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A "NIFTY" HOOK-UP FOR "TEN"

By LIONEL CHESTER

Popular Wireless & Television Times

CUTTING OUT THAT INTERFERENCE

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ALL THE LATEST TELEVISION NEWS
—See Inside

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Looking Up

LOOKING up towards Aberdeen, the student of British broadcasting will find plenty of work going forward. By the beginning of the summer the new transmitter at Nigg should be erected, and the North will know better programmes than ever before.

Meanwhile, the Aberdeen Town Council has approved the plans for the new studios at Beechgrove House, which will take over from the premises in Belmont Street next year.

In addition to the large main studio there will be a dramatic studio, a talks studio, effects, and the usual echo room.

It is hoped to have the new premises ready for the B.B.C. to work in by the autumn of next year.

Itemettes

LESLIE MITCHELL, television announcer at the Alexandra Palace station, has resigned from the B.B.C. to take an appointment as commentator with British Movietone News. The resignation is to take effect in February.

* * *

An American radio firm, with its eye on summer sales, is developing an all-electric flypaper. Innocent of adhesive, this ingenious gadget has a flex lead which plugs into any convenient power point.

The exposed grid on which flies may alight is harmless if touched by the finger; but if a moth, mosquito or fly alights there is a momentary flash—and no moth, mosquito or fly.

Learning Morse

IF you want to learn Morse or to improve your speed of reception, you will be interested to know that Italy will help you, though I do not suppose that this was the intention in Rome. However, that may be, you will find that the Italian Ministry of War has arranged for half an hour's instruction in the Morse code to be radiated on Mondays, Tuesdays, Wednesdays and Thursdays, commencing at 3 p.m.

The stations concerned are Bari 2, Florence 2, Genoa 2, Milan 1, Naples 2, Rome 1 and Turin 2.

Of these, Rome on 420·8 and Milan on 368·6 are high-powered stations well worth trying for if your set is in the hot-stuff class.

They Said It

THE Prime Minister, in reply to a question in the House of Commons asking if arrangements could be made to broadcast the proceedings of the House, said he could not see his way to adopt the suggestion. He had made inquiries, and had ascertained that broadcasting the proceedings would not recommend itself to any considerable section of the House.

* * *

The Highgate magistrate, addressing a woman: "You say that you are in the radio business and are doing badly. Why, everyone has a radio to-day!" The Woman: "But that's the trouble."

* * *

"Before next year is out it is practically certain that television broadcasts will be regularly relayed from theatres and music-halls. The experts are experimenting already with an improved camera with which it is hoped to overcome the difficulty of lighting."—(*The Star.*)

Just a Suggestion

WHEN Mr. Lachlan Macrae, the Glasgow Station Director, answered his telephone some time ago he recited his usual "Hallo" formula, and was surprised to hear the distant voice ask, "Excuse me, mister. but have you got an aeroplane?"

The puzzled station director replied no, he had not.

"Then git yin," said the voice, "fill it wi' bombs, mister, and drop the lot on where the programme is coming from."

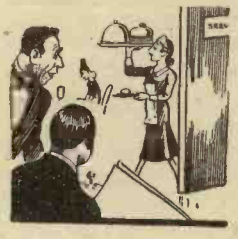
Believe it or not, that is a true story. Mr. Macrae made it public at a luncheon meeting of the Glasgow Publicity Club, when telling his audience of some of the criticisms which reach the B.B.C.

(*Continued overleaf.*)

COUNTRY SIGNPOSTS FOR EINDHOVEN'S NEW AERIAL

Open That Door

ONE of my friends who has a high reputation for veracity (some of my other friends haven't !) is going round telling of a very queer radio coincidence.



He says that he was in one of those restaurants where pukka-sahibs resort when his attention was drawn to the door through which the waitresses fetched and carried. As the waitress approached it, tray-laden, this door opened of its own accord to let her through. It was so extraordinary that, after watching, he asked the head waiter about it, and learned that it was an application of the radio amplifier linked with photo-cell apparatus.

Murmuring his surprise in a Well-I-never, Fancy-that-now manner, the diner turned to his paper to read an article by Miss Margaret Bondfield, Britain's first woman Cabinet Minister. And the first words on which his eyes fell were " Radio can open the door to a wider life for women."

Black Broadcasting

ILLEGAL transmitting stations—what the Germans call " black " broadcasting stations—are so unpopular with the German Government that a law has been passed whereby anybody who is found to own a clandestine station is liable to penal servitude.

This is the penalty merely for having a station which is not licensed ; if the too-enthusiastic broadcaster has been unwise enough to send out any programme which is considered hostile to the Government he is in far worse case, for he may then be charged with high treason.

High treason may render the offender liable to the death penalty.

Such Language

THE missionary zeal which aims to leave no native mind untutored in the niceties of civilisation is cumulative in its action.

At first we had just one or two radio propaganda stations broadcasting in other people's language at infrequent intervals. Then the propaganda grew hotter, the stations became more powerful, their number increased.

Recently Great Britain, who had been adopting a Benevolent-Old-Squire attitude, decided to join in. Italy, as from December 1st, is increasing her talks in Arabic and Hindustani. In addition to talks in the chief European languages the Italian stations will now transmit in Serbian, Greek, Turkish, Rumanian, Albanian, Chinese and Japanese.

Swing It

THE " swing it " idea has caught on in the radio world. That great little Dutch pioneer station at Eindhoven is trying out a novel form of beam aerial which is the very essence of swing.

Instead of being laid out permanently to throw a beam in the direction of say the East Indies, the new aerial has a system of revolving reflectors, arranged on a circular track.

At various points round the track are signposts indicating the directions of " East Indies," " Argentine " and other places, so the canny Dutchmen will be able to swing the beam in any desired direction. At the conclusion of that programme the beam can be swung round to cover the next country to which it is desired to transmit—a cute idea which saves a lot of aerial arrays.

ROUND LONDON'S AMUSEMENTS

(National Programme.)

Eavesdropping on several entertainments on the same night has always proved an amusing experience for listeners. On December 29th the B.B.C. is arranging to place microphones in several centres of varying kinds of amusement. It is hoped to cover a London circus, a Palais de Danse, Ice Hockey, an East End Working Men's Club, a Fun Fair, a Cinema, and a Musical Comedy. The microphones will be connected to one of the Broadcasting House Control Panels, at which a B.B.C. compère will be sitting. All the microphones will be " live," that is the various programmes will be on tap, the compère seated at the control panel will talk about them and, with a switch, take listeners on a magic carpet round London's entertainments.

This novel form of amusement will last for some forty minutes. Much depends on the entertainment value of the different places at the moment of call, and so visits and re-visits will be timed accordingly. For example, listeners may hear a short flash from an ice-hockey match and then, after visiting a fun fair or a cinema, go back to the ice-hockey match to hear what progress has been made. In the case of the circus, some of the acts are not suited to broadcasting. During this period the other microphones will be called on to fill the gap and so back to the circus for some part of the programme more suited to the listening audience. Continuity will be maintained throughout by the compère at the Control Panel.

Revelry by Night

THE police mobile squad who dash in cars to investigate suspicious circumstances, as directed by radio messages, often have some queer experiences. I doubt if any have had a more amusing chase than the car-load of which I heard recently.

Somebody phoned headquarters to say that very late at night a man had been seen climbing into a window. A police car was on the spot within five minutes, and caught their man, red-handed, coming out of a door.

But investigation proved that he was the owner of the house, who returning blotto from a dinner, had determined to get indoors without waking his wife. With infinite difficulty he had managed to climb through a small window, only to find that it belonged to an outdoor lavatory, *the door of which was ajar and led straight back to the garden path from which he had climbed with so much trouble.*

The police, the reveller, and his wife all laughed so much that they woke the neighbours—and a good time was had by all.

High Jinks

YOU would hardly expect that a high wind in Kent would put French wireless sets out of action, would you ? And yet a great deal of bad language which simultaneously arose from Boulogne, Calais, Bethune and other French towns was entirely the fault of the Kentish wind.

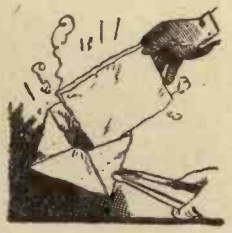
The trouble began when a powerful gust tore a captive balloon from its moorings at the Manston (Kent) aerodrome. Trailing nearly two miles of cable behind it, the balloon made straight for the Continent, evidently bent on making a Channel crossing in record time.

Its safe arrival on the other side certainly created a sensation, for the trailing wires brought down some high-tension cables. Lights went out in thousands of homes, mains sets became dumb, lifts stopped between floors, trams and trolley buses shuddered to a standstill, and about a million people made pointed inquiries about what the blankety-blank was the matter now ?

While electricians were putting this right the balloon made off again.

Postman's Knock

TWO of my letters this week have well-nigh burnt their own envelopes and blistered my fingers, so hotly have they been phrased and penned. One of them was posted at Brighton, from a gentleman whose initials did nothing to denote the state of his mind—for his initials were O. K., and his state of mind anything but.



O. K.'s cup of gall has been brimmed by what he calls the " beastly B.B.C.'s neglect of the South Coast." My sympathy with such robust criticism would have been complete but for the recollection that the Start Point station is now under way. Its aerial system will be directional towards the east, and its power may be 100 kw., so my conscience compels me to remind O.K. that the B.B.C. engineers really are tackling the problem at last.

The other letter—from J. M., of Cockermouth—I have passed on to the parties concerned, with all the weight of my pen added to its plea.

(*Please turn to page* 399.)

RADIO POINTS THE WAY

By J. C. JEVONS

How wireless can ensure a safe aircraft landing in mist or fog

THE railway traveller is safeguarded from point to point along his journey by a system of signalling which is as nearly foolproof as human ingenuity can make it. The time is not far off when the traveller by air will be in practically the same position. He will fly from aerodrome to aerodrome along an invisible track formed by the "overlap" of two beams of wireless energy, and at the end of his journey will glide safely down to earth on the back of a short-wave "landing" beam.

In a sense the airway will be even better served by radio than land transport is at present, because wireless signals are not affected by mist or fog. Road and railway lights and semaphores become practically useless as soon as fog sets in, and land-going traffic is then compelled to go slow for the sake of safety. But once the air is properly "charted" with wireless beams the pilot will be able to keep to his course simply by following the indications of his radio instruments, and will fly with the same confidence and ease as he does in clear weather.

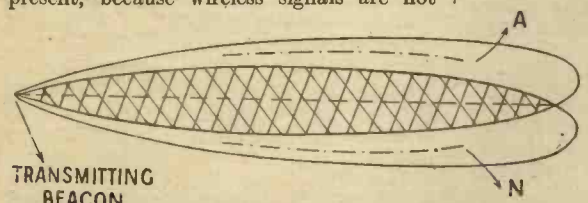


Fig. 1. Two directional transmitters are arranged at an angle to each other so that they radiate beams which overlap slightly along their length.

All this may seem more like a fairy tale than solid fact, but air navigation along wireless beams has already proved a success, both in America and on the Continent. Sooner or later the installation of "approach" and "landing" W.T. gear will be made compulsory at all aerodromes, and we shall hear of no more fog disasters like the recent one at Ostend.

For producing a radio "guide-way," two directional transmitters are arranged at an angle to each other, so that they radiate beams which overlap slightly along their length, as shown in Fig. 1. One beam is modulated with the Morse code letter A, which consists of a "dot" followed by a "dash," whilst the other carries the Morse letter N, formed by a dash followed by a dot.

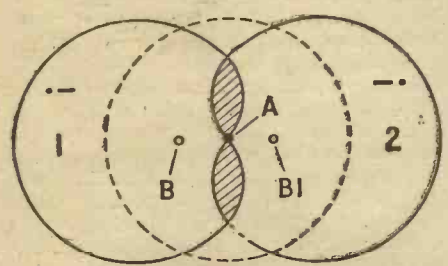


Fig. 3. The effect of switching in the two side reflectors, B, B1, is shown in this diagram.

Along the overlapping portion of the beams (shown shaded) the two sets of dots and dashes will be heard simultaneously, and since they fit neatly together the received signal merges into a single long-drawn-out note. Anywhere outside this region the signal is, of course, broken up definitely into the code letter A or the letter N, and the pilot knows, according to the particular sequence received, in which direction to steer in order to fly towards the shaded zone. Once there, it is a relatively simple matter to find and keep on the centre line.

If the pilot is wearing headphones, he judges by the continuity and strength of the received note. More usually the machine is fitted with a visual indicator, in which two equal columns of light show when the pilot is keeping to the equi-signal line. Or a balance ammeter may be used, on which the correct course is indicated by the needle keeping steady at the centre of the dial.

If the machine deviates to one side or other of the charted course, the radio indicator at once shows by its deflection what is happening, and how the steering must be corrected to get back "on course."

Ultra-Short Waves

Long-range navigational beams of this type are effective up to distances of the order of 150 miles, the signals being received on trailing-wire aerials. For "approach" work, that is for guiding an aeroplane into the aerodrome from distances of less than ten miles, and for "blind" landing in foggy weather, ultra-short beams on 10 metres or under are used. These are transmitted and received by dipole aerials.

Fig. 2 shows the arrangement of a short-wave "approach" beacon. The centre dipole aerial A is energised directly from a high-frequency source, whilst the dipoles B and B1 act as reflectors to modify the shape of the field radiated from A. Each of the B dipoles is fitted with a short-circuiting switch, which is operated periodically through a relay from a rotary commutator C. When a switch is closed that particular dipole acts as a reflector and distorts the field radiated by centre dipole A. When the switch is open the dipole exercises no effect upon the radiated energy.

The field radiated from the dipole A, taken alone, will spread out equally in all directions, in the horizontal plane, so that it can be represented as a horizontal circle with the dipole at its centre. The effect of switching-in the two side reflectors B, B1 is shown in plan in Fig. 3. When the switch of one dipole is closed, and that of the other opened, the original circular field (shown in dotted lines) is distorted into the shape marked 1, whilst when the switching is reversed, the field changes over into the curve marked 2. This produces a central overlap (shown shaded) which looks like a flat-shaped figure-of-eight, and serves as an "approach" beam to guide the pilot towards the aerodrome.

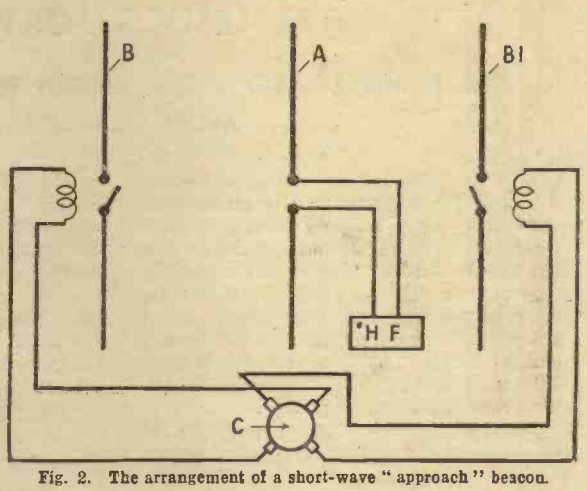


Fig. 2. The arrangement of a short-wave "approach" beacon.

As before, the radiated field 1 is modulated with the Morse code A (. —) whilst the field 2 is modulated with the letter N (— .). The centre shaded path then becomes an equi-signal line along which the pilot flies horizontally by keeping his indicator at zero. The effective range of the approach beam is from six to ten miles.

Fig. 4. The pilot starts to put the nose of his machine down when he reaches M1, and by always flying to constant signal strength is automatically guided along the contour of the beacon, thus reaching the point M2 at the proper landing angle.

In addition to being guided horizontally, it is necessary at a certain point to start the machine on its downward path to earth. This is usually done by means of a second club-shaped field inclined at an angle to the horizontal. For this, another reflecting aerial, similar to B and B1, can be placed vertically above the dipole A in Fig. 2. The additional dipole is also connected to the commutator switch C, so that the "approach" beam is periodically changed over into a "landing" beam, the change-over being made so rapidly that both beams are practically in operation at the same time.

Taking a vertical section through the field radiated by the dipole A alone, it will have the circular form shown in elevation in Fig. 4. There is zero radiation vertically, but maximum radiation in the horizontal plane. When a reflecting dipole, such as A1, is placed immediately above the dipole A, it distorts the original circular field, and pushes it over to one side, as shown by the shaded curve. This, it will be observed, cuts the ground some considerable

(*Please turn to page* 405.)

THE DIAL REVOLVES

By LESLIE W. ORTON

THE 20-METRE BAND :: JZK WORTH TUNING-IN :: ROUND ABOUT 10 METRES

YOU can say what you like (and doubtless will!) but the 20-metre band takes some beating for irregularity these days. On most Sundays lately I've been able to pull in "G's" with a regularity that was astonishing, but the pendulum has reversed, Fate has once again played havoc, and on many occasions I've found hunting for a "G" (even G8SB!) as difficult as looking for a needle in a haystack during a fog at night!

Nevertheless, my "log" is decidedly attractive, for it includes VO1I, VO4A, VO2N, Newfoundland; YI6JA (calling Newfoundland); CT2AB, Azores; CE2QC, Chile; LA6A and LA6N, Norway; QZ5BW, Denmark; PA2AW, Holland; ON4TZ, Belgium; CT1AY, Portugal; CN8GA, French Morocco; W2EI, W2UCI, W4AH, F8PQ, F8DN, F8CN, etc. A Russian station (possibly the North Pole station, Radio UPOL) was heard faintly, but clearly, on about 21 metres on several occasions.

By the way, I've received a further batch of "logs" from readers, and the following from D. D. of Musselburgh, Scotland, is of such startling proportions that I can't refrain from quoting it: CE2EW, CN8AT, CO2AB, CX1AA, ES5D, FA8LC, FB8OO, FT3LY, HA8N, HB9J, HH5PA, HI1X, HK1AZ, I1KM, KA1MF, K4FNY, K6KFZ, LU1GA, LX1TW, LY1AA, NY2AE, OF1FX, OK2MA, OQ5AA, OZ1NW, PK4AU, PY2BA, SU1KG, TF3P, TGI2AY, TI2AV, U3BC, VE9AF, VK2HF, VK2XU, VO2Z, VP2CD, VS2AK, VU2CQ, and many, many more. Can any of you hardened DX-ers beat this Scotch enthusiast's log? His receiver, by the way, is a detector-pentode affair.

