POPULAR WIRELESS, September 28th, 1929.

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

CAPT. ECKERSLEY ON TELEVISION (See Page 125)

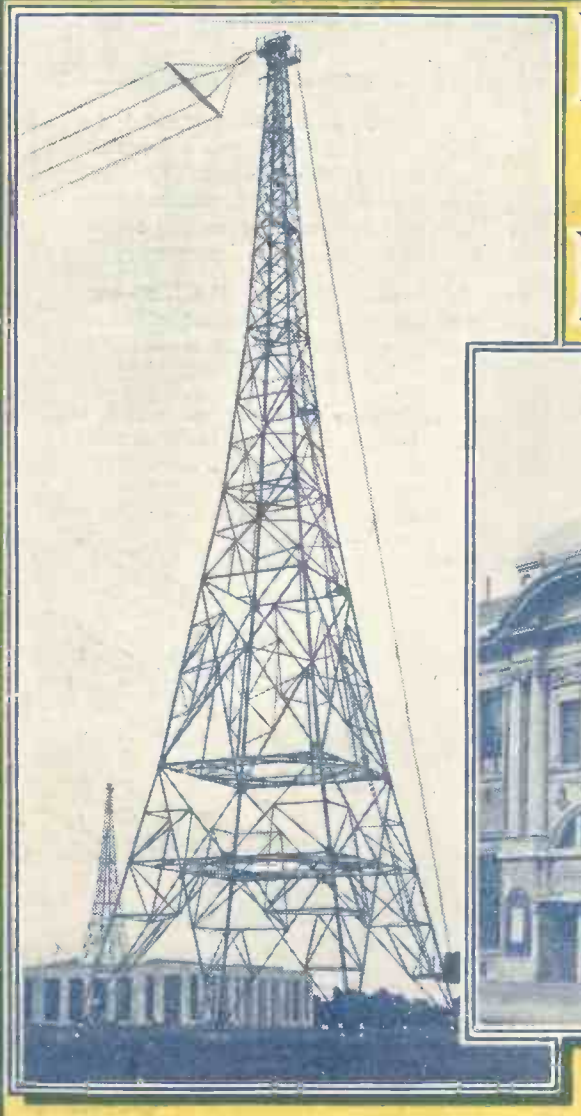
Popular Wireless

Every Thursday PRICE 3d.

No. 382. Vol. XVI.

INCORPORATING "WIRELESS"

September 28th, 1929.



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THE GERMAN RADIO EXHIBITION

BROOKMAN'S PARK

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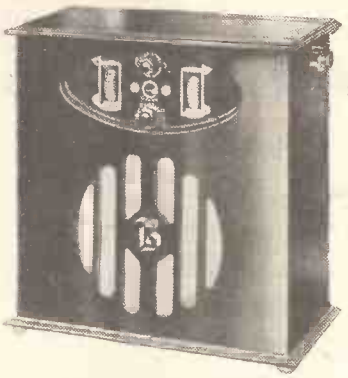

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HERE is the Set you waited for — a receiver you can build yourself that equals factory-built Sets costing three times its price! The wonderful new Brown Receiver has been specially designed for the new B.B.C. Regional Scheme — a scheme which is going to put old Sets out-of-date. With the Brown you'll be able to cut out your local station at will—and get concerts from all over Europe! Tango from Madrid, opera from Rome, dance music from Paris, chamber music from Berlin — your every whim instantly satisfied . . . *at the turn of a dial!* And never before has such a pure, mellow tone and such magnificent volume been heard from a home-built Set. The Brown Receiver is a Set you'll be proud to own—*and you can build it yourself* . . . . in a single evening . . . . even if you've never made a Set before!

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The Brown Receiver has been designed in two models—both for operation either from batteries and accumulator or from your electric light mains. The model illustrated is entirely self-contained; everything is inside the handsome oak cabinet —set, loud speaker, batteries and accumulator—*all out of sight!* Or, if you prefer it, you can build the Brown Receiver without the loud speaker. Read the following details and decide which model you will ask your Dealer to demonstrate.

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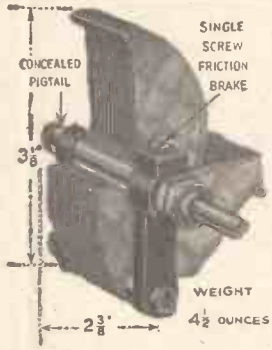
"1930" LOG (mid-line) CONDENSER



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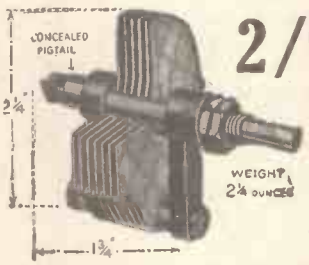
NOTE.
·00015 Double spacing for Ultra Short Wave

"MIDGET" REACTION CONDENSER



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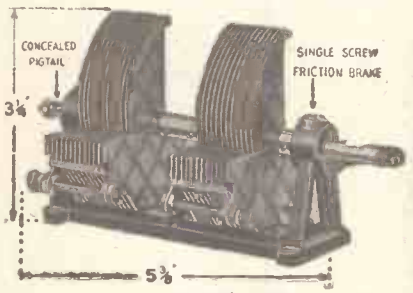
"1930" DUAL GANG CONDENSER



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FORMO Patented INTERNAL NOISELESS "PIGTAIL" is incorporated in ALL FORMO CONDENSERS

As mechanically and electrically perfect as the Formo Condensers of the last season of which we had to treble anticipated production to meet demand.

The patented features are obtainable only in FORMO CONDENSERS. The method of construction is such that the amount of solid dielectric is reduced to negligible quantity.

The "Pigtail" passes through a central hole practically the full length of the spindle, and is securely fastened to the end bearing, which is integral with the Rotor Terminal. The means employed completely overcomes the noises associated with the generally used clock spring and similar loose external devices.

The terminals are placed conveniently accessible. All brass parts are plated.

Small, elegant, but robust condensers of perfect design and workmanship and of highest efficiency.

The patented constructional features of this Gang Condenser (obtainable only in Formo Condensers) permit individual adjustment of each condenser, **thus enabling us to perfectly balance one condenser with another at all positions of the condenser movement,** without destroying the logarithmic curve. The usually-employed method of balancing condensers is by a small auxiliary condenser. This method, however, corrects errors in one position of the condenser only, and as a result the curve of the condenser is destroyed. **By the Formo method, the gang when balanced in any one position remains correctly balanced over the whole scale.**

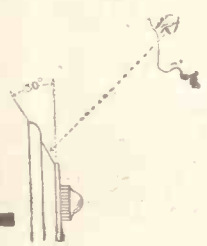
The Finest VERNIER DIAL *obtainable.*

BLACK, BROWN, **3/-** MAHOGANY, WALNUT.

MECHANICALLY PERFECT. POSITIVE BRASS CONTACT drive on SOLID BRASS SCALE ensuring smooth movement, with absolutely NO BACKLASH, NO SLIP, ROBUST in Construction and Trouble Free.
SMALL. EXTREMELY ELEGANT. EFFICIENT.

Price **3/-**

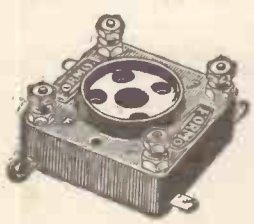
TUNING WITHOUT IRRITATING, UNCOMFORTABLE CROUCH OR STOOP.



As depicted here, the scale and aperture are inclined at an angle of 30° from perpendicular, thereby permitting convenient unobstructed view of scale without need to crouch or stoop.

Black, Brown, Mahogany, Walnut (*Black supplied unless otherwise stipulated*).
(*Centre knob nickel plated*)

Anti-Microphonic VALVE HOLDER



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Price 1/3

FORMO-DENSOR

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Ref.	*Max.*	*to Min.*	*Price.*
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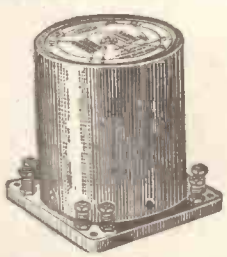
TWO-RANGE TUNER

Price 10/6
Six-Pin Base - 2/-

COMBINATION L.F. UNIT.



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The First Shrouded Transformer on the market
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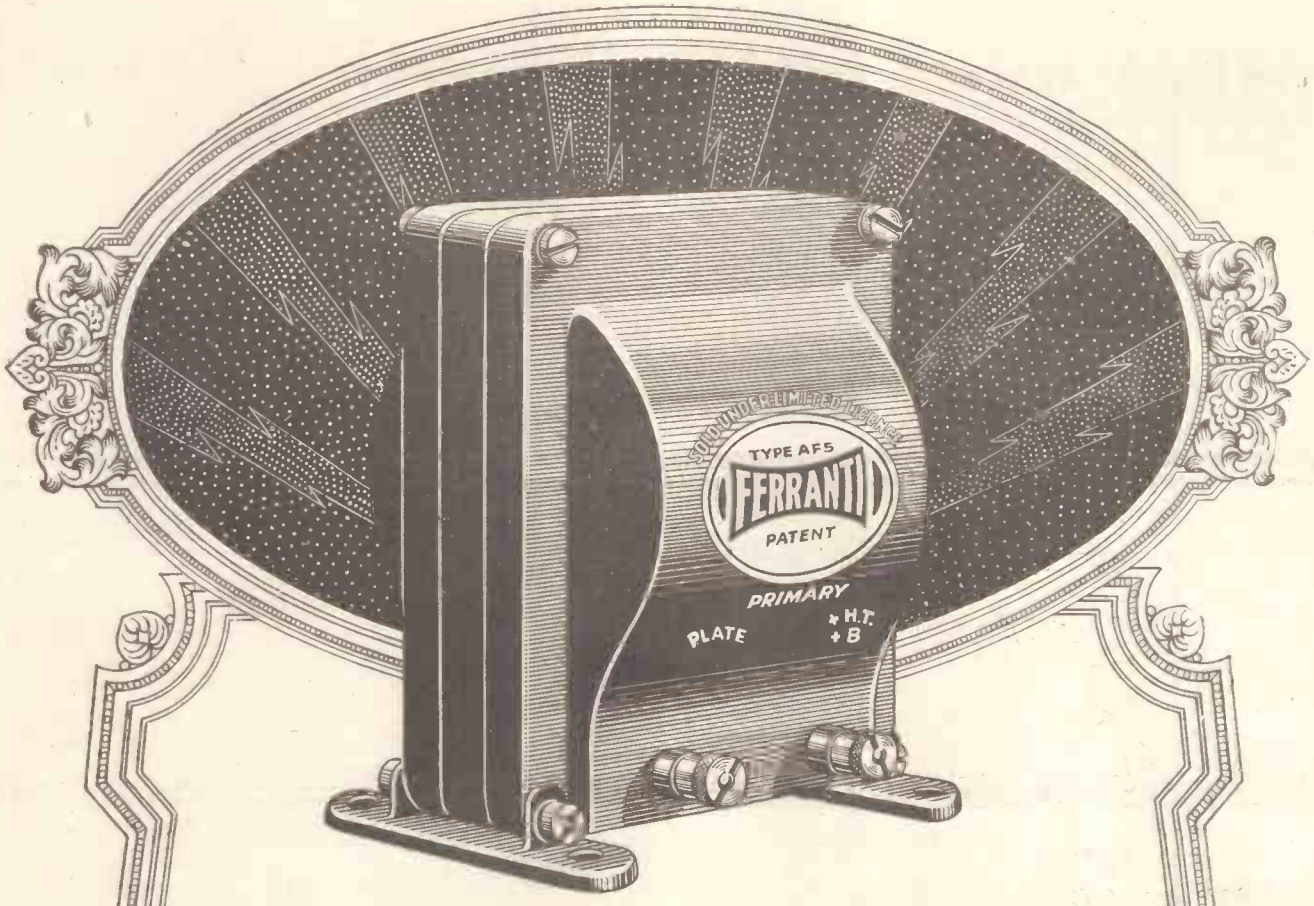

Radio is steadily improving. Transmission embodies greater skill and more efficient apparatus. Better components, better sets and more responsive speakers, with fuller knowledge of their proper use, ensure reception considerably in advance of that which satisfied not very long ago.

The Transformer plays a vital part in this advance. A good set must have a good Transformer.

The Ferranti AF5 is supreme and is the final choice of the experts.

PRICE 30/-

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FERRANTI LTD. HOLLINWOOD LANCASHIRE

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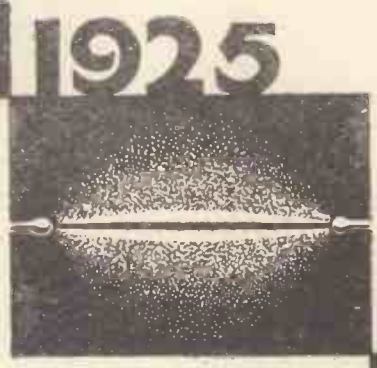
The diagram shows the small emission available with the early valves.



With the coming of the first Cossor Dull Emitter emission increased considerably.

Cossor leads again with a wonderful new filament having a colossal emission.

28% GREATER EMISSION

—28% GREATER POWER
—INCREASED VOLUME
—LONGER RANGE

WITH EVEN LOWER FILAMENT CURRENT CONSUMPTION

Filament emission determines the performance of any valve. Volume, tone, range, length of life, all depend upon emission. The NEW Cossor Valves are fitted with a tungsten cored filament which gives 28% *greater emission*. This amazing new Cossor filament is tremendously strong—stronger than steel—and yet is as pliable as whipcord. Because of its pliability it cannot become brittle. And because it cannot become brittle it will not break even after hundreds of hours of use. So, due to their 28% greater emission, the new Cossor Valves will give you greater volume, longer range and sweeter tone. And because of the tremendous strength and pliability of the new Cossor filament, they will give enormously long life. Use the NEW Cossor in your Receiver. They make old Sets like new.

The NEW Cossor

They're wonderful Valves!

The NEW Cossor is available in a complete range of types including Screened Grid, H.F. Detector, L.F., R.C., Power, Super Power and Pentodes. Your Wireless dealer stocks them.

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Popular Wireless

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MAGIC!
THE IDEAL HOME.
HAIL, COLUMBIA!
IMPROVED FILAMENTS.

RADIO NOTES & NEWS

LONDON REGIONAL.
THE HERETIC.
HUNTING FOR HILVERSUM.

"Magic."

SEVERAL lynx-eyed laddies have been provoked to write to me about that word MAGIC which has been appearing in recent "P.W.'s." "What's the idea?" they ask. "What does 'Magic' mean?"

In pursuit of knowledge, I tackled the Editorial staff, and all I got was provocative grins, winks, and mysterious nods, indicating there is something very special on the boards which is being kept secret at the moment.

What It Means.

I HATE these Sexton Blake and Edgar Wallace tactics, so I determined to have it out with the Editor himself. Boldly insinuating myself into the *sanctum sanctorem* one day I asked him straight out what MAGIC means—And what *do* you think he said?

Well it won't bear repeating—but I can tell you I had to get out quickly. In fact, like MAGIC!

Radio Saves Expenses.

APART from its ordinary virtues, such as helping to save lives and cargo and assisting generally in navigation, radio has recently proved that it can react favourably upon the economics of sea-transport. For the Institute of London Underwriters has now agreed to suspend the additional premiums charged on the insurance of vessels calling at St. John, New Brunswick, if those vessels are equipped with radio direction-finding apparatus.

The Ideal Home.

REPORTED from Copenhagen that two Danish architects have designed the ideal house. The doormat vacuum cleans your boots, the motor-car entering the garage opens the door by itself, and aerials on the roof pick up electrical energy for light, heat and odd jobs. Sounds rather like a labour-saving scheme run a bit wild. However, it is a pity they could not provide a night-silencer for the baby, and wireless forks to combat the smell of fish.

Hail, Columbia!

THE Columbia Graphophone Company seems to think that there is a shortage of radio sets in this country. At all events, it has announced that it has decided to manufacture them, and its Managing Director is reported as saying, "The radio business, in my opinion, has not really begun in England yet." Well, the more the cheaper—and better.

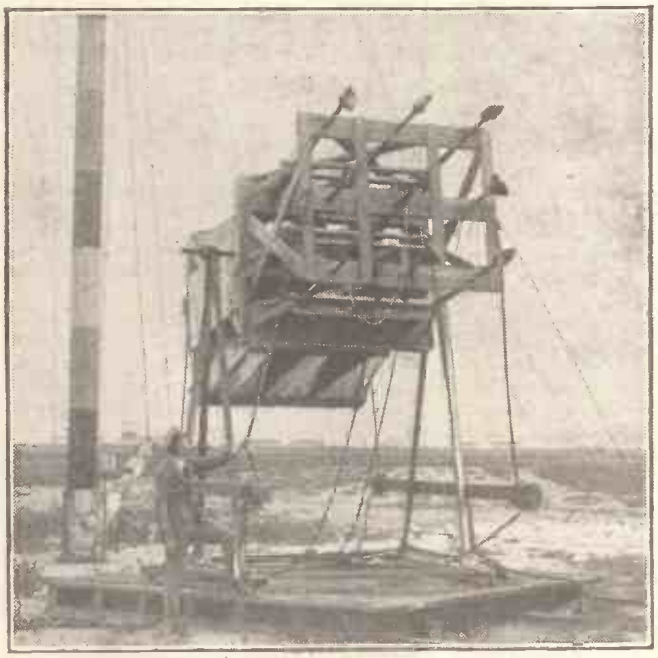
Improved Filaments.

THE Westinghouse Electric and Manufacturing Company announce the development of a new metal which they call "Konel." It was produced by Dr. E. F. Lowry as a substitute for platinum, and is saving about £50,000 monthly in the manufacture of radio valves. "Konel" is said to be harder to forge than steel, and filaments made from it have lives ten times longer than others.

The Noisy Fruit Fly.

THE idea of detecting and amplifying tiny sounds has inspired two American companies to design an apparatus with which to detect the presence in citrus fruits of the larvæ of the Mediterranean Fruit Fly. The theory is that while these chaps feed they are bound to kick up some sort of row—a top plate clicks here, or the peas roll off the knife there—and the microphone is bound to hear it. So we may expect to see American ads. bearing the slogan, "Is your grapefruit silent?"

SHOUTING TO THE ZEPP.!



This is the giant loud speaker used at Lakehurst, N.J., to shout directions at the "Graf Zeppelin" in its landing operations.

The London Regional.

REPORTS so far are to the effect that the new London Regional station comes in with excellent strength and quality. A reader (W. H. T.) who lives under two miles from Selfridge's, and feared that he was not going to have such a punch for his money when Brookman's Park took over 2 L O, writes to say that judging from the tests he has heard he will be better off than formerly. That's the stuff.

New Queen's Hall Series.

THOSE who are enjoying the present series of concerts which are being given at Queen's Hall, will welcome the B.B.C.'s announcement that the 1929–30 season of symphony concerts there will open on October 12th. There will be twenty-three, all of which will be broadcast, and three of them will be choral, "featuring the National Chorus. Sir T. Beecham, Sir H. Wood, Sir Landon Ronald, and several other famous conductors will appear."

New Education.

IF I may give a radio adaptation of a recent idea of E. V. Lucas, I would suggest that the B.B.C. should open classes in listening-in. The syllabus should include, "How to Smile During Chamber Music," "Control of Adjectives when Battery Runs Down in Middle of Item," "How to Explain to Grandma and Get The Sports Results Simultaneously," and, most important, "How to Cure Secret Non-listening."

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from previous page.*)

I Go Exploring.

I RECENTLY visited the largest battery works in the Empire, the Exide and Chloride manufactory at Clifton Junction, near Manchester, where accumulators of all kinds, from the pocket flash-lamp size to the huge batteries for submarines are made, and came away vastly impressed and pleased. The works occupy over 37 acres and give direct work to 2,000 people, and indirect employment to thousands more in branches, service stations, and other industries which supply the company with materials.

Cell Secrets.

HERE I saw the whole process from the lead pot to the packing shop, and had difficulty in tearing myself away from the beautiful machines which punch and roll and slit and pump the lead, slit the ebonite and shove the paste into plates and tubes. The painting and carpentry shops and the store-rooms fascinated me most of all, though the electricity-supply house was a close favourite and came second. One got the impression, "These batteries are scientific instruments." Everything is done thoroughly, everything is tested.

The Human Element.

THE welfare work of the firm is beyond praise. Owing to the lead and acid so largely used, especial care has to be taken to protect life and health, and this is done unsparingly and in detail, special soap and mouth washing jets, and even private tooth-brushes being supplied; dentifrice and hand cream are not omitted. Canteen, library, recreation club, sports ground, pension scheme, evening classes, dental clinic, sick club, these do not exhaust the list of benefits at the disposal of the Exide and Chloride work-people. A very pleasant and instructive day!

It All Depends.

OUR old friend, "Reynolds' News," solemnly warns its devotees that unless they live within two or three miles of a broadcasting station they need "at least" three valves to operate a loud-speaker with strength and clarity. I am afraid that our genial but inaccurate expert has been trying to build a set; hence his gloomy outlook. I notice that in reply to a correspondent he says, "All your troubles will vanish if you use rubber-covered wire for your aerial." What troubles? Is this wire a competitor of Sunlight Soap and Beecham's Pills?

The Schneider Race.

THE relay of the running commentary on the Schneider Trophy Race entailed enormous preparations in the way of equipment. More than two hundred loud speakers were distributed along the shores of the Solent, and on liners in the roadstead. The power to these was supplied by 756 valves, of which 694 were of the super-power type. For H.T. there were 392 30-volt accumulators and 186 60-volt batteries, whilst L.T. called for 227 accumulators. The total weight of the equipment exceeded twenty tons.

Wisdom While You Yawn.

I HAVE been examining the prospectus of the radio tit-bits and hotch-potch in the shape of talks which you will have to switch off until the end of the year. It gave me a pain in the neck. "How to Relax," "Vital Psychology," "History of Embroidery," "Mining Legislation," "The Church and the Economic World," "A Towel Horse Screen." These are a few of the juicier plums prepared for your delight and relaxation. Seriously, though, this programme is for women and students. *We* don't get a look in.

Hitting the High Spots.

THAT delightful tenor, Frank Titterton, in the interests of his bellows has indulged largely in hill-climbing, but has recently conceived the notion of getting aloft in an airplane in order to carry out breathing exercises in the rarefied air "up there." He recommends this to would-be singers. As for me, I strongly prefer the seclusion and security of my bathroom for singing. I have known students of the flute, however, to whom I now wish to recommend this great idea of Mr. Titterton's.

SHORT WAVES.

There is a broadcasting station in Canada operated entirely by one man. There is said to be real enthusiasm in the tones of the announcer as he introduces the comedian, the elocutionist, the singer, and the performer who does the piano interlude.—"Passing Show."

* * *

"I have no objection to broadcasting; but if I broadcast, I am going to say what I like," says Mr. G. Bernard Shaw in the "Yorkshire Evening Post."

* * *

Have you heard the story of the Scotsman who bought a valve, used it for several years, and then took it back to the shop saying he had just learned that it contained a vacuum, and he would like either a gas-filled valve in exchange, or his money back?

* * *

SMASH AND GRAB.

"Broken Window, Cut Hands, One Radio!" runs a headline in the "Streatham News." They could have had ours without all that trouble.

* * *

UPLIFTING.

A local minister recently erected an aerial over 60 feet high. We believe that, in his sermons, he always exhorts his congregation to look up to higher things.

The Heretic.

MR. G. E. MOORE, A.M.I.E.E., writing in the "Electrical Review," as a confessed radio heretic, makes several remarks which will show you the profundity of his error. "I consider that few 'ether searchers' are really unselfish enough (and skilful enough, too) to give their households radio supply from any station that is dependable and musically, or otherwise, satisfactory." Does one have to be clever in order to provide a reliable supply of radio from a B.B.C. station? If Mr. Moore thinks so, he must be a beginner.

The Prophet.

NOT often does the heretic practise prophecy, but Mr. Moore ventures. "The . . . . . amateur-made sets at present in use cannot be expected to provide ultimate satisfaction in respect of either reproduction or real service. The undoubted superiority of expertly-manufactured apparatus, coupled with rising quality, growing complexity, and falling prices must in time surely damp the ardour of most home-constructors and their now sophisticated supporters." Mr. Moore is very far from making contact with the fundamentals of the amateur radio movement, and his reference to its "sophisticated supporters" is a regrettable indiscretion.

More Heresy.

OR perhaps I should say—ignorance. "Curiously enough, the amateur wireless constructor rarely tackles the comparatively simple job of making his set really convenient. The speaker or headphones remain tied to the set. . . ." When a "fan" is continually trying new hook-ups there is no sense in his going to the trouble of installing L.S. extensions to half-a-dozen rooms; when he puts in a permanent set for the household he places L.S. plug-in sockets as required, this practice being as old as broadcasting.

A Relay Station for Newcastle.

AREN'T those Geordies the limit? One of them has pulled my leg well and truly by sending me a small clipping from a newspaper full of references to the *Newcastle relay station!* There, in cold print, it is stated that construction was in hand, and as soon as the relay got going listeners in the Newcastle area would at last be provided with real radio reception! I must admit that I rubbed my eyes and did some fast thinking before I realised that the "Newcastle station" referred to was the one in Australia.

B.B.C. and Pronunciation.

"LINGUIST'S" letter in "P.W." (September 7th) tempts me to point out that, in spite of its efforts to improve the public's pronunciation of individual words, the B.B.C. is apparently overlooking the defects in the speech of its announcers. If you will pronounce "while-sorkstra" exactly as I have spelt it, you will have an example of what a 2 L O man uttered last week. He meant "wireless orchestra." By the way, what a lot of people say "deteriated" when they mean "deteriorated." Have you noticed it?

The Hilversum Hunter.

THE writer of the "Weekly Wireless Notes" in the "Eastern Evening News," who obligingly signs himself "Ariel," as though that name were not the property of Shakespeare and "P.W.," has been asked, he says, what has become of Hilversum, and this has stumped him. He has "wandered all over Europe," and cannot find it. Sad! Let him try 1071 metres.

Radio Club Notes.

THE first radio club to show its head above ground this autumn is the Alma Radio Society, Bermondsey Men's Evening Institute, Southwark Park Road, S.E., which is now open and welcomes new members. Its meetings are held on Tuesdays and Thursdays (7.30–9.30 p.m.) under the direction of Mr. S. F. Harris (G 5 S H). Fee, 1s. per term. Plenty of tools, apparatus and advice. For further details please apply to the Sec., Mr. A. J. Hopkins, 41, Trafalgar Road, S.E.15.

ARIEL.

TELEVISION TODAY

by

CAPT. P.P. ECKERSLEY M.I.E.E.

I HAVE tried throughout my brief career with the B.B.C. to be truthful. A possibly Quixotic policy, and one that makes enemies. As one lives more with the idea of giving public service than of obtaining purely private gain, and as one's only prayer is to remain interested, the policy is not a bad one. Which brings one to the point; what is happening about Television?

I have never attempted to disguise my firm belief that wireless broadcasting has nothing to do with image sending, still or moving, so long as the wave-length problem remains as acute as at present, and so long as the technical development and/or the service aspect of image sending remain as at present.

I am as impressed as ever by the enthusiasm of the television and telepicture experts, but I cannot agree that in the present stage of development the science of television allows an immediate service aspect.

Experimental television broadcasts are to commence next week and, in view of the topicality of this fascinating article, the Editor has decided to hold over Capt. Eckersley's Exhibition article (which was announced last week) for next week's issue. New readers should note that Capt. Eckersley is a regular contributor to "P.W." and that next week, in addition to his special Exhibition article, he will commence his new Query Corner feature. We anticipate a tremendous demand for next week's "P.W," so all readers should make a point of ordering their copies early to avoid disappointment.

The transmitting end of Prof. Karolus' television system.

In Undeveloped State.

The whole point is that television is in an undeveloped state of technical perfection. Its most ardent devotees admit this, but protest that by putting over television transmissions one can vastly improve the device. That is a point I can never see. The B.B.C. never put a new type of microphone into service until they are sure that it is going to be of value from a *service* point of view and then they are only testing it for reliability and maintenance.

The microphone does not "pull itself together" as it sees the white shirt front and black tie of the announcer, and say, "Now I'll improve myself, I'm on service." I have no idea how television is going to be improved along the present lines; if I knew I'd go and do it and test the extent of my ideals as they are affected by public service versus private gain. I'm sure no one else in the B.B.C. knows how to improve it or there would be more resignations surely.

Then there is the argument that the B.B.C. are jealous. But why in the name of sanity should the Chief Engineer of the B.B.C. not wish to add to the importance of the service he controls (to some extent)? If this is a reason for denying television a fair chance, then the Chief Engineer should be sacked, whoever he is.

I have cornered some of the experts whom I know to be utterly sincere and who believe in their ideas, and they tell me there are thousands upon thousands of enthusiastic amateurs ready and willing to make up sets but who have no transmissions to play with.

Now that is getting much nearer to realities. So long as this thing is admitted to be a mechanical toy having a toy's fascination (and evanescence for each individual who plays with it), so long can we start a discussion on common ground. It is a point of view that had escaped me all along until I came into friendly talk with people who held apparently such a widely different interpretation of fact from my own.

