequency communication bands. No ordinary air dielectric variable condenser is ever used on 60 cycles, but the uppermost curve is included because it is often convenient to test flashover voltages at that frequency.

Practical use of these curves is made in the following manner. Begin with the d. c. plate voltage of the tube, multiply by three, and from the chart pick a condenser air gap with that flashover voltage, bearing in mind the approximate frequency the transmitter is to use.

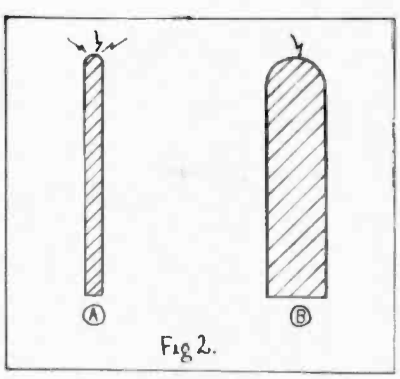


Fig 2.

This procedure applies to circuits that are keyed for c. w. telegraphy. If the tube is plate modulated, use the multiplying factor four.

Split stator condensers, which are widely used in amateur transmitters, have a higher flashover voltage than the air gap alone indicates, as the sections are usually in series in relation to the applied voltages. In a series of measurements made on Cardwell condensers with air gaps from .07 to .218 inch, the flashover voltage for two sections was from 1.6 to 2.1 times that of one section alone.

The L-C ratio of the plate tuning circuit must also be considered. The higher the inductance, the greater the EMF developed across the circuit, and the greater the possibility of condenser flashover. This probably accounts for some cases of flashovers in transmitters using condensers of apparently adequate rating.

"Why worry about occasional flashovers in an air condenser, with its self-healing dielectric?" This question is frequently asked the writer by amateurs and engineers without much practical operating experienced with tube transmitters. The answer is found in the behavior of a vacuum tube operated as an amplifier.

When the L-C circuit in the plate is tuned to the same frequency as that of the exciting source on the grid, the plate current assumes a comparatively low value, only 10 to 20% of its normal value. Off resonance, however, it shoots up wildly. If the full rated plate voltage has been applied, the filament or cathode may readily lose all its emission, or the elements may collapse because of the terrific heat generated by the bombardment of the plate. Cases of tube failure due to careless tuning are only too common.

Now a condenser remains a condenser only as long as its dielectric is intact. A flashover has the effect of short circuiting the plates, with the result that the L-C circuit is thrown out of resonance and the tube takes the shock of suddenly increased plate current. The condenser itself isn't damaged appreciably. A few small pit marks may develop at the sparking point, but these are easily polished off.

The best way to protect expensive transmitting tubes from flashovers is to use condensers of suitable design and to operate the tubes within their rated output, or below it. Plate current jumps caused by off-resonance conditions will then be less serious than with the tubes already loaded to the limit.

Methods of Calculating The Current Carrying Capacity of Resistors

By the Engineering Staff, Aerovox Corporation

IT is often required to find the maximum safe current for a resistor of given resistance and power rating, such as a voltage divider. This problem can of course be readily solved with well known equations, yet it seems to take more time and trouble than is warranted, probably because of the extraction of a square root particularly when fractions are involved. In this article the solution by algebraical methods will be reviewed, showing how one can avoid the fractions; a labor saving chart is also presented, which shows the answer at a glance for practically all such questions and with an accuracy which is sufficient for all practical purposes.

Calculation of Maximum Current or Voltage

The power in a circuit is found by any one of the three well known equations:

$$P = E\ I \quad (1)$$

$$P = I^2\ R \quad (2)$$

$$P = \frac{E^2}{R} \quad (3)$$

depending on which are the given quantities. Here, E is expressed in volts, I in amperes, R in ohms and P in watts. When the power is the required quantity, these equations are to be used, but if the power is one of the given quantities and the voltage or current is required, the equations have to be transposed so as to bring either E or I alone to the left of the equation. This gives:

$$I = \sqrt{\frac{P}{R}} \quad \text{amperes} \quad (4)$$

or,

$$I = \sqrt{\frac{P \times 1{,}000{,}000}{R}} \quad \text{milliamperes} \quad (4a)$$

$$E = \sqrt{P\ R} \quad \text{volts} \quad (5)$$

Before going over to the examples, it is necessary to discuss the voltage divider some more. Such a divider might for instance be rated at 50 watts, allowing a certain maximum current. Now the resistor is divided into sections carrying different amounts of current and consequently dividing the power unequally over the resistor. It should not be thought that since one section is carrying less than its share, that other sections can handle more so as to bring the total up to 50 watts again. That cannot be done; the maximum current is to be determined by supposing that the entire 50 watts is to be divided uniformly and the current found in this way should not be exceeded in any section.

Similarly, the maximum voltage across the resistor may be found by equation (5) again assuming that no current is to be drawn from any tap. If any part of the resistor is to carry less than the allowable maximum current, the maximum allowable voltage is *more* than the value found by equation (5).

Maximum Current Ratings of Standard Resistors

Resist. Ohms	10 Watt	25 Watt	50 Watt	75 Watt
1	3.16 amp.			
2	2.24 amp.			
2.5	2.00 amp.			
3	1.83 amp.			
5	1.41 amp.			
10	1.00 amp.			
15	817			
20	707			
25	634			
30	578			
50	448			
100	316	500	707	877
200	224	354	500	613
300	183	292	408	500
400	158	250	354	432
500	141	224	316	388
750	115	183	258	316
800	112	177	250	306
850	108	172	242	297
1,000	100	158	224	274
1,500	82	129	183	224
2,000	70.7	112	158	193
2,500	63.4	100	141	172
3,000	57.8	91.2	129	158
4,000	50.0	79.2	112	137
5,000	44.8	70.7	100	122
6,000	40.8	64.5	91.2	112
7,000	37.8	59.8	84.6	104
7,500	36.6	58.8	81.7	100
8,000	35.4	56.0	79.2	97.0
10,000	31.6	50.0	70.7	87.7
12,000		45.7	62.0	79.2
15,000		40.8	57.8	70.7
20,000		35.4	50.0	61.3
25,000		31.6	44.8	54.8
30,000			40.8	50.0
40,000			35.4	43.4
50,000			31.6	38.8
60,000				35.4
75,000				31.6

Current ratings given above are all in milliamperes except those designated in amperes (amp.). These currents should not be exceeded in any portion of a voltage divider.

This list contains data on the most popular sizes of resistors. For similar information on other sizes, see other charts.

Mathematical Methods of Calculation

Example 1: What is the maximum allowable current for a resistor of 15000 ohms and 25 watts? Using equation (4a) and substituting values:

$$P = \sqrt{\frac{25 \times 1{,}000{,}000}{15{,}000}} = \sqrt{\frac{5000}{3}} =$$

$$\sqrt{1667} = 40.8 \text{ ma.}$$

Example 2: What is the maximum allowable voltage across a 75000 ohm resistor with a power rating of 10 watts? Use equation (5); substituting values:

$$E = \sqrt{10 \times 75000} =$$

$$\sqrt{750{,}000} = 100\sqrt{75} = 868 \text{ volts}$$

Example 3: A speaker field has a resistance of 1000 ohms and is rated at 6 watts. What is the current required? Use again equation (4a)

$$I = \sqrt{\frac{6 \times 1{,}000{,}000}{1000}} =$$

$$\sqrt{6000} = 77.5 \text{ ma.}$$

Example 4. A resistor of 10,000 ohms is to carry a current of 25 ma., what is the dissipated power? Use equation (2), remembering that I is in amperes:

$$P = .025^2 \times 10{,}000 = .000625 \times 10{,}000$$

$$= 6.25 \text{ watts}$$

If the squaring of a fraction is inconvenient, the equation can be written:

$$P = \frac{I^2 R}{1{,}000{,}000} \text{ watts} \quad (2a)$$

where I is in milliamperes. Using the same examples:

$$P = \frac{25^2 \times 10{,}000}{1{,}000{,}000} = \frac{625 \times 10{,}000}{1{,}000{,}000}$$

$$= 6.25 \text{ watts}$$

The table in this article has been prepared for users of standard size resistors. It shows the maximum allowable current for the most common resistors of this kind; the current is given in milliamperes unless otherwise stated.