Johannesburg Heard

Since Japan took over parts of Shanghai, some startling changes have taken place. XOC on 28·46 metres is now (I understand) in the hands of the Japanese, and I assume the same to be the case as regards XGW on 29·79 metres.

By the way, JZK, Tokio, on the 19-metre band, is well worth tuning-in—he's a colossal signal.

Which reminds me (I don't know why!) that I was startled out of my usual calm when the announcer at an outside broadcast apologised for giving the wrong call! The real call was W8XK, Pittsburgh—it's seldom that such an error occurs.

The 49-metre band has been particularly interesting of late, and "poor old Jo" (ZTJ, Johannesburg) has been heard occasionally. Its schedule is given as from 5 to 9 p.m. on 49·2 metres. A fraction of a metre higher up (on 49·31 metres) you may be lucky enough to tune-in VQ7LO, Nairobi. I've heard him on a few occasions lately.

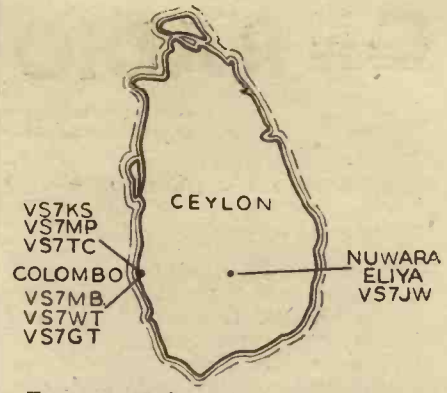
W2XE, Wayne, on 25·36 metres has been a "star" signal. I heard an excellent rendering of "Lost Chord" from here the other day. Volume, using a five-valve "super," was so great that a friend was puzzled at not finding the programme in the "Radio Times." I almost thought I'd have to get some brandy when the call came!

Excellent Ultra-Short-Wave Results

Fed-up to the teeth with DX-ing on 20 metres (there aren't enough "Yanks"), I've been only too thankful to turn my attention to the 10-metre band, for it frequently provides more thrills per minute than all the other bands (not including Henry Hall's!) put together.

My log's not very spectacular, but W1AA, W1HTR, W1CRI, W1FFI, W1JFU, W2IQC, W2TD, W2KAX, W4FT, W5BA, W5EJO, W8HST, and W9FEW were moderate to good loudspeaker signals.

On about 9·55 metres I picked up an American broadcaster broadcasting a talk on wireless stations. Just before the station call, the station faded completely. I'm wondering whether I was listening to a harmonic of W2XAD, Schenectady. I understand that one has been giving DX-ers the thrill of their lives (until they've heard the call!) of late.



Here are some Ceylon amateurs worth searching for.

Even more mysterious was a station heard on about 9·5 metres. I always managed to tune him in when closing down with a "Good-bye. 2, 3." I never was much good at puzzles, and this mathematical-sounding fellow has me floored. Perhaps one or other of you DX-ers hold the key to the mystery. If so, I'll be everlastingly grateful if you will let me into the secret!

The 9·494-metre band is well worth attention. I've heard concerts, talks, and even the "Session chimes" at excellent strength, but, having a touch of 'flu, I've invariably sneezed when the call came!

S.W. Station Identification

By F. A. Beane

LATIN-AMERICAN CHANGES

THE Dominican Republic is constantly clamouring for etheric limelight, and like numerous other Latin-American republics frequently makes changes in its channels, adds to its transmitters, or even shifts them from town to town, completing the move with a new slogan or identification characteristics.

Quite recently **HI5N** moved to Moca City and adopted the title "The Voice of Moca City"; **Santo Domingo** became Trujillo City; **HIN** became "Broadcasting Nacional," and so on. Now **HIZ**, operating on 47·5 metres, has caused considerable confusion by giving up its old slogan, "La Voz de Muchachos," and becoming a second "Broadcasting Nacional"! In full the call is given thus: At 23.40 or 00.40 (the hour Dominican Time), four or five chimes, and the Spanish announcement "HIZ (phon. ah-chay ee thay-tah), en Ciudad Trujillo, Republica Dominicana, Broadcasting Nacional," or alternately as "HIZ, Broadcasting Nacional en Ciudad Trujillo, Republica Dominicana," which, I suppose, is much the same thing!

CB 615, Santiago, Chile

An air of mystery has hung around **CB 615**, "Radio Service," of Santiago, Chile, formerly of 12,300 kc., for some time. Right from the inauguration of its once well-heard broadcasts there was much speculation as to its correct call, then suddenly it disappeared; some said it wandered to the 49-metre band, while others suggested 25 m., but no matter where diligent search was made nothing could be definitely traced of the erstwhile "star." After a while "Radio Service" was forgotten, especially when the Anglo-American Hour broadcaster **CB 1170**, of the same city, made its sensational debut, usurping all others from stardom, a month or two ago. Now a verification (and there is a lot to be said in their favour, particularly from broadcasting stations) from CB 1170 has cleared up the mystery—CB 615 is off the air, having been taken over by Otto Becker, owner and operator of **CB 1170**, the latter is apparently our old friend CB 615 in new guise. In the verification it is stated that CB 1170 (now on about 25·65 m.) broadcasts thrice weekly, on Tuesdays, Thursdays and Saturdays, from 23·00 to 23.45 with the Anglo-American Hour, while the full schedule is daily 15.00–19.00 and 21.00–04.00 G.M.T. In English the station call is invariably given as "You are listening to stations CB 89 and CB 1170, Radio Otto Becker, on 25·64 m., transmitting the Anglo-American Hour," or in Spanish as "CB 89 y CB 1170, Radios Otto Becker, Santiago de Chile."

ON THE SHORT WAVES

BAND-SPREADING

By W. L. S.

A FEW days ago I was reading some very ancient numbers of "QST," the A.R.R.L.'s official journal, from which so many real advances in short-wave technique have come in the past. 'Way back in 1924 I found references to the new technique of "electrical band-spreading." This title naturally attracted my eye, and I read on to see what this epoch-making discovery might be.

IN SERIES

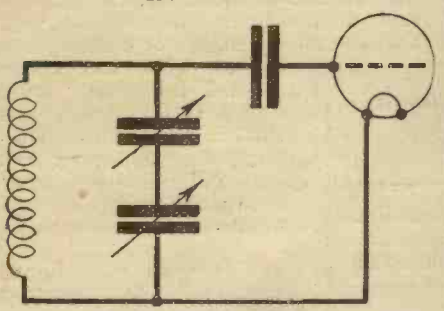


Fig. 1. One form of band-spreading, viz. using two variable condensers in series.

Actually, as it didn't take me long to discover, it meant band-spreading just as we do it to-day—by electrical means such as the use of tapped coils, parallel or series condensers, and so on. Up to that time all band-spreading had been carried out by mechanical means—the use of reduction ratios in dial drives, and so on.

The Usual Scheme

It's rather strange to reflect that the need for band-spreading was realised as long ago as that, when the really short waves weren't in use and when all listening took place above 90 metres or so. Still, I suppose it was the fact that the amateurs had to huddle together in narrow bands that led to it. A commercial receiver which tuned from 90 to 200 metres in one swoop was obviously at a disadvantage when its owner only wanted to receive stations between 90 and 105 metres—so what could be more natural than the reduction in size of the tuning condenser, or the addition of a smaller condenser which would spread the required band out over a full revolution of the dial instead of a few degrees ?

Every reader knows the usual band-spreading scheme—the use of two condensers, one small, and one large. The two are connected in parallel, the band is "set" by the larger condenser and tuning over the desired band is then carried out on the small one.

A little while back I mentioned another one—the use of a tap on the coil, so that the given condenser was reduced in its tuning range by the fact that it was connected only across a few turns instead of across the whole coil.

This week I want to bring two more band-spread schemes to your notice, in case you've never come across them. They're worth trying, anyway, and there's a chance that some little characteristic of one or the other of them will just suit your own requirements.

The first (Fig. 1) consists of using two variable condensers *in series* instead of in parallel. Imagine, for the moment, that they are both of ·0003 capacity. Set the top one "all in" and tune on the bottom one. It will then have a capacity of ·00015, effectively, and will cover just the ranges that you normally expect to cover in short-wave work.

Suppose, however, that you would like these ranges spread out a little, just decrease the setting of the top condenser, and it has the effect of reducing the maximum capacity of the one you use for your tuning.

ALTERNATIVE CONDENSERS

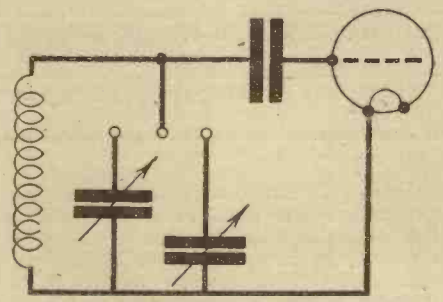


Fig. 2. Another scheme, in which alternative condensers are employed.

Take your coil labelled 41–94 metres. With the top condenser all in, that's the range you will cover. But perhaps you're only interested in the range 41–60 metres : put the top condenser about half-in, and you've got it.

Even if you want to cover the band 41–43 metres, you can do it. Set your bottom ("tuning") condenser all-in, reduce the capacity of the top one until you come to 43 metres, and then leave it alone and tune on the bottom one.

This scheme, as well as the next one, has the disadvantage that you can only spread the band starting from the bottom end. You can't, for instance, get a range of 60–64 metres or anything of that sort. The whole point is to use coils of such a size that the bands you are most interested in come near the bottom end of the tuning scale.

The second scheme (Figs. 2 and 3) is interesting because it involves no extra components and can be arranged entirely by yourself. It consists of using two alternative condensers, one large and one small. Furthermore, these condensers are both on the same shaft, and to change from one to another you use a change-over switch or a crocodile clip, but go on tuning on the same dial, which is, in many instances, a great advantage.

An Old Type Employed

To make the special condenser required you want an old type of short-wave condenser in which the fixed plates are supported by a threaded rod held in an insulating strip at each end. You have to cut through this rod about one-third of the way along, removing one or two fixed and moving plates to give a gap as shown in the sketch.

Thus you have one rotor (divided into two sections) and two completely isolated sets of fixed plates. The sizes of the two sections may be arranged to suit yourself, but I have shown, in the sketch, one with two fixed plates and one moving, and the other having seven of each.

This arrangement can be used with excellent results on the standard four- or six-pin coils if it's amateur bands that you want to spread. Because of the lower *minimum* of the small condenser, the minimum wavelength covered falls down a bit, and the 22–47-metre coil gives roughly 20·5–23 metres, the 41–94-metre coil gives 40–43·5 metres, the 76–170-metre coil gives 75–84 metres.

CONTROLLED BY SAME KNOB

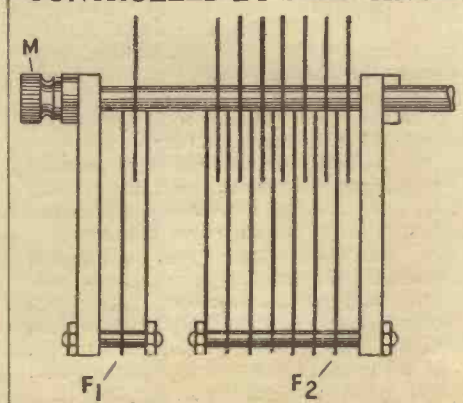


Fig. 3. The condensers in Fig. 2 may both be on the same shaft, and to change from one to the other either a crocodile clip or change-over switch is used.

ON THE SHORT WAVES—Page 2.

POINTS from the POST-BAG

W. L. S. Replies to Correspondents

LOTS of letters this time, so they must be short replies. L. C. B. (Coulsdon) has got his "hot" one-valver down on 10 metres and doesn't find any difficulty in logging DX phone on it. He also gets the sound and vision between 6 and 7·5 metres, and hopes to cover the 5-metre band soon—in fact, he may be doing so already, but hasn't heard anything of note down there.

L. E. S. (S.E.23) reports a great lack of Eastern stations from his new locality, and also South Africa doesn't seem to exist. He can hear anything to the westward—Hawaii and West Coast Americans—although there is a 300-ft. hill to the west of him. I don't imagine that hill will make much difference—work out the path of signals from California and Hawaii on a *globe*, and you will see that they have to come nearly over the North Pole.

L. E. S. has added aerial reaction to the H.F. stage of his short-waver, and remarks that while nearby G stations are talking about bad conditions, he's raking in DX stations all round them! He sends a programme schedule from the Java stations, part of which I quote in column 3.

Using Converters

R. McI. (Norwich) comments on the popularity of the converter. He says, "When you have a 13½-guinea set for which you are only offered about £3 in part exchange for a new one, what's more natural than to start thinking about a good converter to make a short-waver of it?" I know lots of people who have bought new sets (not all-wavers) and rather than part with their old ones at knock-down prices have kept them and turned them into really nice short-wave outfits.

T. L. W. (St. Bees) asks if the long-promised plans of a band-spread "Simplex" Three have yet appeared. No, T. L. W., they haven't. If you use a separate condenser, the best thing is to put the band-setter up high on the panel, the present position of the tuning condenser being occupied by the band-spreader.

F. A. (Chingford), whose letter apparently went astray and reached me a month late, tells me that Z M B J, the New Zealand "luxury liner" is no longer broadcasting. Her transmitter now uses scrambling equipment for ordinary ship-to-shore telephony, and you are therefore lucky if you recognise her. You may, however, pick up Z M B J during tests on ordinary phone, and then when she starts scrambling you'll know that you've got her all the same!

A. M. S. (Birmingham) recently scrapped the "Simplex" Two in favour of an eight-valve superhet, but finds that he can no longer log the real DX stations, although the super naturally brings in all the well-known stations at terrific strength. He wants to know whether to build a new short-waver, such as the "Simplex" Three, or to add the two-stage H.F. amplifier to his superhet in the hope of cutting down the noise and getting DX on it.

Well, A. M. S., it's a problem, but I have found my own superhet much improved by the amplifier. The huge additional H.F. gain makes it possible to keep the L.F. volume control well down, and the noise-level certainly is reduced to an enormous extent. I think you would find the same.

Old Components will Serve

D. G. J. (Middleton) wants a complete list of parts for the little baby two-valver of which I recently gave the circuit. That was the set using a Class "B" valve as a detector and L.F. Well, my own set on these lines uses "all-sorts" throughout—any old variable condensers that happened to be in the cupboard, a set of four-pin coils with the standard turn-numbers, and so on. The condenser in the aerial lead-in is not on the front panel—it is a neutralising condenser mounted on the baseboard. I don't think there's any point in specifying a lot of individual parts for this set—treat it as a junk-box receiver and use up whatever you may have on hand.

D. P. (Wrexham) asks whether the all-mains two-valve short-waver described in the September 25th issue can be used with a pentode in the output stage. Certainly it can. And the pentode you mention, D. P., will run nicely on your power supply of 250 volts 60 m/a.

W. W. (Edgware) has rebuilt his set on an aluminium panel and baseboard in an attempt to get rid of hand-capacity effects, but finds that he has only made them much worse. As he tells me that he has a difficult situation and a very long earth lead, I suggest that he tries the old dodge of tuning the earth lead with a series condenser between it and the set. This simple dodge has been known to work wonders in the most difficult cases.

J. W. (Bolton) wants to build a de luxe all-wave one-valver. I haven't written much about such a thing myself, but I have often thought of converting the single-valve short-waver into an all-wave set, simply by carefully winding high-efficiency coils that will cover the broadcast bands with the ·0001 tuning condenser.

WHEN TO LISTEN IN JANUARY

	Below 15m	15–26m.	26–50m.	Above 50m
N. America	12.00–18.00	11.00–21.00	20.00–05.00	04.00–07.00
S. America	16.00–18.00	20.00–23.00	22.00–03.00	—
Africa	16.00–18.00	18.00–21.00	—	—
Asia	10.00–15.00	13.00–17.00	—	—
Australasia	10.00–13.00	14.00–17.00	07.00–09.00 14.00–17.00	17.00–19.00
Europe	—	All Day	All Day	All Day

Short-Wave News

THE following are details of the short-wave broadcasting stations at present active in Java:

Y D A (Batavia) uses 10 kilowatts on 98·68 metres; Y D B (Soerabaia) uses 1 kw. on 31·2 metres; Y D C (Bandoeng) has 1·5 kw. on 19·8 metres. These stations are on the air on weekdays from 03.30–07.00, 10.30–15.00 and 23.00–00.30—all times G.M.T. On Sundays they broadcast from 00.30 to 07.00 and from 10.30 to 15.00.

In the early mornings, however, Y D A uses 49·67 metres instead of 98·68, and Y D B uses 19·61 metres instead of 31·2. The other stations are P L P and P M N (both at Bandoeng), on 27·27 and 29·24 metres respectively. Both broadcast at the same times as the stations mentioned above. The remaining station is P M H on 44·64 metres, which broadcasts Oriental programmes only.

In addition to the above, there are no fewer than eighteen other stations, but they are not intended for long-distance work. These transmitters are fed from the "key" station at Batavia, but the stations at Soerabaia, Bandoeng and Semarang also have full studio equipment from which important local events can be transmitted.

Poor Conditions

The first week-ends of the transatlantic tests on 160 metres have not been successful because of unsuitable conditions. There is no doubt that the "Yanks will break through some time before the end of January, but at the time of writing they have been non-existent. On 80 metres, on the other hand, there is quite a lot of activity in the early mornings, American stations coming through with at least the strength that is generally expected of them on 40 and 20 metres.

This long spell of bad conditions that we have been having has proved to be something new to the many short-wavers who have not had more than a year's experience. Conditions have been good for a longer period than I have ever known before, and when they suddenly began to fall off at the end of November I thought "This will shake some of 'em up!" And it certainly did. I have been deluged with letters from listeners who innocently inquire what has happened.

Nothing to worry about! We'll have plenty more spells like this, but, on the whole, the next two years should be very good indeed. After that—well, who can say? If conditions gradually creep back to the level of 1933 and 1934, there are liable to be a few disappointed listeners among the crowd who don't realise what a tremendous effect the sunspot cycle has on short-wave radio.

W.L.S.

MY SHORT-WAVE ADVENTURES

By LIONEL CHESTER

A "NIFTY" HOOK-UP FOR "TEN"

WITH my old cherrywood drawing nicely and my latest "invention" close by, I hasten to record my further experiences in the nether regions—namely ten metres and under. I feel pretty braced with life at the moment because, after a lot of trials and errors, I think I have got down to brass tacks—and ten metres!