Should B.B.C. Help?

All admit that the science is not developed; they almost agree that there are fundamental problems to be solved before, for instance, a home television set is as good as a home cinema; all agree that the romance factor is predominatingly in the question, but they will not agree that

(Continued on next page.)

The Jenkins Television Co. (of America) have opened a special television station. Here is seen the inventor of the system with one of the transmitting valves.

TELEVISION TO-DAY.

(*Continued from previous page.*)

the B.B.C. should hold aloof from giving a service, and they should refuse wide facilities.

It becomes easier to argue on this basis; should the B.B.C. or should *not* the B.B.C. take up the time of its real public in catering for those who wish to play with a scientific toy which is, so far as men of science can see, incapable of a service application or of further development on existing lines?

The B.B.C. has thought that with present facilities it would be unjust to take up programme time with television transmissions. They have lately offered a few half hours a week in the morning—this appears to me to be generous.

Further Suggestions.

But, and here is a suggestion to try to resolve difficulties, very soon there will be alternative programmes for 30 per cent of the population of Great Britain and Northern Ireland; could not the B.B.C. give up one wave-length when it is not giving an alternative programme so that the home makers and enthusiasts could play about with what I agree is a romantic and fascinating toy, but which has obviously not as yet, and may never have, a service aspect?

NEXT WEEK

Read

"This Year's Show"

A Commentary on the Wireless Exhibition

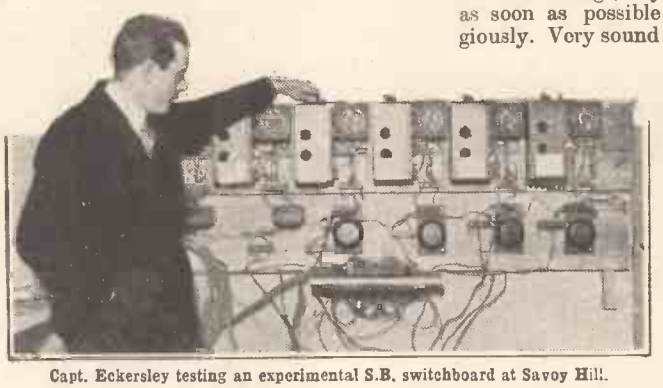
By

Capt. P.P. Eckersley, M.I.E.E

One would suggest, when the service gets going, that there is ample time on Sundays when everyone is at home and when transmission hours are at any rate short. I have never quite understood Sabbatarian policy, because its anomalies are so confusing, but surely no one could object to an occasional television transmission during silent periods for a few innocent people enjoying participation in a fascinating hobby? No one could call it mass enjoyment, so surely no one could complain.

Even if Sunday is out of the question, there are other times. It is rumoured, for example, that there will be no alternative programmes after 10.30 at night. Surely then that could be a time for those who wish to be amused with their hobby. I, for one, would be delighted to see the B.B.C. co-operate in this way.

Finally (and as I am no longer an official factor in this business), might I suggest to the Television people that their best policy is to come out openly and stop all this nonsense about television allowing one to see beautiful actresses in romantic plays, or football matches in Australia, but to say rather that Television affords an interesting hobby to those that dabble, or a quiet entertainment to those who are amused by little scientific marvels? Then surely the matter could stand on the basis of reality.



Capt. Eckersley testing an experimental S.B. switchboard at Savoy Hill.

Meanwhile, Germany has made up a "neutral" transmitter so that any type of receiving set can be bought or made by the public. This is another good idea.

The Side-band Problem.

The Americans have publicly stated that television transmissions demand 100 kilocycles of side-band. The B.B.C. stations could never be made to give this width, not only because the waves used are unsuitable, not only because the whole system would be grossly inefficient, but largely because international agreement limits the side-bands of a broadcasting station to 10 kilocycles.

The Americans are putting up a short-wave set of high power so that they can transmit television to whomsoever wishes to receive it. Would it not be wise for the television people in England to explore the possibility of their using a short-wave channel simply for developing television (cinema film transmissions, for example), and leave speech and music to the stations which can efficiently transmit this type of entertainment.

Something ought to be done to stop this idea that the B.B.C. are holding up a great British invention. As I see it, they are in this case trying to uphold the rights and interests of a majority.

In the centre is seen Mr. Mihaly, the Hungarian television experimenter, at the Berlin Radio Exhibition.

MEASURING THE MILLIAMPS.

FROM A CORRESPONDENT.

THERE is probably nothing which the experienced wireless man more loves to tell the beginner than that he must, above all things, buy himself a milliammeter as soon as possible and use it most religiously. Very sound advice, too, in its way; but just a few words on how to get as much information as possible from the meter would not come amiss.

First of all, one wants to know how much current the whole receiver is taking from the H.T. battery, with a view to forming some idea as to how long the latter ought to last, which really means whether or not it is big enough to stand up to the load imposed upon it by your particular set.

An Important Point.

For example, if you find that your set is taking something not more than 7 milliamps, you know that it is quite safe to run it on one of the ordinary standard size H.T. batteries. Again, if you discover you are taking perhaps twelve milliamps, you ought to have at least a double-capacity battery, and so on.

This first useful piece of information can be obtained by connecting your milliammeter in such a position that it measures the total consumption of the set. To do this you must insert it in series in the lead between the H.T.— terminal on your set and the negative socket on the battery. This wire carries the anode current of all the valves, and so it tells you what you want when the meter is inserted here.

Then, again, you want to know whether your power valve is being correctly treated as to grid bias. You can find this out by inserting the milliammeter in such a position that it measures the current to the last valve only, and then if you have the maker's chart you can see whether the current indicates that a suitable amount of bias is being applied for the particular high-tension voltage in use.

Checking the other Valves.

Measuring the H.T. current to the other valves is just a matter of putting the meter in series with the leads going to the various positive terminals on the set for the detector and the H.F. valve or valves; and this is not as a rule, particularly instructive. One does not generally make adjustments of the H.T. voltage here by means of a meter, but rather by trial and error on actual reception. At the same time, it is just as well to take the measurement when you know that your valves are working properly, and make a note of the figures obtained for future reference, because then you will always be able to tell whether your valves have lost their emission if the question should ever arise.

MORE ABOUT THE EXHIBITION

This forms the completing section of a fascinating stand-to-stand review of the exhibits at Olympia. The first portion of this interesting article appeared in last week's "P.W." Next week a candid critique summarising the show will be published.

MAINTEN MFG. CO., LTD.
Stand No. 226.

Here are shown a full range of A.C. and D.C. mains units, and an all-mains three-valve receiver which makes its first appearance on the market at the exhibition.

MARCONIPHONE CO., LTD.
Stands Nos. 79, 80, 81, 82, 83, 84.

To describe the Marconiphone exhibits in detail would take a full issue of "P.W.," but it would certainly make interesting reading. And even a summary is going to be difficult in the space allotted.

There are receivers, loud speakers, mains units, valves, batteries, eliminators, transformers, public-address outfits, and, in fact, there is a small exhibition of its own. There is an eight-valve frame-aerial super-het. which has a single tuning control and a remote control of volume, and we note that another entirely new Marconiphone receiver operates from batteries or A.C. mains and incorporates three of the upright, screened-grid valves, a detector and a pentode. It is entirely screened, and the operation is greatly simplified by means of ganging, the tuning controls thus being reduced to two. A switch controls the wave-length range and brings in a gramophone pick-up if desired.

The connections to the set are made by means of a patent system of interchangeable cables, which can be attached to batteries or a mains unit with no alteration to the set itself.

There is a new, moderately-priced Marconiphone five-valve portable, and a new four-valve receiver in a metal cabinet designed solely for use with A.C. mains. There is a special short-wave three-valver, of which a special model for tropical climates is made.

An entirely new moving-coil, and a new cone figure in the loud-speaker section of the display, and we note that the range of mains units includes several new models having exceptional attractions.

METRO-VICK SUPPLIES, LTD.
Stands Nos. 148 and 152.

Metro-Vick Supplies, Ltd., are in effect distributors of the radio gear manufactured by leading wireless concerns, and some of the very best apparatus to be found in the whole of Olympia is on these stands. Particular attention should be paid to the mains-driven receivers and mains units, of which excellent examples are shown. Since the fusion of Ediswan, B.T.-H. and Metro-Vick interests, the scope of M.V. Supplies has been very considerably widened, and these stands should on no account be missed.

This is the famous Burndept Screened Portable, which is one of the most interesting exhibits at Olympia.

MIC WIRELESS CO.
Stand No. 56.

Zampa moving-coil loud speakers, Zampa aerial tuners, linen diaphragm loud speakers, radiogramophone amplifiers for A.C. mains operation, and a cone chassis are features of this display.

The B.T.H. Junior R.K. Reproducer—a modern representative of a classic series of moving-coil loud speakers.

MONTAGUE RADIO INVENTIONS & DEVELOPMENT CO.
Stands Nos. 52, 53 and 54.

Beethoven portable receivers and radio gramophones are being shown to the public for the first time.

MULLARD WIRELESS SERVICE CO., LTD.
Stands Nos. 134, 135, 136, 137, 58 and 117.

Here is a wonderful array of valves, and one that is completely comprehensive. Super-power types, screened-grid, pentodes, indirectly-heated A.C. types, directly-heated A.C. types, rectifying valves, and, in fact, valves for every purpose are on show. Other Mullard items are the Permacore transformer, which is exceptionally small and efficient. The famous Mullard Pure Music loud speakers, Mullard P.M. R.C.C. units, supply units for A.C. mains, the Mullard P.M. filament transformer, wire-wound anode resistances, condensers, and potential dividers are on view. A visit to Olympia would be quite incomplete without some fair allotment of time devoted to the Mullard display.

ORMOND ENGINEERING CO., LTD.
Stands Nos. 118 and 121.

The Ormond people have some interesting radio sets to show this year. There is a radio-gram outfit, which is a combination of a four-valve radio receiver and electric gramophone, that will command attention. The Ormond portable also takes the opportunity of making its bow to the public.

An item of particular interest to set constructors is a four-pole loud-speaker unit which is undoubtedly a sound engineering job. The range of Ormond condensers is remarkably complete and includes ganged models and various slow motions in several types. Filament rheostats, L.F. transformers, and a really fine display of dials, are to be seen at these stands.

PAROUSSI, E.
Stand No. 209.

"P.W." readers will quickly spot the Paroussi version of the famous Titan coil on this stand. Screens and screening boxes are specialities of the Paroussi people and a representative collection of these is shown. Every type of screening arrangement that has figured in "P.W." sets is to be seen. Visitors will be able to appreciate the clean finish that marks a Paroussi production.

PARR'S ADVERTISING LTD.
Stand No. 224.

Here is a selection of the actual products which this firm advertises together with reproductions of advertisements and leaflets prepared and published by them. They are also showing the poster design which secured second place out of 500 applications for the open poster competition organised by the radio exhibition authorities.

PARTRIDGE & MEE, LTD.
Stand No. 98.

Mains transformers and smoothing chokes, filter chokes, and H.T. and L.T. units are the chief items on this stand.

PETO-SCOTT, LTD.
Stands Nos. 42, 43 and 44.

The principle exhibits on these stands are fine radio-gram receivers. Of course, the well-known Peto-Scott "Sociable" three, an entirely self-contained set covering both wave-bands, is on view. Also the Peto-Scott "All-British" six, a multi-valver of merit is here. The Peto-Scott "Rover" five portable receiver is shown. These people are also

(Continued on next page.)

This Ormond Receiver is one of the leading attractions at Stands Nos. 118 and 121.

MORE ABOUT THE EXHIBITION.

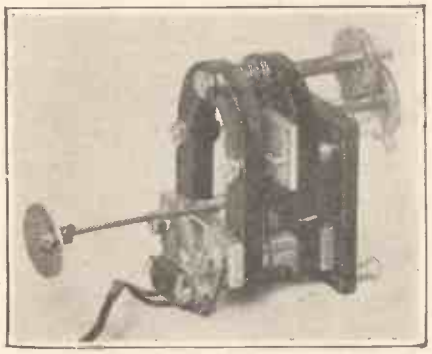
(Continued from previous page.)

exhibiting their "Hotel" electric gramophone which gives you distortionless reproduction of any strength from a whisper to concert-hall volume.

PHILIPS LAMPS LTD.
Stands Nos. 169 and 170.

The Philips show is a good one this year. These are just a few of the items on view. All-electric receiver, type 2514, which employs an S.G. and a pentode, and operates completely from A.C. electric mains. The all-electric receiver, type 2511, which is a de-luxe mains outfit. Its cabinet has a walnut finish and two S.G. valves, and a pentode figures in its circuit. An interesting point is that the receiver can be locked when it is not desired to use it.

There is a Philips H.T. supply unit with four optional anode voltages and one fixed and two adjustable



The Star Duplex Loud Speaker Unit, which the Standard Battery Co. are showing for the Shaftesbury Radio Co., an allied concern.

grid-bias voltages. The Philips battery charger, type 306, is useful for charging both H.T. and L.T. radio batteries, and requires no adjustment under varying loads.

The new permanent-magnet moving-coil loud speaker is sure to attract considerable notice. Its magnets are of a special steel, having an unusually high magnetic flux density. This speaker can be supplied with a built-in, step-down transformer by means of which the moving coil is matched to the

The "Major" Radio Gram cabinet, one of the fine pieces of wireless furniture shown by the Carrington Mfg. Co., Ltd.

The Hart Rado, a 30-volt H.T. accumulator unit, with the capacity of 3 ampere hours.

output of the receiver or amplifier with which it is working. Rectifying valves, public-address amplifiers and loud speakers are also displayed.

RADIO INSTRUMENTS, LTD.
Stands Nos. 122, 123, and 124.

No "P.W." reader should miss these stands, where there is a special exhibit illustrating the development of broadcast apparatus made by the R.I. people since 1922. This exhibit shows the evolution of the low-frequency transformer from the year 1922 and includes the first type of inter-valve transformer designed by Latour. There are also high-frequency transformers, a five-valve set, and a number of other interesting accessories popular in the early days of broadcasting.

Coming to the present, the R.I. people show for the first time some wonderful new mains sets. There is a transportable all-electric three-valve screened-grid receiver, which needs no aerial of any kind. It has not even got a frame aerial. Nevertheless, such is its power that it provides a wide range of programmes. The mains part of the instrument is fitted in a separate compartment below the set. The set itself is completely screened, the whole of the metal case being contained in a box, so that lifting the instrument's lid the top of the screening panel alone is seen.

It is undoubtedly one of the most efficient receivers that has so far been produced irrespective of the number of valves.

A complete range of mains units and mains unit components are also shown by the R.I. people, and you can be sure that the now-famous "Hypermu" L.F. transformer is prominently brought forward.

READY RADIO, LTD.
Stand No. 93.

Ready Radio are exhibiting two new and most interesting products. The Ready Radio selectivity unit, which has become familiarised by the name of "Susie," is a device that is remarkable for its simplicity and efficiency. The Dynamic Reproducer is a new kind of loud speaker, the great features of which are crisp reproduction of speech and faithful response over the whole of the musical scale. Arrangements have been made to demonstrate this loud speaker to all visitors at the firm's showrooms at 159, Borough High Street, S.E.1.

REGENT RADIO SUPPLY CO., LTD.
Stands Nos. 16, 17, and 18.

One of the most interesting aspects of this year's show is that for the first time mains units and sets are given universal prominence. There are almost as many instruments of this type as there are battery-operated outfits. But we are inclined to mistrust the mains productions, due to some of the smaller firms, that have been rushed out to satisfy a growing demand.

However, at the "Regentone" stands, visitors can examine mains gear that is built by a large concern with an established reputation for dependable products. And, let it be said, the prices are right, too.

We notice that the Regent Radio Supply Co. has an even wider range than ever, and on their stands are mains units for all purposes. Of particular interest to "P.W." readers will be a range of components for the home constructor, which include "power boxes" and "filter compacts" all ready for dropping into sets.

And the "Regenstat" must not be overlooked, for this is a resistance of the power type smoothly variable from 250 to 4,000,000 ohms. It can handle up to 10 watts, and has many uses.

All the "Regentone" A.C. mains units embody Westinghouse metal rectifiers. These units are of most distinctive design, and we notice that their outputs are of most respectable order. For instance, the H.T. model W2 gives you a smoothed supply up to 200 volts 100 milliamperes, which is more than enough for the largest of household sets.

Then there is a combined H.T. and L.T. unit of an exceptionally interesting character that should not be missed. Visitors should also note the fine construction and finish of the permanent charger and rectifier units which also figure on the "Regentone" stands, which are indeed laden with good things in the way of mains devices.

SIEMENS BROS. & CO., LTD.
Stands Nos. 69 and 71.

Siemens Bros. & Co., Ltd., tell us that they were so impressed by the position afforded them at last year's radio exhibition that they have secured the same stands again this year. Nos. 69 and 71 have been converted into one stand.

The exhibit consists principally of H.T. and L.T. dry batteries, re-chargeable H.T. and L.T. Leclanché cells and grid-bias batteries. The H.T. battery exhibit includes the popular type, the power type, the super-radio battery for multi-valvers and special high-capacity batteries for portable sets.

A section of the exhibit is devoted to batteries particularly suitable for use abroad where the climatic conditions are usually adverse to primary cells. Crystacel L.T. accumulators of the glass-cell type are included, and we understand that these are now supplied with metal carriers. Two high-class radio testing instruments are shown. Visitors should make a point of securing an interesting booklet that the Siemens people are distributing. This is entitled "Inside Knowledge," and is an informative and well-written production.

SIX-SIXTY RADIO CO. (THE ELECTRON CO.) LTD.
Stand No. 288.

The Six-Sixty Radio Co., Ltd., was formerly the Electron Co., Ltd., and it changed its name in order to bring its title more in line with the names of its well-known productions. They are of course, showing a full range of Six-Sixty valves, and it is interesting to note that these include four types of A.C. valves. Six-Sixty cone speakers, turntables, and cone speaker paper, are also being exhibited at this stand.

STANDARD WET BATTERY CO., LTD.
Stand No. 57.

Visitors should not miss the opportunity of being able to examine at close quarters the various H.T. batteries produced by these people. They will then be able to see that the batteries are far from being the messy propositions many people may think them. Far from being this, they are definitely serious alternatives to any source of H.T. supply for any type of set. The Standard Wet Battery Co. are also showing a new testing unit of ingenious design.

Two of the new Westinghouse Rectifier Units which are shown. Westinghouse units figure in a very large number of mains units and sets shown at Olympia.

SWIFT, LEVICK & SONS, LTD.
Stand No. 240.

All kinds of permanent magnets, cast, bent and stamped in Cobalt and tungsten steels, as used in the radio industry for loud speakers, telephones, pick-ups, measuring instruments, etc., are exhibited here, together with moving-coil loud-speaker magnets, and a specially designed balanced-armature loud-speaker magnet.

SYLVEX, LTD.
Stand No. 231.

Radio crystals and permanent detectors are shown, as well as frame aerial wires and cone papers.

TELEGRAPH CONDENSER CO., LTD.
Stand No. 248.

A comprehensive display of all types of fixed condensers, including paper and mica types for radio reception and transmission, as supplied to the Admiralty and P.O., etc. There are also on view high-voltage smoothing condensers, some of which are tested as high as 80,000 volts D.C., together

(Continued on next page.)

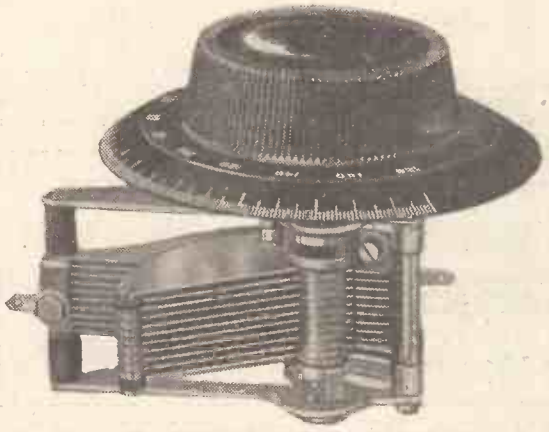
Two Colvern coils. The Colvern people are displaying an excellent range of coils and coil-formers, and various kinds of screens.

MORE ABOUT THE EXHIBITION

(Continued from previous page.)

with a representative type of condenser as recently supplied to the B.B.C. for their new station at Brookman's Park.

T.C.C. electrolytic condensers are shown, and their compactness, in view of their astonishing capacities, will amaze those visitors who have not seen components of this kind before. One of the T.C.C. electrolytic condensers has a capacity of 2,000 mfd.,



A J.B. variable Condenser exhibited by Jackson Bros. It decidedly merits a close examination, for it is an excellent example of modern wireless instrument work.

while there is another of the double type, having a capacity of 4,000 mfd., sub-divided into two sections of 2,000 mfd. each. In this kind of condenser, the electrolytic, the T.C.C. people are showing something entirely new, that is an electrolytic condenser capable of standing up to 40 volts D.C. Its minimum capacity is rated at 500 mfd., and it is contained in a remarkably small case.

Of particular interest to mains-unit constructors is a complete range of sub-divided block condensers in various types and sizes, and in all voltages. Altogether the T.C.C. display is one that no constructor should miss, for although the display is, in a sense, limited, it must be remembered that here we have specialists in the true sense of the word, and the products of specialist manufacturers are always worthy of close inspection.

TELSEN ELECTRIC CO., LTD.
Stand No. 110.

One of the components on this stand is the smaller Telsen L.F. transformer, which is capable of giving a performance out of all proportion with its size and price. There is a bigger Telsen L.F. transformer on view, and the virtues of this one are equally attractive. Those visitors to the exhibition who are contemplating the construction of a set requiring an L.F. transformer should certainly go along to stand 110 and see what the Telsen people have to offer.

TRELLEBORG EBONITE WORKS, LTD.
Stand No. 281.

The latest range of Trelleborg ebonite specialities and radio components, including samples of special

The Six-Sixty Radio Co. prominently display this handsome cabinet cone loud speaker on their stand.

machined work as supplied to the leading manufacturers, are displayed here.

TRUPHONIC RADIO, LTD.
Stand No. 167.

Among the quite new Truphonic lines on show are a mains unit and trickle-charger combined for use with a Truphonic portable, thus transforming it into an all-mains outfit. There is also a Truphonic all-mains portable receiver, and a five-valver of the long-range type covering both high and low wavelengths.

ULTRA ELECTRIC, LTD.
Stand No. 106.

Here are shown the Ultra Air Chrome series of loud speakers which include two cabinet models and three chassis models for manufacturers and home constructors. The special feature of the Ultra Air Chrome speaker is the patent double diaphragm, one comparatively small, which reproduces the higher frequencies, the other fairly large, dealing faithfully with the lower frequencies. The diaphragms are simultaneously operated by a balanced-armature movement.

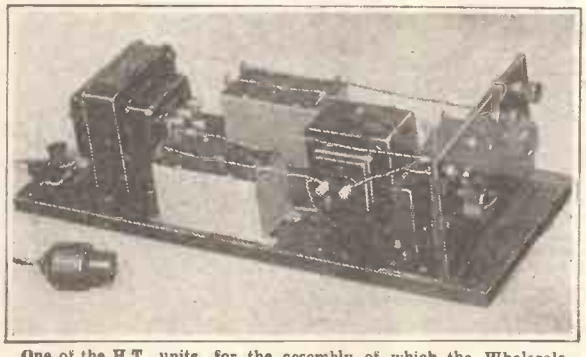
The diaphragms themselves are constructed of specially prepared linen. The Ultra Air Chrome portable five receiver is also to be seen. This set embodies an Ultra Air Chrome speaker chassis, and the five-valve circuit comprises 2 H.F.'s, detector and 2 L.F. stages. The tuning control is in the form of a drum drive, and a three-way switch gives both wave-change and on-off switching.

UNIVERSAL GRAMOPHONE AND RADIO CO., LTD.
Stands Nos. 100, 40 and 41.

The Truvox range of gramophones, radio-gramophones and loud speakers is distinctly interesting. The loud speakers incorporate exponential horns which are claimed to give exceptionally good results. The Murkham pick-up is another special proprietary line embodied in the Truvox radio gramophone.

VANDERVELL & CO., LTD., C. A.
Stand No. 120.

A new H.T. accumulator which makes its introduction to both the trade and public at Olympia this



One of the H.T. units, for the assembly of which the Wholesale Wireless Co. supply kits of parts.

year is one of the special features of the C.A.V. exhibit. Backing this up there is a wide range of batteries for all radio purposes.

VARLEY (OLIVER PELL CONTROL), LTD.
Stands Nos. 154 and 155.

The Varley people have an excellent show of interesting apparatus. Particularly notable is the new gramophone pick-up. The special suspension arrangement employed in the device leaves the armature extremely flexible, so that while there is no serious damage to the record there is also no serious chatter. The scientific nature of the design will be appreciated by all visitors who are able to inspect it closely.

Also prominently displayed is the Varley Ni-core L.F. transformer which is very small but very efficient. Looking at the tiny component in its small, attractive bakelite case, one marvels at the progress that has been made in this type of component during the past few years. Its compactness has, of course, been achieved by the employment of a special nickel-iron alloy core. The Varley people are also showing a panel potentiometer which fulfils a long-felt want. It is available in various resistances from 400 ohms to 50,000 ohms, and it will carry loads up to 25 watts. A unique feature of this device is that its resistance element is interchangeable.

Transformers and L.F. chokes for every conceivable purpose in radio reception are also to be seen at the Varley stand. We must not forget to make mention of the new Varley three-valve mains set, and the new Varley radio-gramophone which occupy prominent positions and are most attractive exhibits. Undoubtedly the Varley show is an excellent one and P.W. readers should make a point of allotting ample time for inspecting it.

Visitors should pay particular attention to the excellent mouldings that figure in Brownie Wireless productions, of which the above is a sample.

WARD & GOLDSTONE, LTD.
Stand No. 290.

Titan set constructors will get a thrill at this stand for, prominently displayed, is the Ward & Goldstone version of the "Titan" unit. But this is only one of quite a host of interesting lines on view. For instance, there is the "Negrolac" aerial, and plug-in coils to suit all wireless constructional sets.

Again, there is a fine range of mains units, while mouldings made for the radio industry in black, brown and other colours are featured. Silk, cotton and Litz wires, multiple radio cables, Quick-grip connectors, Morse keys and sounders, H.T. eliminators, and a representative group of fixed condensers are just a few of the other items that visitors should not fail to examine.

WATMEL WIRELESS CO., LTD.
Stand No. 111.

A stand well worth inspection for it carries some individual productions. The Watmel anto-choke is prominently displayed as is also a constructors' receiver which, although straightforward, has many attractive features.

WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD.
Stands Nos. 13 and 14.

"Install them and then ignore them," is the interesting catch-phrase evolved by the Westinghouse people in reference to their now very well-known products. The entry of these railway signal manufacturers into the radio industry was of a spectacular nature, for but few months elapsed before their rectifiers were in almost universal use. At this show they have new models for exhibition, in addition to the established models which were shown last year. They have a universal charging set designed for battery service station use. This outfit has four circuits, and it can deal with H.T. and L.T. radio accumulators as well as large car batteries.

All mains enthusiasts should visit the Westinghouse stands and acquire any literature that may be available.

(Continued on next page.)

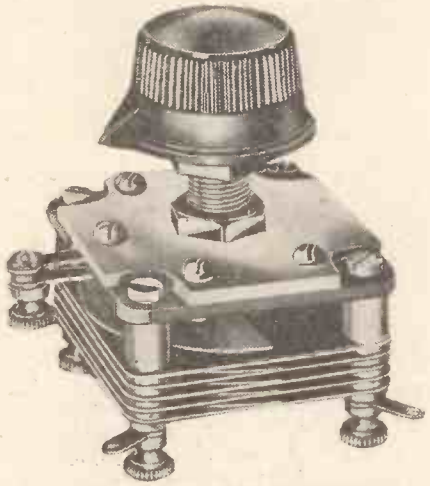
This is a photo of one of the high-class testing instruments Siemens Bros. and Co., Ltd., are exhibiting this year.

MORE ABOUT THE EXHIBITION.

(Continued from previous page.)

WHITELEY, BONEHAM & CO., LTD.
Stand No. 66.

Here are to be seen the famous W. B. valve holders, trustworthy items that are included in the best of sets. Visitors will have the opportunity of seeing exactly what a valve holder should be, for although it is a small component its real importance can hardly be over-rated.



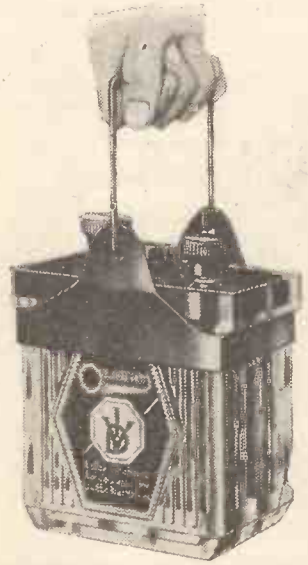
One of the beautifully fashioned variable condensers that figures in the comprehensive display of the products of Garnett, Whiteley & Co.

