

"Service"

A DIGEST OF
ELECTRONIC NEWS
AND VIEWS

THIS magazine is designed to present students with current news and information affecting the field of Electronics. Articles dealing with general business subjects, which in many cases the student finds necessary for his complete success, will also be included. To enable readers to obtain original articles, details of the origin of any condensed matter will be quoted.

Do you want some hard to get radio components? Back copies of "Service"? Some piece of used test equipment? A radio book temporarily off the market? Amplifier? Special set? or indeed anything which may be normally unobtainable due to the present material shortage?

If so, take advantage of the newly formed A.R.C. Trading Post (see page 16). This Service will print your advertisement for you at no cost to yourself—it is gladly extended to you by the College. One page, or more if necessary, will be set aside each month for this purpose. With some thousands of present and past students reading your paper, there is an excellent chance of your wants being filled.

So let us pull together and have that Trading Post page filled each month.

The College does really wish to include in your paper, anything to assist students and past students, not only with their studies, but with their other radio activities. Consequently, if you have any suggestions to offer about improvements or additions to your magazine "Service," send them along by all means, we will be delighted to hear from you.

MARCH, 1946

WHAT TO LOOK FOR IN THIS ISSUE

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YOUR RADIO WORKSHOP

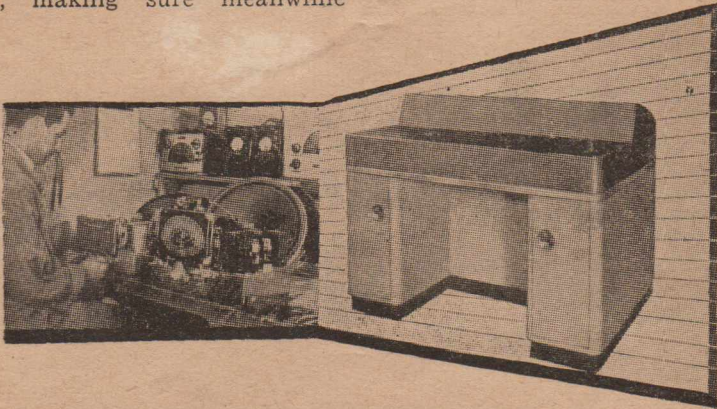
"The Service Bench"

In continuing this series, we now come to what is unfortunately, in many cases, the Cinderella of many radio workshops. It is the service bench. How often have you seen a workshop with good tools, fine equipment and well made fittings completely spoiled because proper provision had not been made to co-ordinate these three into a workmanlike set-up. As a consequence we have taken the test equipment set-up on page 25 of the January issue, and have added those items which are considered necessary for a really efficient work bench—efficient both in operation and in appearance.



Of primary importance when doing work of any kind, and particularly service work, is illumination. Rather than rely on general room lighting we find it a much better plan to employ two adjustable lamps fitted with shields to prevent glare, if possible and with individual switches for economy. As with any type of illumination, the pearl type of lamp is desirable since this further reduces glare. Various types of adjustable lamps are readily available, and once purchased it is then a simple matter to screw them to the top of the bench, making sure meanwhile

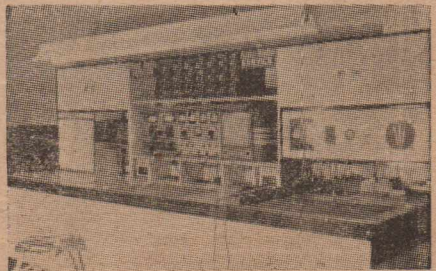
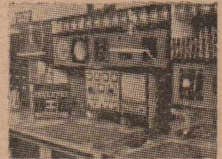
that you do not rely upon the individual switches as the only break from the mains circuit. Instead of doing this it is a simple matter to have the lamps controlled by the same main switch which controls the power points. We say this since it is a matter of good practice to have the switch which controls the main power over the service bench controlling every power outlet and lamp socket at the one time. It is also desirable that all internal wiring inside the panel be made with 1/18 or 1/16 V.I.R. 250 volt-grade cable. The



How much better would the hap-hazard array of equipment shown above, appear if it were built into the snappy streamlined bench on it's right. Also note the considerably improved appearance achieved in the remodelled bench shown in the lower photographs.

This
BENCH
before

and after



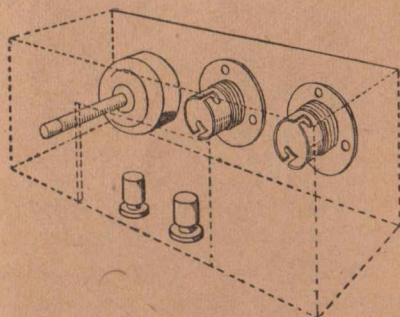
tough rubber sheathed type is the most convenient type to use, special attention should be paid to the earthing system where 7-22 bare copper earth wire is essential. Wiring of this type should only be carried out by a person with the necessary qualifications.