I left off last time with some dial readings obtained with my home-made coils. Since then a really beautiful set of Eddystone ultra-short-wave coils has arrived, and much work has been done putting them into action.

In case you've not met them, let me say they are wound with 14-gauge copper wire—silver plated into the bargain. The ends of each coil act as the plugs, which make a nice tight fit into a little Frequentite base.

Of course, their virtue is "easy change." The 4-turn covers the 4 to 6-metre band, the 6- and 8-turn coils covering between them the 6 to 8 and 8 to 10-metre bands. There's a 3-turn coil for aerial coupling, too.

Now, I started off with the notion that for ultra-short waves plug-in coils were entirely taboo. I had horrible fears of losses through the contact between the coil plugs and the base sockets—not to mention inductive loops in the leads.

Excellent Coils

But I imagine even the purist would not have much to say against this Eddystone system, which seems to me to cut down any possible losses to a negligible minimum. And as for the connections, I hope to show they need be no longer than when the home-made coils are soldered direct on to the tuning and reaction condensers—as I did in my first hook-up, you remember.

One thing is certain: It is quite wrong to try to cover the whole 5 to 10-metre band with one-coil-and-condenser combination. Indeed, I imagine that would be almost impossible. As we MUST use different coils for each section of the 5 to 10-metre band, it seems a good thing to try any reputable system of interchangeable coil units.

And that, roughly, is what I have been doing. My first effort was not exactly a success, mainly because I did not think enough, and simply mounted the coil bases on the baseplate of the metal chassis as with any other coils.

True, the leads were not overlong, but I managed to get my reaction connections reversed—oldest of mistakes by the amateur!—and the ensuing squawks through forcing some kind of oscillation with far too big a reaction coil had to be heard to be believed!

Still, that was put right after vainly suspecting the coils and the ultra-short-wave choke, and away she went—the Chester Two for Ten! At 4 p.m. I resolved a very strong carrier at 128 degrees on the dial—and heard, for the first time, W1COO, of New Hampshire, U.S.

I gather this is one of the strongest of the 10-metre fone brigade, so I could not exactly call the reception a triumph. Do you know, I suffered from what I believe has been described as "divine discontent"—I felt there was something not *quite* right with my set.

And then came the inspiration! I was idly surveying my metal chassis, musing thus: "Hm, if only I could get those coils really close to the condensers—but that means a long lead from the reaction coil to the anode terminal of the valve holder."

And then I saw it! I could have kicked myself for being so blind. *Of course*, move the detector valve holder and the coils up on to the vertical metal panel!

THE DETECTOR LAYOUT

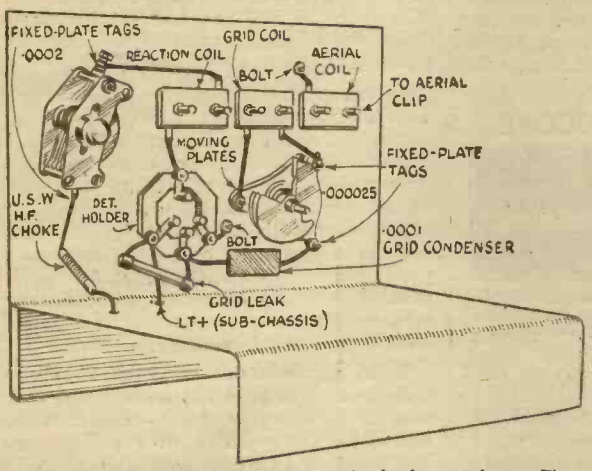


Fig. 1.—Lionel Chester's panel lay-out is clearly seen here. The L.F. components, which are mounted on the chassis base, are omitted for clarity. The diagram illustrates the detector wiring which, of course, is the critical part of the set.

If you will do me the honour of glancing at Fig. 1 you will see how things took shape when I had realised how to use these coils to best advantage. I think you will agree that all the important leads are short.

All it meant was putting the detector valve holder roughly where the reaction condenser was before, and shifting up and sideways the reaction condenser to a spare space near the top right-hand corner of the metal panel.

The tuning condenser stays where it was in the set pictured last time—and the two leads are actually no longer with the Eddystone coil and base than when I had home-made coils soldered direct on.

The three coil bases are arranged in a line above—so that the coils, when plugged in, come about 1½ in. below the top of the metal panel. Actually, I have elongated the drawing of the panel's height so as to get some lettering in—but the leads from the H.F. choke and from the L.T. positive terminal of the valve holder are not more than an inch or so long before going sub-chassis.

This layout means that the detector valve, when inserted in its holder, is horizontal—that is, parallel with the baseplate. There is about one inch clearance between the metallised bulb and the chassis, actually.

On the baseplate itself only the low-frequency components are placed—so there is loads of room to fit these in as the fancy takes you. Indeed, with so much spare room I have not put anything under the chassis, except a wire or two.

Using the Duplicate Tags

Reverting to the panel layout—or rather the back of panel layout!—do please note that I have had to make full use of the duplicate fixed plate tags on both tuning and reaction condensers. But then, they are meant to be used—what?

In case you have forgotten the circuit I am using for these experiments, Fig. 2 will remind you it is a simple detector with series-fed reaction and an R.C.C. low-frequency stage, the output being a Harries type pentode with choke and condenser output.

I feel the circuit, so long as it is simple and good—like this one undoubtedly is—plays second fiddle to *layout* in ultra-short-wave working. I say this because of the truly remarkable difference in results obtained when I got this latest hook-up going.

The signals on ten metres really have been roaring in. At last—rather late in the day—I can believe what others have been saying and writing of the strength of the American amateurs down there.

Loudest of the lot to date is **W 6 N L S,**

(*Please turn to page* 405.)

A STRAIGHTFORWARD CIRCUIT

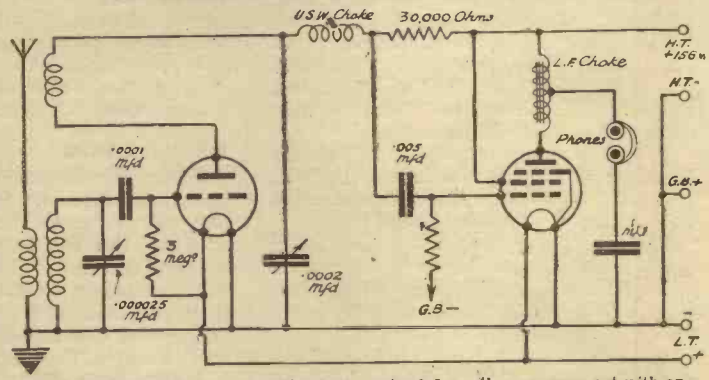


Fig. 2.—The circuit is a straightforward series-fed reaction arrangement with an R.C.C. stage of L.F. Note the choke output scheme.

VALVE VITALITY

SOME FACTORS WHICH AFFECT IT

By J. F. STIRLING

HOW long should a valve last! What is its average working life? What makes a valve "go off"?

Such questions regarding the allotted span of the modern valve are ones which are often asked, especially by the beginner in radio. Seldom, however, are they answered satisfactorily.

There is a reason for this, however, because valves, even though they be of the same type, tend to vary somewhat among themselves. Then, of course, the conditions under which they are required to work are always liable to vary enormously. It is thus an exceedingly difficult, if not, indeed, a totally impossible task to lay down any fast and binding law relating to the longevity of present-day valves.

The "Good Condition" Life

Needless to say, modern valves have a very much increased life over their predecessors of a few years back. Nevertheless, there is no doubt of the fact that even the best of valves has only a limited "good condition" life. This being the case, it is always advisable to bear this fact in mind whenever maximum efficiency is required from a receiving circuit.

Quite a number of valves slightly increase in efficiency during their first three or four hundred hours of working life. This is because a valve operates at its best in a very high vacuum and because many valves tend to have their degree of vacuum increased, or, as the term is, to become "harder," during the first portion of their active lives.

After this, the efficiency of a good valve will remain pretty constant for from 800 to 1,100 working hours—a period of time which, on an average, represents about a year's running.

Why Efficiency Loss Occurs

Thereafter, the valve—even the best of valves—will begin slowly to decrease in efficiency. Gradually its performance will become more and more unsatisfactory. Its insensitivity will grow and grow until eventually it will attain that lifeless condition to which the epithet "dud" is most aptly and properly applied.

Now, why does a valve decay like this? Why should it not go on functioning with reasonable satisfaction month in and month out over a very prolonged period?

First of all, in reply to these queries, there is the filament, that slender life-line of the valve, to consider. Filament deterioration is responsible for by far the majority of the ills which affect the average valve.

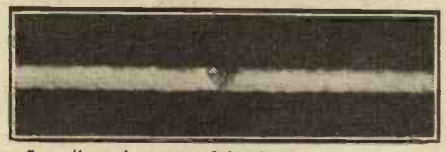
The filament of a valve, as the reader is probably aware, is finer than a hair. It comprises an extremely thin tungsten wire which, by one process or another, has been coated with certain oxides which increase its electron-emitting properties. After a time, however, the filament coating begins to acquire a coarse-grained "crumbly" structure. Bit by bit, particles of the filament coating fall away from the inner tungsten wire, thus decreasing the valve's electron-generating capabilities. As a consequence of this deteriorating process, the valve slowly but surely decreases in sensitivity both as a detector and as an amplifier.

Again, after a thousand hours of life the valve gradually becomes "softer." That is to say, its vacuum decreases. We shall see the reason for this later.

Slowly, also, after the above period of active life, the impedance of a valve diminishes.

Now the impedance of a valve is what we might term its own peculiar electrical resistance. When the impedance or resistance of a valve goes down, its plate-current consumption goes up. Suppose, for instance, that we have a valve of, say, 30,000 ohms impedance. Normally running, this

UNDER THE MICROSCOPE



Seen through a powerful microscope this valve filament instances the manner in which the active coating is slowly shed, thus reducing the valve's efficiency.

valve takes a plate current of a little over a milliampere. The valve's impedance, in the fullness of time, drops to 20,000 ohms or less. The plate current taken by the valve will now rise to 1¾ milliamps, or perhaps even more. Hence, a greater demand will be made on the H.T. supply.

Imagine a series of four or five valves each suffering from this old-age decrease in impedance. A little calculation will suffice to show that the increased demands on the H.T. supply made by such an assembly of veterans will be very considerable. It is on account of this fact that radio technicians are loud in their assertions of the fact that it is never economical to work a valve after it has reached a certain stage in its natural process of deterioration.

A Softening Effect

Mains valves, particularly those of the power variety, suffer from a peculiar form of senility after the limit of their efficient working lives has been reached. Besides undergoing a loss of filament emissivity due to the deterioration of the filament coating, they tend to develop a grid emission. This emission of electrons from the grid of the valve increases the plate current taken, and it also has the effect of "softening" the valve—that is to say, of reducing its degree of vacuum.

All valves suffer from this grid emission sooner or later, and thus all valves undergo a decrease in vacuum as they become more and more senile.

Battery-operated valves have about the longest life of any. A thousand hours of active life in first-class condition which, as we have seen, corresponds in an average case to about a year's use is normal for a battery-operated valve. After this the valve's efficiency begins gradually to wane. Nevertheless, a valve of this type is quite "good" for another year's employment—that is, of course, providing its owner does not object to a little loss in its operating efficiency.

Uneconomical to Work Them

Some valve owners will tell you that they have had valves in operation for three, four and even for five years. Such valves, of course, whilst they may still retain their lives, do not, cannot, work economically. It is therefore a snare and a delusion to endeavour to work a valve after its days of functioning are properly over.

Valves are frail things, even in these days. You may protect your valves from all mechanical shock and injury. Nevertheless, within them go on ceaselessly processes over which you have but little control. Every valve, therefore, has a very definite expectation of life and, averaging all things up, that expectation of life amounts to a year's normal use (1,000 hours, or thereabouts) in tip-top condition, and a further year during which period the valve will show a gradually lessening efficiency.

It is rarely economical and satisfactory to operate a valve after it has got very much past its second year of life—a fact which, although of sorry import to the radio fan, is certainly not without benefit to the valve manufacturer!

FOR NORTHERN LISTENERS

Variety from Rusholme on December 30th

AT Christmas, Leslie's Pavilion at Rusholme will have the privilege—unique in Manchester, at any rate—of being the only theatre running a variety show—all the other theatres are staging pantomimes. Described as a "Super" Concert Party, "The Nobodies" is run on original and, it is said, absolutely new lines. An exceedingly strong cast includes Jimmy Charters, the popular comedian from Morecambe, and an operatic tenor—Duncan Shawe; Christine and Ronald—Christine being hailed as another Nellie Wallace—are Glasgow comedians; and Paul Conrad plays the solo pianoforte in his Bachelor's Band—composed of six single boys—hence the band's title.

Instead of the "Bachelors" holding the stage for, say, twenty minutes at the end of the show, as is the usual custom with bands, they are on continuously from the opening chorus which, incidentally, was composed by Paul Conrad himself. Northern listeners to the Concert Party will, on December 30th, have an opportunity of hearing variety which may prove a welcome change from the prevalent pantomime programmes. It should be a programme well worth hearing.

TELEVISION TOPICS—*Collected by A. S. Clark*

"A.P." TRANSMISSIONS ON BIG SCREEN

WE have had the privilege of witnessing the first demonstration of television pictures received from Alexandra Palace on a large screen by mechanical means. And when we say large, we refer to a picture nearly six feet wide.

Big-screen "mechanical" pictures have been shown before, but either they were sent by land line or employed a much lower definition than the 405-line transmission from Alexandra Palace.

We were shown into a small theatre in which was a decorated stage reminiscent of the average cinema theatre. At three o'clock the lights were dimmed, the curtains parted, and on the screen we saw the usual opening picture of Big Ben, accompanied by the striking of the hour. Then followed a demonstration of ballroom dancing, and our biggest difficulty was in realising that we were actually looking at television and not watching an ordinary film being run through.

Good Detail

The detail was as good as on most cathode-ray television receivers giving a small picture, and the amount of light was equivalent to a cinema projection. The picture was certainly large, clear and bright enough to be comfortably viewed in a theatre holding two or three hundred people.

After a while we moved to where a home television receiver, working on the same principles, was being demonstrated, and strangely enough we were here better able to realise that we were watching television and not film projection. In this case the size of the screen was two feet wide, and of an amazing brightness. Except in so far as the source of light was concerned, this home receiver is really a miniature of the apparatus used for the larger pictures.

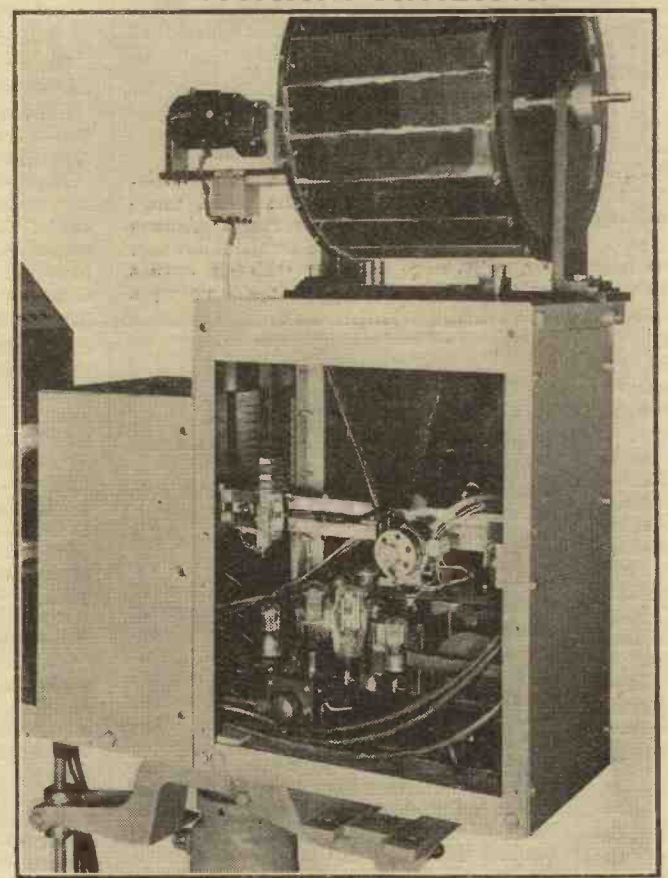
A Mechanical Principle

Most readers will realise by now that the apparatus demonstrated was of Scophony make, for what other system is there at the present which can offer so much? The Scophony instruments work on a mechanical principle involving the modulation of a normal light source, and rather confound the prophets of a few years ago who said that the whole future of television was bound up in the cathode-ray tube.

The Scophony System is based on a number of fundamental inventions. It is because of these inventions, some of which are absolutely revolutionary in their character, that Scophony Limited has been enabled to produce *projected* high-definition pictures of a size, brightness and quality so far unequalled. The two chief inventions employed are *Split Focus* and *Supersonic Light Control.*

The first of these, the "split focus," is an optical arrangement of cylindrical lenses with their axes crossed, so that a beam of light is focused in two separate planes. An advantage of the split focus is that where scanners are employed they can be of a considerably smaller size than would be necessary with ordinary spherical lens systems. Vice versa, with the same size of scanner, a considerably greater amount of light can be usefully employed. For instance, without the split focus the scanner in the Scophony Home Receiver would have to be at least twelve times larger.

THE SCOPHONY PROJECTOR



A photograph showing the essentials of the Scophony big-screen projector. The mirror drum which controls the number of pictures per second can be seen at the top of the picture.

"Scanning" causes an unavoidable loss of light. The picture is scanned in the normal way by a single spot, whether at the transmitting or the receiving end. This spot has to traverse the whole picture at regular and equal intervals.

If the picture is made up of 405 lines and along each line are 500 elements, the single spot goes into the picture about two hundred thousand times.

Consequently only one two hundred thousandth part of the light which could be obtained if no scanning were employed (as in the cinema) is available. This great light deficiency had been overcome by the invention of Scophony light control.

The Scophony supersonic light-control consists of a container, filled with a liquid, at one end of which is a quartz crystal. When the quartz is actuated by a modulated carrier frequency, supersonic waves are set up at a speed corresponding to the velocity of the sound waves in that particular liquid.