WHITTINGHAM, SMITH & CO.
Stand No. 113.

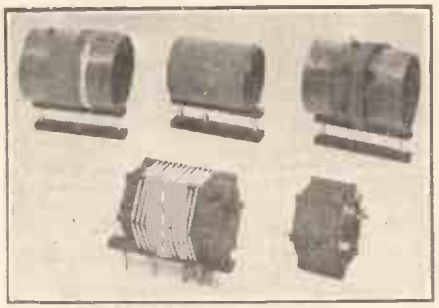
The Portadyne Screened Grid is a portable which will attract attention, while the Portadyne Super Five is an addition to the range of receivers produced by this firm which is certainly deserving of close examination.

WILKINS AND WRIGHT, LTD.
Stand No. 115.

This firm are the makers of the well-known Utility productions. In addition to their switches, which are of unique characters, they are showing low-loss condensers, gauged condensers, drum dial condensers, and Micro dials. There are also Utility thumb control dials, which strike a very modern note. The Utility thumb control dial embodies the mechanism of the ordinary type of micro-dial and both coarse and fine adjustments are provided.



Amateurs should note the handy carrier which the Oldham people supply with certain types of their accumulators. The carrier is a great advance over a box for the purpose.



A group of the "Parex" coils which are to be found on Messrs. Paroussi's stand.

WINGROVE AND ROGERS, LTD.
Stands Nos. 128 and 133.

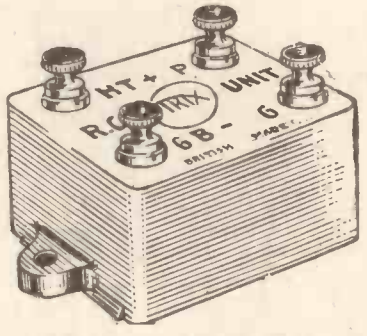
Here are to be seen the various Polar productions. Slow-motion dials, slow-motion condensers, potentiometers, coil holders, and a cone loud speaker having a balanced-armature movement are the main items.

WRIGHT AND WEAIRE, LTD.
Stand No. 221.

In an excellent range of coils is to be seen the famous "Titan" coil unit. There are also switches of heavy, light and rotary types. The heavy and light types of switches have been marketed by Wright and Weaire for some years, but the rotary type is new and it is interesting to note that it can be used in many combinations, including ganging, and for radio-gram work.

Other switches shown are the push-pull, wave-change, and series-parallel, and a switch incorporating a condenser for aerial-loading. This last is a unique device that should achieve great popularity this season.

The full range of mains components which figure on this stand include five-pin valve holders, heavy duty L.F. chokes, transformers, potential dividers,



This is an R.C.C. unit which, among other products, figures on the stands of Eric J. Lever (Trix) Ltd.

and volume controls. Paxolin panels, formers and Empire tubing are also to be found here, while the general components embrace a full range of chokes for short waves, standard and iron core H.F. choke coupling resistances and screens.

THE B.B.C. EXHIBITS.

No radio exhibition would be complete without an exhibit arranged by the British Broadcasting Corporation. At Olympia one can examine in detail at the various stands every conceivable type of modern radio set, component and accessory. These completely cover the listener's "end of the ether," as it were, but an equally important "end" is that from which emanates the wonderful transmissions of music and speech.

It will be remembered that last year the B.B.C. had a series of tableaux illustrating the development of music from the first dawn of musical sense in man up to the present day. We remember that at the time this display was criticised by some as being rather "highbrow." Nevertheless, thousands examined it and long queues waiting to do so could be seen any evening.

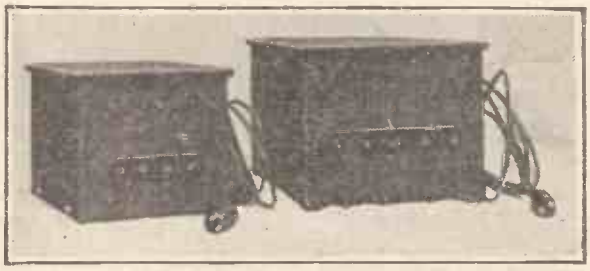
This year, however, the B.B.C. exhibit is of a much more immediate character, and it deals with the behind-scenes phases of broadcasting as carried out in modern times.

There is a series of models very artistically produced, and these are arranged in a logical sequence.

First of all, there is shown a model of Savoy Hill, where on one side of the building can be seen a studio, and on the other side is the London control-room, which represents the second stage in the operation of broadcasting.

Visitors will be able to note all the interior fittings of a modern broadcasting building that are directly concerned with the emission of programmes. Of course, there is much concerning the executive and administrative activities of our broadcasters which cannot be shown even in the ample space allotted.

After the control-room there is shown a model of the Oxford Street transmitter. It is to here that electrical reproductions of the speech and music



Two neat and compact mains units due to Messrs. Ward and Goldstone, who are showing some excellent gear.

energy collected in the Savoy Hill Studios are carried by land-line for conversion into ether waves.

The final stage in the wonderful chain is illustrated by what our broadcasters deem to be a representative listener's home. Whether or not the average visitor to Olympia accepts this as his "average" home we shall never know. Nevertheless, it is a fine pictorial model and completes a nobly conceived and artistically executed display.

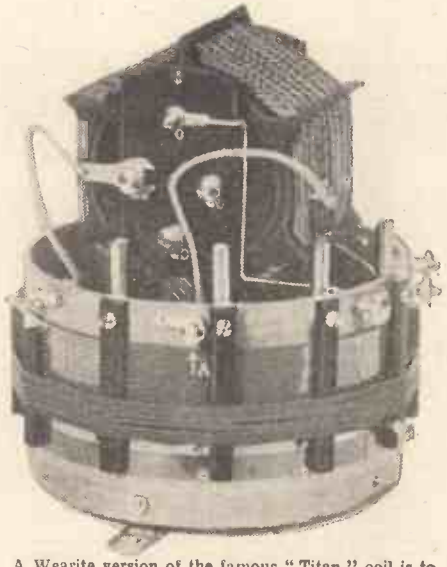
Another interesting feature of the British Broadcasting Corporation's show is a model of the very latest type of broadcasting studio used by the B.B.C. An endless amount of research has to be carried out in connection with the design of studios for broadcasting, and this model will show the type of studio that has been found most suitable for general purposes.

It is on the lines of this fascinating model that the main studio at the new Broadcasting House will be designed.

AND IN CONCLUSION—

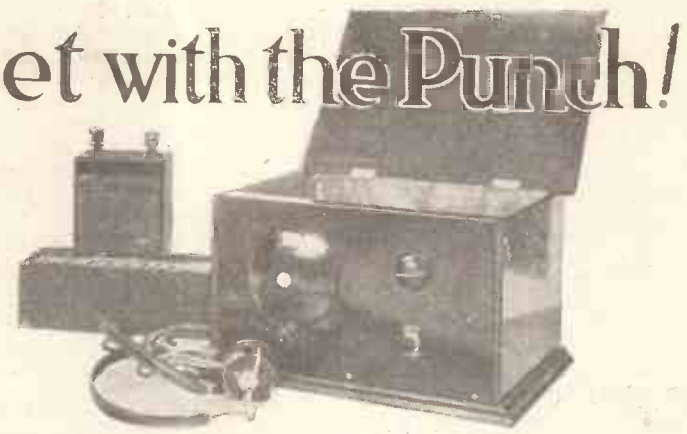
Your official guide will tell you all about the restaurants, post-office arrangements, bands, staircases and so on, but MAKE A SPECIAL NOTE that we want to see you all at Stands Nos. 246 and 249, whether you have radio problems to solve or not. Come along and give us a "Cheerio!"—it is the one chance in the year for us to meet you.

DON'T FORGET TO PAY US
A Visit at Stands Nos. 246 and 249 where Technical Experts are in attendance to answer queries, and original Models of "P.W." Sets can be seen.



A Wearite version of the famous "Titan" coil is to be found on the stand of Wright and Weaire, Ltd.

"JUDY"—The Set with the Punch!



A remarkable little set on decidedly original lines. It is a receiver which will make many friends among constructors who appreciate the finer points of pleasant operation and high sensitivity.

Designed & Described by the "P.W." RESEARCH DEPT.

"JUDY," somehow, does not suggest a very attractive sort of person, but nevertheless, everybody who has made the acquaintance of this particular Judy has succumbed to her charms with great completeness. She really is a very fascinating little person, and what she may lack in looks is amply made up in charm of manner.

Now, "Judy" really happened quite by accident, and you may be interested to know how it came about. Well, some little time ago we realised that we were getting a little bored with the general run of single-valvers in the "P.W." Research Department, and decided that something must be done about it, lest our readers begin to feel the same way.

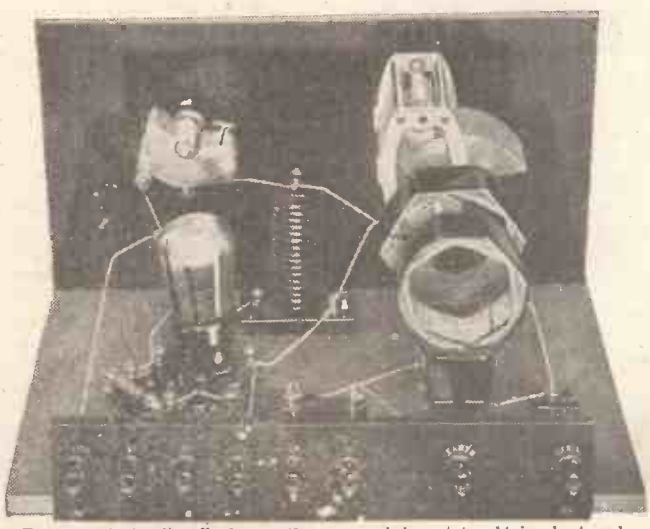
Wanted, Something New!

The possible variations in the more usual kinds of single-valve circuits are not very numerous, and it was evident that something pretty drastic would be needed to produce one which was really novel and interesting.

While we were still feeling depressed by this reflection, someone said that he had always had an idea that there was more in the "anode input" circuit than had ever been got out of it, and what about it? Nobody was much enthused by the idea, for one does not, as a rule, get very far by raking up old circuits and trying to improve them. However, it was remembered that this was a rather promising circuit, and might put us on the track of something good, so we decided to see where our luck would lead us.

First, we tried out the original schemes, and found that our recollection was correct and they were indeed distinctly promising, although some of these had some nasty little habits. The essence of the "anode input" circuit, by the way, is the use of the aperiodic aerial coil for reaction purposes, including it in series in the anode circuit and getting an adjustment of reaction by varying the coupling between this coil and the tuned-grid coil.

We realised pretty soon that one of the greatest difficulties of this type of circuit is just that of the older kind of swinging-coil set, i.e. the wide alteration of tuning produced every time the reaction is altered. Also, there was an added drawback in the difficulty of finding a size for the aerial-cum-reaction coil which should give both suitable aerial coupling and adequate reaction effects. One requirement seemed to call for a rather small coil and the other for a larger one, and a good compromise was not to be found in a moment—putting it mildly!



The special circuit calls for a rather unusual layout to obtain short and direct wiring.

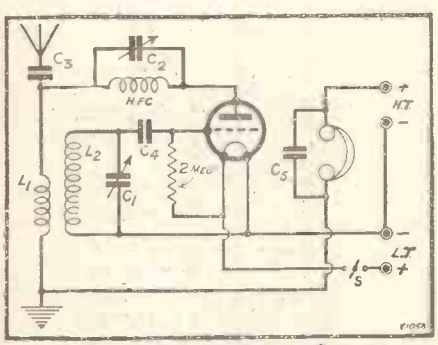
Capacity Control.

The obvious remedy was to try and work in some scheme for a capacity control of reaction such as is used in Reinartz circuits, and while testing some arrangements of this sort we had the sudden brain-wave which resulted in "Judy," with a really novel and interesting circuit with lots of special attractions.

Here is the idea in a nutshell. Make the coupling between the aerial-reaction coil and the secondary fixed, and get your control of reaction this way: put an H.F. choke in series in the anode circuit next the anode itself, which will normally prevent the valve from reacting, and then shunt across this choke a reaction condenser as a variable bypass to allow controllable reaction effects to be got.

That's all there is in it, so far as drawing the circuit on paper is concerned, and you may wonder why anyone should get so enthusiastic over something so simple. The reason is that when we came to try it out

(*Continued on next page.*)



The circuit is a very unconventional and novel one, but there is nothing freakish about its behaviour.

COMPONENTS REQUIRED

- 1 Panel, 12 in. × 7 in. (12 in. × 8 in. will serve) (Resiston, Paxolin, Becol, "Kay Ray," Keystone, etc.).
- 1 Cabinet and baseboard, 7 in. deep (Raymond, Pickett, Camco, Ready Radio, etc.).
- 1 ·0005-mfd variable condenser (Lissen, Lotus, J.B., Utility, Igranic, Raymond, Dubilier, Gecophone, Cyldon, Ormond, Colvern, Formo, etc.).
- 1 ·0002-mfd reaction condenser (Dubilier, J.B., Cyldon, Keystone, Utility, etc.).
- 1 L.T. on-off switch (Bulgin, Lotus, Igranic, Lissen, Benjamin, Magnum, Raymond, Wearite, Ormond, Keystone, etc.).
- 1 H.F. choke (Lewcos, Lissen, Varley, Dubilier, R.I., Igranic, Precision, Raymond, Magnum, Ready Radio, Wearite, Climax, etc.).
- 1 Sprung valve holder (Lotus, Igranic, W.B., Precision, Benjamin, Wearite, Formo, Magnum, etc.).
- 2 ·0003-mfd. fixed condensers (Dubilier Clarke, Lissen, Igranic, T.C.C., Goltone, Mullard, etc.).
- 1 ·0005-mfd. fixed condenser (T.C.C., etc.).
- 1 2-meg. grid leak and holder (Dubilier, Lissen, Ediswan, Cosmos, Igranic, Carborundum, Loewe, Mullard, etc.).
- 2 Single-coil sockets (Magnum, Igranic, Lotus, Keystone, Raymond, Bulgin, etc.).
- 1 Terminal strip, 10 in. × 2 in. × ¼ in.
- 8 Terminals (Belling & Lee, Igranic, Clix, Eelex, etc.).
- Wire, screws, etc.

"JUDY," THE SET WITH THE PUNCH.

(Continued from previous page.)

we found it possessed a most remarkable and highly pleasing feature which one would hardly suspect just to look at it.

You probably know only too well that all ordinary reaction circuits suffer to a greater or less extent from the drawback that any adjustment of reaction upsets the tuning somewhat, and so you have to keep fiddling with the dials all the while, and checking up the tuning every time you touch the reaction.

Well, in this circuit it just doesn't happen, and you will be puzzled to discover the slightest effect on tuning when you adjust reaction. The alteration is there, of course, and can be detected if sufficiently delicate tests are made, but it is so slight that it can scarcely be discovered on the weakest station, and for all practical purposes can be said to be non-existent.

That is a real step forward, you know, and you can imagine how pleased we were when we noticed this peculiarity of the new circuit, and what a lot of "I told you so" was heard from the instigator of this line of experiment!

Remarkable Long-Distance Powers.

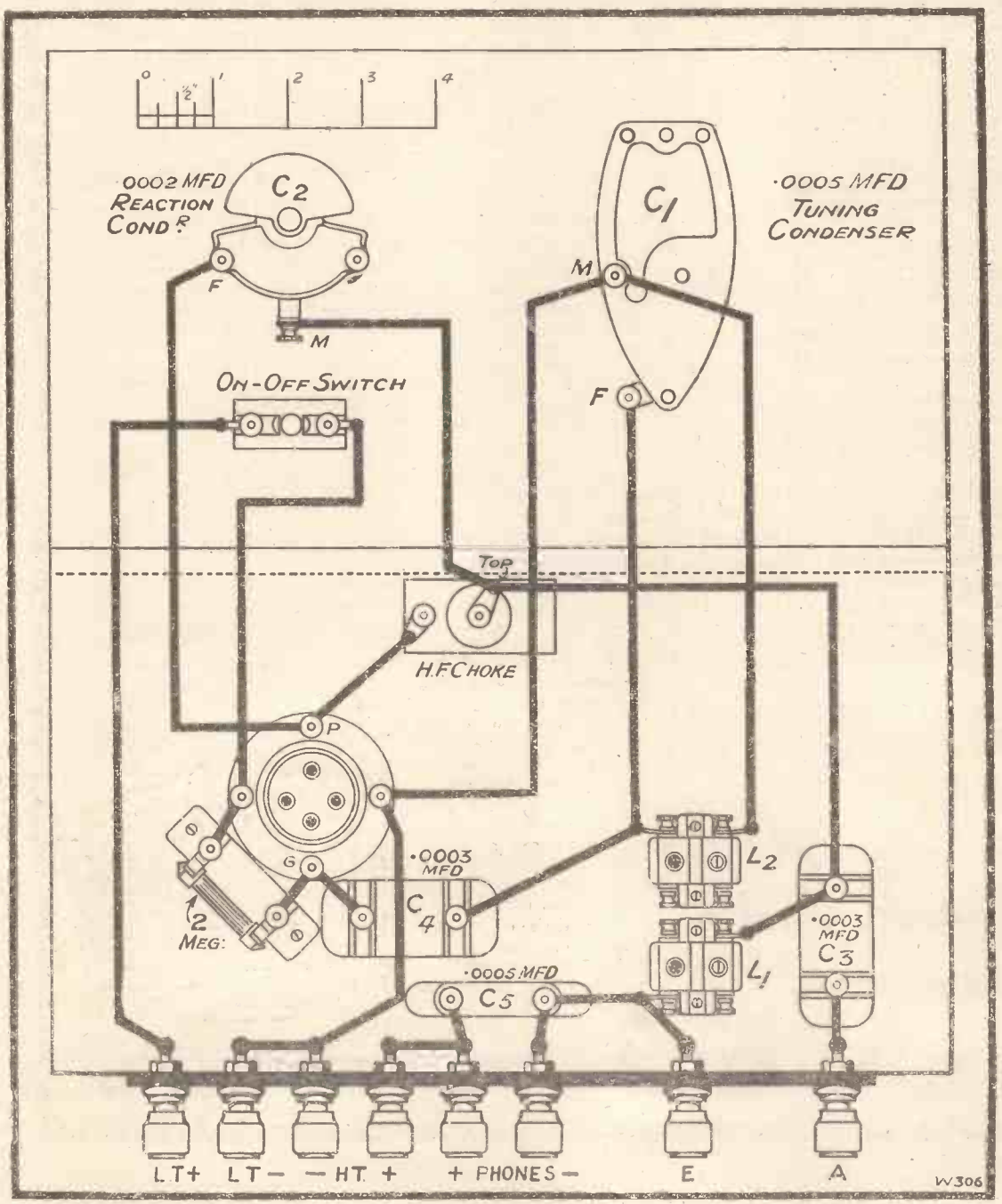
It is, seriously, a very excellent little circuit, and makes long-distance reception on one valve quite a different sort of business. It is really remarkable how one can tune in station after station with only a few moments of the easiest kind of adjustment on each. This appears to result partly from its extraordinary ease of operation, and partly the genuinely high sensitivity of the circuit.

We spent a good deal of time on the details of the set, and some of these are rather interesting. First of all, there was the difficulty of getting a good compromise for the size of the aerial-reaction coil, and this we tackled first. The trouble here is that for proper reaction you want a fair sized coil, say, a No. 50, but for aerial coupling a rather smaller one, such as a No. 35, is desirable in order to get good selectivity. (A large coil is apt to make the tuning rather flat.)

This difficulty was finally overcome with a condenser of suitable capacity permanently in series in the aerial circuit, and this does the trick very nicely, because you can now use quite a large coil and so get plenty of reaction and yet not make the effective aerial coupling very tight.

While we are thinking about coil sizes we may as well just list the correct ones for different purposes in this set. The secondary coil (L_2) should be a No. 60 for low waves, and a No. 250 for long waves.

The combined aerial and reaction coil will usually be a No. 50 for the lower range and a No. 100 or even 150 for the upper, but a little experimenting with different sizes is just as well here, as is usual with aerial coils. You will find you can get the customary alteration of selectivity in this way.



Making a Start.

With other circuit details we will not trouble you, although there are one or two other special features, notably the method of connecting the 'phones in circuit. Instead, we will go on to more practical matters, and give you the remaining information you will need before making "Judy's" acquaintance for the first time. Well, so far as actually making the set is concerned, it is really such a simple job that we cannot add anything really helpful to the details in the diagram and list of parts.

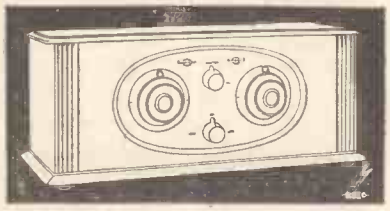
There is just one point we would mention, however, and that is about the reaction condenser. We have indicated a capacity of ·0002 mfd. for this, which is desirable to make sure of proper control with any likely type of valve.

With the more modern freely oscillating valves of the types used as detectors the usual ·0001 or ·00015 mfd. reaction

(*Continued on page* 135.)

At the Bowyer-Lowe Stands

SEE the LATEST ACHIEVEMENTS in RADIO DESIGN—



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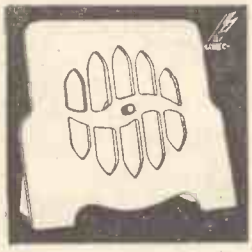
One of the outstanding successes of radio design, now improved in detail. Reproduction is perfectly smooth and even over the whole musical range, and selectivity is amazingly precise. Wavelength ranges are 250/500 metres and 1,200/2,300 metres. No coils to change. A set that will give brilliant results, with few limitations for even the most ambitious searcher.

PRICE COMPLETE **£10**

including valves and royalties. Or by easy monthly payments.



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A new addition to the Bowyer-Lowe range, and the finest accessory of its kind ever offered at a popular price. Notable for its clear and natural reproduction of both music and the human voice.

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STANDS 130 & 131

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❖ ❖ ❖

PENTOVOX 2; PENTOVOX 3; SCREENED VOX POPULI 3 (Battery and Mains driven A.C. and D.C.); SCREENED VOX POPULI 4; RADIO-GRAMOPHONE (Battery and Mains driven A.C. and D.C.); GRAMOPHONE PICK-UP; MOVING-COIL REPRODUCERS, A.C. or D.C.; SENIOR CONE REPRODUCER; JUNIOR CONE REPRODUCER; HIGH-TENSION BATTERIES; COMPLETE RANGE OF TESTED COMPONENTS, including POWER TRANSFORMERS FOR MAINS RECEIVERS.

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"JUDY," THE SET WITH THE PUNCH.

(*Continued from page 132.*)

condenser is quite large enough, so if you have such a condenser on hand by all means give it a trial.

Now for the actual operating data and we have finished. The best valve we found to be of the later R.C. type with not too high an impedance, say, 40,000 to 60,000 ohms, which gives a particularly silky control of oscillation. The more usual H.F. type with an impedance of 20,000 to 30,000 ohms is also good, and there is indeed little difference, so whatever type of detector you may have try it out and see how it goes. Judy is not really particular about it,

Very simple wiring is one of "Judy's" special attractions.

and will be pretty sure to behave nicely if you adjust the H.T. with a little care.

Finally, about the H.T. voltage. We found that Judy is not at all greedy in this respect, and seems happiest with a comparatively low voltage, so we suggest you try figures of from 30 to 60 volts. You will soon find an adjustment which gives you a particularly sweet and smooth control of reaction.

This is, indeed, one of the pleasantest things about the circuit. Almost any good capacity-controlled receiver will give smooth reaction when things are just right, but it often takes quite a bit of experimenting to get them so. With "Judy," on the other hand, only a few moments do the trick as a rule, a mere adjustment of H.T. voltage being sufficient with most valves.

Short-Wave Possibilities.

This feature is obviously of great value for all long-range work, but more particularly on the short waves. This brings us to a rather interesting and important question, for the special feature of the reaction control of the set would obviously be of tremendous value on low waves, where tuning difficulties are so much greater, if it behaved equally well down below.

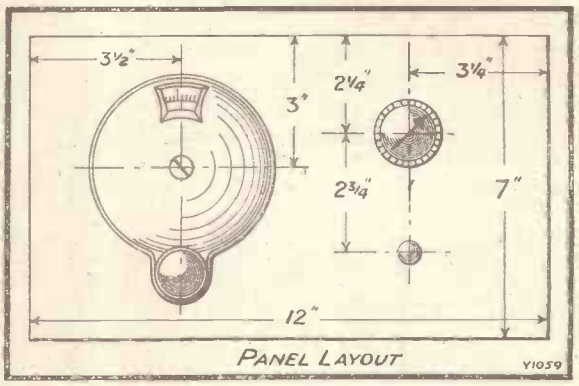
We have accordingly given it a try-out on short waves, and found, somewhat to our surprise, that it does indeed perform exceedingly well here. The reaction control no longer has no perceptible effect on tuning, but that was too much to hope for in any case. It does, however, upset tuning to a very much lesser extent than the more usual arrangements and makes the tuning in of a weak short-wave station decidedly easier. We have here obviously a very promising scheme, and we propose to follow it up in the future.

We rather expected that we should find hand-capacity effects on the reaction condenser troublesome on the short waves, because both sides of the condenser are above earth potential, but they actually turned out to be no worse than usual. This mention of hand-capacity effects at this point reminds us of a matter which applies also to ordinary broadcast work. It is this: some reaction condensers have a grub screw for securing the knob which projects a little above the surface.

Since this screw makes contact with the spindle you should avoid getting your thumb or finger on it when making adjustments to the set, because if you touch it you will find the reaction control is upset. This is particularly important on short waves, of course, but we only mention it as a matter of passing interest: there are not actually very many reaction condensers which suffer from this defect.

The set, as it stands, is quite capable of working well on even very short waves, and you may like to give it a trial. All you require is a few of the special short-wave plug-in coils such as the Igranic and Atlas, and they are not expensive. Insert in the L_2 socket a No. 4, and in the aerial a No. 4 or No. 6, and you are ready for reception on the interesting 20–35-metre wave-band.

To get the best reaction effects on these short wave-lengths you may find it desirable to put a small fixed condenser, such as an ordinary baseboard mounting neutralising type of condenser, in series in the aerial lead. The fixed condenser in the set, of course, is correct for normal broadcast work, but is not small enough for short-waves on all aerials, hence this suggestion for test purposes. If you decide to work on short waves a good deal with this receiver, you can put the extra condenser inside and provide an extra alternative aerial terminal.



RADIO HINTS AND TIPS.

As soon as you have soldered a joint, wipe it over with a clean rag to remove the liquified flux.

* * *

Double-capacity dry-cells are usually able to supply about ten milliamps, whilst up to fifteen milliamps may be taken from a good treble-capacity battery, under economical working conditions.

* * *

Make sure that your grid-bias plugs fit tightly into the battery sockets.

* * *

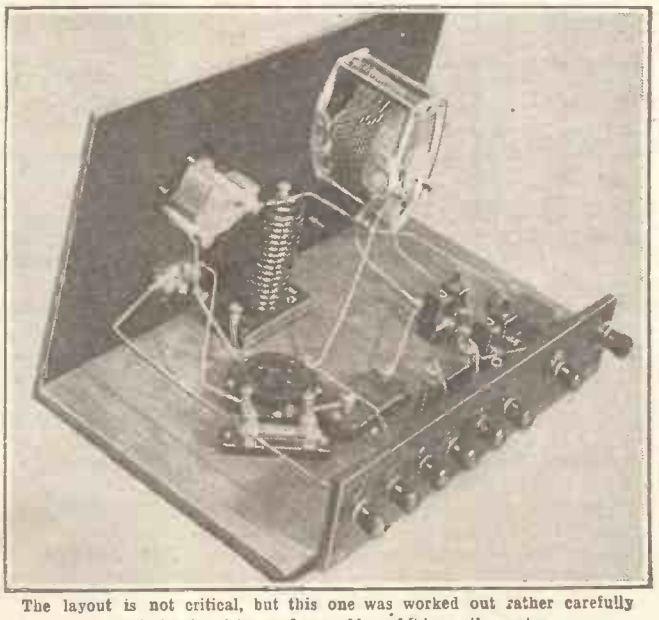
G.B. plugs should be kept reasonably clean, just like any other contacts in a set.

* * *

Don't let your G.B. leads grow "whiskers," as these are liable to give rise to short-circuiting troubles.

* * *

An ordinary elastic band, fitted over the G.B. battery will keep long, flexible leads from getting out of place or tugging at the plugs.



The layout is not critical, but this one was worked out rather carefully to get simple wiring and assembly and it is worth copying.

LATEST BROADCASTING NEWS.

THE BAIRD TRANSMISSIONS.

FOR THE LISTENER'S DIARY—THE ENGLISH CHARACTER—SIR THOMAS BEECHAM IN CARDIFF—ULSTER WIRELESS EXHIBITION, Etc.