Immediately above the modulated oscillator, there may be seen two switches together with a pilot lamp. In our case the left hand switch is the main power switch, the pilot lamp on the right indicates when the power is on at the bench, and the right hand switch is the on-off control for the modulated oscillator. The Valve and Circuit Tester on the left will also require the mains voltage for certain tests, but in this case it is obtained from one of the three point power sockets on the front edge of the bench. The Universal speaker and output meter, which may be seen on the right, does not require the mains voltage for its operation and therefore no switch need be provided.

On the front edge of the bench there are four power sockets; two of these are of the three pin type, whilst the remaining two are of two different two pin types. We have only shown four sockets, and in most cases four will suffice for the average service job. Under some conditions, however, six or even eight power sockets may be considered advantageous. On the left of the front edge of the bench we have a recessed pocket which contains two batten type lamp holders together with two terminals, the whole being covered by a hinged flap. These two lamp holders are connected to the 240 volts in parallel, and also in parallel are the two terminals. Since the voltage of the mains always assumes lethal proportions, and since we have two bare terminals carrying

this voltage, it is essential that special precaution be taken to prevent any part of the body coming in contact with either of the lamp holders or the terminals. The purpose of the hinged flap is to prevent this and also to serve as the switch for the power supply, the two lamp holders and the terminals. Just to the left of the pocket may be seen the head of a small black press switch which is so arranged that the closing of the flap presses the switch and closes the circuit. (See separate illustration for more detail of switch operation.)

A further addition to the bench takes the form of three terminals immediately below the modulated oscillator. To one of these terminals is connected an efficient aerial, whilst the other two are connected together and earthed by the same circuit through which the power supply to the bench is earthed. Whilst only one earth terminal is required normally, it is often an advantage to have an additional earth point for various other purposes. Once again normal practice is followed by installing the aerial terminal with a red cover whilst the two black terminals serve as the earth connection.

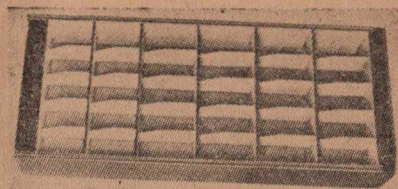


Plan view of recessed pocket—note safety push button.

Up to this point we have dealt with the service bench, and caution is stressed when handling mains voltages. With constant use of power in various forms there is often a tendency to become careless and to do so is extremely dangerous. Both when servicing and installing receivers and also in the maintenance of electrical equipment of any description, it is considered essential that the instrument, whatever it may be, be equipped with fuses having a maximum rating of 10 amps. Thus if the frame of some electrical appliance does become alive, the short circuit, wherever it may exist, will cause the fuses to blow, and the fault must be rectified before the equipment will operate at all. Since you have power available, obviously the best type of soldering iron to use is an electrically operated one. This adds greatly to the convenience of the user, and the bit of the iron may be so adjusted so that even if the iron is left on for a long period there is no undue corrosion of the end. In fact it can be so adjusted that the tinning of the bit does not oxidise.

You may have noticed up to this point that there is no provision made for the installation for a vice on the bench. Since the bench contains highly complex and delicate instruments, and because there is always a tendency to hammer and file at a vice, it has been purposely omitted. Iron filings in particular have an affinity with loudspeaker magnets and the presence of iron filings in a speaker generally leads to untold trouble.

Let us turn our attention to the drawers, of which there are eight illustrated. To many people, eight drawers would ostensibly hold a great deal of gear, yet it is amazing how quickly they can become over-



Drawer may be divided into many handy compartments.

crowded when one does a lot of work. Obviously when it is necessary to find things in a hurry, it is absurd to store such parts as power transformers and filter chokes together with resistors and condensers. It is left to your own discretion how best you may use these drawers, but here are a few hints which may help you. The illustration depicts a drawer divided into thirty compartments. These may be used for the storage of small parts such as condensers and resistors, and they are also useful in storing the various tiny gadgets that most servicemen accumulate. Servicemen, if they are wise, make provision for a small box containing a varied assortment of small nuts, bolts, screws and washers. If these are placed in a tray which may be readily removed from the drawer, they may then be turned out on a table and the required nut or bolt, as the case may be, is always found much more easily. Then with one sweep of the hand they are back in their box and in the drawer again. We suggest that this drawer be one of the top ones so that access to it is easily obtained.

