"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.

Emerson, that great philosopher, offers sound advice in these two quotations . . . .

"IT is easy in the world to live after the world's opinion; it is easy in solitude to live after our own; but the great man is he who in the midst of the crowd keeps with perfect sweetness the independence of solitude."

"TRUST thyself: every heart vibrates to that iron string. Accept the place the divine Providence has found for you; the society of your contemporaries, the connection of events. Great men have always done so . . . and we are now men, and must accept . . . the same destiny . . . not cowards fleeing before a revolution, but redeemers and benefactors . . . Let us advance and advance on Chaos and the Dark."

APRIL, 1948

WHAT TO LOOK FOR IN THIS ISSUE

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HOME PRACTICAL INSTRUCTION LESSON No. 2

(Continued)

EXPERIMENT 2.

VOLTAGE MEASUREMENT.

Although the meter supplied to you is basically a micro-ammeter it can be converted into a voltmeter and employed for measuring voltages merely by connecting a resistor to it. To make your meter into a voltmeter capable of measuring direct voltages up to a strength of 5, connect one end of the 10,000 ohm resistor to one of the meter terminals and connect two lengths of flexible hook-up wire, each about two feet long, one to the other meter terminal and the other length to the unused end of the 10,000 ohm resistor. These connections are shown in Figure 3.

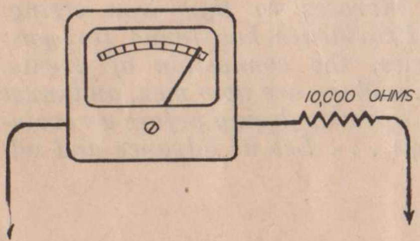

Fig. 3.

Your meter is now capable of measuring voltages and a value of 5 volts applied to it would send the needle across to the right hand end of the scale. Actually, there is no number "5" appearing at the right hand end of the scale but again, we will use the second row of numbers which actually terminates in 50 and we will disregard the nought so that the 50 we will imagine as being 5. Similarly, the 40 will become 4 and the 30 will be regarded as 3 and so on.

To measure the voltage of your battery, connect the two lengths of hook-up wire, marked with arrow heads in Figure 3, to the two outside terminals of the battery. If the battery is in good condition, it should have a voltage of approximately 4.5 volts and this will cause the needle to move nearly to the right hand end of the meter scale. The needle will come to rest about halfway between the numbers 40 and 50 on the scale. As I have already explained, these numbers really correspond to 4 and 5 volts so that if the needle is halfway between, this would indicate $4\frac{1}{2}$ volts. Actually there are ten graduations between 4 and 5 volts on the scale so each one of these will represent 1/10th of a volt. Being a new battery when it is supplied to you, you will possibly find its voltage a little higher than 4.5 volts. You may obtain a reading of 4.6 or 4.7 volts from it.

You should now measure the voltage of the other sections of the battery by connecting the ends of the hook-up wire between the various pairs of terminals. In some cases you will obtain a reading of 3 volts and in other cases a reading of approximately 1½ volts.

Your meter will now prove to be an accurate instrument for checking any other low voltage batteries you may have, such as flashlight batteries. Each cell of a flashlight battery should give an indication of about 1½ volts when in good condition, and you will find that the cells are not much use once their voltage drops below 1 volt.

On no account should you attempt to use your meter and resistor for measuring values of voltage higher than 5 volts. Never connect the meter and resistor to a radio B battery or any other battery which has a voltage greater than 5. Never attempt to measure voltage unless your meter itself is used in conjunction with a high value of resistance as shown in Figure 3.

EXPERIMENT 3.

FAULT FINDING WITH A VOLTMETER.

A voltmeter is a very useful instrument for tracing faults in electrical circuits because frequently a fault causes the voltages in the circuit to be different to those normally existing. If you know what voltages should normally exist in a circuit when it is in good condition, then you will quickly be able to determine the faults by measuring with the meter to find out which voltages have changed and are no longer normal.

To provide a circuit on which to practice, connect together the battery, 14.8 ohm resistor and lampholder as shown in Figure 4. On screwing the lamp into the holder you will find that it glows dimly if all your connections are in good order.