NEXT Monday (September 30th), at 11 a.m., the B.B.C. will transmit from 2 L O the first Baird programme. Strictly speaking it will not be television, but telecinematography and telelography, because there is no immediate intention to do the direct transmission. The reason for this is that the B.B.C. cannot spare the two channels required for vision and speech simultaneously.

Accordingly, the Baird programmes will be of "bottled" material in the first instance, and there will not be a simultaneous accompaniment of spoken words. The Baird Company hope to get the use of the two channels when Brookman's Park is working, but the B.B.C. has doubts about the side-bands.

For the Listener's Diary.

Here are some important items in forthcoming evening programmes for those who keep a radio diary:

Saturday, October 5th (2 L O and other stations).—Running commentary by Capt. H. B. T. Wakelam on the Rowland Hill Memorial Rugby match, England and Wales v. Scotland and Ireland, at Twickenham.

Thursday, October 17th (2 L O and other stations).—Norwegian National Programme.

Friday, October 11th (5 G B) and Saturday, October 12th (2 L O and other stations).—"Peep-bo-hemia," a new show by Gordon McConnel.

Wednesday, October 16th (2 L O and other stations).—Broadcast of Shaw's play, "Captain Brassbound's Conversion."

November 11th (Armistice Day).—Studio performance of "Journey's End," specially adapted for the microphone by the author, Mr. R. C. Sherriff.

The English Character to be Discussed.

An important discussion on "The English Character," between M. Andre Maurois, the author of many recent books which have been widely read in England, notably "Ariel" and "Disraeli," and Professor Salvador de Madariarga, who is Professor of Spanish Studies at Oxford University and Fellow of Exeter College, Oxford, is to take place in the London Studio on Friday, October 11th, at 9.20 p.m.

Professor Salvador de Madariarga is also a member of the Sub-Committee of Arts and Letters, of the Committee of International Co-operation of the League of Nations. Mr. Desmond MacCarthy will act in the dual capacity of chairman and interlocutor.

Sir Thomas Beecham in Cardiff.

Sir Thomas Beecham is to conduct the National Orchestra of Wales, which will be specially augmented for the occasion, at a concert in the Empire Theatre, Cardiff, on Sunday evening, October 6th. The concert has been arranged in aid of the Imperial League of Opera, and part of it between 9 and 10 p.m. will be broadcast. The artistes are Evelyn Howard-Jones (pianoforte) and Francis Russell (tenor).

A Feature From Bristol.

The Lord Mayor of Bristol is to preside at a special concert which is to be relayed for Welsh listeners from the 6th Gloucestershire Regiment Headquarters, St. Michael's Hill, Bristol, at 7.45 p.m. on Friday, October 11th. The programme will include the story of Bristol's citizen soldiers from the time of the French Wars to the present time, and there will also be chorus singing of famous songs under the direction of Mr. Joseph Jenkins.

Church Unity in Scotland.

All stations throughout the country are to broadcast the great service of praise and thanksgiving of the newly-united Church of Scotland which the Rev. Dr. Donald Fraser is conducting in Glasgow Cathedral on Sunday, October 6th. The relay is important to religious people throughout the British Isles, inasmuch as the service is designed to express gratitude for the consummation of the long-desired union.

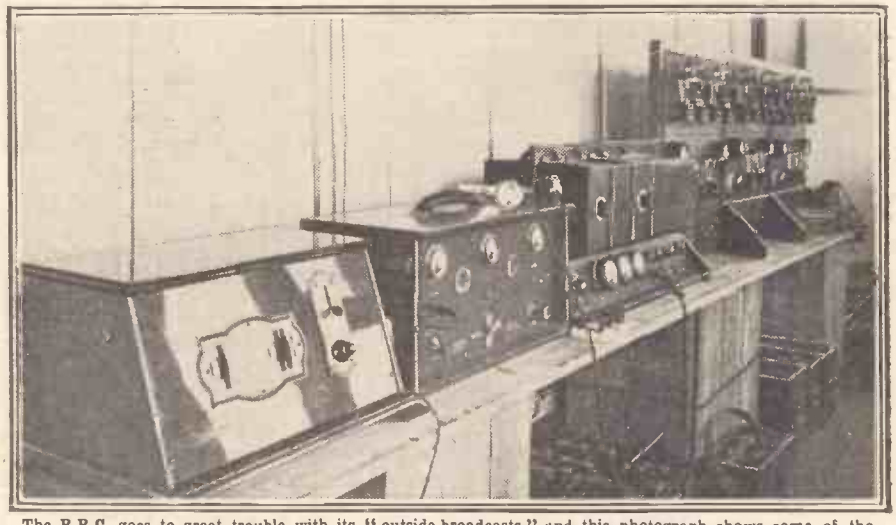
Ulster Wireless Exhibition.

The fifth annual exhibition organised by the Ulster Wireless Traders Association will be opened by the Minister of Commerce for Northern Ireland, the Right Hon. J. Milne Barbour, D.L., M.P., on Wednesday, October 9th, when speeches in connection with the ceremony will be broadcast by the Belfast Station from the Ulster Hall.

New Regime in Scotland.

Scottish listeners will be particularly interested in a talk to be given on Tuesday evening, October 8th, by Mr. David Cleghorn Thomson in which he will outline the future procedure of broadcasting in Scotland occasioned by alterations in personnel at Glasgow and Aberdeen.

"WE ARE NOW TAKING YOU OVER . . . ."



The B.B.C. goes to great trouble with its "outside broadcasts," and this photograph shows some of the apparatus used at Ryde Pier to make the Schneider Trophy relay a success.

TECHNICAL NOTES. By Dr. J. H. T. ROBERTS, F.Inst.P.

CONDUCTION IN RECTIFIERS.

FREE ELECTRONS, Etc.

I HAVE received several enquiries as to the mechanism or "mode of action" of the copper oxide rectifier—whether the conduction of electricity through a system of this kind differs essentially from the conduction through other types of conductor—and as this subject is very interesting scientifically, probably you may care for a few remarks upon it.

In the first place it would appear that the conduction of electricity, both through liquids and through solids, is carried on by the movement of electrons similarly, in a general way, to the conduction of electricity by the electron stream in a radio valve.

Free Electrons.

In the case of a solid which is a good conductor, such as copper, it is assumed that there are a number of so-called "free-moving" electrons which are so loosely attached to the electronic systems of the atoms of the metal that the application of an exceedingly small electro-motive force is sufficient to set them in motion and so cause an electric current to pass through the conductor.

The fact that Ohm's Law holds with solid conductors, even down to very small applied electro-motive forces, shows that the E.M.F. required to dislodge these electrons must be exceedingly small.

In the case of a liquid it appears that an ionised condition is necessary before electric conduction can take place and it has been assumed, in a general way, that the conduction is similar to the conduction through a solid, except that the freedom of action of the electrons is much less.

(*Continued on page* 180)

THE EXHIBITION—AND TELEVISION.

Some comments on the commencement of the radio Show and on the television experiments now starting from 2LO.

By THE EDITOR.

THIS is our second special Exhibition Number, in which we continue the review, stand by stand, of the exhibits of the firms at the New Hall, Olympia. And we trust that, by the time this second Exhibition Number is in the hands of our readers, many thousands of them will not only have paid a visit to the Exhibition, but in particular will have made a point of calling at our Stand to inspect the receivers we have on view there, and to ask any questions of the technical staff in attendance.

Next Week's Number.

We had intended to include in this issue a special article by Captain Eckersley on the Exhibition, but this has been unavoidably postponed for inclusion in next week's third Exhibition Number. In place of Captain Eckersley's article on the Exhibition, we are publishing this week his latest views with regard to television and, in view of the fact that television broadcasts are definitely to begin in experimental form on September 30th, Captain Eckersley's article will undoubtedly be read with widespread interest.

With regard to the television broadcasts (which by the way, we exclusively announced in POPULAR WIRELESS), we understand, as reported by one of our news commissioners, that these experimental transmissions will be unaccompanied by speech.

As our readers know, it is not possible to broadcast television and speech without making use of two distinct wave-lengths; one for the television transmission, and one for the speech, etc. The great difficulty to-day, of course, is to provide spare wave-lengths; and, Heaven knows, Captain Eckersley has found it difficult enough, and so have other experts at the Prague Conference, to find room for all those stations of various European countries which desire adequate wave-length representation.

The Present Position.

Consequently, it must not be thought that the B.B.C. are "doing things by halves" because they are only granting the Baird Company (to begin with, at any rate), one wave-length for television purposes. Possibly (but only possibly) when the Brookman's Park twin-wave station is really into its stride—and that will be in about a year's time—facilities may be granted to the Baird Company, or to any other television company which proves that its transmissions are worth while, for broadcasting not only television but the accompanying speech, music, etc.

We wish to emphasise once more that these television transmissions are distinctly experimental in nature. They will consist of five half-hourly transmissions a week, and as the Postmaster General pointed out some months ago (and with whose remarks the B.B.C. officials associate themselves), these transmissions cannot be *guaranteed* as proving satisfactory, except as an interesting experiment.

But although we have expressed more than once our technical doubts as to the efficacy of a bona fide service of television—that is, bona fide in the sense that it will enable listeners clearly to see important pictorial events in detail—we feel confident that many of our readers will be definitely interested in these transmissions, not only because they will enable amateurs to appreciate the present position of television from the technical point of view, but because, even though crude images may be received, the fascination of the game cannot be denied: and for this reason, if for no other, we definitely welcome television transmissions.

Undoubtedly many readers of POPULAR WIRELESS and our contemporary journals, "Modern Wireless" and "The Wireless Constructor," will wish to own their own television receivers, and we understand from the Baird Company that, although the Company itself will not manufacture television receivers, they will be manufactured under licence by certain approved firms.

The exact position of the home constructor has not yet definitely been settled, but of course the bona fide experimenter may, under the laws of the Patent Office, make use of any patent for experimental research; and as many thousands of readers of POPULAR WIRELESS and our associate journals are of the experimental class, we anticipate that quite a large business will be done in television parts for the purpose of building up television experimental receivers.

Home Constructor's Position.

We, of course, do not wish to be misunderstood on this point and, as we have pointed out more than once, this facility granted by the Patent Office for the use of patents for experimental purposes *only* applies to bona fide experimenters; that is, to those amateurs who are definitely engaged in research work for the purpose of improving upon known inventions.

However, we hope to be able to state very shortly the Baird Company's attitude to those home constructors who, merely for the fun of the thing, wish to build television receivers. It is quite likely, of course, that kits of parts will be marketed, and we certainly advocate the adoption of the method. Complete receivers will probably be on the market at a price as low as £12; and others, as we have stated before, anything over £20, to £80 or £100.

Further information we hope to be able to place before our readers in due course, but in the meantime we should like to take this opportunity of expressing the sincere wish that these television transmissions will prove successful, and that they will indicate that another branch of the great hobby of radio has been opened up definitely as a source of entertainment and instruction for the thousands of keen amateurs in this country.

USEFUL RADIO REMINDERS

If you use a metal case, or have a metal panel, be careful not to let leads (especially H.T. leads) touch this accidentally, or serious damage may result.

* * *

If acid from an accumulator is spilt on clothes or a carpet, it should be neutralised *immediately* by liberal applications of ammonia, or a strong soda solution.

* * *

On no account connect up a mains unit without reading the manufacturer's directions carefully, as serious damage may be caused by wrong connections.

* * *

When changing coils remember that if the metal pins on these touch the wrong sockets, or other metal, you may burn out a valve, short a battery, or do other damage.

* * *

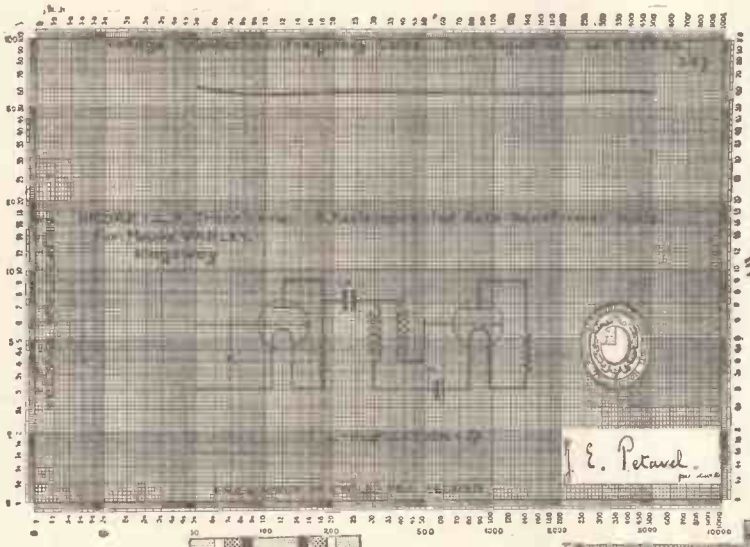
Sets that have been out of action for a month or so nearly always develop bad contact, due to loose terminals, etc, so they should be gone over carefully with pliers before being placed in service again.

* * *

Voltmeter readings should be taken with a high-resistance instrument when the set is working, if you want the true figures.

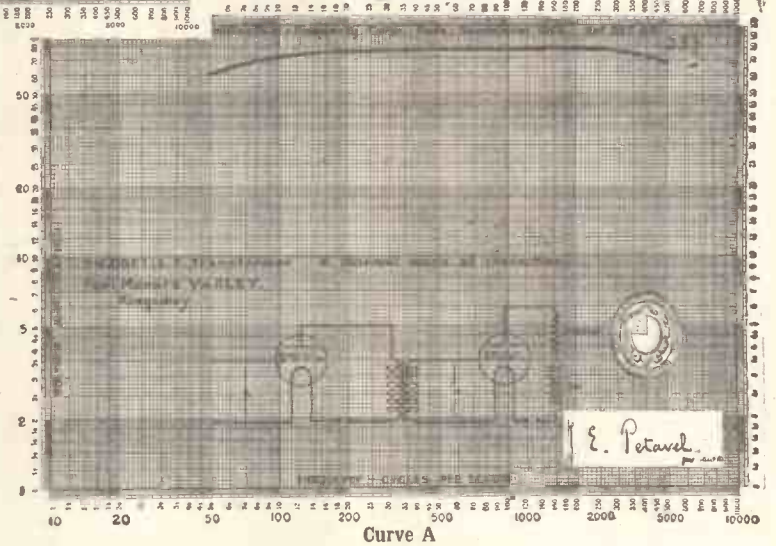
VARLEY

—NOW TAKE THE LEAD IN L F INTERVALVE TRANSFORMERS



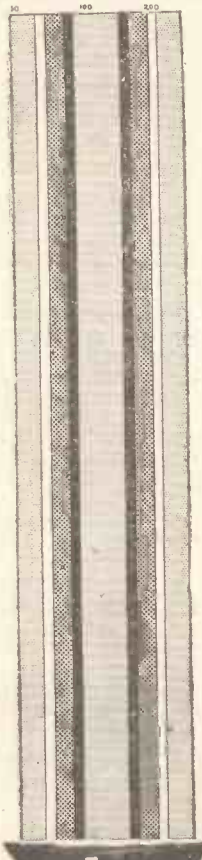
Curve B

NICORE I.



Curve A

Stands 154 and 159 Olympia



Nicore I. is housed in an attractive bakelite case, with terminals and soldering tags.

You have only to look at these curves to see that for yourself. They show what the curves of no other transformer can show—perfect amplification of the deep bass notes together with constant response at all frequencies from 50 to 5,000 cycles. After all it was only to be expected—for in the early days of Broadcasting the coils for most of the well-known Transformers were wound by Varley; then, after months of research, came our success with the nickel iron alloy core, and to-day we are able to market at an amazingly low price two L.F. Intervalve Transformers whose performance is second to none.

Curve "A" is that of Nicore I. used in the ordinary transformer arrangement showing an amplification of the order of 80, between 100 and 5,000 cycles, and over 60 at 50 cycles.

Curve "B" is that of Nicore I. used in the Resistance feed auto-transformer arrangement showing an amplification of 60 and a perfectly straight line between 50 and 5,000 cycles.

No attempt has been made to retain inaudible side-band frequencies; the discerning public will not be slow to realise that our efforts have produced curves which are, like everything else connected with Varley, perfectly straight. *Write for Section D of the Varley Catalogue.*

Nicore I. (List No. D.P.1.). Ratio 4-1. Price **£1.0.0**

For RADIO

OLIVER PELL MANUFACTURE

Varley

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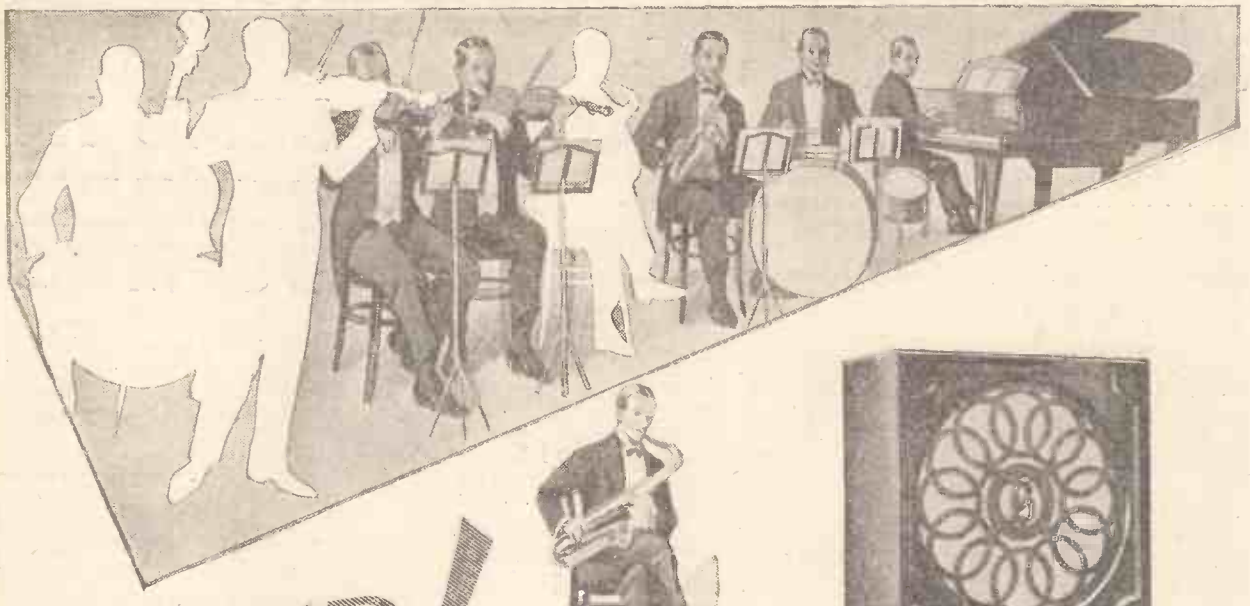

FOUND!

THE REST OF THE ORCHESTRA

HERE, at last, is a loud speaker that does not cheat you of half the broadcast! It finds the missing artistes! It reveals instruments hitherto silent. It gives you notes you've never heard before. It is the new Brown Duplex Loud Speaker.

Because it incorporates the latest Brown improvements in design—the wonderful "Vee" movement and the new Duplex cone—this latest Brown triumph gives far more realistic reproduction than any heard before. Every instrument and every note—high *and* low—is reproduced *true-to life.* Its tone is sweeter and more mellow. Its volume is richer and more magnificent. In short, if you buy a Brown Duplex Loud Speaker you hear the broadcast in your home *as it is played in the studio.* Ask your Wireless Dealer.

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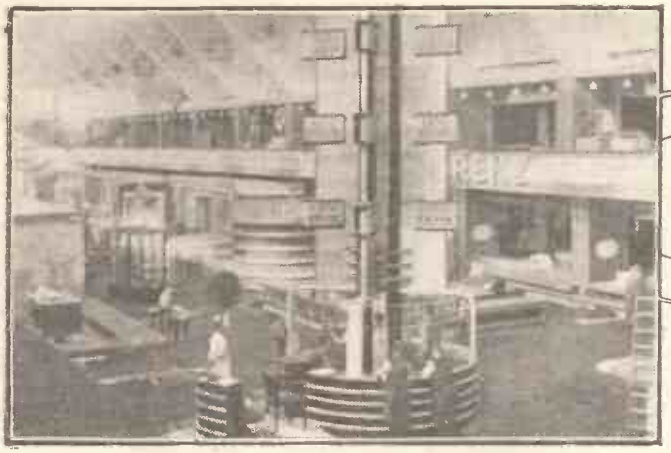
BY THE WONDERFUL

See them at the NATIONAL RADIO EXHIBITION Olympia—Sept. 23 to Oct. 3. Stands 213-4-5

Brown

DUPLEX LOUD SPEAKER



THE GERMAN RADIO EXHIBITION

A review of the recent Berlin Show.
From OUR SPECIAL CORRESPONDENT.

AS I have already mentioned in an article solely devoted to the present status of television in Germany the main attractions of the great German Wireless Exhibition are the different systems of television shown together and working under the same conditions.

The big German firms Telefunken, Siemens & Halske, and A E G naturally had the most imposing stands. Just as one entered the door to the main hall Telefunken greeted one on both sides with two large stands. The new Telefunken screened-grid valve seemed to me to be most

A super speaker unit—the enlarged model of a famous loud-speaker drive.

interesting. The valve itself has been completely covered by a thickish metal coating. It is this valve that greatly contributes to the rather astonishing efficiency of a new receiver brought out by the same firm. It uses one of these screened-grid valves, a detector stage and two note magnifiers. The results, even on a bit of wire hung out of a window, are astonishing.

There are no really new discoveries this year. Moving-coil loud speakers with permanent magnets at last have made their appearance here. The electro-magnetic systems are still to the fore, some with six-pole magnets. The usual type is four-poled. One firm showed a very excellent loud speaker with a transparent diaphragm. On the other hand, I thought the decorative loud speakers exhibited by a well-known papier mâché firm were pleasing in design and with really good tonal properties. They employ a four-pole magnet and an exponential horn, which is wound round so as to fit any of their designs. I saw something like a porcelain clock, a Chinese griffin, and other mantelpiece ornaments, all made from papier mâché and finished like china.

Preventing Parasites.

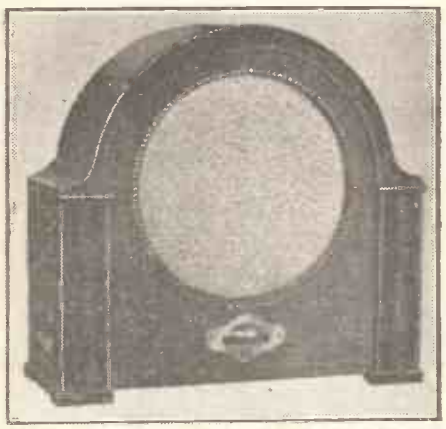
Germany never was the ideal spot for the home constructor, he has always been in the minority here, and so no wonder if this year, even less than other years, he has not been catered for as well as the set buyer has. Of course, sets are much less expensive here than in Britain, and the actual cost of home constructing is no lower than buying the finished article, especially if you take the added mechanical perfection of the bought article into consideration.

Some fixed and variable condensers, a new type of tiny little coil with a very high value of inductance and, owing to its small size, extremely little possibility of interference with other circuits, are shown. Talking of interference, numbers of firms were showing apparatus for preventing parasitical currents emanating from such domestic machines as carpet sweepers, high-frequency massage apparatus, etc. Owing to the campaign of the German Broadcasting Company, the R.R.G., it is hoped that everybody will fit their machines with these parasite-killers, and then we will be on the way to quieter radio.

Interesting Short-Wavers.

Short-wave receivers are at last here. It has taken some time for the factories to decide to build them. I saw one short-wave receiver working on the super-het. principle and was told that this would probably be the most stable of systems. It works with six valves, one of which is of the screened-grid type. The receiver covers a band of from 10 to 100 metres without any necessity of changing coils, and was used for the relay of the Schmeling-Paolini fight from America via the Berlin broadcasting station. I was told that this receiver would work off the mains very well. The price in Germany ranges round about £36.

Sets working straight from the mains are there in hundreds, and, at last, even sets working on direct-current mains. Prices are not too high, either. The famous firm with the triple valve shows new distance sets working from the mains, and the set is standardised so that the dealer just has the set in stock, and can sell the set, either

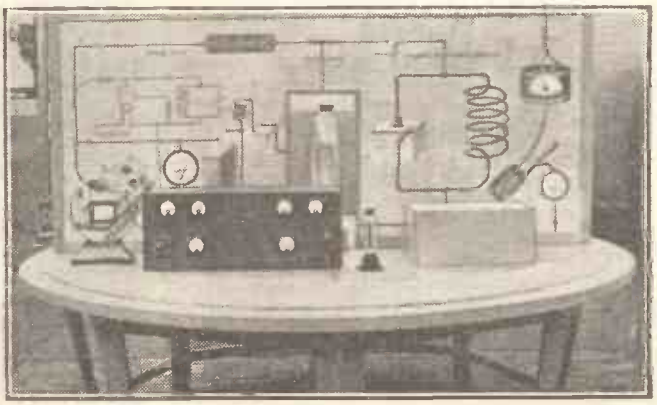


This novel instrument combines the loud speaker and receiver.

with batteries or with an alternating- or direct-current mains adaptor, for which room has been left in the interior of the set.

Hardly any portable sets were to be seen, the few shown are very transportable but hardly quite portable. The lighter ones will work only with a nearby station, the only really efficient portable working off distant stations with a loud speaker is that by Lorenz. Six valves and a L.S. built into it. The new "jelly" accumulators can be used too.

(Continued on next page.)

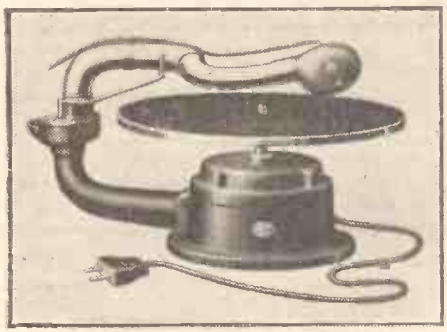


An interesting model based on an elementary transmitting circuit.

THE GERMAN RADIO EXHIBITION.

(Continued from previous page.)

The jelly accumulator is just our ordinary accumulator filled with some liquid which very soon gets a little thicker than jelly, in fact nearly quite dry, and absolutely will not spill. In spite of mains working the battery receiver is still very much alive. The reason? Well, no mains receiver really does work



An electrical pick-up drive unit which has proved very popular in Germany.

quite silently when you have headphones on, and electro-dynamic loud speakers let you hear some of the hum, be it ever so slight.

Of the three large halls occupied by the Great German Wireless Exhibition part of the last hall was devoted to the television apparatus exhibited by the German Reichspost and to the other exhibits shown by the Reichspost and the Reichs-Rundfunk-Gesellschaft, the all-German broadcasting organisation. The R.R.G. has placed its exhibits in the hands of Dr. Antoine, the statistician of the company, who very kindly explained to me the meaning of all the varied and striking features shown.

When Lights are Low.

In the centre of the room there was "Broadcasting," by a well-known German sculptor, showing the earth and several aerial masts with waves emanating from them. Behind it, on the central wall, was a painting which most likely has attracted the greatest number of eyes. You see the old Egyptian and Roman posts, then all down the ages the different means of conveying news all rushing towards one goal: Broadcasting.

On the other wall a huge clock strikes one's eye. As it is continually in motion the minute hand rushes round, and as the hour hand reaches a new circle representing a certain hour of the day the circle is illuminated and shows you the activity of the German stations at just that hour. Only 4 a.m. shows a blank; 3 a.m. was still filled by relays from America. If this is perhaps not a daily occurrence it very nearly is, owing to the frequent flights of the Zeppelin.

Portables are of the multi-valve type. Here are shown two examples of the leading make.

Fixing Frequency.

Opposite is the space in which the German Post Office exhibits a complete short-wave transmitter, similar to the one which has just been taken into operation at Königswusterhausen for broadcasting. In the same room we notice a complete single wave-length-working station, and plans of how the whole thing works in Germany.

As will be remembered, all the B.B.C. stations work on a single wave-length employing the tuning-fork method for keeping in tune. In Germany one has gone further, and sends a fundamental frequency to all the stations in question; this fundamental frequency is multiplied at the station

One valve firm outlined the map of Germany and their agents' districts by means of valves.

proper, amplified and radiated. The only means for doing this is along specially laid cables which have now been completed between Berlin and Stettin, and Berlin and Magdeburg, the German stations now working on a single wave-length. Every one and a quarter miles huge "pupin" coils have to be inserted in the cables, so as to keep the frequency pure.

Higher Power Coming?

Closely related to the question of single wave-length working is the question of Regional stations. I asked Dr. Bredow, the Post Minister's Broadcasting Commissioner, and the man at the head of German broadcasting, if Regional stations would probably be making their appearance in Germany soon. Dr. Bredow pointed out that Germany was made up of old historical centres of culture, and that there was no one large centre like France had in Paris. Therefore, Regional stations, strictly speaking, would not be possible to any great extent, as one would always have to consider the claims of these centres, of which there are about eight in Germany.