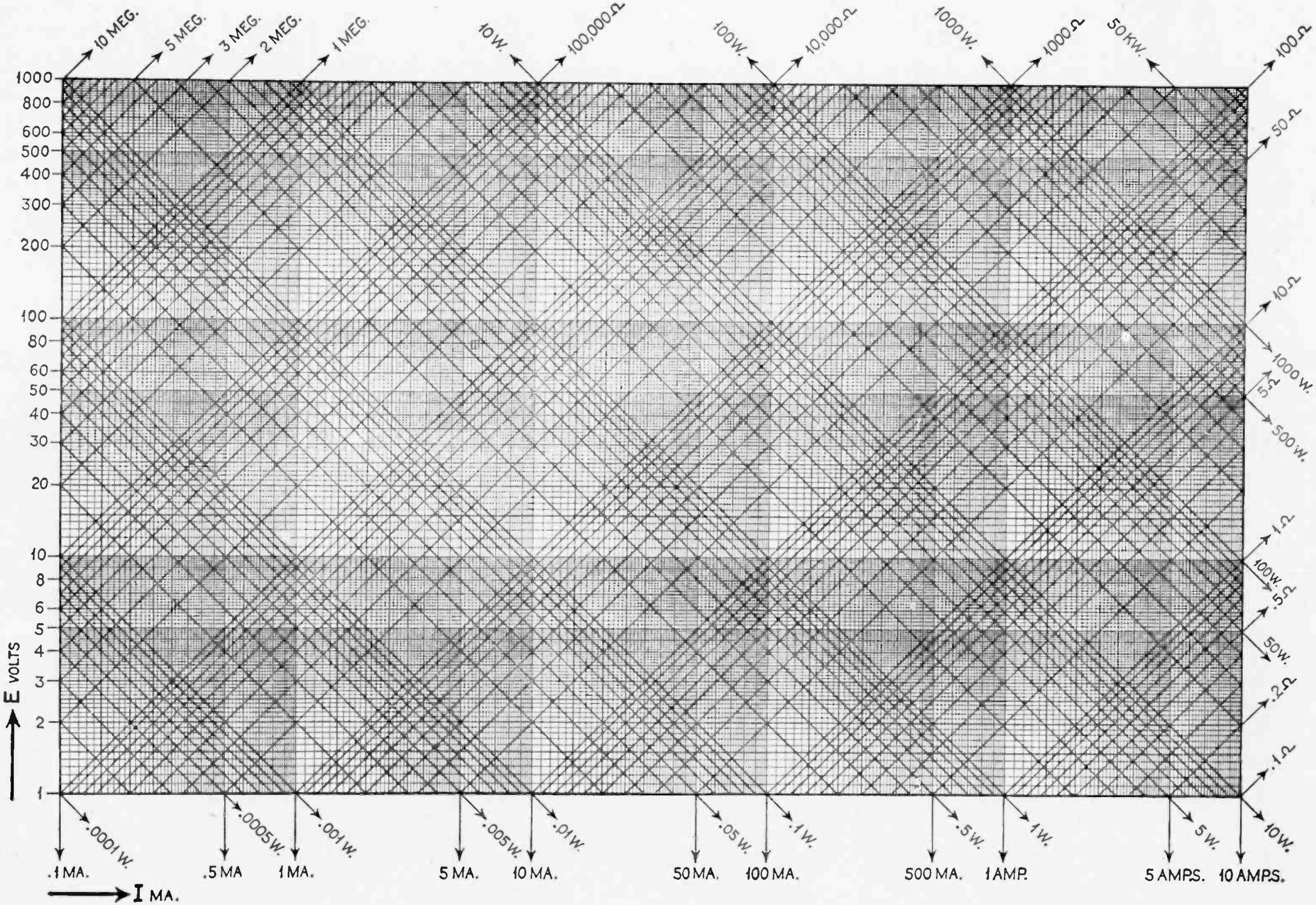
It is of course impossible to give the figure for all possible cases in a table. The nearest approach one can make to such an ideal is to provide a chart and even then it is difficult enough to cover the complete range and to obtain sufficient accuracy to be of any use.

Logarithmic divisions are the only ones which permit the coverage of a wide range keeping the accuracy the same percentage throughout the range. The given problem could be solved either by a chart of the "alignment" type (also called "abac" and "nomograph"), or by the one shown. Both have their advantages. The first one does not have the page so full of lines but it requires a straightedge to get a solution. The second one does not require this; when two of the quantities: volts, milliamps, ohms or watts, are known the other two can be found immediately.

The chart covers a range which should be large enough for all radio work involving receivers and amplifiers. The ranges are from 1 to 1000 volts, from .1 ma to 10 amperes, from .1 ohm to 10 megohms and from .1 milliwatt to 10 kilowatts.

The lines are plotted on regular full logarithmic coordinate paper. Current is measured along the horizontal axis

(Continued on Page 13)


10 MEG.
5 MEG.
3 MEG.
2 MEG.
1 MEG.
10 W.
100,000 Ω
100 W.
10,000 Ω
1000 W.
1000 Ω
50 KW.
100 Ω
50 Ω
10 Ω
1000 W.
5 Ω
500 W.
1 Ω
100 W.
.5 Ω
50 W.
.2 Ω
.1 Ω
10 W.
1000
800
600
500
400
300
200
100
80
60
50
40
30
20
10
8
6
5
4
3
2
1
E VOLTS
.0001 W.
.0005 W.
.001 W.
.005 W.
.01 W.
.05 W.
.1 W.
.5 W.
1 W.
5 W.
.1 MA.
.5 MA
1 MA.
5 MA.
10 MA.
50 MA.
100 MA.
500 MA.
1 AMP.
5 AMPS.
10 AMPS.
I MA.

Electron Mechanics of the Cathode-ray Tube

(Continued from Page 9)

the beam of electrons vertically and horizontally, that is, in a zig-zag fashion until the whole surface of the screen has been irradiated. The deflecting action may be accomplished by either electrostatic or electro-magnetic fields. These fields must be at right angles to one another and must intersect at the tube axis. In practice, one field is controlled by the current or voltage under observation; the other is controlled by an alternating voltage to give a desired timing control. This field serves to spread the rays or tracing over the fluorescent screen. Whatever method is employed for deflecting the electronic beam, it only need be remembered that the rays are attracted or repelled by the mechanical charges in the electric field. How this is done follows:

Theory of Deflection

The cathode-ray particle is an electron, nothing more or nothing less; therefore an electron is a moving electrically charged mass, and its rectilinear propagation follows directly from the well-known principle of inertia in its motion, and its path in an electrical field is parabolic in analogy to that of a stone thrown in the earth's gravitational field. Cathode ray particles may be attracted or repelled by a static or magnetic force when in the field of these forces. At this point it is well to remember that an electrical field produces a magnetic field, hence, it is this force that deflects the cathode ray beam. The theory of deflection is based upon electron mechanics which teaches: An electron moves from right to left with a velocity v, and has a charge of value e, the electron constitutes an electrical current moving from left to right. The value of this current is the number of units passing any point per second. The current value is therefore e, because e units have passed per second. In one second this electron has covered a length of path v, having an equivalent current strength of e (electro-static units) in a length of conductor v. (the cathode ray beam is a conductor.) If a current of strength I and length L is placed in a magnetic field H, Ampere's law states that such a current will be urged at right angles to the field and the current flow by a force HiL. In the case of the cathode-ray particle, a negative electron, the analogy would be Hev. There is no explanation to the fact that an electrical current is acted on by a magnetic field. This is an observation of natural law which has no explanation, and the only adaptation which must be made when dealing with electrons is that a moving electron constitutes a current, the direction of which, in the conventional sense, being opposite to the motion of the electron. The law of electro-magnetic vibration states: That a magnetic vibration is always at right angles to the electric vibration and proportional to it, and both are at right angles to the direction in which the waves move. There is, therefore, a unique relation between electric and magnetic vibrations in an electric wave, this is graphically shown in Figure 3. Here, the magnetizing force or strength of the magnetic field is represented in the horizontal plane, that is, in the direction of the lines of force.

The theory of scanning or deflection may be summarized as follows: The direction of vibration of the electron is always in the plane of the electric vibration, and perpendicular to the direction of propagation of the waves, and is also perpendicular to the plane of magnetic vibration; hence, the intensities of the magnetic and electric fields are in time phase and space quadrature.

How Cathode-ray Wave Patterns are Developed

No simpler nor better explanation can be given in describing how cathode-ray wave patterns are developed than the information disseminated by the Western Electric Company, pioneer manufacturers of cathode-ray tubes and electronic apparatus. The explanation follows:

The electron stream in passing beween the lower deflecting plates (see Figure 2) are deflected toward the positive plate to an amount depending upon the momentary electric field set up by the potential difference between the plates. A second deflection at right angles to the first will take place when the second pair of plates is reached if a difference of potential exists between them. The result is that at any instant the recording point forming the end of the electron stream occupies a position on the viewing screen, which, both in direction and distance from its normal position is the resultant of the deflecting forces due to the differences of potential acting at that instant. In linear measurement, this distant amounts to about one millimeter for each volt of the resultant potential difference. If the variations of the two intensities are cyclic and the frequencies of the cycles bear some simple integral ratio to each other, the two components will be the same each time for any point in the cycle of the lower frequency and, therefore, the spot will travel over the same path repeatedly and produce a stationary pattern. The pattern may be considered as a plot in rectangular coordinates of the relation between the two intensities or, if one of the fields is made to vary with time in some known manner, the variations of the other field with respect to time may be studied.

The plot showing the relation between the two intensities varies with any change in phase, amplitude, frequency or wave shape of either of the deflecting fields. Figure 4 shows how the spot follows the variations in the two deflecting fields. In this case the two fields are 90 degrees out of phase, but of the same amplitude, frequency and wave shape. At the start of the cycle the first field is zero (A — 0°) and, therefore, produces no deflection of the electron stream. The second field at this same instant is at maximum (A_1 — 0°) and a maximum deflection of the stream is produced when it passes between the pair of plates to which this field is connected. As a result of the two forces, the spot will occupy the position A_2. When the two fields have passed through 30 degrees of their cycle, the first field has increased to B, the second decreased to B_1, and the spot is at B_2. At 60 degrees the fields are at C and C_1, respectively, and the spot at C_2, and so on.

Figures 5 to 15, inclusive, illustrate the changes in pattern resulting from variations in the form controlling factors mentioned at the beginning of the preceding paragraph. In each figure A represents the pattern B and C the deflecting fields.

Figures 5, 6, 7 and 8 show changes in the pattern resulting from changing the phase of the deflecting field C but not B.

Figures 11 and 12 show the pattern remains unchanged when the phase of both deflecting fields B and C are changed alike.