The lamp used in this manner may represent the filament circuit of a radio valve.

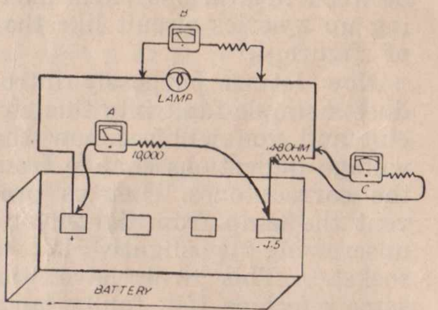

Fig. 4.

Now with your meter connected to the 10,000 ohm resistor as shown in Figure 3, so that it is a voltmeter, connect the two ends of the flexible wires, which should be 2 or 3 feet long, firstly to the two terminals of the battery as shown at A in Figure 4. If the meter shows full battery voltage of approximately 4½, you will know that the battery itself is in good condition.

Now move the voltmeter to B and touch the two sides of the lampholder. The meter in this case should register a voltage of approximately 1 volt. Make a careful note of the exact reading of the meter at this point.

Next move the voltmeter to C and measure the voltage drop across the 14.8 ohm resistor. If you add the voltage measured at this point to the voltage measured at position B you will find that the two added together exactly equal the voltage of the battery as measured at position A. Thus, you can see that the voltage of the battery divides between the various parts making up a series circuit like that of Figure 4.*

Now let us purposely introduce a simple fault into this circuit and you will see how the voltage indications change from the correct ones. Let us prevent the lamp from lighting by unscrewing it slightly in its socket. This will have the same effect as if a faulty lamp is used.

If you now make your measurements, you will find at position A that the voltage of the battery is still correct. At position B, instead of finding a small voltage you will find the full voltage of the battery is present. This is due to the fact that no current can pass through the lamp or resistor and consequently there is no drop in voltage caused by the resistor so that the full voltage appears across the lampholder, even though this voltage is unable to drive any current through the lamp itself.

When you connect the meter to position C you will find that no reading is obtained because of the fact that no current is passing through the 14.8 ohm resistor and therefore will not produce any drop in voltage across it.

Unfortunately, you cannot very well make the 14.8 ohm resistor defective to test and see what happens when this condition arises without actually damaging it. However, if this resistor were to be broken, you would find on making your measurements that you would obtain full battery voltage at A, no voltage at B, because no current would be passing through the lamp, and you would obtain full battery voltage across the two ends of the resistor with the meter at position C.

Another slightly different method of using a voltmeter for locating a break in a circuit is illustrated in Figure 5. In this case, one of the flexible leads from the meter should be permanently connected to the positive terminal of the battery and the other flexible lead moved around the circuit from one

* See A.R.C. Service Engineering Course Lesson 7.

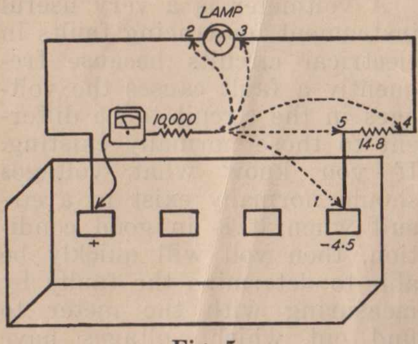

Fig. 5.

point to another as numbered on Figure 5. At position 1, you will check the battery voltage. If all of the other parts in the circuit are in good order, you will find at position 2 that you obtain no reading, at position 3 you will obtain a reading of approximately 1 volt, at position 4 you will obtain a similar reading, while at position 5 you obtain a reading of the full battery voltage.

You can see how the readings would change in the event of the lamp being faulty by unscrewing the lamp slightly in its holder and checking again the voltages at each of the points from 1 to 5.

EXPERIMENT 4.

TESTING FOR SHORT CIRCUITS.