Should there be any international agreement that every country would decrease the number of its transmitters, then Germany would not be able to stand back, but as long as she could she would have to stand by the present number of exclusive

The Telefunken receiver using a screened-grid valve.

waves. There was another development which I pointed out to Dr. Bredow: What about higher power in Germany?

We all know that Prague will shortly begin broadcasting with 60 aerial kws. Oslo and Stockholm and Warsaw the same. Dr. Bredow said that if again no international agreement could be arrived at to stop the use of extreme high power or to limit its use, Germany again would have to follow the path laid out by her neighbours and increase the power of some of the stations which would be most likely to be drowned. (In connection with this I have heard talk in other directions of a 100 kw. for the Rhineland, the same for the South, and the same for the East.)

The transparent diaphragm gives this speaker a peculiar appearance.

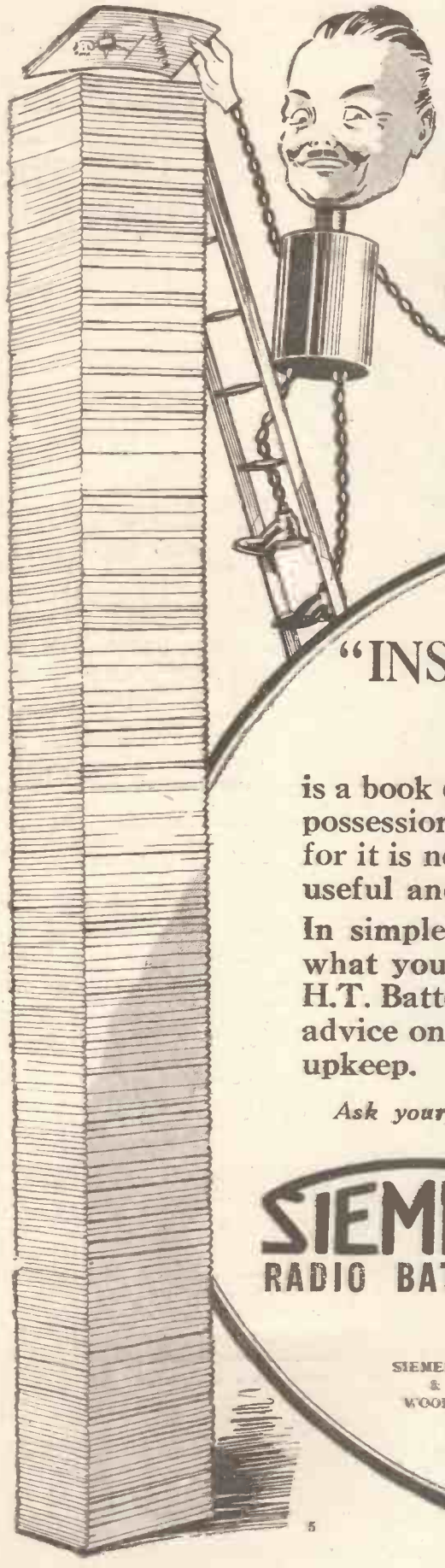
Continental Comparisons.

The Great German Wireless Exhibition has certainly given us an idea of what is going forth on the Continent.

On the whole, it gives me the impression of being a splendid show. It is all the healthier because in no one particular is there such a spectacular advance as to dwarf other aspects.

Radio in Germany is undoubtedly going forward apace, and it is with the utmost interest that I shall visit the London show at Olympia to compare wireless progress in Britain with that on the Continent.

A three-valver, mains-operated and metal enclosed, typical of German design.



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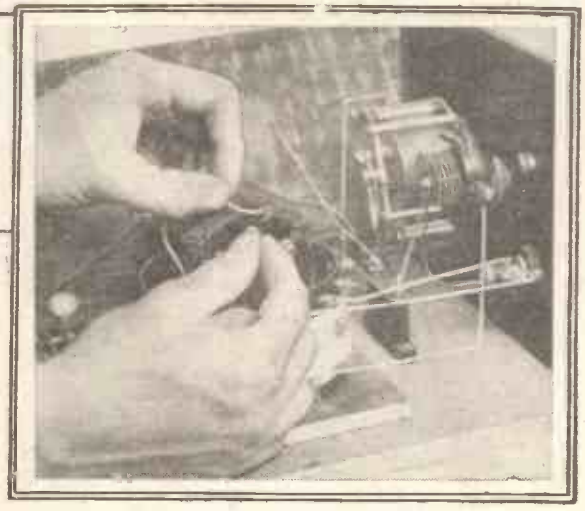
5

COUPLING THE AERIAL



This is a very important subject, for the aerial coupling plays a great part, both in regard to the set's selectivity and its sensitivity. And in the following article very interesting and useful tips are given on the various methods adopted.

By L. H. THOMAS.

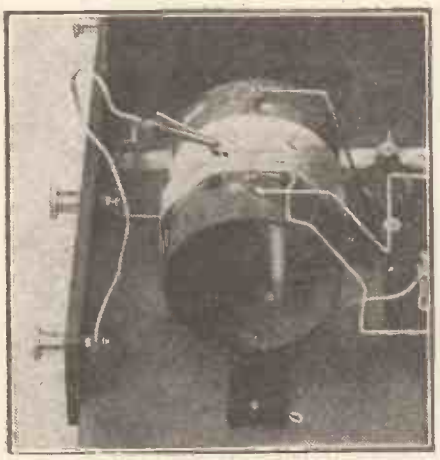
IT seems to be the fashion among home constructors just recently to decry the merits of H.F. amplification, saying that, apart from the increased selectivity rendered possible from its use, it has no advantage over L.F. This and other equally doubtful remarks have come my way very often during the past few months, chiefly, be it said, from those who have never handled H.F. in their life, and especially those who are proud owners of one of the various proprietary receivers assembled from kits of parts.

It is not my intention to discuss the causes of this point of view in any detail, but there are various points that may with advantage be brought to the notice of the "detector and note-mag." enthusiast, particularly with regard to methods of improving selectivity and general efficiency, without having to resort to the H.F. amplication of which he appears to be so scared.

Too Much Strength.

Now it has always been a little weakness of mine to stick to the opinion that, were someone to design a detector circuit of such extreme selectivity that (having no regard to efficiency or signal-strength at all) any signal coming from a reasonable distance could be tuned in *free of all interference*, but no doubt incredibly weakly, then all the troubles of radio would be at an end. Once one has produced a clear signal, as opposed to a strong signal, one can amplify it to taste and, making due allowances for imperfections in the amplifier, it will *still* be a clear signal.

In other words, the obvious thing to aim at is an "R2" signal with no background, rather than an "R5" signal with an "R3" background.



The "input" section of a modern set, showing how the aerial is taken to one or other of various tappings on the aerial coil.

Human nature being what it is, this state of affairs is incredibly rare! There are thousands of sets in operation capable of giving really excellent selectivity which have been completely spoiled in this respect by the fact that the owner has been disappointed with the signal strength of some station or other. He has gradually improved it by such methods as tightening the aerial coupling, lengthening the aerial, perhaps even using "direct on grid" aerial coupling (an unpardonable sin from the neighbours' point of view!) and similar small adjustments.

And so, all unsuspecting, he has completely ruined the selectivity of an otherwise excellent receiver, and, finding that he can no longer receive foreign stations at all well, says "2 L O (or whoever the local is) must have increased power lately; I can't cut him out at all." And so the matter rests.

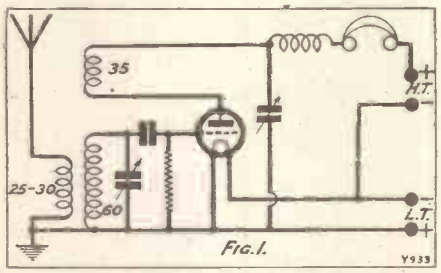


FIG. 1.

This state of affairs all arises from the perfectly understandable desire to squeeze the very utmost possible amount of noise from the minimum number of valves, to the wonder of one's admiring friends.

Is It Worth While?

But is it all worth while? I, personally, have no objection at all to confessing to my neighbours that I am receiving 5 G B no more loudly on three valves than they are on two. I think, most decidedly, that it is more this spirit that actuates those of whom I am speaking than the fact that they cannot cannot afford to add another valve.

Therefore, the point I wish to make most clearly may be summed up in the words: "Increase the selectivity of your circuit even at the expense of much loss of signal strength, which can be easily made good by the addition of a further note-mag."

I am, of course, talking exclusively to the vast brigade of "H.F.-less fans," and, in general, my remarks will not apply at all to those who do use a stage or two of H.F.

Luckily for us, the methods of increasing the selectivity of the average receiver are very numerous and very simple. First of all, unless you have an extremely short aerial, give up all idea of using the ancient scheme of coupling it directly to the top of the grid coil. The selectivity of this arrangement, generally speaking, can be summed up by the word "nil."

There is very little to choose on most counts between some good form of capacity coupling and inductive coupling; personally, for no particular reason, I prefer the latter.

A Simple Circuit.

Fig. 1 shows a single-valver with a "tight-coupled" (*not* direct-coupled) aerial circuit. Approximately suitable sizes for the coils, if of the ordinary plug-in variety, are given. The No. 25 or 30 aerial coil is quite tightly coupled to the secondary, and no attempt is made to tune it.

The selectivity obtainable with this circuit is really extraordinarily good when one considers the ease with which the average broadcast receiver one meets could be converted to comply with these requirements. If one tunes the aerial at all it must be much more loosely coupled.

Incidentally, a local receiver using the old "direct-on-grid" arrangement on 2 L O's wave-length used to receive severe interference from my transmitter working on 21 *metres!* Given a "tight-coupled" circuit of the Fig. 1 type the owner was absolutely unable to tell me whether I was transmitting or not.

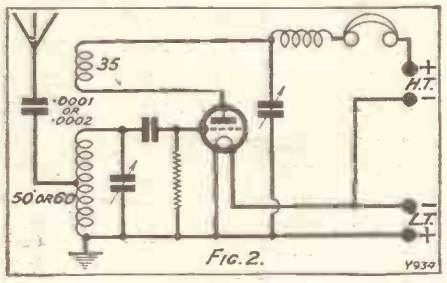


FIG. 2.

An alternative, of the capacity-coupled variety, makes use of what was formerly known as the "C.A.T." (constant aerial tuning) method. The old arrangement usually had the aerial taken directly to the top of the grid coil through a ·0001 fixed

(*Continued on page* 147.)

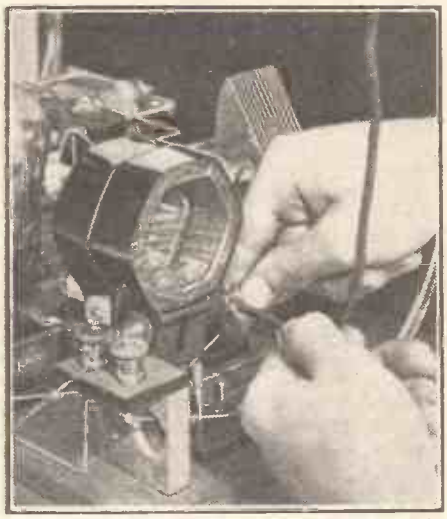
COUPLING THE AERIAL.

(*Continued from page* 145.)

condenser. This was in many cases inadequate, but the modification of it shown in Fig. 2 is really quite good.

Here the aerial is taken, through the ·0001 or ·0002 fixed condenser, to the centre-tap of an ordinary centre-tapped plug-in coil. Fig. 3 shows a circuit using an "X" coil, giving an almost exactly similar effect. With both of these arrangements the damping effect of the aerial on the grid circuit is rather greater than in the case of Fig. 1, so that it is usually necessary to use a No. 50 coil for ordinary broadcast reception. Sometimes (depending largely on the aerial itself) a No. 60 can be used.

The extraordinary thing, in my opinion, is that each of these arrangements is so extremely effective that one would reasonably expect to find them in universal use. Actually they might be quite unknown, judging by the number of sets utilising



An "X" coil used in the aerial position, as at Fig. 3.

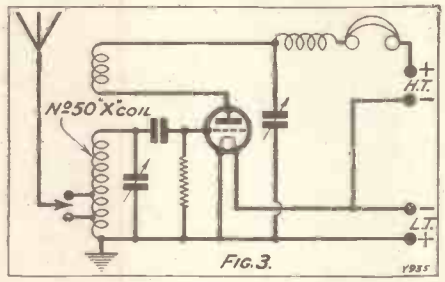
them. Naturally, compared with sets using H.F., the selectivity even now is not of a very high order.

Now to come to some arrangement capable of giving something still higher. We must remember always that no circuit with a high H.F. resistance can possibly tune sharply. High H.F. resistance may be caused simply by losses in the coil, by a poor variable condenser, by bad circuit layout, or, most common of all, the introduction of the losses in the aerial system and aerial circuit into the grid circuit by too tight a degree of coupling. There are all sorts of other ways of ruining the selectivity of a circuit, but we must not consider too many of them at once. We are chiefly concerned at present with the aerial circuit and its losses.

Improve the Aerial.

Do not, therefore, lose sight of the obvious fact that the aerial and earth themselves are far too often a cause of inselectivity. In the words of a lecturer I once heard, "Overhaul your aerial until it is far better than anything you have ever had up previously. Then pull it down again, and make it at least twice as good as it was before."

Do the same with the earth, and avoid bad joints like the plague. A short-direct earth lead should be aimed at if humanly possible, and an aerial lead-in that comes straight through a tube in the window frame to the aerial terminal of the set is a far greater asset than most imagine.



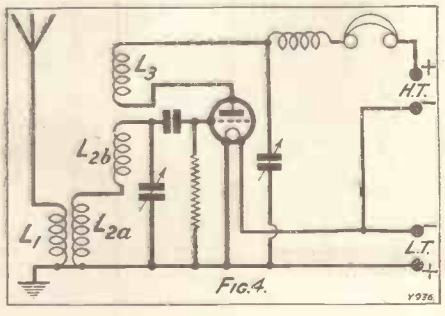
There is no need to go to great lengths in striving for efficiency in the aerial coil, since the losses in the aerial and the earth themselves, however proud of them we may be, will always, unfortunately, be high in comparison with those of the coil.

The grid circuit, however, is another story. Use a good coil and a good condenser, and, if possible, connect the condenser directly across the coil and solder the joints. By which I mean do not connect the coil from the grid condenser to the filament leg of the valve, the condenser lead taking a "short cut" to the L.T. switch or some similar place instead of returning to the same point as the coil.

Also remember the old reminder to keep the coil in such a place that its field will not intersect the L.F. transformer, variable condenser, metal panel, etc.

The Split Secondary.

When we have made sure of all these points it will be worth while to use the circuit shown in Fig. 4. POPULAR WIRELESS has published one or two sets employing this or similar circuits. This particular variety is known as a "split-secondary" circuit, half of the grid (or secondary) coil being coupled to the reaction coil, the other half to the aerial circuit. In addition to an increase in selectivity this circuit has the most desirable result of lessening the effect of the degree of reaction upon aerial tuning. The aerial coil in an ordinary "three-coil tuner" is, naturally, coupled to the reaction coil as well as to the secondary, and this is, in a certain measure, responsible for the "interlocking control" that is noticeable on so many sets; when the reaction coil is slackened off to prevent oscillation the wave-length of the aerial circuit immediately changes, on account of the change in the degree of coupling between all three circuits, and we lose the



station we are listening to and have to retune, perhaps having to reset reaction yet again.

The split secondary circuit is free from this effect, since the aerial circuit is not directly coupled to the reaction coil at all.

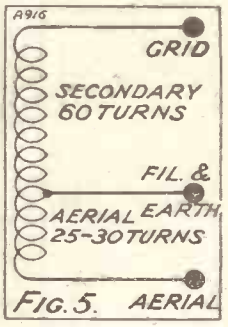
The two halves of the secondary coil should be arranged at right angles, and the half that is coupled to the aerial coil should be the "earth" half, exactly as shown in the diagram. Two No. 30 coils may well be used for the secondary, or even two No. 35's, since the fact that the two halves are not coupled reduces the total inductance.

This circuit is very convenient if home-made coils are used, since the two six-pin formers, or some similar scheme, can be employed for carrying the two pairs of coils, and the layout is simplified accordingly.

It is outside the scope of a short article like this to describe in detail the many other forms of improved detector circuit, but, for the benefit of those using home-made coils of all kinds, the following hints may be of interest.

Practical Details.

Effective arrangements are: A secondary of about 70 turns wound to fairly small diameter, the aerial coil consisting of 20 turns wound over it on the former, and at the filament end, the reaction coil being about an inch further down the former and consisting of 40 turns; a secondary coil of 60 turns tapped at 20 turns, the aerial being connected to this point through a ·0001 or ·0002 condenser; an aerial coil wound on "beyond" the filament end of the coil, as shown in Fig. 5, still using one continuous coil. Secondary, 60 turns; aerial, 25 to 30 turns.



Innumerable other arrangements are possible, and I hope that readers, having tried one of the schemes outlined herewith, will wake up to the possibilities and evolve something of their own to suit their particular purpose and conditions.

FOR YOUR NOTEBOOK

Don't rely on an ordinary house switch to cut off the supply from your mains apparatus—sometimes it doesn't!

* * *

If you are taking H.T. from the mains, remember that your aerial may be at high potential, unless the unit is an up-to-date one.

* * *

The long strip of a flash-lamp battery is the negative pole, and the short strip the positive.

* * *

A shock to the telephones, such as is caused by dropping them upon the floor, is liable to damage the permanent magnets and to render them insensitive.

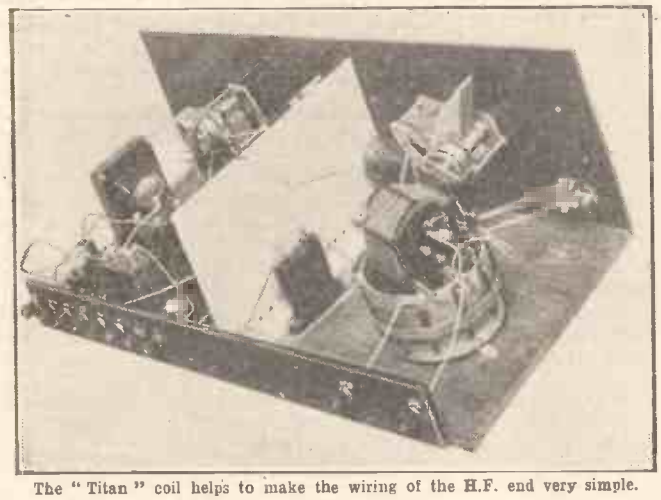
* * *

If you use a celluloid accumulator it may be an economy to renew the electrolyte every twelve months or so, especially if the accumulator is a cheap one.

MORE ABOUT THE "P.W." FOUR.

Here are some further practical notes about the fine four-valver described last week. Don't forget to go and see it at Olympia.

FIRST of all, two more points about the L.F. side. We have found it rather safer in our own experience to have the two transformers of different makes or different types, and we should be inclined to advise you to do the same unless you are certain that the two transformers you propose using are quite safe. Secondly, you will note that a plain output circuit is provided,



The "Titan" coil helps to make the wiring of the H.F. end very simple.

and it is to be understood, as usual, that if you are going to use a super-power valve it is rather desirable that you should add an output filter as a separate unit.

Now, there is a feature of the H.F. side of which we deliberately omitted mention previously, because we did not want to bring in any side issues until we had got the main idea of the set quite clear. This is a form of H.F. volume control, which you will see on the panel in the form of a 50,000-ohm wire-wound potentiometer. This is the same type of component as is used in mains H.T. units for voltage adjustment, and it serves to control the voltage on the screening electrode of the H.F. valve.

A Valuable Feature.

This enables you to cut out one of the usual connections to the H.T. battery, which in this set is made at the same point as the anode of the valve. It also enables you to find the correct working voltage for the screening electrode very quickly and simply by tuning in a fairly weak station, and then turning this knob until you get it as loudly as possible. Then, when you tune in a powerful station, you can control its volume to a nicety by the variation of voltage at this point.

While on the matter of voltages, it may perhaps be as well to give some idea of the working adjustments for all the H.T. battery leads. H.T.+1 feeds the H.F. and first L.F. valves, and should be given at least 120 volts if you hope to get the best results of which the set is capable. H.T. + 2 is for the detector, and should have the usual 40 to 70 volts, adjusted to give the smoothest reaction. H.T.+3 is for the power stage, and here again you should give the valve the maximum available up to the maker's rating, which is usually about 140 or 150 volts. At any rate, do not work below 100, and certainly not less than 120 volts if you can help it. If your battery is one of 120 volts, of course, you can join H.T.+1 and +2, and connect them to the maximum voltage point on the battery.

The Valves.

Valves for the set should be these: The H.F. valve must be of the upright screened-grid variety, that is to say, one of those with the anode brought out to a terminal on the top of the cap. The detector should be the H.F. type with an impedance of about 20,000 ohms, the first L.F. preferably one of the L.F. or G.P. types with an impedance of about 10,000 to 18,000 ohms, although another H.F. type can also be used here if required, to obtain the very loudest possible signals from weak stations. The L.F. type is somewhat to be preferred for general purposes, however, since it usually gives slightly better quality on the more powerful stations.

The last stage must, of course, be at least a power valve, and for the finest quality and the greatest undistorted volume, it should be of the super-power type. This will, of course, depend upon whether your H.T. supply is capable of standing up to the current of such a large valve. Grid bias on the first L.F. stage will be of the order of 1½ to 3 volts for the H.F. type of valve or 3 to 4½ volts for the L.F., while as regards the last valve you should go by the instructions contained in the carton of the valve, since different makes vary very much in their requirements.

Special Switching Precaution.

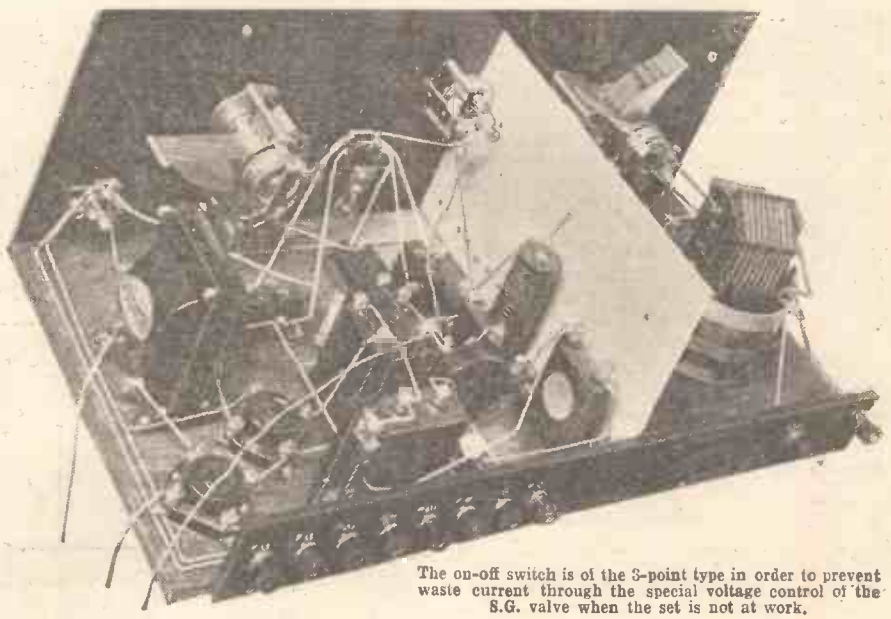
Constructionally you will require very little beyond the clear photographs and diagrams given last week, but we should just like to warn you as to one or two points. First of all be very careful to obtain the correct types of switches, or you may find some little difficulty in following the wiring. In this connection we should perhaps mention that the on-and-off switch is of exactly the same type as the first (left-hand) wave-change switch, a three-point type being used here in order to switch off the H.T. potentiometer which provides the adjustable voltage for the screening electrode of the H.F. valve. The ordinary type of L.T. switch will not do here, because you would then be taking a constant small current from your H.T. battery night and day.

The type of switch you want for the purpose has been described many times in connection with wave-change sets, but it may be as well to be explicit, because we find readers sometimes go wrong over this detail.

The correct type is really a three-point on-off switch. It has three connecting points upon it, and in the "on" position all three are switched together and all are separated at the "off" setting.

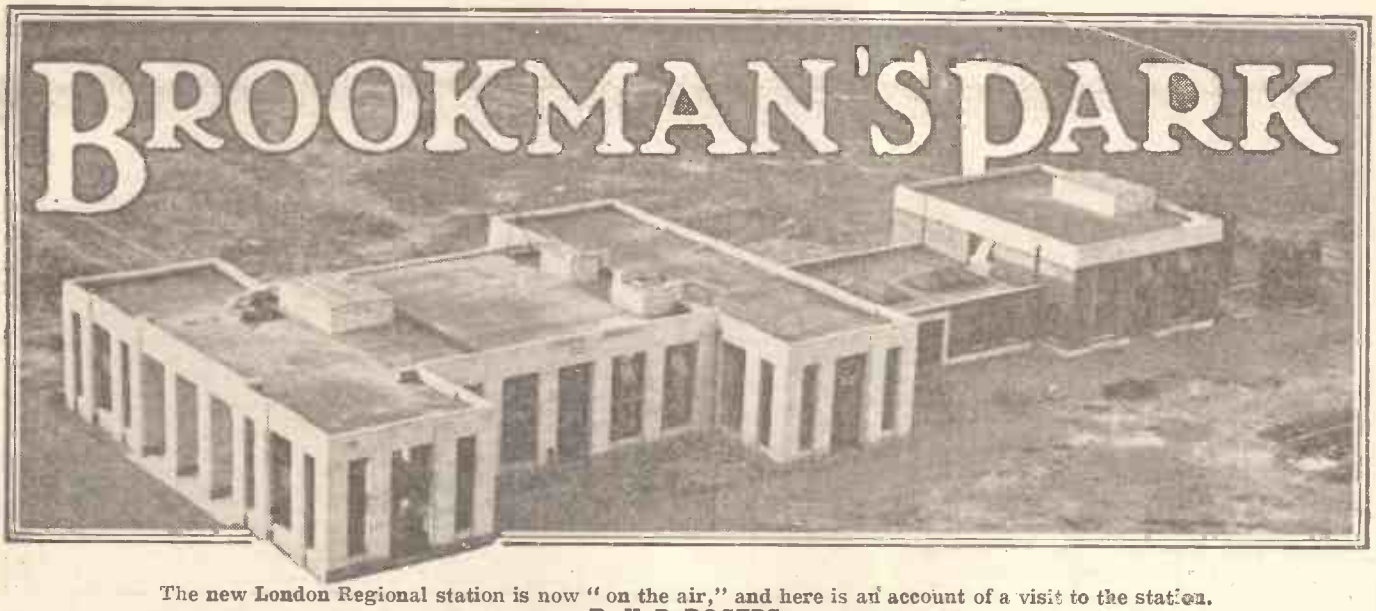
A Wiring Hint.

Do not forget, too, that you must use insulated wire for all the leads which pass through the holes in the screen to avoid short circuits between the wire and the metal. The popular "Glazite" or ordinary bare wire covered with Systoflex sleeving is recommended here. Now, with a final recommendation that you should make a rather careful copy of the layout of this set, we can leave you to make it up and find out for yourself what a very fine outfit it can be.



The on-off switch is of the 3-point type in order to prevent waste current through the special voltage control of the S.G. valve when the set is not at work.

BROOKMAN'S PARK



The new London Regional station is now "on the air," and here is an account of a visit to the station.
By K. D. ROGERS.

"THE London Station is now closing down; but there will be a test transmission from the new Brookman's Park station at midnight on 356·3 metres. Good-night everybody. Good-night!" There is a pause while the wave of 2 L O is switched off, and then the ether comes alive again as the strains of a quintet are heard at tremendous strength.

Here in the north-west of London, only a few miles from the new station, we rush to our receivers to reduce the volume, for instead of the few kilowatts in the London aerial some 12 to 15 miles distant, we are now getting the effects of the 30 kw. or thereabouts in the new Brookman's Park aerial only five or six miles away. Moreover, the Brookman's Park aerial is well out into the country so that there is very little absorption or screening due to buildings, etc.

"What is this Brookman's Park station like?" you may ask. I will try and describe it to you in as few words as possible, but with the aid of the photographs I think you will be able to get some idea of this latest achievement of the B.B.C.

Situated in a remarkably flat field of some 30 to 35 acres, there is a low stone building (the station itself), roughly in the centre of the field, occupying about three-quarters of an acre. At the four corners of a rough square there are four steel towers, one at each corner.

The Aerial System.

These are the masts, which are of the lattice tower type and are insulated from earth at the base, and carrying two aerials parallel to each other, and running roughly east and west.

The masts are only 200 feet high—much lower than would have been chosen from an engineering point of view, but, unfortunately, there are Air Ministry limitations on the height of masts which may be erected near London, and so the height had to be fixed at this low figure. Other Regional stations throughout the country will, I believe, have masts very much higher than this, reaching up to about 700, or more, feet.