You may have your own ideas for the storing of tools, and there are many ways in which this may be efficiently accomplished. If, however, you decide to store them in a drawer, it should also be one

of the top ones so that they too may be readily accessible. Once again it is an absurdity to throw heavy tools in cheek by jowl with small ones, for here too many minutes can be lost in rummaging for the correct tools. A well tried idea is a small sliding tray, about one third the length of the drawer and fitted so that it may slide easily back and forth. All that is necessary to accomplish this is to nail two small wooden runners parallel to the top of the drawer and about one inch down. The wood or metal tray may be then pushed to one side to gain access to the tools which lie in the bottom of

the drawer. At the same time it hold such small tools as scribes, long nosed pliers, steel rules, dividers and so forth.

The six remaining drawers are available for whatever equipment you may have on hand, and it may be safely said that at least one drawer will be used solely for the storage of tubes. This could well be one of the bottom drawers, since a great many repair jobs do not require the replacement of tubes.

Next month, amongst other items, we will give you some illustrations of well equipped radio workshops.

AN INTERESTING LETTER

SOUTHAMPTON ISLAND, N.W.T.,
CANADA.

Dear Mr. Graham.

On arrival in Canada I was sent up to this Island as a Radio Operator-Meteorologist and we are completely isolated from the outside world except for radio. We operate a weather and communications station for the Radio Aviation Division of the Department of Transport, Canada.

At present I am up to Lesson 33 and have the rough answers written for lessons 26a to 30 inclusive but will not be able to get them in this mail because of the limited amount of time on hand. To-day an aircraft of the R.C.A.F. landed here on its way to Cape Dorset, about 200 miles to the east and north of this station, and on its return trip tomorrow morning it is stopping here for petrol and mail. This is the first time we have seen anyone from outside for a long time.

Southampton Island is situated at the northern end of Hudson's Bay, and it is a rather desolate place. It is as flat as a pavement and the only hill of any height is Mount Minto 1100 feet high.

There is some hope that soon another plane may come up here and by that time I will have many more lessons finished. We have quite an elaborate radio station at this isolated base. We have 4 transmitters, each of 2500 watts, one of 250 watts, and a Simultaneous Radio Range Station which is the latest type used in Canada and the United States.

Our Officer-in-Charge has chosen me as serviceman, and I get quite a bit of practical experience when time permits. We have 5 communication receivers. Three Hammarlund Super-Pros, one National RCK, and one Mackay Marine Receiver. All the transmitters are remote controlled.

Last Autumn we cut 120 tons of ice to last us for the winter because the lakes freeze solid and the snow is not clean, due to sand being mixed with it. This base was built by the Americans and was taken over by the Canadian Government. This is one of three bases which cost the Ameri-

can Government about \$70,000,000 to construct. There are enough power plants here to light a small town and there is a lot of heavy equipment like steam shovels, bulldozers, tractors, trucks, launches and hundreds of other things. There are only 10 of us Canadians up here and the rest are Eskimos.

Due to the fact that we have to do a lot of extra work when not on duty, the spare time I get for studying is limited and I manage to do quite a bit while on duty. Being on duty up here is much easier than being off duty because while on duty we send weather reports, pilot balloon observations, and radiosonde reports, but off duty we have to work on Diesel engines, truck engines, haul in the ice, check equipment, wash floors, and many other things, so a person has to be rather versatile to be up here.

When I leave this island, I expect to get on a Radio Range Station near, or in a city, and then I will be able to do some radio repair work in my spare time. As I already have a full time job in Radio I will be quite content if I can repair a few odd sets each month to supplement my regular pay. At present I am earning about forty-two pounds, fourteen shillings per month including isolation pay. At less isolated stations I will be getting 35 pounds a month, and when I pass my Barrier Exams I will get a further increase in pay.

In this job, radio servicing plays a big part because no matter how good an operator is as regards speed in sending and receiving, he cannot advance one bit unless he knows his equipment and can repair it. Your radio course will play a big part in my future as regards that point and I am glad I enrolled with the Australian Radio College. Although I have had over 5 years' experience with transmitters, I have not had much with receivers, but always managed to get along. After finishing this course, however, I will understand much better the whys and ways of receivers.

While in Australia, I worked for a short time at Thom & Smith's, manufacturers of Tasma radio, and gained some good factory experience which has come in very handy more than a few times

V. B. BENEDETTI.

SERVICEMAN'S SIGNS

We mentioned last month that they should be ready soon—Sorry, but the makers now advise that they cannot supply until next year. But here's better news—look out next month for a description of some special theatre slides the College is having designed for A.R.C. Students. Full details in April "Service."

THREE USEFUL GRAPHS

The subject of compilation and use of graphs is a very interesting one, and for students and designers alike they will always fill a specific requirement. The average person is interested in graphs solely from their "use" viewpoint, and the man faced with the necessity of constant calculation finds them an indispensable tool.

No graph, however well compiled, reproduced, and read, is perfectly accurate. There always exists the need for interpolation between coordinates, and this is the primary cause of inaccuracy, but the results obtained are sufficiently accurate for all practical purposes.

