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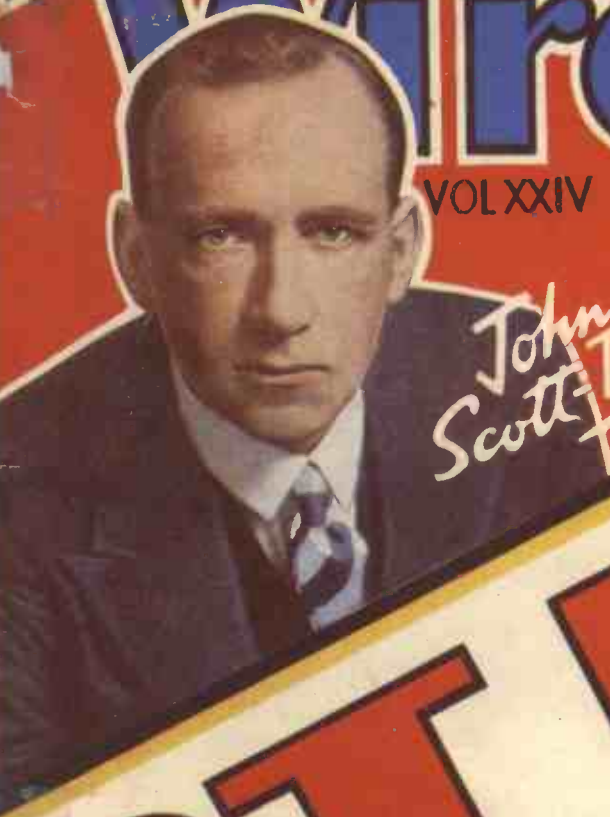
VOL XXIV No 594 OCTOBER 21st 1933



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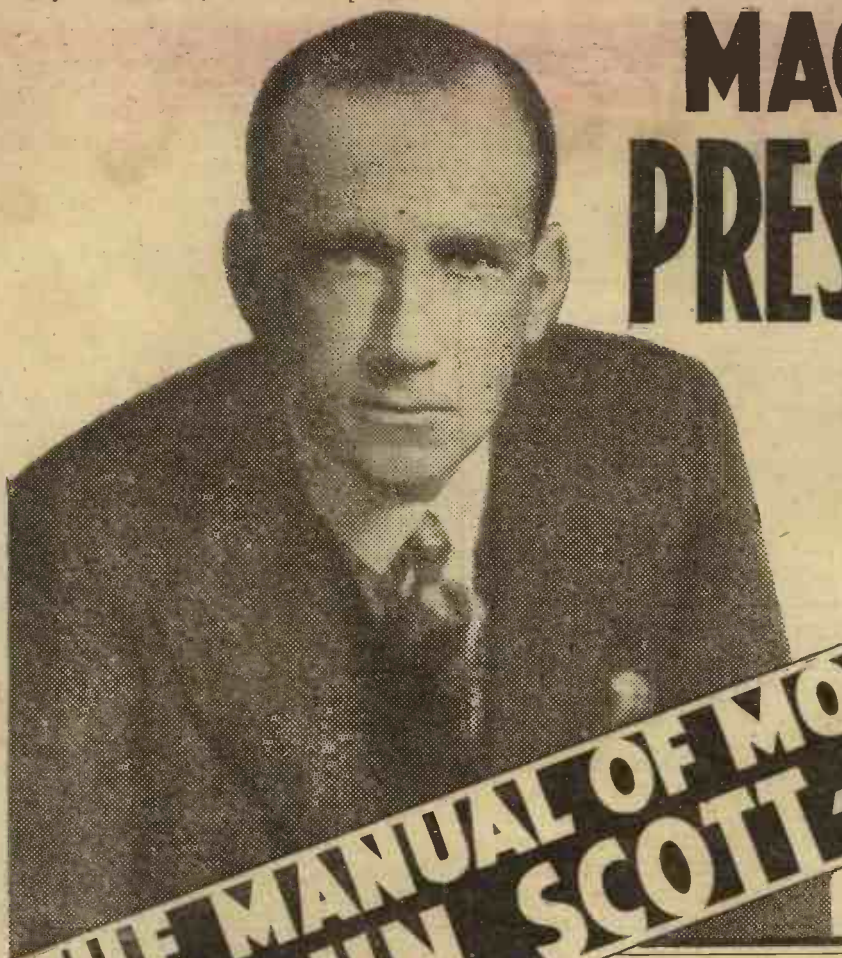
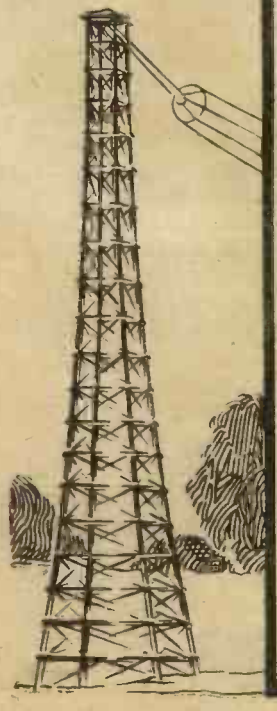


THE MANUAL OF MODERN RADIO BY JOHN SCOTT-TAGGART



Mr. John Scott-Taggart says:—

It is not for me to comment on my own work. But, speaking with years of experience of technical book production, I say this: I am amazed that the publishers have been able to offer, at negligible cost to the reader, such a large and beautifully-bound and printed volume. Authors are notoriously critical of these matters. But I am delighted with the way they have handled what is my biggest and best book. It is certainly an astonishing bargain.

I can assure all my friends—old and newly found—that in the "Manual of Modern Radio" they will possess a comprehensive volume as handsome as I believe it will be useful.

John Scott-Taggart

JOHN SCOTT-TAGGART'S MASTERPIECE

A new book on radio has been written. It is called "The Manual of Modern Radio." We have secured the exclusive British rights of what will undoubtedly become an international classic.

Let us tell you about this book and our truly amazing offer regarding it. It is almost enough to say that it is written by JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E. His qualifications for writing this book are unrivalled. His present position in the world of radio is assessed elsewhere in this issue.

It guarantees the strict technical accuracy of a volume which covers the whole field of modern radio technique. But, in addition to the great authority which is lent to this new book of reference, the readers benefit by Mr. Scott-Taggart's genius for writing so that "he who runs may read."

Since he was only eighteen John Scott-Taggart has been an instructor. At that age—before he was officially old enough to be in the Army at all—he was Chief Sergeant—Instructor in Signalling to a Highland Brigade. During a spell from the trenches in 1917, and now as an officer in the Royal Engineers, he became Instructor in Wireless to the First Army; he was nineteen years of age!

In that year began his famous articles on valves, which were virtually the first revelations to the public of the revolution in technique effected by the valve. A brilliant writer himself, he was—as far back as 1919—appointed Radio Book Critic to both the leading electrical journals in this country, viz. *The Electrician* and *The Electrical Review*. This double distinction was a great tribute to a reputation **already established fourteen years ago.** His predecessor as regards *The Electrician* was Dr. W. H. Eccles, D.Sc., F.R.S. (who has been President of the Institution of Electrical Engineers, of the Physical Society, and of the Institute of Physics, and Adviser to the British Government). It was on Dr. Eccles' advice that *The Electrician* offered Mr. Scott-Taggart the post mentioned.

"The Manual of Modern Radio," therefore, is by one who, above all others, knows how to write a book on wireless. His ability to impart knowledge to the veriest beginner in a clear, simple, accurate manner is proved by one simple but overwhelming fact:

Three-quarters of a million copies of his books have been bought by the wireless public!

His dozen books, the first of which appeared twelve years ago, have appealed either to the amateur, the technical student, or the radio engineer; immediate success has attended the publication of each. Several have been translated into foreign languages.

It is seven years since Mr. John Scott-Taggart has found time to write a wireless book. His "Manual of Modern Radio" is a monumental work—a landmark in the literature of wireless technique. Within its pages he has brought the whole art of radio reception and the use of valves.

The Manual is "red hot" as regards recent developments. If you are interested in such things as H.F. Pentodes, Iron-Core Coils, the Double-Diode Pentode, Cathode-Injector systems, Metal Detectors, Class B Amplification, the Capehart Circuit, Metal Valves, Quiet Automatic Volume Control, the Pentagrid—here in this book will you find all you want to know.

But if, on the other hand, you are a novice who would like to know a little about "how the wheels go round," here again is the book for you. Scores of circuit diagrams are duplicated in pictorial form to help the beginner, and it has been assumed that the reader knows nothing whatever about electricity or science. All one needs is the ability to read.

From the most elementary beginning the proud owner of this handsome volume will find himself being lured on from chapter to chapter by the fascination of its style. He will be learning without knowing it—an education without tears!

And how he will benefit by it! In hard cash, and results from his set, a reading of this investment will yield a generous dividend.

The "Manual of Modern Radio" will occupy an honoured place on your bookshelf. Beautifully bound in green cloth and printed in clear type, it will form a treasure-house of facts and advice from which to draw upon. Look at the chapter headings on page 224; they are the simple labels to sections packed to the brim with easy-to-understand facts, advice, criticisms.

What a book of reference this Manual will become! Some of the contents have never yet been published. Have it at your hand and you will never be at a loss. An international authority on radio will be at your service. The volume is as handsome as it is useful.

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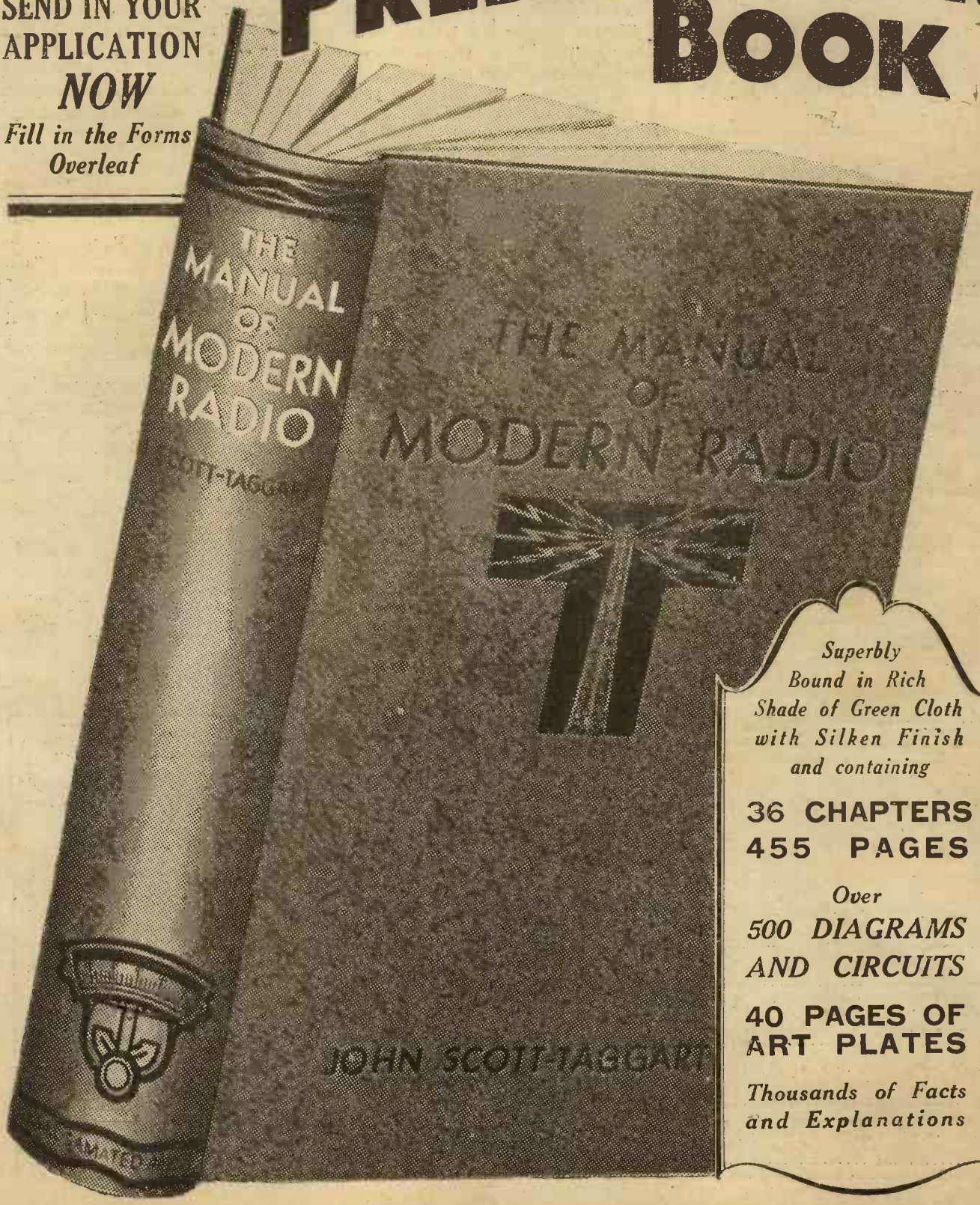

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As this volume is only available to regular readers, if you have not placed a regular order for POPULAR WIRELESS you must do so at once. This offer applies only to readers residing in Great Britain and Northern Ireland. Irish Free State readers are not eligible.

THE book covers a whole field of modern wireless reception. Every type of valve and every kind of circuit is dealt with. The very latest technique is incorporated. The bare chapter titles cannot do justice to the hundreds of subjects covered by what is a unique and all-embracing record of modern methods. No such book has been published in any country.

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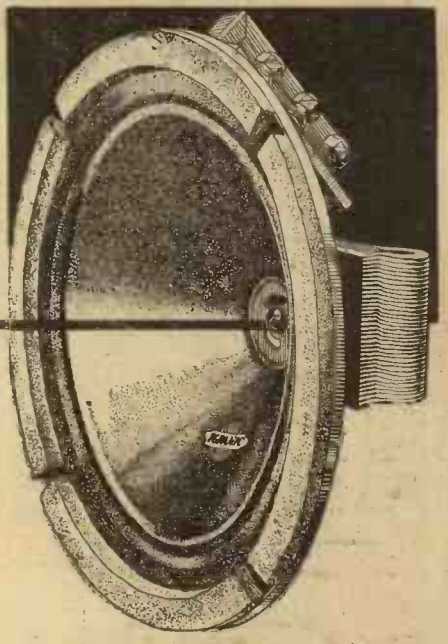

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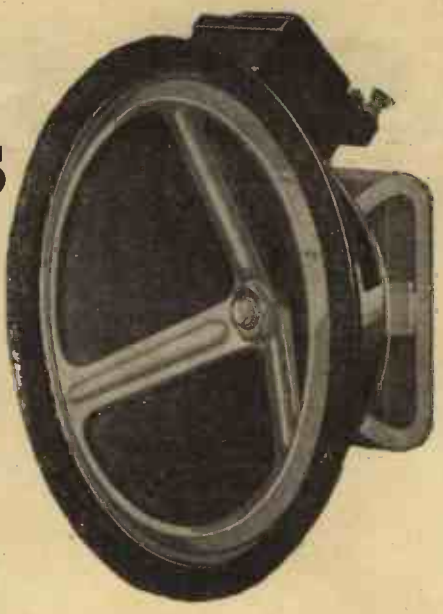

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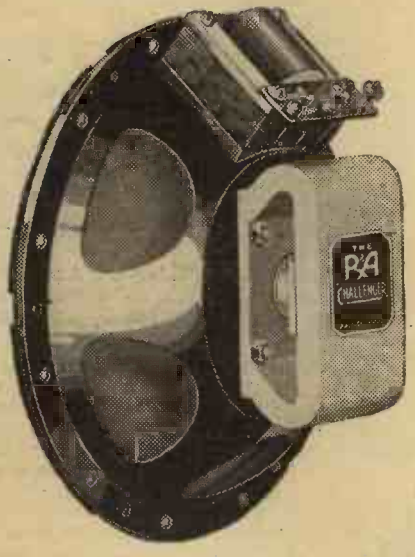

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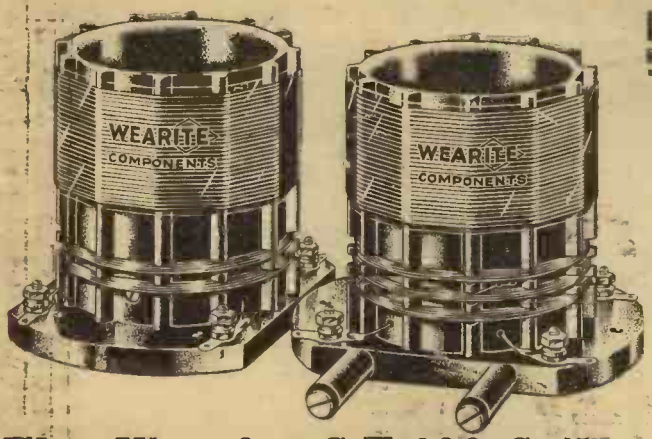

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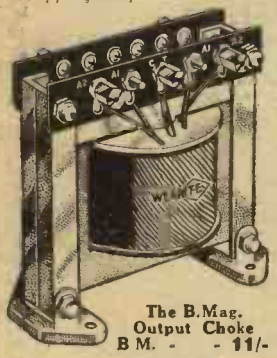

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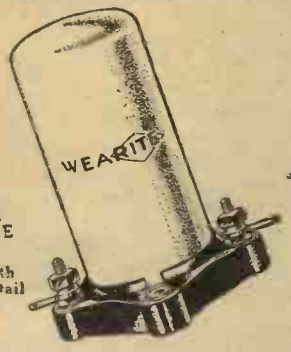

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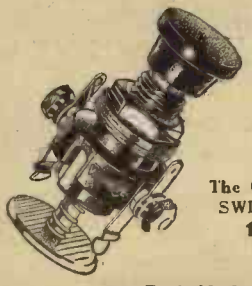

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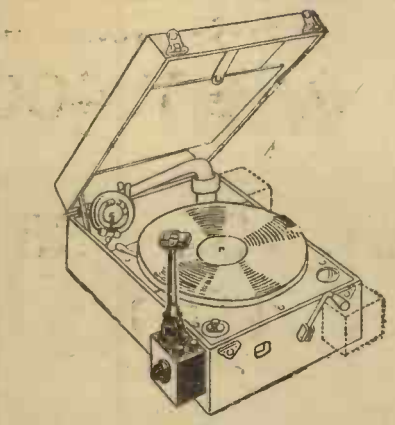
Screen-Grid Anode Connector for Valve Protection

ELECTRICAL REPRODUCTION FROM A PORTABLE GRAMOPHONE



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W.E.	(2) 5,000 ohms. Metallic Resistors	1/-
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C.C.	·0005 Tubular Condenser	1/-
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POPULAR WIRELESS
THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
Technical Editor: G. V. DOWDING, Associate I.E.E.
Assistant Editor: P. ROBERT BIRD.

Managing Editor: N. F. EDWARDS.

Chief Radio Consultant: P. P. ECKERSLEY.
Assistant Editor: A. JOHNSON-RANDALL.
Chief of Research Dept.: K. D. ROGERS.

HENRY HALL'S TRIP
THE "P.W." COMPETITION
THAT "BOGEY" VAN!
SOME INTERESTING FIGURES

RADIO NOTES & NEWS

OUR BRITISH "BOBBIES"
RADIO IN INDIA
THOSE BAGPIPES AGAIN
A RARE "BIRD"

America Tells Henry.

HENRY HALL'S account of his American researches was a bracing ordeal which proved, at least to me, that our best bands and their conductors are the best for this country. The "split-second" method of presentation, whilst necessary where ether-time is sold, is foreign to our notions of fireside enjoyment. It would leave us time to say only, "That's a band, that was"!

I am glad that Henry went, though. Maybe he will now know what to guard us against. He can be sure that his reception at Radiolympia was not a token of our love for dance music gone mad, crooners and the like.

What Henry Did Not Tell Us.

NOTHING can be more certain than that Henry was overwhelmed with hospitality and that it was rounded off by many a good yarn. One story, which has come to me from an American source, is that one of the big band leaders told him that his income was $15,000 a week.

Henry came away feeling dizzy, because that means £156,000 per annum at par—which is real money. Later they debunked him and reduced the aforementioned income to $5,000 per week, which, for America, is just fairish. "Brother, can you spare a mansion (with swimming pool) in the Adirondacks?"

This Means More Work.

RADIOLYMPIA and Glasgolympia were worth while—a thousand times, because they resulted in work for many men and women and were a nasty kick in the neck for Ole Man Depression. Why, I hear that the H.M.V. people alone have had to engage more than a thousand extra "hands" to cope with their Exhibition orders!

By the way, I wonder whether the general public realises that the Hayes factories are producing over a thousand complete sets and nearly a million components every twenty-four hours.

Our Radio Play Competition.

FIRST, as usual, practical, helpful and topical, "P.W." goes many lengths ahead in instituting, in collaboration with the B.B.C., its Radio Play Competition, the prize being not only £50 but the assured production of the winning play.

Here, for some clever reader, is perhaps the beginning of fame and fortune as a radio playwright. Were I not debarred from so doing I would enter the lists at a gallop and put every ounce of me into the contest. I am looking forward to the result with keen interest.

Hints to Competitors.

DON'T take these hints as authoritative; just think them over, however. First of all, I suggest that a radio play cannot stand up on the strength of "sound effects" alone; it must have a plot, a good plot and preferably an "ending" which is not a mere tapering-off.

The "effects" are to be used in order to supply, as far as possible, what is lacking because the play cannot be seen. Remember that many successful short-story writers banked on the surprise ending, *the zip in the tail*; O. Henry, for a good example.

A Few More Hints.

DO not offer dialogue which is mere "slapstick and custard-pie," or which is so brilliant that eighty per cent of listeners will not follow your scintillating sallies. Get down to real life—which is *not* the *salon* of South Kensington or the Chelsea studio.

If I were competing I should eschew crime, drunkenness, gambling and drugs. People nowadays are not very much different from their fathers, who loved Dickens. So go for the *heart*, nevertheless missing Dickens's super-sentimentality.

I'll swear that most folk like stories of the middle class much more than those which feature the *terra incognita* of Mayfair, Park Lane and "the Ritz."

This is an exceptional issue of "Popular Wireless." A unique issue.

For the first time in the history of the paper John Scott-Taggart, the world-famous radio engineer and designer of the finest sets ever offered to the home constructor, gives exclusive details of his latest masterpiece—the "S.T.500."

I have placed at Mr. Scott-Taggart's disposal more than thirty-three pages of this issue. He has used them magnificently. Each page breathes the spirit of his intense enthusiasm for his latest and greatest set.

I have little more to write. Build the "S.T.500." Now is your chance. "Popular Wireless" offers you the greatest radio event of the year.

THE EDITOR.

Radio Relay Systems.

ACCORDING to a writer in the "Electrical Review" there are now about three hundred radio relay systems operating in this country. The Post Office licence under which they work has more restrictions than permissions.

The relay company may not initiate a programme, play a gramophone record or even make an announcement. It must keep a log-book of its receptions and transmissions, and the licence gives the P.M.G. the right to prohibit reception from certain Continental stations. Proprietors may, however, wear their "old school" ties!

Our P.O. Van.

THE Americans simply cannot swallow the Post Office detector van story—except as a radio joke. The whole business is so like a bit of their own native bluff that they applaud it as such, but say "Apple sass" when asked to take it seriously.

You see, there are no pistols or impudent reporters or fat and brutal policemen connected with these little round-ups, and so the American is unable to regard them as bits of real life. Now, I ask them—do they think that mere Englishmen could *bluff* Scots into paying licence fees?

An Illuminating Census.

A CENSUS taken by a contemporary amongst 30,000 families in the United Kingdom reveals that 25,000 of them have radio sets. Of 14,000 sets 34·5 per cent were a year old and 1·6 per cent nine years old. Sixty-five decimal three per cent of the sets were three-valvers and 17·6 per cent had four or more valves. Forty-seven decimal six per cent were either amateur-made or made by local dealers.

(Continued on next page.)

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

Amongst the trade-built-sets there was no make of particular prominence, the-leading make being only 9-3 per cent. On the other hand, the most popular make of valve accounted for 42 per cent of the total number used in these 14,000 sets.

The New Police Force.

THERE is such a lot in the newspapers nowadays about the police, their new college, their pocket wireless sets and so on, that I am sure many people believe that one of the foundations of England's liberty is being tampered with. What we want, say the old-fashioned folk, is a good, solid "bobby," with no frills but a mule's kick in his truncheon.

No less than four promising youths have asked me whether they are likely to qualify for a place in the police "officers'" college on the strength of their familiarity with radio. I assured them that the police have more interest in "crooks" than in "anode bends."

Society Paragraph

OH YEZ! The Bec Radio Society began a new session on September 28th, and extends a hearty welcome to new technical and non-technical members. The syllabus looks good to me, and I notice that it includes experiments in television and the formation of a short-wave transmitting and receiving section.

Fee for the term of 26 weeks is five shillings. Please apply to the Hon. Sec., Mr. A. L. Odell, Bec Literary Institute, Bec School, Beechcroft Road, London, S.W.

Glorious Beer.

JUST plain beer, and pretty poor stuff, too, has revolutionised America for a second time. The first time was when the Americans chucked tea into Boston Harbour. Los Angeles County is now prospering by beer.

The miniature golf courses and the theatres are combining amusement with free beer—of a sort (they ought to try Kent's strong brown ale!)—and although all this has nothing to do with wireless, the radio pages of their newspapers are full of beer.

Presently they will announce that an American discovered beer, ignoring the fact that King Harold was defeated and the Spanish Armada was beaten on Beer.

Liquor and Lambda.

LAMBDA stands for "wavelength" in radio. Now see how the repeal of Prohibition in America affects radio there. From "Variety," a U.S.A. paper:

"Lord & Thomas has closed for a $5,000,000 account with the Schenley Distilleries, which markets Golden Whisky, has the Martell cognac and Heidseck champagne agency for the U.S."

The certainty of repeal is so generally accepted that the L. & T. agency is going ahead planning its campaign, which may also include a radio show.

Indian Radio on the Mend?

IT is refreshing to learn that radio in India is sitting up and taking a little nourishment. The Director of the Calcutta station states that broadcasting shows a small profit this year.

Whether this happy turn of the tide is due to lessened piracy or only to increased listeners as a result of the B.B.C.'s Empire broadcasts, I do not know. But it is a sign that law and order are being more observed, and that is welcome.

A greater use of broadcasting would undoubtedly bring a greater measure of peace and contentment to that demagogue-ridden country.

SHORT WAVES

"I say, old man, do you know enough about wireless to come and help me discover what's wrong with my new set?"

"Yes, I know enough about it not to!"

* * *

A WORD TO THE B.B.C.

Is it not time we heard a first-class wedding performance broadcast? I am confident Mr. ——, as an Old Bridegroom, would make a brilliant commentator.—"Punch."

* * *

It is claimed by a scientist that if the nervous system is sufficiently nourished a man can live to be 180.

In fact, he might even succeed in paying off that last instalment for his wireless set.

* * *

"Visitors to the Manchester Exhibition should not fail to inspect these beautiful models. The stand decorations include a magnificent LANDSCAPE BY GAINSBOROUGH," runs an advertisement.

But we understood this was a Wireless Exhibition.

* * *

MUSIC IN THE AIR!

Now the wireless is playing
In the maisonette above,
Where a baritone is braying
Of his everlasting love;
And the awful oscillation
In a set across the street
Trying some new foreign station
Makes the medley more complete . . .

Yes, there's music in the ether,
You can hear it everywhere,
And I long to get a breather
Of less musical fresh air.
So I'm off to be a diver—
In the depths I may be drowned,
But I shall not care a stiver
If I cannot hear a sound!

—"Answers."

Do Such Things Happen?

WHEN I read that a clergyman had determined to leave his flock in order to lead a bagpipe band I rubbed my eyes, for that sort of thing, I thought, happens only in the topsy-turvy land of dreams. But it appeared to be a real newspaper, complete with photograph of the would-be bagpipe king.

Then I was shot by a sudden fear. Suppose this meets the eye of a Dawnay or a Maschwitz! Or suppose—being bagpipes—Sir John Reith should issue a Napoleonic edict and create a two-years series entitled "Foundations of (Scotch) Music," illustrated with yon band! Yes, it *is* a nightmare, after all.

A White Man's Toy.

A MAN who has just returned from the wilds of Bolivia tells me that his demonstrations of wireless on a powerful receiver failed completely to impress the Indians of that country. They listened dutifully enough, but plainly regarded the set merely as a toy of that childish creature the white man. Much more interest was shown in his "boot-trees," and his safety-razor almost caused a riot. But his greatest triumph was the extraction of a cork with a corkscrew! They just loved the "plop."

Rapid Rejoinders.

J. T. F. (Yeovil).—The reply is in the *negative*. My negative of "P.W." on Ben Nevis was a wash-out because, as I said, my fingers were numbed. But "P.W." was well and truly affixed to the old observatory. L. S. (Cape Town).—Much obliged, but I get only three months holiday (I don't think!) per annum—hardly enough for an investigation of South African radio. Be a good South African and call diamonds every time.

As for you, T. C. (Wigan), I can say only this—tell the missus from me that Radio Paris is just as good as Blackpool, except for the "rock." N. S. P. (Bath).—Noo! I have no financial interest in "P.W." All my money seems to be in income-tax bonds minus nought per cent. But I have no money, anyway.

American Radio Humour.

THE Ogpu and a pack of bloodhounds are searching for a Russian violinist who does not claim to have played before the late Tsar. If found he will be presented to the American radio public as a novelty.

It is estimated that if every radio violinist who claims to have been Court fiddler has each played a two-minute selection for the Tsar, the last of the Romanoffs would have spent 119 years 10 months and 24 days listening to "Dark Eyes." Thus speaks an American "columnist," who adds the epigram: "He who laughs last will not be invited to the studio again."

ARIEL.

THE MAN BEHIND THE S.T.500

THERE are four wireless personalities whose careers are recorded in "Who's Who." One of these is John Scott-Taggart, M.C., F.Inst.P., A.M.I.E.E.

You see him—or rather part of him—on this page. We want you to know him. There is a double reason. He has designed the autumn boom set for us—the "S.T.500" described in this number. He is also the author of the "Manual of Modern Radio," the great presentation volume available to every reader of POPULAR WIRELESS.

We want you to know something about him because we believe the public has a right to know the credentials of their advisers and the solid record of achievement which has marked the career of one who now offers both a great design and a great book.

We have, in this issue, broken a tradition of eleven years. Hitherto all our star sets have been designed by our own research laboratories, and readers will know of their great success. This year, however, we have the privilege to present to you the design of Britain's acknowledged leader in this field. Needless to say, we can wholeheartedly recommend this set to you.

Although the name Scott-Taggart—and his initials S. T.—are known to probably everyone with a wireless set, there will be many thousands who, with this issue, will be taking up radio for the first time. To these, particularly, some biographical details of our eminent contributor will be of interest.

John Scott-Taggart, although only thirty-six years of age, is a pioneer of the valve era in which he has played an unusually constructive rôle. His first valve patent was filed sixteen years ago.

A Great Inventor.

Few modern inventors will fail to have one or other of Mr. Scott-Taggart's numerous patents cited by the Patent Office against their broader claims.

Amongst his inventions which are in common use to-day are the use of a series-aerial condenser in the aerial (1921). He was the first British patentee of the use of multiple-grid valves for radio reception by applying different frequencies to the grids (1919). He is the inventor of most of the more recently used systems for heterodyne reception, e.g. the mixer valve, the anode-injector system, the various multi-grid valve systems. He was, as Professor Hazeltine declared in 1926, the inventor of the neutrodyne in this country. Reflex circuits of various types were developed by him. He was the inventor of the use of a negatively biased rectifier or diode for delayed automatic volume control, a system now almost universally used when A.V.C. is employed. His Negatron negative-resistance method of generating oscillations has been used by the Post Office for long-distance communication, and was fitted to several hundred ships.

The importance of his inventions may be estimated by the fact that the following companies, amongst others, have purchased them from the concerns with which Mr. Scott-Taggart has been associated. Marconi's, Radio Communication Company, Ltd., Mullard Radio Valve Company, Hazeltine Corporation (U.S.A.), La Radiotechnique (France), Telefunken (Germany), Commercial Cable Company (U.S.A.) and Edison Swan Electric Co., Ltd.

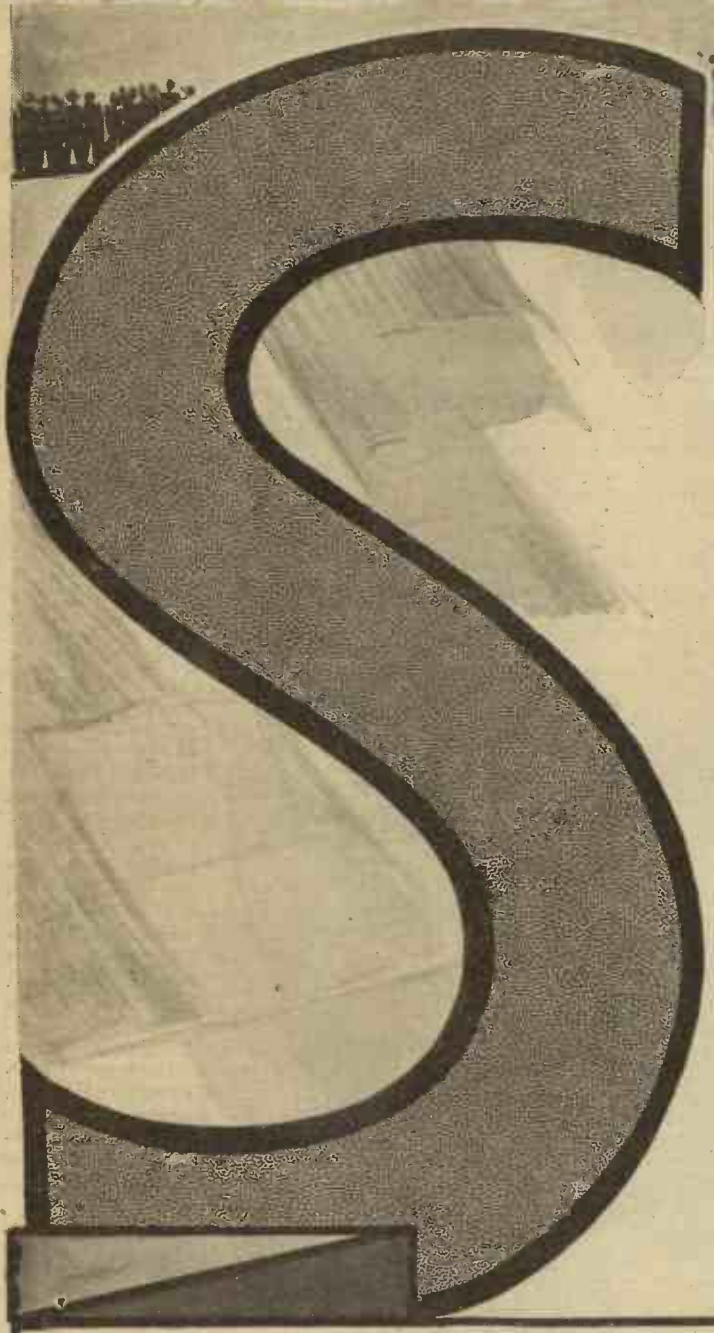
As a consulting engineer Mr. Scott-Taggart enjoys an international reputation. He has been adviser on patents to the Radio Communication Company, C. F. Elwell, Ltd., and Mullard Radio Valve Company. He has acted as technical adviser to the Radio Manufacturers' Association of America, which represents the American radio industry, and to the Independent Radio Manufacturers (U.S.A.).