An Ingenious Scheme

The container has on either side of it a lens, and when light is passed through the container and focused on to a scanner, and from the scanner on to a screen, an image of the light control itself is, by means of suitable lenses, formed on the screen. If the modulated carrier frequency is now applied to the quartz crystal nothing will be seen on the screen until the scanner, which is between the screen and the light control, is rotated at a speed that follows exactly the speed of the liquid.

The modulation then becomes visible on the screen as an image. In the liquid the waves produced by the element frequency on the quartz crystal are equivalent to one scanning spot on the screen. A large number of scanning spots are therefore used simultaneously.

In the demonstrations we saw 150 of these scanning spots were thrown on the screen simultaneously. Incidentally, only 5 to 10 watts is required to operate the Scophony light control, thus avoiding excessive power requirements and keeping the maximum voltage in the receiver down to two or three hundred.

Simple Operation

The operation of the home receiver is extremely simple and there are no expensive parts requiring frequent replacement.

Finally synchronisation is obtained by the use of synchronous electric motors controlled by the synchronising line frequency transmitted with the pictures from Alexandra Palace.

The only way in which a cathode-ray receiver could be said to score over the Scophony is that in the reproduction of stills there is a slight movement to be detected due to mechanical methods of scanning. But even this almost negligible criticism will no doubt be overcome in later models.

PANTOMIME FROM "A.P."

"Dick Whittington and his Cat," television's first Christmas pantomime, will be transmitted from Alexandra Palace on Boxing Day, with Queenie Leonard making her first appearance as a Principal Boy. A strong cast will also include Olive del Mar, in the part of Alice; Cyril Fletcher as the Emperor of Morocco, Dudley Rolph as Fitzwarren, and William Stephens as Sammy. Tiddles the Cat will be played by Brenda Perry.

TELEVISION TOPICS—*Continued*

"TELEFRAMES"
Items of general interest

REFLECTION EFFECTS

HAVE you ever noticed when looking at television pictures a sort of shadow or ghost outline around a sharp-edge dark object on a light background? At first thought it might appear that this was due to some maladjustment in the receiver or some light effect at the transmitter.

What is the most likely explanation is that some form of reflection or echo is occurring and the signals are being received twice by the receiver. The ghost effect represents the second and weaker reception of the signal.

* * *

MAZDA VALVE CHANGES

Users of Thyraton valves for time-base circuits should note that the makers of these valves recommend in the case of the T.21 that the maximum generated voltage across it should be limited to 120 volts.

While on the subject of Mazda valves, the following notes will also be of interest: The filament current of the L.21/DD has been reduced from 0·15 to 0·1 amp., the other characteristics of the valve remaining unaltered.

Stocks of the following valves are now completely exhausted and no further supplies will be available: S.215B, Pen.425, P.625A, P.625B, PP.3/425, U.65/550 and D.C./H.L.

* * *

BETTER FILM TRANSMISSIONS

More or less coincident with the installation of the new and more sensitive Emitron camera at Alexandra Palace studio, an improvement has been noticed in the illumination of the films transmitted. Although we have at present no confirmation of the fact, we believe that the new camera technique has been applied to film transmission and accounts for the recent improvement.

* * *

SPEED IN AERIAL ERECTION

To look at a television aerial you would gather that it was a complicated thing to erect. In many cases it may be, but not in the case of the Murphy model, which has been specially designed for easy and quick erection. One of the firm's engineers recently erected one of these television aerials in eleven minutes! It is stated that the timing was taken from the arrival with the ladder, but did not include the final fixing in place of the feeders.

* * *

SOME COSSOR RECTIFIERS

Those building-up apparatus for television should not forget the useful range of rectifiers in the Cossor range. Among types recently introduced are the following: A full-wave rectifier with an output rating of 20 milliamps at 2,000 volts; a voltage doubling valve. With a good transformer, the latter valve should give a voltage of about 2,000 across the load points of the circuit, and up to 20 milliamps should be available. A third valve is the S.U.2150, a half-wave rectifier capable of giving voltages up to 5,000 providing the current taken does not exceed 2 milliamps.

* * *

PATTERN TESTING

Patterns obtained on the screen of the cathode-ray tube are used very often in the testing which precedes the passing-on of a complete instrument to the packers. The processes in a television receiver are so different from those in a normal radio receiver that special methods of checking them over have to be adopted.

A chosen signal is applied to the television receiver and forms a pattern—quite stationary—on the screen. The sharpness and correctness of this pattern tells the testing engineer more about the functioning of the receiver than actual pictures would, and enables him to carry out any final adjustments that may be required.

* * *

TELEVISION CINEMAS

Recent statements suggest that keen work is still going on with the possibility of television cinemas. It has been stated that a firm may start a series of 300 in the New Year.

Reproduction will be on a full-size screen, and colour films will be included in the transmissions. Recent Baird developments in big-screen and colour television have shown that the technical considerations are capable of solution.

CONCERNING FLUORESCENCE

VERY little is known concerning the precise nature of fluorescence. The prevailing theory which seeks to explain the production of fluorescence has it that when a ray of light, a beam of terrifically high-speed electrons such as constitutes the cathode rays, or other form of energy rays, strikes a fluorescent material, the energy beam thrusts aside some of the constituent electrons of the fluorescent substance. Immediately the energy beam ceases, the electrons in the material take upon themselves an "as-you-were" position, that is to say, they return to their former positions within their atoms. In doing so they give out tiny quantities of energy, this energy-emission manifesting itself in the form of light—the pale, somewhat ghostly, yet, at times exceedingly vivid, light of fluorescence.

Phosphorescence

That, in a nutshell, constitutes the present theory of fluorescence, of the mechanism of light production at the screen surface of a television cathode-ray tube. Exactly why such effects should take place in certain materials and not in others we do not know. Nor, for that matter, have we any precise idea as to why the electrons of the fluorescent substance should allow themselves to be thrust aside so readily by the cathode-ray or other fluorescence-exciting beam.

There is another form of fluorescence which has been known for hundreds of years. This is called phosphorescence, a phosphorescent substance being one which shines in the dark after being previously "excited" by exposure to strong light rays. Clock and watch dials are frequently painted with such luminous materials in order that they can be read in the dark.

Now the phenomena of fluorescence and of phosphorescence are very similar in nature. In fact, according to modern theories, they are both merely variations of the same thing. In a fluorescent substance, as we have already seen, the thrust-aside electrons return to their original positions (emitting light flashes in the process of doing so) immediately the exciting cathode ray, light or other form of energy-beam ceases. In a phosphorescent material, however, the scattered electrons return only slowly—one by one, so to speak—after the passing of the exciting beam. That is why a phosphorescent substance will shine in the dark for a long time after it has been exposed to sunlight.

Perhaps the most useful of these all-fluorescent materials is a naturally occurring mineral composed, mainly, of silicate of zinc, and which is known to mineralogists as "willemite." Willemite is a white material. It glows brightly under cathode-ray influence, but unfortunately it glows with a greenish colour. It is only by admixture of other more white-glowing fluorescent substances with willemite that the almost pure white glow of the very latest high-intensity television cathode-ray screens has been made possible.

Most amateur scientific workers are acquainted with the ghostly glow of phosphorus in a darkened room. This luminescence of phosphorus, however, is not true phosphorescence, strange as such a fact may seem, for the glow of phosphorus in a darkened room is not due to actual light or electrical ray excitation, but merely to the slow oxidation of the phosphorus. It is, therefore, extremely unlikely that any use of the luminous properties of phosphorus will ever be made in television work.

A Remarkable Material

One of the most remarkable luminescent materials in the whole realm of Nature is radium. Radium and its salts glow vividly in the dark. They may be said to possess the property of permanent phosphorescence. Here again, however, the vivid and most remarkable radium-glow will, one believes, never be made use of for television purposes owing to the fact that the light-emission of radium, intense though it may be, is *absolutely uncontrollable*. It is possible, however, that exceedingly minute traces of radium when admixed with the usual cathode-ray screen fluorescent materials might ultimately be found to heighten the glow-intensity of the latter.

A curious fact concerning both fluorescence and phosphorescence is that the vibration frequency of the fluorescent or phosphorescent light is always *less* than the frequency of the exciting beam of rays. In this respect, the fluorescent or phosphorescent material acts as a sort of diminutive step-down transformer of energy rays, taking in rays of a high frequency of vibration and delivering up rays of a considerably lower vibrational frequency.

HOW TO SPEND CHRISTMAS

SEEN ON THE AIR

News and Views on the Television Programmes

By L. MARSLAND GANDER

WITH genuine and perhaps sentimenal feeling of regret I say farewell with this issue to the readers of "Seen On the Air." I can only express the hope that they have enjoyed reading of the early struggles, the triumphs and disappointments of television half as much as I have enjoyed writing about them.

And now for good news: It has been officially stated in the House of Commons that, as I forecast many weeks ago in POPULAR WIRELESS, the Government will give a further grant to the B.B.C. for television. The amount is still in doubt.

A Press colleague suggests £500,000, but I think he is probably lumping in the large amount which the Government will have to find for the construction of new transmitters for the foreign language service, also the funds for the maintenance of that service. May I cheekily suggest that he misread his "P.W."?

Readers will remember, however, that some time ago I gave figures suggesting that at least £60,000 was required for the provision of new studio accommodation before the increase in daily hours of transmission from three to four. The B.B.C. is much more likely to proceed with the conversion of St. George's Hall than with the adaptation of the theatre at Alexandra Palace. There is influential backing for the proposal that immediate steps should be taken to amalgamate the sound and vision programmes so that each programme may serve a dual purpose.

The Amount

I have heard it suggested in semi-official circles that £200,000 will be the amount of the further Government grant for television, but even this must be regarded as speculative.

And now, B.B.C., the ball is at your feet. Go straight for the goal. Sunday programmes next, then another hour a day. Better and brighter programmes. We have heard the slogan so often that there is a danger it will become meaningless, but it should mean everything to the future of television.

Politicians just now are vastly interested in the future of television as it affects the cinema. The other night I was suddenly whisked off to a disused, unheated cinema at Bromley, in Kent, there to see the B.B.C. programme picked up and projected on to a large screen by the Baird system. The screen measured 8 feet by 6 feet, and the method of projection was interesting. The apparatus used resembled a magic lantern; that is to say, the picture was projected from the front through a powerful magnifying lens. There the resemblance ended, for instead of the "slide" the picture was produced on the base of a small cathode-ray tube. The screen was directional, so that at acute angles the brightness was not particularly good. But, sitting in the centre of the stalls, at a distance of about thirty feet, the illumination was surprisingly effective.

I was informed that the brilliance was about a third as great as that of a small cinema screen. The most astonishing part of the demonstration was that the 405-line picture enlarged to such a size should have been so satisfactory as regards definition. In my opinion lack of definition was less important than the lack of light.

I regard this as striking practical demonstration that 800 lines will be as much as could be wanted on a full-sized screen. This is delving far into the future, but the Bromley demonstration and the Scophony demonstration, which I understand is being described elsewhere in this issue, bring the whole question of cinema television into practical politics. Before dealing with the implications I should like to say one more thing about the Baird big screen: The picture was not green, as other large pictures produced by the cathode ray principle are. It seemed to me more of a sepia than a black and white, though it had a faint yellowish-green tinge in it.

I was informed that the Gaumont-British group, in one of whose cinemas this big screen was shown, intended to give public exhibitions of the B.B.C. programmes. Whether cinemas may legally give such exhibitions is a question which can only be decided by the Government, and at the time of writing there is a question down for answer by the Postmaster-General on the subject.

The B.B.C.'s ruling is that the Corporation has no power either to authorise or prohibit public exhibition. Readers of these Notes will be familiar with all the arguments pro and con. As regards cinemas I understand that the Performing Rights Society has no objection since cinemas hold a licence. But what would happen if a Gaumont-British cinema exhibited British Movietone News transmitted by the B.B.C.?

The Government has accepted the principle that the B.B.C. must have a monopoly of television broadcasting, and on that point will be adamant. But at the same time there must be some future for the big screen. Where is all this research leading? The cinemas have the right to expect some benefits from a new invention which is closely allied with the talking film. The B.B.C. cannot adopt a dog-in-the-manger attitude, holding a monopoly and offering the cinemas nothing. Similarly, the Government cannot stifle invention and rule that television is for home consumption only.

"Stunt" Value

I do not wish to suggest that the big screen is perfect; far from it. But it is certainly well on the way to perfection, and even now has considerable "stunt" value. Matters will probably come to a head when the B.B.C. televise the Derby from Epsom next June. It may be expected then that many cinemas, both of the Gaumont-British and the Odeon circuits, will seek permission to reproduce to their afternoon audiences pictures of the Derby as it is run. Will the Government grant permission? The way out seems to be to do so on payment of a fee, which money will help to provide the funds the B.B.C. need so sorely for television.

There is no analogy in sound broadcasting which will help in the solution of these matters. On national occasions, such as the Christmas broadcast by the King, the B.B.C. raises its ban on reproduction in public, but there has never been any suggestion that people should pay for admission to public halls to hear complete programmes through the loudspeaker.

Television will look back to the early days of Radiolympia, 1936, and recall all that has happened since then in "Diary for 1937," an hour's programme to be presented on the last night of the Old Year. D. H. Munro, productions manager, who has been planning this ambitious pot-pourri since September last, is arranging a combination of film records and "live" studio presentation which will tell the story of the world's first high-definition television service. Guest artists; films taken side by side with the television camera at events such as the Coronation Procession, sporting contests, and shooting in the film studios; memories of the high spots in "Picture Page"—all these will be combined in a high-speed programme.

GERMAN AIR FORCE'S RADIO EQUIPPED BOATS

Telefunken direction-finders are used on the German Air Force motor-boats. The up-to-date equipment on these boats enables them to maintain communication with seaplanes and to locate them easily when they are in trouble.

CUTTING OUT THAT INTERFERENCE

A chat on the "man-made" static problem, and some hints on its elimination

ALTHOUGH the modern radio set does everything that is required of it in the way of separating one station from another, and eliminating interference from this source, there is still another form of interference which no set can deal with.

This is the particularly irritating trouble known as "man-made" static, or in other words the picking up on the set of external electrical interference.

Where does this interference come from? you may ask. Well, there are unfortunately a large number of sources from which these annoying noises can originate. To mention a few, there are trams and trolley-buses, neon signs, nearby electrical machinery such as motors and dynamos, vacuum cleaners, electric sewing-machines, medical apparatus of the high-frequency type, and so on.

How It Can Arrive

How does the interference get to the set? The answer is that it can be picked up on the aerial in just the same way as broadcasting, or it can come in via the mains, and into the set by way of the mains connection. At this stage we would mention that interference from this latter source is prone to attack mains sets. Battery receivers are immune from its direct effects, but they can still pick up the trouble by induction. In fact, any metal objects passing close by the set or aerial lead may act as carriers for the interfering waves, and so pass them on.

This sounds rather tragic, and makes one wonder how on earth one can hope to remedy matters. Fortunately, it isn't so bad as all that. There are special devices which stop the unwanted interference from getting into the set.

For example, Messrs. Belling-Lee, to mention one firm, have carried out a lot of research into the problem of "man-made" static, and are able to supply suitable suppressor devices for stopping mains-borne interference, as well as suppressors for fitting to electrical apparatus and thus eliminating the trouble at the source.

When you hear strange buzzing or crackling noises in your set you must first of all find out whether the set itself is faultless. Sometimes the noises may be due to a defect inside the receiver, and not to "man-made" static, so it is useless thinking about corrective devices if the trouble is one which merely requires the attention of a service engineer.

Tracing the Trouble

But assuming the set to be in first-rate order, how does one start to track down the trouble?

First remove the aerial and earth leads and listen to whether the noises are still present in the loudspeaker. If so, it is evident that the aerial and earth leads are not picking up the interference. Hence it is probable that the mains are acting as interference carriers. The remedy is not difficult. You can get a service engineer or other competent person to fit a suppressor at the point where the mains leads enter the house. Such a suppressor consists of a couple of condensers and a choke (or two chokes), thus providing a means of bypassing the interfering waves to earth. If the interference is being picked up on the mains wiring inside the house, then a suppressor can be fitted to the main socket from which the connection is made to the set.

All complaints of interference are investigated by a special G.P.O. squad who are equipped with suitable trouble-tracking apparatus. Here is one of the G.P.O. experts with a portable set and small interference-locating aerial.

Sometimes a vacuum-cleaner or other household device is the culprit, in which case a suitable suppressor will prevent any interference from this source affecting nearby sets.

Interference that is picked up by the aerial can be overcome by the fitting of a screened downlead or one of the special anti-interference aerials sold for this purpose.

Erecting a Special Aerial

The idea is to erect the horizontal part of the aerial above the interference zone, and screen the downlead so that this part of the aerial system is immune from any external effects. The efficiency of a well-designed "anti-static" aerial is high, and its fitting is frequently the only solution to the trouble.

Actually, the best scheme of all is to silence the interference at the source, always provided the source can be located and that the owner of the offending apparatus is willing to have the necessary suppressors fitted. Nothing, however, can be done to compel the owner of offending apparatus to have a suppressor fitted, but soon it is probable that legislation will come into force making it an offence to interfere with sets used for broadcast reception. Those who are troubled with interference from external electrical equipment can always rely upon helpful advice in a practical form from the Post Office engineering department.

There is a special section who deal with this type of interference, and a complaint from a listener quickly brings the interference sleuths to the spot. Then with their special apparatus they are able to locate the source of trouble, and so indicate the best method of overcoming it.

As can well be imagined, unless the source of the interference is quite obvious—as, for example, it would be if there was a generator or high-frequency medical apparatus in a neighbouring house—special forms of interference-locating equipment are necessary. So you will appreciate that expert aid is practically essential.

LIGHT AND ELECTRONS

By CARDEN SHEILS

An ingenious application of the electron-multiplier

WHEN an electron travelling at high speed strikes against a metal surface, the force of the impact sets free other electrons by secondary emission. This effect has, of course, been known for quite a long time, but it is only recently that it has been applied to produce a type of amplifier which promises to rival the valve in sensitivity and general performance.

The " electron-multiplier," as it is called, is a natural development of the growing importance of the photo-electric cell, particularly as applied to television. Like the valve, the photo-electric cell works with free electrons, but it can only produce them in small quantities.

Colossal Amplification

The filament of a valve liberates a copious stream of electrons, and there is no particular advantage in using secondary emission to produce more. But in a photo-electric cell, the initial supply of working electrons depends, not upon heat, but upon the relatively feeble impact of a ray of light, which at most is only capable of producing an output of a microamp or so. A current of this order must be amplified by passing it through a valve before it can be put to any useful purpose.