On the following pages are three graphs whose uses are outlined in the text, together with examples. The first two are reproduced for the benefit of students who may at some time require them for ease in design calculations, whilst the third will be found distinctly advantageous both to designers and servicemen—power, voltage, current and resistance forming an integral part of any work on either radio or electrical appliances.



Resistance and Reactance in Parallel.

The first chart represents a considerable saving of time when one is faced with the necessity of calculating the impedance of resistance and reactance in parallel. Instead of laborious manipulation of formulae, the required impedance may be read off the chart directly.

Here is an example. Find the impedance when a resistance of 20 ohms is connected in a parallel with a reactance of 20 ohms. First find 20 ohms resistance on the horizontal axis of the graph, then follow the vertical line extending upwards from this point till you reach its intersection with the line projected from 20 on the vertical axis of the graph. The point of intersection is approximately half way between the impedance curves for 20 ohms and 10 ohms. The required impedance is thus approximately 15 ohms.

The same procedure is followed in using the second chart for resistance and reactance in series.

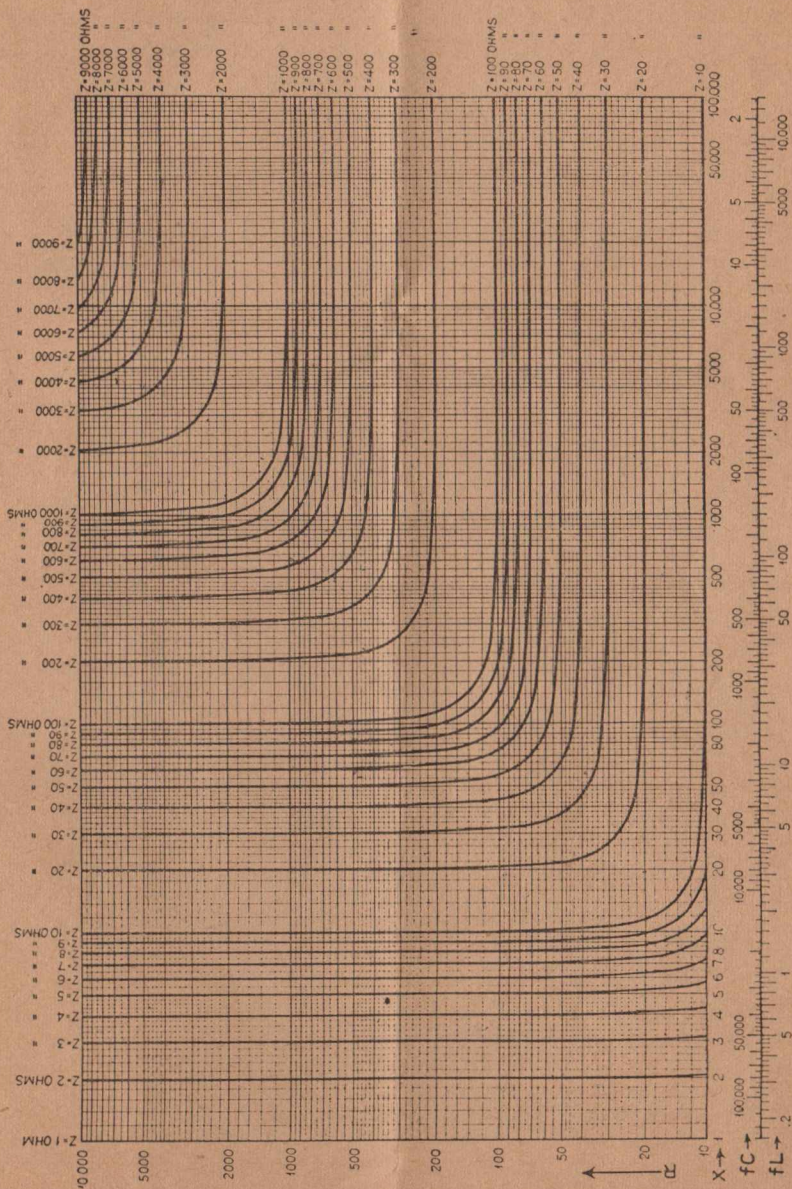


Current, Voltage and Power Curve for Resistance.