To examine the effect of a short circuit, let us use the 14.8 ohm resistor, lamp and battery in similar fashion to that in diagram 4, with the exception that we deliberately introduce a short circuit in the form of a wire connecting with the right

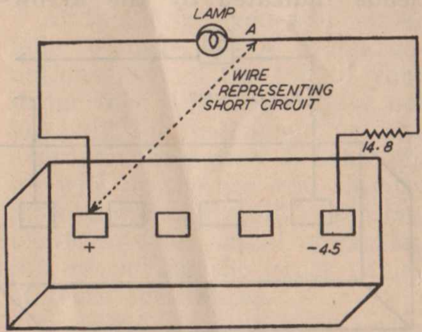

Fig. 6.

hand side of the lamp to the positive terminal of the battery as shown by the wire in Figure 6. When this short circuit is introduced, current from the battery will not pass through the lamp but will take the alternative path through the short circuit to the point marked A and then will pass on back through the 14.8 ohm resistor to the battery.

In this case, when we measure the voltage of the battery as shown at A in Figure 4, we will obtain a normal reading. When the meter is connected, as shown in Position B, to measure the voltage applied to the lamp, we will obtain no reading, and of course the lamp will not be alight. Again, when the meter is connected as shown in position C, we will obtain a reading of full battery voltage because the full voltage of the battery is reaching the 14.8 ohm resistor without having to drive current through the resistance of the lamp.

Previously, when we had an open circuit in the lamp, by unscrewing it in its holder, we obtained full battery voltage when measuring across the lamp in position B of Figure 4. On this occasion, when there is a short circuit across the lamp, as shown in Figure 6, we obtain no reading across the lamp. You will see that the different types of faults reveal themselves by the fact that different voltage indications are obtained when they exist.

EXPERIMENT 5.

CONTINUITY TESTER.

For tracing out the circuits of a radio set or other electrical equipment, and for testing some of the parts, a continuity tester is a very useful instrument. This will reveal when there is a complete path for current through any portion of a complex circuit. A simple continuity tester may be made by employing a $1\frac{1}{2}$ volt section of the battery and the lamp connected together as shown in Figure 7.

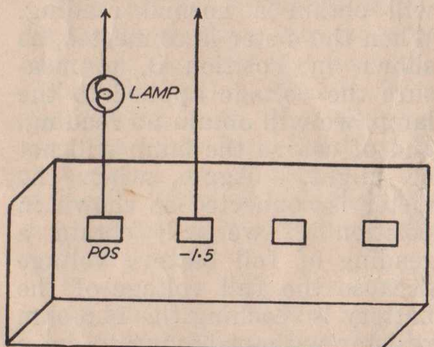

Fig. 7.

By using two lengths of flexible hook-up wire, connect the battery and lamp to any electrical circuit and if there is a continuous path of low resistance, then current will pass through the lamp and cause it to light. If there is a slight amount of resistance in the circuit, the lamp will light dimly. On the other hand, if there is a complete open circuit or a very high resistance path the lamp will not light at all.

The lamp supplied with your kit is rated at $2\frac{1}{2}$ volts and it is permissible to use it for a short period of time with 3 volts applied from the battery. However, it is not advisable to use it for very long under these conditions and on no account, should you connect the lamp across the full $4\frac{1}{2}$ volts of the battery or it will burn out and be of no further use to you.

A continuity tester of this nature is quite useful for checking the windings in an electric motor or for testing coil windings in radio receivers, and other similar circuits.

EXPERIMENT 6.

SENSITIVE CONTINUITY TESTER.

If you wish to check the continuity of circuits containing a higher value of resistance, up to several hundred thousand ohms, then you may use your meter, 10,000 ohm resistor and battery as shown in Fig. 8. On no account omit to use the 10,000 ohm resistor, otherwise your meter will be damaged.

When the two long flexible leads indicated by the arrow-

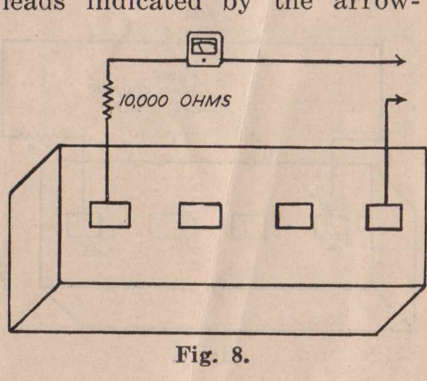

Fig. 8.

heads in Figure 8 are touched to a circuit of low resistance you will find that the needle will move right across to a position corresponding to the full battery voltage, i.e. about 4½ on the scale. On the other hand, when the leads are connected to an open circuit, through which no current can flow, naturally, the meter needle will stay at zero. Again, if the two leads are touched to a circuit containing several thousand ohms of resistance, the needle will take up a position somewhere along the scale.