International Reputation.

This concern represents the greater portion of American radio concerns. He has also been British patent adviser to the De Forest interests in the U.S.A. and the Huth Gesellschaft of Germany. He was consulting engineer to His Master's Voice

(*Continued on page* 316.)

HERE IT IS!



S.T.500 RADIO'S

JOHN SCOTT-TAGGART describes

I AM new to POPULAR WIRELESS.

A stranger, almost.

But not quite. Because in 1922, when this weekly journal was first established, I was honoured by being invited to become Chief Technical Adviser.

I resigned to establish what became a highly successful technical publishing organisation. The "Wireless Constructor" and "Modern Wireless" were two journals which I founded.

I was in competition with POPULAR WIRELESS—an enemy! The Editor of this journal is to-day presenting me to you in flattering terms.

You will agree with me that the situation is a rather curious one.

And yet to me it is a serious one. When the Editor said to me, "We want to give 'P.W.' readers the set of their lives. That's why we want you to do it for them," I could not restrain a smile.

But as a matter of fact I was tremendously keen on the suggestion. Here was a chance of appealing to a great new public. I resolved to put the very best I was capable of into this POPULAR WIRELESS set I was to design.

And here it is—the "S.T.500."

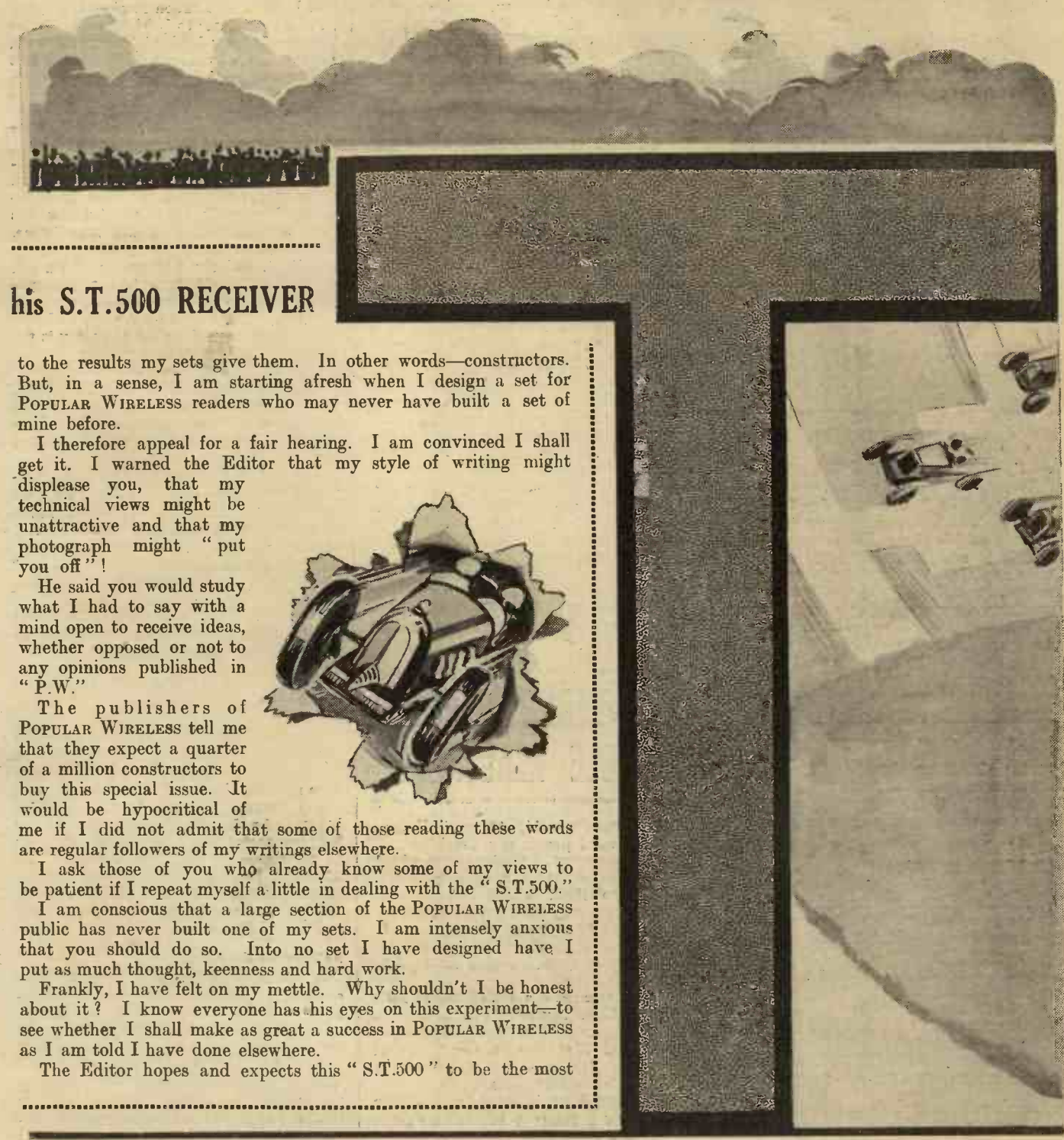
Of course, I had moments of doubt.

Here was a new public. I wondered whether you would be sympathetic towards an outsider. You have become accustomed to your regular designers, their methods of presenting their "boom" sets. You have had conveyed to you technical ideas with which I may, in some cases, have disagreed—perhaps violently.

I am afraid I have a reputation for being "awkward": for thinking all wrong what other designers think is all right.

I am not popular.

Except—and please do not think I am boasting—amongst those who have to spend their money and listen



his S.T.500 RECEIVER

to the results my sets give them. In other words—constructors. But, in a sense, I am starting afresh when I design a set for POPULAR WIRELESS readers who may never have built a set of mine before.

I therefore appeal for a fair hearing. I am convinced I shall get it. I warned the Editor that my style of writing might displease you, that my technical views might be unattractive and that my photograph might "put you off"!

He said you would study what I had to say with a mind open to receive ideas, whether opposed or not to any opinions published in "P.W."

The publishers of POPULAR WIRELESS tell me that they expect a quarter of a million constructors to buy this special issue. It would be hypocritical of me if I did not admit that some of those reading these words are regular followers of my writings elsewhere.

I ask those of you who already know some of my views to be patient if I repeat myself a little in dealing with the "S.T.500."

I am conscious that a large section of the POPULAR WIRELESS public has never built one of my sets. I am intensely anxious that you should do so. Into no set I have designed have I put as much thought, keenness and hard work.

Frankly, I have felt on my mettle. Why shouldn't I be honest about it? I know everyone has his eyes on this experiment—to see whether I shall make as great a success in POPULAR WIRELESS as I am told I have done elsewhere.

The Editor hopes and expects this "S.T.500" to be the most

RACING MODEL

popular set of any published in "P.W." for many years. I knew eight months ago that this was his expectation. I decided I should not let him down. I resolved I should not let myself down. But, above all, I determined I should not let the readers of "P.W." down.

So here you have the "S.T.500."

It may be the only set I shall design for you. The Editor says he offers you the "S.T.500" as a possibly unrepeatable bargain which should be snapped up.

This is complimentary to me. I can only say that throughout the months I have been designing the "S.T.500" (and rejecting a score of other circuits I have tried) I determined to do all I could to keep my reputation safe.

You may not have another set of mine in "Popular Wireless," but I have determined that this one shall make us understand each other. And make us friends.

Let us now get down to the actual receiver. You will find a concise description of the circuit on page 287. The results the set has given are on page 278. A Rapid-Construction Guide starts on page 289, while operating notes are to be found on page 284.

Must Appeal on Merit.

But before you read these pages I should like to enjoy your hospitality for half an hour: to sit in a comfortable chair opposite to you and talk of this "S.T.500."

I want you to ignore the fact that I have designed it; I do not wish to trade on a long, successful experience of set designing for the home constructor. Nor should you have regard to the fact that this is the autumn set for "Popular Wireless," and therefore the one they think you should build.

The set must appeal solely on its own merits. I want you to let me argue its case. I expect a hundred thousand "S.T.500's" to be built as an absolute minimum! Your friend across the road will build it; that fellow at the works or the office will talk to you about it. People will ask you—and perhaps you will ask them—"What do you think of this 'S.T.500'?"

All opinions will not agree. Violent controversy has greeted every set I have designed. I relish it. I want people to think about my designs; I would rather they thought the wrong way than not at all. And I know that within a month controversy will be dead; the successful experiences of tens of thousands will have killed it. I speak simply from what has occurred before.

The first thing you will have noticed about the "S.T.500" is that it has extra control knobs. I was the first in this country to offer the modern style of one-knob screened set. So I am in a very favourable position to criticise it!

The fact is that much greater selectivity is nowadays required, as it cannot be achieved by ordinary simple methods. The vogue of ordinary single or double-circuit receiver is definitely over.

The simple set has gone for ever. Simplicity of circuit is discredited, and simplicity of control for the home constructor remains an ideal.

The wireless Press has not been wholly free from the desire to accommodate the average reader who wants results, simplicity and economy.

Designers Must Look Ahead.

The results you do not know until you have built the set, so that the tempting selling points have been simplicity and economy. *The two easiest to achieve!* The day of reckoning is now here. Sets which achieved a very considerable popularity a year or two ago are declaring their weaknesses. They are breaking down under the heavy load of interference. **If there is any lesson at all to be learned from this, it is that a receiver should be designed not to achieve a temporary success under existing conditions, but a lasting success under conditions which will become worse.**

Let us see what the history of broadcasting tells us:

BALANCED PHASE DOUBLE REACTION!

In 1926 there were 119 stations in Europe, and their total power was 150 kilowatts. Within three years 81 stations were added, and the total output was now 600 kilowatts. The Prague Plan, which arranged the European stations so as to result in a minimum of interference, was obsolete by the spring of 1931, when 261 broadcasting transmitters were radiating a total power of 2,860 kilowatts.

To-day, excluding a lot of minor little stations which, however, can produce a considerable amount of background noise, whistle and distortion, the number of stations is 240, and the total energy output is about 5,000 kilowatts.

The Prague Plan, believed to be heaven sent, is now proving to be the very devil. But the new arrangement of stations under the Lucerne Plan of 1933 is not likely to please anyone but local-station listeners.

Mighty Voices Growing Mightier.

What of the future? Insignificant stations are to blossom forth as monsters; stations already working on considerable power, are to increase their power.

Frankfurt is going up from 17 kw. to 60 kw.; a station, Nice-Corsica, at 60 kw., is available. Naples, now 1·5 kw., will be able to go to 60 kw. Falun, now ·5 kw., can go up to 100 kw. Seville has 1·5 kw. at present, but it is entitled to go up to 100 kw. Graz, now 7 kw. (and next door to London Regional!), will, after January, still be next to London Regional, but will be able to increase to 100 kw. Stations like Trondheim (now 1·2 kw.), Viipuri (13 kw.), Lisbon (2 kw.), Sundsvall (10 kw.) and others will be able to go up to 100 kw.!

Listeners in the Shadows.

The position would not be so bad if all the stations acted together, but this, of course, will not happen. Some stations will introduce plans for new stations immediately, while others will wait one, two or three years. Meanwhile, the selectivity demands upon a wireless receiver will be extreme. Huge steam-roller stations will spring up overnight, and the programme, 9 kc. off, which you have been enjoying will suddenly cease to be. It will be so seriously interfered with that all enjoyment will be lost. **The powerful station of to-day is the swamped and mutilated station of to-morrow.**

We may take it, then, that the B.B.C. will intend, and rightly so, to be masters in their own home. The increase in the power of the new Daventry will be the first step, but will it be the last?

The present Regional stations are permitted under the Lucerne Plan to increase their power from 50 kw. to 100 kw. There seems no shadow of doubt that ultimately they will do this.

Where the shadow will occur will be over the millions of aerials within the zones of the B.B.C. Regional stations.

Those who live near the B.B.C. have been lashed with whips, but they are to be chastised with scorpions.

You may consider that I am trying to make your flesh creep. I am. I tried to do so a year ago, and a year before that, and I was justified. By all means, if you wish to do so, follow the design of one who thinks that the worst has been reached; he probably thought that the worst had been reached years ago.

The average receiver, built or bought, begins to be obsolete from the moment you have connected it to your aerial. It is not at all surprising that the appeal of the ordinary home-constructor's set design lasts about three weeks. Big Ben, when first heard on such a set, tolls its death-knell and the cabinet becomes its coffin.

Anticipating the Future.

So far my own system has worked successfully. By producing only one, or at the most two, big sets per year the wireless public knows where it stands—at least, as far as I am concerned. Each individual reader can make up his mind whether he likes or dislikes my sets; but if he decides not to build it he can pnt me completely out of his mind and consider other designers' products. If, on the other hand, he decides, as I hope he will, to build this set, for example, he will know that I shall stand by the receiver and not pull down the building I have only just erected.

Security of tenure is as important in a wireless set as in any other branch of life.

It is an incontrovertible fact that a receiver without full facilities for enhancing selectivity as conditions demand is only designed to cope with conditions as they are to-day. If a set can do this it accomplishes a great achievement. But it is inevitable that every week that brings greater interference will throw a greater burden on the receiver. Since the receiver cannot be

altered, the results from the loudspeaker will be. Imagine a car which may give very good results on the level roads of Holland being taken to Switzerland. Devoid of proper gearing and reserve power, the car starts up the foothills on the approach to the Alps; as the gradient increases the car labours, and finally the struggle is abandoned.

The owner of the car did not foresee that he might want to use it outside of Holland. This, of course, is a hypothetical case, but the need for reserve adjustments is very plain.

Full control of selectivity, with a possibility of increasing it, has been a feature of each of my three national sets. The subsequent history of these sets has startlingly justified the policy I adopted. Vast numbers of the "S.T.300" and "S.T.400" were built.

The first receiver was a cheap, simple three-valve set, but with far more controls than any other receiver making the same appeal to the public. It was, in fact, a turning point—*and a hairpin bend at that*—in designs for the home constructor. Hitherto the simplicity fetish had held sway, and a complete reversal of public opinion took place. The "S.T.400" is a four-valve development, also generously provided with controls.

Designs that Endure

How have these two sets served in the hands of the public? **The reply can best be summed up by stating that the "S.T.400" and "S.T.300" sets are current designs to-day. Both receivers were actually at the last Radiolympia, and no one thought it at all odd that these sets should be on show nearly a year and nearly two years respectively after they were published. As far as I am aware, no builder of the "S.T.400" has changed over to another designer's set, and I know of no one possessing an "S.T.300" who has changed his set unless it be to convert it into an "S.T.400."**

This is a truly remarkable tribute to both sets when one considers that it was the custom for thousands of constructors to build new sets every few months. Chopping and changing had so far become fashionable that to keep a given design in commission for even six months was something unusual. The reason for the continual changing was not interest in the hobby, but sheer dissatisfaction, and a praiseworthy, if despairing, search for something better.

Let us now get down to the technical aspect of the "S.T.500" and see how and why it is different from other sets, and whether the difference is one of detail or *principle*.

Too many circuits of to-day are the mummified relics of an obsolete technique, while most new-born circuits go straight from their swaddling clothes into their winding sheets.

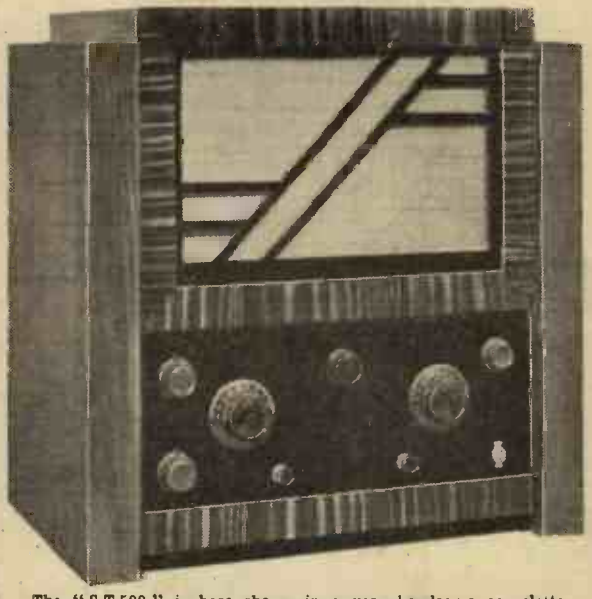
The circuit of the "S.T.500," in my opinion, is not only novel, but necessary.

The Panel Controls

The most casual glance at the receiver will indicate that its panel boasts several knobs. Three of these are switches, and as such are in no sense of the word controls. Two switches are for waveband changing, and one is for switching the set on and off. This leaves four panel controls and two tuning condenser dials. There are two tuned circuits, called respectively the aerial and the anode circuit. Such circuits are sometimes tuned by a single-control knob, but there are several reasons why such a simplified arrangement is unsatisfactory.

The upper left-hand knob on the panel is a series-aerial condenser which controls the high-frequency input and selectivity of the aerial circuit; at the bottom left-hand corner is an aerial-reaction knob, which provides reaction for the aerial circuit and still further increases its selectivity.

A CONSOLETTE VERSION



The "S.T.500" is here shown in a very handsome consolette cabinet complete with speaker. This artistic design was prepared specially for the set.

A Revelation in Sensitivity

Between and above the two tuning dials is a differential anode-coupling condenser which has proved so extraordinarily effective in the "S.T.300" and "S.T.400" sets. On the extreme right, in the top corner of the panel, is the ordinary reaction knob, which provides reaction on to the anode circuit.

The whole receiver consists of a stage of S.G. high-frequency amplification, followed by a detector, a driver valve and a Class B output arrangement.

Those readers of POPULAR WIRELESS who have built sets of the detector and 2 L.F. type have no conception of the increased selectivity which they can obtain from quite an ordinary H.F. amplifying stage. Sensitivity to weak signals will also be greatly increased.

My detector is of the sensitive, leaky-grid condenser type, but uses a much smaller value of condenser than usual in order to obtain better results; the explanation of this will be given later.

The Class B output ensures much better quality and much greater volume than have hitherto been obtainable on the ordinary battery-valve arrangement. In fact, the results obtainable with the "S.T.500" will astonish those who have not yet tried a properly designed Class B outfit. This development puts the battery set in a position to compete with the mains receiver on its own ground, which has always been that of volume and quality. There is the added merit of economy of H.T. When the set is "on," but signals are not being received, the H.T. current for the output valve is only about 1 or 2 milliamperes, whereas it would be nearer 12 or 14 for a power valve. On the Class B valve you only use as much H.T. as the loudness of the signals needs. On quiet passages of music the current from your battery is negligible.

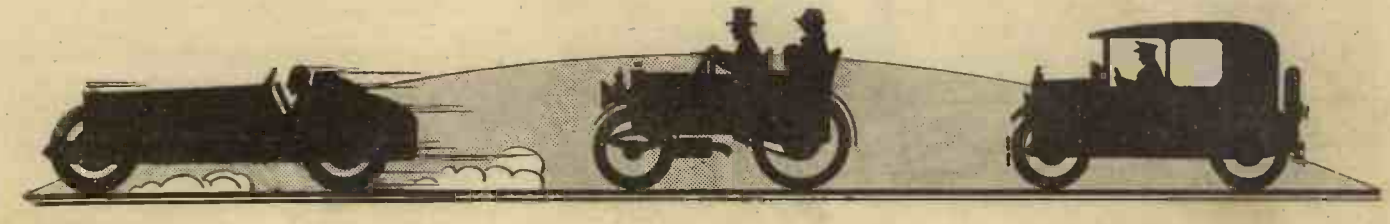
A Sound Investment

If an ordinary power valve is used you are spending perhaps pounds a year on H.T. current which is never made use of. **This is because the average anode current of an ordinary power valve is the same whether you are receiving a whisper or the crash of cymbals. You have to have a large current so that the crash of cymbals can be "handled." But it is like buying and maintaining an hotel so that you can spend your summer holiday there. In Class B you pay for what you use, and the scheme will pay for itself in a month or two.**

The high-frequency amplifying system of the "S.T.500" is highly effective for reasons which will be given in a detailed description, **and the effect of applying reaction to both the aerial and the anode circuits simultaneously is to enhance signal strength and selectivity beyond anything which has been hitherto obtainable with two circuits.**

This is not a general claim, but simply a technical fact, since the reduction of losses on two circuits *must* result in a degree of selectivity which it is impossible to obtain by taking advantage of the ordinary resonance effect of two tuned circuits, to one of which reaction is applied.

The first and almost the most vital decision you have to make is whether the



Glorious Volume and Depth Made Possible With

various knobs frighten you or not. In spite of the great success of the "S.T.300" and "S.T.400" sets, there is still a great deal of prejudice against multiple controls. This can easily be understood, and no one is more alive to the need for simplicity in the operating of a wireless receiver than myself.

It is generally recognised that, while single control is sought, it is impossible to obtain the same degree of selectivity or sensitivity unless all tuned circuits are individually tuned to the station to be received. The ganged set nearly always involves some discrepancy of tuning at some point or other on the wavebands.

For You or Your Grandmother?

The question of control generally raises the point: "Who is to operate the receiver?" If you are building a receiver for your grandmother I would advise something less effective but more simple than the "S.T.500"; or else tell her to leave some of the controls alone. My own idea of the average amateur, however, is that he is not a grandmother. We must come to an understanding on this point at once.

Commercial receivers are so cheap that something more than price prompts a man to build a set himself. The wireless constructor obviously has a greater technical interest in the subject than the lay person, who twiddles a knob without the slightest idea of how the set works. If you build a pseudo-factory-built receiver you are simply placing yourself in the same position as the completely non-technical old lady.

You may turn the knob a little more slowly than she does, and perhaps get a little more accuracy of tuning, although the modern visual tuning arrangement will deprive you even of that consolation. Unless you can employ your skill to obtain better results you might just as well give up wireless as a hobby altogether.

If you gave Steve Donoghue a cart horse in the Derby in which all the other horses are of a similar type I would not be at all surprised if he were beaten by every driver of a dray. Put Stainforth in the cockpit of an old Avro and he would probably get left behind by every joy-ride pilot in the country. Do you imagine that Sir Malcolm Campbell would be able to get more out of a 1925 Austin Seven than anyone else? I very much doubt it.

The moral is that the machine should match the man. A tricycle may be the safest and best form of transport for an invalid old gentleman, but I cannot imagine Woods, who makes a habit of winning the T.T. races, proving his mettle in such a saddle.

Simplicity versus Results.

The presentation of a complete set of golf clubs to me would be a sinful waste. I could do better with a single iron than with the whole bag. Completely devoid of any golfing skill, I not only do not desire a bagful of clubs, but even think that golf would be a better game if only one club were allowed!

The frank realisation of one's inability to handle more than one knob on a wireless set may stamp one as a non-technical enthusiast, but it is no disgrace. I dare say there are people who could drive a locomotive if it only had one control, but I cannot imagine the driver of the Flying Scotsman being satisfied with such an engine. One-knob control in every phase of life brings everyone to a single level, and it is a lower level than that which could otherwise be obtained.

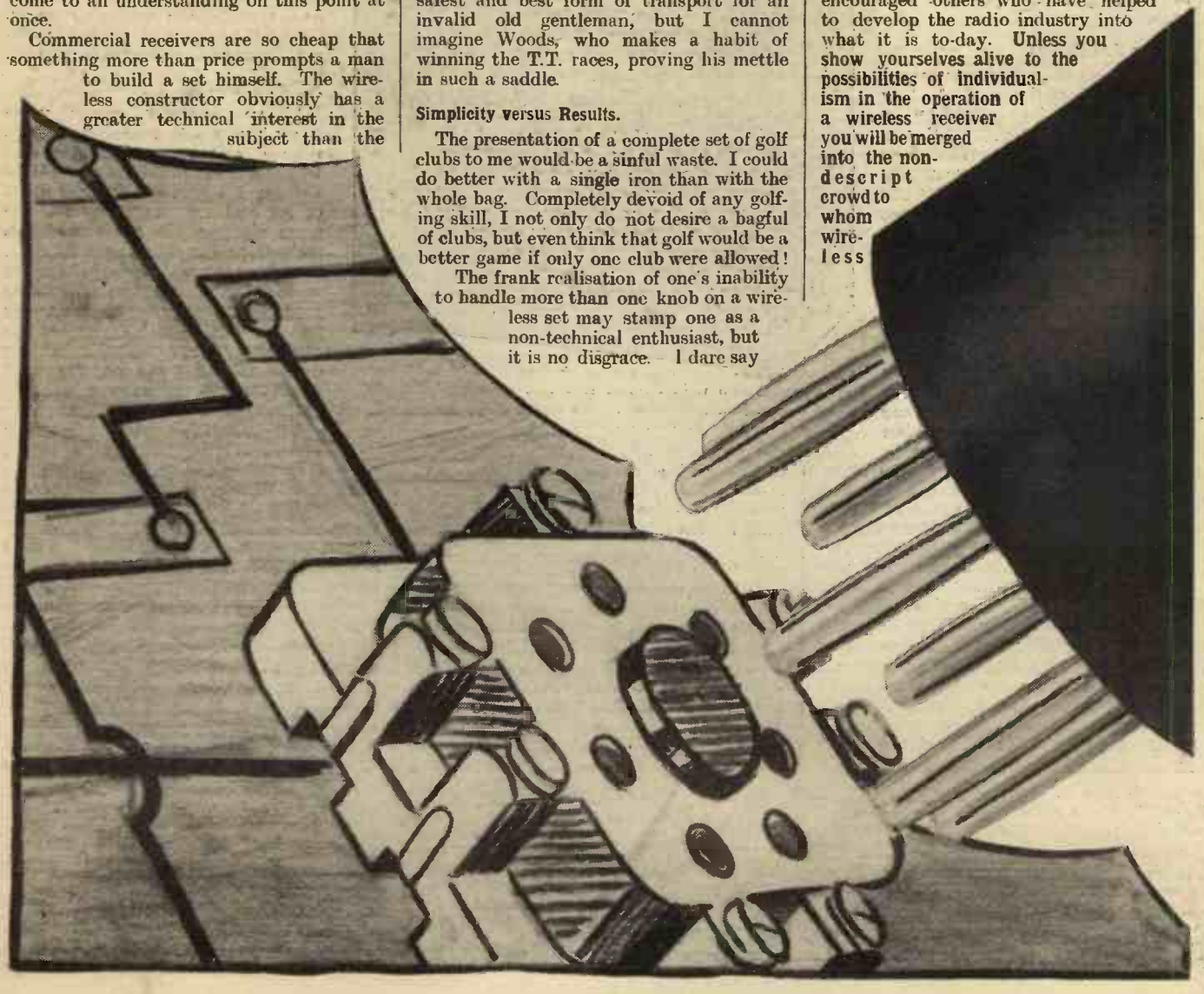
There are some people devoid of "road sense." To put into their hands the steering wheel of the slowest family car would be as felonious as administering cyanide.

Similarly, there are wireless people who have no "panel sense"; they are at sea with two knobs and at the bottom of the sea with three.

If you are one of these you are wasting your time by reading this. Panel sense is easily acquired, but those who fear controls must simply put up with poorer results.

Maintain Your Pioneer Supremacy.

Many of you were pioneers who popularised broadcasting in its early days and placed it on the sound foundations on which it now stands. You built and listened and encouraged others who have helped to develop the radio industry into what it is to-day. Unless you show yourselves alive to the possibilities of individualism in the operation of a wireless receiver you will be merged into the nondescript crowd to whom wireless



Class B Output

means nothing more than a dial inscribed with the names of stations.

Such experience and skill as you have acquired through the years will count for nothing. You will be unable to use it. You will be forced to operate receivers which you know are less effective than they should be.

Wireless will lose its interest as a hobby. The zest of home construction, of a fine receiver built with your own hands, will have vanished. You will have joined the lost legion of wireless enthusiasts.

As a means of introducing wireless to a new public, there may have been some justification for the "simplicity era." I am glad, however, that I had no hand in it. Let me disclose what occurred, as far as I was concerned, in 1926. The sale of wireless books and constructional envelopes, blue prints, etc., by Radio Press, Ltd. (of which I was the head), was on a huge scale.

Taking Drastic Action.

These publications continued to sell long after I was convinced that technical progress in my laboratories had made many of the press designs obsolete, or at least obsolescent.

In 1926 I determined to take drastic action to prevent the building of sets which I felt would be sooner or later—and probably sooner—incapable of coping with new conditions and a greater interference. In view of the big business done in instructional books and envelopes large stocks had to be carried.

I stopped all advertising of obsolescent designs. In spite of this, sales continued.

A Magnificent Gesture.

I then decided on the drastic step of refusing to sell any publications of my own, or of the many other authors who wrote for me, which contained designs no longer representative of the new methods which were being developed, all of which involved high-frequency amplification. Large stocks of publications were, at my order, destroyed. Compensation was paid, and paid willingly, to printers and authors. This clean sweep involved a personal loss to myself of several thousand pounds. No one suffered but myself, and there could be no greater testimony to the technical sincerity of a designer than this gesture.

If there are any knobs on the "S.T.500" other than the tuning controls and reaction, about which you have the slightest doubt whatsoever, you can leave them strictly alone and, if it will make you any happier, you can actually take the knobs off! The set will then become a very good average receiver, every bit as good as the kind of "simpler" set which you might otherwise choose to build.

The reason why the extra controls can be left at "normal" (usually either in a vertical position or to the left) is that the controls are not interdependent. None of them is a vital link in a chain. Set controls are essentially part and parcel of the circuit of a set. Without them the whole set will fail. An example of such a control is a tuning dial. If it is not tuned correctly, the desired station will not be received.

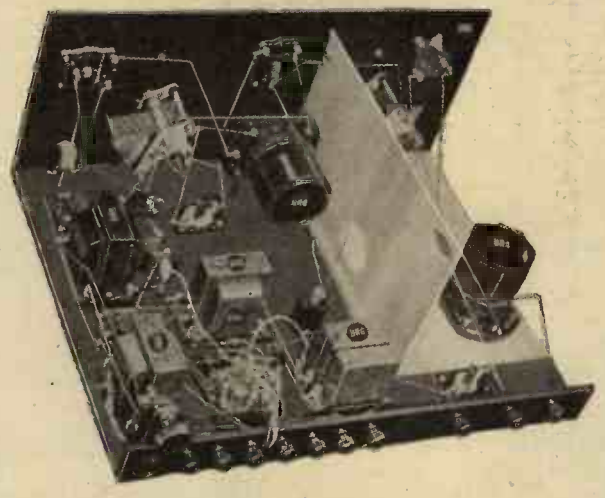
Only Two Essential Controls.

On the other hand, a control such as reaction will greatly improve signal strength and selectivity on any well-designed receiver, but it is not an essential control in the sense that the set will not work without it. Fewer stations may be obtained and more interference experienced if the reaction is faulty or not used, but it is not a direct link. The only essential controls on the "S.T.500" are the tuning dials, and in this respect the set is no different from any other. Every other single control on the "S.T.500" could be ignored and yet leave the set operating quite effectively.

(*Continued on page* 234.)

S.T.500

EVERY PART GUARANTEED



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SCOTT-DESIGNED

Contrast this type of control with, say, five separate tuned circuits each separately controlled by a knob. Every single circuit has to be correctly tuned, otherwise the desired station will not be properly received. To all but the experienced man the tuning of such a receiver would be about as easy as finding the combination for a safe. Hundreds of different combinations of values of the condensers could be tried without getting the desired stations.

Exactly the opposite is the case in the control of the "S.T.-500." You are bound to tune in stations even if all the extra controls are set at random. Admittedly, selectivity, sensitivity, volume and quality may be impaired. But the extra controls are what I call the parallel type and not the series type.

A good example of the series type of control is the trimmer of a gang condenser. It is an actual link in the chain, and if wrongly adjusted the set will simply not work. The average factory-built set is all links, and it takes a factory to see that the links all fit together. It is a cardinal policy, adhered to in the case of every set I have so far designed for building on a national scale, that the extra controls shall be refinements.

In my opinion, no "variable" should be capable of throwing the set out of working order if incorrectly adjusted. Secondly, each control should produce a very definite and easily observed effect when it is separately operated.

The "S.T.500" is a racing model, and the effect of its controls may be compared to the additional refinements on a car or on any other racing models. Take a racing yacht, for example. It has one or two main sails which are always in use, but the skipper can raise and lower other sails to obtain a faster performance. He can let out that rope or pull in this one in order to take advantage of every breeze or every change of tide. **His extra sails are refinements, but they make all the difference between winning or losing a race.** By stripping and simplifying their craft the captains of the "Britannia" or "Shamrock" can turn these racing yachts into sailing barges.

Apart from all other benefits, extra controls are needed to compensate for differences in valves and in the components of a receiver which may vary to some extent amongst the same type and manufacture, but which vary even more between different types. Such things as an S.G. choke or a reaction choke may cause a very wide variation in performance due to differences in inductance, resonance peaks, resistance and self-capacity.