Figures 5 and 10 show the change in the pattern resulting from changing the wave shape of the deflecting C but not B, when both fields are in phase.

Figures 5 and 9 show that the pattern remains unchanged when the wave shape of both deflecting fields B and C are changed alike, when both fields are in phase.

Figures 7, 11, and 13 show the changes in the pattern resulting from changing the wave shape of the deflecting fields when they are not in phase.

Figures 7 and 14 show the change in the pattern resulting from changing the amplitude of the deflecting field B but not C when both fields are in phase.

Figures 5 and 15 show the change in the pattern resulting from changing the frequency of the deflecting field C but not B, when both fields are in phase.

Bibliography

Watson-Watt, R. A. "The Cathode-Ray Oscillograph in Radio Research," His Majesty's Stationery Office, London, England

Instruction Book and Treatise, RCA Parts Division, Camden, N. J. (send 10c to cover mailing)

See further references in the volumes of Science Abstracts, Engineering Index, Industrial Arts Index, and the Proceedings of the I. R. E.

Methods of Calculating the Current Carrying Capacity of Resistors

(Continued from Page 11)

(X-axis) and volts along the vertical (Y-axis). When this is done, the locus of all points representing a given resistance will form a line making an angle of 45 degrees with the X-axis. All these lines are parallel, sloping upwards to the right. All points representing the same power are situated on a straight line which makes an angle of 135 degrees with the horizontal, sloping upwards towards the left. These slanting lines are again spaced in logarithmic proportion, forming the network with quadruple index.

Use of the Chart

A few examples will best illustrate the use of the chart. Suppose the e.m.f. in a circuit is 100 volts and the current is 100 ma.; what is the resistance and the power? Beginning with the 100 ma. mark on the horizontal axis, follow the vertical line to the intersection with the horizontal 100 volt line. This is also an intersection of the slanting lines. Following the one going upwards to the left read 10 watts; following the other, towards the right, read 1000 ohms.

A 5000 ohm resistor has a rating of 20 watts; what is the maximum current and corresponding voltage? Following the 5000 ohm line until the 20 watt line is reached. Follow the vertical lines down and interpolating by estimation read 63 ma. Then follow the horizontal lines towards the left and read 316 volts.

New A-C. Mains Operated Speech Input Equipment at Lausanne*

By DIPL. ING. E. METZLER and R. W. HARDISTY

A new and up-to-date studio building has recently been inaugurated by the Societe Romande de Radiophonie at Lausanne, Switzerland. This studio building, which caters for some of the programmes originated in French-speaking Switzerland, incorporates many new features and has been equipped with the latest type of all-mains speech input equipment. This article deals with the design of this equipment and its application to the various types of programme transmitted in modern radio broadcasting.

THE new studio building of the Societe Romande de Radiophonie, which was opened for service in February, 1935, is situated close to the main Lausanne-Berne road at La Sallaz at a height of about 700 meters above the Lake of Geneva in a rapidly developing suburban area.

The Societe Romande de Radiophonie has operated a broadcast service in Lausanne from the earliest days of broadcasting when the small telephone transmitter, then located at the Lausanne airport, was used and broadcasting had to be suspended when service messages to aircraft were transmitted.

In 1930 the new Swiss National Transmitter at Sottens was opened, and broadcasting in French-speaking Switzerland entered on a new phase of development.

Shortly after the opening of the Sottens station, the Bell Telephone Manufacturing Company was commissioned with the reequipment of the five existing studio centres in Switzerland: Berne, Basle, Lausanne, Geneva, and Zurich, as well as the installation of a new studio building at Lugano to serve the Italian-speaking region.

In 1933 the Societe Romande de Radiophonie (S.R.R.) decided that the studio accommodation at Lausanne was inadequate for their needs and purchased a site at La Sallaz, where the new studio now stands.

The new building is constructed of cement-faced brick, the walls of the studio which are also constructed of brick being insulated acoustically from the outer shell of the building.

There are seven studios and an artificial echo room. The largest studio is a concert hall and has been designed to accommodate the Suisse Romande Orchestra. It is 25 by 15 by 10 meters high and is equipped with a concert organ.

There are three medium sized studios for chamber music and radio plays; the two radio play studios being differently treated acoustically. Two talks studios, an effects studio, and the echo room complete the programme accommodation in the building. The remainder of the building provides for the administrative offices, a lounge for the orchestra, a music library, and the caretaker's living quarters.

The principal floor plans of the building are shown in Figs. 1a, 1b, and 1c, from which it will be seen that only two of the studios are visible from the Control Room. This has necessitated a very complete signalling system.

Overlooking the two radio play studios is the Dramatic Control Panel Room. This room contains an eight channel mixer which can be placed in the hands of the dramatic producer to enable him to fade his actors in and out as required during the play. On each side of the Dramatic Control Panel itself are the gramophone reproducer sets, used for effects during plays and for regular broadcasts of gramophone music. Stock market reports and sporting announcements are made from this room. The Dramatic Control Room is therefore also used as an announcer's room.

In order to enable a correct modulation control to be effected during large orchestral broadcasts, two special control rooms have been provided. These have been equipped with a gain control potentiometer and a wide range loudspeaker combination so that the studio musical director or other official can himself control the modulation of the programme during the performance of the concert, while listening to the programme under conditions as nearly ideal as possible.

New Standard Speech Input Equipment

Amplifier Design

The amplifiers which make up the New Standard Speech Input Equipment as installed at Lausanne have been designed for either mains or battery operation, and have the advantage of low consumption obtained by the use of quarter ampere repeater type valves throughout. They do not, therefore, suffer from the disadvantage of heavy filament battery consumption when operated from batteries, and their background noise when supplied from a-c. mains is as low as that obtainable by the use of special type equipotential valves, the actual noise level due to a-c. components in the filament current being below the level of the noise due to the various sources of noise in the valves themselves.

The total gain between microphone and line is divided among four amplifiers. A microphone amplifier with a gain of 12 db. used between moving coil microphones and studio mixers and an "A" amplifier with a maximum gain of 70 db. constitute the "low level" amplifiers. In general, one microphone amplifier per microphone and one "A" amplifier per studio are employed.

The "high level" amplifiers constituting the remainder of the chain are a "B" amplifier and a "C" amplifier with a combined gain of 45 db. One "B" amplifier per programme channel and one "C" amplifier per output line are employed where more than one broadcaster is supplied with the same programme. In the installation now being described, output branching is not performed at the studio building, and a "B" amplifier with a single output is used. This amplifier has a gain of 35 db.

Figs. 2a, 2b, and 2c show the circuit arrangements of the microphone and "A" and "B" amplifiers, respectively.

In every type of amplifier the filament circuits of all valves are built out, where necessary, to 4 volts and are brought to separate terminals on the panel. Every amplifier can therefore be operated from 6 volt, 12 volt, or 24 volt batteries by suitably connecting the filament circuits. With 6 volt and 24 volt supplies there is sufficient margin of voltage to include filament decoupling chokes as a safeguard against crosstalk through the battery; with 12 volt and 24 volt supplies all grid bias potentials can be taken from resistances in the filament circuits.

Plate circuits are arranged for 130 volt or 200 volt supplies and the equipment is therefore generally capable of being adapted for operation from batteries which may already be in service.

Metering arrangements for plate currents have been eliminated from the panels and are arranged at a central point on the equipment. This arrangement makes it possible to mount the amplifiers anywhere on a standard repeater type rack without the necessity of taking into consideration the question of accessibility, except for occasional valve replacements.

Only the high level ("B," "C" and monitoring) amplifiers have any apparatus, projecting in front of the mounting plate; all valves in the low level (microphone and "A") amplifiers being mounted under the can covers.

The elimination of noise due to mechanical and acoustic shock on the valves has received special attention. Every amplifier both high and low level, is equipped with spring mounted valve sockets which, in the case of the low level amplifiers, are themselves mounted on a sprung platform weighted with the input and output transformers. In the microphone amplifier, the valve is mounted under a felt-lined metal cover and a similar precaution is taken for the first two valves of the "A" amplifier. Fig. 3 shows a bay of "A" amplifiers with covers removed. On the high level amplifiers metal shields are used over the projecting valves.

All amplifiers are equipped with interstage equalisers so that the distortion at each end of the frequency range due to the transformers may be compensated. By this means the overall characteristics of a system comprising microphone amplifier, "A" amplifier, "B" amplifier (and "C" amplifier when used for output branching) can be adjusted to lie

*Reproduced by courtesy of "Electrical Communication," April, 1935.

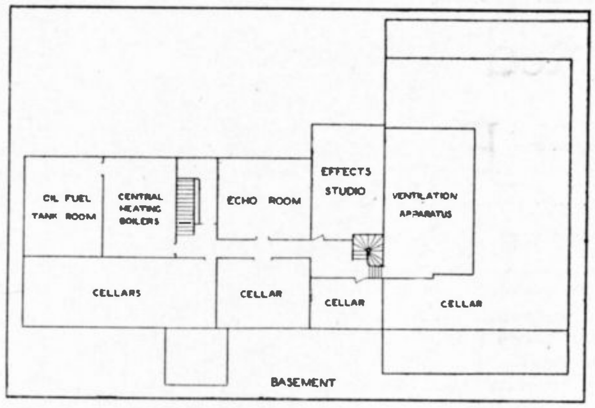


Fig. 1a—Floor plan.