A continuity tester of this type is quite useful for checking not only resistors in radio receivers but also transformers, coil windings, headphones, loudspeakers and many other parts. If you have an assortment of radio parts on hand, you should test them with the unit and observe the results you obtain. You can also use it for testing the continuity of other electrical appliances such as lamps, irons, electric motors, toasters and other such pieces of equipment.

At this stage, you will not be able to make use of the graduations around the top of your meter face because we have not yet built the instrument up into a proper ohmmeter. Later on, we will, by the use of a slightly more complex circuit, make our meter into an actual ohmmeter for measuring the exact values of these resistances.

In using the continuity tester shown in Figure 8, if you check the continuity of the lamp and the 14.8 ohm resistor you will find that the needle will register almost full battery voltage in each case because both of these items have a very low value of resistance.

A great deal of valuable practical experience can be obtained in using meters and reading meter scales from the experiments outlined above. In order to safeguard your meter, always keep in mind the following points. Never use your meter as it is supplied to you, for measuring values of current higher than 500 microamps. Never use your meter to measure voltage or as a continuity tester without using in addition to it a high value of resistance such as the 10,000 ohm resistor supplied. Even with the 10,000 ohm resistor do not attempt to measure values of voltage greater than 5. A meter of the type supplied to you is suitable for measuring direct voltage so do not attempt to measure alternating voltages with it.

Without even trying, anybody can be late occasionally, but it requires forethought to be late regularly.

· · · · ·

Discussing the type of milk which should be supplied to school-children, the chairman of the town's health committee said:

"What this town needs is a supply of clean, fresh milk, and we should take the bull by the horns and demand it."

RADIONIC ELECTROMIX - - - -

Eddy Current was a *conductor* on a *Wave train* which used to pass over the *Wheatstone Bridge*. One day, passing down the aisle he saw a *standing Wave* and found a seat for her. She told him her name was *Jenny Rator* and asked him the *transit time*. Eddy got *shunt-excited* and his heart started *motorboating*. He asked her if he could be a *wave guide*. Seeing his *thermal agitation*, her *admittance* got the better of her and she told him she already had a boy friend named *Mike Rofarad*. In well-*modulated* tones she told him she was *biased* against *Mike* because his *input capacity* needed a *volume control* and unless he *limited* his *amplitude* he always got *loaded*. At this *cross talk, Eddy Current* saw her *driving point* and said he would try to be a *converter* for Mike Rofarad. At noontime, at the *Antenna Feed* he was putting a *pi-section* into his mouth with a large *insertion loss* when he saw *Mike*. He was *stagger-tuned* as usual and was finding it difficult to maintain his *vertical position*. His *stability* was poor and he was highly *unbalanced*. Suddenly he yanked out an *electron gun*, focused it at Eddy Current and pulled the *trigger*. The *shot effect* was terrific. When the *space charge* had cleared away, a large *cavity* was found in the *ground*, and Mike Rofarad had disappeared. When Eddy saw Jenny Rator that night, he told her what had happened. Her *crystal* eyes watered and in the *intensity* of her grief she nearly had a *breakdown*. Then Eddy began to *sweep* her off her feet. Eyeing her *characteristic curves* he pledged her undying *fidelity* and presented her with an *intensifying ring*. Feeling the *mutual induction* between them they decided to try *critical coupling*, and were hence *matched* by a preacher. Then they set out to celebrate, got *saturated*, and became a very *twisted pair*.

E. A. Uttendorfer.

TELEVISION - - - -

"Yesterday's cables announced that Ambassador Butler's St. Paul factory would soon start a fifty million dollar television project on the Chicago lake front.

"Television is the Ambassador's baby.

" 'I'd like to see it out here,' he says. 'The country is ideal for it, and it would spread like wildfire. It's the coming thing; nothing can stop it.