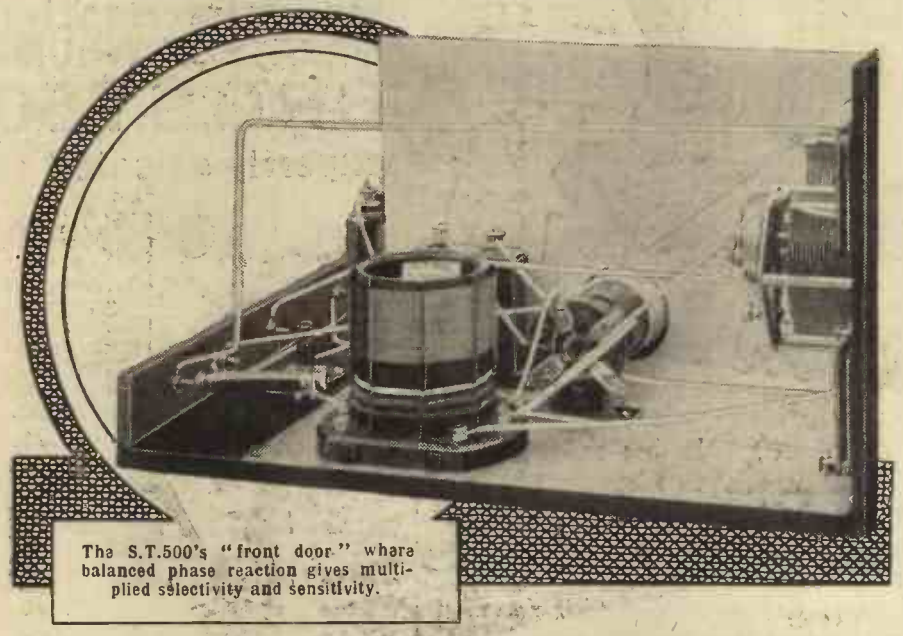
The reader is advised to adhere to the components used by the designer, but there is no guarantee that he will always do so, and it is clearly desirable to provide controls which will bring the set up to the very high level desired in spite of difference in individual sets.

I say very definitely that, unless you are prepared to add some controls, consistent results are not obtainable. **The designer who gets excellent results in his own laboratory will find that conditions in different homes vary enormously. I have been in scores of constructors' homes from Land's End to John o' Groats, and I believe I know your own local problems as probably no other designer does.**

I can design, and have designed, receivers for dithery hands and shaky intellects. It is, however, a relief to design a receiver for a public which can appreciate flexibility and real racing-car performance.

The mania for simplicity in home-constructed sets has led to a welter of unsatisfactory receivers which are now making their owners discontented and reproachful.

VIEW OF THE AERIAL END OF THE "S.T.500"



The S.T.500's "front door" where balanced phase reaction gives multiplied selectivity and sensitivity.

Here you see the aerial end of the receiver. The aerial coil is of the "S.T.400" type. An "S.T.300" aerial coil may be modified by the constructor by adding a very simple aerial-reaction coil.

TAGGART

The fault, however, is chiefly the public's. Those who have been beguiled by the clean look of a panel are now finding out that what one gains on the swings one loses on the roundabouts, *and the roundabouts are proving very big and noisy.*

The swings themselves have lost all their attraction. There are certainly a million sets hopelessly out of date, and I should be inclined to put the figure at nearly four million. Most of the other sets are obsolescent. This applies to commercial and amateur-built receivers. Probably the greatest trouble of all is being caused by the cheap three-valve sets.

One-knob control definitely limits the technical development of a receiver. The necessity for absolutely accurate ganging of the different tuned circuits makes it impossible to apply any device for improving signal strength or selectivity owing to the risk of upsetting the ganging. A curious situation has already arisen with regard to the new iron-core coils. These coils have a greater efficiency than air-core coils of the same size. Owing to their lower resistance, any error in tuning of one circuit will cause a much greater change in overall response. Since the resonance curve is sharper it is much more important to tune accurately.

This means that with iron-core coils ganging is increasingly difficult. The inventor of one brand of iron-core coil tells me that the efficiency of the coil has deliberately to be made less than it could be in order to make it commercially possible for set manufacturers to gang their circuits. In other words, separate condensers become even more advantageous as the efficiency of the coil increases, while if the tuning of each circuit is kept fairly flat —i.e. unselective—ganging is greatly simplified.

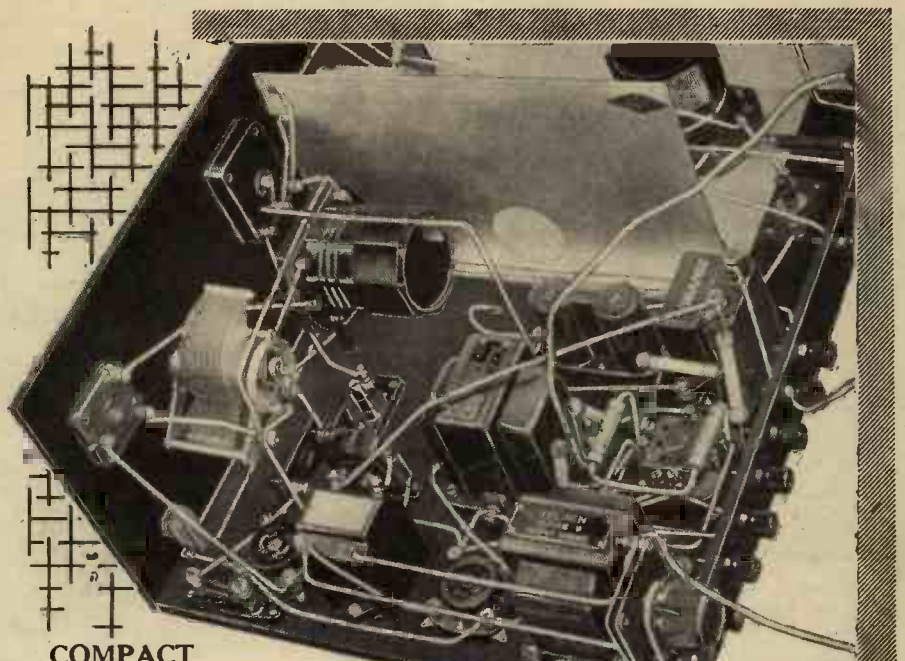
In the case of the "S.T.500" I have applied reaction to both the aerial circuit and the anode circuit, so that the efficiency of both circuits is extremely high. It would be quite impossible to use ganging with such a circuit; the very slightest variation of capacity or inductance or stray capacity would prevent the double-reaction system from being used.

There is thus no chance of the scheme being used by set manufacturers. It is a technical development of the utmost importance which cannot be used for the simple reason that a ganged condenser could not be employed. What a wonderful opportunity for those with just that little extra tuning ability!

It is a justification of my opinion that the technique of a home-constructed set should be utterly different from that of a factory set. What is a stumbling block to the factory can be the golden opportunity of the constructor.

Even apart from the double-reaction scheme there are important features in the "S.T.500." The selectivity of nearly every set is fixed, or partly fixed. How much different is it on the "S.T.500," where the selectivity and sensitivity are completely adjustable over its whole range on every wavelength and on each waveband! If interference gets worse in the future you can simply make a small alteration to the control on the panel and your set progressively

THE DETECTOR, DRIVER AND CLASS B



COMPACT BUT EASY TO BUILD

This view shows how simple even the more compressed part of the set is. Class B is used, and the component in the bottom corner is the output choke, which is not bought if you buy a moving-coil speaker with Class B terminals.

THIS SET

The S.T.500 gives Enormous Magnification with

becomes more selective. Even if you are not prepared to use the controls in the way intended you can, by rotating the aerial and anode couplers to the left, increase the general selectivity of the set every few months if you find interference increases, as you undoubtedly will do.

You who are reading this must choose now whether you propose to wear the strait-jacket of simplicity or whether you prefer the flexibility of the "S.T.500."

Avoiding Counterfeit Simplicity.

I could easily have simplified the panel by inserting at least two of the controls inside the set. This, however, would only be a half-measure. It would certainly popularise the set amongst those who were not prepared to stop and think. **Conditions of reception, however, vary at every degree on the dial, and for that matter at every hour of the day.**

If you can get a big increase in volume or a striking improvement in selectivity by the slight turn of a knob it is better that the control should be on the panel, where it is easily to hand. No one wants to climb under a motor-car every time a gear is to be changed; nor does a golfer want to go back to the club house every time he wants a mashie niblick, even though he may look simpler on the golf course without his bag of clubs.

The idea of full-range, panel-controlled selectivity of each circuit in a receiver was introduced by me on the "S.T.300." Before that time it was customary at the most to provide a certain degree of variable selectivity on the aerial circuit of a receiver; the tuned circuit between the valve was completely ignored, although a tapping was sometimes provided to increase the stability of the set. **The introduction of differential anode coupling, as well as an aerial coupler, enabled the selectivity of both circuits to be varied over the whole range.**

The aerial and anode couplers are the two main selectivity-volume controls; the rotation of either in an anti-clockwise direction will improve selectivity, while a rotation to the right will improve volume. In practice the anode coupler will very rarely go beyond the half-way position, and sometimes, with some valves, no advantage will be gained by rotating the anode coupler further to the right.

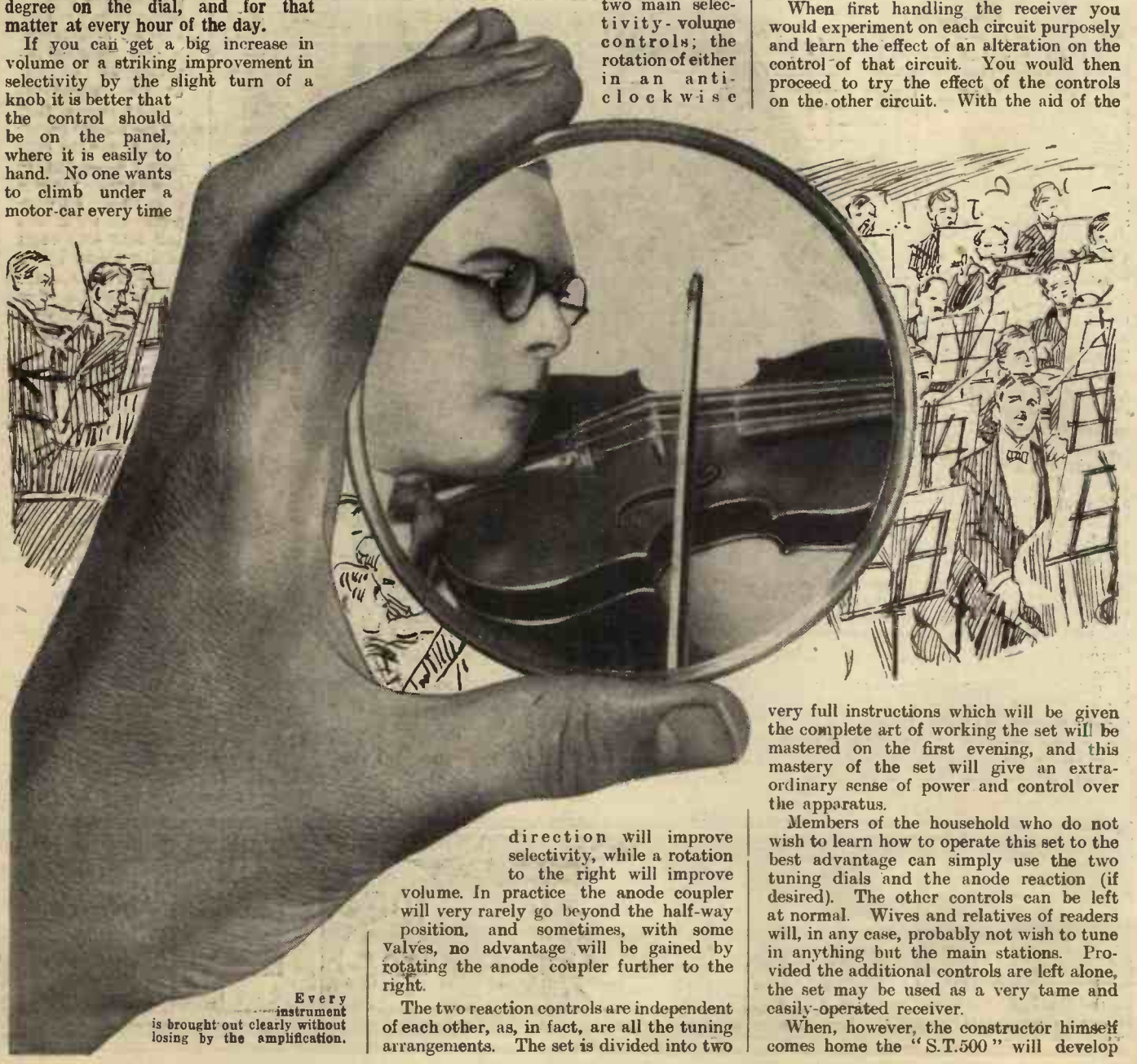
The two reaction controls are independent of each other, as, in fact, are all the tuning arrangements. The set is divided into two water-tight, so to speak, compartments; these are the aerial circuit and the anode circuit, and the aerial circuit is tuned by means of the left-hand dial, while its selectivity and strength of signals are governed by the aerial coupler and the aerial-reaction knob.

The anode circuit is tuned by means of the right-hand dial, while its selectivity is governed by the anode coupler and the ordinary reaction knob. **The two circuits are therefore identically treated,** and you can either have high selectivity on the aerial circuit and flattish selectivity on the anode circuit, or vice versa. In extreme cases you would have the maximum selectivity on each circuit.

When first handling the receiver you would experiment on each circuit purposely and learn the effect of an alteration on the control of that circuit. You would then proceed to try the effect of the controls on the other circuit. With the aid of the very full instructions which will be given the complete art of working the set will be mastered on the first evening, and this mastery of the set will give an extraordinary sense of power and control over the apparatus.

Members of the household who do not wish to learn how to operate this set to the best advantage can simply use the two tuning dials and the anode reaction (if desired). The other controls can be left at normal. Wives and relatives of readers will, in any case, probably not wish to tune in anything but the main stations. Provided the additional controls are left alone, the set may be used as a very tame and easily-operated receiver.

When, however, the constructor himself comes home the "S.T.500" will develop



Every instrument is brought out clearly without losing by the amplification.

Absolute Realism of Tone

new life and will respond submissively to intelligent handling. Sound common sense is the only qualification necessary for working the set, and speed of tuning is a feature of the working of the receiver, since everything is under complete control. There are no fluky results.

The "S.T.500" can, therefore, be operated as a "family bus," whilst in the hands of its master it becomes a true racing model.

This, surely, is the ideal to aim at in the design of a wireless receiver. The thrill of receiving station after station, cutting down interference as if you were sandpapering the roughness off a piece of wood, makes the controls a delight to use. You **can hear them chopping off the excrescences of interference which may be clinging to the desired station. You can hear them bring a signal up from a whisper to a glorious outpouring of melodious sound. You can hear them reducing an overpowering signal to one of pleasant strength. In fact, the controls not only give you authority over the set, but mastery of the ether.**

Those who feel their interest in radio is flagging, who want to recapture the thrill and enthusiasm with which they listened to their first set, will find in the "S.T.500" something to rekindle their joy in radio.

The Responsibilities of Success.

I want every reader of this issue of POPULAR WIRELESS to appreciate that, with a string of successes behind, I feel the very great responsibility in offering a new design. It is a very simple matter to see how the public is building a new receiver by consulting the component manufacturers, especially the coil-makers.

Within the first five days of my last set—the "S.T.400"—being published, 40,000 home constructors ordered the coils. This, of course, must have been before any of them had heard the set at work. It was purely a question of faith. Faith in my reputation as a designer. It would be hypocrisy on my part not to feel pleased about a matter of this kind. But it also makes it tremendously important not to let the public down.

Quite half a million pounds will be spent in the next week or two by builders of the "S.T.500." It is a very large sum of money, and I feel intensely the responsibility. But I have no qualms. No set I have yet designed has been more deliberately conceived or based on such a wide experience in all parts of the country of the novel principles involved.

A fully complete and fully technical service, conducted by an efficient staff working in the closest co-operation with myself, is ready to help you if you have any kind of trouble whatsoever. You can proceed to build the set with the full confidence that it will be backed up by the proprietors of POPULAR WIRELESS and by myself. I urge you to start building the receiver at once. If you lack faith

(*Continued on page* 261.)

The following Dubilier Condensers and Resistances are chosen by Mr. John Scott-Taggart for the S.T. 500

Three Type B.B. non-inductive type fitted into moulded bakelite cases. 250 volts D.C. peak.
Two 1 mfd. 2/6 each.
One 2 mfd. 3/6.

Three Type 4401 Tubular Paper Condensers.
Two ·005 mfd. 1/3 each. One ·0005 1/-.

One Type 670 Moulded Mica Condenser.
·00005 1/-.

Five Dubilier Metallized Resistances, one watt type. Two 5,000 ohms. Two 10,000 ohms.
One 250 ohms, 1/- each.

One Dubilier Grid Leak.
1 megohm, 1/-.

PROOF POSITIVE of DUBILIER SUPREMACY

Scott-Taggart's personal choice for his S.T. 500

100% British and dependable as the Flag

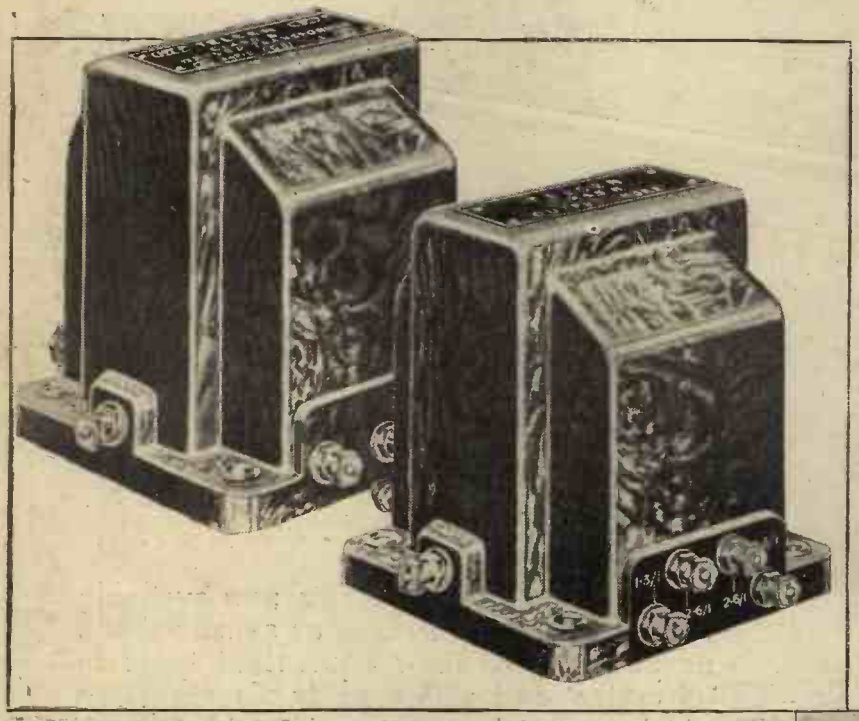
DUBILIER
CONDENSERS & RESISTANCES

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA RD., N. ACTON. LONDON. W.3

TELSEN

Class B COMPONENTS

SPECIFIED BY MR. JOHN SCOTT-TAGGART



For the P.W. "S.T. 500"

THE Telsen 'Class B' Driver Transformer and the Telsen 'Class B' Output Choke each represent the finest components of their respective types it is possible to produce, providing, at reasonable prices, a performance which is literally unsurpassed. Mr. John Scott-Taggart, like many other famous set designers, has shown his appreciation of this fact by specifying and using them in preference to all others. What better evidence of their superiority can you wish for than this?

TELSEN 'CLASS B' DRIVER TRANSFORMER

Made in two ratios, covering the requirements of all the 'Class B' Valves available at present.

RATIOS

Overall 1-1; Primary to half-secondary 2-1. Overall 1.5-1; Primary to half-secondary 3-1 **8/6**

TELSEN 'CLASS B' OUTPUT TRANSFORMER

For matching to M.C. speakers having low resistance speech coils. *Primary resistance 200 ohms per half-winding* - - - **8/6**

TELSEN 'CLASS B' OUTPUT CHOKE

For matching to M.C. speakers having either a high resistance speech coil or a low resistance coil and input transformer. *D.C. resistance 220 ohms per half-winding. Total inductance 18 henries* - - **8/6**

TELSEN 7 PIN VALVE HOLDERS

Specially designed for 'Class B' valves. Contact sockets extended in one piece to form soldering tags. Terminals numbered according to standard R.M.A. system.

Rigid Type - - - - - **1/6**

Anti-Micro Type - - - **1/9**

The illustration above shows the position occupied by the Telsen 'Class B' Driver Transformer and Output Choke in the built-up P.W. 'S.T.500.'

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

or are ultra-cautious, by all means wait and hear someone else's set. But if you delay you may have to wait for your components.

My advice is: Start your "S.T.500" to-day. I am sure you will never regret the decision.

Let us now go into more detail regarding the reaction system of the "S.T.500." My last set—the "S.T.400"—involved a reaction chain in which the anode circuit of the detector provided reaction both to the grid circuit of the detector and also to the aerial circuit.

The reaction applied to the aerial circuit completed its circuit back to the detector valve via the differential anode coupler. Changes in anode coupler, therefore, changed greatly the reaction on both circuits.

Moreover, reaction on the aerial could only take place when both aerial and anode circuits were in tune, and alterations in tuning consequently affected the reaction.

In spite of these objections, which at that time were regarded as insuperable, tuning the "S.T.400" presented no great difficulty, since the aerial reaction could be cut out and only brought into use when the other selectivity adjustments fell just short of complete success and when the desired station had already been tuned in.

In the "S.T.500" all these objections have been removed and aerial reaction is used, not as a last resort but as a perfectly docile and advantageous aid even to *finding* a station and bringing it up to full strength. The complexities of the former scheme—which were freely admitted in my "S.T.400" description—no longer exist.

Independent Double Reaction.

The reaction for the second tuned circuit (i.e. associated with the grid of the detector valve) is obtained from the detector valve. The reaction for the aerial circuit is independently obtained and is derived from the S.G. valve.

This arrangement makes double reaction extremely straightforward. The two tuned circuits are kept wholly stable and either may be made more selective quite independently of the other. Sensitivity is simultaneously increased, and whereas in the "S.T.400" aerial reaction was used essentially to improve the selectivity, on this set—the "S.T.500"—aerial reaction will be often used to provide a delightful increase in volume apart from any merits of improved selectivity.

For the daylight reception of weak signals I regularly use it, and even at other times often use the aerial reaction only.

Unparalleled Long Wave Performance.

The results on the long waves are even more startling, since reaction on this waveband is notoriously bad on many sets. In fact, the long-wave band, which in my opinion provides some of the finest and most consistent radio entertainment to be had, is treated with contempt by most designers—chiefly, I think, because their circuits are stripped of the extra controls which would give equal efficiency on both wavebands. Since the god of simplicity must be worshipped at all costs, the long-wave band is offered up as a sacrifice!

Another reason why I favour aerial reaction even over anode reaction is that the damping of the aerial and earth is very much greater than that of the anode circuit of the S.G. valve on the tuned anode circuit.

The aerial circuit—the first in the whole set—is in the greatest need of help, yet it is always the anode circuit which receives the sympathy. Is it any wonder that the aerial circuit responds with almost pathetic enthusiasm as reaction is applied to it?

As one turns the aerial-reaction knob "up," one can hear the big aerial resistance being wiped out and signals previously a whisper rise in strength until majestic volume is reached. And yet the same signals will collapse to nothing if the aerial tuning dial is moved a degree to either side of the correct tuning point. Could a more ideal result be obtained? No parched and withering plant could sprout more quickly and eagerly after an unexpected fall of rain.

The aerial circuit of practically every set in Britain is robbed of the help which is always given to the anode circuit. Yet it needs the help more than its sister tuned circuit.

We designers recognise its need. We know what a terrible load the aerial-earth system is on the first tuned circuit in the set. I believe I was the first to appreciate to the full the need to lift some of this burden. At any rate, I invented the series-aerial condenser as used not for tuning but for improving aerial selectivity.

A heavily laden man moves sluggishly. A tuned circuit connected to the heavy load of an aerial-earth system is sluggish. One can make the first tuned circuit less so by inserting a series-aerial condenser which separates the aerial losses from what, by itself, may be quite an efficient tuned circuit.

This arrangement increases selectivity, but will very greatly decrease signal strength if the full selectivity benefits are to be obtained. It is a mixed blessing. You can evade the pressing claims of creditors by placing a big distance between you and them; but you will then find it just as difficult to collect any money that others may owe you.

The first tuned circuit shirks the burden of the aerial circuit by placing a small capacity as a separator. But the aerial retaliates and says: "Very well, I shall feed weaker signals to you."

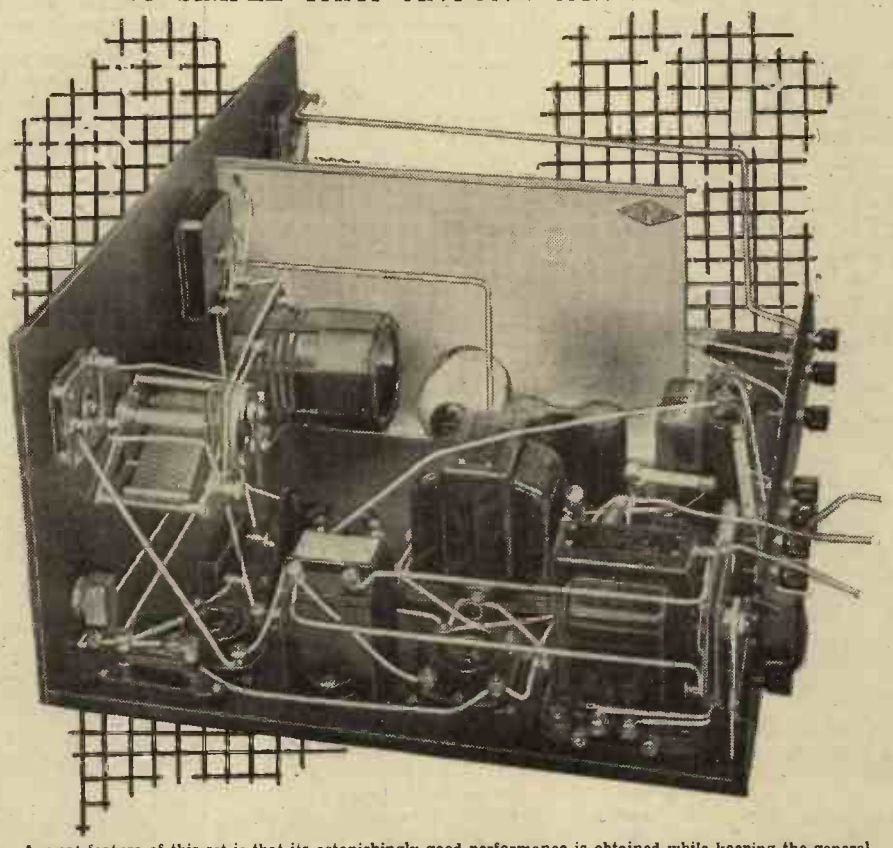
The aerial is like a tyrannous father who supports a son who wants to live a free life. The father says: "You can cut yourself adrift if you like, but I shall cut off your allowance." The son may therefore make a bargain to have a little more freedom but a smaller allowance.

Fallacy of Shortened Aerials.

This is what happens on the average set. The designer compromises between signal strength and selectivity. The aerial may be an Old Man of the Sea, but, after all, he does deliver the goods. We cannot do without the collector of our signals.

A favourite nostrum for selectivity is: "Shorten your aerial." This quack remedy lessens the aerial load but also reduces signal strength. A series-aerial condenser

SO SIMPLE THAT ANYONE CAN BUILD IT



A great feature of this set is that its astonishingly good performance is obtained while keeping the general constructional design extremely simple. Those who may have built the "S.T.300" or "S.T.400" will be able to use their panels, screen, condensers, terminal strip, L.F. transformer, S.G. choke, and other components.

Aerial Losses are Wiped Out

is also to some extent a questionable tonic, but *if variable and on the panel* you only take it when really ill, i.e. when interference on a particular station is bad.

If you have lopped off some of your aerial you have to take your medicine whether you are ill or well. When, on a certain station, or at a certain time of day, you know you could let things rip, you cannot very well go out and extend your aerial; but on my sets you can get the same effect by increasing the capacity of the aerial coupler.

Gains Without Losses.

But cutting off your signal strength to spite your interference is regarded as inevitable. This is the eternal—and infernal—see-saw. Signals up—selectivity down. Selectivity up—signals down.

Now, at last, the "S.T.500" knocks the see-saw off its hinges. By applying reaction to the first tuned circuit we can wipe out the aerial losses. The aerial can now be brought closer to the tuned circuit; if a series-aerial condenser is used this is done by increasing the capacity of the condenser. Without reaction the aerial resistance and other causes of losses would immediately impair the selectivity and flatten tuning. **But the reaction not only restores the original selectivity but provides a far higher degree of it. Moreover, not only does the close connection with the aerial result in very much stronger signals, but the reaction is now applied to these stronger signals and makes them stronger still!**

The see-saw law under which we have grovelled for so long is not only repealed but actually reversed. Not only does double reaction unshackle every bond-servant of the harsh tyrant, but increased selectivity is now accompanied by greater signal strength.

It is, however, still possible, when desired, to obtain weaker strength while retaining equal selectivity, since the aerial coupler can still be reduced, and then will feed less H.F. into the set. Wide variations in volume are thus possible while maintaining full selectivity.

When a person was wasting away the doctors of past centuries would apply leeches to suck the life-blood of their patients. The designer who wants greater selectivity on his aerial circuit proceeds to starve it of signals! From now on each prescription will be as technically sound as the other.

To double the amplification of the S.G. valve is an extremely difficult proposition. But to multiply the strength of signals fifty times in the aerial circuit by means of aerial reaction is a simple matter. The new reinforced signals will be amplified by the S.G. valve in the ordinary way, and signals of fifty times the strength obtained on an ordinary set will be applied to the detector.

Benefits of Double Reaction.

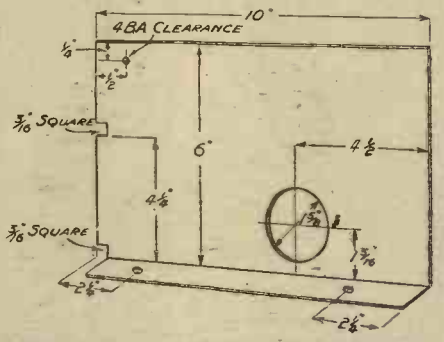
Well begun is half done. This is superlatively true of a wireless set where all the complications, difficulties, technical subtleties and miscellaneous losses occur after the first tuned circuit. **A tainted spring will pollute a mighty river. I want you to start well in your set. Build up your signals at the very beginning and filter out the biggest portion of the interference before it is amplified. You can do all this if you apply double reaction to your set.**

If you prefer to mumble the shibboleths of the high priests of simplicity you must not blame me if you find difficulty in getting adequate volume and selectivity. If you leave till too late in the set the task of sifting out the interference and increasing the signal strength do not shift the responsibility on to me.

No parent would dream of underfeeding a child and allowing it to grow up wild and uncivilised, with the idea that when it was ten years old the process of nourishment and education could begin. Yet in every single design you pick up the aerial circuit is underfed and under-disciplined. Charity on such sets not only begins in the anode circuit: it ends there.

The principle of starving the aerial circuit to make it more selective is comparable to

A SIMPLE SCREEN



The screen between the input and output of the S.G. valve. An "S.T.300" or "S.T.400" screen will serve, but note the upper notch.

a gardener lopping off most of the stems of a plant so that it will require less water to live. And, all the time, the little extra trouble of carrying a watering-can would turn the weakling into a flourishing plant with a profusion of flowers.

My advice to you is to encourage the weak signal when it first appears in the set. Give it reaction, which will build it up in the critical stage of its progress. This reaction will only build up signals in the immediate vicinity of the desired wavelength, so it is possible to make the desired station tower over its former bullying neighbours. The desired signal may then be sent out into the world, i.e. passed into the set. It will experience further growth and a final sprucing, but it has been launched with every advantage.

The comparative merits of different receivers is illustrated pictorially in accompanying diagrams.

Fig. 1 shows three aerial circuits. (1) is a plain tuned circuit directly between aerial and earth. Signal strength is good, but selectivity is really terrible. You can try it for yourself; improving the coil and condenser will not make very much difference when the aerial load is a big factor.

(2) shows an aerial-coupling condenser in use. This will at once improve selectivity, but as the capacity of the condenser is decreased the improved selectivity is accompanied by a rapid falling off in signal strength.

This is the see-saw effect. **Even if the condenser capacity is made exceptionally low you still have all the losses in the coil and condenser; therefore under the most favourable conditions you cannot get more than a fair degree of selectivity and, of course, you will get comparatively very little signal strength (especially as the wavelength received increases),** because the aerial is almost disconnected. If the aerial coupler had a minimum of zero the aerial would actually be disconnected.

Reaction Reigns Supreme.

The absolute theoretical limit of selectivity is reached when the inductance and condenser are free of the aerial load. But this theoretical maximum selectivity is not—and cannot be—anything but hopelessly inadequate, because there remains—and always will remain on any coil—the heavy losses in the coil and condenser.

The trouble in many a set is that by the time you have made it selective there is no station there to select. Most sets do not even have a variable-series-aerial condenser, or else you have to fumble with a pre-set buried somewhere in the set and neither intended for nor capable of use to suit the conditions of interference which vary at every degree on the dial on both wavebands and at every hour of the day.

But even if my policy of having the control boldly to hand on the panel is adopted the results are mean compared to those obtainable with the aerial-reaction scheme of (3). The reaction coil R is fed from the S.G. choke L_1, the reaction condenser C_1 enabling the reaction to be adjusted to the best value. The S.G. valve, of course, also acts as an H.F. amplifier and feeds the subsequent circuit, which is omitted for the sake of simplicity.

Fig. 2 shows the resonance curve of different aerial circuits using (a) an air-core coil, (b) an iron-core coil of efficient design, and (c) an air-core coil with reaction. The height of each curve represents the signal strength obtainable, while the average width of the "mountain" is an indication of selectivity.

In practice, the selectivity of the reaction arrangement is very much higher, because one can afford to cut down the original signal strength and then bring it up with reaction. By this method the amount of interference at the base of the "mountain" in Fig. 2 becomes very small, and for a given signal output from the speaker the selectivity with aerial reaction is enormously greater than with any other method.