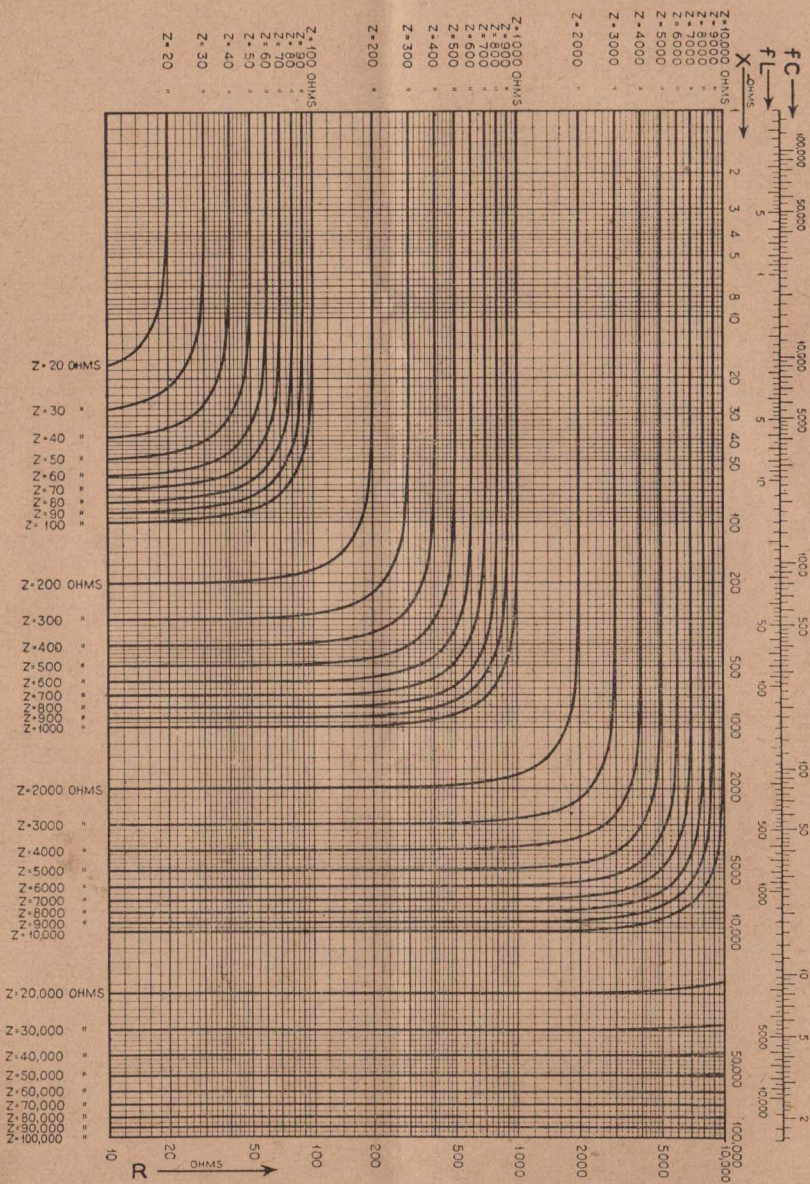
This chart enables ready calculation of either current, power, voltage, and resistance when any two factors are known. For example, find the power developed across 10 ohms when 1 ampere flows through it.

Commencing at 10 ohms on the lower horizontal axis of the graph follow the vertical line upwards from this point till the intersection of this line and that projected from 1 amp. on the left hand vertical axis is reached. Then follow the diagonal line projected from this point to the right until the right-hand vertical axis is reached. The figure shown as this point is the power dissipated in the resistor, namely 100 watts.