" 'There's a fortune for the people who get in on the ground floor out here.' "

From the "Daily Telegraph"
—27th January, 1948.

Mr. Butler is the American Ambassador to Australia.

SIR ERNEST FISK LECTURES ON TELEVISION DEVELOPMENT

A large number of Radio technicians, including many students of the "College", at the invitation of the Institution of Radio Engineers, Australia, were privileged to hear an outstanding lecture entitled "Modern Developments in British Television" delivered by Sir Ernest Fisk on 4th March at the Assembly Hall, Sydney.

It is difficult to conceive any person better fitted to speak on this subject than Sir Ernest, who is Managing Director of what is possibly the world's foremost television organisation, namely, Electric and Musical Industries Limited of England.

Sir Ernest, at present on a brief visit to Australia, will be remembered as Chairman and Managing Director of Amalgamated Wireless (Australasia) Ltd. up until 1945, when he left for England to take up his duties with E.M.I.Ltd.

The lecture, as the name implies, was one of outstanding interest to all associated with the radio industry and was delivered in a manner which once again emphasised Sir Ernest's phenomenal ability to present a complex technical subject in a fascinatingly simple manner, which held the interest of both technical and non-technical members in the large audience present.

Some of the more interesting points covered in the lecture are set out below.

Sir Ernest stated that nearly all the fundamental developments relating to television originated in the United Kingdom, and that although the war had caused a cessation of television broacasting in England, a regular television broadcasting system had been re-introduced since the war and a variety of new developments had been the fruitful outcome of a large laboratory staff working in the extensive laboratories of the E.M.I. organisation.

The first practical possibility of television was suggested by the observation on the part of two engineers working in a cable station, of the fact that the metal, selenium, changed its resistance in accordance with the intensity of light falling on it. This photo-sensitive property of selenium suggested the possibility of converting the various impulses of light and shade, making up a scene, into electrical pulsations which could be transmitted by cable to a mosaic of a large number of small electric lamps located at a remote point.

From this time, the middle of the last century, numerous developments by a number of outstanding scientists and engineers gradually made the way possible for the introduction of the first practical television broadcasting service, developed by John Logie Baird and operated by the B.B.C. in London in 1932. This system ran for two years and transmitted regular television broadcasts for the entertainment of viewers in the London area.

It was realised quite early in the stage of television development that it would be impossible to send simultaneously all of the infinitely large number of details making up a complete scene, and consequently it became necessary to "scan" a scene so as to analyse it into an extremely large number of individual points of light and shade. Each of these points of light and shade then had to be transmitted one by one to the receiving point and re-assembled in their correct positions on the reproduced scene.

Due to an effect known as "persistence of vision" of the human eye, the repetition of a large number of individual scenes at a rate exceeding about 10 per second provides the illusion of moving pictures and the early Baird system divided each scene up into 637 elements and transmitted 12½ complete scenes per second. A noticeable flicker was a rather objectionable feature of this early system and in addition reproduced scenes lacked detail and clarity. However, this was the first practical television broadcasting system for the benefit of the public.

In 1936, the B.B.C. commenced a new television broadcasting service capable of a much higher degree of clarity and free of noticeable flicker. With this system, a scene to be transmitted was analysed into 405 parallel strips and each strip was transmitted, dot by dot—a total of some 200,000 elements making up each scene. The complete scene was transmitted in a 25th part of a second so that this repetition rate of 25 pictures, or "frames" per second eliminated the effect of flicker.

The high frequencies involved, in a high definition television system, make it impossible to have transmission on the ordinary broadcast band of frequencies, and consequently in England, the television carrier wave, carrying the scene details, was transmitted at a frequency of 45 megacycles whilst the carrier wave for transmitting the accompanying sound signals was transmitted at 41.5 megacycles.

The early camera tubes available when this high definition system was first introduced, were only capable of an efficiency of 5 per cent. in making use, by conversion into electrical impulses, of the stored effect of light reflected from a scene to be televised. Later developments produced a much more efficient tube, known as the "Super Emitron", which had an efficiency of 20 per cent. in this respect. This improvement made possible the transmission of outside sporting events under ordinary lighting conditions and also transmissions from theatres and similar places of entertainment.