The distance between each of the masts at Brookman's Park is 600 feet, and there are 900 feet between the building and each aerial. Below the centre of each aerial is a small square stone building, containing the feeder system, coupling the feeder wires from the main building to the aerial itself, and underneath, radiating from this building is the earth system consisting of a number of wires buried one foot below the surface of the ground, the ends of the wires forming an oval extending about 200 feet on each side of its particular aerial, and 150 feet beyond each mast.

The main building is of stone for the most part, with a gravel path running round and connecting with the road some 150 yards away. As we walk round the building we notice that at the back are two large oil tanks, each containing some 75 tons of fuel oil for running the Diesel engines which operate the generators. Besides these tanks is a cooling device for the circulating water for the engines.

"Home-made" Power.

Entering the back door we come to a room containing a boiler capable of heating the whole building from the heat obtained from the engine exhaust gases. Incidentally, there is also an oil-fed boiler for heating purposes when no engines are running.

Next to this is the power-house itself containing the four Diesel engines generating some 300 h.p. each and consisting of six-cylinder engines mounted on a single bed of concrete, underneath which is a special bed of cork. Between the bed of concrete on which the engines rest and the rest of the building is a gap some 14 in. wide, so that the whole of the engines and their generators are mechanically isolated from the rest of the building. In this way the vibration of the engines cannot be transmitted to other parts of the building.

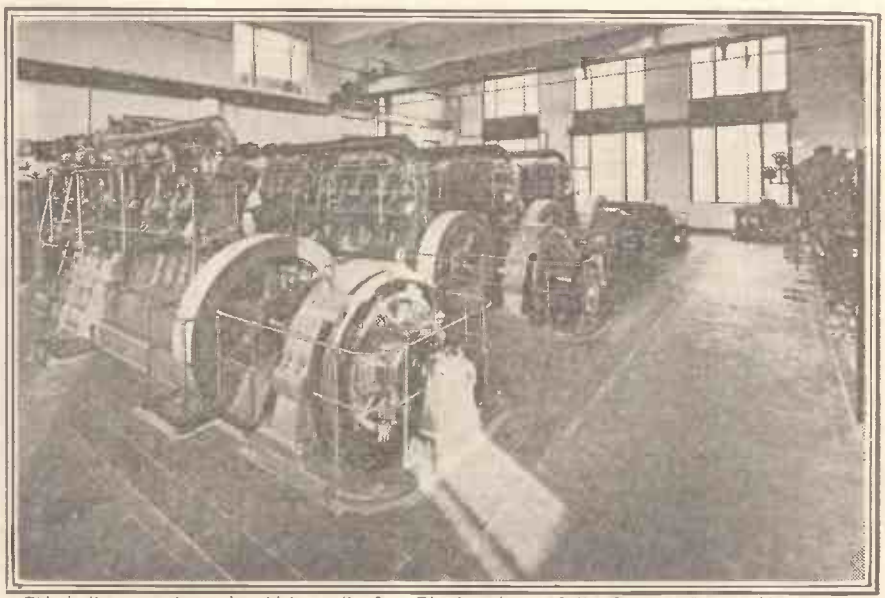
30-50 Kilowatts.

The engines are started up by means of compressed air operating on two of the cylinders, after which the oil fuel is switched on and the other cylinders are switched in in pairs.

Next to the engine-room the storage battery is housed, this battery having a capacity of some 2,000 ampere hours, and being capable of supplying current for the operation of the station at full load for half an hour.

In order to obtain 30 kw. in the aerial there is only need to run one engine for each

(*Continued on next page.*)



This is the power-house in which are the four Diesel engines and the dynamos for providing electric power for the whole station.

BROOKMAN'S PARK.

(Continued from previous page.)

transmitter, that is for each wave-length, but the power in the aerial can be put up to 50 kw. or more if two engines with their generators, per transmitter, are used.

The main motor generator room contains six large generators, and a number of small ones. The three largest generators are situated in the centre of the room, and generate 160 kw. at any voltage between 7,000 and 12,000 D.C. These are for the high-tension supply to the anodes of the main transmitting valves.

The arrangement of these generators is rather interesting in that each set consists of three machines on one bedplate—a driving motor and then two generators in series connected to it, each generator with two commutators capable of producing a voltage of 3,000 each. The commutators, in each group, are connected in series so that something like 12,000 volts are available.

Always a "Spare."

When the station is running on full load, with both transmitters working on the two wave-lengths, two of these motor generators will be in use, while the third one acts as a spare for either transmitter. Three other large machines in this room are used for heating the filaments of the transmitting valves, and there are also a number of small motor generator sets supplying grid negative voltages and separate anode supplies to drive a modulating amplifier stage of the transmitters. All these generators are grouped in threes, one for each transmitter, with a spare, so that the whole of the apparatus is duplicated throughout (one for each wave-length), and in addition there is a spare set of generators, so that no delay shall occur in the case of a breakdown.

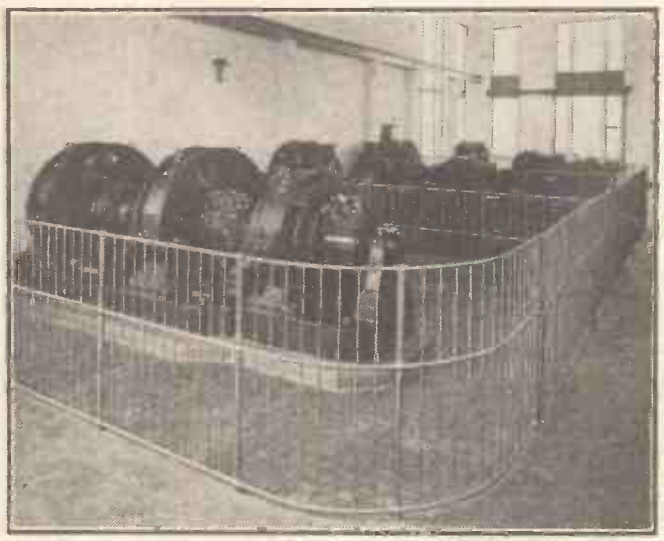
Next, going through the building towards the front, we come to the largest room of all, the transmitting hall. This contains the two transmitters along two sides and facing each other, while running at right-angles at one end is the main switchboard which controls the output from the generators in the room behind.

Directly underneath each transmitter, and the switchboard, there is a vault which contains all the wiring between the switchboard and the transmitters and the various accessories such as the water tanks for the transmitting valves.

In the middle of the transmitting room are two control tables, one for each transmitter, and at each of these sits an engineer watching the operation of the transmitter by a row of metres on the control table.

A novel feature about the water system for cooling the valves is that it is totally enclosed, so that distilled water can be used instead of ordinary tap water, which would cause scale to form on the anodes of the valves.

Safety devices are provided on all dangerous portions of the apparatus, so that it is impossible to open the doors or "gates" of any of the units without cutting off the electrical supply. The transmitter high-frequency portion is neutralised in the same way as at 5 G B, and eventually the Brookman's Park station will be tuning-fork controlled so that it shall automatically keep dead on its wave-length.



The three 12,000-volt D.C. motor generators for supplying the anode potential and current of the main transmitting valves.

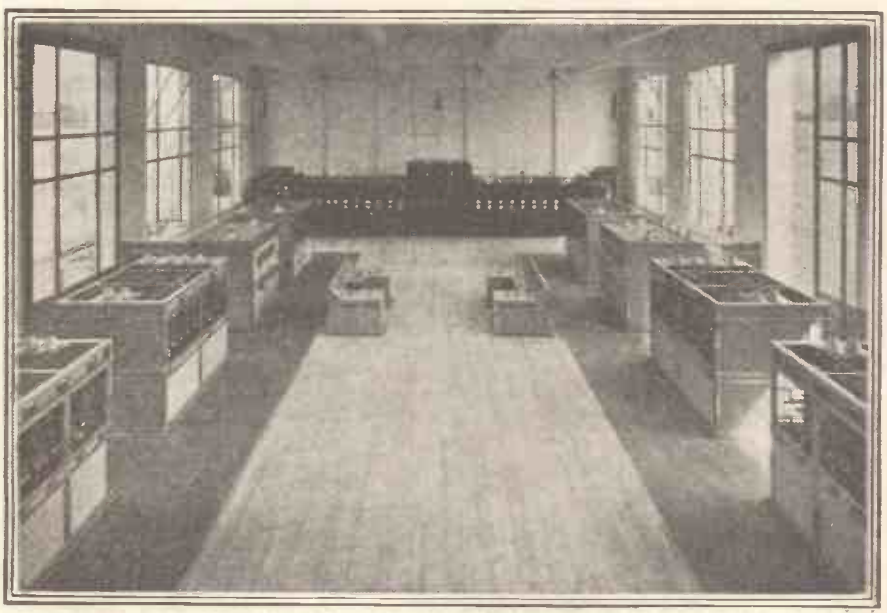
Efficient and Artistic.

Next to the main transmitter hall are two control rooms where the programme is received on the telephone lines running to Savoy Hill. These two rooms, one for each transmitter, contain all the necessary amplifiers and controlling gear, while the lines to Savoy Hill are underground all the way to ensure constancy of performance and reliability.

Here in these control rooms also are small receiving sets built in so that the modulation can be tested as received from the aerial of each transmitter, as well as controlled and watched in the ordinary line circuits.

Everything has been done to make the station as up-to-date and as perfect as possible, and there is no doubt that it is a wonderful achievement from a technical point of view, and also from the point of view of appearance, the station being both systematically and artistically laid out. In fact, the artistry with which the station has been designed gives one the impression that one is walking round an electrical exhibition rather than a high-power modern broadcasting station which is really designed to do actual hard work and not merely to look pretty.

Finally, in addition to all the various rooms which have briefly been described, there is a test room, where precise measurements of the performance of either transmitter can be made, and upstairs there is a small studio for local speech or music tests if necessary.



A general view of the transmitter hall. On the left is the complete transmitter and control for the northern aerial, the apparatus for the second aerial being seen on the right.

Uninterrupted Service.

The cost of this modern wonder is stated to be under £150,000, and its final opening will mark the beginning of a most important era in the history of British broadcasting.

Brookman's Park is to take up the work of the London Station very gradually, and it will not be till the end of the year that the two full waves are in operation, and that the old 2 L O in Oxford Street finally thinks about closing down. The programmes from Brookman's Park, of course, will come from Savoy Hill, and later from Broadcasting House, being sent by land-line.

There are no external power lines to break down; while the duplication of apparatus all through the station, and special change-over switches so that valves may be replaced without any loss of time, should enable a unique uninterrupted service to be maintained.

So much for the first of the Regional stations. The second in under way, and before very long I hope we shall see completed the whole of the Regional scheme, which should place Great Britain in the forefront of the world's broadcasting services.

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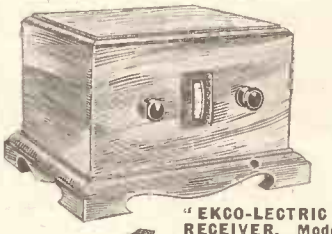

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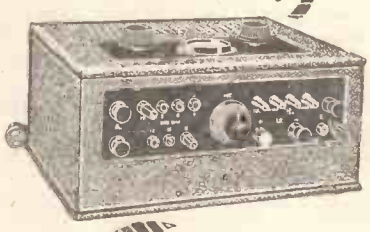
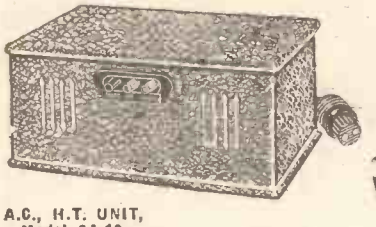
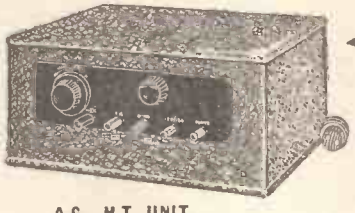


ALL-POWER UNIT, D.C. Model C.1A. £9-15-0 complete.



A.C., H.T. UNIT, Model 2A 10. £3-10-0 complete.



A.C., H.T. UNIT, Model 4T 60 £7-5-0 complete.

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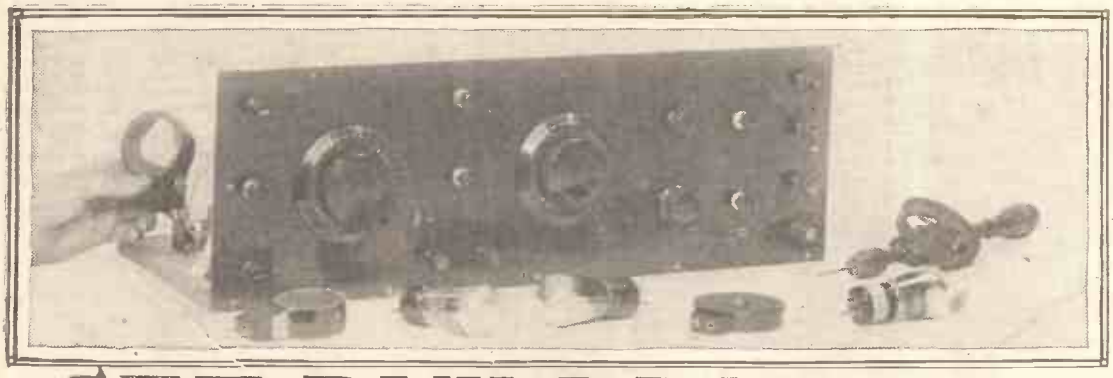


SET-BUILDING ECONOMIES

A practical article for constructors.

By D. GLOVER.

IF you want that set you are going to build to possess the triumvirate of virtues—selectivity, sensitivity and purity of reproduction to the highest possible degree—you must be prepared to spend a good bit of money on it.

Now the general standard of radio components is, these days, a pretty good one, and if you buy the cheapest of everything throughout, your results may still be fairly passable. On the other hand, if you buy the best of everything your money will not be wasted. It is quite likely, however, that your individual requirements will admit a little cheeseparing of one or other quality as it were.

That is to say, you might not be so cosmopolitan that hyper-super-sensitivity is essential as you must scour the whole five continents! Likewise, you may not be so musically critical that nothing but "straight-line" reproduction will answer your purposes.

Very Important Items.

Sensitivity and selectivity go together, one is of no real value without the other. A set that will receive fifty programmes will be of little use if the fifty programmes run into each other and cannot properly be separated. Similarly, a power to select tightly packed programmes will be useless without the power to receive stations from which to select.

Now it may be useful to constructors if we briefly summarise the duties of the most commonly met components in regard to sensitivity and selectivity and quality. If you want good loud-speaker reproduction, whatever you can do to the set will be fruitless unless the loud speaker itself is a first-class reproducer.

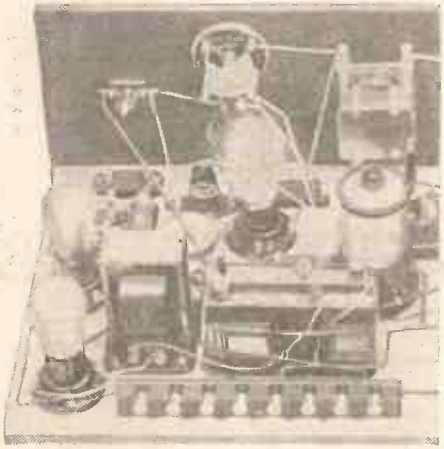
The loud speaker is the most unsatisfactory radio item of all. That is to say, there are a few that are very good and a lot that are, at the best, mediocre. There is so much real difference between loud speakers that the effect of a really good one tacked to a really bad set will undoubtedly be superior to that of a poor loud speaker deriving its input from the most magnificent set ever built.

Of equal importance are the valves, but, fortunately, there are very few valves on the market that are anything but quite good. Therefore, in regard to these accessories it is a question of the careful choice of type rather than the selection of makes (which is made more easy in view of the standardisation of types which rules).

But we must get back to the set itself. There is not much to be found in the H.F. end of the set that will play a very great part in the quality of reproduction. For this we must examine the L.F. stages.

A "Key" Component.

Here you will probably find an L.F. transformer. This is a key component and one of the few items to be found in a radio receiver the performance of which can be fairly well weighed up by a characteristic curve. All the leading makers of L.F. transformers publish characteristic curves



L.F transformers are vital components, and should be very carefully selected.

of their components, but there are a large number in the cheaper class that do not give such evidence of capabilities.

If you are not out for quality, you will buy one of the cheap transformers, but you do get good value for money with those that are higher priced. And, remembering that other people will probably have to listen to your set as well as yourself, the few extra shillings for one of the better-known makes will be a good investment.

You pay for something more than mere mechanical construction in those higher-priced transformers, for a transformer is not like a condenser, the design of which may play but little part in its electrical operation. Both the design and construction of an L.F. transformer determine what distortion it is going to cause. That is rather a cruel way to put it, but you will realise the importance of the article if you can appreciate the fact that the best of L.F. transformers causes a certain amount of wave form and frequency distortion, while the worst will do a terrible amount of mangling.

L.F. chokes are also components that need careful selection. You will pay as much for condensers, grid leaks, anode resistances, and other such items as your conscience dictates. "Buy the best of everything" is a slogan which only a few fortunate ones can live up to.

I think we have dealt with everything that can seriously affect the reproduction. I am taking it for granted that you will adhere to the values of the components specified in the constructional details of the set you are going to build, but do not forget that components of doubtful origin may have doubtful electrical values.

That a grid leak is marked 2 megohms should not be accepted as evidence that its resistance is of that value. If the article also bears the name of a well-known manufacturer it is pretty sure to be quite O.K., because in radio few makers of dud stuff live long enough for their names to become well-known.

On the H.F. side we are more concerned with sensitivity and selectivity. All coils, H.F. chokes and H.F. transformers which figure in the circuit can be regarded as master components. In S.G. circuits an H.F. choke may be of paramount importance, and only the very best of makes should be purchased. And the coils and transformers, too, can make an enormous difference to the set's performance. There can be all the difference between a dud, lifeless outfit and a first-class programme collector.

The Cheaper Productions.

Providing the insulating materials which are included in their constructions are of good character, valve holders, coil holders, variable condensers, fixed condensers, and so on, can, as with the "minor" L.F. components I have indicated, be subjects for economising.

Nevertheless, it must be pointed out that serious faults are at times traced to faulty insulation in such articles. You can with safety get the cheaper productions of well-known manufacturers, disregarding perhaps the finish and appearance of the component, without sacrificing efficiency.

In a short article of this nature it is impossible to go very deeply into every aspect of component selection, but I have endeavoured to convey a few broad principles which will help you.

CORRESPONDENCE.

"ARIEL'S" FAIRY TALES.

MOVING-COIL SPEAKERS.—AN ENGINEER'S SET DESIGN.—THE "PRESTO" THREE.—THE "TITAN" THREE.

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

"ARIEL'S" FAIRY TALES.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to Mr. Harry W. Daly's letter anent my previous letter and the results I stated I obtained practically without batteries. Will you inform him that my voltmeter, which is one of the best on the market, is quite O.K.

For Mr. Daly's information I might mention that really I was not serious. One reads about such wonderful claims made by some of your readers, obviously impossible and in the nature of fishermen's tales, that I merely thought I would cap the lot. I am afraid "Ariel" publishes rather a lot of these fairy stories in his weekly contribution, and I am afraid he does it really to fill in space.

I must apologise to Mr. Daly if he took me seriously, but I rather hoped my letter would have the effect of letting the "Romancers" see one person at least does not believe them.

I met a man the other day who boasted 60 stations on his . . . . .* at speaker strength. I gave him the opportunity to easily earn five pounds; but in practice I found his actual bag was six stations.

Yours faithfully,
B. GLADSTONE.

P.S.—The plates of my output valves were actually getting 360 volts.

Kensington, W.14.

* Mr. Gladstone refers here to a well-known set NOT of "P.W." design.

MOVING-COIL SPEAKERS.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to your issue of August 31st, containing a letter of appreciation from J. M. R., of Devonport. Whilst agreeing with your correspondent regarding the efficiency of the various circuits published in your valuable journal, I note with great interest his remarks about the coil-drive speaker.

If J. M. R.'s letter is to be taken seriously I am of the opinion that he has never heard a moving-coil speaker working correctly, and that he should not make statements in wireless papers, at any rate, or he may find his postbag considerably more than his previous replies. Perhaps he has connected his moving-coil speaker the wrong way round. If he has I would quite agree with him that the speaker connected this way would not be an ideal reproducer.

Having been a serious experimenter for some seven years I would like to appeal to some "P.W." readers in Devonport, who have moving-coil speakers, to give J. M. R. some idea of what such a speaker can do. I am sorry that he is too far away from my place or I should be only too pleased to let him hear my own M.C. and amplifier, which would make him withdraw his remarks.

Incidentally, should your correspondent wish to build a really good set, I am sure that "P.W." could cater for his needs, but he would have to use more than 60 volts H.T.; but no doubt his existing battery would be very handy for grid bias.

Trusting you will be good enough to spare a little room for the above letter in your paper, of which I have been a constant reader since its first issue.

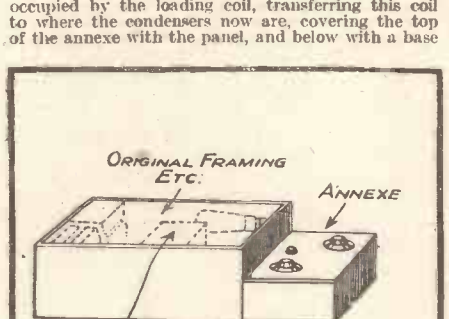
Yours faithfully,
Colne, Lancs. "ONE OF THE L.S.5 BRIGADE."

AN ENGINEER'S SET DESIGN.

The Editor, POPULAR WIRELESS.

Dear Sir,—In view of the desirability of keeping variable condensers dust tight, especially in portables, I would suggest a two-valver on the lines of Mr. English's "Traveller's" Two in the "Modern Wireless" June number, with the condensers and perhaps the rheostat in an attached annexe, with the controls and dials readably placed out of harm's way on a panel inside the suit-case.

This could be done by increasing the space now occupied by the loading coil, transferring this coil to where the condensers now are, covering the top of the annexe with the panel, and below with a base



The suggested set layout.

sliding or screwed on. The depth of the condensers would allow the panel to be at a lower level than the rest. The valves, etc., could still be left open and accessible as at present, though a sliding cover of fibre, etc., could easily be fitted.

Further, and apart from the above, where extreme lightness is not required, as other things often have to be carried at the same time, why not get the double advantage of more space for this purpose, and a larger frame aerial as well as accessible H.T. plugs by using a 20-in. or large suitcase with a frame in the lid easily detachable, as well as or instead of round the set. Perhaps Mr. English or your staff would indicate a good set on these lines. The set has the advantages of a wave-change switch, alternative outside aerial and auto grid bias.

Yours faithfully,
"CIVIL ENGINEER."

London.

THE "PRESTO" THREE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having built the "Presto" Three featured in your paper of recent date, please let me congratulate the staff of the paper for the very splendid set they have given us.

Using exactly the components as specified, the results are almost unbelievable, for volume and the number of stations received are far above what I expected to get, and it is easily the best set I have yet put together.

I am using 2-volt valves, and instead of an H.F. valve for the second valve I am using an L.F. valve which I was using in my previous set; the results cannot, I am sure, be improved in any way.

I am using a Ferranti A.F.5 transformer, which I suppose has something to do with the extraordinary volume I am getting.

As I built the set in an evening from start to finish, and had it going the same evening, it cannot be said that it is a difficult set to put together.

With many, many thanks,

Yours faithfully,
JAMES EMTWISTLE.

12, Davenham Road,
Darwen, Lancs.

THE "TITAN" THREE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Just a few words in praise of your "Titan" Three, which I consider to be the most efficient three-valve set "P.W." has designed. I have read "P.W." since its early days, and have constructed dozens of sets from it.

I had rather disappointing results with the set at first, but eventually traced the trouble to a faulty H.F. choke. Recently I received as many as 33 stations on the loud speaker with this set, all at good volume, as well as numerous other transmissions which were either weak or badly jammed.

Stations seem to roar in at all parts of the dial with little or no reaction. The local station, 5 P Y (five miles), comes in at terrific volume, but I rely on 5 X X and Radio-Paris for my programmes. Hilversum seems very weak in this part of the world and Morse interference is prevalent on all wave-lengths.

Wishing "P.W." every success in the future and thanking you again for such an excellent set.

I remain,
Yours sincerely,
W. T. CHAPMAN.

Saltash.

SHORT-WAVE NOTES.

By W. L. S.

A DULL period does at last seem to have spread over the shorter waves, in readiness for the great change that usually comes with the winter. Surely there has never been a year like 1929 for consistent results throughout the summer, and we cannot tell yet whether these fine conditions have been making up for last winter, or whether we are to have a bad winter now to compensate for them!

A New Country

One or two regular listeners have written and told me that they regularly hear S N I A A on the amateur waves, working with stations all over the world. S N is not a recognised prefix, and I rather thought he was a pirate. Mr. G. C. Allen, however, has been good enough to pass on the official information that his Q R A is "Ford Smith, Ascension Island, South Atlantic Ocean." Here's a new country for the "DX merchant" to go out after. Ascension Island is quite a novelty!

A Birmingham correspondent remarks upon the strength and clarity of the two broadcast stations on 31·4 metres or so—P C J and the new Copenhagen station. He finds them as simple to pull in as stations on the ordinary broadcast band, and gets them both without reaction. He adds that American stations require a good deal of "wangling," but patience will bring them in at full strength.

In another interesting letter Mr. R. Price Mann, of Aden, Arabia, comments on 5 S W and other controversial topics. He says: "My experiences seem to corroborate other readers with regard to 5 S W, which comes in poorly compared with such stations as P H O, and what programmes!" He mentions an American coming in at full loud-speaker strength on about 16 to 17 metres. Has anyone else come across him? I cannot remember him myself.

Another interesting newcomer is H S 1 P J, Bangkok, on 16·9 metres. He apparently uses 20 kw. and broadcasts on Sundays from 12.30 to 14.30 G.M.T. In Aden the "local" is Nairobi, but reception varies rather greatly.

After this last week's work I have come to the conclusion that I shall have to build myself two separate short-wave receivers for my own use—one for use with the transmitter, built purely to cover the amateur wave-lengths, and, naturally, with a very small condenser indeed. The other will have to cover the range from 15 to 36 metres with only one change of coils, and I shall probably use two S.G. stages.

It is impossible nowadays to use a receiver simply for "DX" work on the amateur bands and to expect to receive anything else of interest on it, since it either means about eight changes of coils or such a close scale on the tuning condenser that the entire amateur band occupies about five degrees thereon!

Pentode as "Buffer"

A friend has put a useful-looking scheme before me for using a pentode before the detector as a "buffer" valve, and he claims that high amplification is also obtainable after judicious "wangling" of values and voltages. I will not say any more about it until I have tried the scheme for myself.

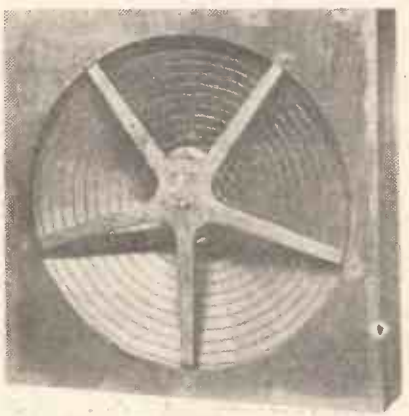
What has the winter in store for short-wave enthusiasts? At the Show many manufacturers boost their ordinary components, and seem reticent about any short-wave gear that they are marketing. But you must wander round for yourselves; afterwards I hope to comment upon some of the more useful short-wave apparatus to be seen at Olympia.

FROM THE TECHNICAL EDITOR'S NOTE BOOK

Tested and Found—?

CELESTION LOUD SPEAKERS.

I WAS walking along the sea-front at Margate not so long ago and was led, magnetically, towards a spot from whence orchestral music was emanating. It appeared to be coming from a refreshment saloon and so it was, but via a large loud speaker suspended above the door. The



One of the Celestion "shell-case" loud speakers. Note the novel diaphragm construction.

reproduction really was excellent, so good indeed that I went nearer to examine the loud speaker at close quarters. It was a Celestion.

More recently still I had one of the Celestion models C14 on the test bench in the laboratory. This is a beautiful instrument and it is indeed good news that it is now obtainable in oak at £11. It is the sort of loud speaker that makes the most of anything that is given to it in the way of input. It gets everything "off its chest" cleanly and crisply.

SPECIAL DIAPHRAGM CONSTRUCTION.

No doubt due to its very special diaphragm construction, it has just that correct proportion of continuance, together with, as the musicians say, plenty of attack. Its response covers a very wide range of frequencies and the attainment of adequate bass is not achieved at the expense of the higher frequencies. Additionally, it is a remarkably handsome piece of furniture, as indeed are all Celestion productions, their woodwork being the highest expression of the craft.

At the same time I tested two of the new Celestions, ZB type shell case loud speakers. These are complete Celestion loud speakers except that their containing cabinets are, as the name suggests, merely shells. They have been produced for constructors to embody in their own cabinets or sets. There are four of these types available, Z 10 B at £3 5s., Z 11 B at £4, Z 12 B at £4 10s., and Z 14 B at £5 17s. 6d.