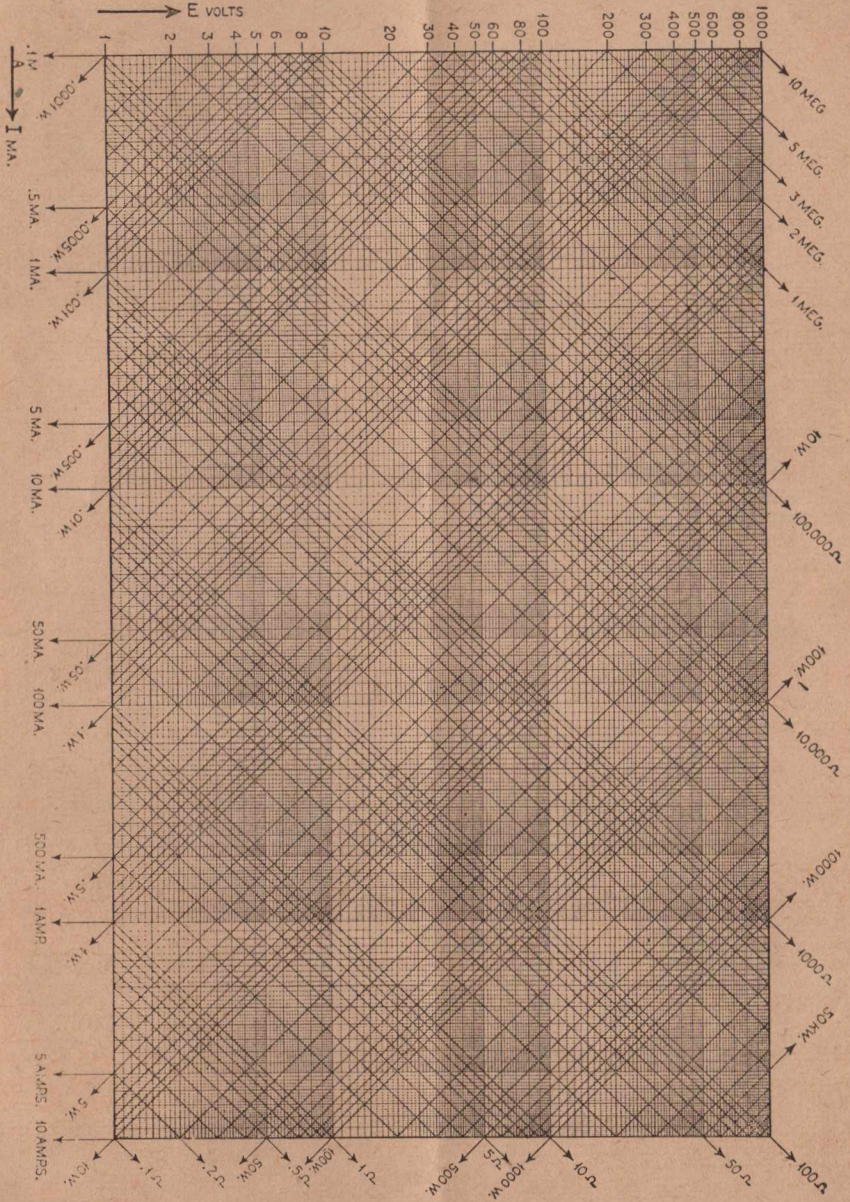
REACTANCE AND RESISTANCE IN PARALLEL



REACTANCE AND RESISTANCE IN SERIES



CURRENT, VOLTAGE AND POWER CURVE FOR RESISTANCE



How to Value Experience

May I say that seniority alone is not the best reason for promotion. Experience cannot be measured by years. Unless a man is always learning, his years of experience are not of much value.

In a certain school, a young teacher was promoted over the head of a much older teacher. The older teacher made a protest to the Head Master. He said: "You have forgotten my twenty years' experience."

The Head Master replied: "No, you are mistaken. You have only one year's experience twenty times."

The Head Master was right. One man with five years' experience may be more competent than another man who has had twenty years, either because he has had various jobs, or because he had made improvements in his one job.

The test is — how much has a man LEARNED during the years of his experience? A retailer can have a shop for twenty years and still know very little about the art of retailing.

FAILURE MAY BE ONLY POSTPONED SUCCESS.

—The Efficiency Magazine.



Can you have your old job back? Are you kidding?" —ELECTRICAL CONTRACTING, Oct.

Help Wanted

Private industry in America will be able to absorb every man who wants a job during the next ten years, in the opinion of Joseph Gerl, president of Sonora Radio and Television Corp. After the war the radio, television and electronic industry will employ 450,000 (100,000 pre-war), he predicts. There probably will be 3,000 new FM stations and 1,000 television stations. Including radio, phonograph and television dealers, distributors and service men, the industry may expect to utilize as many as 4,500,000 persons (there were 5,800,000 in all phases of the auto business.

—Electrical Merchandising.

Sea Lawyers

A minister, a scientist, and a lawyer were adrift on a life raft in the tropics. At last they sighted land. But the wind died down while they were a short way from the beach. The lawyer, the only one who could swim, volunteered to go ashore with a line and pull the raft to land. The minister knelt and prayed for his safety.

Then the lawyer dived in. He saw the black fin of a shark making straight for him. The shark disappeared, then came up on the other side, having passed under the swimmer. Shortly they saw another, even bigger, shark darting towards him, but this one also swerved just in time.

After the lawyer had reached shallow water, the minister said to the scientist: "There you are, you doubting Thomas; there is proof of the power of prayer."

"Power of prayer, hell!" retorted the scientist. "That was just professional courtesy!"

THE READER'S DIGEST

A man ran into the house of a neighbor and shouted: "I say, Mrs. Murphy, your husband has just laid his hands on ten thousand volts."

"Good gracious!" said Mrs. Murphy. "Now we'll be rich! How much is that in English money?"

Possessions vanish and opinions change,
And passion holds a fluctuating seat;
But, by the storms of circumstance
unshaken,
And subject neither to eclipse nor wane—
Duty exists.

—W. Wordsworth.

TECHNICAL BOOK REVIEWS

Is Shakespeare archaic? Many, were they asked this question would hastily purchase a 50 watt amplifier, turn up the volume control, and shout: "Yea verily!" Others, mildly—even meekly—would whisper: "Not so." One's preference is a sacred thing, and I would fall in the latter group.