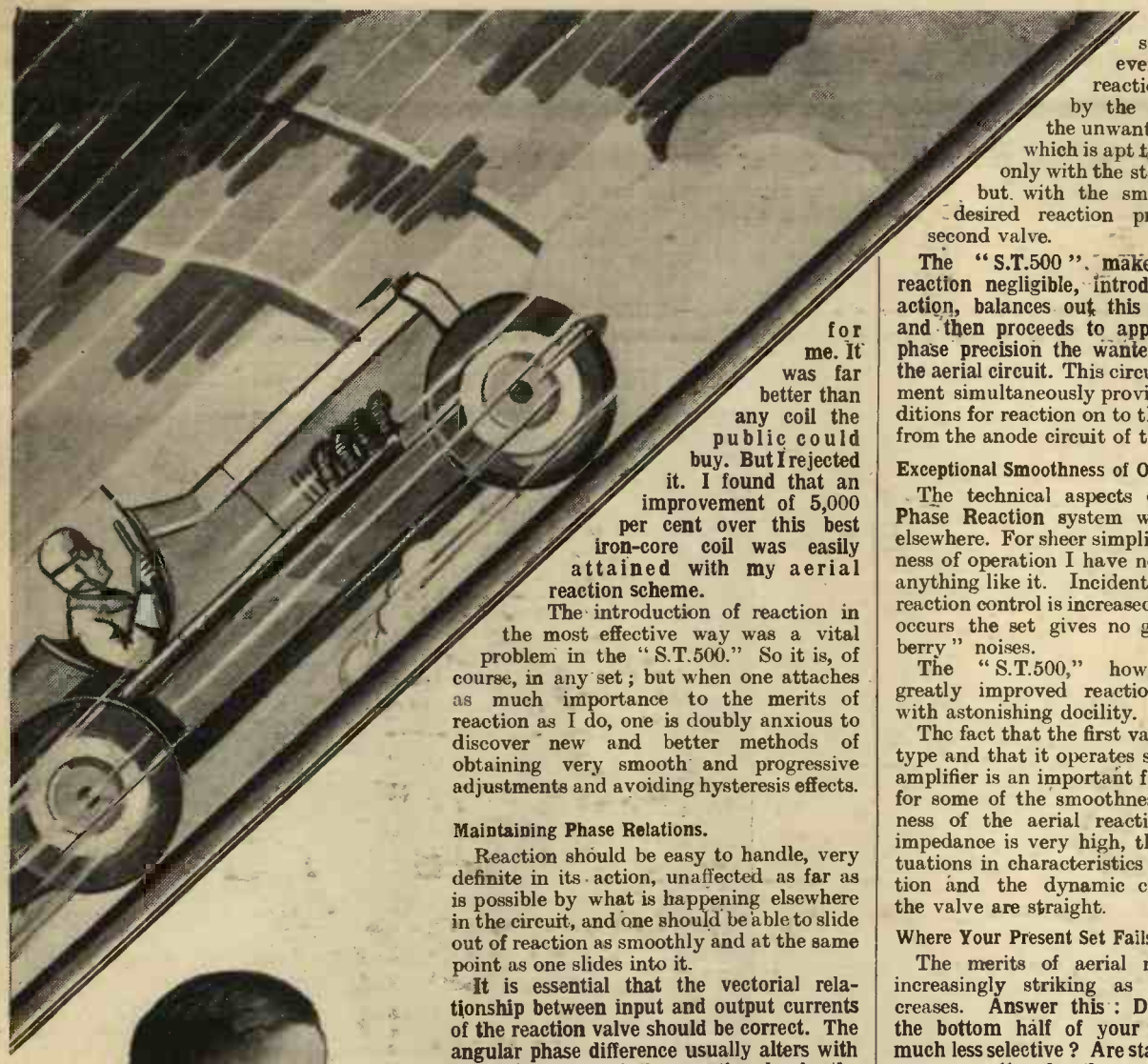
Fig. 3 gives some idea of the comparison.

Better Than Iron-core Coils.

The general efficiency of aerial reaction depends upon how effectively the reaction can be applied. Theoretically one might expect a circuit with full reaction to be literally millions of times better than a plain circuit, since the circuit resistance can be reduced to zero. There are, however, certain practical and theoretical limitations to the extent to which one can use reaction.

While seeking an efficient coil I had an ultra-efficient iron-cored coil specially made

(Continued on page 264.)



for me. It was far better than any coil the public could buy. But I rejected it. I found that an improvement of 5,000 per cent over this best iron-core coil was easily attained with my aerial reaction scheme.

The introduction of reaction in the most effective way was a vital problem in the "S.T.500." So it is, of course, in any set; but when one attaches as much importance to the merits of reaction as I do, one is doubly anxious to discover new and better methods of obtaining very smooth and progressive adjustments and avoiding hysteresis effects.

Maintaining Phase Relations.

Reaction should be easy to handle, very definite in its action, unaffected as far as is possible by what is happening elsewhere in the circuit, and one should be able to slide out of reaction as smoothly and at the same point as one slides into it.

It is essential that the vectorial relationship between input and output currents of the reaction valve should be correct. The angular phase difference usually alters with the adjustment of the reaction knob, the wavelength being received, and the tuning of the circuits.

The trouble is always greater when there is an H.F. valve in the set, there being two tuned circuits and two valves contributing reaction. I am speaking now of every receiver. The reaction contributed by the first valve is of the unwanted inherent type which is apt to play havoc not only with the stability of the set but with the smoothness of the desired reaction provided by the second valve.

The "S.T.500" makes the inherent reaction negligible, introduces reverse reaction, balances out this reverse reaction and then proceeds to apply with absolute phase precision the wanted reaction on to the aerial circuit. This circuit and its adjustment simultaneously provides the best conditions for reaction on to the second circuit from the anode circuit of the second valve.

Exceptional Smoothness of Operation.

The technical aspects of my **Balanced Phase Reaction** system will be described elsewhere. For sheer simplicity and smoothness of operation I have never experienced anything like it. Incidentally, when either reaction control is increased until oscillation occurs the set gives no grunts or "raspberry" noises.

The "S.T.500," however, combines greatly improved reaction arrangements with astonishing docility.

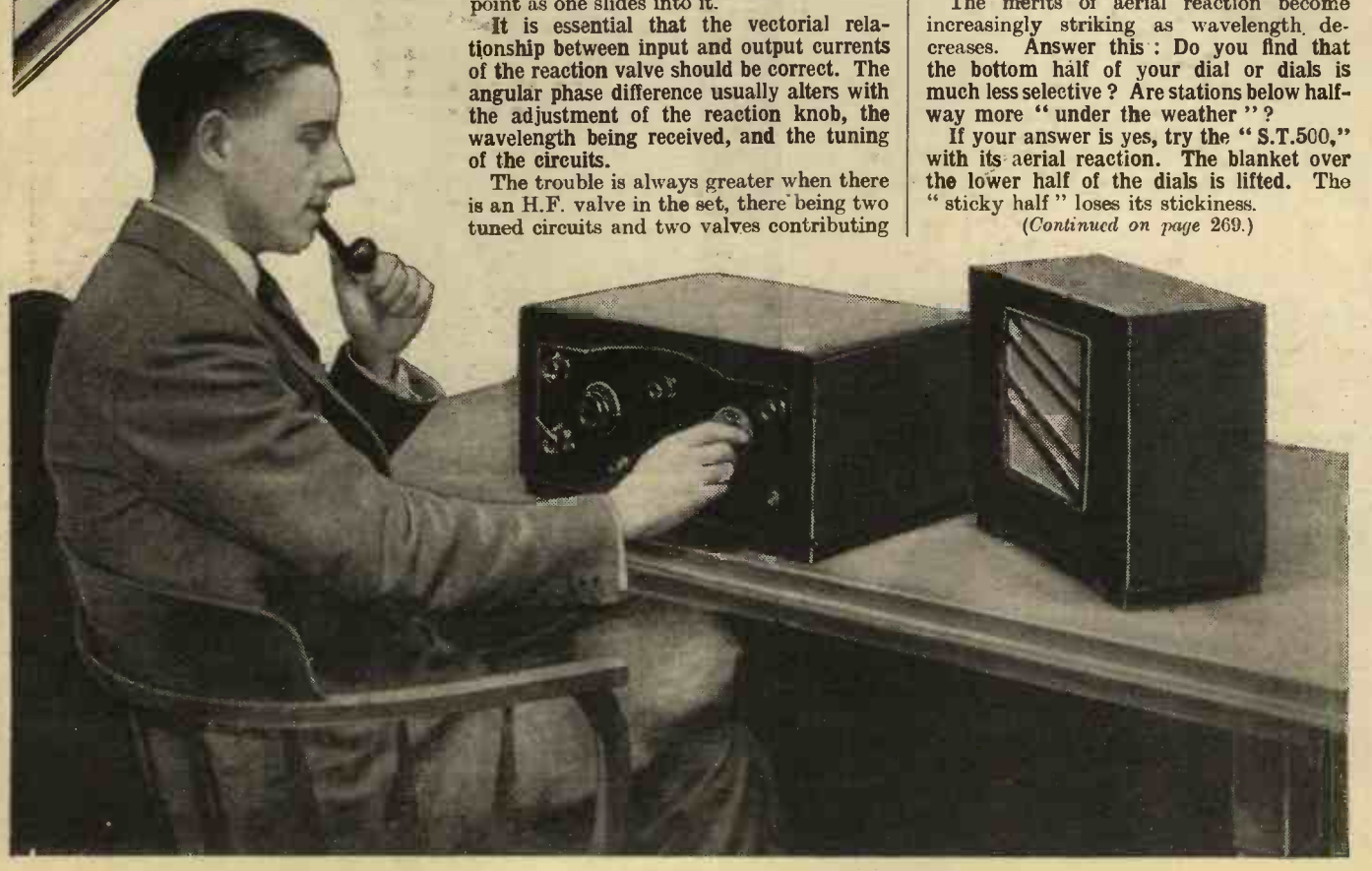
The fact that the first valve is of the S.G. type and that it operates solely as an H.F. amplifier is an important factor accounting for some of the smoothness and effectiveness of the aerial reaction. The anode impedance is very high, there are no fluctuations in characteristics due to rectification and the dynamic characteristics of the valve are straight.

Where Your Present Set Fails.

The merits of aerial reaction become increasingly striking as wavelength decreases. **Answer this: Do you find that the bottom half of your dial or dials is much less selective? Are stations below halfway more "under the weather"?**

If your answer is yes, try the "S.T.500," with its aerial reaction. The blanket over the lower half of the dials is lifted. The "sticky half" loses its stickiness.

(*Continued on page* 269.)



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Complete Kit of parts, less valves and cabinet.
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1 Ready Radio S.G. Binocular Choke		3	0
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3 ·0005 Log Law Condensers		5	3
1 T.C.C. ·0005 Tubular Condenser		1	0
1 Pr. Ready Radio S.T.400 Coils		3	6
1 Varley Niclet Transformer		7	6
1 W.B. Universal Valve Holder		1	0
1 T.C.C. ·0005 Mica Condenser			8
2 Push-pull Switches		1	3
1 250-ohm Thermium Resistance			6
1 Ready Radio Reaction Choke		1	6
1 Bulgin 7-pin Valve Holder		1	6
1 Ready Radio 1-meg. Grid Leak			6
1 Grid-Leak Holder			6
1 Ready Radio ·0003-mfd. Differential Condenser		2	6
2 T.C.C. 1-mfd. Fixed Condensers, type 50		5	0
2 T.C.C. ·005 Tubular Condensers		2	6
1 T.C.C. 2-mfd. Condenser		3	6
1 Toggle Switch		1	6
1 J.B. ·00005 Baseboard Preset Cond.		1	0
1 J.B. ·0001 Baseboard Preset Cond.		1	0
2 10,000-ohm Thermium Resistances		1	0
2 5,000-ohm " "		1	0
2 Benjamin 4-pin Valve Holders		1	8
10 Belling-Lee type "R" Terminals		2	6
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1 Pr. Panel Brackets			6
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Epoch Moving-Coil Speaker and Class B Unit, with valve	£3	3	0
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Only 10½ guineas in oak cabinet. In walnut, mahogany or limed oak cabinet, 10/- extra.

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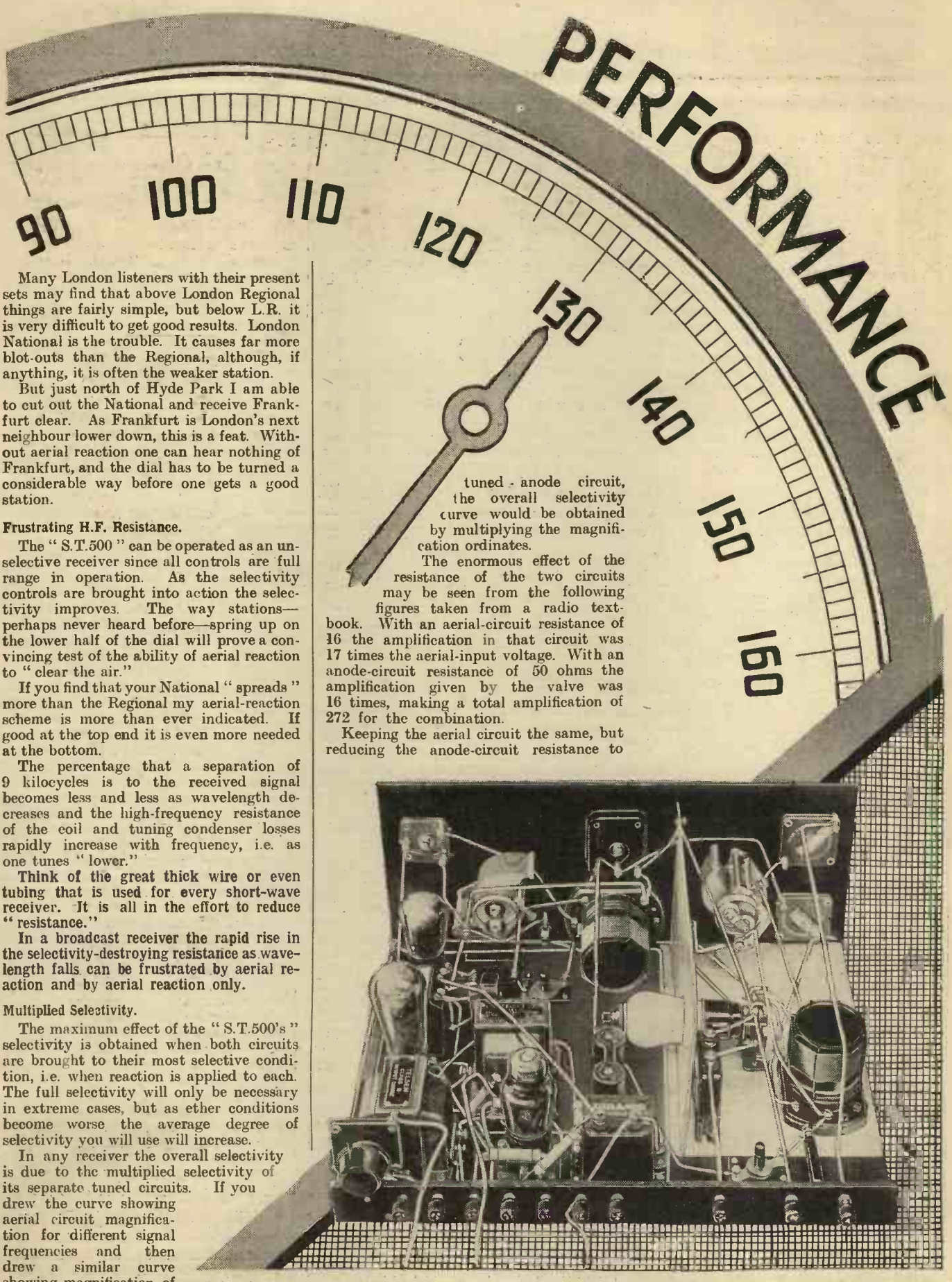


Many London listeners with their present sets may find that above London Regional things are fairly simple, but below L.R. it is very difficult to get good results. London National is the trouble. It causes far more blot-outs than the Regional, although, if anything, it is often the weaker station.

But just north of Hyde Park I am able to cut out the National and receive Frankfurt clear. As Frankfurt is London's next neighbour lower down, this is a feat. Without aerial reaction one can hear nothing of Frankfurt, and the dial has to be turned a considerable way before one gets a good station.

Frustrating H.F. Resistance.

The " S.T.500 " can be operated as an unselective receiver since all controls are full range in operation. As the selectivity controls are brought into action the selectivity improves. The way stations—perhaps never heard before—spring up on the lower half of the dial will prove a convincing test of the ability of aerial reaction to " clear the air."

If you find that your National " spreads " more than the Regional my aerial-reaction scheme is more than ever indicated. If good at the top end it is even more needed at the bottom.

The percentage that a separation of 9 kilocycles is to the received signal becomes less and less as wavelength decreases and the high-frequency resistance of the coil and tuning condenser losses rapidly increase with frequency, i.e. as one tunes " lower."

Think of the great thick wire or even tubing that is used for every short-wave receiver. It is all in the effort to reduce " resistance."

In a broadcast receiver the rapid rise in the selectivity-destroying resistance as wavelength falls can be frustrated by aerial reaction and by aerial reaction only.

Multiplied Selectivity.

The maximum effect of the " S.T.500's " selectivity is obtained when both circuits are brought to their most selective condition, i.e. when reaction is applied to each. The full selectivity will only be necessary in extreme cases, but as ether conditions become worse the average degree of selectivity you will use will increase.

In any receiver the overall selectivity is due to the multiplied selectivity of its separate tuned circuits. If you drew the curve showing aerial circuit magnification for different signal frequencies and then drew a similar curve showing magnification of the S.G. valve and its tuned-anode circuit, the overall selectivity curve would be obtained by multiplying the magnification ordinates.

The enormous effect of the resistance of the two circuits may be seen from the following figures taken from a radio textbook. With an aerial-circuit resistance of 16 the amplification in that circuit was 17 times the aerial-input voltage. With an anode-circuit resistance of 50 ohms the amplification given by the valve was 16 times, making a total amplification of 272 for the combination.

Keeping the aerial circuit the same, but reducing the anode-circuit resistance to

The speed a car can maintain is an indication of it's performance capabilities, and similarly with the " S.T.500 " its ability to cope with all conditions all the time is the measure of its performance.

Make This Your 1934 Set and Get 1936 Performance

1·5 ohms by means of reaction, the total amplification was increased from 272 to about 7,000 times!

This startling result is a practical proof of the merits of anode reaction, but my whole point is that aerial reaction will give an equally startling result. The amplification of the aerial circuit depends on the resistance. If we halve the resistance we double the amplification.

Proved in Half a Minute.

If we reduce the aerial-circuit resistance to half an ohm by reaction we should get signals 32 times as strong—i.e. an amplification of 544. And this is before the signals are amplified by the S.G. valve! If we apply more reaction—as is easily done on the "S.T.500"—the figures become even more remarkable.

Since the overall selectivity of two tuned circuits is due to the multiplication of the amplification ordinates, any improvement of aerial-circuit selectivity will pay handsomely.

On an aerial circuit of 16 ohms resistance the amplification of a desired station was 17. An undesired station of equal strength but 9 kilocycles off was amplified 9 times. In other words, it was more than half as strong as the wanted station! But the designer of this receiver applied reaction to the anode circuit, and relied on this process for selectivity. The valve and anode circuit now amplified the desired signal 400 times and the interfering signal only 30 times.

Selectivity means cutting the interfering signal down in respect to the desired one. In the above example the aerial circuit cuts the interference down by less than a half; the anode circuit, with the aid of reaction, cuts it down to a thirteenth of its value.

What is regularly done on the anode circuit can be equally effective on the aerial circuit. But no one does it! The constructor — untrammelled by "simplicity" — can do it, and I show you the way.

Multiple reaction means multiplied selectivity. Half a day could be spent in mathematical explanation, but half a minute on the set will bring you proof.

Triumphs of Aerial Reaction.

Listen for some obscure station—perhaps a feeble Russian—on the "S.T.500." The dials are correctly set, but everything is silent. Anode reaction fails to help, but is left at a medium value. Look at that knob at the left bottom of the panel. It is the aerial reaction. Turn "up" the knob a little and slightly tune the aerial dial. The station emerges. Increase the aerial reaction. Signals swell up. Note that the set throughout is as stable as a rock. The music now fills the room.

Turn back the aerial reaction. Other stations may still be excellent, but the obscure station has sunk again into obscurity. Yet it can be conjured back by the simplest operation in the world: aerial reaction.

Try for some other station. It may be not only obscure but buried in a morass of interference. It may have a precious programme covered by the undergrowth of sprawling stations.

Here is a clear case for aerial reaction. The interfering stations on either side cling stubbornly at first to the desired station. As the latter's volume increases with reaction, the jamming stations begin to lose their grip and slip away as the desired programme emerges triumphant. Aerial reaction!

Whether you are seeking stronger signals or a purer programme, aerial reaction is so effective that you may tend to forget anode reaction. Many readers will probably prefer to use aerial reaction first and leave anode reaction at zero or a small value. The set is then almost as simple to operate as a detector and L.F. receiver. The anode circuit is then flatly tuned and searching is extremely easy. But, of course, anode reaction will often be needed.

The high performance of the "S.T.500" is due chiefly to multiple reaction producing multiplied selectivity simultaneously with multiplied signal strength. Add perfected Class B to what you have got so far, and you can imagine the performance of the set!

This, perhaps, is a good point at which to remind readers that Class B is not a sensitive arrangement. It will give a big output, but it requires a fully adequate input. A steam roller is a "powerful" piece of apparatus, but you could not drive it with a 1 h.p. motor-cycle engine.

The ordinary four-valve Class B set—and its number is and will be legion—will work loudly on a strong signal, but disappointment will be experienced on weaker stations. Let every reader be warned.

Four valves are the fewest you can use if you are to enjoy the merits of Class B, a three-valve set being worse than a det. and 2 L.F., except as a local-station receiver.

The weak link even in all four-valve Class B sets will be in the lack of sensitivity. In the "S.T.500," however, we amplify our signals many times by reaction before ever they are applied to the S.G. valve for normal amplification. They are then efficiently amplified by the S.G. valve and afterwards undergo further amplification by the aid of anode reaction. **After this triple magnification they will do more than justice to the Class B output arrangements. Can the same be said for other Class B "fours"?**

What Class B Must Have.

There is a more subtle reason for requiring adequate H.F. magnification. It is this: If the H.F. amplification is insufficient, good quality is impossible. If you choose your Class B "four" without regard to the vital question of sensitivity you will find that not only are your foreign signals unexpectedly weak but unhappily distorted.

The sensitivity of the "S.T.500" is high, to begin with. It is increased by the use of aerial reaction and by the additional advantage that a bigger aerial input can be arranged since the extra aerial-load effect can be wiped out by the aid of reaction: a double advantage already explained.

It is because I can afford a bigger input that I now use an input-aerial condenser more than ten times the size of those in my previous sets. It is now ·0005 mfd. as against ·00004 mfd. The normal disadvantages of large capacity disappear with aerial reaction, and the advantages (including improved signal strength) are multiplied.

The relative merits of four types of circuits can be seen at a glance in Fig. 4. There are two tuned circuits (aerial and anode) in each diagram, and the amount of interference in each circuit is illustrated by circles. One circle means that one station only is heard, i.e. the desired signal. A second circle indicates that there is some interference, while several circles indicate more interference—perhaps by several stations.

The more circles, the more interference. The circles in the anode circuit represent the currents there, and therefore the overall effect of the two circuits. The top circuit shows a simple H.F. arrangement with no reaction at all. Some attempt at selectivity is made, and the anode circuit helps, but results are poor. The second circuit (b) shows the same circuit with reaction on the anode circuit; aerial-circuit interference is the same as before, but improved selectivity of the anode circuit is illustrated by fewer circles.

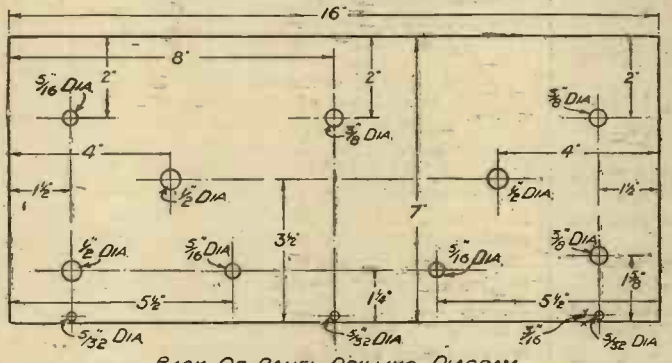
Approaching the Ideal.

This type of circuit is representative of most designs offered to the home constructor, although a series-aerial condenser is often added.

The third circuit (c) is similar to my "S.T.300," a simple and effective three-valver. Aerial selectivity is improved (but only up to a point and only with loss of signal strength) by the variable aerial-series condenser. The arrangement, in my opinion, still represents the best that can be done without aerial reaction. The

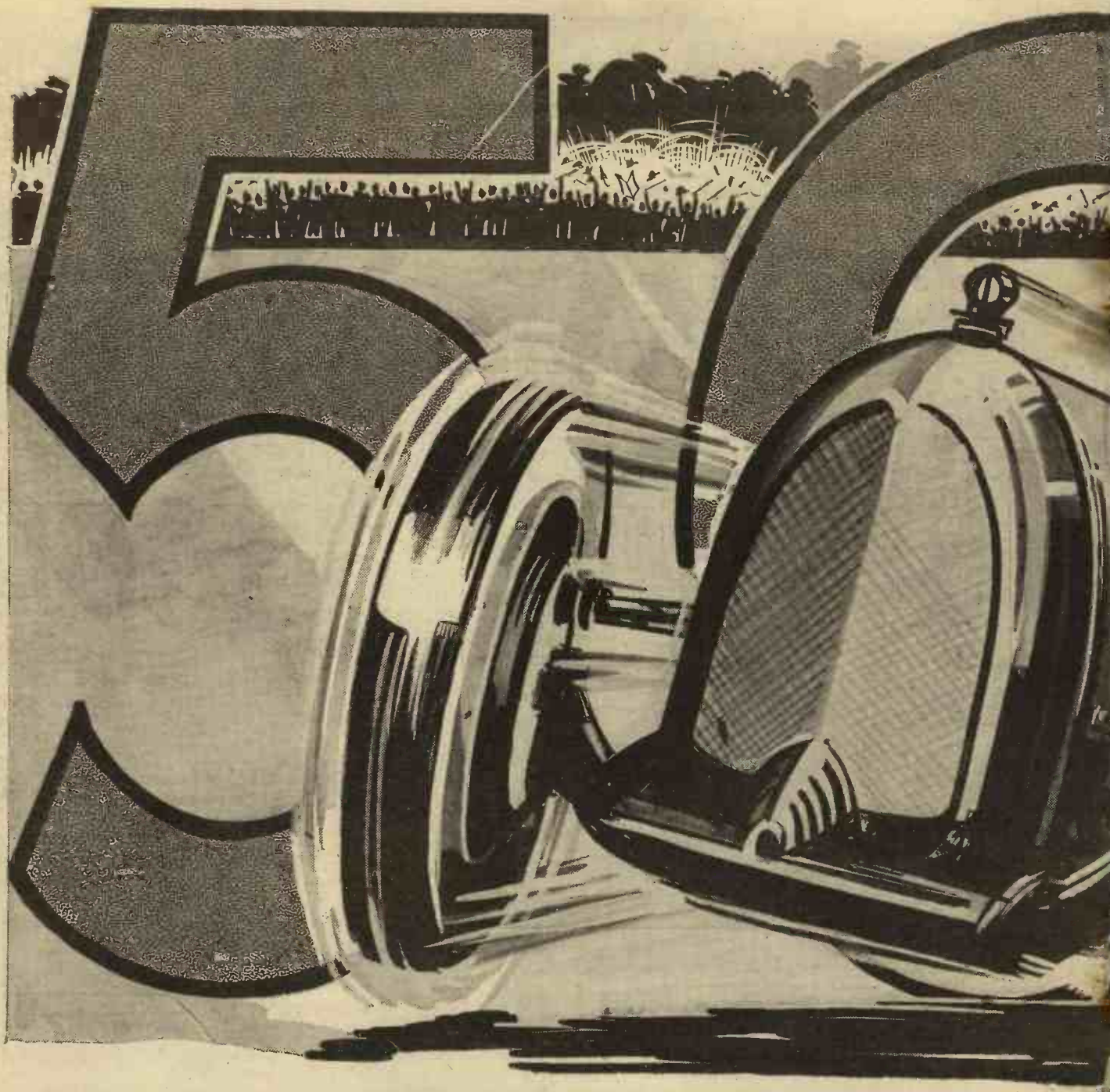
(*Continued on page 272.*)

IF YOU DRILL YOUR PANEL



BACK OF PANEL DRILLING DIAGRAM

This drilling diagram shows the back of the panel. Note particularly that it is of the back of the panel, not the front. Pilot holes are first drilled from the back, and the main holes from the front.



anode circuit employs my differential-anode-coupling system with reaction, and is therefore highly selective. The aerial circuit—as in all sets—is the weak point and tends to let through some interference.

Making it Hard for Gate-crashers.

The bottom circuit (d) is the elementary form of my present set—the "S.T.500." Aerial reaction is employed and "front-door" selectivity is enforced. The single circuit will not alone keep out all interference, but when the anode circuit has had a second "whack" at interference the result is only one circle—representing the currents of the desired station without interference.

I have spoken of multiplied selectivity, and explained how any improvement in signal strength or selectivity, *if carried out on the hitherto neglected aerial circuit*, will be multiplied by the S.G. valve and its anode circuit.

Let me give a simple illustration to explain multiplied selectivity. We can regard each of the two tuned circuits as gates to a mansion. The aerial circuit is the outer gate, while the anode circuit is the inner gate.

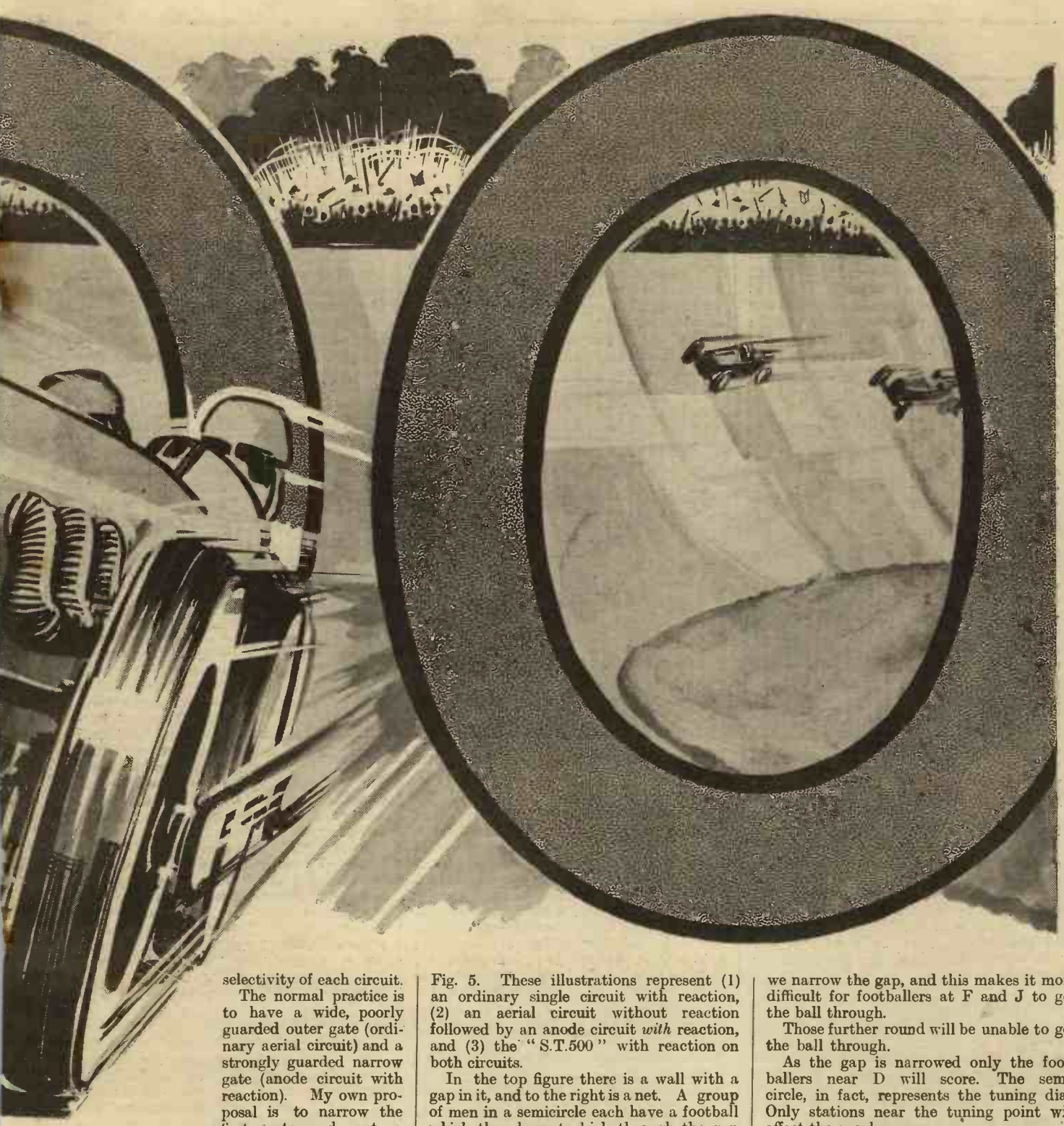
First consider a receiver with a single-tuned circuit without reaction (as in a simple crystal set). We can compare this circuit to a wide gate to a mansion. An invited guest (the desired station) finds himself surrounded by a crowd of gate-crashers (interfering stations). The gate-keeper may turn a few back, but the man with a ticket will find that a crowd of rowdies enter the mansion with him.

What steps can we take to ensure admission by ticket only? We can narrow the gateway so that a big crowd cannot get through. In technical terms, we improve the selectivity of the aerial circuit. We can only do this up to a point by lessening the aerial load or by using iron-core or other efficient coils, or by both methods. An immensely more effective method is to use reaction, but the gate even then is not one-station wide.

Improving on Normal Practice.

The gatekeeper is liable to be overpowered by muscular interfering gate-crashers. So we establish a second gate through which visitors must pass and show their credentials. The second gate is, of course, the second tuned circuit. The first gatekeeper may let a few rowdies through, but the second gatekeeper can tackle them.

The guard at each gate may, if the crowd is large and turbulent, require strengthening. This is equivalent to increasing the



selectivity of each circuit.