As they are Celestions pure and simple there is not much need for me to say anything about the performances they give. No doubt a very large proportion of "P.W." readers have heard one or other of the Celestion loud speakers in operation, and I would advise those who have not to take the earliest opportunity of so doing. For sensitivity, volume handling qualities and general excellence of performance they are well in the van.

During the run of the Radio Exhibition Celestion loudspeakers can be heard in the special demonstration room that the Celestion people have engaged.

VOLTRON BABY CONDENSERS.

The Voltron Company of Ponders End, Middlesex, recently sent us one of their Voltron Baby condensers. This reaction condenser is designed on particularly rigid lines and the two moulded bakelite end plates are securely clamped. This little condenser is also fitted with a pigtail, and this is insulated so that it cannot short-circuit against the fixed vanes.

There is no sloppiness of movement in this component, its action has just the right mixture of smoothness and stiffness. A cleanly moulded milled knob pointer is provided in either black or brown, as required. The capacity of the device is ·0001 mfd., and the price is 3s. 9d.

The famous Celestion C12 model.

A LISSEN H.T. MAINS UNIT.

Lissen enthusiasts need not go anywhere else for any of their radio gear now, for the Lissen people are making everything needed for any type of radio outfit. Many of their productions are, of course, household words. There can be few people who have not heard of Lissen H.T. batteries, loud speakers, variable condensers and other such items. Something Lissen that is quite new, however, is the popular model D.C. eliminator of which there are two types, and of the type A which sells at 27s. 6d. we recently received a sample for test.

Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

The design of this mains unit is quite novel. You will be able to judge its appearance from the accompanying photograph.

This is the Lissen Mains Unit that was tested.

On the top are five sockets in which wander plugs can be inserted. The one socket is for an earth connection and it is to here that the earth lead is taken instead of to the set.

Next to this socket comes the H.T. — and then H.T. + 1 80-volts, H.T. + 2 60 volts, and H.T. + 3 120 to 150 volts. The eliminator has been specially designed for the more advanced type of home-constructed set, such as the Lissen S.G.3, Cossor "Melody Maker," Mullard "Master Three," etc. It is, of course, suitable for use with any other type of outfit (using a power not exceeding that which the unit will give).

COMPLETELY SATISFACTORY.

On D.C. mains of 200 to 250 volts, up to 12-milliamps of current is available. This is ample for a three-valve set, using a power valve in the L.F. stage and an S.G. valve, taking the smaller order of anode current. In its handsome moulded case of figured walnut design the unit has a definitely attractive appearance and, as it occupies but little space, it can, if desired, be mounted in a receiving cabinet. To facilitate this three holes are provided for fixing purposes.

A connecting lead and plug for fitting to any standard light socket is provided and it is to be noted that the lead is of a substantial character. On test we found the unit completely satisfactory, the smoothing being most efficient. Even on moderately bad mains there was an absence of hum.

Britain's Greatest Radio Achievement!

A wonderful new Cossor Melody Maker—a year ahead in design! more powerful, more handsome and simpler than ever. Made in two types (*a*) for A.C. Mains use and (*b*) for battery operation. Type (*a*) uses electric light supply—it needs no H.T. Batteries or L.T. accumulators. Type (*b*) operates from batteries in the usual way. Both models have the same beautiful cabinet and simple controls. No coils to change—switch alters wavelength. Balanced control—no "tricky" tuning—turn only *one* knob to hear the programme you want. Enormous range—over thirty stations any evening at full loud speaker volume. Amazing selectivity—specially designed for B.B.C. alternative programme scheme. Uses the wonderful NEW Cossor Valves—the season's most sensational valve development.

Synchronised One-Dial Control

★

No Coils to Change

★

The 1930 Cossor "Melody Maker"

Latest Screened Grid Circuit

★

A.C. Mains or Battery Operation

★

A. C. Cossor, Ltd., Highbury Grove, London, N.5.

CA 488

H.T. LEAKAGE

Practical Hints on High-Tension Battery Economy.

By J. F. CORRIGAN, M.Sc., A.I.C.

IT sometimes happens that a comparatively new high-tension battery is found to have run down more or less completely before its normal time, and that it is useless for further work.

Such a state of affairs is indicative of some form of leakage from the battery which is taking place more or less continually. It is, however, often enough a rather difficult matter to trace such a leakage, and, therefore, in this article, I want to suggest a few points which should be attended to when investigating troubles of this nature.

Fig. 1. Using a milliammeter in series with the H.T. battery to test for leakages.

In the first place, of course, if the H.T. battery is not one of a reputable make it is possible that a form of internal leakage may have been taking place. And, of course, even the best battery, if it has been stored in a very dry place for some considerable time, will in the end show ominous signs of deterioration.

Switch Connections.

The interior of a good high-tension battery should have an appearance similar to that shown in the photograph, Fig. 3. Here, it will be noticed, each individual cell is carefully insulated top and bottom and on all sides from its neighbours, and that the cells also are insulated from the sides of the cardboard container.

If, of course, a battery does not show these signs of careful manufacture, it is easily possible that any failure experienced with it may have been due to internal leakage between the cells.

Many amateurs desirous of obtaining the smoothest possible current from their H.T. batteries place a 2-mfd. condenser across the battery terminals, and arrange that an H.T. battery switch is placed in the position indicated by the *dotted* circle in the diagram, Fig. 2.

Now, in such an instance, it is obvious that if even the very slightest leakage takes place through the condenser, the battery will soon run down, for the leakage will be continual and unsuspected. It is always better, therefore, to place the switch before the condenser (shown by the circle S in the diagram, Fig. 2), for, in such a case, any possible leakage which may take place through the condenser will, at the least, not be a continual one.

Testing with a Milliammeter.

Naturally, all condensers used in H.T. circuits should be tested periodically for leakage faults. About the most practical way of doing this is to connect up the condenser in series with a low-reading milliammeter. A slight direct current leakage through the condenser will thus be detected

It is, indeed, a good plan to go over all condenser portions of the set occasionally with an H.T. battery and a sensitive milliammeter, as shown in the illustration, Fig. 1, and thereby to test the effectiveness of the condensers' insulation.

Similarly, it is occasionally advisable to test out various areas of the panel material in this manner. That is to say, simply by connecting up an H.T. battery in series with the milliammeter, and then by making contact at two different places on the panel with the free leads from the battery and milliammeter. In this manner, areas of faulty insulation in the panel may be detected at once, although they may have remained quite unsuspected for a considerable time.

Some grades of ebonite, for instance, which have been subjected to the influence of strong sunlight for some time, tend to decrease in insulating power, and the above test will discover any serious faults of this nature.

Again, some amateurs, although they are careful to make all soldered joints correctly and neatly, somehow or other seem to forget to wipe away any traces of flux which may have fallen on to the panel in the neighbourhood of the soldering operations.

Now, it is reasonably certain that when traces of soldering flux are present in the neighbourhood of the H.T. circuit of a set they will set up some form of slight, but nevertheless continuous high-tension leakage, which may possibly give endless trouble, mystification, and annoyance to the owner of the receiver.

The moral is obvious. When constructing a receiver, or when acquiring a newly-constructed one, see that no traces of flux or anything similar remain below or at the back of the panel.

Dust upon the upper surface of a panel—especially that nasty, gritty, and all-penetrating grime which is so universally present in our manufacturing cities—will act as a slightly-conducting film, and

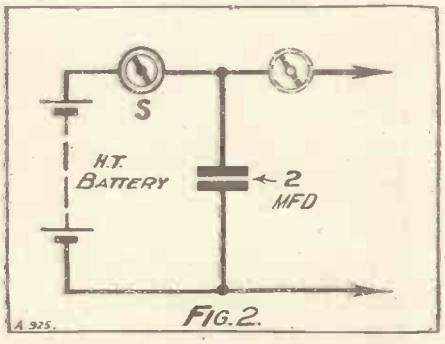


FIG. 2.

so set up a certain amount of high-tension leakage. Such leakage may, of course, be undetectable by the use of a milliammeter, but, nevertheless, it will be present continually whenever the set is in operation.

It should be borne in mind that the continual leakage of even a tenth of a milliamp of current from the H.T. battery will suffice to cut down the working life of the battery many hours.

Preventing Leakage.

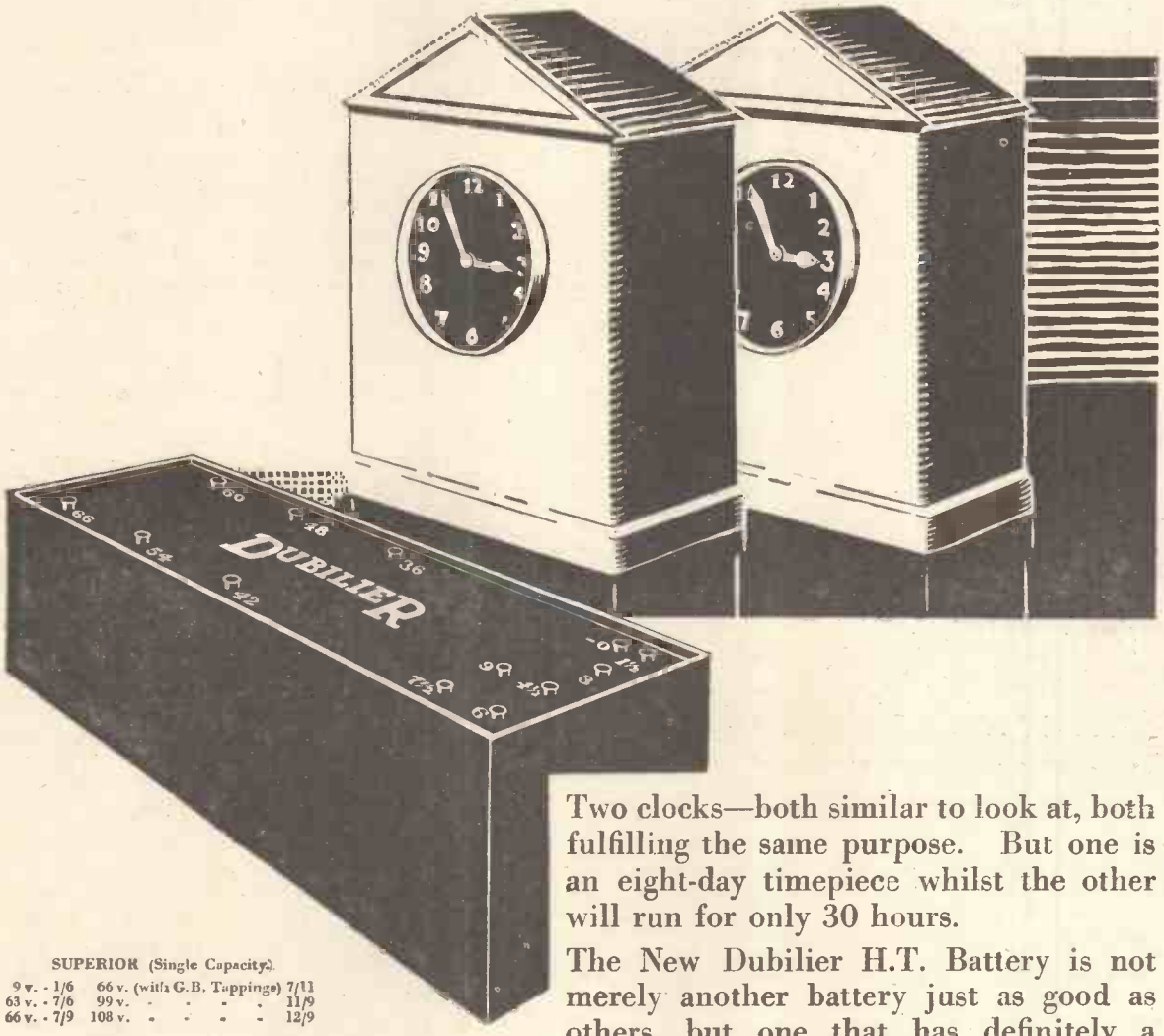
When it comes to having leaks of anything from one-quarter up to two or three milliamperes in the battery or receiver circuit—and such is not infrequently the case—the rapid deterioration of the high-tension battery is easily understandable.

Summing up, therefore, in order to prevent H.T. leakage in your receiver, preiodically test each condenser in the circuit, and, also, any insulating material, such as areas of the panel, composition holders, and so forth, which may be included in, or be present near the H.T. circuit.

Finally remember that you should always switch off the H.T. battery when the set is not in use.

Fig. 3. The interior of a well-made H.T. battery showing the careful insulation of cells.

BOTH LOOK ALIKE BUT ONE RUNS LONGER



SUPERIOR (Single Capacity).

9 v. - 1/6	66 v. (with G.B. Tappings)		7/11
63 v. - 7/6	99 v. - - - -		11/9
66 v. - 7/9	108 v. - - - -		12/9

SUPREME (Treble Capacity)

60 v. - 13/6 63 v. - 14/3
100 v. - 22/-

THE DUBILIER BATTERY

Two clocks—both similar to look at, both fulfilling the same purpose. But one is an eight-day timepiece whilst the other will run for only 30 hours.

The New Dubilier H.T. Battery is not merely another battery just as good as others, but one that has definitely a longer working life.

Dubilier realised the need for a longer-lived battery. After months of research and experiment they have produced one.

You can read about it in the booklet—"A Bit about a Battery"—which you can get free on request. You can best prove its claims by using one in your set now.

DUBILIER CONDENSER CO. (1925), *LTD.*,
Ducon Works, Victoria Road, North Acton, London, W.3.

Visit us at STANDS Nos. 181 and 182, Radio Exhibition, New Hall, Olympia.

B.2

All Editorial communications to be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

IS GRID BIAS NECESSARY?

T. B. (St. Helens.)—"Not having used a loud-speaker set before, there are several things that puzzle me, but worst of all is this grid bias. What is it for and is it really necessary?"

Grid bias is absolutely essential if you are to get pure results and to run your set economically. Unless adequate and sufficient grid bias is used distortion is bound to occur, especially if the signals are loud enough to operate a fair-sized loud speaker.

Furthermore, unless you use the correct bias, the valve will be passing a much higher anode current than it should do and, in consequence, the drain upon your H.T. battery will be heavy and it will quickly run down, thus involving you in unnecessary renewal expenses. This is not the whole of the trouble, for the heavy anode current will tend to decrease the life of the valve itself, so that all things considered, the absence of grid bias will tend to put up the running costs of the set very considerably.

As the grid bias costs practically nothing to use on account of the fact that no current is supplied—but merely a pressure or voltage—it is obvious that on no account should you try to economise by omitting to give your valves the correct grid bias.

A CONTINUOUS HOWL.

P. R. (Nr. Oxford).—"The set has not been touched in any way at all, but whereas it used to be perfectly clear and strong, it is now very distorted and weak and there is a continuous howl. The only thing I think it may be is the H.T. battery, which has now been in use nearly four months. Is this too long and do you think that a new battery would cure the trouble?"

All the symptoms you mention are consistent with a run-down H.T. battery, so we have no doubt that when you have replaced yours by a new one the set will be just as good as formerly.

SETS TO BUILD.

M. C. C. (Birkenhead).—"Re the 'P.W.' blue prints, will you let me know the numbers of these which you can supply containing descriptions of two-valve sets, three valves, or more?"

The following is a list of the "P.W." 6d. Blue Prints for Constructors in stock, showing the circuits employing two valves or more.

BLUE PRINT No. 9.—H.F. AND DETECTOR (TUNED ANODE COUPLING WITH REACTION ON ANODE). Selective circuit, suitable for long-distance reception on the 'phones.

BLUE PRINT No. 10.—H.F. AND DETECTOR (TRANSFORMER COUPLED WITH REACTION). Selective circuit for Continental reception on 'phones.

BLUE PRINT No. 13.—TWO-VALVE REFLEX, EMPLOYING VALVE DETECTOR.

BLUE PRINT No. 16.—H.F. (TUNED ANODE), CRYSTAL DETECTOR AND L.F. (WITH SWITCH FOR LAST VALVE). An excellent circuit for all-round reception.

BLUE PRINT No. 17.—CRYSTAL DETECTOR AND TWO L.F. WITH SWITCHES. Can be used for "Crystal only" and with either one or two stages of L.F. amplification. Useful loud-speaker circuit giving good volume up to 12 miles from a main broadcasting station.

BLUE PRINT No. 18.—REFLEX EMPLOYING CRYSTAL DETECTOR, WITH SWITCH FOR L.F. AMPLIFIER. Useful two-valve circuit, similar to the famous "'P.W.' Combination Set," capable of fair long-distance reception. It is rather non-selective as a rule, but will work a loud speaker

(*Continued on page* 164.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 162.)

up to about 20 miles from a main broadcasting station.)

BLUE PRINT No. 24.—THE "SPANSPACE" THREE. Three-valve receiver employing one neutralised H.F., valve detector with non-radiating reaction control, and one L.F. valve. Specially intended for long-distance reception on 'phones, and loud speaker at moderate ranges.

BLUE PRINT No. 26.—A "STRAIGHT" FOUR-VALVER (H.F., DET. AND TWO L.F. WITH SWITCHING). Suitable for loud-speaker reproduction at moderate distances, using three valves. Continental and other stations can be received on the loud speaker with the fourth valve "on."

BLUE PRINT No. 28.—A "MODERN WIRELESS" FIVE-VALVER (H.F., DET., and THREE L.F.). Designed with the object of giving good all-round results, this set will provide excellent reproduction from the local station, and a number of British and foreign stations.

BLUE PRINT No. 32.—THE "CUBE SCREEN" THREE (H.F. VALVE, NEUTRALISED AND SCREENED, DETECTOR AND L.F.). A sensitive long-range set, giving 'phone signals over great distances, and loud-speaker results from the nearer stations.

BLUE PRINT No. 34.—AN H.F. AND DETECTOR TWO-VALVER (TUNED TRANSFORMER, NEUTRALISED). A simple receiver for long-distance headphone work.

BLUE PRINT No. 35.—THE "UNIVERSAL" THREE. Detector and two resistance-coupled L.F. stages, with provision for the use of two valves in parallel in the last stage. "Reinartz" reaction is employed, and a tone control is also provided.

BLUE PRINT No. 36.—THE "SPANSPACE" FOUR RECEIVER (H.F. DETECTOR, AND TWO L.F.). A sensitive and sciective set for long-range loud-speaker reception. Switching is provided on the L.F. side.

BLUE PRINT No. 38.—A TWO-VALVE L.F. AMPLIFIER. One resistance and one transformer-coupled stage.

BLUE PRINT No. 40.—THE "SUPER SCREEN" THREE. A highly sensitive long-range receiver with one stage of H.F. (Screened grid valve) detector, and one transformer-coupled L.F. stage.

BLUE PRINT No. 42.—THE "Q AND A" THREE. A simple set (Det. and two L.F.) to give full volume on the local station, with a possibility of long-distance work when a little skill in handling has been acquired.

BLUE PRINT No. 43.—THE "INEXPENSIVE" FOUR. A simple and easily-built four-valve set (H.F. Det., 2 L.F.) for long-range loud-speaker work.

BLUE PRINT No. 44.—THE "ECONOMY FIVE." An inexpensive, sensitive, and selective five-valve set (2 H.F. Det., 2 L.F.) for long range loud-speaker work.

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers an unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Inquiries should NOT be made in person at Fleetway House or Tallis House.

BLUE PRINT No. 46.—THE "REGIONAL" THREE. A simple but efficient set for both short and long broadcast wave-lengths with a switch for changing over. Will work a loud speaker from the local station, 5 G B and 5 X X, also usually several foreign stations.

HINTS ON TUNING.

"H.F.-DET." (Bicester, Oxon).—"I have never had a wireless before, but this set has two tuning handles, one marked aerial and the other reaction. At present I am content to leave them and to listen to the British stations only, but I feel that when the winter comes I should like to reach out and get some of the other stations from Europe and so on. To do this I shall have to learn how to operate these two dials properly, and I should be glad of some hints on this."

To get other broadcasting stations, you must learn to use reaction properly, so as not to interfere with your neighbours.

Choose a time when no broadcasting is on from the B.B.C stations, such as late at night or else on a Sunday outside programme hours. First of all set the tuning dial at, say, 100, then slowly and carefully advance the reaction condenser. As reaction is increased the set gets more and more sensitive, and presently this becomes apparent because you will be able to hear that the multitudes of little noises which denote the set is "alive" are becoming louder.

Presently, as reaction is slowly advanced still further, there will be a sort of "plop," and then a gentle "breathing" or rushing sound, denoting that the set is oscillating. If you wet your finger and touch the aerial terminal you will find that there are very loud double clicks every time you touch. If you keep on tapping with one hand, and with the other gently slacken off the reaction condenser you will find that there is a very definite place at which the set oscillates and the taps become very loud. When reaction is *below* that point, the taps are still clear, but nothing like so loud as formerly. When you are *above* the oscillation point, the tap is absolutely loud and clear, and every time the finger is removed from the aerial terminal the rushing sound is heard.

Now, in tuning for long-distance, the great thing is to adjust the set so that it is nearly, *but not quite*, oscillating. Supposing the tuning dial is still set at 100, and we start off on the reaction condenser, listening carefully to the results. At first the set sounds normal, but presently when reaction gets stronger the set sounds livelier.

Presently, as reaction is increased, there is a sort of click or plop, and the oscillation-hiss sets in showing that the set is oscillating (and causing

(*Continued on page* 166.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 164.)

interference with others, perhaps). The reaction condenser is now at, say, 58, but if it is retarded to about 55 degrees or so, the oscillation ceases, and the set, though very sensitive, is not causing interference with other listeners. Being now in a very sensitive condition, it might be thought that it could be left, and this is all that is necessary for tuning. Alas! No!

Handling the Two Dials.

Unfortunately, in such a case, as soon as one alters the tuning dial the set either starts oscillating or else it begins to lose its sensitivity, according to whether the tuning dial is turned down or up. The trouble is that more reaction is required for the longer waves than for the shorter waves, so that every time the tuning dial is altered the reaction dial has to be altered with it, if maximum sensitivity is to be retained.

In this instance we are supposing that the tuning dial was originally set at 100, and that the set oscillated when reaction was brought up to 58, but stopped oscillating when reaction was retarded to 55. If the *tuning* dial is slowly turned down from 100 towards 90 it will not have travelled many degrees before the set starts oscillating again. Consequently it is generally necessary to turn the tuning dial with the left hand slowly, keeping the right hand upon the reaction condenser, ready to slacken off a degree or so as soon as the set starts to go into oscillation.

Having once mastered the signs of oscillation and the method of controlling reaction so that the set can be kept near the oscillation point *without actually "going over,"* the most convenient way of tuning round the dial is the following. Set the tuning condenser at maximum, and then bring up the reaction until the set is nearly, but not quite, oscillating. Keeping the one hand over the reaction knob, slowly turn the aerial condenser with the other hand, moving it as slowly as possible and listening carefully.

If, as the tuning is slowly altered downwards, the reaction tends to get too strong, turn it off carefully, but not too far or the set will lose sensitivity.

The Final Touches.

The great thing is to keep the two dials "in step" with the set breathing very, very quietly, and only just on the verge of oscillation. When you hear a station, try to "hold the tuning" with the left-hand dial, whilst you adjust the reaction with the right hand to the required degree. Remember, that *too much reaction is absolutely fatal to success.*

The set is in its most sensitive and best long-distance-getting condition when it is on the verge of oscillation, but if it is allowed to oscillate, not only will the required signal be lost or become merely a chirp, but you will be wasting your own H.T. and

rendering yourself liable to a rebuke from the Postmaster-General, for oscillation is an offence against the conditions of your receiving licence. With a little patience you will soon acquire the knack of balancing the tuning and the reaction so that as one is moved the other follows on, and keeps the set at that required pitch where it will pick up very, very weak stations, but will not make a sound in any neighbouring listener's set. Finally, do not forget that reaction causes distortion of the received programme, so that the less reaction you can use the better. For really pure loud-speaker reproduction no reaction at all should be employed, and if the set is not powerful enough to give this, an extra valve or valves are required, it being hopeless to expect real volume and clarity if an inadequate number of valves is employed.

CONNECTIONS FOR CRYSTAL SET.

F. J. (Cambs.)—"Mine is a home-made coil tapped at 20 and every five turns after that. I am told it was for use in a 'Crocodile Crystal Set,' and should like to know the connections for this. Also what extra parts are required in addition to the coil (which is mounted on a small baseboard)."

The only parts extra to the coil and the base on which it is mounted are a crystal, four terminals and a tapping clip, in addition to the small screws, flexible wire, etc., for making connections. The wiring up is simplicity itself. One end of the coil is taken to the earth terminal and to one of the telephone terminals.

The remaining telephone terminal goes to one side of the crystal detector and the other side of this detector goes to the aerial terminal and by means of a flexible lead to any selected tap on the coil from 50 to 20. The set is, of course, not very selective, and is, in fact, one of the simplest that can be made but it is capable of giving surprisingly good results.

The best position for the tapping clip must be found by experience, and do not forget that if at any time you change wavelength it is necessary to change the position of the tapping clip to correspond with the new conditions.

CHANGING OVER THE COUPLING UNIT.

F. L. G. (Carshalton, Surrey).—"It is rather an old-fashioned set, being nothing more than a detector with Reinartz reaction and two low-frequency magnifiers (one resistance and one transformer).

"About twelve months ago the transformer broke down and since then the set has been put away, but on re-examining it I find it is in perfectly good condition and have decided to put in a new transformer. I should like to

(Continued on page 168.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 166.)

change over the position of the transformer so that instead of being in the detector valve circuit, the resistance-capacity unit is there, and the transformer (which is of low ratio) would be in the plate circuit of the second valve.

"Would this be O.K., as the markings on both these are similar, and should I simply undo the R.C.C. unit and change it over to the other valve circuit, putting the transformer in place of this?"

Yes, it will be quite O.K. to do as you suggest. The change should make no real difference to the operation of the set, except that we agree it would be worth while trying to reverse the order of the units in the way suggested, and that grid-bias values, etc., may have to be altered a little, and also the H.T. positive voltage, if a separate lead is used to supply the detector valve's plate circuit.

INSULATING THE LEAD-IN.

D. G. D. (Huddersfield).—"Is it a fact that even if the lead-in is insulated it should not be brought close to a steel window frame? What difference can this make if a good insulated covering is round the wire?"

In wireless we are constantly up against the fact that the ordinary insulator is *not* an insulator. In the ordinary electrical sense of the term, air, for instance, is an almost perfect *insulator*, but in wireless we use condensers with air dielectric, and we find that the wireless currents flow across these just as well as though there was a connecting wire across them!

There is, of course, a technical explanation for this, but lack of space prevents us entering into it here. All we would say is that what is a good insulator to ordinary electrical currents is quite capable under certain conditions of acting as a good conductor to high-frequency currents of the type with which we are dealing in wireless.

It is this fact which governs the position of the lead. Although it may be properly insulated and, therefore, it may be impossible for *ordinary* electric currents to leap off it across to the steel window frame, and so to earth, the aerial lead-in will *not* be carrying "ordinary" electric currents. Instead, it will be carrying the high-frequency currents which are liable to pass across small spaces filled with air, rubber, or other insulation. Thus, in order to prevent the H.F. currents from running away, the only safe plan is to remove the wire altogether from proximity to the surfaces which are connected to earth. It is for this reason that the placing of the lead-in right away from walls, roofs, etc., is so frequently recommended in this journal.

CHECKING THE FILAMENT VOLTS.

S. G. F. (Merionethshire).—"Having had long experience of the importance of maintaining the set at the correct voltages, etc., I am arranging for milliammeter and voltmeter checks at all possible points. The one that puzzles me most is getting the exact filament voltage applied to the valve, for although I built the set with plenty of room, it is not very easy to take the voltmeter connections right down to the valve.

"I understand that a misleading reading is obtained if the valve is pulled out and the reading is taken then, so I have decided to bring out leads from each side of the filament terminals of the valve holder to points on the panel where I can easily connect up the voltmeter. Does this strike you as a sound scheme or can you suggest any improvement?"

The stunt is quite a good one and we have, in fact, employed it with success. If the spacing of the wiring is reasonably well done, there is no need for the extra wiring to impair the receiver's efficiency in any way, and the whole job can be neatly done with plugs and sockets or similar gadgets.

The valve leads for each valve should be marked — and +, and should terminate in sockets on the panel arranged symmetrically in a row. If the voltmeter is provided with red and black plug ends to the leads you can read off each valve's exact filament pressure very easily and quickly.

UNDERGROUND AERIALS.

S. T. F. (Fulham).—"Is it a fact that underground aerials give just as good reception as ordinary ones?"

In our experience, no. Surprisingly good results can be obtained with this class of aerial, under certain conditions, it is true, but generally speaking the results do not compare with those obtainable with a good outdoor aerial.

One of the disadvantages of such a buried aerial is that it must be insulated just as well as the ordinary aerial, so that it should be buried in pipes or laid in a tiled tunnel, and this alone generally involves more work than would be needed for the erection of an ordinary outdoor aerial.

(*Continued on page* 170.)