Is A. A. Ghirardi's *Modern Radio Physics* out of date? Few in this case could shout the "Yea verily." Just as the basic principles of our English speech have not changed, so have *Radio Physics* remained the same. Had Socrates built a coil and condenser in ancient Greece, and had he applied an alternating current to it, the oscillatory circuit would still have oscillated.

Your A.R.C. course does not require the addition of any textbook, but if you thirst for knowledge and desire to study more and more, you will need go no further in your search for radio fundamentals than *Modern Radio Physics* by Alfred A. Ghirardi. 970 pages of excellent material for 45/-.

Obtainable from all leading Booksellers.

Radiotron Designer's Handbook

The purpose of "Book Reviews" is to help guide the student of radio toward the class of textbook material available which will be most suitable and helpful to him. There are many text books so abstruse as to be useless to a great number of people, and it is for this reason that we often hesitate before recommending a particular book.

There is a book, however, about which we have no hesitation. Far from being hesitant we strongly

recommend it to every person who reads this article and who is interested in radio. The *Radiotron Designer's Handbook* must be undoubtedly the best value in text books available. It possesses 344 pages of concise information relating to every aspect of modern radio, including approximately 30 graphs, trigonometrical tables, logs and antilogs, wire sizes, etc.

The price of this remarkable book is within the range of almost any person's pocket and despite this, the type is exceptionally good, and is set on good quality art paper.

There are in all 40 chapters and the sub-headings of one of them—taken at random—will give some idea of its thoroughness to detail.

Chapter 6.

Negative Feed-back

Feed-back, positive and negative—Feed-back over single stage—two stages—three or more stages—the effect of Feed-back—Negative Voltage Feed-back—Negative Current Feed-back. Derivation of Formula for Negative Voltage Feed-back—Gain—Gain Reduction Factor — Harmonic Distortion — Noise—Frequency Response—Plate Resistance — Gain — Input Resistance — Amplification of Negative Feed-back — Single Ended and Push-pull Amplifiers—Summarised Design Data for Negative Voltage Feed-back and Negative Current Feed-back.

A limited number of these books are available from the College.

Price 6/- plus 4d. postage.

STRATOVISION

The January article on Television ("Science Looks Ahead"), which, you will recall, was a forecast made by Prof. Low, outlined one method of increasing the range of Television Transmissions by taking the transmitter aloft. It was pointed out that several problems, such as the weight of the transmitting equipment and power supply, rendered this unpractical at that time. However, in the light of present-day knowledge and experience gained with aircraft during the war, the idea is now a practical one. This being the case, what are the advantages of a television transmitter in an aircraft, and how will they affect the average man?

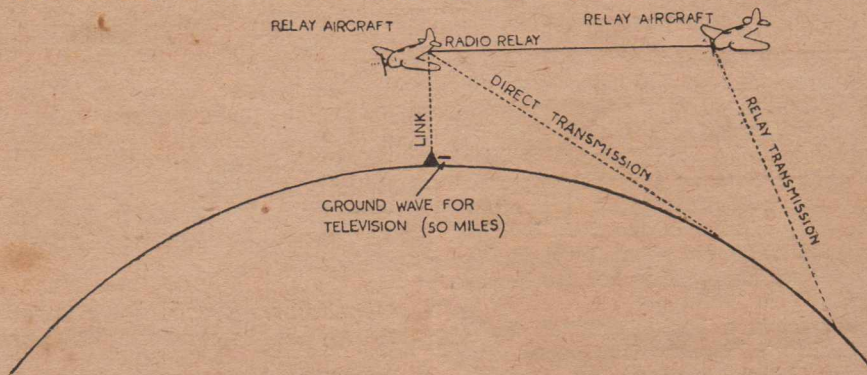
It will be remembered that broadcast frequencies are of such a low order that they can follow easily the curvature of the earth's surface—ground wave. The slightly higher frequencies employed for "short wave" transmissions also have the ability to produce a ground wave, and in the case of long distance transmission, their propagation is easily possible by reflecting them from the ionised "Heaviside Layer," that exists approximately 100 miles above the earth. It can be seen that the receiving aerial may be far below the horizon and still receive both ground and sky wave signals.

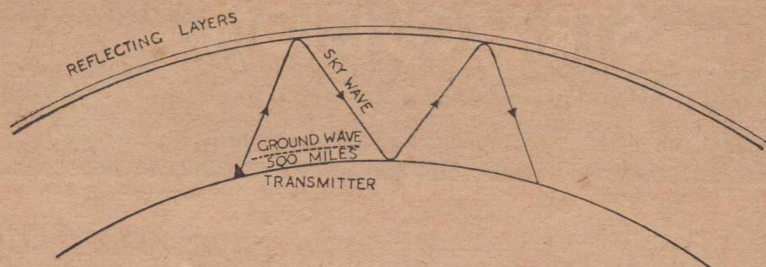
With Television and Frequency Modulation, because of the very high frequencies involved, the signals do not follow the earth's curve and are almost entirely absorbed. Nor does the ionosphere reflect the sky wave back to earth.