The normal practice is to have a wide, poorly guarded outer gate (ordinary aerial circuit) and a strongly guarded narrow gate (anode circuit with reaction). My own proposal is to narrow the first gate and put a very strong guard there, i.e. to keep out the jostling crowd before they get into the grounds. I retain the narrow second gate and its guard, and thereby permit only the desired guest to enter the house.

Narrowing the Gaps.

In other words, I apply reaction to both circuits separately, and thus keep the bulk of interference out at the very start. The bit that may get through is cut out by the second circuit.

The merits of the double-gate arrangement can be fully appreciated by a study of Fig. 5. These illustrations represent (1) an ordinary single circuit with reaction, (2) an aerial circuit without reaction followed by an anode circuit *with* reaction, and (3) the "S.T.500" with reaction on both circuits.

In the top figure there is a wall with a gap in it, and to the right is a net. A group of men in a semicircle each have a football which they have to kick through the gap in the wall into the net. The footballs represent signals from different stations, the gap in the wall represents the degree of selectivity of the circuit, and the net represents the output signals from the set.

A man at D can shoot through the gap straight into the net. This is equivalent to the desired station. But men at E, F, H and J can all shoot into the net.

A very wide gap makes it easy for anyone to "score"; it is as if goalposts were very wide apart. A tuned circuit with little or no reaction admits many undesired stations. If we apply reaction effectively, however, we narrow the gap, and this makes it more difficult for footballers at F and J to get the ball through.

Those further round will be unable to get the ball through.

As the gap is narrowed only the footballers near D will score. The semicircle, in fact, represents the tuning dial. Only stations near the tuning point will affect the speaker.

The Stone Wall Circuit.

Interference on a single circuit, even with reaction, will be great, so we introduce a stage of H.F. amplification, thus providing a fairly flatly tuned aerial circuit and a sharply tuned anode circuit. This corresponds to having to kick the football through two gaps. This is shown in the second diagram (2) of Fig. 5. A large gap in a wall is followed by a small gap in a second wall. The man at D has only to kick straight ahead and his ball will pass through both gaps and so into the net.

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S.T.500

DESIGNED BY
JOHN SCOTT-TAGGART
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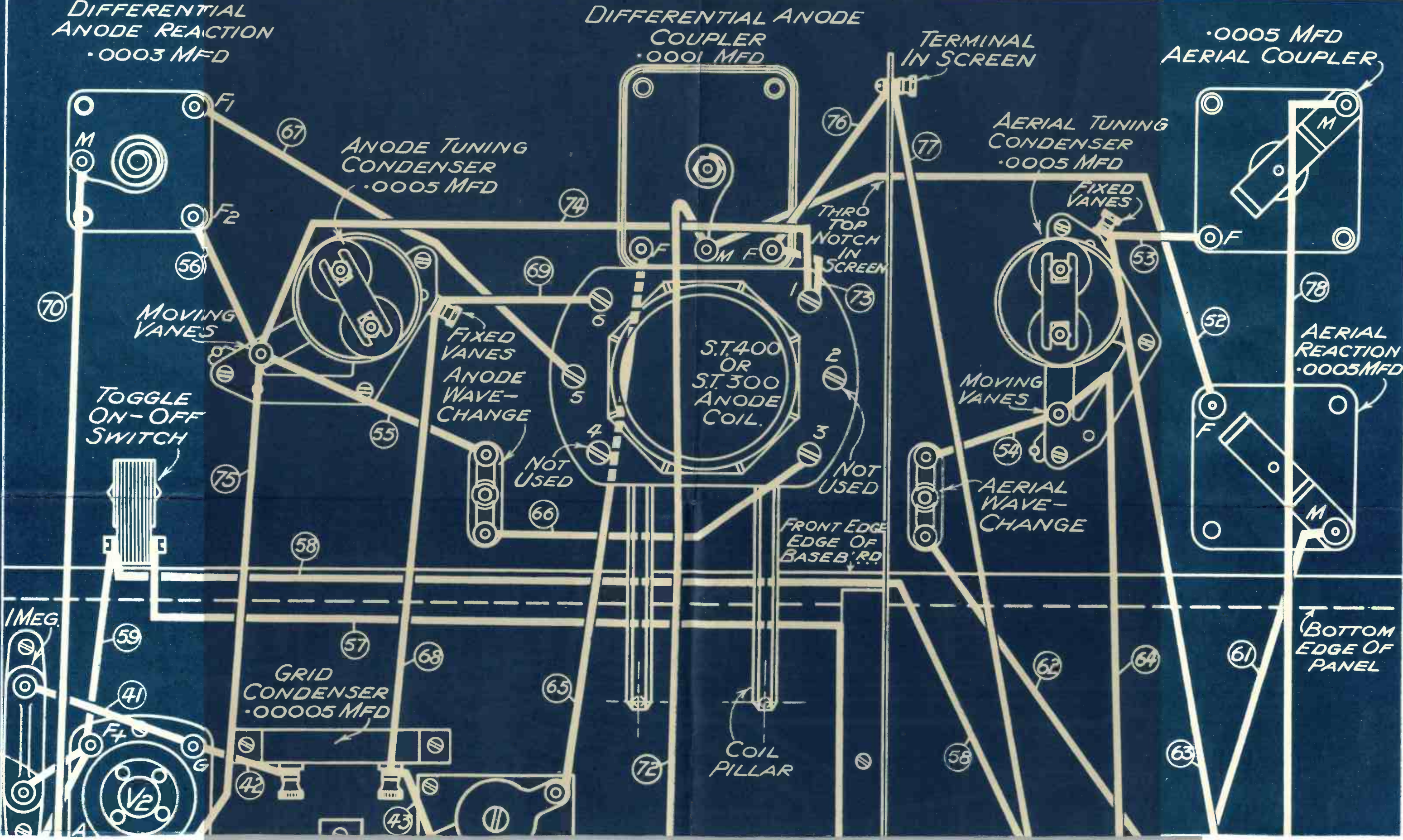

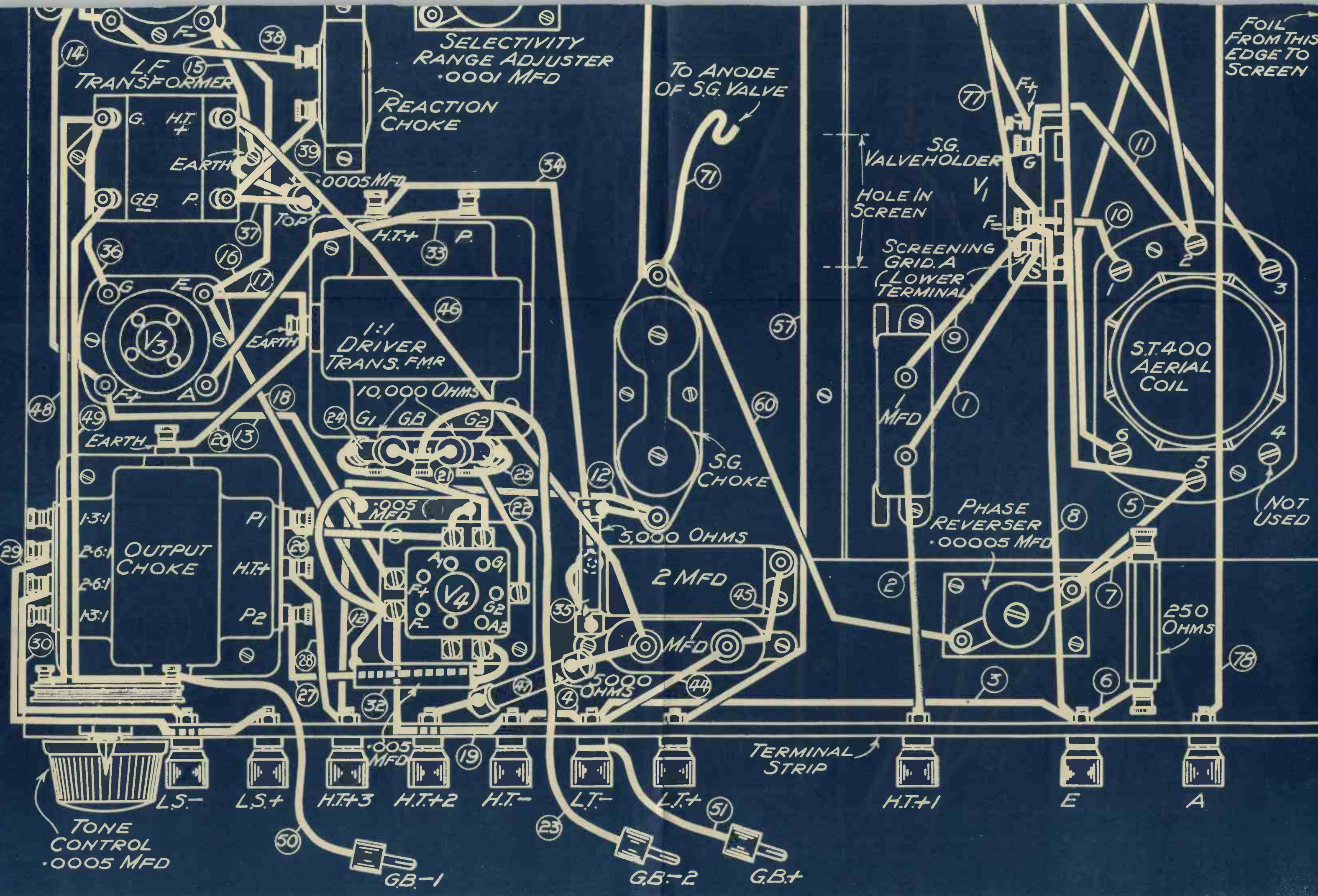
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V3
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A
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10,000 OHMS
G1
G2
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5,000 OHMS
2 MFD
·1 MFD
·005 MFD
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NOT USED
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2·6:1
2·6:1
1·3:1
OUTPUT CHOKE
P1
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G1
V4
A2
TERMINAL STRIP
TONE CONTROL ·0005 MFD
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H.T.-
L.T.-
L.T.+
H.T.+1
E
A
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Everyone Will Envy You Your "S.T.500"

A man at E or H will also be able to score a goal. But a man at F or J will be able to get the ball through the first gap with ease, but not through the second gap; the second wall will act as a barrier.

In a wireless set of the ordinary two-circuit type the tuning on the aerial circuit is flat, and on the anode circuit is sharp. Selectivity is better, but stations on either side are liable to get through.

In the "S.T.500," however, I narrow both gaps as in the bottom diagram. The first gap permits some interference, but far less than in the preceding arrangement; such interference as gets through the first gap (i.e. circuit) is, however, stopped by the stone wall of the second circuit. Just as only a man standing at D can shoot a ball into the net, so only a single station at any point on the dial can produce an effect on the speaker.

Multiplied selectivity may be illustrated in several other ways. Try this experiment. Place a table-napkin ring on the table about a foot from the eyes. Close your left eye, and with the right look through the ring at some object. Move your head to either side. Note that there are several positions from which you can see the object through the ring.

Now place a second ring about two feet beyond the first ring.

Place your head (keeping it the same distance away) so that you can see the object through both rings. Now move your head to each side. You will find that you can only see the object with your head in one position. This is equivalent to greater selectivity in a wireless set. The smaller the rings the more striking the experiment.

Some Simple Analogies.

If football is too strenuous let us play croquet. A group of players can knock a ball through a single hoop from quite wide angles, as shown in the top diagram of Fig. 6. The wider the hoop (the more unselective the circuit) the more people could knock their balls through.

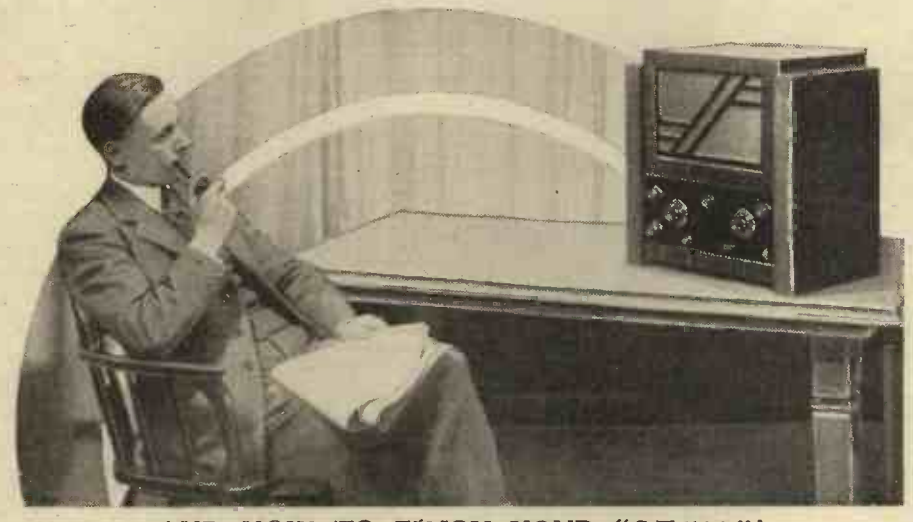
But suppose the problem is to hit the ball through two hoops in a line. Only one person can get through both hoops, and his ball must be in line with the two hoops, as shown in the bottom figure. If another player (E or F) to one side (interfering station) tries he may get through the first hoop (first circuit), but will fail at the second hoop (second circuit).

If we made the first hoop much wider than the second, several players, instead of only one, could shoot through both hoops; this is shown being done in the second picture of Fig. 6. **This is exactly what other designers are doing: they provide a big, wide, easy first hoop for their signals, and so interference finds its way into the speaker.**

Alternative Operating Methods.

The amount of interference shown by shadows on aerial and anode dials is shown in Fig. 7. In each case there are two tuned circuits, and the second dial indicates the overall selectivity. The top pair shows two circuits without reaction—an arrangement rarely if ever used by the home constructor.

The second pair shows reaction on the anode circuit only; results are much better.



AND NOW TO ENJOY YOUR "S.T.500"!

The bottom pair are the dials of the "S.T.500." Aerial reaction is now being applied, thus greatly increasing aerial selectivity and therefore the overall selectivity.

The amount of "spread" on each dial of the "S.T.500" is completely under control, which incidentally makes the set so easy to use when finding a station. One can operate the "S.T.500" in two ways: Either it can be set for maximum selectivity; hair-breadth tuning is then necessary, and the inexperienced man may experience difficulty in finding a desired station which will emerge from silence into full power and back to silence in a single degree of the dial.

Or he can use the receiver so that tuning is flattish. The station is then very easily found, but will need a little cleaning up.

Advantages of Panel Control.

By a movement of the selectivity controls the interference is "sandpapered" off and the station is then french-polished! The cleaning-up process may take ten seconds or in a very bad case fifteen seconds. **You hear the wanted station all the time.**

The process is like polishing a silver vase. If ultra-selectivity is used, to begin with, it is like having to hunt all over the house for the vase

The advantages of having a full panel control of the selectivity of each circuit are fully appreciated within ten minutes of handling the set for the first time. It may take you half an hour to learn to get the best out of the controls, but I am going to tell you all the simple rules. It is quite unnecessary to know the technicalities of the operations but obviously I would prefer constructors to know what is happening.

Life is certainly simpler living in a tent in the Sahara or in an ice-house in the Arctic, but for real comfort and future happiness it is probably better to live in a cosy, well-furnished house even if it is necessary to open and close a few doors.

It is simpler to have a cold bath (with single-knob control), but personally I am glad I learnt at an early age to adjust to a nicety the h and c.!

A considerable degree of selectivity can be obtained by the proper use of three or more tuned circuits. But this involves more H.F. valves, or else a loss of signal strength which can, in any case, not be afforded on a four-valve Class B receiver. Screening and ganging become necessary and the chance of success is greatly reduced and a loss of signal strength is certain through "misganging wastage." Band-pass circuits, if used, present further opportunities for complication loss and distorted peaks. Fewer and better circuits was my motto in designing the "S.T.500."

Although I frankly admit the "S.T.500" lends itself to hotting-up in the hands of the user, yet this has been my very aim. The hotting-up process is, however, very simple and there is nothing chancy or tricky about it. **The set starts where the conventional type ends, so that you can always convert the "S.T.500" into a "family bus" by setting all the controls to normal.**

The Cost of Caution.

The more conventional a set the trickier it usually is, since there is no provision for different aerials and earths, different battery voltages, different components, different valves, etc. The designer has either to allow for the very worst combination of troubles (in which case the set will be hopelessly inefficient) or else take a chance on average conditions. Even this last step means that good conditions, good components, good batteries and good valves cannot be taken advantage of; the owner is hobbled, tethered by the designer's cautiousness. But the set builder who is handicapped by bad conditions cannot make the most of his apparatus. He is not merely tethered, but has a halter round his neck.

The "fixed" or "simple" receiver is either under-efficient or over-risky.

On This Page: The Advised Components

There is no such thing as average conditions, except in theory.

Have you an average earth? Do you live an average distance from the B.B.C.? Has your H.T. an average voltage and your valve an average emission? Are you of average height, average complexion, average girth? Do you wear average-sized collars with an average-coloured tie? If so, by all means build a set designed for the average man in average conditions.

Most of us live in a row of houses, but that is no reason why we should live in a row of minds.

Allowing for Individual Conditions

A wireless receiver for the home-constructor should be a highly individual instrument. It should be adaptable to circumstances, but easily adaptable.

I anticipate that between 100,000 and 200,000 "S.T.500's" will be built. I prophesy now that, for a given result, no two of these sets will be adjusted exactly alike. You cannot have it both ways; you must either get the same high standard of performance by adapting the controls to suit individual conditions, or you must do without the controls and get different standards of performance.

Suitable controls do not add to the trickiness of a design; they remove it. A "fixed" design *must* vary in its performance under different conditions—perhaps two neighbouring houses in the same street. The aim in my sets, and especially in the "S.T.500," is to cut-out the risk by compensating controls.

The value of this policy has been proved up to the hilt on my other sets, and the only objection is an unwarranted fear of complexity. **It is for you to decide what results you want; then, and then only, consider the question of "simplicity."**

My advocacy of controls in my own sets has naturally led to some imitation. If other designers follow my policy effectually, I shall be only too glad. We are all aiming at providing better radio sets, and I have respect for others who are conscientiously making for the same destination, even if it is by a different and perhaps sometimes mistaken route.

But mere knobs for knobs' sake is ridiculous. A reader who inquired at a wireless dealer's about one of my sets was shown another type. The reader showed his impatience, and the young assistant retorted: "What's wrong with it? It's got nine knobs."

If I can ever get the same results with fewer knobs as I can on the "S.T.500," I assure you I shall be the first to rejoice and you shall be the first to hear of it.

The basic reason for the "S.T.500's" success is multiple reaction, bringing in its train multiplied selectivity and multiplied signal strength.

Exhaustive Experiments

But the introduction of aerial reaction was a whole problem in itself. A score of different arrangements were tried exhaustively before the "S.T.500" arrangement was invented.

Let me tell you the difficulties which had to be solved. A year ago I introduced aerial reaction in the "S.T.400." In this case the reaction came from the detector valve and was distributed between aerial and anode circuits. The scheme is highly successful, but it requires that both

(*Continued on page* 280.)

5,000% BETTER!

In the hopes of obtaining simplicity combined with maximum efficiency, the designer of the "S.T.500" had a special iron-core coil made for use in the aerial circuit.

A specially efficient iron core was employed, resulting in a very considerable improvement over all existing iron-core coils as available to the public. Iron-cored coils have a very great and useful function in many sets, but this super-efficient coil for the aerial circuit was totally inadequate when compared with the simpler and cheaper coil with the "S.T.500" inventor's Balanced Phase Double Reaction System.

An improvement of five thousand per cent was obtained—a colossal gain which any constructor of the "S.T.500" can easily reproduce.

COMPONENTS AND ALTERNATIVES AS OFFICIALLY APPROVED BY MR. JOHN SCOTT-TAGGART

Component	Makes used by Designer	Alternative makes of suitable specification recommended by Designer
2 S.T.500 coils (same as S.T. 400 coils)	Colvern	Telsen, Wearite, Ready Radio, Lewcos, Sovereign, Goltone
2 ·0005-mfd. tuning condensers	Ormond, type R.493	Graham Farish, Polar, J.B., Utility, British Radiogram, Telsen, British Radiophone
3 ·0005 solid dielectric (preferably log mid line) variable condensers	Graham Farish "Litlos" log mid line	Polar, Telsen, Ready Radio,
1 ·0001-mfd. differential reaction condenser	Telsen, type W.353	Graham Farish, British Radiogram, J.B., Polar, Igranic, Ready Radio
1 ·0003-mfd. differential reaction condenser	Polar	Graham Farish, British Radiogram, Telsen, J.B., Ready Radio
1 baseboard pre-set, ·0001 mfd.	J.B., type 1088	Graham Farish
1 baseboard pre-set, ·00005 mfd.	J.B., type 1087	Graham Farish
1 Class B driver transformer	Telsen, ratio 1 : 1	R.I., Lissen, Ferranti, Varley, Benjamin, Wearite
1 Class B output choke	Telsen	Ferranti, R.I., Lissen, Varley, Wearite, Multitone
1 L.F. transformer	Varley "Niclet" Type D.P.21	Lissen "Hypernik," Ferranti, Telsen, Lewcos, L.F.T.6A, R.I. "Hypermite," Tunewell, Igranic, Multitone
1 S.G. choke	Telsen, type W.74	Graham Farish, Wearite, Lewcos, R.I. "Dual Astatic," Ready Radio, Bulgin S.5, Sovereign Super Amplion binocular
2 4-pin valve holders	Benjamin "Vibrolder"	Graham Farish, W.B., Telsen, Lissen
1 5-pin valve holder	W.B. "Universal"	Graham Farish, Lissen,
1 7-pin valve holder	Graham Farish	Ferranti, Wearite, W.B., Benjamin
1 H.F. choke	Lissen, disc type L.N.5092	Graham Farish, Lewcos, Igranic, Telsen, Wearite Amplion
1 1-megohm grid leak	Ferranti, synthetic type S.	Graham Farish, Dubilier, Erie, Ready Radio, "Thermion"
1 holder for same	Ferranti	—

Component	Makes used by Designer	Alternative makes of suitable specification recommended by Designer
2 5,000-ohms resistances	Dubilier 1-watt metallised	Graham Farish, Erie
2 10,000-ohms resistances	Dubilier 1-watt metallised	Graham Farish, Erie
1 250-ohms resistance	Graham Farish "Ohmite"	Dubilier, Erie
1 2-mfd. fixed condenser	Igranic	Graham Farish, T.C.C., Dubilier, Telsen, British Radiogram
1 1-mfd. fixed condenser	T.C.C., type 50	Graham Farish, Dubilier, Telsen, Igranic British Radiogram, Ferranti
1 1-mfd. fixed condenser	Dubilier, type BB	Graham Farish, T.C.C., Telsen, Igranic, Ferranti
2 ·005-mfd. tubular condensers	T.C.C., type 300	Graham Farish, Telsen, Dubilier
1 ·0005-mfd. tubular condenser	Graham Farish	Telsen, T.C.C., Dubilier, Igranic
1 ·00005 mica condenser	Lissen	Graham Farish, Dubilier, T.C.C.
2 push-pull on-off switches	Lissen, type L.N.5070	Telsen, British Radiogram, Benjamin, Wearite, Tunewell, Bulgin, W.B., Ormond, Sovereign, Ready Radio
1 toggle on-off switch	Bulgin S.80	—
1-ply baseboard (16 in. × 12 in.) with Metaplex section	Peto-Scott	—
1 panel, 16 in. × 7 in. × ¼ in.	Peto-Scot	Permcol, Goltone
1 S.T.500 screen	Peto-Scott	Magnum
1 terminal strip	Peto-Scott	—
1 bracket for ·0005-mfd. variable condenser (tone control)	British Radiogram	—
10 terminals	Belling-Lee, type R	Igranic, Clix, Bulgin
3 wander-plugs (G.B.)	Clix	Igranic, Belling-Lee, Eelex
4 wander-plugs (H.T.)	Belling-Lee	Clix, Eelex, Igranic
2 spade terminals	Clix	Belling-Lee, Eelex, Igranic
Connecting wire (glazite 20 S.W.G.)	Lewcos	—
Flex, screws, etc.	Peto-Scott	—
1 anode connector	Belling-Lee	—
Special cabinet	Peto-Scott	—

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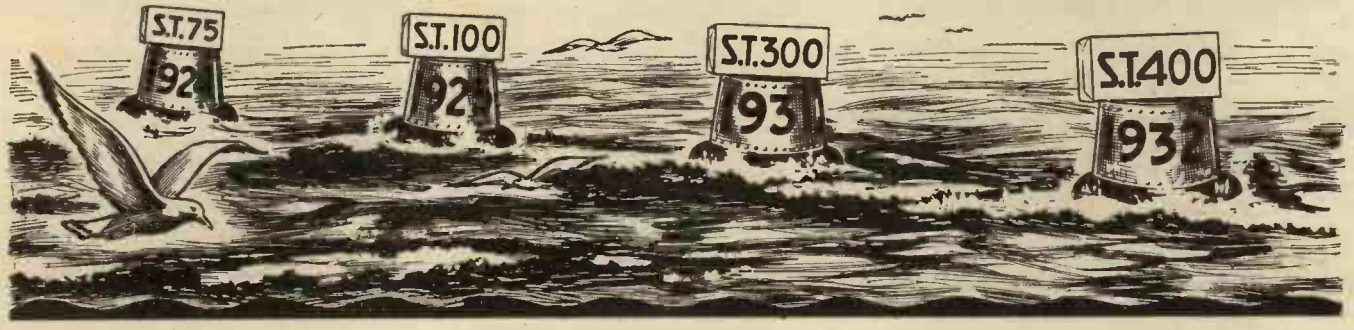

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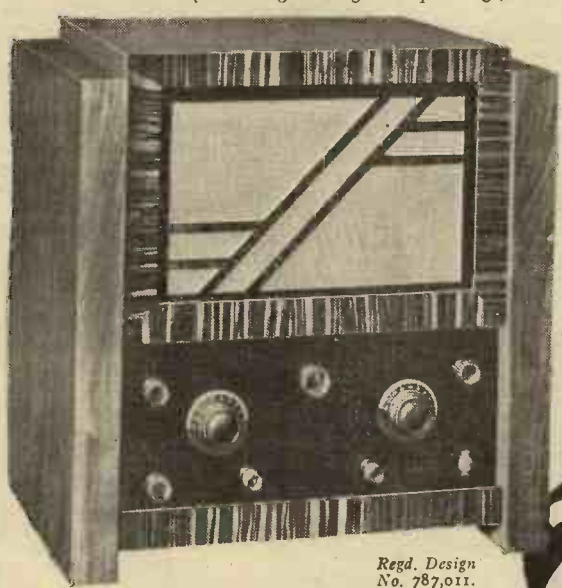

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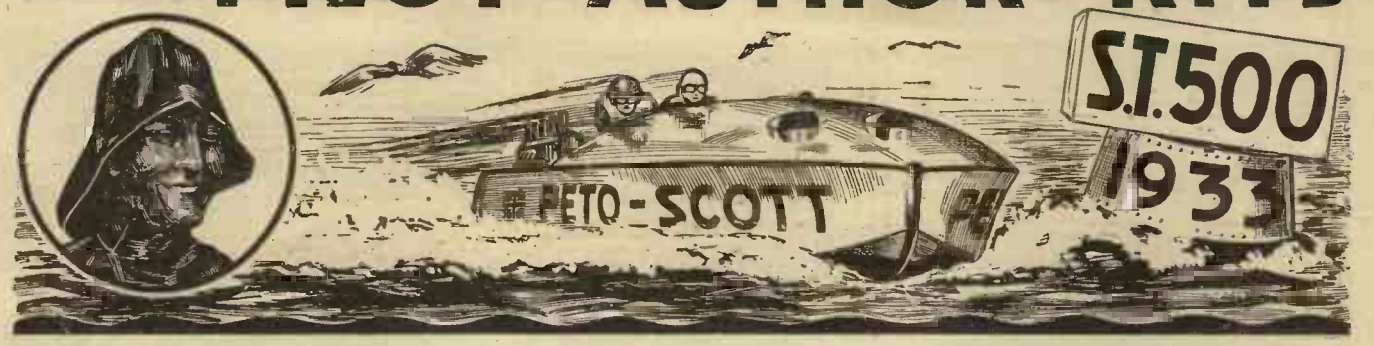

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1	PETO-SCOTT ebonite panel, 16" × 7" × 3/16", ready drilled	3	3
1	PETO-SCOTT S.T.500 screen	1	9
1	PETO-SCOTT ebonite terminal strip (ready drilled)		9
	PETO-SCOTT flex, screws, connecting wire	2	6
2	COLVERN S.T.500 coils	8	0
2	ORMOND type R.493 ·0005-mfd. tuning condensers	15	0
3	GRAHAM FARISH "Litlos" ·0005-mfd. variable condensers	6	0
1	TELSEN type W.353 ·0001-mfd. diff. reaction condenser	2	0
1	POLAR ·0003-mfd. diff. reaction condenser	3	0
1	J.B. type 1088 B/B pre-set ·0001-mfd. condenser	1	0
1	J.B. type 1087 B/B pre-set ·00005-mfd. condenser	1	0
1	TELSEN Class B driver transformer, ratio 1-1	8	6
1	TELSEN Class B output choke	8	6
1	VARLEY "Niclet" L.F. transformer, 3-5 to 1	7	6
1	TELSEN type W.74 S.G. choke	3	6
2	BENJAMIN "Vibrolder" 4-pin valve holders	1	8
1	W.B. "Universal" 5-pin valve holder	1	0
1	GRAHAM FARISH 7-pin valve holder	1	3
1	LISSEN disc type LN.5092 H.F. choke	2	0
1	FERRANTI 1-meg. synthetic grid leak and holder	1	6
2	DUBILIER 1-watt metallised 5,000-ohms resistances	2	0
2	DUBILIER 1-watt metallised 10,000-ohms resistances	2	0
1	GRAHAM FARISH 250-ohms "Ohmite" resistance	1	6
1	IGRANIC 2-mfd. fixed condenser	3	0
1	T.C.C. 1-mfd. fixed condenser, type 50	2	6
1	DUBILIER type B.B. 1-mfd. fixed condenser	2	6
2	T.C.C. ·005-mfd type 300 tubular condensers	2	6
1	GRAHAM FARISH ·0005-mfd. tubular condenser	1	0
1	LISSEN ·00005-mfd. mica condenser		6
2	LISSEN type LN.5070 push-pull on-off switches	1	8
1	BULGIN S.80 toggle on-off switch	1	6
10	BELLING-LEE type R terminals	2	6
3	CLIX wander plugs		4½
1	BRITISH RADIOGRAM bracket		3
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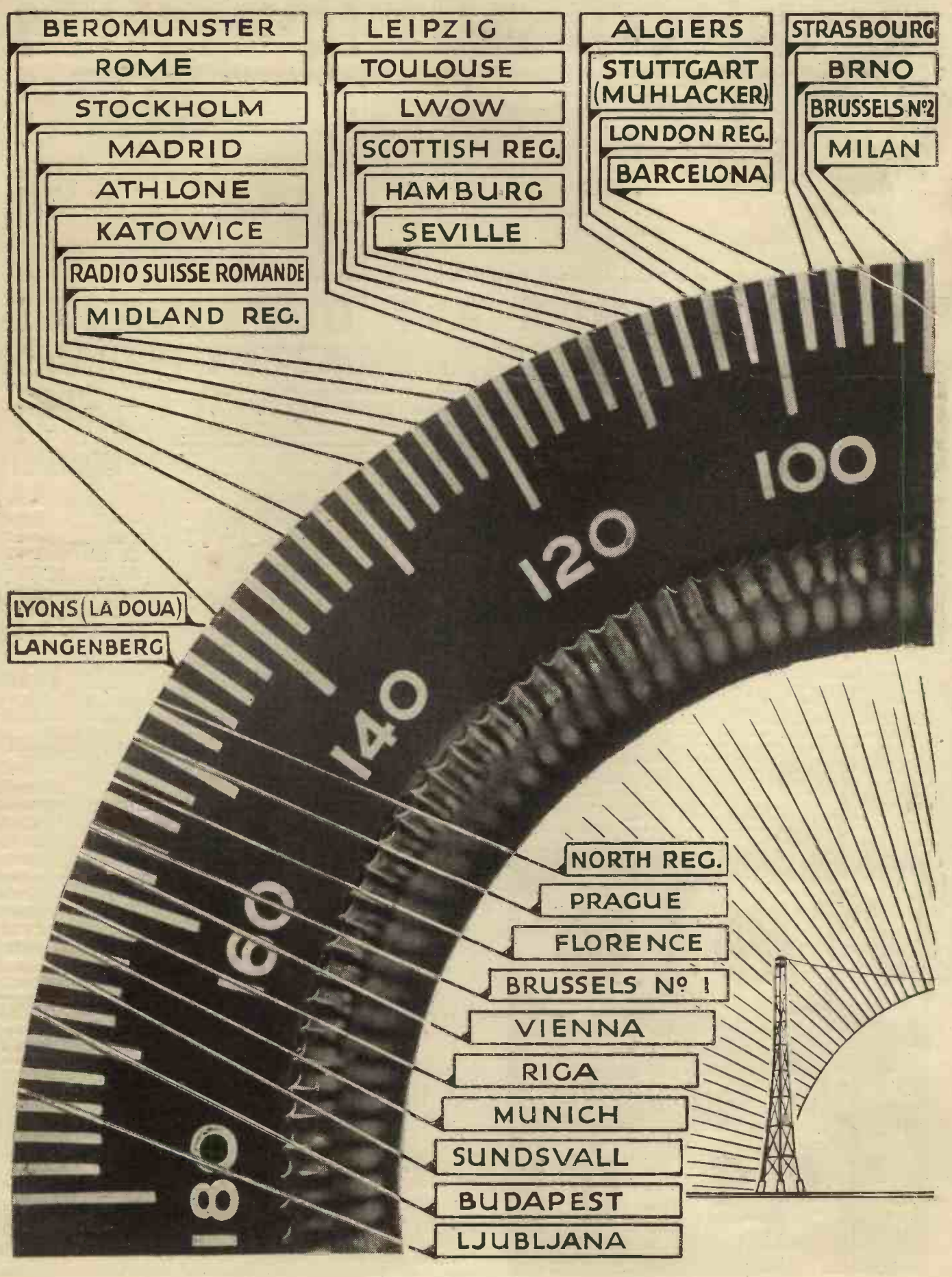
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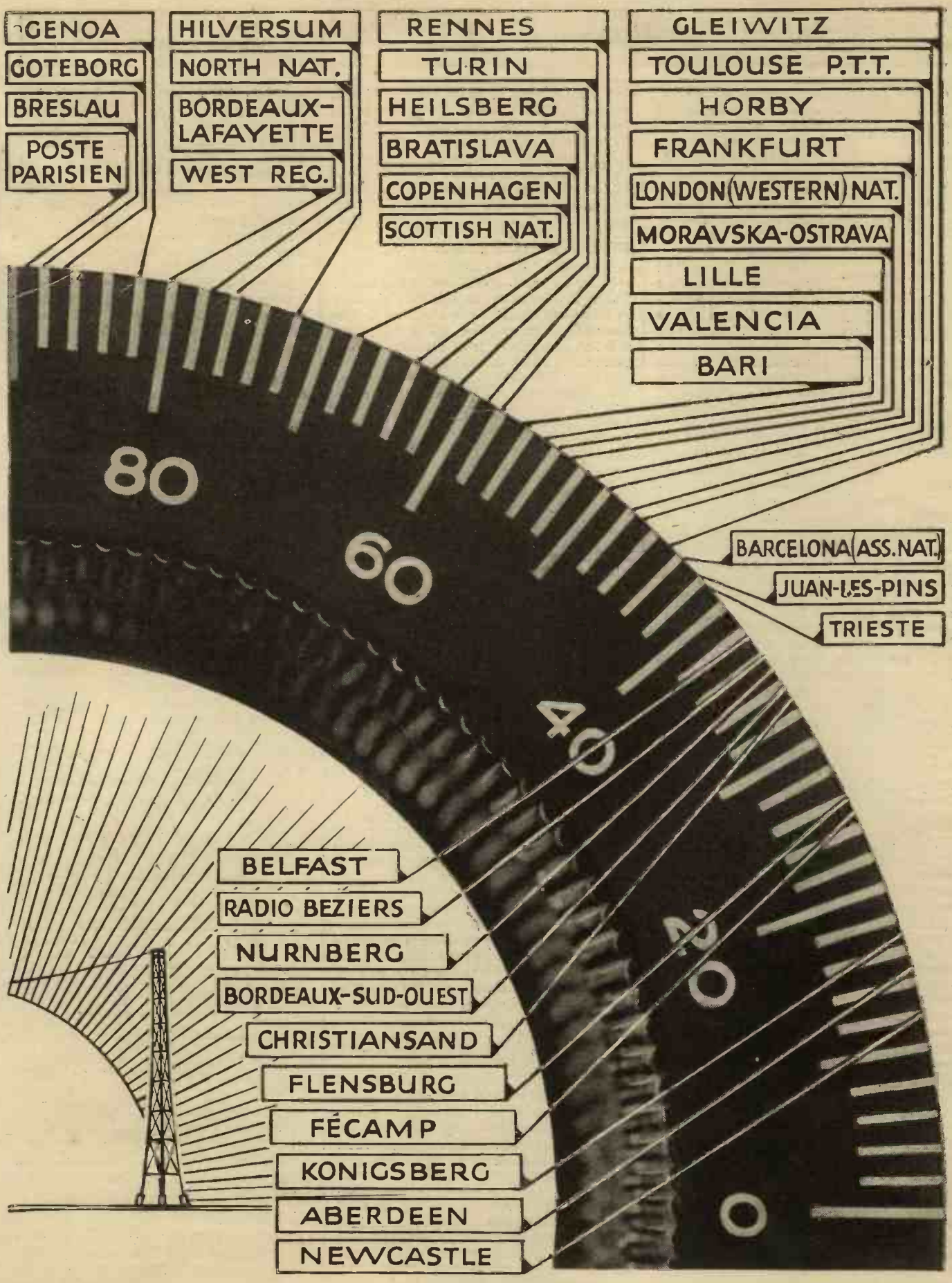
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Secrets of Balanced Phase Double Reaction

circuits be in tune. Large changes in reaction can be caused by one of the circuits being out of tune or if the anode coupler is reduced to a low value. The smoothness of the reaction is also impaired somewhat by the detector valve being in the reaction chain.