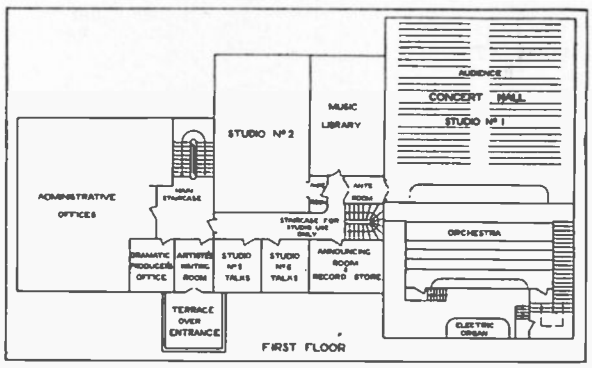


Fig. 1b—Floor plan.

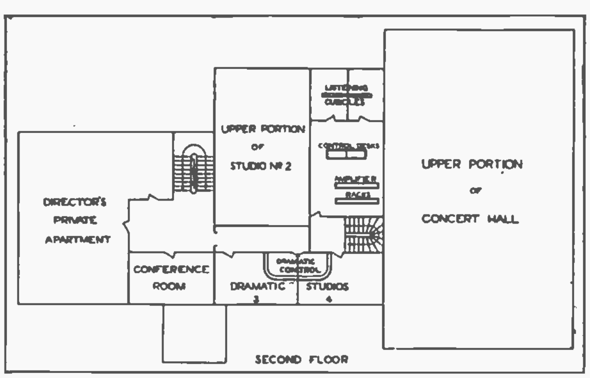


Fig. 1c—Floor plan.

within 2 db. in the range of 30—10,000 cycles. Special precautions in the amplifiers have been necessary to ensure stability, since the overall gain from microphone to line exceeds 100 db.

Single-output "B" amplifiers and "C" amplifiers are supplied with multi-ratio output transformers so that the output impedance can be adjusted to be considerably less than that of the line it feeds, and the amplifier thus sends a constant voltage to line independent of the impedance variations of the latter.

Mixer Design

Throughout the system only one type of mixer potentiometer is used. This potentiometer provides twenty-two steps and a cut-off position and can be built up to two, three and four-channel units, terminating and building-out resistances being provided so that all mixers have input and output impedances of 200 ohms. Special arrangements have been made to reduce crosstalk to a minimum. Each potentiometer is furnished with an auxiliary cam-operated contact which opens only in the "cut-off" position and which is used to operate warning light relays, etc. The attenuation per step increases as the total attentuation increases and a smooth fade-out without sudden cut-off is therefore obtainable.

Reproducer Sets

The gramophone equipment supplied is designed for 78 r.p.m. and 33⅓ r.p.m. playing speeds. The pickup arm is equipped with an indicating scale so that the pick-up may be lowered at any predetermined point on the record. The gramophone sets are built on a unit basis as "playing units," each consisting of a pick-up, motor, turntable, and fader mounted on a steel plate. The fader is of the same type as that used on the mixer panels and the auxiliary contacts are used to operate a device for raising and lowering the pick-up. This feature is especially useful when using effects records in radio drama, since the pickup may be lowered on to a groove in the record in which the desired noises occur.

Signalling System

In a modern studio building where many, if not all, of the studios are out of sight of the Control Room, a complete and unambiguous signalling system is essential.

The signalling system which has been adopted after prolonged experience on Standard Speech Input Equipments provides a "Ready" signal between the studio and the Control Room, and a "Start" signal between the Control Room and the studio. In addition, a red warning light in any studio lights when the microphones in that studio are connected through to the amplifiers. This red lamp is entirely automatic in operation and is independent of the "Start" signal.

The "Ready" and "Start" signal system consists of a green lamp in the studio and a corresponding switchboard lamp in the Control room. These two lamps light simultaneously and can be lit or extinguished either from the studio or from the Control Room. The lighting of the lamps by the studio leader, or conductor of the orchestra usually constitutes the "Ready" signal and the extinction of the lamps by the control engineer constitutes the "Start" signal.

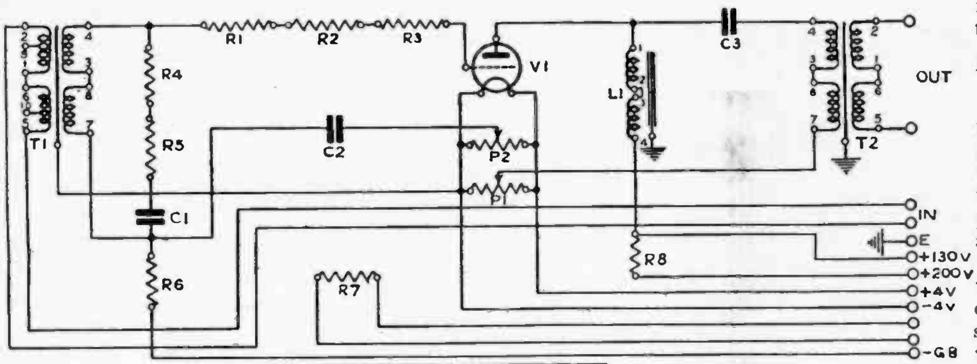
In addition to the above, a simple system of blue lights is used from the Dramatic Control Room as cues for the actors to speak their lines during the performance of the radio plays. These lamps are operated by locking keys on the Dramatic Control Panel and can be extinguished only by the producer.

Level Indicators

The Lausanne installation is one of the first to use the newly developed Standard Programme Meter. This device is a rectifying valve voltmeter which is arranged to have an approximately logarithmic characteristic so that level is indicated directly in decibels. The milliammeter included in the plate circuit is specially calibrated from a level of—35 db. to a level of +5 db. referred to a zero level of 4 volts. A single frequency calibrating oscillator is provided to enable the zero indication at 4 volts to be checked and adjusted periodically.

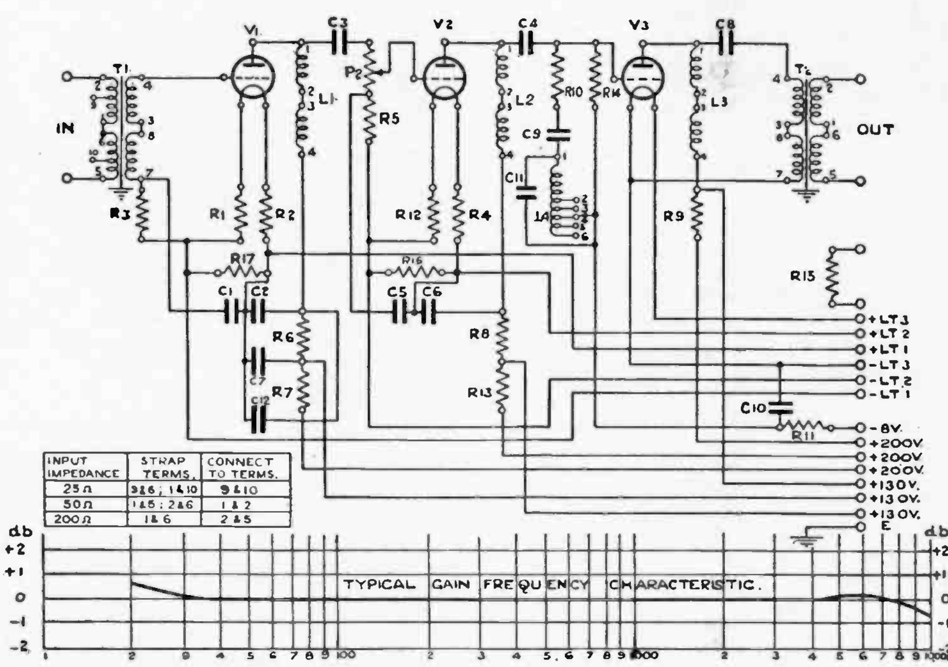
The advantage which the new panel offers over the other types of level indicators can best be appreciated after actual control of a musical broadcast. The special logarithmic scale is obtained without the use of multi-electrode valves or of specially constructed meters, two reactance coupled valves only being employed.

The calibrating oscillator used with the programme meter can also be used to check the attenuation of an outside broadcast circuit. The circuits normally used for outside broadcasts vary in length from 1 or 2 to 20 or 30 miles, and Standard Electric outside broadcast amplifiers are used at the pick-up point. These amplifiers have a rectifier meter connected across the output; and, by transmitting a known level from the studio with the oscillator, the attenuation of the circuit can be measured roughly by means of the meter on the outside broadcast amplifier. The operator at the remote pick-up point can then adjust his amplifier gain so as to feed the correct level to the studios.