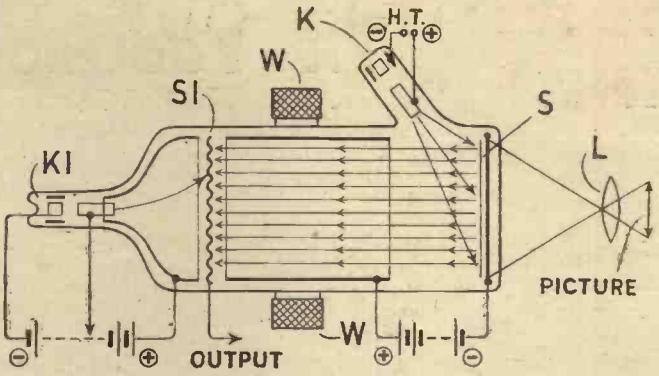
The new electron-multiplier is, however, capable of delivering all the current that is required to operate any relay, or to perform any ordinary duty—for it will give an output up to several amperes if necessary. The few electrons that are first liberated when a ray of light falls upon the photo-sensitive cathode are promptly focused into a beam, which is then propelled against a " target " electrode, where each individual electron produces a crowd of others. These are, in turn, forced to strike against a second target, where they set free more secondary electrons, and the process is repeated from target to target until the stream has " multiplied " itself up to the required strength.

Application to Television

This method of amplification is specially marked out for use in television, where everything depends upon making the most of whatever light is available. At the transmitting end, for instance, it offers a way of increasing the effect of the light from the picture or scene to be televised, so as to improve the strength and quality of the outgoing signals. At the receiving end it can be used to " intensify " the light produced by the fluorescent screen so as to increase the brilliance, and therefore the size of the final picture.

One of the latest applications on these lines is based on the discovery that it is possible under certain conditions to regulate the amount of secondary emission given off from a surface, the control being effected by the action of light.

Suppose, for instance, that one side of a specially prepared screen is bombarded by primary electrons, so that it gives off a uniform cloud of secondary electrons. Then a ray of light focused on the other side of the screen is found to regulate the strength of this cloud, making it stronger or weaker as the light itself changes in intensity.



The cathode-ray tube in this figure is provided with two cathodes, K and K1, and two screens, S and S1.

The action is illustrated in the accompanying Figure, which shows a cathode-ray tube provided with two cathodes K and K1, and two screens, S and S1. The first screen S is made of a very thin sheet of oxidised aluminium, which is covered with a coating of caesium, only one molecule thick. When such a screen is bombarded with primary electrons, it will liberate many more secondary electrons from the surface in the ordinary way, but the number given off at each point can be regulated by the intensity of a ray of light focused at a corresponding point on the reverse side.

The purpose of the cathode K and its associated " gun " is to " spray " a stream of electrons equally over the inside face of the screen S, so that a uniform emission of secondary electrons takes place from every point of its surface.

If the picture to be televised is now focused on the outer side of the screen through a lens L, the different light-and-shade values of the picture produce a change in what is happening on the other side.

The uniform cloud of secondary electrons is at once broken up by the effect of the light, so that the electron stream now varies in density from point to point. That is to say, the different tone values of the picture begin to show themselves as variations in the strength of the stream of electrons coming from the inside face of the screen.

The first point about all this is that the feeble energy of the ray of light from the picture has been replaced by the energy of a fluctuating stream of electrons.

The second and more important point is that the stream itself has been produced by secondary emission from the screen S, and is therefore altogether of a higher order of density than the ordinary or primary emission produced when light acts directly upon a photo-sensitive surface. The net result is that the effective energy of the original light has been " stepped up."

Once having made this step-up transformation, the production of television signals follows the usual course. The stream from the screen S is focused by an external magnetic winding W on to the photo-sensitive screen S1, which is similar to that used in the Iconoscope " camera," except that it is double-sided.

The charges produced by the stream on the inside surface are therefore repeated on the outer surface of the screen S1, where they are scanned by an electron beam from the cathode K1, and used to modulate the outgoing carrier-wave in the ordinary way.

RADIO NOTES AND NEWS

(*Continued from page* 385.)

" Sweet Lavender "

CRIES of Old London have a sentimental appeal to the collector and antiquarian. But " Sweet Lavender," " Chairs to Mend " and the other old favourites must now beware of a rival, for somebody with more brains than breath to spare has suggested the idea of using an amplifier for street cries.

The advantages are obvious ; the musical tinkle of the muffin-man's bell may strike a sentimental chord in the bosoms of the faithful, but for good, rousing, clear-cut descriptions of crisp crumpets or other street wares it cannot compare with a loud-speaker. Thus equipped, no street-vendor need fear that a husky throat would halve his advertising powers ; he merely holds his microphone closer, turns up the volume control, and makes every housewife within hearing acutely muffin-conscious.

" Radio Letter-Box "

FURTHER news of those radio-newspaper receivers in America to which I referred recently suggests that they will retail at a little over £20.

Instead of having an audible output they will work through the night at printing the news supplied to them by a special radio newscasting station. This news will appear on a strip of paper about six inches wide, and will contain all the last-minute stuff, together with sketches, cartoons and so forth.

The Last Round-Up

I HAVE already wished you a Happy Christmas in our Christmas Number, but as these words will appear just before the great festival I want to sign off this week with a rousing salutation to one and all.

Have a good time, my hearties, for life is short and time is fleeting. What the future holds nobody knows ; but the Cup of Life which Fate hands you to drink is always palatable if laced with some good old-fashioned courage, and a dash of humour. So why fret about what's coming to you ?

Here's hoping that the New Year will fulfil your old desires, will bring you new friendships, and will, now and then, give you time to think of your old pals.

ARIEL (P. R. Bird.)

THE FOOLPROOF PHOTOCELL

How the once popular radio rectifying crystal has contributed to the evolution of the photo-electric cell

DO you remember—I address here the many "older hands" at the wireless game—those departed days during which you contentedly and even enthusiastically fiddled about with various crystal rectifying contacts in an endeavour to abstract the last ounce of sensitivity and signal-loudness from your crystal receiver? Valve-operated sets were an expensive luxury to many of us in those days, and the humble home-constructed crystal receiver completely filled the radio horizon of countless amateurs.

The precise mode of action of the crystal rectifier was something of a mystery. It is, indeed, a more or less unsatisfactorily explained phenomenon even in modern times. But many wireless amateurs in those early broadcasting days who were sufficiently keen to take a more than passing interest in the subject of crystal rectification found, to their surprise, that these mysteriously functioning crystal contacts were possessed of a number of remarkable powers. Crystal contacts, for instance, could be used as ordinary current-rectifiers, the contact passing current in one direction but almost entirely suppressing current flow in the opposite direction. Crystal contacts were found which would amplify. Curious heat effects were found to be associated with some crystal contacts. Other contacts, again, were discovered to be sensitive to changes in pressure. It was apparent to all who took the slightest interest in the subject of rectifying crystals that the average crystal contact possessed very versatile powers.

Experimentally Discovered

In 1924, Dr. L. O. Grondahl, an American physicist, when experimenting with crystal contacts discovered another latent power which they possessed. Dr. Grondahl found that many contacts between dissimilar crystal or mineral surfaces were sensitive to light and that, in actual fact, such contacts could be utilised to convert light-energy into electricity, currents of the order of microamperes being sometimes obtained when special mineral contacts were exposed to strong sunlight.

If you have an old crystal detector and a very sensitive galvanometer you may be able to demonstrate crystal light-sensitivity for yourself. Connect the crystal contact across the galvanometer and illuminate the contact very strongly by burning a length of magnesium ribbon a few inches away from it. If the contact is at all light-sensitive and your indicating instrument is sufficiently delicate to give an indication of a few micro-amperes of current, you will obtain a reading on the instrument, proving that a portion of the light-energy of the burning magnesium ribbon has actually been changed into electricity by the crystal contact.

Galena-copper, molybdenite-silver, iron pyrites-tellurium are good contacts for carrying out the above experiment with, but, generally speaking, *any* contact between two dissimilar materials is more or less light-sensitive.

From the elementary experiments detailed above to the latest forms of all-purpose photocells may appear to be a long stride in the sequence of technical development. Actually, however, such is not the case. Having obtained an insight into the nature of the light-sensitivity of crystal contacts, technicians and physicists have not found it a difficult matter to develop stable photo-cells which are capable of being put to many different uses. Such cells are of the type now known as the "Dry Disc Photo-voltaic cell." They all operate upon similar principles and they make use of a light-sensitive contact between metallic copper and a film of copper oxide.

In commercially produced photocells of this type a small disc of highly purified metallic copper has deposited upon one side of it by chemical means a very fine film of copper oxide. So fine, indeed, is the copper oxide film that it is transparent. A coating of varnish is laid over it in order to protect it from the deteriorating effects of the atmosphere. The copper disc is fitted into a moulded case and suitable connections are taken from the metallic copper of the disc and from the oxide film. The moulded case possesses a glass window through which the disc is illuminated. When light rays impinge upon the face of the disc, the oxide film becomes negatively charged and the copper behind it acquires a positive charge. As a result, negative electrons are shot out of the oxide film and they pass across to the metallic copper with which the oxide film is in intimate contact. So long as the light influence acts upon the disc, electrons continue to be ejected from the oxide film. Thus, a small current flows through any external circuit to which the instrument may be connected. If the instrument is not connected to any external circuit, the ejected electrons, after traversing the copper disc, return to their starting point in the oxide film.

Now, although for actual television purposes there exist more suitable and specialised forms of photocells than those of the type described above, these "dry disc" photo-electric cells can be put to multitudinous uses. A well-made cell of this type constitutes, indeed, a veritable foolproof photo-cell. So far as one can tell, the cell never wears out, never becomes insensitive, and it is not put out of action by mechanical shocks and similar disturbances. Of its very construction, the light-sensitive contact cannot get out of adjustment and, exposed to good illumination, the cell will deliver up a current which can be measured in milliamps.

Photocells of the "dry disc" type have a sensitivity very closely approaching that of the human eye. As the light rays decrease in wavelength from the ultra-violet end of the spectrum, the sensitivity of the cell, like that of the human eye, increases up to a point somewhere in the green-yellow region of the spectrum. After that, the cell's sensitivity decreases as the infra-red end of the spectrum is approached.

The reaction of the "dry disc" photocell to light influence is instantaneous. There is no "lag" effect. Also, the current delivered up by the cell is proportional to the intensity of the light.

Measuring Light

Hence it is that cells of this simple type are being used increasingly for scientific and technical purposes of all kinds. Measurement of light intensities in connection with television illuminations forms one of the cells' applications. Another application is the cells' employment as photographic exposure meters, not only in connection with television-camera work, but for all amateur purposes as well. For detecting and registering the presence of light rays and light beams of all kinds the photocell of the type described in this article possesses innumerable uses.

Yet, strangely enough, the exact mechanism of the cell's functioning is not known. Based upon principles very closely related to if, indeed, not identical with those underlying the operation of the crystal radio rectifier, the "dry disc" type of photocell is, undoubtedly, atomic in its action. In some way the light waves are able to knock electrons out of the copper oxide constituent atoms, and these electrons find it comparatively easy to travel across the copper-copper oxide contact in the direction of the copper, but experience a great difficulty in proceeding in the reverse direction.

Exactly how the light rays knock electrons out of the copper oxide atoms is a problem which electrical physics has yet to solve satisfactorily. Fortunately, however, the uncertainty about the cell's precise mode of action in no way affects its use in actual practice. These simple and foolproof photo-cells, based, fundamentally, upon the action of the now almost obsolete radio rectifying crystal, have come to stay for television purposes and other uses.

J. F. S.

RANDOM RADIO REFLECTIONS

By VICTOR KING

EXPERIMENTING ON THE LISTENER :: GIVE US BETTER TELEVISION PROGRAMMES :: MISUSE OF THE ENGLISH LANGUAGE

Lovely Lesley Brook, Warner Brothers First National star, finds rest and relaxation in listening to broadcasting on her Marconiphone receiver.

THE EXPERIMENTAL HOUR

THIS B.B.C. of ours entirely and completely amazes me at times. For example, that so-called "Experimental Hour" that they are running. What is it? They shove on a play about spiritualism. Where's the experiment in that? What was the difference between that and some of the previous spook plays they have run? Only, so far as I can see, that the others dealt with ordinary, straightforward spooks in the manner that is traditional for spook stories and plays, whereas the "experiment" introduced the orthodox medium and seance circle.

There was no experiment in technique whatever. If it could be called an experiment at all it was merely a try-out to see if the listening public would stand for spiritualism on the air. This is my opinion. And it is my further opinion that—— But I expect you all think the same way.

The second "experiment" was to do Shakespeare in the language of his day. Thank goodness it occupied only half an hour. I don't mind dipping into a book of selected wise-cracks from the "Avon Bard's" works, but I can't sit and listen to yards of it spilled pontifically by actors, however good. And to make it even worse by jangling up the language—— Phew! What an "experiment!"

NOVEL PLAY PRESENTATION

I'd like to see some real "experimenting" done. Something original and enterprising. Or at least something the B.B.C. itself has never done before. For instance, why not combine variety and symphony? Have some good single and double comedy acts and a sketch or two superimposed on Bach, Wagner or whatnot.

Or throw the "mike" open to amateur dramatic societies for an hour or two per week. Let the "amateurs," through a central organisation, compete for the honour of going on the air. Some of the amateur companies are every bit as good as professional ones. And they'd bring disinterested enthusiasm and perhaps new ideas and technique to the mike.

But they'd have to have a free hand or it would never be an "experiment" at all, but merely bunches of players drilled round to standard B.B.C. ways.

I've tried to get the B.B.C. to run a play experimentally on American lines. But they wouldn't.

I still think British listeners would like it. You know the sort of thing—really snappy presentation with a commentator to pull the whole thing together. The thing is pushed off in this kind of way:

Fade in string rendering of some quiet melody. Fade down after a few bars and superimpose voice of commentator.

Commentator.—Ladies and gentlemen, the story which you are now to hear concerns the last will and testament of John Bonnaker. And with obvious appropriateness it commences in a solicitor's office. That of Messrs. Smith, Smith, Smith, Smith, Pottleberry and Tootington of Chancery Lane, London. The Smiths are no longer *in situ*, so to speak, for the last of them retired from the legal front line in Coronation year. Queen Victoria's coronation! They are the voices of the present partners, Messrs. Pottleberry and Tootington, which we shall hear, and it is Mister Pottleberry who says ——

Fade out background music and switch Pottlebury straight in.

With no break at all the voice of the artist is heard, and the dialogue gets under way.

At the end of a scene there is no pause, a spot of music breaks straight in and then the commentator is off again. In this manner:

Fade in theme melody for short period. Then fade down and superimpose voice of commentator.

Commentator.—Fifty thousand pounds for Martha Bonnaker and the equally fortunate Anne! If—and there is that one little condition—they will live together for one year. Twelve months under the one roof and all expenses paid! And their reward? Twenty-five thousand pounds each! And no questions asked. Is it all quite as simple as it seems? We wonder. Anyway, the scene changes to Cincinnati in the United States of America. Picture a busy main street (*fade out music and fade in background of not-too-loud street noises,*) with a constant stream of cars gliding along it; hurrying pedestrians, leisurely policemen—cops they call them over there; lots of shops and all the other things you find in busy streets anywhere. Even a stationary car, which appears to have stopped because of engine trouble. A young woman is diving under its bonnet. She seems rather annoyed about something. She is saying —— (*Switch straight over to Anne Bonnaker and fade-down street noises and bring in car engine with periodic popping.*)

There is one very obvious advantage in this "re-iterational" treatment, and that is those who switch in after the play has begun can easily pick up the threads of it. But more importantly the action is pepped up. With a first-class commentator the whole dramatic content of the play is lifted right up.

HENCE THE "PLUMS"?

Well, I note that the B.B.C. have adopted yet another of my various suggestions. This time that they should run episodic serials. Hence the "Plums." Of course, it isn't an entirely original suggestion. They've been doing that sort of thing for years in the United States. Perhaps we shall get plays soon on the lines I have mentioned. In any case, here is subject-matter for an "Experimental Hour" much more in line with popular tastes than "jargonised" Shakespeare. At least, that is what I think. But then, I must admit I'm a bit of a low-brow!

AND THIS TELEVISION!

SOME of it's very good. But—— My hat! The other day they put on a foreign choir, and for about a quarter of an hour all we got was just a row of not-too-attractive faces bellowing queer yodelling sounds.

And that "ballet" and "Masque" stuff! No, I'm not pleading for an unbroken series of "red-nosed" comedians and jugglers, but I do plead for a bit more imagination and a holiday from the be-spatted highbrow element.

"Journey's End" was a grand success, but for every hour of that sort we get two or three of mediocre stuff that is sheer waste of the television camera's time.

QUESTION OF GRAMMAR

I HAVE been severely taken to task by a Brighton reader because, as he puts it, I "misuse the English language." He bases his accusation mainly on a split infinitive or two and an occasional misplacement of prepositions. He also dislikes "Americanisms."

Well, I'm quite imperturbed. It's always been my idea that an intimate kind of feature like this should be written in an unpedantic, conversational sort of way. After all, this is V. King having a weekly chat to his "P.W." friends. Not an essay.

Besides, I'm not so sure that it isn't arguable that a "chat" in print would be wrong if it endeavoured to maintain a purely literary style. Normally, the written word tends to lag behind the spoken word. For language is a dynamic, changing thing. How many of us speak in accordance with the strict rules of grammar?

I do feel that a colloquialism, even a slight looseness of phraseology here and there, is quite defensible if colourfulness such as you get in animated conversation is to be transmitted to the printed page.

Which reminds me: Our Editor, Mr. Dowding, is very worried about a slip in his amazing little book, "True Prediction." For the benefit of all of you who possess a copy it occurs on page 22. Eight lines from the top the second "inorganic" should read "organic." He tells me he read the original "copy" through twice and the printed proofs three times, and is quite at a loss to understand how the slip escaped his eagle eye.

I can quite appreciate that a little "brick" of that kind in a book so obviously carefully written must be very annoying, and I sympathise with the author very much, though it doesn't affect his arguments in any way,

(*Please turn to page* 405.)