COMPARE—

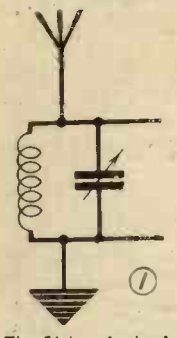


Fig. 1(a). A simple aerial circuit. Very inselective.

From a luxury adjustment in the "S.T.400" aerial reaction has become "standard equipment" on the "S.T.500." Separate independent reaction for each circuit has been introduced for the following reasons:

(1) It is far simpler to operate.

(2) Each circuit requires a different amount of reaction, and a separate independent supply enables the right amount to be given without affecting the other.

(3) Reaction can be applied to either circuit and all its benefits obtained, even though the other circuit is not in tune. It can, in effect, be completely off tune.

(4) Searching for a weak station becomes simply finding it.

(5) The differential anode coupler is not in the reaction chain, and the general H.F. amplifying functions are thus kept separate from reaction.

(6) Each circuit can be separately adjusted to the desired selectivity and sensitivity, as if in separate compartments.

(7) Aerial reaction is obtained from an S.G. valve, providing ideal conditions for supplying reaction; the S.G. is only amplifying H.F., and its characteristics are not modified by having to detect.

Currents That Must Keep Time.

Other factors, however, contribute to the remarkable smoothness of the aerial reaction. The greatest difficulty in all reaction circuits is the application of feed-back currents in the right phase.

This means that the strengthening currents must be fed at exactly the right time so as to assist most effectively the currents in the grid circuit. To keep a child's swing on the move one can give it a push at the end of every swing, but the push must occur at the right moment for effective results. There is no difficulty about frequency in reaction; the nigger in the woodpile is the timing of the reaction currents.

If the timing is 180 deg. out of phase the reaction currents act in an opposite way and oppose the original currents. This reduces signals. The reaction currents may, however, be induced in the grid circuit at an intermediate number of degrees. Instead of hitting the nail on the head, so to speak, it is given a slanting blow.

And floppy reaction is one result. The angular displacement will vary, no doubt, with the adjustment of the reaction condenser. Instead of the reaction increasing right up to the point of oscillation it works well at first, but as reaction is increased the valve suddenly oscillates. **This means that reaction has been arrested long before its full effects have been enjoyed; sometimes, signal strength may even fall off, after a point, due to an improper phase relationship between reaction and original currents.**

Effects of Inherent Feed-back.

Where an H.F. valve is in use, reaction requires an extra-special amount of study. There is always some inherent reaction in all sets using H.F. amplification, due to stray couplings, and this will always form a percentage of the total reaction—and a percentage which can actually ruin proper reaction. The inherent reaction can cause the wrong valve to oscillate, render the whole set unstable (or stable under special conditions only) and produce reaction hysteresis in the set and hysteria in the operator.

—THESE—

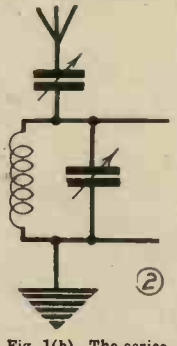


Fig. 1(b). The series-aerial condenser greatly improves selectivity, but signals are weakened, and a limit to selectivity is soon reached.

Everything in the set modifies the inherent reaction—and I am still speaking of all sets. There are no two sets alike. The slightest difference in a valve, the minutest difference between two coils, the shifting of a component a thousandth part of an inch will alter the amount of inherent reaction. There is inherent reaction in the most stable set on earth, and the amount of it varies enormously from one home-constructed set to another.

Yet in nine out of ten sets there is no effective control of it or means for keeping it within the desirable limits. It is one of the greatest causes of erratic results in home-built sets.

Sometimes, you get accidentally good results, perhaps only on one or two stations, or when your batteries are at certain voltages, or when you change a valve (possibly for a worse one). This is when reaction is getting on the aerial circuit by virtue of inherent coupling in the set. The vice has become a virtue, but it is a tricky, accidental advantage and we are better without it.

Turning Accident into Certainty.

The "S.T.500" applies trained, disciplined reaction under perfect control to the aerial circuit, and so what was a rare accidental advantage is obtained with certainty and in greater measure on every station and under every possible set of conditions.

A technical study of the "S.T.500" circuit will recall that its solidity has been assured. Solid foundations are required before reaction can be applied with certainty and success. A set must not be "up in the air," i.e. on the point of oscillation, before reaction is applied. With the "S.T.500" you can, if you wish, apply the most critical reaction with the confidence that the basic circuit itself is rock-like in its stability and a perfect foundation from which to work up to any degree of sensitivity and selectivity desired.

The application of reaction from a detector to its grid circuit is a much simpler problem than applying reaction from the output of an H.F. valve to its own input. This is because in the latter case there is a tuned anode circuit and phase-shifting is very troublesome.

The whole problem is completely solved in the "S.T.500," although it took months to provide the right solution. The actual reaction currents are taken from the S.G. choke and fed through a variable reaction condenser to the aerial reaction winding. The phase is correct, the choke (instead of the tuned anode circuit) being made the controlling source of reaction.

Applying Reverse Reaction.

Reverse reaction is also applied from the S.G. choke by means of a pre-set condenser of ·00005 mfd. and a resistance of 250 ohms. This constitutes a phase-reversal circuit of a frequency discriminating type, and positive reaction is applied to balance this out and then to reduce the effect of the aerial-circuit resistance by currents injected in exactly the correct phase.

The whole aerial reaction arrangements, including the balance-phase system, provide exceedingly smooth and helpful reaction at all tuning points on both wavebands. It is certainly more effective than any other reaction scheme I have ever tried, including simple single circuit sets.

The pre-set condenser of the phase-reversing circuit is not critical in adjustment; about a fifth of the way will usually prove perfectly suitable.

—THREE METHODS

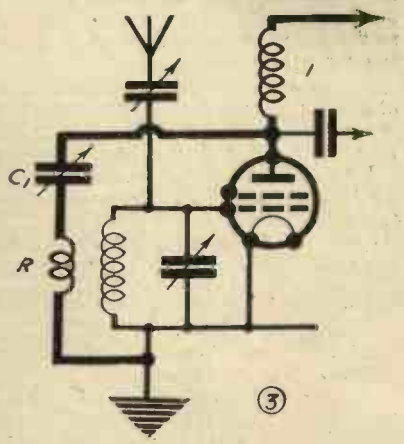


Fig. 1(c). The double-reaction circuit of the "S.T.500" wipes out aerial losses. Multiplied selectivity is accompanied by multiplied sensitivity.

I hope to give a full technical explanation of the whole aerial reaction system in a future issue.

The Grid Condenser.

You have probably noticed that the value of the grid condenser is ·00005 mfd. This is half the value I have previously used and a sixth of the value used by many readers.

Grid-condenser values are apt to be ignored. People are inclined to say: "Well, if designers haven't made up their minds about grid condensers after all these years, it is time they did!"

Well, the values of many condensers have been treated as sacred—almost taboo. To alter them is sacrilege. A ·0003-mfd. and 2 megohms resistance was a holy combination at one time; it is still venerated by many. I have done a great deal, however, to popularise ·0001 mfd. and 1 megohm. Now I offer ·00005 and 1 megohm!

SENSITIVITY!

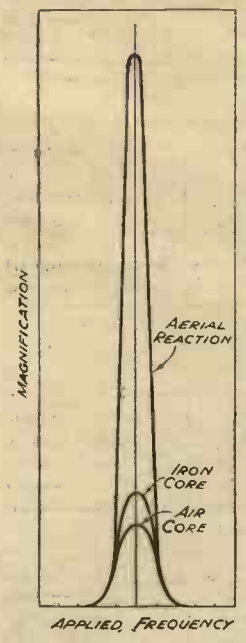


Fig. 2. Resonance curves show improvement of iron-core coils over the air-core type, and the vastly greater superiority of aerial reaction. The height indicates sensitivity.

The general design of a set may govern the most desirable combination. The size of the grid condenser will influence, amongst other things:

(1) The selectivity of the anode circuit.
(2) The high-note response of the set (improving it).
(3) The time-constant of the rectifying system.
(4) The sensitivity of the set.
(5) The amount of the reaction current.
(6) The relative degrees of reaction at different wavelengths.
(7) The smoothness of reaction.

A reduction in the size of the grid condenser will improve selectivity by reducing the damping due to grid current during the rectification process. This fact is, perhaps, insufficiently appreciated.

An improvement in signal strength is also obtained up to a certain point. If the grid condenser is reduced beyond this point signal strength falls off.

I have found that a reduction in grid condenser value also improves reaction control, and there are several other reasons to be found in the list given above for the choice of ·00005 mfd. in the "S.T.500."

Exposing the Band-pass Fallacy.

A criticism which was levelled at the "S.T.400" was that the high selectivity produced by two lots of reaction would cut down the high-note response of the set. The same thing will be said of the "S.T.500." Let me say that this criticism was ill-founded in theory and confounded in practice.

The parrot cry of "Mustn't cut off top. Oh, no, we mustn't cut off top," was arrogantly piped by hundreds of pseudo-technicians, and a few weeks later lisped by many smaller fry, who wanted to appear "in the know."

The band-pass craze, of course, fostered the idea; after all, it was its chief justification. Lovely square peaks—which probably not one in a hundred ever got—were worshipped as the Japanese reverence the snow-capped Fujiyama.

Band-pass enthusiasm nourished the top-note craze. Commonsense—and the report of a Government Department (not necessarily the same thing)—killed it.

A certain amount of top-note cut-off is believed by many practical listeners to be desirable as a means of eliminating heterodyne whistles, needle scratch, and miscellaneous mush.

Where Tone is Controlled.

But even if the full-note response is kept in the speaker, there is no need to keep it in the H.F. circuits. In other words, one can "cut off top" by selectivity and restore the reduced notes in the L.F. part of the set. The ultimate result is the same as if one used the most perfect band-pass.

It is, however, getting unfashionable to talk of "cutting off top." The band-pass enthusiasts are feverishly hunting about for a new catch-phrase, but some of their land-lubber followers may not have noticed the change in the tide. If you come up against some of these stragglers as regards the "S.T.500" tell them this:

The tonal output of a set is not the result of cutting off or preserving the top-note side-bands, but of the effect of perhaps a score of component values and adjustments, some, perhaps, increasing top and others reducing it. It is the designer's job—my job—to give you good quality; and there are a dozen places where compensation can be provided, even though it is not at once obvious from the circuit diagram.

As for side-band cutting, I should do a great deal more if I could—compensating for it, of course, elsewhere in the receiver.

In a Class B set, owing to the pentode-like characteristics of the valve, there is a tendency to exaggerate the high notes: so much so that, even if the side-bands have been cut on the H.F. side, we need to do some more "cutting-off of top" in the L.F. side to keep the tonal response correct.

Various resistances and condensers provide for this, and in the "S.T.500" I have added a separate variable tone control which enables the listener to have his music or speech as he likes it, and also to provide a means of singeing off high-note interferences (such as whistles) if experienced on some stations.

The tone-control is effected at the earliest L.F. part in the set, and this will result in further H.T. economy, since undesired frequencies will not be amplified.

To many constructors the use of Class B will be a revolution in technique and in results attained. Let us consider the matter in more detail.

In considering "quality of reproduction" you must consider the risk of (1) frequency distortion; (2) amplitude distortion.

I say definitely, and with the experience of listening to hundreds of home constructors' sets and speakers, that seven out of ten sets twist the incoming music not, of course, out of recognition, but out of *realism*.

The output from the speaker is an imitation, a false reflection of the original. Yet weeks of habit, perhaps years of custom, have dulled the ears and worn down the critical sensitiveness of the listener.

Giving the Constructor Quality.

The set is lovely! The selectivity may be poor, but the quality is grand!

Listening, as I often do, for hours to my own experiments on quality reproduction, I find my ears becoming deadened to imperfections. Measuring instruments, however elaborate, cannot replace the human ear as the final arbiter of "good quality."

After hours of work my intellect may be alive and critical, my brain may assure me that this or that technical alteration should produce a difference in tone, but my hearing tiredly declares: "The quality is good; leave it at that."

There is only one cure: A brisk walk in the fresh air and then a return to the set. As a standard I have a receiver working with two larger-power output valves working off 400 volts. It is designed to give as near perfect quality as is electrically possible. This quality is then compared with that given by the new receiver undergoing test. With a refreshed hearing imperfections loom up and cry aloud to be put right.

The average constructor has not these facilities. I have them because I am not an amateur; it is part of my profession to recognise poor-quality reproduction and advise on how realism may be obtained. But most listeners are blissfully unaware of what they are missing. Many have become acclimatised to indifferent quality.

Import the "S.T.500" into your home, hear it handle with ease the loud booming reverberations of Big Ben, the passionate crescendo of an opera, and I think you will say: "This is the real thing that I used to think mine was."

SELECTIVITY!

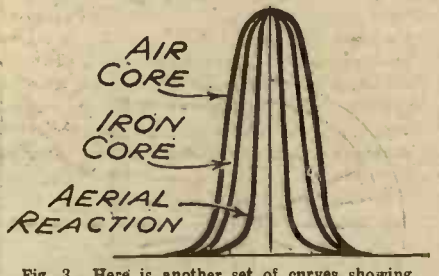


Fig. 3. Here is another set of curves showing how interference is much less with "S.T.500" reaction. The H.F. outputs have been made equal. Selectivity is indicated by the narrow width of the reaction curve.

The Receiver Which Ensures Amazing Results Everywhere

You may say it regretfully as one who jettisons a prejudice long nourished and beloved.

And let me say frankly that there is no greater difficulty than that of persuading a man that his reproduction is not up to scratch (or too full of scratch !).

Only by direct comparison will the most prejudiced constructor realise the difference between a tolerated reproduction which has grown into "pleasing reproduction" and that which can be simply called "the real thing."

My experience has been that when he has heard the "S.T.500" his appreciation of the contrast has been instantaneous and generous. There has been no niggardly acknowledgment or a "Well, perhaps, on the whole the '500' has it."

And when, as frequently has happened, I have noticed that the constructor himself owns a really good-quality speaker (not necessarily of moving-coil type), we have hitched it on to the "S.T.500" and obtained just the same results.

"Vital With Truth."

There is something to be said for not knowing anything better. If I saw the Taj Mahal I shouldn't care very much for Bush House. Having looked down from a peak in the Canadian Rockies into the gorgeous valley of Banff, I find it difficult to appreciate a trip to Snowdon.

As an inventor I instinctively hate the placid, contented frame of mind, but I know it makes for happiness. But ought we to be happy with something less than the best, when the best is within reach ?

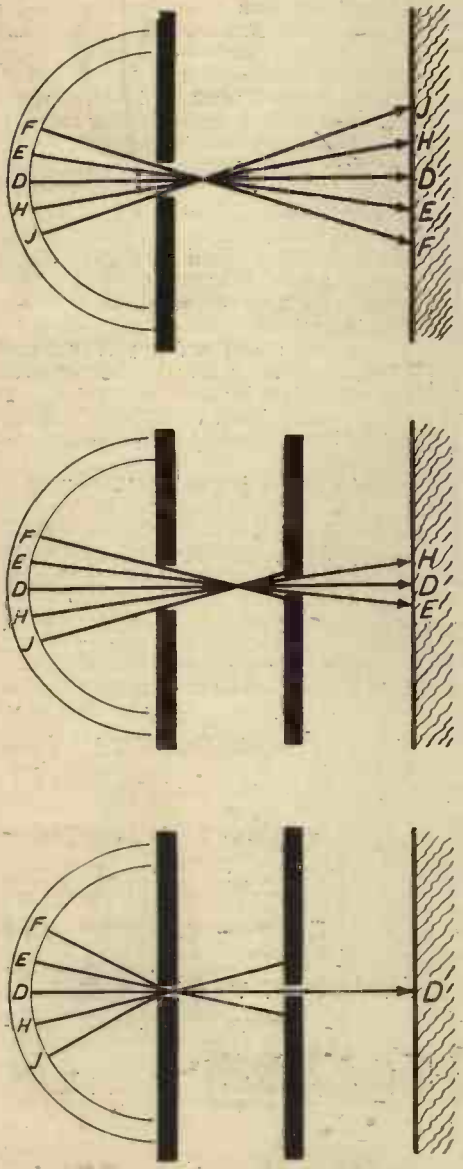


Fig. 5. An ingenious method of describing the merits of multiple circuits with reaction. Footballers (corresponding to the various stations affecting the receiver) try to kick their balls into the net—i.e. the loudspeaker. It is easy to do so in the simple single circuit, even when reaction is employed. Fig. 2. shows that by arranging an extra wall with a gap, it becomes increasingly difficult to "score." With the "S.T.500" it is possible for only one station to get through—the desired station.

THE S.T.500 WINS!

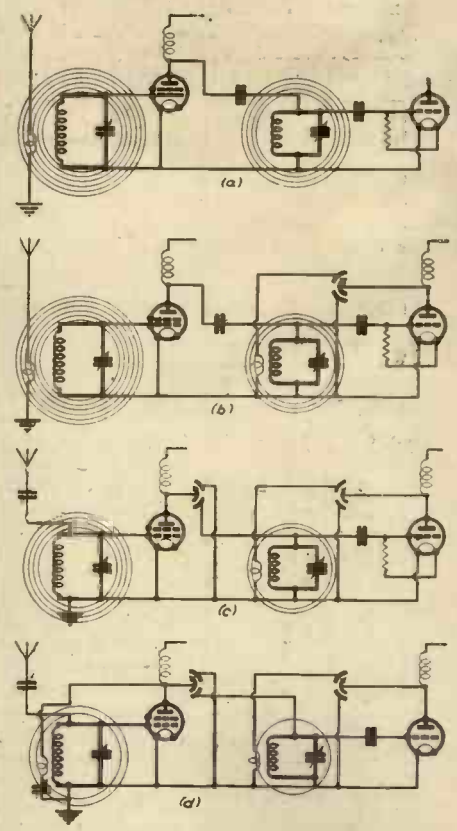


Fig. 4. The top figure shows the simplest two-circuit receiver. The circles indicates the number of stations producing currents in the circuit concerned. The second circuit shows the improvement when reaction on the anode circuit is employed. The third figure shows the "S.T.300" and the benefits of a small aerial condenser and differential anode-coupling. The bottom figure shows the "S.T.500" in elementary form. Only the desired station (one circle) appears in the final circuit.

Is it fair to one's judgment—not to mention one's family—to deprive it of the full enjoyment which comes from real "quality" reproduction sparkling with life and vital with truth ?

A Low Barrier.

Lack of money and shortage of leisure form a barrier between us and many of the beauties of life.

But the barrier between second-rate and first-rate radio is so low that even the financially harassed and most busy listener can leap it. I hope that this article will provide the springboard. J. S.-T.

S.T.500—82 STATIONS!

82 stations have been received on the S.T.500. The 70 stations of the medium waves are marked around the large aerial dial on pages 278-279. The anode tuning dial readings will be approximately the same. The readings given are actual ones on the designer's original set. The long wave stations received are Huizen, Radio Paris, Deutschlandsender, Daventry, Moscow (Komintern), Eiffel Tower, Warsaw Motala, Luxembourg, Kalundborg, Oslo, Moscow (Trades Union).

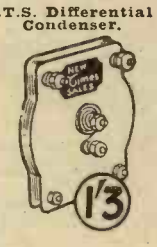
S.T. 500 EASIBILT CONSTRUCTOR KIT

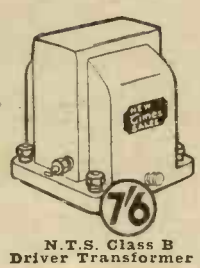
GUARANTEED MATCHED AND TESTED PARTS

Having just acquired a large, modern component Factory, we are able to assist S.T.500 constructors considerably by supplying them direct, eliminating, therefore, the usual middle-man's profits. This saves you up to 33⅓% on the cost of building your S.T.500. Build with complete confidence an N.T.S. Easibilt Constructor Kit. In addition to these advantageous features, every component part is matched, tested and fully guaranteed. Complete down to the last screw with FREE FULL-SIZE BLUE PRINT AND COPY OF "POPULAR WIRELESS," OCTOBER 21, 1933.

N.T.S. S.T.500
COMPONENTS SAVE YOU MONEY

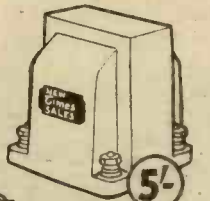
N.T.S. Differential Condenser.

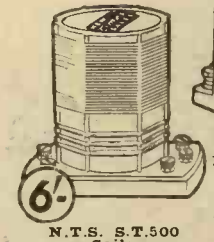




N.T.S. Class B Driver Transformer

N.T.S. Baseboard Trimmer.

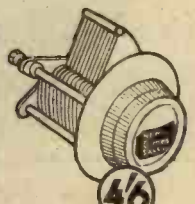




N.T.S. Super L.F. Transformer.

N.T.S. S.T.500 Coils.

N.T.S. Valve Holder.

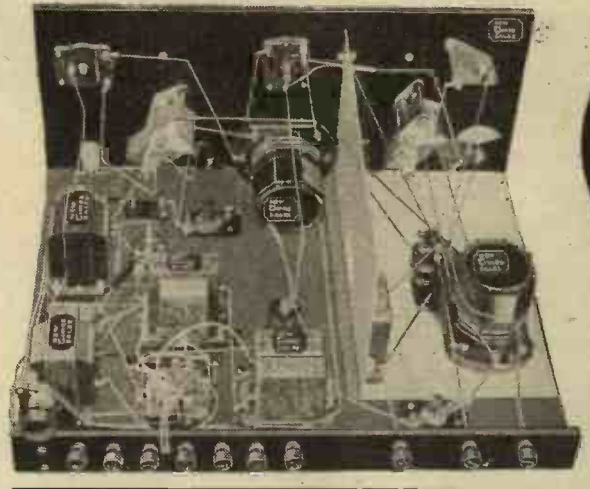


N.T.S. Slow-Motion Condenser.

N.T.S. Fixed Condenser.

FREE FULL SIZE BLUE PRINT WITH EVERY KIT

and copy "Popular Wireless" S.T.500 issue.



YOURS FOR **6/9**

Balance in 11 monthly payments of **6/9**

KIT 1

Comprising Kit of matched parts as listed, including ready-drilled Panel and terminal strip, S.T.500 Screen, Peto-Scott Metaplexed Baseboard and "Class B" Output Choke. With Free Full-Size Blue Print and Copy of "Popular Wireless" Oct. 21st. Less Valves and Cabinet. Cash or C.O.D., Carriage Paid.

£3 : 15 : 0 or 12 monthly payments of **6/9**

THESE PARTS are MATCHED, TESTED AND GUARANTEED

		s.	d.
1	**PETO-SCOTT** plywood baseboard with Metaplex section, 16" × 12"	1	9
1	**N.T.S.** panel, 16" × 7" × 3/16", ready drilled	3	0
1	**N.T.S.** S.T.500 screen	1	6
1	**N.T.S.** terminal strip, ready drilled		9
1	**N.T.S.** bracket for tone control condenser		3
2	**N.T.S.** S.T.500 coils	6	0
2	**N.T.S.** slow-motion ·0005-mfd. tuning condensers with dials	9	0
3	**N.T.S.** ·0005-mfd. solid dielectric reaction condensers	4	6
1	**N.T.S.** ·0001-mfd. differential reaction condenser	1	3
1	**N.T.S.** ·0003-mfd. differential reaction condenser	1	6
1	**N.T.S.** baseboard pre-set ·0001-mfd. condenser		9
1	**N.T.S.** baseboard pre-set ·00005-mfd. condenser		9
1	**N.T.S.** Class B driver transformer, ratio 1-1	7	6
1	**N.T.S.** Class B output choke	6	0
1	**N.T.S.** super transformer	5	0
1	**N.T.S.** S.G. choke	2	6
2	**N.T.S.** 4-pin valve holders	1	0
1	**W.B.** "Universal" 5-pin valve holder	1	0
1	**GRAHAM FARISH** 7-pin valve holder	1	3
1	**N.T.S.** disc type H.F. choke	1	6
1	**N.T.S.** 1-meg. leak with wire ends	1	0
2	**N.T.S.** 1-watt metallised 5,000-ohm resistances	1	6
2	**N.T.S.** 1-watt metallised 10,000-ohm resistances	1	6
1	**N.T.S.** 250-ohm resistance		9
1	**N.T.S.** 2-mfd fixed condenser	2	0
2	**N.T.S.** 1-mfd. fixed condensers	3	0
2	**N.T.S.** ·005-mfd. tubular condensers	1	6
1	**N.T.S.** ·0005-mfd. tubular condenser		9
1	**N.T.S.** ·00005-mfd. mica condenser		6
2	**N.T.S.** push-pull on-off switches	1	4
1	**N.T.S.** toggle on-off switch	1	3
10	**N.T.S.** terminals	1	8
	Flex, screws, 3 wander plugs, connecting wire, etc	2	0
	KIT "A," CASH OR C.O.D.	**£3**	**15**	**0**

Separate items in this Kit sent Cash or C.O.D. Part Kits, value over 40/-, on Easy Terms. Orders over 10/- sent Carriage and C.O.D. Charges Paid. Send for latest lists.
MAIL ORDER ONLY. NO CALLERS.

KIT 2 As Kit 1, but including 4 specified valves only. Cash or C.O.D., Carriage Paid,
£6 : 0 : 0 or 12 monthly payments of - **11/-**

KIT 3 As Kit 2 but with Peto-Scott Specified Consolette Cabinet. Cash or C.O.D., Carriage Paid,
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KIT 4 As Kit 2, but with Peto-Scott Specified Consolette Cabinet. Cash or C.O.D., Carriage Paid,
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If Permanent-Magnet Moving-Coil Speaker required, add 15/- to Cash Price or 1/3 to first and each monthly payment.

FINISHED INSTRUMENT

Assembled from N.T.S. components and broadcast tested, complete with valves and in specified Peto-Scott Table Cabinet. Cash or C.O.D., Carriage Paid,
£8 : 9 : 6 or 12 monthly payments of - **15/6**

As above, but Ready to Play in Peto-Scott Specified Walnut Consolette Cabinet with Peto-Scott Permanent Magnet Speaker. Cash or C.O.D., Carriage Paid, £9.15.0, or 12 monthly payments of 18/-.

To **New Times Sales Co.** 56, Ludgate Hill, London, E.C.4.

Please send me N.T.S. Easibilt S.T.500 Kit..... for which I enclose £.....s.....d. Cash/Deposit.

NAME.....

ADDRESS.....

.....P.W., 21/10/33.

EST. 1924.

OPERATING your S.T.500

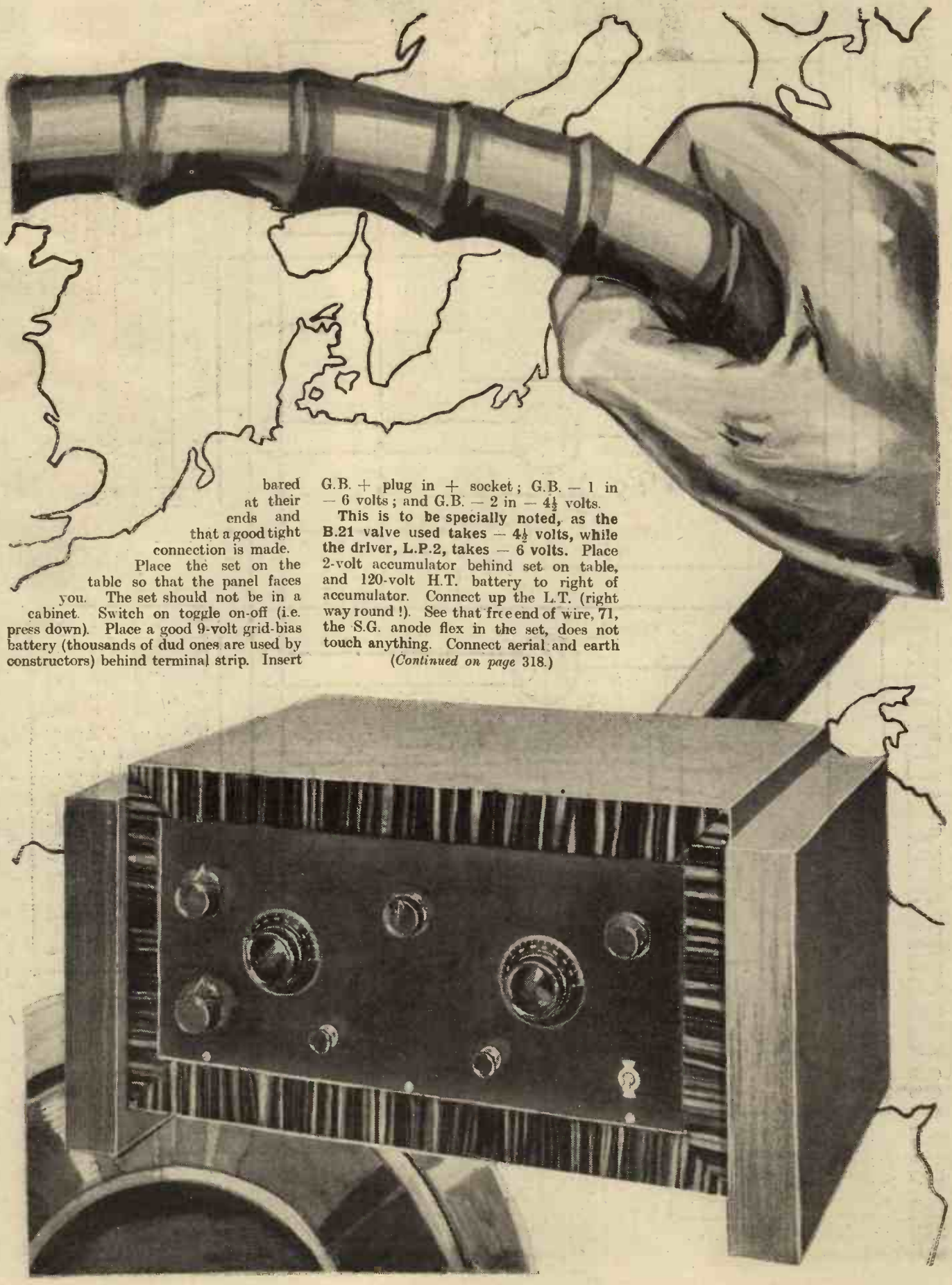
HERE are the brief instructions necessary to operate your "S.T.500." Fuller information will be given in a later issue. Incidentally, may I say that everyone who builds this receiver should read everything I have to say about it during the next month. I want you to get real service on this set, and there may be some point not fully appreciated which I can clear up or emphasise.