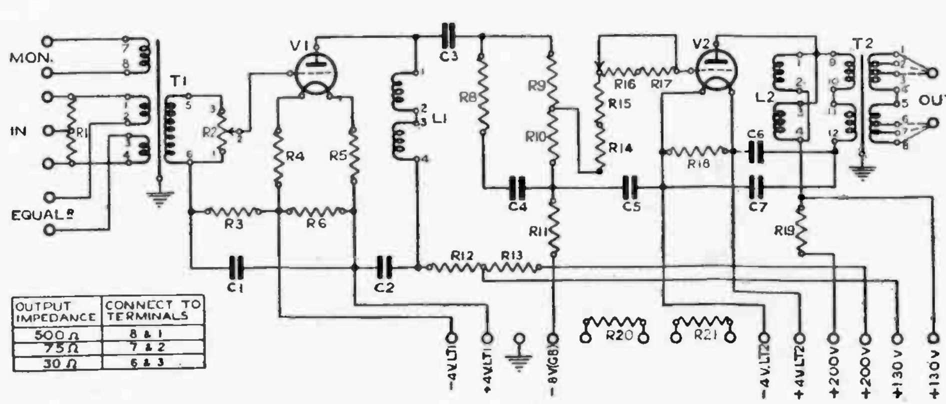
INPUT IMPEDANCE	STRAP TERMS.	CONNECT TO TERMINALS
25 Ω	9&6 ; 1&10	9 & 10
50 Ω	1&5 ; 2&6	1 & 2
200 Ω	1&6	2 & 5

Fig. 2a—Circuit Schematic of Microphone Amplifier



INPUT IMPEDANCE	STRAP TERMS.	CONNECT TO TERMS.
25 Ω	9&6 ; 1&10	9 & 10
50 Ω	1&5 ; 2&6	1 & 2
200 Ω	1&6	2 & 5

Fig. 2b—Circuit Schematic of "A" Amplifier



OUTPUT IMPEDANCE	CONNECT TO TERMINALS
500 Ω	8 & 1
75 Ω	7 & 2
30 Ω	6 & 3

Figure 2c—Circuit Schematic of "B" Amplifier

Mains Operation

From the outset it was decided that the entire equipment should be operated from the 220 volt, 50 cycle a-c. mains with the exception of the signalling system and the intercommunicating telephone system, which are operated from a 24 volt battery.

Two schemes suggested themselves. In the first scheme each amplifier is associated with a separate rectifier and smoothing panel for both high and low tension supply; while in the second scheme, floating batteries used in conjunction with large central rectifiers and filters are controlled by means of voltmeter relays, so that at all times battery power is available in case of mains failure, while the batteries cannot be overcharged due to the action of the voltmeter relays.

After careful consideration, the Swiss Administration selected the first scheme. Each amplifier panel is, therefore, associated with a rectifier panel located on a separate rack assembly so as to minimise induced fields. The rectifier panels incorporate two stages of filtration and these are found to attenuate the residual hum sufficiently to permit satisfactory operation of the high level amplifiers. Microphone amplifiers and "A" amplifiers are, however, each equipped with an additional smoothing panel incorporating a third stage of filtration. These smoothing panels are located on the amplifier bays close to the amplifiers with which they are associated in order to avoid induction from the input of the filtering system to its output, the attenuation in the filters being of the order of 110 db. for the low tension, and 130 db. for the high tension.

Two transformers are provided, stepping the 220 volt mains down to 35 and 125 volts respectively for low and high tension supplies, and each rectifier panel takes its supply from a separate low tension and a separate high tension winding.

The background noise on the system, when supplied from the mains, is reduced to the level of the valve noise.

Circuit Arrangements in Lausanne Speech Input Equipment

Microphones

Standard moving coil microphones have been used for all general pick-up work, condenser microphones being retained for orchestral broadcasts. Circuit arrangements have been provided to take care of widely different output levels of the two types. In addition, it was necessary to cater for a certain number of carbon microphones for use in the effects studio and in the echo room where stringent quality requirements do not exist.

The solution arrived at involves the provision of the microphone amplifiers described above for all moving coil and carbon type microphones. These amplifiers are rack-mounted and are located in the main amplifier room where they can be under constant supervision and so have an advantage over the condenser microphone amplifiers which must be located in the studios. The amplifiers for the carbon microphones supply polarising current derived from the filament circuit rectifiers to the microphones themselves. Fig. 4 shows the general system layout from which it will be seen that the three

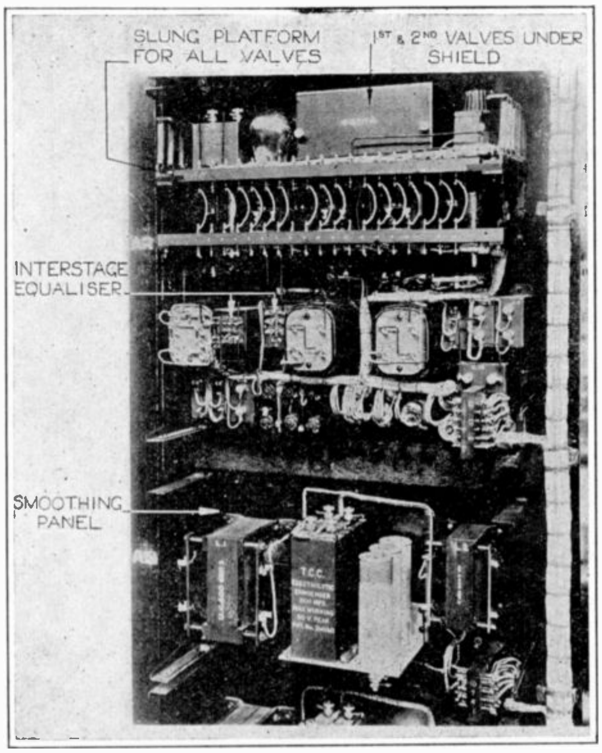


Fig. 3—"A" Amplifier Bay (Rear view, covers removed)

principal studios are each equipped with several microphones and the outputs of their associated microphone amplifiers are brought to four, three and two-channel mixers. The object of these mixers is to obtain a realistic reproduction of all the instruments in the orchestra, and for this reason the placing of the microphones and the setting of the mixers demand a great deal of patient experiment on the part of the programme staff prior to the broadcast. When the final settings have been decided upon they are recorded, and the conditions obtained can then be repeated during the broadcast performance.

With a view to the employment of a Dramatic Control Panel and for other reasons, high level fading and switching was decided upon, and every programme source, studio, gramophone, etc. is equipped with an independent "A" amplifier so that at the switches on the engineer's control desk the level of the studio programme is approximately equal to that from the outside broadcast lines. This condition can be realised by the individual adjustment of gain provided in each "A" amplifier.

When used for the production of a radio play, any studio can be patched to any input channel of the Dramatic Control Panel, and thenceforth it is completely under the control of the producer up to the time that the patching cords are removed and the studios are again connected to the regular control and switching desks for normal programme use. While connected to the Dramatic Control Panel, the red warning lamps in the studio are automatically operated when the producer fades out the studio. The layout of the Dramatic Control Panel has been carefully arranged for operation by essentially non-technical personnel.

Another interesting feature of the installation is the provision of artificial echo. This device was at one time used in an endeavour to simulate concert hall acoustics when using a small heavily damped studio, but its use is now almost entirely confined to the provision of special effects in radio plays.

Artificial echo is produced by splitting off a small portion of the microphone output and reproducing the sounds by means of a loud speaker in a reverberant room. Here the reverberant sound is picked up by another microphone and the output of this microphone is mixed with the output from the studio. A common way of achieving this result is to split off the output of the studio "A" amplifier at a level of about —10 to —20 db. as shown in Fig. 5. The arrows indicate the direction in which the amplifiers operate. An additional amplifier (A.S.A.) is often added, as shown as a precaution against singing round the path a, b, c, d, e, and f.

In the Lausanne studios, however, the echo room loudspeaker is fed from a separate microphone and the resultant reverberant sound may be mixed either at low level on the studio mixer or at high level on the main control positions or on the Dramatic Control Panel. With this arrangement there is no possible singing path and an anti-singing amplifier is not required.

The programme control equipment is duplicated so that it is possible for rehearsals before the microphone to be conducted at any time while broadcasting is in progress. Two control desks are provided in the Amplifier Room, each being associated with a "B" or line amplifier, and each having access through its switching panel to every studio or programme source inside the building or to any outside broadcast line. In case of a breakdown of one programme channel it is possible immediately to pick up the studios in use on the other channel and to continue the broadcast with a delay of only 10 or 20 seconds. Crosstalk between the two programme channels received very careful attention and the figure measured on the installation was in accordance with C. C. I. requirements for crosstalk between repeaters (10 nepers =87 db.). The "B" or line amplifiers are designed for one output only; further output branching is performed at the Lausanne Repeater Station to which the output of the studio amplifiers passes. Here there are four branching amplifiers connected with the broadcast repeater which feeds lines to Sottens Broadcaster, Berne, Geneva (local broadcaster), and Martigny. The fourth amplifier (Martigny) also feeds the local teleprogramme amplifier which provides the programme to subscribers' loudspeakers on the Lausanne automatic exchange.

The above reference to teleprogramme services in Switzerland may call for some further comment. The service was instituted in the larger towns in 1931 and provides telephone subscribers who rent an amplifier-loudspeaker equipment with reliable high quality reproduction from one of the three Swiss programmes (German, French, or Italian). This service is provided entirely from the toll cable system and is therefore unaffected by weather conditions or by other sources of interference. It is now available in nearly every important town in Switzerland and is being extended as rapidly as the high quality toll circuits themselves can be extended to the towns concerned. The service is made use of by the studio for quality checking and for verification of the circuits when a change over to another studio is made. Such a change-over occurs several times daily when the Geneva studio takes up the French programme or when the news bulletin is read from Berne. In certain cases relay operation has been arranged so that the reversal of the repeaters may be effected from the studio building itself, but in other cases where manual operation is involved it is of interest to check on the teleprogramme service whether the switch-over has been correctly performed. This can easily be done because the teleprogramme service is branched across the output of the Lausanne Repeater Station and, unless the repeater is switched over to receive the transmission from the studio continuing the programme, no output from the teleprogramme service will be obtainable. A check by the radio receiver ensures that the programme reaches the broadcasting station. It is thus possible to check the programme at each stage of its transmission between the studio and the broadcasting station.