A still later development in television camera tubes is known as the C.P.S. Emitron which is even more sensitive than the Super Emitron and makes possible practical television transmission even under adverse lighting conditions.

The method of reproducing a scene is to re-assemble on the screen of a large cathode ray tube, the innumerable spots of light and shade into which the scene has been analysed at the transmitter. Cathode ray tubes with a screen up to 21 inches in diameter have been developed. A 15 inch diameter tube provides a picture 12 inches by 9 and a complete television scene and sound receiver employing this type of tube sells in England for approximately 100 guineas.

Perhaps the most popular size of cathode ray tube in both England and the United States of America is the 10 inch size and the receiver embodying this type of tube sells for about 60 guineas. A still smaller receiver is available at 40 guineas.

The range of a television transmitter in the London area is about 50 or 60 miles, and at present between 30,000 and 40,000 homes are equipped with receivers. Later this year, a second television broadcasting station will be opened at Birmingham to relay the programme transmitted by the London service.

Three television broadcasting sessions are transmitted daily and two on Sundays. Programmes comprise full lengtn plays, direct transmissions from theatres, variety shows, information service, illustrated lectures, art exhibitions, solo artists and outside broadcasts, especially of sporting events and pageantry.

Sir Ernest forecast that by the end of 1948 there would be 65 transmitters operating in the United States of America, where, although television services have only recently been introduced, development is proceeding at an extremely rapid rate. He also suggested that there would be almost one million sets in operation by the end of 1948 and that in a few years' time, in the United States of America there would be something of the order of 60,000,000 viewers.

In connection with colour television, Sir Ernest stated that a lot of work had still to be done and that it will be perhaps 10 years before colour television becomes a practical proposition. At the present time, television in black and white transmission provides an excellent and acceptable service and is far less costly than colour television which is still only in an experimental stage.

Amongst the many interesting lantern slides exhibited by Sir Ernest were several photographs taken directly from the screens of television receivers in England and these confirmed Sir Ernest's claims that television at this stage has technically advanced to a state of perfection which provides a highly acceptable and practical service.

ELECTRONIC THICKNESS GAUGES

Two oil companies have developed units to measure wall thickness of pipe, tubing, pressure vessels and to detect cracks and corrosion.

Texas Co. has evolved the Penetron, which uses gamma rays to measure wall thicknesses up to $\frac{3}{4}$ in. within an accuracy of plus or minus 3%. Radium salts are in a needle with directing shield. Rays passing through the wall are picked up by a detector and amplified for transmission to the measuring circuit. The unit will not detect pinholes, pinhole corrosion, fine cracks or laminations.

Shell Oil evolved the Probolog, which detects and records internal defects, as pinholes, cracks, corrosion, and erosion pits, as well as differences in chemical composition of non-magnetic materials. A unit for magnetic materials is being developed. The device is electronic, but also incorporates a neon blinker when a record is not required. In operation, a probe is pulled mechanically through the tube.

—*American Machinist*

ELECTRONIC CRACK CATCHER

Metal wire, tubing and bars can be tested for cracks at mass-production speed with a British electronic device. When the material is passed through the field of the inductor of one of a pair of oscillators in the tester, the beat frequency is changed when a crack is present. This causes a large variation in the reading of the output voltage meter. To avoid worker fatigue and to insure against missing short flicks of the meter pointer, a neon lamp flashes at the same time. And to make the operation entirely automatic, a relay in the circuit operates a small compressed-air paint sprayer, which marks the faulty material over the crack. The relay is adjusted to close when the neon lamp fires, and it can be made to fire at any depth of crack from 0.0005 to 0.25 in.

—*Electronics*, Oct.

THE RIGHT SPIRIT

Anzac Day falls this month, so this item from our local paper seems appropriate:—

Returned ex-servicemen of Eastwood have the right idea. A party of them devoted a day of the Easter break to laying down a concrete drive for a fellow Digger who is paralysed as a result of war injuries.

One member of the Eastwood Soldiers' Club lent a power-driven mixer, others loaned barrows and seven workers set to and accomplished a very creditable job.

Another GOOD EXAMPLE!

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