I will now assume you have completed the set by means of the guide. Check wiring extremely carefully to see the wires are properly connected and that there are no short-circuits to the screen, earth sheet or components

Check—and Be Sure !

If you have other coils than those I use, it is vital to see that the terminals from windings correspond to the Colvern's. If differently numbered and you do not allow for this the set will obviously not work.

To check wiring, I advise a constructor, as a perfect check, to ask a friend to read out to him the numbers on the Rapid Guide. You then follow the wires on the set from this description. It is vital to see that the wires are properly



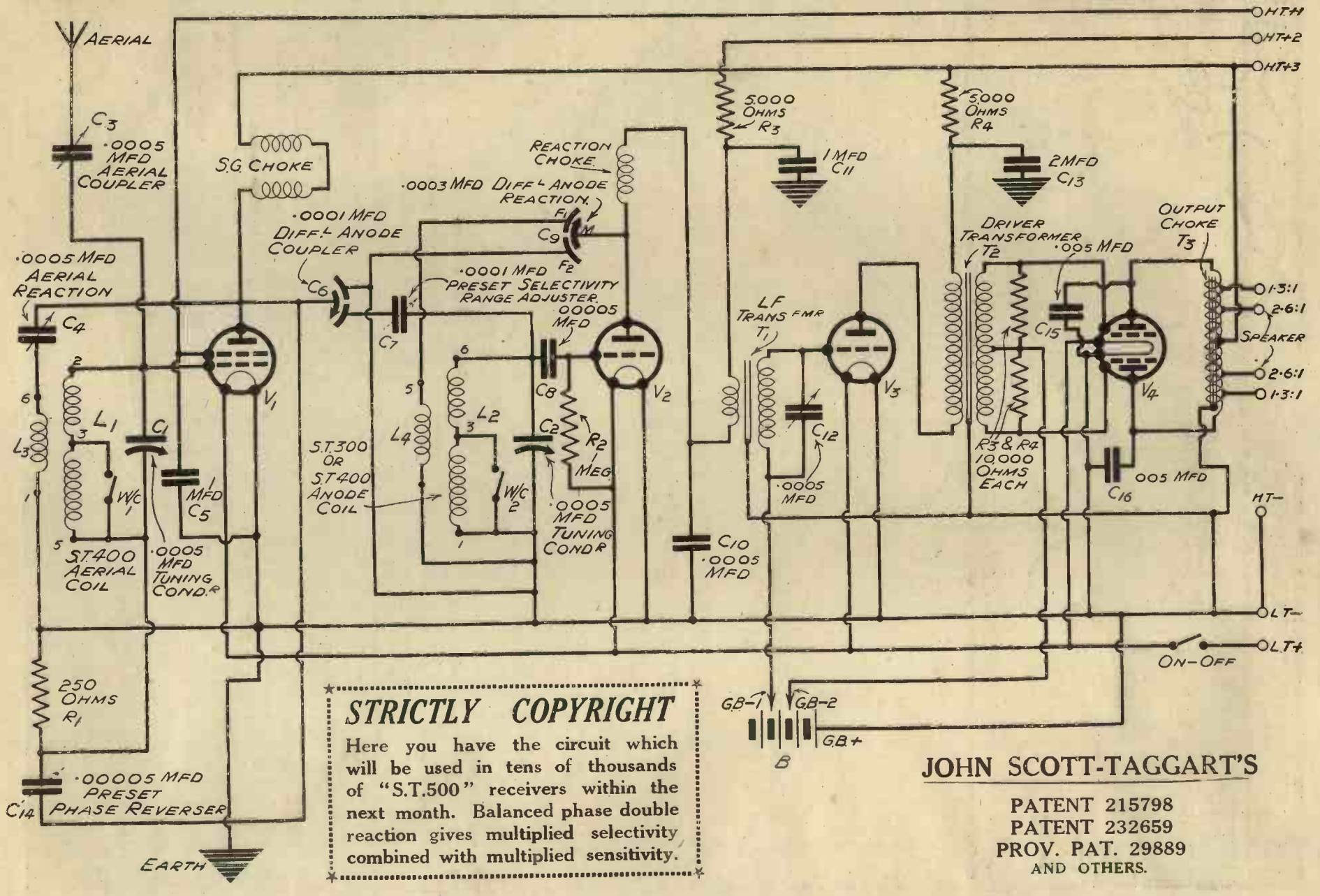
bared at their ends and that a good tight connection is made.

Place the set on the table so that the panel faces you. The set should not be in a cabinet. Switch on toggle on-off (i.e. press down). Place a good 9-volt grid-bias battery (thousands of dud ones are used by constructors) behind terminal strip. Insert G.B. + plug in + socket; G.B. — 1 in — 6 volts; and G.B. — 2 in — 4½ volts.

This is to be specially noted, as the B.21 valve used takes — 4½ volts, while the driver, L.P.2, takes — 6 volts. Place 2-volt accumulator behind set on table, and 120-volt H.T. battery to right of accumulator. Connect up the L.T. (right way round !). See that free end of wire, 71, the S.G. anode flex in the set, does not touch anything. Connect aerial and earth

(*Continued on page* 318.)

THE S.T.500 CIRCUIT SPECIALLY DEVELOPED FOR "POPULAR WIRELESS"



STRICTLY COPYRIGHT

Here you have the circuit which will be used in tens of thousands of "S.T.500" receivers within the next month. Balanced phase double reaction gives multiplied selectivity combined with multiplied sensitivity.

JOHN SCOTT-TAGGART'S

PATENT 215798
PATENT 232659
PROV. PAT. 29889
AND OTHERS.

THE 500 CIRCUIT

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

SOME people are façadists.

The front, or façade, is the chief thing that matters to them. Go to any wireless exhibition and you will hear façadism rampant. The "look of the thing" is as important to many people as the technical results—until they get the set home. Then harmony with the furniture will not make up for discord in the reception.

In Italy, in country districts, you will find many magnificently fronted churches. As you stand before them you gain an impression of beauty and dignity. Behind the inspiring stone front (a foot thick) is a tin shack.

Many a well-informed visitor to a radio exhibition returns home with the impression that he has been to a furniture show.

The home constructor looks for something more than beauty of cabinet work. He suffers none of the agonies which rack the layman in his choice of cabinet—whether to buy the tombstone or the coffin.

Circuit that Matters.

And yet even the constructor, if he is inexperienced, may prefer his panel rather than his music to be "clean." But, when all is said and done, a wireless set is a scientific instrument. It is performance that counts and the circuit that matters.

The "S.T.500" circuit (whose principal feature is an unique and highly successful method of applying reaction to both tuned circuits) may be considered in four stages:

(1) The aerial circuit.
(2) The H.F. amplifying valve and anode circuit.
(3) The detector.
(4) The Class B output.

The aerial circuit has provision for:

(a) Varying the H.F. input.
(b) Application of reaction.

The variation of input of H.F. to the first valve is of great importance. A wireless receiver must have a volume control, and there is no better place for it than at the very beginning of the set. A reduction of volume by reducing the series-aerial condenser (called the aerial coupler) simultaneously improves selectivity.

The need for an H.F. type of volume control is increased by the fact that the "S.T.500" employs reaction which increases signal strength at the same time as selectivity. To start with an excessive amount of H.F. input is undesirable, because the amplification after reaction would result in cumbersome magnification.

If selectivity is sought, the input currents (as controlled by the aerial coupler) should be reduced to such a value that when double reaction has been applied the output volume from the speaker is brought up to the right loudness. The aerial coupler is thus an essential control.

BALANCED PHASE DOUBLE REACTION

Use of Aerial Coupler.

When aerial reaction is not used the aerial coupler controls the selectivity of the aerial circuit as well as the H.F. input. Reducing the aerial coupler improves selectivity; turning the aerial-coupler knob to the right increases the aerial coupling and flattens tuning.

When aerial reaction is used the aerial coupler's function is primarily to reduce H.F. input. If signals are weak, however, one uses as much "coupler" as is necessary. This is also usual during daylight reception.

Aerial reaction is obtained from the S.G. choke via a variable ·0005 "solid dielectric" condenser which preferably should be of the log-law or similar "tuning" type, since this will make for convenience in reaction handling.

PERFECTED CLASS B

The aerial reaction is really a combination of both positive and negative reaction. A phase-reversal circuit consisting of a 250-ohm non-inductive resistance and a pre-set condenser having a maximum of ·00005 mfd. are common to both grid and anode circuits; the amount of reverse voltage is controlled by the pre-set, but the adjustment is not at all critical. The reverse-phase voltages are developed across the resistance and are applied to the grid of the S.G. valve.

I have called the arrangement **Balanced Phase Reaction**: it makes for uniformity of results and much smoother and more effective reaction. The proportion of negative to positive reaction falls as aerial reaction is increased.

The H.F. Stage.

The H.F. amplifying valve is of the maximum-efficiency S.G. type,—e.g. a Cossor 220 S.G. Valves of lower efficiency, such as were first introduced (e.g. Cossor 215 S.G., Mullard P.M.12, etc.), are workable but not recommended; variable-mu S.G. valves (if of high maximum mutual conductance) and high-frequency battery pentodes can be used.

The second tuned circuit, which I call the tuned anode circuit or simply "the anode circuit," is of the choke-fed type, and is, of course, connected across grid and filament of the detector valve. The amplified currents are fed to the tuned anode circuit through a differential anode coupling condenser called the **anode coupler**.

This, when it is at zero (i.e. full left), will pass on a minimum of H.F., and volume will fall, but not to zero.

MULTIPLIED SELECTIVITY

At low values of anode coupling signal strength will fall off, but anode reaction will bring it back to some extent. With no reaction, volume will increase (but selectivity will decrease) if the anode coupler is turned to the right.

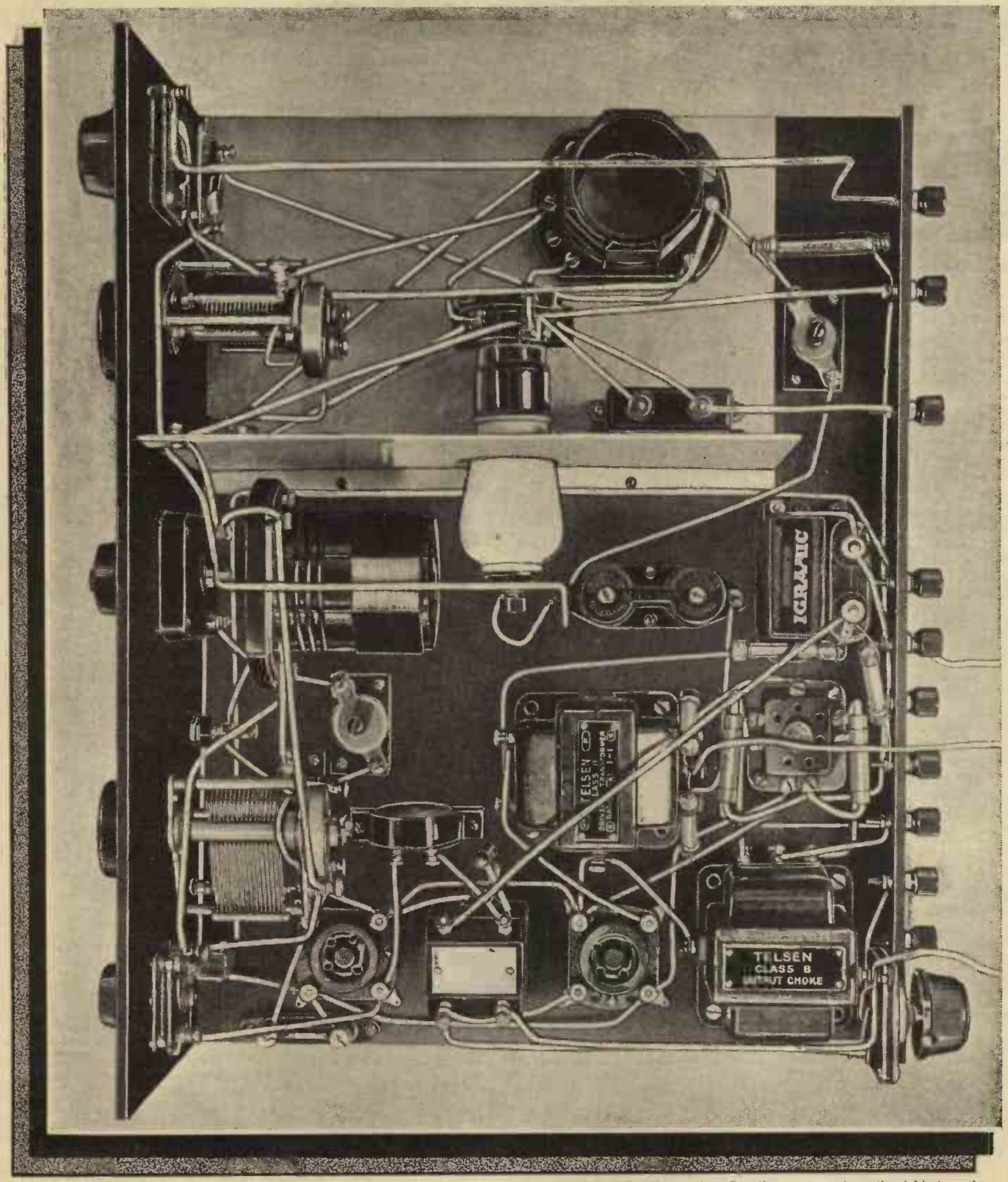
The Anode Coupler.

Without use of anode reaction, or with only a little, the anode coupler will be used for increasing selectivity by turning the knob to the left. In this position the anode load is reduced and selectivity rises.

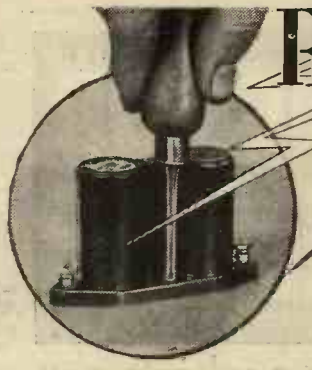
With anode reaction the anode coupler will always be used as far to the left as possible (consistent with output volume), especially when aerial reaction is also being used. Otherwise the amplification on nearly all signals would be excessive and the whole set overloaded. Excessive anode coupling would in these circumstances result in no louder signals; selectivity

(*Continued on page* 314.)

Scores of Foreigners : Amazing Quality : Economy



An almost vertical view of the "S.T.500." Every single component in the set may be seen. Note the Balanced Phase Reaction components on the right above the screen. The selectivity range-adjuster below the anode coil is also clearly visible. The tone control is in the bottom right-hand corner.



Rapid-Construction Guide for the S.T.500

MY rapid guides used in previous sets have proved enormously popular and various improvements have now been added; for example, you are told when finally to tighten the terminals.

The following guide gives you every single step to take to build the S.T.500. Great trouble has been taken to ensure minute detail and extreme accuracy and the various steps are in the best and most time-saving order. The detail is great because it is assumed that the reader has never built a set before in his life. Explanations of the order of construction are not given, but the reasons will be appreciated by constructors who ignore the guide.

Details make for speed.

The wiring in the finished set may be checked by getting a friend to read out the numbered list while you check the wires on the set; it is unnecessary to consult the blueprint for this purpose.

If you use different components slight obvious variations must be made. If you intend to fit a radiogram switch (Wearite type 123) any two contacts may be used in place of toggle switch which need not in this case be bought. Full details for using S.T.500 for gramophone work will be given very shortly.

(A) Study component list, see which items you already have (and which you can guarantee are O.K.) and order the rest without delay. Avoid using a component again which may have been the cause of undiagnosed failure in a previous set. If buying new components or valves I very strongly advise you to use the same components as I did, but in no case to wander from the list of alternatives; no responsibility whatever can be taken for results if this warning is not heeded. If you are thinking of buying a new speaker the cost of the choke is saved. Decide whether to use a Class B moving-coil speaker or an output choke for your existing speaker.

(B) Examine components. Try valves in valve holders to see that pins make good contact. (If old valve holders are used see that they are in good condition and that no metal part will touch baseboard.) See that vanes of variable condensers are free from dust and do not touch at any point; pigtails on them should be examined. The upper plates of the ·0001-mfd. and ·00005-mfd. open-type pre-sets must (after temporary removing adjusting knob) be bent up so that a low minimum capacity is obtainable. Make sure that all terminal screws are secure in all the components and tighten the nuts underneath if necessary.

(C) Check size of baseboard (16 in. × 12 in.) and of panel (16 in. × 7 in.). The sizes are important if you have a cabinet into which they must fit, and you should make any small alterations before the set is built.

(D) Examine screen to see that it conforms approximately to sketch, modifying it if necessary. Note that a small hole is in screen for later insertion of a terminal.

Follow the order carefully.

(E) If Metaplex baseboard is used check size of metallised surface. Under no circumstances should the metallised surface extend beyond the screen.

(F) Take 6½ in. × 10 in. earth sheet (metal foil) and fix it down flat over one corner of baseboard (as shown in blueprint), securing by means of four tacks or drawing pins in corners; make sure that tacks are clear of screen or any component.

(G) Lay blueprint face upwards on baseboard; the aerial end of blueprint, of course, goes over the earth sheet. Keep blueprint steady with a weight. Using bradawl, prick through into baseboard the fixing holes of all baseboard components, including holes for anode-coil pillars and holes for vertical screen-fixing screws, making sure that the holes for screen correspond with your own screen (screen-fixing holes vary slightly).

(H) Remove blueprint and prepare holes in baseboard for anode-coil supporting pillars and countersink these holes from underneath. (See that holes go through baseboard as shown in sketch illustrating method of mounting anode coil.)

(J) Prepare with bradawl the two already-pricked holes for fixing vertical screen. (The holes are merely in preparation for receiving small wood screws: the vertical screen is not fixed at this stage).

(K) Clean earth sheet (with emery paper) where it will later be held down by ledge of vertical screen.

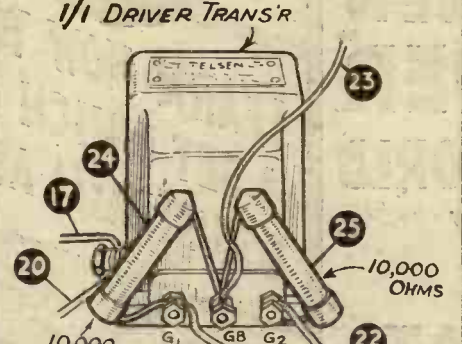
(L) Remove superfluous terminal C from the W.B. universal valve holder. Discard the bent metal socket. Put terminal aside for later use.

(M) Using blueprint as check for their positions, screw down the following in the order given: W.B. universal valve holder (marked V1 on blueprint), S.T.400 aerial coil, 1-mfd. (T.C.C.) on metal foil, phase-reverser ·00005-mfd. pre-set, S.G. choke, 1-mfd. (Dubilier) on uncovered part of baseboard, 2-mfd. condenser, 7-pin valve holder, output choke (if used), driver transformer, valve holder V3, L.F. transformer, valve holder V2, 1-megohm resistance in holder, reaction choke, grid condenser, selectivity range adjuster.

(N) Mark out and drill terminal strip (or buy same). Countersink three fixing holes. Fit ten terminals loosely into terminal strip, which is then fixed to edge of baseboard by means of three countersunk-head screws (unless fixing holes are countersunk do not use countersunk-head screws as splitting of the ebonite may occur).

(O) Fit tone-control ·0005-mfd. variable condenser to tone-control mounting plate; fix mounting plate to terminal strip by means of nut and bolt.

THEY STABILIZE IT!



This sketch shows the two 10,000-ohm resistors which go across the two secondaries of the driver transformer.

(P) **WIRE BASEBOARD COMPONENTS** with stiffish insulated wire, e.g. bell wire or one of the advertised varieties, such as Glazite. To save the reader time and trouble I have numbered the wires in the most convenient order for connection.

Use the following list to find the wires quickly on the blueprint and note their shape on the perspective drawings and photographs. The numbers of wires are the same in all drawings. You need not read the wording after the wire if you can find the wire without.

It is very important to tick off the numbers on this list after completing each connection. No terminals should be finally tightened until the word "tighten" appears in brackets after the terminal concerned. When the word "tighten" appears it means all wires to that terminal are in place; then tighten firmly, as it may be more difficult to do so later.

N.B.—Valve holder filament terminals are marked F+ and F— in blueprint for purpose of identification, although not so marked on the valve holders themselves; likewise I have labelled certain terminals G1, G2 and P1, P2 to assist in their identification.

(1) Screening-grid terminal (tighten), marked A on W.B. valve holder to neighbouring 1-mfd. condenser.
(2) Same terminal (tighten) of the 1-mfd. to H.T.+1 terminal (tighten) on terminal strip.
(3) Earth terminal on strip to L.T.— terminal on strip; this wire runs on baseboard and next to terminal strip.
(4) L.T.— terminal on strip to H.T.— terminal on strip.
(5) ·00005-mfd. phase-reverser terminal nearest aerial coil to aerial-coil terminal No. 5. [All coil-terminal numbers apply to Colvern S.T.400 coils].
(6) Earth terminal on strip to one terminal (tighten) of 250-ohm Ohmite resistor. This wire supports one end of the resistor.
(7) The other terminal (tighten) of 250-ohm Ohmite to ·00005-mfd. phase-reverser terminal (tighten) nearest aerial coil.
(8) Earth terminal (tighten) on strip to upper filament terminal F— of W.B. universal valve holder V1.

Tick off completed connections.

(9) Same upper filament terminal F— of W.B. valve holder V1 to nearest terminal (tighten) on neighbouring 1-mfd.
(10) Aerial-coil terminal (tighten) (1) to upper filament terminal F— on W.B. valve holder.
(11) Aerial-coil terminal (2) to control grid terminal (tighten) on W.B. valve holder V1.
(12) S.G. choke terminal nearest terminal strip to H.T.+3 terminal on strip.
(13) 7-pin valve holder terminal (tighten) F+ to valve holder V3 terminal F+ nearest baseboard edge.
(14) Same terminal (tighten) F+ of valve holder V3 to valve holder V2 filament terminal F+ nearest baseboard edge.
(15) L.F. transformer earth terminal (if any) [in case of Niclet used it is one of fixing screws] to valve holder V2 filament terminal F— furthest from baseboard edge.
(16) Same V2 terminal F— furthest from baseboard edge to valve holder V3 filament terminal F— furthest from baseboard edge.
(17) Same V3 terminal F— furthest from baseboard edge to driver transformer earth terminal.
(18) Valve holder V3 filament terminal (tighten) F— furthest from baseboard edge to 7-pin valve holder V4 filament terminal F— nearest terminal strip.
(19) Same V4 F— terminal nearest terminal strip to H.T.— terminal (tighten) on terminal strip.
(20) Driver-transformer earth terminal (tighten) to output-choke earth terminal (tighten).
(21) Driver-transformer terminal G1 to 7-pin valve holder V4 grid terminal (tighten) G1.
(22) Driver-transformer terminal G2 to 7-pin valve holder V4 grid terminal (tighten) G2.
(23) Driver-transformer terminal GB via 12 in. length of flex to G.B.—2 plug (tighten).
(24) Driver-transformer G.B. via 10,000-ohm resistor to driver-transformer terminal (tighten) G1.
(25) Driver-transformer terminal (tighten) GB via 10,000-ohm resistor to driver-transformer terminal (tighten) G2.
(26) Output-choke terminal (tighten) P1 to 7-pin valve holder V4 anode terminal A1.

Tighten terminals when told.

(27) Output-choke terminal (tighten) P2 to 7-pin valve holder V4 anode terminal A2.
(28) H.T.+3 terminal (tighten) on terminal strip to output-choke terminal (tighten) H.T.+.
(29) L.S.+ terminal (tighten) on strip to output-choke terminal (tighten) 2·6 : 1 furthest from strip (there is another terminal further still from strip, but it is not a 2·6 :1).
(30) L.S.— terminal (tighten) on strip to output-choke terminal (tighten) 2·6 : 1 nearest strip.
(31) 7-pin valve holder V4 anode terminal (tighten) A1 via ·005-mfd. tubular condenser to 7-pin valve holder V4 filament terminal F—.
(32) 7-pin valve holder V4 anode terminal (tighten) A 2 via ·005-mfd. tubular to 7-pin valve holder V4 filament terminal (tighten) F—.
(33) Valve holder V3 anode terminal (tighten) A to driver-transformer terminal (tighten) P.
(34) Driver-transformer H.T.+ terminal (tighten) to 2-mfd. condenser terminal nearest 7-pin valve holder V4.
(35) Same terminal (tighten) of 2-mfd. (i.e. nearest 7-pin valve holder) via 5,000-ohm resistor to S.G. choke terminal (tighten) nearest 2 mfd.

(*Continued on page* 292.)

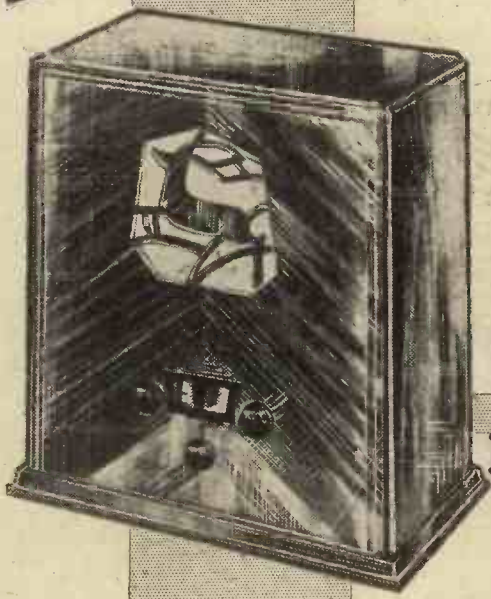
SHORT-WAVE LISTENING ALL-WAVE "SKYSCRAPER"!

At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World Skyscraper 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra-Short and Short-Wave transmissions from the ends of the earth.

SUCCESS IS CERTAIN—GET THE CHART AND JUDGE FOR YOURSELF

COMPLETE WITH WALNUT CABINET AND MOVING-COIL LOUDSPEAKER.

£8.2.6



And remember you get these stations through Double Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries. Lissen have made this All-Wave All-World radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia *direct* on a set you have built yourself, it makes you an enthusiast to realise what a wonderful thing you have created! And when you see the Great Free Chart of the All-Wave All-World "Skyscraper 4," which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. YOU CAN'T GO WRONG! But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper 4," the SET THAT SPANS THE WORLD!

CHART FREE

LISSEN ALL-WAVE ALL-WORLD 4 "SKYSCRAPER"

POST THIS COUPON

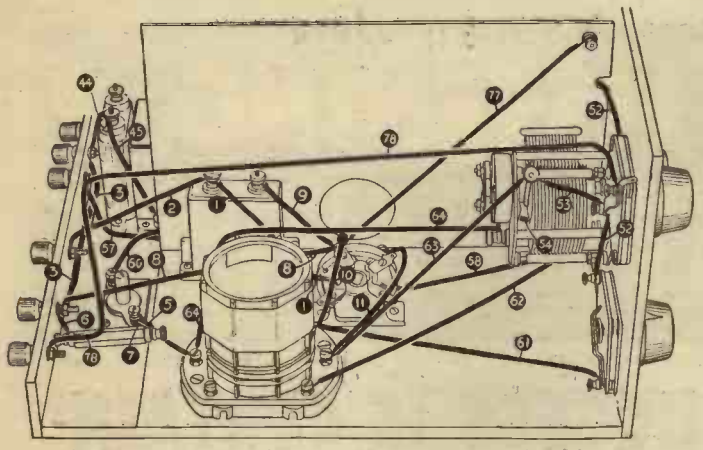
To LISSEN, LTD
Publicity Dept.
Isleworth, Middlesex.
Please send me FREE CHART of the All-Wave All-World 'Skyscraper.'

NAME .....

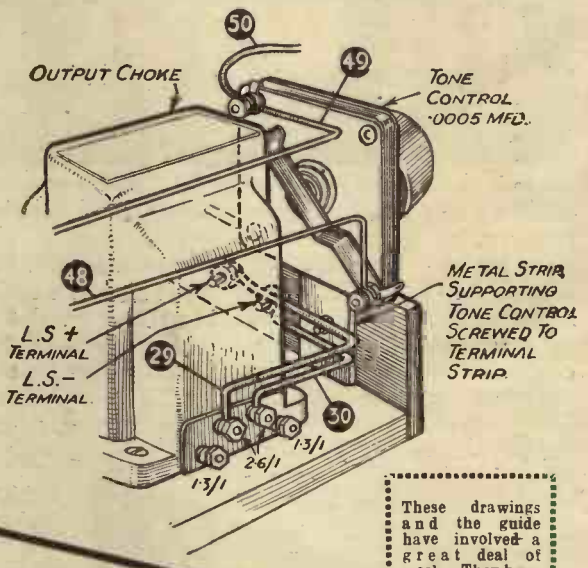
ADDRESS .....

.....

P.W.1134



Immediately below you will see how the connections are made to the tone control. The output transformer is not used if a Class B speaker is employed.



Note the connections to the phase-reverser. Enough details are given on this page to build the set, but further practical information will appear next week. The above drawing shows most of the aerial side of the set. The various wires go straight between terminals but, where considered necessary, extra information (such as height above base-board) is given in the rapid construction guide. The position of wire 52 is important and is best shown on the blue-print.

These drawings and the guide have involved a great deal of work. They have been very carefully checked and, while appearing complicated, will prove invaluable.

This lower drawing gives the detailed shape of all but a few of the wires. These are to be seen in other illustrations. To obtain the best idea of the shape of wires it is a good plan to look for the same number of wires on the various views. These drawings enable an exact duplicate set to be made if so desired.

These drawings are to show the general shape of the wires whose numbers correspond with those in the guide. The photographs are an extra check on the arrangement of the wires. It is advised that the blue-print be used as the master standard for the actual point-to-point connections.

Every Conceivable Detail is Given Here

(36) Valve holder V3 grid terminal (tighten) G to L.F. transformer (Nickel) terminal G.
(37) L.F. transformer terminal P via ·0005-mfd. tubular to L.F. transformer earth connection (tighten).
(38) Valve holder V2 anode terminal A to reaction choke terminal (tighten) nearest grid condenser.
(39) Reaction choke terminal (tighten) nearest driver transformer to L.F. transformer terminal (tighten) P.
(40) Valve holder V2 filament terminal F+ nearest baseboard edge to 1 megohm resistance terminal (tighten) nearest strip.
(41) 1-megohm resistance terminal (tighten) furthest from strip to valve holder grid terminal G.
(42) Same grid terminal (tighten) G of valve holder V2 to nearest terminal (tighten) on grid condenser.
(43) Grid-condenser terminal nearest selectivity range adjuster to selectivity range-adjuster terminal (tighten) nearest grid condenser.
(44) L.T.— terminal (tighten) on strip to adjacent 1-mfd. terminal furthest from 7-pin holder V4.
(45) Same terminal (tighten) on 1-mfd. to 2-mfds terminal (tighten) furthest from 7-pin valve holder.
(46) L.F. transformer H.T.+ terminal (tighten) to nearest terminal on 1-mfd. nearest 7-pin valve holder V4.
(47) Same terminal (tighten) on 1-mfd. nearest 7-pin valve holder V4 via 5,000-ohm resistor to H.T.+2 terminal (tighten) on strip.
(48) L.F. transformer terminal (tighten) G to tone-control ·0005-mfd. condenser lower terminal (tighten).
(49) L.F. transformer G.B.— terminal (tighten) to tone-control ·0005-mfd. upper terminal.
(50) Same upper terminal (tighten) on the control condenser via 8-in. flex to G.B.—1 plug (tighten). Make sure connection to plug is good.
(51) Connect a 7-in. flexible lead (having a G.B.+ plug at one end) under the terminal head of L.T.— terminal on strip (see blueprint).

THIS CONCLUDES THE BASEBOARD WIRING.

(Q) Mark out and drill panel (or buy same). My panel-drilling diagram is a back view and is for marking back of panel. (On no account use it to mark the front of panel.) Small pilot holes are first drilled from the back (the final holes being drilled from the front). Any marks on panel front (to assist the reading of dial and coupler positions while working set) are best scratched immediately after drilling pilot holes. Their position is vertically above pilot holes and the scratches should show about one quarter of an inch when knobs are fitted. The three holes for the panel-fixing screws should be countersunk, otherwise panel will probably fracture when countersunk screws are used.

(R) **FIT PANEL COMPONENTS** in following order: toggle on-off switch, two push-pull wave-change switches, one ·0003-mfd. differential reaction condenser, one ·0001-mfd differential anode coupler, one ·0005-mfd. aerial coupler, one ·0005-mfd. aerial reaction condenser, two ·0005-mfd. slow-motion tuning condensers. If aerial wave-change switch is of different type turn it around if necessary to clear vertical screen.

Do not fit any knobs or dials at this stage, except those on wavechange switches.

(S) **WIRE PANEL COMPONENTS** as follows:
(52) Differential anode coupler moving vanes middle terminal to ·0005-mfd. aerial reaction upper terminal (tighten). This wire passes close to panel where it will later pass through top notch in vertical screen. It is important that this wire should follow the route on the blueprint, especially where it passes midway between aerial coupler and aerial tuning condenser.
(53) Aerial coupler fixed vanes lower terminal (tighten) to aerial tuning condenser fixed vanes terminal (this terminal is on the side of the Ormond condenser).
(54) Aerial tuning condenser moving vanes terminal (i.e. at end in case of Ormond type) to upper terminal (tighten) of aerial wavechange switch.
(55) Anode tuning condenser moving vanes terminal (i.e. at end on Ormond type) to anode wave-change switch upper terminal (tighten).
(56) Anode reaction condenser fixed vanes lower terminal F2 (tighten) to anode tuning condenser moving vanes terminal (i.e. terminal at end on Ormond).
(T) Hold panel temporarily in position against baseboard and mark on baseboard the points above which the on-off switch terminals will come. Remove panel. Prepare wires for later connection to toggle switch, viz. (58) from W.B. valve holder V1 lower filament terminal. This wire will leave toggle, goes round behind toggle and then runs along baseboard close to panel until the screen is passed.

Prepare wire (57) from toggle to L.T.+ terminal on strip; this wire will leave toggle, run along baseboard and half an inch away from front edge of baseboard until it turns off near vertical screen. The general shape of these two wires is obtainable from blueprint, drawings and photos.

(U) Connect end of prepared wire (58) to W.B. valve holder V1 lower filament terminal (tighten) F+. Leave toggle end of (58) free.