Monitoring, therefore, can be effected on the outgoing line from the studio building, at the output of Lausanne Repeater Station, and by a radio receiver at the output of the Sottens broadcaster. In the amplifier room, in the two listening cubicles, in the effects room, and in the Dramatic Control Room, all three of the above monitoring services are available on omnibus circuits. A fourth circuit connected with the output of the second programme channel is also available. Elsewhere in the building only the teleprogramme service is obtainable.

At all points loudspeakers of the teleprogramme type with self-contained amplifiers are installed. These can be branched across any of the four omnibus circuits and each circuit is adjusted so

(Continued on Page 21)

Actions of The Federal Communications Commission

Applications for New Broadcasting Permit

International Ladies Garment Workers Union, N. Y. City, 970 kc., 1 kw.
Caller-Times Pub. Co., Corpus Christi, Tex., 1330 kc., 1 kw.
Roberts MacNab Hotel Co., Jamestown, N. Dak., 1420 kc, 1 kw.
W. H. Kindig, Hollywood, Cal., 1300 kc., 1 kw.
George B. Storer, Detroit, Mich., 680 kc., 1 kw.
Golden Empire Broad. Co., Redding, Cal., 1370 kc., 100 watts
Thomas Broad. Service, Inc., Quincy, Mass., 1200 kc., 100 watts
Florida West Coast Broad. Co., Tampa, Fla., 1370 kc., 100 watts
Black Hills Broad. Co., Rapid City, S. Dak., 1370 kc., 100 watts
Northern California Amuse. Co., Yreka, Cal., 1500 kc., 100 watts
Hyman Altman, Detroit, Mich., 1370 kc., 100 watts
Pampa Daily News. Inc., Pampa, Tex., 1200 kc., 100 watts
Plainview Broad. Co., Plainview, Tex., 1500 kc., 100 watts
Bell Publishing Co., Belton, Tex., 1370 kc., 100 watts
Dudley J. Connolly & Co., Chattanooga, Tenn., 1200 kc., 100 watts
Valley Broadcasting Co., Pomona, Cal., 1160 kc., 250 watts
A. Corenson, Pasadena, Cal., 600 kc., 250 watts
Honolulu Broad. Co., Ltd., Hilo, Hawaii, 1420 kc., 100 watts
California Sales Contract Co., San Francisco, Cal., 1280 kc., 500 watts
L & S Broadcasting Co., Waycross, Ga., 1200 kc., 100 watts
E. L. Sherman & H. L. Corley, Trinidad, Colo., 1370 kc., 100 watts
Walker Jamar, Duluth, Minn., 1500 kc., 100 watts
Golden Empire Broad. Co., Sacramento, Cal., 1500 kc., 100 watts
Herbert L. Blye, Lebanon, Pa., 1240 kc., 100 watts
Herbert L. Blye, Union City, Pa., 1420 kc., 100 watts
Carl S. Taylor, Dubois, Pa., 850 kc., 250 watts
Raton Broad. Co., Raton, N. Mex., 1500 kc., 100 watts
Waycross Broad. Co., Waycross, Ga., 1200 kc., 100 watts
E. W. Patrick, Brookfield, Mo., 1210 kc., 100 watts
Howard W. Haskett, Santa Rosa, Cal., 1280 kc., 250 watts
Pacific Acceptance Corp., San Diego, Cal., 1200 kc., 100 watts
L. E. Robideaux, Bend, Ore., 1500 kc., 100 watts
William S. Thellman, New Castle, Pa., 1200 kc., 100 watts
The Attala Broad. Corp., Columbia, Miss., 1200 kc., 100 watts
Ralph E. Smith, San Diego, Cal., 1200 kc., 100 watts
Springfield Newspapers, Inc., Springfield, Ohio, 1120 kc., 250 watts
L. & S. Broad Co., Atlanta, Ga., 1210 kc., 100 watts
Oil Capital Broad. Assn., Kilgore, Tex., 1210 kc., 100 watts
R. E. Chinn, Moorhead, Minn., 1500 kc., 100 watts
Mason City Broad. Co., Mason City, Iowa., 1420 kc., 100 watts
W. L. Gleeson, Salinas, Cal., 1210 kc., 100 watts
Mrs. C. A. S. Heaton, Las Vegas, Nev., 1420 kc., 100 watts
Marysville-Yuba Publishers, Marysville, Cal., 1210 kc., 100 watts
Kelsey-Jenny Commercial College, San Diego, Cal., 1210 kc., 100 watts

New Applications Granted

National Broadcasting Co., Chicago, Ill. Authorized to use visual broad. station WX9AP, Freq. 1606, 2020, 2102, and 2760 kc., 2 kw.
Isle of Dreams Broad. Corp., Miami, Fla., New pick-up Station freqs. 1606, 2020, 2102, and 2760 kc., 50 watts
WBNS, Inc., Columbus, O., General experimental 31100, 34600, 37600, 40600 kc., 2 watts
WCBD, Inc., Waukegan, Ill., General experimental same as above
East Texas Broad. Co., Tyler, Tex., General experimental pick-up freqs. 31100, 34600, 37600, and 40600 kc., 30 watts

TELEGRAPH DIVISION MODIFIED RULE 28

RULE 28. Insofar as practicable, call signals of radio stations wlil be designated in alphabetical order from groups available for assignment, depending upon the class of station to be licensed. Because of the large number of amateur stations, calls will be assigned thereto in regular order and requests for particular calls will not be considered except on formal application the Commission may reassign calls to the last holders of record.

A Tough Order

TWENTY-ONE radio broadcasting stations, many of them outstanding, must appear before the Broadcast Division of the Federal Communications Commission on October 3, 1935, and at a hearing prove that their continued operation will be in the public interest. Pending the outcome of the hearing they will be granted temporary licenses.

The stations cited are:

KNX, Los Angeles; WBAP, Fort Worth, Tex.; WGAR, Cleveland, O.; WBAL, Baltimore; WGR, Buffalo, N. Y.; WHEC, Rochester, N. Y.; WHO, DesMoines, Ia.; WIOD, Miama, Fla.; WIND, Gary, Ind.; WIRE, Indianapolis, Ind.; WJAS, Pittsburgh, Pa.; WJJD, Chicago; WJR, Detroit, Mich.; WKBW, Buffalo, N. Y.; WOW, Omaha, Neb.; WOWO, Fort Wayne, Ind.; WSMB, New Orleans; WTMJ, Milwaukee, Wis.; KFRC, San Francisco; KMBC, Kansas City; and KMOX, St. Louis, Mo.

Applications for renewal of licenses were designated for hearing, for the most part, because the stations at various periods carried a program entitled "Marmola," a preparation represented to reduce fat. That preparation has been under the ban of the Post Office Department for some years and also is in disfavor with the Federal Trade Commission. Some of the stations still carry that program.

In cases where renewal application is not now pending the Commission adopted a minute reading:

"Applications for renewal of license ordered to be filed under Rule 17 and upon receipt thereof said ap-

(Continued on Page 19)

Radio Inspector—You want a Broadcast License on THIS?

ASSIGNMENTS

Vessel *Radio Operator*
SS Haiti—R. Wilson
SS Seminole—C. A. Luckenbach (Jr.)
SS Exeter—D. Decker (Jr)
SS Shawnee—T. J. Burns (Jr)
SS Pecos—H. Weinstein
SS Cities Serv. Toledo—G. Bird
MS Tampa—E. Rocks
SS Excalibur—E. Fazulek (Jr)
SS Black Gull—R. Jacks
MS New Orleans—S. Rosenberg

BALTIMORE

W. W. Bruce—J. J. Kares
Walter Miller—J. W. Geweken
Vacuum—T. W. Braidwood
Firmore—H. B. Bell
Imlay—Vic Ehlers
Santore—Chris. Voss
Clairton—C. E. Seibert
Howard—C. W. Core
City of Norfolk—H. M. Shade
City of Newport News—J. H. Major
City of Hovre—M. E. Bartles
City of Hovre—F. H. Flanders
Silver Sword—E. R. Messina
Oradell—E. J. Fredholm
Marore—M. Courchene
Magneric—O. Thiess
Oakmar—J. V. Pohlman
City of Hamburg—C. E. Cook
Eastern Glade—J. C. Lawler
Willboro—A. G. Goldbach (relief)
Beaconlight—Frank Carroll

BOSTON

Harvester—M. C. Wakeaield
Trawler Cornell—J. Fiste (relief)
Tug Wyoming—A. Fallabella
Southern Sword—R. T. Hemmes
Telde—A. L. DiMattia

CLEVELAND and GREAT LAKES

Western States—Charles Macomber
Eastern States—H. Uhl
City of Cleveland III—J. Mitchell
City of Cleveland III—J. Spychalski
Sumatra—Wm. J. Slettner
Tug H. B. Williams—M. Jensen
Carferry Ashtabula—A. H. Freitag
D. L. Callender—L. L. Duell
John F. Cushing—August Geseki
Wm. E. Fitzgerald—R. Guthrie
Harvester—Frank Zurek
J. Floyd Massey Jr.—J. J. Schmitt
Sinaloa—Peter Javurek
J. M. Kennedy—H. C. Swanson
Michigan—Joe Bubna
Pioneer—E. Blazek
Yosemite—J. Craver
Presque Isle—F. Sager
Cadillac—Chas. Lohner
Ishpeming—E. Dietz
Frontenac—Joe Perrault
J. H. Sheadle—Gardner
James E. Ferris—Silas Mikhelson
J. J. Sullivan—H. Siebert
A. A. Augustus—John B. Clark
Joseph G. Butler—W. Crave
J. P. Walsh—Keene
A. M. Byers—Milligan
Yacht Olive K.—D. McGaffin
P. D. Block—Clyde Shaw
N. F. Leopold—Carter
W. D. Calverly—Frank Caster