For these reasons Television signal is confined to line-of-sight distances.

Operation from Aircraft

It is obvious that if the transmitting equipment is at a high elevation the line of sight distance is increased. It is also obvious that the higher the transmitter the greater the effective coverage. One very important aspect needs now to be considered—that of power. Due to the high absorption of the signal near the ground, very highly powered transmitters are required to cover such relatively small distances as 50 miles. Having the transmitter isolated from the ground reduces the attenuation and allows greater coverage with smaller power output. Since a low powered transmitter in a plane can effectively send signals to a ground station 200 miles distant, it follows





that a signal sent from a highly directional radiator will travel even further to another high flying aircraft. This allows for radio relay stations separated by, say, 300 miles, and it is easy to visualise two stratovision transmitters maintaining a constant link between the capital cities of the eastern States. Compare this with ten highly-powered ground stations between Sydney and Melbourne, or the coast of co-axial cable at £1,000 per mile. A very great saving.

The use of low power transmitters will allow the operation of about five Telecasts and four or five F.M. programmes, the power being obtained from the 'plane's engines. This would constitute a loading of about 40 per cent. of en-

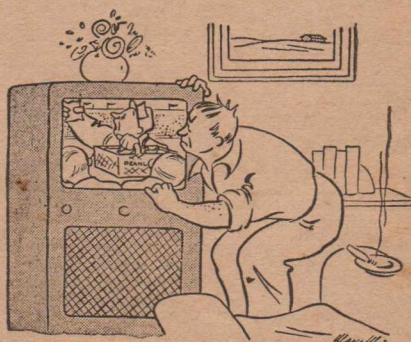
gine power, and we are told that this is not serious.

The signals from the studio are easily fed to the various transmitters by direct radio links, and the provision of several programmes blanketing relatively enormous areas will certainly help to defray programme production costs. Normally the sparse population of country districts could never support the cost of a transmitter and expensive programme production. Stratovision supplies nearly all the answers at about one-thirteenth the cost. This ought to please the advertising programme sponsor, and it will certainly please the viewers who otherwise may not be viewing at all.

Painless Probe.

An electronic medical probe has been developed to indicate irregularities of bone and organs under the skin and determine the size and placement of large organs of the body when the patient cannot be moved to X-ray or fluoroscope installations. Consisting of a transmitter, receiver and indicator, the instrument traces body irregularities through dielectric variations. By attaching a crayon to the probe it is possible to draw an outline of the heart on paper placed against the chest.

—Electronics.



—'He caught it! Now he's shaking off tacklers! He's loose—'
—ELECTRICAL MERCHANDISING, Oct.

A.R.C. TRADING POST

**A free Buy - Exchange - Sell
Service for A.R.C. Students**

Four Valve, 6 volt vibrator mantel set
B/C. Set and 8 inch speaker in separate
cabinets. Less battery, will accept £10.

E. DACH,
25 Wardell Road,
Petersham. LM 4202.
N.S.W.

WANTED TO BUY—"Radio Hobbies,"
February, September, October, 1945.

C. L. CRAIG,
12 Browns Road,
Wahroonga.

Wanted—Signal Generator/Oscillator with
output meter preferred.

R. MOODY,
1 Dixon Street,
Flemington, N.S.W.

Exchange or sell several 1-4V series
Valves. Also 27's and 3006's. 0-15 m.a.
meter. Transformers 2.5V; 4V; 5V;
7.5V FIL. 385 and 600 H.T. All about
80 m.a.

H. TRAVELLER,
46 Cook Road,
Marrickville, N.S.W.

Several AVO—Meters urgently required.
Model No. 7 or similar. Will pay top
price for good instruments.

K. SCHUBERT,
47 Metropolitan Road,
Enmore, N.S.W.

WANTED—One A.R.R.L. Handbook, any
condition.

K. KIMBERLEY,
226 Elswick Street,
Leichhardt, N.S.W.

FOR SALE—Push-pull 6V6-10 watt speech
amplifier. Suitable gramophone reproduction
or indoor P.A. work if high impedance
crystal mike is used. Less mike and
speaker £15—perfect condition.

L. C. SMITH,
5 Grosvenor Street,
Croydon, N.S.W.

FREE SPACE

FREE SPACE

Do you want to buy, sell, or
exchange something with a
fellow student? If so, the Col-
lege will gladly insert your
advertisements free of charge
on this page. Write carefully
—or, better still, print your
advertisement. Condense it to
30 words or less, and it must
be confined to radio subjects.
The College of course reserves
the right to re-write adver-
tisements as necessary, or to
reject those that may not fit in
with the spirit of this service.