QUESTIONS AND ANSWERS

By K. D. ROGERS

CROSS-MODULATION AND ITS EFFECT ON SELECTIVITY

THAT FAINT BACKGROUND

H. F. P. (St. Albans).—*I have a selective and sensitive five-valve set with two H.F. stages and bandpass. I get a very large number of stations but, unfortunately, I can hear the two London stations together.*

When I am tuned to National I can hear the Regional, and vice versa. I cannot understand it, for I can tune-in other programmes between these two without their interfering.

You have probably got your H.F. valves biased wrongly. It sounds to me as if you have that nasty phenomenon called cross modulation. This is due to one or other of the H.F. valves of the set receiving too strong a signal from the local—a signal which causes the valve to rectify owing to the fact that the grid input voltage from the station runs too far to the right—the positive end—and the valve rectifies slightly.

In the output circuit you then have a mixture of H.F. and rectified H.E. That in itself will not matter, except that when the valve is in a state of bias—applied by the signal, not the bias arrangements of the set—which makes it a rectifier, any residue of a local powerful station which gets through the tuning of the set will also be rectified. And it will mix with the other components in the anode circuits of the valves.

Now, when you are properly biased and the H.F. valve or valves are not rectifying, you have full control of the tuning circuits of the set. Even if a slight amount of an unwanted station gets through the first H.F. valve—as it will do—it can be tuned out in succeeding stages of tuning. It will then not arrive at the detector circuit.

That cannot be said of any rectified signal in the H.F. circuit. The rectified impulses of the unwanted station—which have arrived because the wanted station is coming in too strongly and is biasing the valve too far towards the positive—will become inextricably mixed with the H.F. in the anode circuit of the first valve. They will then be passed on in a form of modulated H.F. to the second H.F. valve, be amplified and then passed on to the detector.

You have, in fact, turned your first valve into a sort of transmitter. It provides H.F. in its output, but you are applying rectified signals—the unwanted ones, for the rectified portion of the wanted station does not matter—to its output, and you have them modulated H.F.

If you are listening to the Regional and the National breaks through, is rectified and passed to the anode circuit of the first H.F. valve, you have in that circuit the H.F. of the Regional plus a little of it in rectified form, and on top of that you have traces of National in rectified form. The result is that the second H.F. valve and the detector are supplied with Regional H.F. cross modulated with National. That modulation you cannot get rid of, no matter how much you tune.

The cure can take either of two ways, or a combination of both. It can be a cut down of the input to the set from the aerial by some convenient means, or it can be carried out by further negative biasing of the first valve in order to prevent the strong Regional (or wanted signal) biasing it too positive and causing rectification.

I prefer the former method or a combination of the two. If you go piling negative bias on in order to prevent the valve becoming too positive, you may upset its curve and you may make it rectify on the negative swings instead of the positive ones. I am assuming, of course, that you are using multi-mu valves. Even these will rectify at the negative end if the bias is overdone. But before they do so you usually obtain a certain amount of distortion which is undesirable.

Cut down your input from the aerial and you will be all right. A switch cutting out the aerial altogether when you tune to locals will probably do the trick. With the set you have you can probably get the station on a short piece of wire instead of the aerial, and if a short length is left between the switch and the receiver you will be all right.

SPEED OF CHARGING

T. P. K. (Salisbury).—*I have a battery set and am getting a trickle charger. What should be the rate of charge for the L.T. battery?*

That depends on its capacity. The rate of charge is usually provided on the battery by the makers. A trickle charger generally gives about ·5 amp, so that you can reckon that is the rate at which you will be charging your battery. If the battery is a large one, however, it would be better for it if you bought an ordinary charger giving perhaps one or two amps, and instead of putting the battery on to trickle-charge every time the set was switched off, you put it on charge about once a week, dependent on how much it was used.

Most battery charging should be carried out at about a tenth of the actual ampere-hour capacity of the battery. In other words, if the battery is small—having a capacity of 10 ampere hours it should not be charged at a greater rate than 1 amp. If the capacity is 30 ampere hours it should not exceed 3 amps.

You will find that in small batteries a standard charging rate of about ·5 amp is used and recommended.

Be careful if you use a trickle charger on a small battery that you do not over-charge. It is easily done, and I have seen more than one battery ruined by being on constant charge, even though it was not being used on the set. One battery I came across had disintegrated badly. It had been used about four hours per week, and the rest of the time—night and day—it had been left on trickle charge at ·5 amp.

You should calculate roughly how much power you take out of the battery and arrange to put in just a little bit more.

THE W.B. "LONG-ARM"

This compact unit is the W.B. "Long-Arm" control for extension speakers. It provides a means of switching a distant set on or off at the extension point—an ideal scheme for those who have an extension in their bedroom or some other part of the house remote from the receiver.

Thus if your valves take ·4 amp total and you use the set twelve hours a week you will be taking 4.8 ampere hours out of the battery. You should then give it sufficient charge to recover that amount and a little bit more "for luck."

Something like the teapot with its teaspoonful for each person and "one for the pot."

With a ·5-amp charger and the consumption of 4.8 ampere hours you should give the battery about 10 to 12 hours of charging. You can see that this can be given all in one go—during a night and part of a day, and it is definitely a good plan to run the battery without the charge for four or five days and then to boost up for a number of hours at the end of that period. That is much better for the battery than charging for an hour or so every evening or night, or leaving it on the charger overnight each day.

It is not good for a battery to go on charge all the time it is not being used unless you take a fair amount out of it. It results in unnecessary gassing. Let the battery run a down a bit, then put it on charge and let it gas for a couple of hours quite freely before it is taken off charge.

WHEN THE PENTODE GOES

My pentode valve seemed to blow up the other night. I was doing something to the loudspeaker while the set was going, and one of the leads slipped off. There was a flash in the valve and it is apparently ruined. Would the speaker leads coming off do that?

They might. It would depend on whether the signal coming through the set was large or not. If you had the receiver going full blast and it was a mains set with an output of perhaps three watts you might quite easily ruin the valve in that way.

What happens is this: When the loudspeaker is disconnected it takes the "load" off the valve. In other words, the valve is not supplying speech *output*. The path for the speech current has been broken. But the input to the grid of the valve is still present, a matter of some volts. And the valve itself in such a set is frequently still being supplied with H.T. through some choke filter.

So it goes on piling up voltage in its anode circuit voltage which cannot—to put it loosely—get away in the form of current. With a pentode valve of large calibre the voltage may build up to considerable figures and with a powerful signal it may and does build up to a figure sufficient to break down the insulation inside the valve between its electrodes.

There is a sudden flash in the bulb and the accumulated A.C. voltage (caused by the amplification of the speech signal voltages) jumps across inside the valve, often ruining it.

That is what has probably happened in your case. It is never safe to disconnect a speaker from a set when in use. And that being the case it is obviously not safe nor desirable to fiddle about with the speaker leads while the set is running.

In any case, it is rather unwise from the aspect that you might receive a considerable shock when handling a mains operated receiver in that manner. Don't forget that you have not only the H.T. voltage but the A.C. voltage to contend with. When these are added you might have a very nasty surprise.

THE SUPER-QUALITY RECEIVER

K. P. (Maidstone).—*Can I use a Piezo electric pick-up with the super quality receiver described by Mr. Scott-Taggart?*

You can, but I am not sure whether you would have trouble with overloading or whether you would obtain good enough volume control with it in the detector position.

You would have to keep the control well over to the minimum end most of the time. But I should certainly try it. If you find that it is too sensitive for the set you can transfer it to the grid circuit of the first L.F. valve quite easily. But try it in the detector position first. If you have to transfer it you will find that it is quite easy—merely the usual pick-up change-over switching arrangement.

AERIALS FOR PORTABLES

A. J. (Bexley).—*How is it that a portable set works without an aerial when every other type of set needs one?*

A portable has an aerial just like any other set, but it is built into the cabinet and takes the form of a closed loop or frame. Actually it is similar to a large tuning coil and acts as the first tuned circuit of the receiver. Of course, the signal pick-up is not so effective as on a normal aerial, and for this reason portable set circuits need to be pretty sensitive. One of the advantages of a frame aerial is its directional properties, a characteristic which adds to the set's selectivity. You will notice that portables are invariably provided with a turntable so that the set can be rotated into the best position for reception.

IMPORTANT NOTICE

Readers are advised that technical enquiries and other communications which they have been accustomed to send to "POPULAR WIRELESS" may in future be addressed to "THE WIRELESS WORLD" for attention, at Dorset House, Stamford Street, S.E.1.

UNCONVENTIONAL WAYS OF USING VALVES

WE have become so accustomed to plugging in a valve and leaving it that we are apt to forget that a valve is capable of performing duties other than was intended by the makers.

For example, a pentode valve may be used as a triode by regarding the auxiliary grid as an anode. This gives the valve somewhat the same characteristics as a small-power valve, and is particularly useful in those cases when a pentode does not give satisfaction. I mean, you need not regard such a pentode as being in the nature of a white elephant.

Similarly, a screen-grid valve often makes an excellent detector by using the screen grid as an anode. You can connect the legitimate anode and screen grid together, but this hardly makes any difference.

If you are interested in low-voltage work you should certainly try using a pentode in the following manner :

Apply a voltage of about twenty to the anode. To the grid apply about 9 volts. The signal should go to the auxiliary grid. This can be used either for detection or low-frequency amplification. Some pentodes have the outermost grid connected to L.T. –, but this idea works best with those valves which have the outermost grid connected to the innermost.

The diode is a classical example of what I mean. By taking an ordinary three-electrode valve and joining the grid and plate together we have what is called a diode, giving distortionless rectification. Unfortunately, it is somewhat insensitive.

There is scope for finding out new uses for valves in the multi-grid and combined valves. The Q.P.P. pentodes can be used as a pentode detector and pentode output, thus giving loudspeaker reproduction from one (?) valve. The combined driver and Class B can also give loudspeaker working by using the driver portion as a detector and applying the output of this to the Class B section of the valve via a driver transformer of 1/1 ratio. Naturally, the volume is not so loud as with the usual arrangements, but there is a certain amount of novelty in being able to work a loudspeaker off one valve.

W. N.

FOR WEST OF ENGLAND LISTENERS

A GRAND CHRISTMAS CONCERT will be held in the Landithy Hall, Madron, Cornwall, on December 30 ; Bernard Fishwick, the Chairman, well-known as a radio actor and singer, will announce the items in dialect. Those taking part will be the Mabe Carol Singers ; Peter Sandry, who will tell Cornish stories ; Jack Collings, a fisherman from Port Isaac ; the Sladesbridge Hand-bell Ringers ; and the Madron Guise Dancers who will present a Christmas play, bringing in all the traditional figures —St. George, the Turkish Knight, Father Christmas and Beelzebub among others.

RADIO'S GREATEST MYSTERY

Our contributor discusses the perplexing problem of electro-magnetic action

DEEPEST and most profound among the many problems associated with the fundamentals of radio and electricity is the ever recurring question of what constitutes a magnetic or an electro-magnetic field and what, also, is the nature of electro-magnetic action.

Surprising as it may seem, physical and electrical science is, even at the present day, in a state of almost abysmal ignorance concerning the above matters. Yet the well-known properties of the electro-magnetic field not only underlie the whole of radio science but, also, the greater part of the multitudinous electrical applications which, during the past half-century, have, by their enormous convenience, grown into the very fabric of modern civilisation.

I am not going to solve any problems for you in this article. Rather, I am going to make one or two problems concerned with radio and electricity seem all the more mysterious and all the more insoluble. There is no doubt, of course, that, in the fulness of time, to use a Biblical phrase, a complete understanding of these mysterious matters connected with the fundamentals of radio and electricity will be forthcoming. Yet, if I may hazard a guess, the complete solution of all these mysteries will not be forthcoming in our time. A future Faraday or, more accurately, perhaps, a Clerk-Maxwell yet unborn, may, at some future age, give his life to their solution. The present generation, however, is a more utilitarian one. It cares little for electrical and radio fundamentals so long as a continual stream of convenience-granting electrical applications are poured out by the battalions of electrical and radio technicians now engaged in mass-scale industrial research.

Field of Influence

There are few people who are unaware of the fact that a "field" of influence surrounds even the simplest magnet. If we take a common horseshoe magnet and lay it down on a table and then place a sheet of paper over it and scatter iron filings over the paper, the filings will arrange themselves in such a manner as to reveal a well-defined pattern of lines proceeding from the poles of the magnet. Such are the well-known "lines of magnetic force."

All experimenters know that similar lines of force surround a wire carrying an electric current. We find it mighty convenient to imagine such a wire as being surrounded by lines of force sticking out all round it, and by special modifications of the above iron filings experiment it is possible to make visible the supposed pattern and arrangement of these lines of force surrounding the current-carrying wire.

Magnetism is a mystery. But, if anything, electro-magnetism, the special form of magnetism associated with electric currents, is a greater mystery still. We are gradually coming to believe that electro-magnetism is of a more fundamental nature than magnetism itself and that the latter may, in all probability, be nothing more or less than a special permanent form of electro-magnetism caused by the tiny current-generating movements of the atoms or molecules in specially treated iron and other metals and alloys.

Be that as it may, such a hypothesis does not attempt to solve for us the meaning of electro-magnetism and the nature of the electro-magnetic field.

Theoretical text-books of electricity have made us so accustomed to explanations which drag in time and time again the terms "electro-magnetic fields" and "lines of force" that it has become almost second nature for a technical man to believe implicitly in the reality of such phrases.

Yet—and here is the most profound of electrical and radio problems—we have utterly no proof of the existence of "lines of force" or of "electro-magnetic fields" containing so many lines of force per unit area. All such considerations are Man's, and Man's alone. They are not Nature's creations, and it is very probable that, ultimately, we shall discover that there are no such things as "lines of force" surrounding a magnet or a wire carrying a current.

Consider a rod-shaped magnet or a rod which carries a current and which, according to present-day theory, has surrounding it innumerable lines of force arranged uniformly around it like so many whiskers or bristles. If, now, the rod magnet or the rod conductor be slowly and uniformly rotated on its own axis, do the magnetic or electrical "bristles" rotate with the rod like the spokes of a wheel when the hub is revolved? If you accept the "lines of force" theory of electro-magnetism, you must answer the above question in the affirmative because you will sink very deeply into the theoretical mire if you try to suggest that the rod revolves and yet, at the same time, its "bristles" remain stationary.

Many have been the practical experiments made in electrical research laboratories in an endeavour to determine once and for all this vexed and fundamental question. All such experiments have resulted in negative results. We cannot detect the motion of the "bristles" when a rod-shaped magnet is rotated, and slowly it is dawning upon us that, since such "bristle" motion cannot be detected, it may be on the cards that there are actually no such things as these electrical or electro-magnetic "bristles." In other words, that electro-magnetic fields and "lines of force" are all purely imaginary.

New Theory Wanted

If we do away with electro-magnetic fields and lines of force we must put something in their places. An electro-magnet, a radio moving-coil, a transformer, a choke coil—all these applications of electro-magnetic action function perfectly satisfactory, no matter what our conception of their inner mode of action may be.

It is precisely here that the trouble in the realm of theoretical electricity and radio arises. We are beginning to disbelieve in electro-magnetic lines of force, fields and what-not, yet we have nothing satisfactory to put in their places. All modern science, looking at the entire question most fundamentally, can say is that electro-magnetic action, such as that, for instance, which occurs in a transformer, is due to a strain, a local deformation in the Ether.

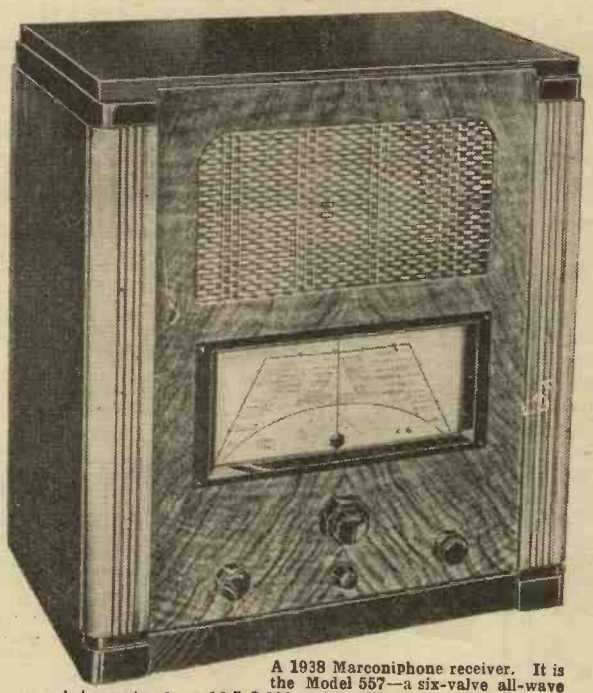
This may be a step forward in the matter, but it is countered by the fact that we have no knowledge of the Ether.

The more one considers the nature of magnetism and of electro-magnetism, the more one contemplates the supposed electro-magnetic lines of force and links of influence, the more mysterious do these matters become.

There is, indeed, no matter whether we as individuals realise it or not, equally as profound a depth of mystery lurking within the inner functioning of the humblest of radio components as there lies behind the operation of the colossal and universal force of Gravity.

J. F. S.

A FINE ALL-WAVER



A 1938 Marconiphone receiver. It is the Model 557—a six-valve all-wave superhet covering from 16·5–2,000 metres. The price is 12½ guineas.

RANDOM RADIO REFLECTIONS

(*Continued from page* 401.)

and can be corrected easily enough in subsequent editions.

I think it's a credit to both the writer and the printer that to my knowledge no errors have come to light in the part of the book which deals with character classifications and analysis of your future prospects and probabilities, and so on.

EGG—FINAL WORDS

LET our old Birkenhead friend close the subject for us with the following amusing verses :—

" EGGSPLANATORY "

Oh, Kindly Readers, pause awhile, One little moment Stop,
Our Worthy Victor cries for aid,
His Beastly Egg won't Pop,
Because it's Incompressible, Unless, perchance, it's Not.

A Man named " Chaub," Exotic Name, Goes into things a lot,
And gives us many reasons why
The Hen Fruit will not Pop,
But maybe there are reasons which Good Master Chaub Forgot.

For instance : What was Mama's Name Amongst the Barnyard ruck ?
And was Papa, by any chance,
The Famous Donald Duck ?
These vital facts, we ought to know, or else we're in the muck.