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THE ONLY VALVE WITH A WRITTEN GUARANTEE AS TO PERFORMANCE AND LIFE.

If you have not already tried P.R. Valves send remittance as per list—we will post you a valve or a set of valves, for seven days' trial. If you are not fully satisfied, return parcel for full refund. You take no risk whatever. We replace all breakages and execute orders *by return of post.* No delay—the promptest service in the country.

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ASK YOUR DEALER FOR THEM. ACCEPT NO OTHER.

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3/6 EACH. Postage 4d.

POWER 6/6 Each Postage 4d.

SUPER-POWER 10/6 Each Postage 4d.

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Type	Fil. Volts	Amp.	Imp. Ohms.	Amp. Fac.	
PR 2	2	·095	28,000	13	H.F. Det.
PR 3	2	·095	15,000	8	L.F.
PR 4	2	·095	120,000	32	R.C.
PR 9	3·5-4	·063	18,000	14	H.F. Det.
PR10	3·5-4	·063	10,000	8·7	L.F.
PR11	3·5-4	·063	88,000	40	R.C.
PR17	5-6	·1	18,000	17	H.F. Det.
PR18	5-6	·1	9,500	9	L.F.
PR19	5-6	·1	80,000	40	R.C.
PR20	2	·15	7,000	6	Power
PR40	4	·15	7,000	6	"
PR60	6	·1	5,000	6	"
PR120	2	·3	2,750	4	S.P.
PR140	4	·2	2,500	4	S.P.

2 Valves or more POST FREE.

GUARANTEE. All valves despatched under guarantee of Money Back in Full if not satisfied within 7 days. All valves carefully packed and breakages replaced free.

LIST OF P.R. SUPER GOLDEN SERIES.

4/6 EACH. Postage 4d.

POWER 7/6 Each Postage 4d.

SUPER-POWER 12/6 Each Postage 4d.

SCREENED GRID 15/- Each Postage 4d.

Type	Fil. volts	Amp.	Imp. ohms.	Amp. fac.	
GPR 2	2	·095	24,000	13·5	H.F.Det.
GPR 3	2	·095	12,000	9	L.F.
GPR 4	2	·095	40,000	32	R.C.
GPR 9	3·5-4	·09	22,000	14·5	H.F. Det.
GPR 10	3·5-4	·09	10,000	9	L.F.
GPR 11	3·5-4	·09	44,000	41	R.C.
GPR 17	5-6	·14	20,000	17·5	H.F. Det.
GPR 18	5-6	·14	11,000	9·5	L.F.
GPR 19	5-6	·14	15,000	41	R.C.
GPR 20	2	·15	6,000	7	Power
GPR 40	4	·15	6,000	7	"
GPR 60	6	·15	6,000	7	"
GPR 120	2	·3	3,000	4·5	Super Power
GPR 140	4	·2	3,500	4·5	"
SG25	2	·2	220,000	150	S.G.

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SOLDERING SET Complete **7/6** or LAMP only 2/6

SIMPLIFIES ALL SOLDERING

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 168.)

HEARING THE NEW STATION AT BROOKMAN'S PARK.

M. F. G. (Potters Bar).—"When I first picked it up it appeared to be a gramophone record and later there was talking, the strength first thing being good and at other times fading away. I thought it might be the new Regional station at Brookman's Park, but this seems unlikely, as there was noticeable distortion, and I think the B.B.C. pride themselves on the purity of their transmission. Do you think this was Brookman's Park in daylight, or how do you account for it?"

There are so many transmissions now on the ether that it is impossible to identify these unless full particulars of wave-length, etc., are given, but in your case, as you are close to the Brookman's Park station; we should say there is but little doubt that this is where the signals emanated from. The fact that they were distorted at times is nothing to go by, for at the present time the station is still in the experimental stage and may be testing on closed circuits under various experimental conditions.

ADDING A STAGE OF R.C. COUPLING.

S. S. (Plymouth).—"I have the necessary anode resistance, coupling condenser, grid leak and valve holder, to add an extra stage to my two-valver. Can you give me a description of the necessary wiring in words, as I prefer this to a diagram?"

First of all, you must mount the valve-holder in a suitable position on the baseboard, arranging the holder for the anode resistance close to it. Near the grid of the valve-holder mount the coupling condenser and the grid leak. You will require an extra H.T. positive terminal and two extra L.S. terminals.

To wire up join the anode resistance to those wires which now go to the loud-speaker positive and negative terminals on the set (the loud speaker being disconnected from these, of course), and all wiring being as short as possible. When the anode resistance is connected across the points which previously were joined to the loud speaker, connect that end of the anode resistance which is now joined internally to the plate of the second valve to one side of the new coupling condenser.

The other side of this condenser must be joined to the grid socket of the valve holder and also to one end of the new grid leak. A flexible lead which plugs into a grid-bias battery at the required negative voltage must be joined to the other end of the grid leak. One of the filament terminals on the new valve holder must be taken to the lead on the old set which at present joins the grid-bias positive and the two valve filament sockets together. (This lead goes also to earth, etc.)

The other filament socket on the new valve holder is joined to a lead which connects to the remaining two sockets on the other valve holders. Finally join up the plate socket of the new valve holder to one of the new loud-speaker terminals (negative), and then join the positive new loud-speaker terminal to the new H.T. positive terminal. This completes the wiring.

The Sets for RESULTS

"Best Way" TITAN SETS

The Titan One
The Titan Two
The Titan Three
The Titan Four

are profusely illustrated with full diagrams and instructions for building in the

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The reader has the choice of anything from a simple one-valver to a de-luxe 4-valve set with built-in wave-trap and wonderful long-distance loud-speaker performance.

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Explains how to use your radio set as an Electric Gramophone. Here, for the first time, are given full details for the electrical reproduction of your favourite records.

Gramophone Pick-ups and how to use them; Valves for your Radiogram Receiver; and Operating your Electric Gramophone are explained in detail, and in addition there are complete instructions for making the "Best Way" RADIOGRAM FOUR—a splendid set designed for use with a pick-up as well as for Radio Reception.

You can easily build them

PRESERVING FULTOGRAPH PICTURES

Some practical methods of making the pictures last are described

By F. JACQUET.

SINCE the first practical inception and utilisation of that ingenious machine, the Fultograph, it has always struck me in the light of being a great pity that the pictures obtained by it tend so greatly to lack permanence. I know, of course, that there are good folk who affect a contempt for these "blotting-paper tracings," as they term them, but, say what you will, the Fultograph is able to produce some delightfully sketchy and broadly impressionistic effects which are well worth preserving.

And then, too, there is the fact that behind the production of these miniature reproductions there is a most fascinating application of modern radio science.

I think, therefore, that the generality of radio amateurs are interested in the progress of the Fultograph, despite the fact that such machines are not yet as common as is, say, the average portable radio set. And it is often the case that one comes into possession of a few of these radio-transmitted pictures, either from a local dealer or from a more fortunately situated friend who is the owner of a Fultograph receiver.

The reader will be aware, I imagine, of the fact that the Fultograph picture consists of an image delineated in iodine. The porous paper base of the picture is impregnated with a soluble iodide and the pulsations of current entering into the receiver decompose the iodide, liberating free iodine in the pores of the paper. In this manner the Fultograph image is built up.

Extremely Volatile.

Now, anyone who has experienced the operation of painting the skin with tincture of iodine will be aware of the fact that after a day or two, the brown stain vanishes. It is true that a small proportion of the iodine is absorbed by the skin, but the majority of it is merely volatilised away by the heat of the hand.

(*Continued on page* 174.)

PRESERVING FULTOGRAPH PICTURES.

(*Continued from page* 172.)

Iodine is, in fact, an extremely volatile substance, and, even at ordinary temperatures, a few crystals of iodine will go off into vapour if they are allowed to stand in an exposed position for a few days.

Hence you will see why an ordinary Fultograph picture is only somewhat more permanent than an untoned photographic print. Keep it in a warm room exposed to the air, and it will fade sooner than you want it to do. Expose it to the hot rays of the sun in a bright window, and the fresh chocolate-brown tone of the picture will quickly change into a washy yellow.

An Airtight Frame.

Exposed to chemical fumes, the iodine image of a Fultograph picture will often prove even more unstable, whilst should the picture come into contact with even a weak alkali solution, it will vanish altogether. As witness, for instance, Fig. 1, where we see a Fultograph picture being removed by the simple act of wiping a soda solution over it.

The preservation of an iodine picture is, of course, mainly a chemical problem, but it is evident that if some means can be devised of keeping the surface of the picture permanently out of contact with the air, a much greater degree of permanency will be given to the image.

Unfortunately, Fultograph pictures cannot be varnished over with celluloid or other spirit varnish solutions, because such solutions have a solvent action upon iodine, and therefore their application would result n the picture being removed, or, at the best, badly smudged.

The picture, however, can be subjected to a special form of passe-partout framing which will keep it out of contact with the external air, and, in such a state, it will last for almost an indefinite period. Sandwich the picture between two perfectly clean sheets of glass, and bind them at the edges with strong damp-proof binding.

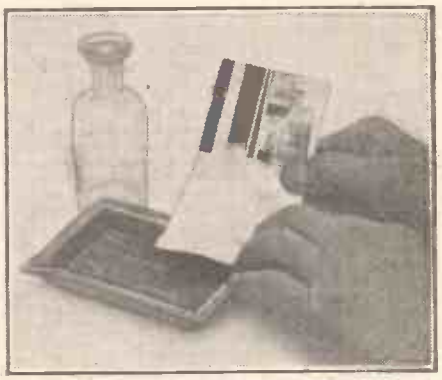

Fig. 1. Removing the Fultograph image with weak caustic soda solution. This illustrates the deleterious action of alkali solutions on images of this nature.

As an extra precaution against the inroads of air or moisture, apply one or two coats of clear varnish to this edge-binding. When dry, place a suitable piece of cardboard behind the bound-up picture, and then secure this firmly by means of some decorative passe-partout binding.

(*Continued on page* 176.)

PRESERVING FULTOGRAPH PICTURES

(Continued from page 174.)

The photograph, Fig. 2, shows the result of this process. It may be added that the Fultograph picture illustrated here has been bound up for several months in the manner described above, and it has yet to suffer any appreciable change.

It may be of interest for possessors of Fultograph pictures to attempt a few experiments in the sizing of these articles,

Fig. 2 An historic Fultograph picture. The first Fultograph cartoon broadcast by the B.B.C., in October, 1928. It is treated as described in the article.

for, if the operation is carefully carried out, the texture of the paper can be greatly improved. Merely make up a medium-strength solution of clear size, and then pass the picture through the *cold* solution,

subsequently blotting away the superfluous liquid, as indicated in the illustrations, Figs. 3 and 4.

In this way, the size will fill up the pores of the paper, making it more suitable for any form of mounting which may afterwards be undertaken. If carefully done, the loss of tone in the picture, due to the slight solubility of the iodine deposit in water, will be very slight indeed.

Readers who, during their youths, have had chemistry lessons, and who have been tortured by chemical equations and formulae, will, no doubt, recall the fact that when iodine and starch are brought together, an intense blue coloration is formed, this coloration constituting a very delicate test for the presence of iodine. Interesting experiments involving this peculiar colour change can be carried out with Fultograph pictures merely by running them through a weak solution of starch.

The brown image will turn to blue of one shade or another, depending, of course, upon the quantity of iodine comprising the image. The only drawback to these experiments is that the blue coloration tends to spread into the whites of the picture.

Another Interesting Method

Another interesting method of Fultograph picture preservation which is, at least, well worthy of a trial, consists in rubbing a paste (made by dissolving paraffin wax in pure castor oil until, when cold, it acquires the consistency of petroleum jelly) over the surface of the picture. Needless to say, this wax preparation should be used but sparingly.

The idea is, however, to fill up the pores of the paper and to cover over the iodine

Fig. 4. Blotting away the Mixture.

image with a preparation which will resist the action of air, moisture, and deleterious fumes, and if the job is carried out with reasonable care, the picture will not be rendered objectionably greasy.

Very recently the news comes that an amateur "Fultographer" (if one may be allowed the use of the term), Dr. Alfred J. H. Iles, of Taunton, has worked out a new method for the preservation of Fultograph pictures which he considers more efficient than any other preservative process.

Dr. Iles' method is simplicity itself. All he does is to lay the Fultograph picture face downwards in a dish containing a solution of common alum. The solution is prepared by dissolving one tea-

Fig. 3. Passing the picture through a size bath.

(Continued on next page.)

PRESERVING FULTOGRAPH PICTURES.

(Continued from previous page.)

spoonful of alum in a pint of water. The Fultograph picture is immersed in the alum bath for a few minutes, after which it is taken out, briefly rinsed, and then dried without heat. By this process, Dr. Iles claims that a Fultograph picture can be made as permanent as a photographic negative or print after fixing and washing, the action of the alum being to harden the pores of the paper and thus to inhibit the escape of the tiny particles of iodine from them.

Copying the Picture

But, of course, the best method of preserving a record of a Fultograph picture is either to copy it photographically, which task naturally implies the possession of a camera and photographic requisites, or else, after sizing the paper, to go over the image in detail with waterproof Indian ink. In this manner you will obtain a tracing of the picture in black.

All you need to do now is to put the picture away in a warm oven for a few hours for the iodine to volatilise away, or else to rub the picture over with a rag moistened with a little soda solution. This will remove the iodine image immediately, particularly if caustic soda be used, leaving the Indian ink tracing untouched.

SHORT-WAVE NOISES.

By G. P. KENDALL, B.Sc.

ANYONE with a little experience of short-wave reception must know that work on the lower waves is always apt to be a very much noisier process than ordinary broadcast reception. All sorts of odd sources of noise which have little or no effect on a broadcast receiver, seem to be discovered on the shorter waves, and while much of it is no doubt unavoidable, it is just as well not to get into the way of thinking that a general rowdy background is inevitable on the short-waves. A certain amount of it is certainly removable, and a little perseverance will often lead to a surprising improvement.

Much of the general noise is no doubt due to quite obvious and well-known causes in the receiving set and its auxiliary gear, They are fairly obvious matters of attending to such details as the connection to the moving vanes of the variable condensers, removal of all imperfect contacts in the wiring, and so on. Do not forget that anything in the nature of a plug-in component, such as a coil or a valve, is a particularly important danger spot.

Unusual Causes

I am thinking more at the moment of some often little suspected causes of short-wave noises, things which are entirely outside the receiver, and which will often not occur to the operator as possible causes of the trouble at all. If you want to get an idea of the sort of thing I have in mind,

(Continued on next page.)

SHORT-WAVE NOISES.

(Continued from previous page.)

put on the 'phones and make your short-wave receiver oscillate, preferably adjusting it until it is only just oscillating, then handle some metallic objects on a table near-by, such as a few tools, etc., moving them about so that they touch one another and make intermittent contact, and see what sort of noises you hear. If you are on a fairly short-wave, the results are likely to surprise you considerably!

Two Peculiar Cases,

Having got some idea of the kind of thing which may happen, just look about at the surroundings of the receiving set and see if you can detect any possible causes of noises. Usually one can say that anything making contact intermittently with anything else is liable to kick up a noise, certainly if the two objects are of a metallic or at any rate of a conducting nature. For example, I once heard a most peculiar case in which a really pronounced scraping noise was eventually traced to the plug of a bath which used to hang by a chain and swing to and fro gently in the breeze from the bathroom window! Apparently, the plug was scraping lightly against the side of the bath, and the intermitting contact resulting when the bath was a little damp was quite sufficient to set up a very fine artificial thunder-storm in the receiving set in the next room.

Another most obstinate case of which I once heard was eventually traced to a couple of water pipes in the attic of the house, which crossed one another at an angle and only made very light contact. Every time one of the taps at the far end of these pipes was turned on or off the slight vibration of the stopping and starting of the water flow shook the pipes slightly and produced extraordinary "fireworks" in a short-wave receiver quite a long way off on the floor below.

Those Electric Light Switches,

These examples should serve to give you an idea of the kind of thing to look out for, so if you seem to be getting an unusual amount of noise in your short-wave receiver, noises, moreover, which do not appear to vary with atmospheric conditions in a natural sort of way, have a look round for microphonic contacts in metal work almost anywhere in the house, and probably your persistence will be rewarded in the end. Of course, on no account forget the possibilities of troubles from the house lighting wiring, and get some one to work all the various switches in the house whilst you are listening. You may find one eventually which is unusually noisy, and which may quite likely set up crackling noises even when left switched on.

During the period of the Radio Exhibition, Messrs. F. A. Hughes & Co. Ltd., sole concessionaires for the famous Blue Spot range of loudspeakers and the well-known Blue Spot unit, are giving special demonstrations at

Maclise Mansions,
Addison Road Station,
Kensington, W.

All readers are invited to visit these premises where the full range of Blue Spot products can be seen and heard.

A CHAT ABOUT BATTERIES

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

THE re-charging of a high-tension battery from D.C. mains is a very simple matter, and only involves the use of a limiting resistance which may conveniently take the form of an electric lamp to ensure the correct current passing through the cells. As a simple rule, it may be taken that if a charging voltage of about 2½ volts per 2-volt cell be applied the correct charging current will flow through the cells without the use of any limiting resistance.

As, however, it is not usually possible to adjust the total voltage of the battery in relation to the voltage of the mains in this way, it is generally necessary to employ a resistance in series. All you then require is the use of a milliammeter to enable you to find the proper lamp for the purpose, and thereafter the milliammeter is no longer required.

H.T. Charging.

The recharging of the H.T. battery from A.C. mains is an equally simple matter if you have a suitable rectifier. As there are several such rectifiers now on the market, it is unnecessary for me to single out any particular one for mention.

With low-tension batteries the recharging on D.C. mains is done in precisely the same way as in the case of a high-tension battery, that is, by the introduction of a series

resistance. Inasmuch, however, as the voltage of the mains is usually about 10 to 20 times the voltage required for the purpose of charging the 6-volt battery, there is a great wastage of energy in the limiting resistance and consequently the method is very uneconomical. However, in view of the convenience most experimenters prefer not to worry about the question of economy in charging-current.

Step-Down Transformer.

When charging a low-tension accumulator from alternating-current mains it is the invariable practice to use a step-down transformer to reduce the voltage to something in the region of that of the low-tension battery. This stepping-down of the voltage avoids the heavy energy-loss which I have just mentioned in connection with the D.C. mains.

But a rectifier is needed between the low-tension output side of the step-down transformer and the battery which is to be charged. Here, again, there are numerous types of low-tension charger on the market and lack of space alone, quite apart from any other consideration, prevents me from giving a list of chargers whch may be used.

Capacity.

Now I want to say something about accumulators in general which, although it will seem very simple in itself, is something which I find is not generally recognised by

(*Continued on next page.*)

A CHAT ABOUT BATTERIES.

(*Continued from previous page.*)

the experimenter. I refer to the ampere-hour capacity of the accumulator. Many listeners, especially beginners, are apt to think that if an accumulator is rated, for example, at 50 ampere-hour capacity it will operate the set at a current consumption of 1-ampere for 50 hours, or ½-ampere for 100 hours, and so on.

Consequently if the battery, after being recharged, is put into operation—let us say at a total filament current consumption of 1 ampere—and after a total use of perhaps 20 to 30 hours, it shows signs of failing, the user wonders what is the matter with it and concludes either that the battery is wrongly rated or that it has not been properly recharged.

Working Limits.

Now this may be quite wrong; the battery may have been thoroughly recharged, and it may be in perfectly good condition and properly rated by the makers. But if you plot a curve showing the relation between the voltage of the battery on the one hand, and the total number of ampere-hours drawn from it on the other hand, you will find that whilst the voltage remains comparatively steady for a considerable proportion of the total capacity of the battery, it will then commence to fall with further use and may in some cases drop very rapidly. The result of all this is that you cannot expect to draw from a battery *under ordinary working conditions* a total amount of electricity represented by the rated ampere-hour capacity.

I know that many readers will be very surprised to hear that they cannot actually draw under working conditions 50 ampere-hours from their much-treasured 50-ampere-hour-capacity accumulator. but the fact remains. You will find that you get much better service and more constant results (and incidentally prolong the life of your battery) by confining the working between limits of perhaps 20 to 25 ampere-hours output (before recharging) in the case of a rated 50-ampere-hour-capacity battery.

TECHNICAL NOTES.

(*Continued from page* 136.)

A Special Case.

When it comes to the passage of electricity through a copper oxide rectifier we have a state of affairs where the current can pass in one direction with almost the same freedom as in a solid metallic conductor, whilst when the current is seeking to pass in the opposite direction there is a very considerable resistance.

As a matter of fact, although dry rectifiers, especially of the copper oxide type, have been brought to such perfection and are now an eminently practical proposition, the precise nature of their action is still not fully understood.

Inasmuch, however, as there appears to be practically no change in the constitution of the elements of the rectifier (under ordinary working conditions), it certainly appears that the conduction is closely related to the conduction through metals

(*Continued on page* 181.)

TECHNICAL NOTES.

(Continued from previous page.)

and would, therefore, be due to the passage of these so-called "free-moving" electrons.

Voltage Variations.

The voltage which is supplied to the anode of a valve from an A.C. mains-supply unit depends always upon the actual current drawn from the unit, and in the majority of cases the voltages and the load depend very definitely upon one another. I am often asked why a mains unit should not—like an H.T. accumulator battery or, for the matter of that, an H.T. dry battery—maintain a reasonably constant voltage output with varying loads.

The answer to this question is not difficult to understand, although it would take rather more space than I have available to go into it in detail. The simplest way, however, is to give an explanation in general terms, the application of which to the problem will then, I think, be appreciated.

Transformer Loads.

Suppose you have a step-up transformer, the secondary of which gives on open circuit, say, 100 volts. If this be a small transformer, in which the "regulation" will almost certainly be very poor, the voltage will immediately be pulled down when a load is thrown across the terminals of the secondary.

If, therefore, you use this transformer for applying a voltage of, say, 80 or 90 volts under working conditions it means that a slight variation in the load will cause an appreciable variation in the output voltage. Suppose, however, you are only requiring an output voltage of 10 volts, you can obtain this by throwing a heavy load across the secondary of the transformer and tapping-off the voltage you require. In this case, since the transformer is already carrying a heavy load, a slight additional load will not make very much difference, and therefore you may expect to obtain a reasonably constant output voltage for the required circuit.

Waste Current.

This means, however, wasting a good deal of current in order to bring the transformer out of what we may call the "sensitive" region to keep it in what we may call the "stable" region. As a matter of fact, a similar system can be used—and is sometimes used—with mains units, but it means increasing the cost of the unit and is generally not worth while.

Provided the output voltage remains constant when the load is constant, there is really not very much to trouble about since the load is not likely to vary very much under ordinary conditions. If the voltage of the mains unit is adjustable, it is always a comparatively easy matter to ensure that the correct voltage is supplied to each valve under working conditions, that is, when the unit is under load.

(Continued on next page.)

TECHNICAL NOTES.

(*Continued from previous page.*)

This is one of the reasons why I have more than once emphasised the importance of testing the output voltage of the eliminator under working conditions and also of making the test with a high-resistance voltmeter, which will not seriously interfere with the load conditions already in the circuit.

Needle Tracking.

The tracking of the needle across the surface of the record is one of those little matters which seems so simple that you can scarcely imagine it is worth while giving any serious thought to it. As a matter of fact, the correct tracking makes a considerable difference, not only to the reproduction which is obtained from the record, but also to the useful life of the record. "Tracking" is a subject which has received a good deal of attention from some gramophone designers although, on the other hand, unfortunately there are large numbers of gramophones of the cheaper variety in which no attention at all appears to have been paid to this important point.

In case it may not be clear what is meant by "tracking," perhaps I should explain that it refers to the circular path which is traced out across the record by the needle-point during its journey from the outer edge of the record towards the centre whilst the record is being played. In all ordinary cases this path, as I have just mentioned, will be an arc of a circle, the centre of the circle being the centre-of-rotation of the remote end of the tone-arm or pick-up arm (as the case may be).

Making the Record.

Now, when a record is being made in the recording studio the recording soundbox or "recording pick-up," as we may call it for simplicity, moves in such a way that the cutting point or cutting stylus, which cuts the original record upon the wax, travels across the record in a straight line which is a radius of the record; that is to say, the line, if produced in one direction, will pass through the centre-of-rotation of the recording turn-table.

Theoretically, then, we ought to have our reproducing soundbox or pick-up move along a straight line and in such a position that the needle-point moves along a radius of the gramophone turntable.

A Compromise.

This is clearly impossible with an ordinary tone-arm and therefore we make a rough approximation to the ideal conditions by

(*Continued on next page.*)

TECHNICAL NOTES.

(Continued from previous page.)

having a reasonably long tone-arm or pick-up arm so that the curvature of the path of the needle is comparatively small, that is to say, the curved path is not seriously different from a straight line.

What is more important than the curved track, however, is the varying angle between the soundbox or pick-up and the track of the record in which the needle is lying. I am purposely using geometrical terms very loosely when I speak of "the angle between the soundbox and the track," but I think it will be easier to understand; to be more accurate, I should say that if we consider the track in which the needle is lying and we produce the vertical plane tangential to this track at the point where the needle rests and then we consider the vertical plane containing the movable system of the soundbox or pick-up, the angle between these two planes is the angle which represents the error in the setting of the pick-up in relation to the record.

Adjusting the Tracking.

In the case of an ordinary tone-arm it is generally impossible for the user to make any adjustments; if the tracking is very bad you just have to put up with it. But in the case of the pick-up carrier arms which are mounted upon a weighted pedestal, you *can* do something to get reasonably correct adjustment.

The simplest way is to select a point somewhere about the middle of the recorded selection on the record—that is, half-ways between the inner and outer circular groove—and to arrange the position of the pick-up carrier so that the direction of the carrier-arm is approximately tangential to the centre track at the point where the needle rests.

With the pick-up carrier in this position the error will increase as the needle is moved towards the inner tracks and will increase as the needle is moved towards the outer tracks, being at a maximum when the record starts and when it finishes, and being zero (or a minimum) when the record has been played about half-way through.

Needle Setting.

Before leaving this question of the setting of the pick-up or soundbox, I should like to refer also to the angle between the needle and the horizontal surface of the record. Some users turn the soundbox round in its socket until the needle is very nearly perpendicular to the record surface. This causes an undue amount of scratching of the records and shortens the life. It is preferable to stagger the needle fairly considerably and an angle of about 45 degrees to the vertical (that is, half a right-angle) will generally be found to be about the best position.

There seems to be a popular impression that if the needle is made to slant forward something is lost in the reproduction. As a matter of fact, this idea is quite wrong—I am referring, of course, to "needle-cut" or "transverse-cut" records, which are practically exclusively used to-day—and you will find that the angle of about 45 degrees is the best position at which to use the soundbox.

In some gramophones a stop is placed in such a position that it is impossible to turn

(Continued on next page.)

TECHNICAL NOTES.

(Continued from previous page.)

the soundbox round to this angle and it has to be used at an angle of about 60 degrees to the horizontal; this, in my opinion, is bad practice and a soundbox should be capable of being adjusted to a smaller angle than 60 degrees.

False H.T. Values.

I was referring the other day to the important question of the matching of the impedance of a valve and corresponding transformer winding. Of course, the same considerations apply in the case of the last or output stage of a receiver and the windings of the loud speaker.

It is a very general practice to introduce the loud speaker into the plate circuit of the last valve, and in that case the impedances should be matched as nearly as possible. As a matter of fact, in many cases the impedances are quite different.

In this connection there is a further important point which should be borne in mind if the best possible reproduction is to be obtained and that is that the placing of the loud speaker in the plate circuit of the valve interferes—in some cases seriously—with the H.T. voltage which finally reaches the plate. Sometimes the impedance of the valve will be higher than that of the loud speaker, but in the case of a fairly high-resistance speaker and a power valve of comparatively low impedance the difference between the two may not be so great as you would at first imagine.

In any case, inasmuch as the resistance of the speaker is comparable with that of the valve there would be an appreciable voltage-drop accounted for by the windings of the speaker. This is particularly serious where large anode currents are involved. The result of all this is that the plate of the output valve may not be receiving anything like the voltage which you imagine, or which was specified by the manufacturers; consequently the valve is operating right off its proper characteristics, gives reduced amplification and can handle only small grid-swings.

Choke Output.

As I have mentioned before, it is preferable to use a choke-coupled output filter in which a high impedance is combined with a very low ohmic resistance.

Keeping Out D.C.

One of the main advantages of a choke or transformer output is that it is possible by this means to keep the D.C. out of the loud-speaker windings. There are two main reasons for keeping the direct current out of the loud-speaker windings: One is that, as often as not, the current is passed into the loud-speaker in the wrong direction and tends to demagnetise the permanent magnet, and the second is that, even if this condition does not arise, there is a danger of the magnet being saturated, and therefore not operating at its maximum efficiency.

BRITISH PATENT No. 257,122.

The proprietor of this patent relating to "Improvements in Radio Frequency Amplifying System," is desirous of entering into equitable arrangements by way of grant of licences on royalty or otherwise for the purpose of securing the manufacture and development of the invention in this country. Communications in first instance to:—

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