NEW ORLEANS

Sama—Wm. J. Neel
Munplace—R. Wickboldt
Virginia—Arthur Pilzecker
Granada—W. E. Ford
Granada—A. T. Teeter (2nd)
Granada—Cyril Burck (3rd)
West Tacook—L. T. Blackburn
Sahale—J. H. Bigford
Clearwater—A. Wilkerson
Cananova—Arthur Betterton
Sixaola—Marks P. Matherne
Sixaola—Wm. Cleveland Ahearn
Copan—Delery Freret
Castilla—Thurman Wilson

New York

Socony Vacuum—K. F. Blakely
Manhattan—T. Serois
Shawnee—E. Cole
Seminole—T. Cain
Black Hawk—H. Hewey
Colorado—C. Scruggs
West Humpaw—B. Bernstein
Birmingham City—E. W. Oja
Dixie Arrow—F. Bogut
H. H. Rogers—B. B. Ferguson
President Roosevelt—L. C. Wyndom
Lillian Luckenbach—L. E. Millhollin
Virginia—A. Stanford
Ponce—H. S. Kuchta
Santa Rita—A. E. Spicer
Santa Monica—W. P. Paschal
A. C. Bedford—F. J. Mitch
Eagle—J. Gottesfeld
Santa Rita—M. Camillo
Oriente—H. Blatt
Dixiano—J. L. Showers
Excelsior—J. W. Voshell
Chincha—L. H. Brennan
Brilliant—T. R. Harrison
Paul H. Harwood—M. J. McDonough
Concord—A. L. Wilson
Chattanooga City—E. P. Foster
Scanmail—M. Sanborn
Oriente—J. Gottesfeld
Pennsylvania—G. M. Curtin
Santa Barbara—E. R. Fritz
Mayan—G. W. Stewart
Mayan—R. Cupp
Relief—J. H. Periman
Christy Payne—G. R. McCallum
Granada—R. Foster
Birmingham City—W. Disney
Bessemer City—C. M. Wonneberger
Meton—D. Moir
St. John—H. Blatt
American Importer—W. J. McEntee
Birkenhead—H. Wallin
Ancon—F. De LaHunt
American Farmer—T. L. Siglin
Santa Lucia—J. P. Kelly
Santa Lucia—S. Kovacs
Yankee Arrow—A. J. Walker
Standard—W. E. Gilson
Beaconlight—J. K. Aird
Cathlamet—A. L. Wilson
Memphis City—E. W. Oja
President Roosevelt—Donald Shaw
J. A. Moffett, Jr.—F. E. Carrol
Oriente—L. R. Bevensee
Thomas Tracy—C. A. Maki
West Lashawy—C. H. Weir
Mohawk—C. P. White
E. T. Bedford—Mac. Bougere
F. W. Abrams—H. Kleinklaus
T. J. Williams—R. Cuthbert
Mevanta—A. McCarter
China Arrow—C. G. Berger
Ponce—L. B. Markowitz
Ed. Jeromac—Nicholas Close (Ch)
E. Jeromac—R. S. Horscroft
Black Hawk—H. Hewery
Colorado—C. Scruggs
Haiti—H. W. Martin

Portland, Ore.

General Pershing—Roy Welbon
General Pershing—Harry Schoolfield
General Sherman—Karl Steiner
General Sherman—Ted Toppi
General Lee—Everett Henry
General Lee—James Crouse
California—Ben Cohen
Illinois—W. T Shultrich
Michigan—Dallas L. Hughes
Texas—Roy Whittington
Iowa—John Walker
Oregon—Howard McMahon
Pennsylvania—K. V. Harris
Washington—John Robinson
New York—Gordon Burnett
Wisconsin—Walton F. Mee
Kentucky—A. A. Marsh
San Angelo—Frank Caldwell
San Anselmo—Earl Garrick
San Bernardino—Herbert Oliver
San Clemente—D. E. Youngberg
San Diego—Claude Wareham
San Domingo—Dewayne Duncan
San Felipe—M. R. Darby
San Gabriel—James Dinsdale
San Julian—Edward Betts
San Marcos—Ralph Dernbach
San Simeon—Donald Kelsey
San Vincente—F. G. Luecke
San Pedro—Sydney Ferguson
San Rafael—C. P. Burt
San Lucas—R. L. Norgard
Peter Kerr—L. K. Bradley

A Tough Order

(Continued from Page 18)

plication will be designated for hearing."

In April 1929 the Federal Trade Commission issued a cease and desist order against the Raladam Company, distributors of Marmola. The concluding order in that case directed that the Raladam Company to cease and desist:

> "From representing Marmola as a remedy for the treatment of obesity unless such representation is accompanied by a statement that Marmola cannot be taken with safety to physical health except under the direction and advice of competent medical authority."

In that order the Federal Trade Commission indicated that the promiscuous sale and use of Marmola is inimical to the public health and possible menace to the public welfare.

The Supreme Court of the United States, however, reversed the Federal Trade Commission in that case on the ground that competition in interstate commerce was not shown but made this statement:

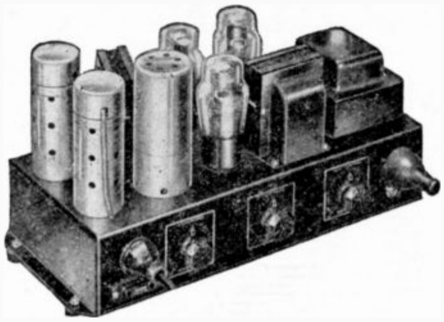
> "Findings supported by evidence warrant the conclusion that the prepaparation is one which cannot be used generally with safety to physical health except under medical direction and advice."

The Post Office Department some time ago cited Marmola in fraud order proceedings and at the conclusion of the hearing Marmola producers stipulated they would go out of business and cease its mail distribution. Subsequently the Marmola Company reorganized, becoming the Raladam Company. While dis-

(Continued on Page 20)

NEW APPARATUS

A. P. A. Amplifier



THE Radolek Company announces a new high quality genuinely all-purpose model medium power Public Address Amplifier.

This amplifier was especially designed for the countless medium sized installations in which higher power and therefore necessarily more costly amplifiers are not necessary. Its low cost and excellent quality opens a new field for the Public Address Installation Engineer.

Pre-eminently flexible, allowing the use of carbon, and capacity, dynamic or velocity microphones—operating up to 7 dynamic speakers—provided with complete plug-and-socket—input and output connections—two input channels with complete mixing and fading equipment—hum-free—equipped with toe control and with a flat frequency characteristic curve from 100-7000 cycles, 8 watts.

New Condenser Line

A new line of porcelain encased mica transmitting condensers, designed for amateur, police and small broadcast transmitters, has been brought out by the Cornell-Dubilier Corporation, 4377 Bronx Boulevard, New York. Designed as the Type 86, the line includes thirteen sizes ranging from .00005 mf. to .1 mf., in voltage ratings from 2000 to 12,500 volts.

These new condensers are especially recommended for plate blocking, grid and tank applications. Their power factor is extremely low and they will carry their full rated load over long periods without heating up.

The mica condenser elements are hermetically sealed in heavy glazed porcelain containers, which are provided with mounting feet and screw terminals. These cermatic cases are not subject to absorption effects when placed near the powerful fields of tank inductors, and they therefore eliminate that appreciable loss that occurs when metal cased capacitors are used in a crowded transmitter.

New Velocity Microphone

The new SR 80 velocity microphone by Amperite has 4 db. higher output than ever obtained before in velocity microphones. This is in part due to the new nickel aluminum magnets which are used. These magnets are much stronger than even the best Cobalt magnets available today.

A new ribbon is also used in this microphone which makes it possible to use it against wind velocities up to 50 miles per hour without in any way damaging the ribbon.

The directional properties of the microphone do not restrict the angle of pickup. Its area of coverage without frequency discrimination is greater than that of any diaphragm type microphone. Over an angle of 120° front and back, the frequency discrimination between 30 and 10,000 cycles is less then o.1 db. The sound level is uniform within this area. With the Amperite velocity, special arrangements of orchestras are, therefore, unnecessary. The high pitched instruments will be properly reproduced irrespective of their position.

The variation in sound intensity with distance from the microphone is 70% less with the Amperite velocity than with any pressure type microphone.

With the above in mind and the uniform reproduction over the entire audible range without peaks, the new SR-80 is ideal for studio work and its increased output makes it very desirable for remote work.

New Universal Oscillograph

A new inexpensive Oscillograph with a variety of control panels, which are easily interchangeable so that the Oscillograph will exactly fit field or industrial and laboratory investigations and a wide selection of galvanometers for producing up to eight records, is announced by the Westinghouse Electric & Manufacturing Company. Among other features 1) the new type PA Universal Oscillograph offers simultaneous viewing, the phenomena can be viewed while photographing, 2) daylight loading holder which can use 5, 10, or 200 ft. of 5" wide film or paper, and arranged so exposed portion can be cut off at any time desired without disturbing supply, 3) wide range of speed by variable speed motor, 4) interchangeable galvanometers and vibrators and 5) automatic type ½ cycle starting time. The complete Oscillograph with controls exclusive of film-holder measures 25" long x 8½" wide x 9½" high and weighs approximately 50 lbs.