Did Donald do the pressing ? Was Henrietta coy ?
Can Victor tell us of the Sex ?
The News we would enjoy.
Another Henrietta ? Or a " Ducky " Darling Boy ?

Now, Hear the Truth, In language plain, Let all contention stop,
Pressure's the Same, Inside and Out,
If Fresh—Ye Egg Can't
POP.

We know Our Victor far too well. He is no Village Rube,
He'll never try to fill his Tyre
With Egg Juice in its Tube,
He'll just use Air, like all of us, we safely may conclude.

With Compliments and Respects,
" Our Old Friend,"
K. T. HARDMAN.

* * * *

BUT hold on, here's a letter just arrived that I think I must let you see. It is from Mr. Armstrong, of Kendal. He says :

" May I throw my egg ? Here goes :

" The gentleman who says that there is enough pressure in an egg to blow up a motor-car tyre probably means that on decomposition of the contents (albumenous) of an egg, sufficient hydrogen sulphide gas is given off to inflate a tyre. (Have you never heard a bad egg " pop " when cracked ?)

" Another small matter.

" The perfect liquid has no elasticity—by that I mean its volume cannot be decreased by an increased pressure upon it. BUT PRESSURE IS A SURFACE PHENOMENON—you can exert a pressure on any surface ; that the substance " inside " the surface decreases in volume is merely incidental to this.. (Don't you say " pounds per square inch " ? And surely " square inch " denotes an area, with no indication of thickness, hence volume.)

" I wonder if any of your readers can find any holes to pick in *this* argument ? "

Can you ? I can't ! But is he right ? Or is he right ?

MY SHORT-WAVE ADVENTURES

(*Continued from page* 391.)

hailing from " sunny California," as he mentioned. He came in at 162 degrees. Then there was a vociferous gentleman at 151 degrees—who drawled away for twenty minutes and then clapped out his call-sign like greased lightning—I *think* he said W8FYT.

But who cares ? So many others have come my way I don't mind missing a few call-signs. My log includes W3AUC, W3AKX, W1KJK, W1HQN, W9AGA, W8AUX and W8EBS—the last-named worked by a " YL " in Rochester, N.Y. Very, very snappy ! I don't know where they learn all the technical jargon, but these American women certainly can shoot a good line of ham talk.

A Heterodyne Muddle

I have also got that Baltimore " high fidelity " station, call sign W3XEY on 9·5 metres—this at 93 degrees on my dial. But there seems to be a whale of a heterodyne muddle around that point, and only now and then does anything intelligible come through.

" If you wanna know, maw . . ." and then, " Yes, I do want to know, whah, whah, whah . . ." *ad nauseam*. I suppose these stations give perfectly good local reception—like the police signals on 8·4 metres or thereabouts.

I give these few details just to show how things are going—not to prove I am the " champ " DX-er !

Afterthought : I have given up my grid-leak " pot." as I find I must have full grid volts positive to get loud signals. I still get a bit of a " plonk " with my oscillation—but I have another idea up my sleeve to try dodging that without losing sensitivity.

Dear me, my pipe's gone out !

RADIO POINTS THE WAY

(*Continued from page* 387.)

distance in front of the beacon, so that there is a danger of the aeroplane crashing into the transmitting aerials on its way down to land.

It must be remembered that we are dealing with curves of equal field strength, so that the outer surface of the shaded curve in Fig. 4 corresponds to points in space where the field intensity remains constant. On the other hand, along the centre line A O signal strength would steadily increase as one gets closer to the transmitter, and could obviously not form a suitable gliding path.

When an approaching plane first picks up the landing beam signal at a certain predetermined strength, corresponding to the point M1, the pilot starts to put the nose of the machine down. He continues his downward path, and by always flying to constant signal strength, so that his radio indicator remains steady at the same point on the dial, he knows that he is keeping along the contour of the beam. In this way he finally reaches the tangential point M2 at the proper landing angle.

IN RETROSPECT

The Record of Radio

By J. C. JEVONS

THE first official demonstration of wireless was given by Marconi on Salisbury Plain in the summer of 1896, when signals were received over a distance of four miles. A few weeks afterwards messages were sent across the Bristol Channel at a range of over nine miles, and Sir William Preece, who represented the Post Office, was moved to say, "There is something in this new invention."

A couple of years later, Sir Oliver Lodge discovered the principle of electric tuning, which, in effect, introduced a special bond of sympathy—technically called Syntony—between the transmitter and receiver, and greatly increased the working range. In 1901 Marconi transmitted Morse signals across the Atlantic, from Poldhu in Cornwall to Newfoundland, and long-distance telegraphy was an accomplished fact.

Transmitting Speech

The next advance was to tackle the problem of transmitting speech. This required the production of a steady train of wireless waves to "carry" the low-frequency "sound" current across the ether. Actually, the first to generate continuous waves of radiation frequency was Poulsen, who used a special form of circuit developed by Duddell from the ordinary arc lamp. But the Poulsen arc did not prove quite steady enough for the purpose in view.

In 1904 Sir Ambrose Fleming took out his first patent for the thermionic valve—a two-electrode affair—which was really invented to take the place of the "coherer" as a detector of wireless signals. Two years later, de Forest added the grid, and then nothing much happened until 1913, when a number of inventors, including de Forest and Armstrong in America, Meissner in Germany, and Franklin over here, stumbled more or less simultaneously upon the principle of reaction. In other words they found that by back-coupling the plate to the grid the valve became not only much more sensitive as an amplifier, but could also be used to generate continuous carrier-waves of high frequency and constant amplitude.

This discovery of reaction "revived" the valve, and launched it on its way to fame.

In wireless telephony it is necessary to "modulate" the carrier wave, which is at a high level of energy, with low-frequency speech currents of comparatively feeble strength. Colpitts found one way of doing it and Heising another. There are, of course, other problems involved in transmitting speech instead of Morse signals. For instance, the circuits must be designed to accommodate side-band frequencies; the carrier-wave must be "stabilised" at a constant frequency; and a higher all-round grade of transmission is essential.

Speech was first transmitted by radio across the Atlantic from New York to Paris in 1915. At that time there were no high-powered valves available, and no fewer than 500 separate tubes, each rated at 15 watts, had to be connected up in parallel.

Shortly after the War the stage was set for broadcasting. The valve was "in charge" at the transmitting end, right from the beginning, but was challenged for some time, in reception, by the simple crystal. The competition was, however, short-lived, and the valve and loudspeaker finally swept the board as soon as certain essential improvements had been made.

Valve Development

The original bright-emitter valve was replaced first by the dull-emitter, which consumed far less "juice," and then by the indirectly-heated type, which was still better adapted to be driven from A.C. supply mains. Next, the introduction of efficient "eliminator" units solved the problem of the high-tension supply, and the way was made clear for the manufacture of mains-driven sets by mass production.

Simultaneously a new technique of sealing metal to glass led to the manufacture of water-cooled transmitter valves, rated at kilowatts instead of watts. On the receiving side, the neutrodyne, the screened valve, and finally the pentode gave listeners more and more effective high-frequency amplification, with a correspondingly increased "reach" and greater selectivity. Corresponding valve developments on the

(*Please turn to cover iv.*)

425 STATIONS ON S.T.900

A further weekly report from Mr. Leslie Perrins

Reception week November 21st to 28th, 1937.

Dear Sir,—The week under review has been uncertain for short-wave reception, but despite the conditions the S.T.900 has again proved its remarkable capabilities. It is unfortunate that my occupation prevents me from giving this set a trial during the daytime, as I know there are several distant stations who broadcast only on weekdays, either in the morning or afternoon.

I, however, have obtained highly successful results at week-ends in daylight, as this and my previous reports have shown. During this week I had the opportunity to show a very proud owner of a well-known make of seven-valve superhet all-wave set the possibilities of the S.T.900. He remarked that the "X"-reaction, when operated properly, made such a wonderful difference to the signal strength of a distant station that it seemed one had added an extra two or three valves to the set. Upon seeing the coils changed, his remark was "that is simplicity itself." He was also delighted to see how I separated **Podebrady** from **Zeesen D J A** on 31 metres, and vice versa (although these stations are only 9 kc. apart) by applying the bias to the H.F. valve through the selectivity plug being inserted in the upper socket.

The most interesting reception of the week has undoubtedly been from **V K 2 M E Sydney**, on Sunday the 28th, between 2 and 4 p.m., and I held the programme for the two hours it was on at moderate L.S. strength. The amazing part of this signal was the way in which I was able to keep powerful **Zeesen D J A** right in the background by the use of the selectivity plug and full application of the "X"-reaction. I am confident it would not have been possible here in Birmingham without these features. The stations received this week besides the locals were as follows:

Sunday 21st., 10.30 a.m., 19 m., **Zeesen D J Q** and **D J B**, full L.S. Orchestral records including "Die Fledermaus." 10.45 a.m., 25 m., **I 2 R O 4**, full L.S. Music, and **S B P Motala** at full L.S., giving a service relayed from Stockholm. 11 a.m., 25 m. **Moscow R N E**, fairly lifted the roof with "Hallo! Good afternoon, everybody. This is Moscow calling from the Radio Centre. Workers of all lands unite." This was followed by a series of political talks and news in English.

Monday 22nd. Enjoyed, at 8.45 p.m., Dvorak's "New World" Symphony from **Lyons P T T** without any noticeable fading. This was followed by some quite good songs in French.

Wednesday 24th., 7.40 p.m., 31 m., **W 2 X A F Schenectady** at good L.S. Duets on two pianos.

8.30 p.m., 31 m., **O L R 3 A Podebrady** at full L.S., giving a very good pianoforte recital which included the "Funeral March" at 9.10 p.m. Closed with news and bells. No fading whatsoever. 9.30 p.m., 31 m., **Zeesen** at good L.S. Songs and choruses. 10.45 p.m., **W 2 X E Wayne, N.Y.**, on 25.36 m. (note new wavelength) at good L.S. Concert with announcer Ben J. Lawrence. At 11 p.m., called in English, French, German and Italian.

11.10 p.m., 25 m., **I 2 R O 4 Rome** at moderate L.S. [Talk, 11.15 p.m., 28.94 m. **E A J 43 Tenerife** (Canary Islands) at moderate L.S., announcements in Spanish. Played some call on a bugle followed by piano and violin recital. 11.25 p.m. Picked up a station about 29 m. at moderate L.S., giving Cigany music. I wondered who it could be, and at 11.30 p.m. I was informed in Dutch that I was listening to "**Hier Nirom P M N, on 28.99 m., Bandoeng, Java.**" Then followed a programme of waltzes, including "Invitation to the Waltz" and "The Merry Widow."

11.55, 49 m., **W 8 X K Pittsburgh**, at good L.S. A serial sponsored by "Anacin" ("a sure and safe cure for headaches"). Call at 12 midnight.

12.5 a.m. (Thursday), 49 m., **C O C D Havana** and **V E 9 H X** at good L.S. Both on the same wavelength. It was amusing to listen to these two alternately overpowering each other.

Thursday 25th. Gave a demonstration to three "P.W." readers. W. H. Brampton, 22, Wainwright Street, Aston, Birmingham; F. Crow, 75, Leopold Street, Birmingham; F. Hill, 210, Berry Wood Lane, Great Barr. Among some 30-40 stations received clear of one another within one and a half hours were Luxembourg, Radio Paris, Kalundborg, Athlone, Stuttgart, Cologne, Lyons, Prague, Fécamp, Lille, Munich (31 m.), **W 2 X A F Schenectady** (31 m.), **W 1 X K, Millis** (31 m.), **W 3 X A U Philadelphia** (25.36 m.), **W 2 X E Wayne**, several Zeesens (25 m.), Rome **I 2 R O 4**), and (31 m.) **O L R 3 A Podebrady.**

Friday 26th, 10 p.m., 10 m. **W 2 X A D Schnectady** at moderate L.S. News and concert. 10.30 p.m. Jack Armstrong in a "Wheaties" serial. 10.45 p.m., 16 m., **W 3 X A L** at moderate L.S., a programme of new songs.

Saturday 27th., 13 m., 1.30 p.m., **Wayne W 2 X E**, at good L.S. Concerts, etc., were enjoyed by all at home from this station without any attention to the set for three and a half hours.

8.50 p.m., 25 m., **W 2 X E Wayne**, at good L.S. Commentary on Army v. Navy match, which Army won by 6 to nil. Names of players who figured prominently in this game were Frank Case, Dusty Cook and Sticky-Fingered Solomon (the last name amused tremendously all who were listening). At 9 p.m. the lights were turned on (so the commentator said) to illuminate the ground on a very dull day. 9.10 p.m., Army had won, and the crowd charged on the field. 9.15 p.m., orchestra. 9.30, 28 m., **E A J**, 43 m., at moderate L.S. War news.

Sunday 28th., 10 m., several French, Dutch and English amateurs who complained of bad long-distance conditions on this band.

12 mid-day, 20 m., amateurs. **W 3 M D Vineland, N.J.**; **F 8 D C France**; **O N 4 Q Z Belgium**; **G 5 N I England**; **W I N W U.S.A.**; **O N 4 A W Belgium**; **G 8 V V England**; **P A O W I Holland**; **L A 1 F I Norway**; **O Z 5 B W Denmark**; **F 3 K P France**; **S M 7 Y A Sweden**; **G 5 N Y England**; all at full L.S.

2 p.m., 31 m., **V K 2 M E Sydney**, at moderate L.S., opening with Laughing Jackass, followed by the call and address of station, etc. The programme included march with male chorus. Paul Whiteman and his Trumpet Orchestra in "Ol' Man River." A ballet. Stanley Holloway in an Old Sam story. (We were all highly amused by this, as it is a long time since we have heard "Old Sam," and never thought that we should next hear him from Australia.) Carson Robinson and His Pioneers in a Camp Fire Concert which included "Old Folks at Home," "Little Liza Jane," and "Good-night, Lady." "Stein Song" by Male Chorus. Jessie Matthews in "Head Over Heels in Love," and "May I Have the Next Romance With You." Closed down at 4 p.m.

I have now increased my total number of different stations received to 425, despite the unfavourable short-wave conditions, and I feel that no matter what programme from U.S.A. may be desired the S.T.900 will receive it providing a suitable S.W. station is on.

LESLIE A. PERRINS.

101, Sycamore Road,
Aston, Birmingham, 6.

TECHNICAL JOTTINGS

By Dr. J. H. T. Roberts, F.Inst.P.

Varied items on matters of general interest

I SUPPOSE most people who use the mains for the electric supply to their receivers nowadays are possessed of all-mains sets, in which the unit, or units, for converting the electric supply into a suitable form will be contained within the set itself. But there are still quite a large number of people who work their sets from the mains by the aid of external mains units. Most units nowadays are equipped with output terminals for supplying grid-bias voltage, as well, of course, as the various high-tension voltages, but there are to my knowledge a large number of units in existence which do not have grid-bias terminals.

If you happen to possess such a unit and you have previously been using a battery for grid bias, you can dispense with the latter and obtain the grid bias from the unit itself by some comparatively small adjustments.

A Mains Dodge

One method which is often used is to connect a resistance between the negative high-tension terminal of the unit and the corresponding terminal of the set. The previous high-tension negative terminal will now give you the negative bias voltage. It is advisable, however, to connect a fairly large capacity condenser, 1 or 2 microfarads, across the terminals of this resistance in order to bypass any alternating voltages. The value of the resistance may conveniently be 5,000 ohms (the maximum value, that is), and you can then obtain various grid-bias voltages from zero up to as much as 30 volts by adjusting the value of the resistance. This resistance must be an adjustable one, I forgot to say.

Effect on H.T.

You will notice that when using the above arrangement the grid-bias voltage is subtracted from the high-tension voltage and thus, if you vary the grid-bias voltage, you will produce corresponding variations in the high-tension voltage from the terminal of the unit which you are using. These variations will be in the opposite sense, that is to say, as you increase the grid-bias voltage you will decrease the remaining H.T. voltage.

Using the Choke

Some people object to the encroachment of the grid-bias voltage upon the H.T. voltage, and therefore do not favour the above-mentioned method. If you feel this way about it you can utilise the voltage-drop across the choke for the purpose of providing grid-bias voltage. In this case, in order to vary the voltage you will need a high-resistance potentiometer connected across the ends of the choke, the grid-bias voltage being tapped off from the slider of this potentiometer. The value of the choke may be, say, 50,000 ohms.

I should mention one point, which is that the smoothing choke must be in the negative supply lead. This choke will act just as well as a smoothing choke in one lead as in the other, so if it is at present in the positive lead it will be necessary to transfer it to the negative lead, that is if you wish to make use of it as a source of grid-bias voltage as explained above.

Remember to Decouple

There is one further point which I should like to mention before leaving this question of getting grid-bias from the mains unit, and that is a point with regard to decoupling. You may quite probably find it necessary to put in some form of decoupling with the arrangement mentioned above. If this turns out to be the case, a simple dodge is to put a decoupling resistance, say 100,000 ohms, in series with the lead from the slider of the potentiometer, or in series with the lead from the slider of the variable resistance, according to which method you choose.

Increasing the Power

It is a very common thing for people to want to get more power out of their sets, just as there is scarcely any motorist who does not at some time or other feel that he could do with some more engine power, provided he did not have to pay anything extra for it.

As regards the extra power from the radio receiver, it often puzzles people to know how this can be done without fundamental changes in the circuit arrangement and construction of the set. As a matter of fact, however, you can sometimes get quite an appreciable increase of power from a set by relatively simple means.

Output and H.T. Voltage

As often as not you can get this extra power by nothing more serious than an increase in the anode voltage on the output stage. This will, of course, necessitate extra grid bias in order to regulate the anode current and keep the valve operating on the proper part of its characteristic curve. Obviously this will throw an extra load on the high-tension source, and if this happens to be a dry battery you must be prepared for the consequences. If the battery is of the low-duty type it won't last you so long, and it may pay you to use a heavy-duty battery.

Trying a New Arrangement

If you care to go in for more drastic changes you can consider the question of converting to the quiescent push-pull or Class B systems, in which case you will find that the question of extra current consumption is not nearly so important. In fact, you can use quite large anode voltages without unduly increasing the load on the H.T. source.

If by these or other means you have increased the power-handling capacity of the output stage of the set you must not think that this alone is sufficient. Remember that it is only the power handling *capacity* (I use the word capacity in the sense of *ability* and not, of course, in the sense of condenser capacity) which has been increased and, as I have mentioned before in these Notes, the mere increase in the ability to handle does not mean that the power to be handled is necessarily available. A manufacturer may have a factory

(Continued overleaf.)

SOME FACTS ABOUT CONDENSERS

A chat on the energy losses which may occur in even the best constructed condensers

By F. S. POUND

MANY of us, I think, are apt to imagine that a radio condenser—fixed or variable—is a perfect instrument, and that it delivers up without any loss whatever every scrap of current-energy which is fed into it.

Alas, however, there is no such thing as a perfect condenser. There is, indeed, no such thing as an ideally perfect device of any kind whatsoever which will give out as much energy as is fed into it. If such a device could be found, the solution of the problem of perpetual motion would be brought a step nearer.

Following the universal rule of all instruments, the radio condenser abstracts, dissipates or wastes a little of the electrical energy which is fed into it. True it is that in the case of a well-designed and well-constructed condenser this wastage factor is never very high. Yet, in all cases it is appreciable and no more so than when short waves, with their ultra-high frequencies, are being dealt with.

A Straightforward Presentation

The matter of condenser losses is rather an abstract subject for many radio amateurs, simply, I think, because the subject is usually paraded in all the frightening panoply of mathematical symbols. The entire subject, however—and it is one of much interest—can be presented for the reader's reflection in a few brief phrases. Thus, the radio worker, although he may not be able to control in any degree his condenser's losses, will have an ample idea of their nature and will be in a position to guard against any possible heightening of these losses.

Condenser losses are of three different types: Resistance losses, eddy-current losses, and dielectric losses.

It may surprise some beginners to learn that a condenser, with its ample metallic surfaces, may actually present a resistance to the current flow. Yet such is the case even when the condenser is well constructed. When, however, the condenser is of the old pattern, having poor and ill-designed bearing-contacts, these resistance losses mount up enormously.

The same applies, of course, to fixed condensers. If, for any reason, there is faulty contact between the hidden plates in these condensers (that is to say, between the plates of the condenser which should be connected together), the resistance of the instrument rises, and much current-energy is required to overcome it.

Unavoidable Losses

Eddy-current losses are quite unavoidable in condensers, but fortunately these current losses are the least serious of all. Such losses are due to the formation of little whirls of current ("eddy currents") which are induced in the metal end-plates of a condenser and, also, in the condenser plates themselves. The energy for the formation of these wasteful currents is taken from the electrical energy which is fed into the condenser. Hence it is that even if the creation of eddy currents was the only source of loss in a condenser, the output energy of the condenser would be smaller than its input energy by an amount exactly representing the current energy taken in the creation of the eddy currents.

Eddy currents increase in amount with increase in the current frequencies which the condenser has fed into it. In short-wave work therefore, when the frequencies dealt with are exceedingly high, eddy current loss may at times be very considerable in a tuning condenser.

The third class of condenser losses, the "dielectric losses," are due to the absorption of a portion of the energy flowing through the condenser by the insulating materials used in the building-up of the instrument.

"Capacity losses" these might be called, for they are due to a sort of condenser effect existing within the condenser itself.

These dielectric losses are, other factors being equal, highest when the condensers have end-plates of non-metallic materials. Such losses occur frequently in fixed condensers. In order to reduce them in variable condensers, the condenser is "skeletonised" as far as practicable. That is to say, it is built up in a light thin framework embodying the least possible mass of material.

Dielectric losses decrease as the current frequencies fed into the condenser increase. Hence, in short-wave work with modern instruments they are seldom appreciable. In condensers tuning-in long-wave stations, however, the dielectric loss factor becomes a matter to be carefully guarded against, since the longer the wavelength the smaller is the frequency of the current which it induces in a receiver.

What we may term "accidental" losses in condensers have not been included in the above enumeration of condenser sources of energy wastage. Yet, in actual practice, such losses may amount to much more than the whole of the "normal losses" (as we may conveniently call the resistance, eddy-current and dielectric losses) put together.

Consider, for example, a leaky condenser, a fixed condenser say, the insulating medium between two or more of whose plates has been slightly punctured and which consequently allows trickles of current to penetrate directly from plate to plate.

The "accidental" loss of such a condenser will, at times, be enormous. Indeed, it might be sufficient to prevent a set's normal working.

In all good class condensers steps will have been taken to keep the losses as low as practicable.

An ingenious scheme instituted by the Columbia Broadcasting System of America to facilitate outside broadcasts. The weird-looking arrangement with the sunshade on top is a telescopic periscope with which the commentator is able to see over the heads of spectators. The "mike" is fitted just below the periscope eye-piece.

TECHNICAL JOTTINGS

(*Continued from previous page.*)

capable of turning out thousands of some particular article per day, but unless he can receive the orders, on the one hand, and the material, on the other hand, the mere ability to handle a large turnover is of very little use.

Function of Detector

In particular, in the case we are considering, it usually means that you have to increase the output from the detector so that the newly found ability of the output stage can be made use of. Increasing the output from the detector means that it will be necessary to increase the voltage applied to the detector itself so as to avoid overloading. With the quiescent-push-pull arrangement you can use pentodes or triodes.

Overloading the Speaker

Finally, there is the loudspeaker to be considered. It is not very likely that you are going to increase the output from the set so greatly as to get into difficulties with overloading the loudspeaker. At the same time, if the power-handling capacity of the speaker is unusually small, or if, on the other hand, the normal output of the set was comparatively large before you increased it, then you may find that the speaker "can't take it."

SELECTIVITY IN TUNED H.F. CIRCUITS

By A. W. YOUNGMAN.

So far as the listener is concerned selectivity in a radio receiver can perhaps be best defined as the ability of the tuned H.F. circuit to discriminate between wanted and unwanted signals, or the means of receiving the desired transmission to the exclusion of all others. Technically speaking, the explanation involves the consideration of the reactances and resistance, and in order to more fully understand the behaviour of a tuned H.F. circuit it is advisable to deal with the principles governing A.C. circuits and resonance.

It is well known that when an A.C. voltage is applied to a circuit containing pure inductance and capacity, an A.C. current will flow first through the coil and then into the condenser. As the current rises to its maximum value a magnetic field will be created round the coil which acts in opposition to the current and tends to prevent it reaching its peak value. Similarly, as the current falls and the magnetic field collapses, the opposition again becomes manifest in tending to prevent the current from reaching its zero value. This opposition is not resistance in the physical sense, but an inertia effect opposing any change in the current. It is known as the inductive reactance and equal to $2\pi fL$, depending upon f, the frequency of the generator, and L, the inductance of the coil. In a pure inductive circuit its effect causes the current to lag behind the applied voltage by 90°.

The magnetic field created round the coil when the current was rising collapses when the current falls, and now flows into the condenser, reappearing in the form of an electrostatic field in the condenser dielectric. By virtue of the electronic distortion in the dielectric of the capacity a voltage is produced across the condenser plates, and the stress of this distortion against the voltage offers a further opposition known as the capacity reactance. Opposing any change in the voltage it is equal to $\frac{1}{2\pi fc}$, depending upon f, the frequency, and c, the capacity. In a pure capacitative circuit the effect of this reactance causes the current to lead the voltage by 90°.

A resistive circuit differs from the inductive and capacitative circuits in that when the current flows through the physical resistance the opposition offered does not cause a phase displacement by retarding or accelerating the current in relation to the applied voltage. Any opposition offered by the physical resistance is overcome by heat dissipation, and in consequence the current and applied voltage are at every instant in phase, or step; neither lead nor lag being evident.

Effect of Resistance

Whilst pure inductance and capacity, by virtue of their reactances $2\pi fL$ and $\frac{1}{2\pi fc}$, cause a current lag and lead respectively of 90°, and that a resistive circuit offers no phase displacement it will be clear that if resistance is included in an inductive or capacitative circuit the current will not lag or lead the applied voltage by exactly 90°, but by a figure between this angle and zero depending upon the value of R the resistance. This is extremely important, and as will be seen later, determines the ability of a coil in regard to both selectivity and magnification.

Assuming for the time being that resistance is excluded and the circuit contains inductance and capacity only, it will be seen that when the A.C. voltage is applied two similar voltages will be produced across the inductive and capacitative branches and that the current flowing will be determined by the reactances $2\pi fL$ and $\frac{1}{2\pi fc}$ respectively. The total current flowing through the circuit will be the simple sum of the two currents flowing through the inductance and capacity and if resistance is not included these currents will be exactly 180° out of phase.

As the total current flowing through the circuit is determined by the reactances, which in turn are controlled largely by the frequency, it follows that if the latter is made adjustable a point will be reached at one particular frequency where the two reactances are equal and offer similar opposition. Under such circumstances $2\pi fL = \frac{1}{2\pi fc}$, in which case the currents in the two branches L and C will be equal. As these are opposite, or 180° out of phase, one will completely cancel the other, and since physical resistance, R, is excluded the total current in the circuit is reduced to zero. Resonance is now said to exist.

In the foregoing it has been assumed that resistance was excluded. Unfortunately, this state of affairs cannot exist in practice and some resistance must be present if only that inherent in the wire with which the coil is wound. Where physical resistance is present it follows that some current must be absorbed and dissipated in heat, with the result that a small current, depending upon the value of R, the resistance, flows through the circuit. The fact that such a current flows alters the conditions outlined above, because the total impedance, i.e. opposition offered to the current, does not depend upon the inductive and capacitative reactances alone, but a combination of these values and the resistance. It has been stated that the two reactances are equal to $2\pi fL = \frac{1}{2\pi fc}$, and as these completely cancel at resonance the only opposition offered to the current is that of the resistance.

Conditions at Resonance

At resonance, then, it is permissible to replace the total impedance by R alone. This factor must also be taken into consideration in determining the dynamic resistance or, in other words, the total impedance at resonance.

Selectivity is technically expressed as the ratio of the reactance to the resistance, which in the case of the coil is equal to $\frac{2\pi fL}{r}$ and is sometimes referred to as the "Q" factor of the coil. Moreover, the magnification of the circuit is also determined by this combination from which it will be readily noted that the inclusion of R, the resistance, is not required where a high standard of selectivity is desired. Obviously the greater the resistance the smaller must be both the selectivity and magnification of the circuit, and in consequence of this resistance is deleterious.

The degree of selectivity obtainable also depends upon the ratio of the inductance to the capacity, $\frac{L}{C}$, and as the wavelength to which a circuit will tune is the sum of LC, if the inductance is doubled and the capacity halved, not only will the circuit tune to the same resonant frequency, but in addition the selectivity would be increased. In this way it would at first appear that the ideal tuned circuit to overcome the selectivity problem should include a large inductance and small capacity. Whilst this is true up to a point, the "Q" factor, $\frac{2\pi fL}{r}$ must be considered in the calculation from which it will be seen that as a larger inductance would necessitate a greater number of turns of wire the resistance must be increased by this addition. In consequence, the gain is not so great as might appear.

In practice the inductance and capacity are arranged to give the most suitable values for both medium- and long-wave working. With a fixed value of inductance and a given band of frequencies, the resistance is now the only factor which determines the selectivity.

For many years the problem of obtaining a high standard of selectivity has presented a difficulty to the radio set design. At different times various schemes were introduced which consisted chiefly of anti-resonant or wave-trap devices in the aerial circuit. In some instances large-diameter Litz wound coils were employed as a means of reducing the effective resistance with a given inductance value.

The type of coil largely employed in modern receivers to overcome the foregoing difficulties is the iron-cored type. These are smaller and more compact coils in comparison with the air-cored type, but also, and what is more important is that fewer turns of wire are used in obtaining a similar inductance value.

JOHN WATT'S PLANS FOR THE NEW YEAR

By "P.W.'s" Special Correspondent

BECAUSE he believes that there is a real demand for them, John Watt, B.B.C. Director of Variety, intends to continue non-vocal dance band broadcasts in the New Year. There will be three each week—"B.B.C. Ballroom," "Thé Dansant" and one late night session on Wednesdays.

John Burnaby will continue to handle the "B.B.C. Ballroom" broadcasts, and Douglas Lawrence the "Thé Dansant" programmes.

The late night programme will not come from the studios, but from an outside broadcast point.

"I am sure," says John Watt, "that there is a large number of people who loathe singers in dance bands—possibly because they have been labelled 'crooners'!"

LATE NIGHT DANCE MUSIC

Plans for the late night dance music on records, to be broadcast on the National wavelength during the first quarter of the New Year, are complete. They include the following arrangements:—

Mondays.—Record Session. A programme devoted entirely to one band each week.

Tuesdays.—Dance Music (Non-vocal).

Wednesdays.—Swing Time. This has been a Wednesday evening feature for some months and consists entirely of swing music.

Thursdays.—Dance Music. Popular current tunes.

Fridays.—Hot from the press. Recent dance tunes.

MORE DAYTIME VARIETY

John Watt intends to expand daytime variety programmes.

He feels that afternoons, particularly, have been rather the Cinderella of variety broadcasts, and as a partial corrective anyway, gramophone programmes, planned, built and produced with all the care and precision that are devoted to "live" broadcasts, will be heard more frequently by listeners during the daytime. They will be produced more on the lines of "live" variety broadcasts and will be handled by Leslie Perowne and George Gordon of the Variety Department.

"We want to get rid of the idea," Leslie Perowne said to "P. W." "that gramophone records are used merely as 'fill-ups.' We are going to try, therefore, to give our gramophone programmes more 'production' than they have, perhaps, had up to now, by means of scripts, compères, and so on. Believe it or not, people do still actually write to the B.B.C. thanking 'the announcer who chose the nice records I heard after lunch to-day.'"

GRAMOPHONE VARIETY

The projected programmes of gramophone Variety during the January–March quarter are as follows:

To-day's Favourite.—A programme devoted entirely to one British artist (fortnightly, alternating with "Americana").

Records at Random.—As the title implies, picked from a miscellaneous collection of light records (weekly).

Sound Track.—Music from films (fortnightly, alternating with "Show Tunes").

Here They Are Again.—Old dance and popular tunes played again (weekly).

Rhythm on Records.—Popular dance music (weekly).

Americana.—A programme entirely of American artists (fortnightly, alternating with "To-day's Favourite").

Show Tunes.—Music from the theatres (fortnightly, alternating with "Sound Track").

Song and Dance.—Popular dance music and songs (weekly).

Swing fans will welcome the news that a swing music feature is to be broadcast each week during the first quarter of the New Year. The first is to be called "Boulevard Rhythm," a tour of Paris night clubs and their bands, and Leslie Perowne hopes also to have a series in which each programme will be devoted to a different instrument of the dance band presented by a well-known player.

These, too, will be daytime programmes.

IN RETROSPECT

(*Continued from page* 406.)

low-frequency side increased the power output and improved the quality of loud-speaker reproduction.

The progress made in valve technique was followed by the use of automatic volume control to overcome the effects of "fading" on long-distance reception, whilst various other refinements, such as automatic tuning control and variable selectivity, gradually brought the receiver to its present stage of development.

Meanwhile high-definition television made its appearance on the ultra-short waves.

Although television is not included in the present survey, the opening-up of the wave-band below 10 metres is too significant a fact to be ignored. It clearly points the way to the future broadcasting of ultra-short-wave "sound" programmes, partly in order to relieve congestion on the medium and long waves, and partly to provide programmes of a definitely-higher musical quality than those to which we are now accustomed.

Because of overcrowding, long and medium-wave broadcast transmissions have for some time been limited to a sideband "spread" of nine kilocycles on each side of the carrier frequency, although this cuts down the full scale of musical frequencies by at least a half. By moving down to the region below 10 metres, this limitation is avoided, and a very large number of independent programmes could be transmitted at full musical quality, without any risk of mutual interference.

"METEROLOGY"

A Serviceman's Experiences

THE other day, needing an H.T. battery, I slid into one of our village radio stores. The shopman dived behind a bag of carrots and fished up a 120-volt battery. He put a meter across it. It read zero. He dived again, with the same result. Three times he repeated the operation. "Proper dud lot," he commented. It seemed too much of a coincidence, so I ventured to suggest that perhaps the meter wasn't altogether blameless. He gave it a thoughtful bang on the counter, put it across one of the batteries, and the pointer shot over to 150 volts. This seemed a bit optimistic, but near enough to the mark for practical purposes, so I risked it.

Good Batteries Sent Back

As he was parcelling it up, he remarked gloomily, "Sent three of them back to the makers last week, and I didn't half let them have it. Wonder what they'll say?" Unfortunately, wireless manufacturers are extremely tactful, or their report might have considerable entertainment value.

Few meters are as bad as that, but some of the inexpensive moving-iron variety can play puzzling tricks at times. In ninety-nine per cent. of tests they behave satisfactorily, but every now and then they will lead you up the garden. Usually I carry a moving-iron multi-range meter for rough tests, leaving my "Avo" at home for more delicate work. In two cases last year the moving-iron meter landed me in the soup.

The first was a cheap 5-valve portable of the aperiodic 2 H.F. type with a bare minimum of components. After putting it in order, I took a m/a reading of the output. It was surprisingly high. Removed the power valve. Consumption dropped 10 m/a. Ah! open grid circuit. Tested transformers. Tested everything. No open circuits anywhere. Then the solution dawned on me. H.F. currents in the meter. I hadn't a condenser with me to shunt across the meter, but next time I passed that way I took the "Avo" along. It read sedately 7 m/a.

A Puzzling Effect

The second case was still more puzzling. It was a 5-valve superhet with Q.P.P. output. With the meter in H.T. + (max.) and screen leads, readings were quite normal. But an attempt to gauge the total consumption with the meter in H.B. — lead produced a surprising result. The needle kicked right across the scale with such violence that, but for the "stop," I feel sure it would have done several complete revolutions before coming to rest. At the same time the volume from the set increased alarmingly. I switched off, and detached the meter. Volume came back to normal.

I was so surprised that I wrote to the makers. They, in turn, were equally surprised, as they had never come across a similar case. What was really puzzling was that the same meter had read, without any pranks, the output of quite a number of these receivers. An investigation brought to light no flaw in the receiver, and as the set was obviously getting plenty of bias it was judged safe to let it carry on. That was three months ago. The owner reports that the set is still going strong on the same H.T. battery. Its A.V.C. is operating correctly, and quality is up to standard. At the moment it is one of life's little mysteries, but I have a shrewd suspicion if that little moving-iron meter could only talk, it would burst into a flood of abject apologies.

E. O'M.

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S.S.