New Trimmer Condenser

Because the drifting of trimmer condenser capacities has at times seriously injured radio receiver sensitivity, the research department of Solar Manufacturing Corporation has worked on this problem for several months to determine causes of drifting. A new small cermatic base trimmer just brought out by this concern is designed to eliminate drifting, as constructional features which might cause drifting have been eliminated. Under the pressure of average settings, the top plate has anchorage at both front and rear. The new trimmer is called the "Perma-Set", and is supplied in maximum capacities of 30 mmf. to 180 mmf.

A Tough Order

(Continued from Page 19)

tribution through the mails was eliminated, distribution through drug stores was substituted.

While the Commission under the law has no authority to censor programs it is charged with the duty to see that stations are operated for the pubic welfare and the courts have held that the Commission can take cognizance of broadcasts inimical to the public health.

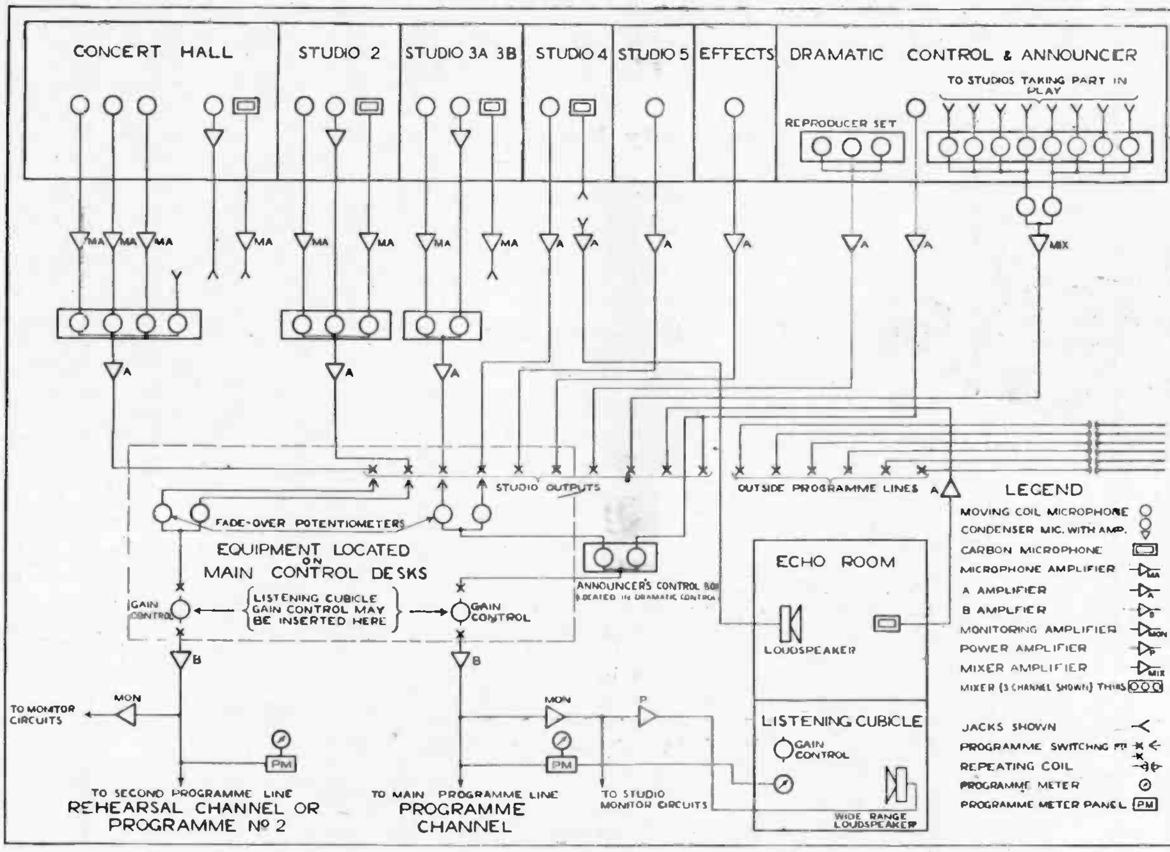


Fig. 4—Overall Circuit Layout

New A.-C. Mains Operated Speech Input Equipment at Lausanne

(Continued from Page 17)

that a peak voltage of 3 volts is not exceeded. The loudspeaker amplifiers are all fitted with volume controls.

In places where microphones are installed, the monitoring service is cut off as soon as the associated "A" amplifier is connected at the Control Desk. The relay used to cut off the loudspeaker also cuts off the intercommunicating telephone and puts the "busy tone" on the line.

In the two listening cabins for the special modulation control of a musical programme, wide range loudspeaker combinations are used. These are fed from a special power amplifier through dividing networks which split the frequency range into two bands which are then reproduced by the low-frequency and high-frequency units.

A special feature of the installation is an arrangement whereby the announcer may introduce his microphone on the programme at any time without the intervention of the control operator. This feature is useful, especially when a gramophone recital is being given; it then enables the entire programme to be handled by one man, since volume compression has already taken place when the original recording was made, and no further modulation control is therefore necessary when the record is broadcast. The large studio also incorporates an announcer's position so that announcements may be made from the studio itself.

Future Developments

In the main amplifier room, provision has been made for a second row of seven amplifier racks which should provide adequate space for apparatus required in connection with future extensions. With a view to future television development, the building has been electrically screened by means of vertical copper wires inside the walls and a roof of copper sheeting.

The Societe Romande de Radiophonie is now in possession of the largest and most up-to-date studio building in Switzerland. Great credit is due to the judgment and foresight of the Building Committee presided over by Mr. Baud, chairman of the Swiss Broadcasting Co., and in particular to the architect, M. Brugger, for the provision of many features which will prevent the building from becoming out of date due to future developments in radio broadcasting technique.

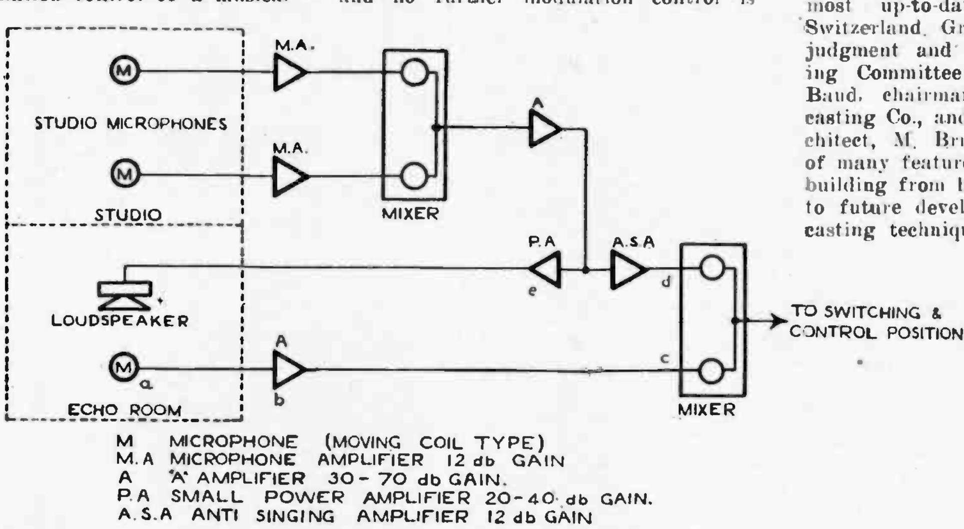
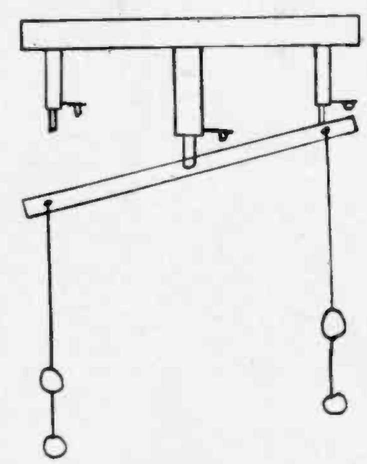


Fig. 5—Echo Circuit Schematic

A COUPLE OF "KINKS" From KBTM

By H. L. KIMSEY, Chief Operator

Here is something we use at KBTM. We have a rather high gain amplifier in our studios, so instead of using a remote amplifier, we just use a Mike to line transformer to couple our W. E. double button Mike to our remote line. I use four volts on the Mike at about 12 mils per button. This used up to distances of several blocks from the studio, and by the way we have been using a cuing system almost exactly as described by Ted Binder in your April issue of Commercial Radio. It works out very nicely and is used with above coupling transformer. It is much easier than carrying a separate radio to listen to the program.



Here is another one used here at KBTM. We have constructed a lighting antenna grounded switch. I have seen several small stations with switches that were not of the low pass variety. Most of them were mounted on slate or composition material, and in most cases were eye sores to the station. Ours is of the ceiling type with ropes attached to the blade to do the switching. We use two three inch stand-off insulators for the ends of the switch, and a five inch stand-off insulator for the center. These were made by the Johnson Company. They are mounted on a fourteen inch piece of hard wood and a twelve inch of strap copper is used for the blade. The switch clamps are connected from a double throw, single pole switch. The ropes are connected to the ends just inside the switch jaws. This makes a very pleasing looking switch and is a good insulator.

NEW RULE

On May 1st, the Federal Communications Commission adopted the following rule:

No one serving in the Federal Communications Commission on or after July 1, 1935, shall be permitted to practice, appear, or act as an attorney or agent in any case, claim, contest or other proceeding before the Commission or before any division or agency thereof, until two years shall have elapsed after the separation of the said person from the said service.

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