(V) Connect one end of prepared wire (57) to toggle terminal (tighten) nearest push-pull switches, leaving other end of wire free.

(W) **FIX PANEL TO BASEBOARD** by three screws, having tucked end of (58) behind toggle.
(57) Connect free end of (57) to L.T.+ terminal (tighten) on strip.
(58) Connect free end of (58) to toggle terminal furthest from push-pull switches.
(59) Same toggle terminal (tighten) furthest from push-pull switches to valve holder V2 filament terminal (tighten) F+ nearest baseboard edge. This wire goes under (41).
(60) Phase-reverser ·00005-mfd. condenser terminal (tighten) nearest 2-mfd. condenser to S.G. choke terminal nearest panel. This wire is kept about three-eighths of an inch above baseboard.
(61) Aerial reaction condenser lower terminal (tighten) to No. 6 terminal (tighten) on aerial coil.
(62) Aerial wavechange lower terminal (tighten) to No. 3 terminal (tighten) on aerial coil.
(63) Aerial tuning condenser fixed vanes terminal (tighten) [i.e. terminal on side in Ormond type] to No. 2 terminal (tighten) on aerial coil.
(64) Aerial tuning condenser moving vanes terminal (tighten) [terminal at end in case of Ormond type] to No. 5 terminal (tighten) on aerial coil.
(65) Anode differential ·0001-mfd. coupler fixed vanes terminal (tighten) nearest anode tuning condenser to selectivity range-adjuster terminal (tighten) nearest earth sheet.

(X) Fix the two mounting pillars on the S.T.400 anode coil and fix pillars from underneath baseboard with the two countersunk-head screws (see sketch for method of fixing anode coil). The coil is now in position on its pillars.
(66) Terminal No. 3 (tighten) on anode coil to anode wave-change switch lower terminal (tighten).
(67) No. 5 terminal (tighten) on anode coil to anode reaction condenser fixed vanes upper terminal (tighten) F2.
(68) Grid condenser terminal (tighten) nearest selectivity range adjuster to anode tuning condenser fixed vanes terminal (on side, in case of Ormond).
(69) Same fixed vanes terminal (tighten) on anode tuning condenser to No. 6 terminal (tighten) on anode coil.
(70) Valve holder V2 anode terminal (tighten) to anode reaction condenser moving vanes terminal (tighten) nearest side edge of panel.
(71) Fix the previously bared end of a 3-in. length of flex to S.G. choke terminal furthest from strip. The other end is bared and is for later connection to anode terminal on S.G. valve.
(72) S.G. choke terminal (tighten) furthest from terminal strip to middle moving vanes terminal (tighten) of ·0001-mfd. differential anode coupler. This wire leaves S.G. choke terminal and rises vertically for 4 in. and then travels horizontally towards the ·0001-mfd. differential and then drops to make connection with middle terminal.
(73) ·0001-mfd. differential anode coupler terminal nearest aerial tuning condenser to No. 1 terminal on anode coil.
(74) Same No. 1 terminal (tighten) on anode coil to anode tuning condenser moving vanes (terminal at end in case of Ormond).
(75) Same moving vanes terminal (tighten) to valve holder V2 filament terminal (tighten) F— furthest from baseboard edge.

(Y) **FIX VERTICAL SCREEN** with two screws having given screen and earth sheet a final rub with emery paper where they will come in contact, seeing that wire (52) passes through top notch and that (58) passes through bottom notch.

(Z) Fit terminal (previously taken from W.B. valve holder as suggested) to screen after cleaning with emery the screen near the hole.
(76) ·0001-mfd. differential anode coupler terminal (tighten) nearest screen to terminal on vertical screen.
(77) W.B. universal valve holder V1 upper filament terminal (tighten) F— to terminal (tighten) on vertical screen.
(78) Aerial terminal (tighten) on strip to upper moving vanes terminal (tighten) on ·0005-mfd. aerial coupler. The wire proceeds horizontally for 1 in. towards panel, then rises 4 in. vertically and then proceeds horizontally to the aerial coupler.

THIS COMPLETES THE WIRING.

Fit knobs and dials to panel components, turn spindles of the four solid dielectric condensers (this excludes the two main tuning condensers) as far anti-clockwise as possible looking from front of set. Fit knobs with their pointers pointing horizontally to left.

Turn the two main tuning condenser spindles as far anti-clockwise as possible (i.e. moving vanes fully "out") and fit dials with their zeros opposite prepared scratch marks (if any) on panel. Fit slow-motion knobs to tuning condensers.

YOUR S.T.500 IS NOW COMPLETE.

Please turn to operating instructions and enjoy it.

J. S.-T.

TWO EVENINGS OR LESS!

The "S.T.500," if built by this ingenious rapid guide, can be made and built in a few hours. By 10 p.m. the second night you will have Europe to entertain you.

START TO-DAY!

If the article on the "S.T.500" has inspired interest, start building it at once, and enjoy its remarkable performance as early as possible. This set is our big Autumn star receiver.

THE MIRROR OF THE B.B.C. By O. H. M.

THE JANUARY SCRAMBLE

The Lucerne Plan—On Christmas Day—The Truth about the B.B.C. and Television—Some Dates to Remember.

THE Amsterdam meeting of broadcasters does not seem to have helped very much towards ironing out the prospective difficulties of the great change-over to the Lucerne Plan in January. Fortunately, however, the B.B.C. is taking steps to minimise the dislocation.

I hear that extra power will be used while stations settle down to their new channels. Even so, however, listeners should allow for a period of uncertainty, especially as the B.B.C. programme builders are not putting on anything like their best talent in the second half of January and in February.

Bells of Bethlehem.

It is still very "hush-hush," so I just whisper that all the broadcasters of the Western Hemisphere are likely to relay the bells of Bethlehem at the appropriate time on Christmas Day. I wonder who will do the running commentary.

Reorganisation Misfires.

The great scheme of reorganisation of the B.B.C. seems to have miscarried in at least one direction. There was a plan to transform the News Section into a Department of Topicality, with staff qualified to "produce" news and dramatise events of the day. Mr. Lionel Fielden was to have been in charge.

But all this has fallen through. Mr. Fielden will stay where he is in the Talks Department and Mr. Holt, as a practical Pressman, will continue to direct the news in a professional way, for which small mercies many thanks!

The Television Muddle.

With all the contradictory statements that are floating about concerning the future of television it is perhaps just as well that I am able to tell the truth. The present thirty-line transmissions which go out four half-hours a week on 261 metres are under notice to stop on March 31st, and the B.B.C. engineers and administration certainly mean them to stop then.

Between now and Christmas the B.B.C. ultra-short-wave transmitter will experiment with apparatus provided by the Baird Company. This will have to be cleared out before the end of the year, then the B.B.C. will begin active co-operation with the apparatus provided by Electrical and Musical Industries Limited. This is the apparatus next to be tried out. So that is the position.

A TRUNK CALL FROM CANADA

An operator at the London Exchange plugging in a call from Montreal. This Radio Exchange, as it might be called, is used for linking up transatlantic calls with telephone subscribers on this side of the Atlantic. The operator on the left is seated in front of the New York switchboard.

A Relay From Woolwich.

This year November 5th falls on a Sunday, but no doubt we shall explode our few fireworks on the night before. However, on Sunday morning, November 5th, which, by the way, is also Armistice Sunday, the B.B.C. is relaying the parade service at the Royal Garrison Church of St. George, Woolwich, as part of the National programme for that day.

The service will be conducted by the Senior Chaplain to the Forces, the Rev. B. K. Bond, and the musical part will be performed by the Royal Artillery Band, conducted by Major E. C. Stretton.

Special Anniversary Programme.

Here is a lot in a little space:

Saturday, October 21st.—Special anniversary of the Battle of Trafalgar programme. This has been arranged by Alan Wade and is a first episode from "The Dynasts," by Thomas Hardy, comprising nine scenes from that epic drama of the war with Napoleon, and dealing with the Battle of Trafalgar and the death of Nelson.

"The Blue Boar."

Monday and Tuesday, October 23rd and 24th.—National and Regional stations respectively. Roger Quilter's light opera, "The Blue Boar," with Amy Augarde in her first appearance before the microphone.

Ina Souez, Raymond Newell, Appleton Moore, Mark Raphael, Norah Gruhn and Samuel Dyson are also in the cast. Instead of dialogue to carry along the story, the musical items will be linked together by a narrator.

The "Circus Princess."

Thursday and Friday, October 26th and 27th.—Kalman's operetta, "The Circus Princess," with John Hendrik in the leading part. Harriet Bennet, never yet heard in England, but holding a big reputation in America and Australia, where she has sung in "Rose Marie" for two years, to play the Princess.

(*Continued on page* 317.)

Weekly jottings of interest to buyers.

THE advertising columns of "P.W." are always interesting. That much may be deduced from the large number of letters I receive each week from readers concerning products that have been advertised.

But this week very special interest attaches to the advertisers' announcements on account of the publication in this issue of Mr. Scott-Taggart's great new set, the "S.T.500." Judging by the phenomenal success of Mr. Scott-Taggart's previous designs, I haven't the slightest doubt that the "S.T.500" will be built by literally hundreds of thousands of readers.

In the ordinary course of events it is one of my pleasurable tasks to provide weekly notes of interest to buyers. This week the only advice I can give is that you study with more than usual interest the numerous advertisements that are appearing. I am confident that you will find something to interest you on every single page.

G.F. Catalogue Now Available.

A week or two ago I mentioned in my notes that Graham Farish were about to produce a new catalogue, and I am glad to be able to pass on the news that adequate supplies of this new catalogue are now available.

The range of products that is now being produced by this enterprising firm is bigger and better than ever, and includes such components as ganged condensers, Class B driver transformers, Mansbridge-type condensers, etc.

May I remind all those who are interested that it is available under our postcard literature service. **(No. 51.)**

A New Watmel Leaflet.

An informative leaflet on the important subject of volume controlling has just come to hand from Watmel.

In addition to giving details and prices of the various resistances and potentiometers included in their range, this new Watmel brochure gives some useful information on the question of volume controlling in general.

Since it is a leaflet that is likely to be of interest to home constructors, "P.W." readers can obtain a copy through the medium of our postcard service. (No. 58.)

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

USEFUL BENJAMIN UNIT

THERE are supposed to be two classes of constructors. In the one are those who like to experiment and do not object to a considerable amount of tinkering with bits and pieces in order to achieve their ends; and in the other those who look for the shortest and easiest cuts.

Personally, I do not think any such arbitrary classification is possible. Indeed, I would go so far as to say that the above types of constructor represent two extremes.

And in any case I fancy that there are very few indeed who will deliberately choose an unnecessary complication in face of a simple alternative.

That is why I believe the Benjamin Economiser Unit will prove very popular. There does not seem to be any reasonable excuse for purchasing the individual items needed to apply the Westector Economising scheme when they are available in the one compact unit at approximately the same price.

The saving is more than a mere saving of space. Circuit connections are greatly reduced, and the constructor has the assurance that the elements employed are completely suitable for the purpose.

Gone is the need to prepare a shopping list (admittedly not large) and, perhaps, wander from shop to shop to make the various purchases.

And in this particular case the old and sometimes valid objection that unified apparatus prohibits experiment and close adjustment does not apply.

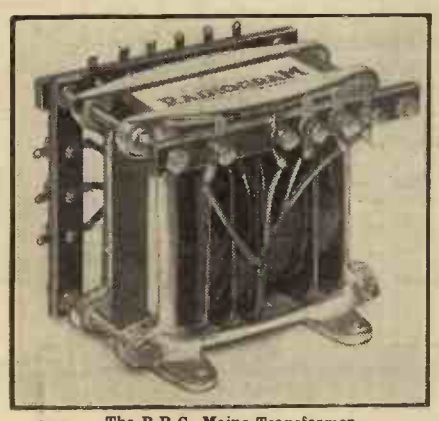
The Benjamin Economiser Unit provides for all normal requirements perfectly satisfactorily.

As you have no doubt gathered, it incorporates a Westector wired to condensers and resistances for H.T. economising in a power or pentode stage (alternative terminals are fitted).

You probably know the scheme. If you've been reading your "P.W." regularly you will; but perhaps I'd better insert a brief description of it for the benefit of new readers.

Well, as all battery-set owners will realise only too keenly, the output valve of a set, whether it be an ordinary power or pentode type, takes a fair amount of H.T. current. Perhaps ten milliamperes. This current is steadily draining away from the H.T. battery, whatever the volume from the loudspeaker.

There is just as much when a single fiddle is quietly playing or a very weak station is coming over, or even during programme pauses, as there is when the speaker is delivering a really loud passage.



The B.R.G. Mains Transformer.

The Economiser alters all that and proportions the H.T. current in accordance with the volume, and thus effects a considerable saving.

And this Benjamin Economiser Unit forms a most convenient method of adding this money-saving system to any ordinary set.

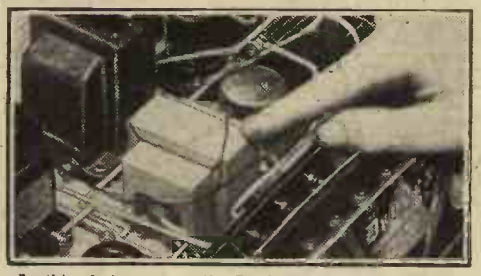
It works perfectly. A meter convincingly proves it. There isn't the slightest effect on the quality or volume. The saving is made without sacrifice. I think it is a fine scheme, and I hope Benjamin's enterprise in making it so readily available to all meets with the full success it deserves.

A BRITISH RADIOGRAM TRANSFORMER

My recent remarks regarding the progress made by British Radiogram are further endorsed by the fact that they have now extended their activities to the making of a new mains transformer, which is a specialised type of component not easily manufactured without real technical ability and production skill behind it.

This B.R.G. Type 56 Mains Transformer in question is designed specifically for the Westinghouse H.T. 12 unit to get 250 volts H.T. at 80 ma. There is an L.T. output of 4 volts at 3 amperes.

Input tappings to suit any voltage between 200 and 250 volts are provided, so that it will suit most mains.



In this photo you see the Benjamin Economiser Unit actually in a set.

I was at once favourably impressed by this B.R.G. transformer, for it is robustly constructed on obviously sound lines.

The frame is heavily built and the windings carefully sectionised. On test there was negligible temperature rise and good voltage regulation on both L.T. and H.T.

It is a transformer we can recommend, and the price is the very reasonable one of 22s. 6d.

A GRAHAM FARISH CONDENSER

Have you ever noticed how often it seems to happen that the most wires join to the component with the smallest terminals?

It's an exasperating shortcoming. Even as I write my mind flies to innumerable sets of the past in which I have been confronted with large fixed condensers bearing tiny terminals and whole handfuls of fat wires to join to them!

The Graham Farish Fixed Condenser.

And it is remembering this which makes me view the substantial terminals on the Graham Farish 1-mfd. fixed condenser (and other similar values) with intense pleasure. There is an unusually generous length of shank on each. You can bare no less than ⅛ inch of it and the milled nut still has ample threads left to it.

A small point? No, I consider it a vitally important one. The whole working of a set can go by the board through an odd lead wandering off a flimsy, overtaxed terminal.

Another sound, practical feature of this Graham Farish condenser is that it can be mounted either vertically or horizontally equally well.

It is built into a strong bakelite casing, attractively coloured red, it holds its charge well, and its actual capacity closely follows its rating.

A good component, thoughtfully designed, is this Graham Farish condenser.

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

IT was extraordinary how Billy Merson's show, "Taking You Over," improved in quality and vigour as it progressed. Billy Merson himself wasn't as prominent in the programme as he might have been. But in his one big turn as a Roman Cæsar he was something that suited his pompous style. He is without a rival in this sort of thing.

The other snippets of parts he played weren't Billy Merson parts at all, so were unimpressive. There was very little new ground broken in any of the departments, but the surprise endings of the sketches were much appreciated.

* * *

There's nothing like a good beginning to everything. Vernon Bartlett attaches great importance to opening sentences, and will spend a long time in their preparation. There's wisdom in this. Writers of burlesque do the same, apparently, though they don't usually show the same wisdom. It seems the rule for them to open their show with a regular babel of noise, everyone, including principals, going it hammer and tongs.

This may create atmosphere, but it also creates a difficult situation for the listener. He has to spend a good deal of time sorting everyone out, and this interferes with his enjoyment. Whereas, if the principal characters were introduced in turn, the listener would be spared endless trouble. Atmosphere may be lacking for a time, but I prefer above everything else to know where I am at the earliest possible moment. "Daylight Robbery" was the latest offender.

* * *

Here are two Poste-Parisien items. Try to find time to listen to the Sonora Radio Dance Orchestra broadcasting modern dance music for a couple of hours every Saturday. Their leader is Fred Hoffman. They are good! I came across them quite accidentally, but I shall take them now as regularly as I do a hint.

I understand they are very popular across the Channel, and owe their success to their having studied the requirements of the mike and adapting their interpretation thereto. An obvious expedient, I would have thought.

* * *

The other concerns the new announcer operating there. Possessing a rather expressionless voice, he contrasts strikingly with his two colleagues. I can imagine he isn't exciting enough for French listeners, though to English listeners learning French at the feet of these announcers there may be some small advantage in this less exuberant style.

* * *

I like the idea of broadcasting excerpts from forthcoming plays. Of course, it is a borrowing from the cinema, but, unlike the cinema, it is only possible in the case of revised plays, unless records of new plays are made during rehearsals. I am inclined to think that even this would be worth while, as these excerpts, like those of the film, do arouse interest.

* * *

The dozen plays included in the present Drama Festival are interesting not only in themselves, but also for the light they throw on the development of radio drama. To my mind, "Danger" and "The Wrong Bus" might have been two of the most recent plays written, instead of being six or seven years old. I couldn't recall either of them; but in "Danger" I thought the effects were excellent and more realistic than those of "The Wrong Bus," in spite of the first-class crash at the end of the latter. I must say, too, how I like the small cast. It makes listening so much easier.

* * *

Mr. C. W. Lyle's general introduction to the autumn series of sports talks was a remarkable survey of the world's sports. He had to travel the whole world in 15 minutes; he omitted no sport of any standing; he gave considerable detail. Obviously, he had to race against time, and he couldn't conceal the fact. This was the only fly in the ointment.

* * *

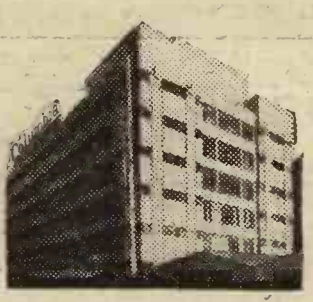
Mr. Lyle's remarks on the enthusiasm of all Americans for their national game, and the way American radio fosters this enthusiasm, emphasised the B.B.C.'s tendency to treat our national game as if it were a thing of no special importance. True, Saturday evening's First News Bulletin contains the football results. But they are always given last, often yielding pride of place to results of only local interest.

(*Continued on page* 312.)

Columbia's amazing radiogram offer!

A FOUR-VALVE ALL-ELECTRIC RADIO-GRAMOPHONE WITH MOVING COIL SPEAKER AT 23 GNS.

SPECIAL FEATURES: 1. Band-pass circuit. 2. Flood-lit scale calibrated in wave-lengths with station-finder. 3. Energised moving-coil speaker. 4. Provision for additional speaker. 5. Universal automatic brake. 6. Volume control common to both radio and gramophone. 7. Induction motor (A.C. model). 8. One knob tuning with reduction gear. 9. Three aerial tappings. 10. Mains aerial device. 11. Low running costs.



SPECIFICATION

Circuit—*Bandpass aerial circuit, screen-grid high-frequency amplifier, followed by tuned-grid power-grid detector. Parallel-fed low-frequency transformer coupling to pentode output.* **Speaker**—*Energised moving coil. Provision for additional speaker of high or low resistance.* **Controls**—*Gramophone LW, MW, 'Off'. Switch, single knob tuning for three-gang condenser. Volume control which also operates on pick-up.* **Motor**—*Induction type (A C model).* **Cabinet**—*Walnut.* **Valves**—*A C model: MS4B, MH4, MPT4, U12.* **Output**—*1½ watts.* **Current Consumption**—*65 watts on radio, 95 watts on gramophone.* **Wave-lengths Range**—*200-550 medium-wave metres; 1,000-2,000 long-wave metres.* **Voltage Range**—*200/250 volts, 50/60 cycles.* **Size**—*34 ins. high, 23½ ins. wide. 16½ ins. deep.* **Price**—*23 guineas.* **Hire-Purchase Terms**—*Deposit £2.8.6 and 12 monthly payments of £1.19.0.*

THE FINEST VALUE EVER PRODUCED BY THE GREAT COLUMBIA FACTORY

Here is the chance of a lifetime to buy a luxury radio-gramophone at an amazingly low figure. For 23 GNS. you are offered an instrument that embraces every material advancement of radio and gramophone science—combined in an instrument which needs but plugging into your electric light supply to bring you the finest programmes that modern broadcasting has to offer, and superb rendering of gramophone music—both with an amazing fidelity of tone.

Columbia have never had more confidence in an instrument than they have in this—representing as it does the greatest value for money to-day—an instrument that might reasonably be priced at many pounds more. This radio-gramophone is a standard product of the great Columbia factory—the largest in Europe—and like all Columbia instruments has undergone nearly eleven hundred tests as part of the routine of manufacture—which explains Columbia's confidence in this product. Read the brief specification given—then take the first opportunity of seeing and hearing it at any Columbia dealer's. Remember, this is a chance not to be missed!

Columbia

RADIO AND RADIO-GRAPHOPHONES

COUPON: *To the Columbia Graphophone Co., Ltd., 98 Clerkenwell Road, E.C.1.*

Please send me particulars of the new Columbia all-electric Radiograph-Four, Model 620, without obligation.

NAME .....

ADDRESS .....

PW 211633

ECKERSLEY EXPLAINS-

Experimenting for a hobby is our Chief Radio Consultant's subject this week. He comments on the fact that quite useful work can be done with comparatively simple apparatus. In his own words, "while you may never discover anything which will make your fortune, you will in any case have a grand time."

"THE ordinary man—we have to face it—is an anarchist. He wants to do as he likes. This anarchism has been at work since the beginnings of civilisation."

So says Mr. Bernard Shaw, and it is none the less true for that.

I do not intend to discuss anarchy, its value as a stimulant or its nuisance to the community. I open in this way to show you that you can indulge your desire to do what you like, to be free within certain limits, without hurting anyone else, if you will take up experimental work. Whatever the limitations of its scope, experimental work is the greatest of all employments, because it leaves one and one's imagination free to do what it likes, but nevertheless disciplines it in terms of the results achieved.

Good Work with Make-Shifts.

People keep coming to me with ideas. They are frequently more imaginative than sound, more ingenious than factual. I say my piece—I hope not discouragingly—but I have to tell the truth as I see it; and then, if the recipient of my opinions is still sceptical, I say: "Go and try it."

He replies: "How can I?" Well! There are limits, but a tremendous amount of good work has been done with plasticine, string, cardboard, sealing wax, wire and a few "good-enough" instruments adapted ingeniously to the accuracy required.

The joy of experimental work can be severally classified, as: (1) it employs the hands in making things; (2) it employs the mind in devising things; (3) if ever it yields results you may be sure that you have succeeded. Your opponents' inviolable laws never let you get away with an untruth.

Big Expenditure Unnecessary.

You may reply: "Oh, yes, I know it's all very well for you; your laboratory is stacked with every kind of instrument you ever need; but think of me—I cannot go out and just order Moulin voltmeters and test sets and resistances and—oh, everything."

I am not so silly as to suggest that one can, at once, set up a laboratory without the expenditure of any money; but I do suggest that you need not spend a great amount for a given receipt of pleasure if you set about things properly.

I am in the midst of a research at the present moment. I have used only four instruments, as: two types of valve voltmeter, a thermo milliammeter and a test set. I could have used one valve voltmeter and the thermo milliammeter was very, very useful, but nevertheless a bit of luxury which saved a lot of time.

If I were setting up a laboratory on my own, and I had, as indeed is true, very little money to spend, I would first and foremostly buy a test set, one which told me D.C. amps. and volts over a wide range. I should try to get it second hand, but if I couldn't, and if it was too expensive, I should realise that all I really wanted was a sensitive milliammeter for nearly all my work.

Making a Voltmeter.

If you will remember that voltage equals current times resistance you have made a voltmeter. Suppose you want a voltmeter 0–8 volts for L.T. and 0–200 volts for H.T. You have a milliammeter reading, say, 0·5 milliamperes. Thus, with 8 volts through a resistance of 1,600 ohms, you get 5 milliamps. So your milliammeter, connected through a resistance of 1,600 ohms, is a voltmeter. Connected through 10,000 ohms it is a voltmeter to 200 volts.

How to measure ohms? Well, you might start by assuming that a low-tension accumulator half discharged gives exactly 2 volts. Then apply your laws. So build up. Don't want everything at once. Make up valve voltmeters by putting negative on the grid of a valve like an A.C./H.L.2. But it's the spirit I want to get over; if anyone wants it I should be delighted to give further advice on how to measure quantities.

"Science is Measurement."

It *is* so difficult answering questions without data given. "Oh, doctor, I feel so ill; what is the matter with me?" Suppose one had to write a reply to that and explain what was wrong! At least the indication of a pain somewhere would help the poor doctor. He might even give a correct diagnosis if the sufferer had observed things such as temperature, pulse and so on: if he had, in fact, presented the results of simple measurements.

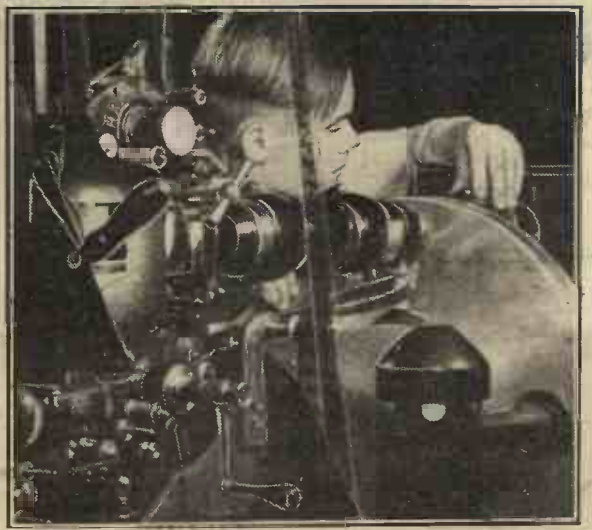
But there's no question about your being ill. Nor anarchistic against the community. Nor vastly out of pocket. Nor an offence to your neighbours. On the contrary, if you take up this hobby, while you may never discover anything which will make your fortune, you will in any case have a grand time.

* * *

All the time new ideas are pouring out of people's brains. These ideas come because people are experimenting. On its lowest terms, if you set up a little laboratory, you will appreciate better what is going on; on its highest you will become one of those who will be allowed to work (or, I feel, play is a much better word) in a well-equipped laboratory and give to the world something of worth and consequence.

POPULAR WIRELESS and "Modern Wireless" and the rest are all the time working for you, turning out new sets for you to make. You will be helping them to help you if you will take up a study of the technique. But no study is complete or even worth while unless you have means to do practical experiments.

GERMAN TELEVISION EXPERIMENTS

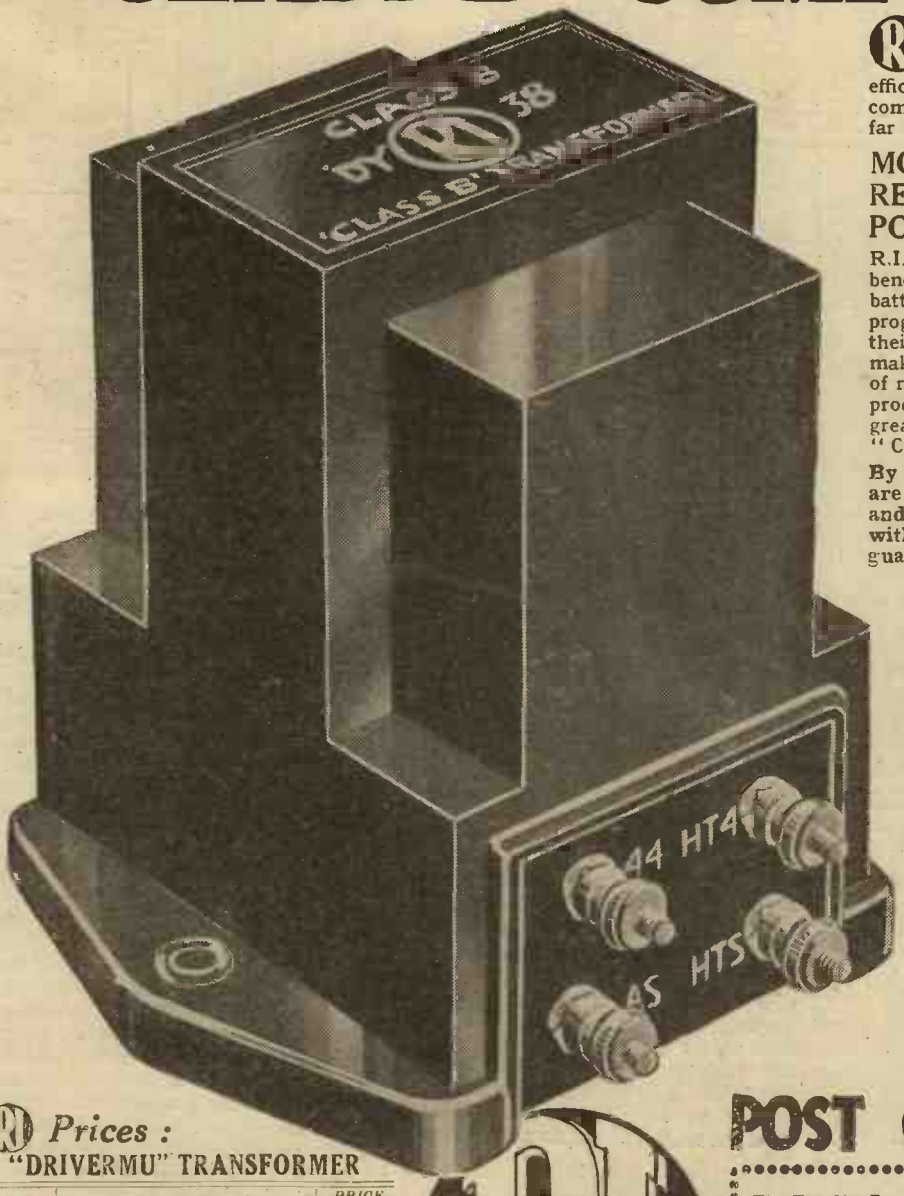


In Germany television is going ahead by leaps and bounds, and this photograph shows an experimental film transmitter. It is possible, for the principles involved in an advanced system of this nature, to originate in the home laboratory of an amateur.

SPECIFIED FOR ALL GOOD 'CLASS B' CIRCUITS INCLUDING THE S.T. 500.....

DRIVERMU

'CLASS B' COMPONENTS



R.I. as the foremost designers and producers of transformers and chokes in this country, have set the standard of efficiency in "Class B" with their "Drivermu" components, which are universally acknowledged far and away the

MOST EFFICIENT AND MOST RELIABLE "CLASS B" COMPONENTS—AT ANY PRICE

R.I. have done most to make the remarkable benefits of "Class B" attainable by every battery set user. They have introduced the most progressive developments in the system, and by their collaboration with the "Class B" valve makers in the first instance, and the vast amount of research work that resulted, have succeeded in producing the components that give, to the greatest extent, the performance for which "Class B" was evolved.

By installing "Drivermu" components you are sure of greatest power, superior quality and absolute freedom from distortion, together with utmost economy in H.T. They are guaranteed to give—

THE FULLEST ADVANTAGES OF AN ALL-MAINS SET USING AN ORDINARY H.T. BATTERY ONLY

CONVERT YOUR EXISTING SET INTO "CLASS B"

The R.I. 'Class B' Booklet Will Show You How

This brochure tells you all about "Class B" in the simplest possible language, and enables even the most inexperienced constructor to understand exactly what he is doing with "Class B." It shows you at a glance what combinations of valves, transformers and chokes are needed for every desired output. The diagrams are easily understood and apply to the conversion of old and to construction of new sets. Ask your dealer for a copy or

POST COUPON TODAY

To Radio Instruments Ltd. Croydon, Surrey

Please send me your "Drivermu" Brochure Free and Post Free. Also your Broadsheet of Components.

Name .....

Address .....

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(Enclose in ½d. stamped unsealed envelope). P.W.

Prices :

"DRIVERMU" TRANSFORMER

List No.	*RATIOS*		*PRICE Royalty 1/6 extra*
	Total	*Per Secondary*	
DY37	1 : 1 and 1·5 : 1	2 : 1 and 3 : 1	15/-
DY38	2 : 1 and 2·5 : 1	4 : 1 and 5 : 1	15/-
DY39	1 : 1	2 : 1	11/-
DY41	2 : 1	4 : 1	11/-
DY42	1·5 : 1	3 : 1	11/-
DY43	2 : 1 and 1·6 : 1	4 : 1 and 3·2 : 1	15/-

R.I. "CLASS B" CHOKE *No. DY 40 Ratios 1:1, 1·2 : 1, 1·5 : 1, and 1·8 : 1. Over 90% efficiency* **12/6**

R.I. LTD

SHORT-WAVE NOTES

BY W. L. S.

All the interesting news and views of current short-wave practice.

WHO says that activity in the 5-metre sphere is not causing interest? A few days ago I was parading the streets with my car in the vicinity of my native town, complete with 5-metre transmitter and receiver, with aerial à la "fish-pole." Four hours later an enterprising (and unknown) gentleman removed the car to some spot so remote that neither I nor the police have seen it since. But the 5-metre gear wasn't there!

The result is that, just at present, I am burdened with a very nice lot of gear suitable for use in a car, but have no car to use it in! And if I ever find that man!

I am asked, by the way, to announce that G 6 K A and G 5 N C are carrying out telephony transmissions nightly on 5 metres. G 6 K A transmits from 23.00 to 23.30 G.M.T., and G 5 N C from 23.30 to midnight. Reports are particularly wanted. Please forward them, in the case of G 6 K A, to R. S. G. B., 53, Victoria Street, S.W.1, and in the case of G 5 N C to his own address—H. Osborne, 77, Barrett Road, Walthamstow, E.17.

Has any other reader heard the station reported by C. F. W. (Hove)? This is New Brunswick, Canada, transmitting experimentally on about 46 metres. I find all the 45–50-metre stations coming in extremely well lately. Incidentally, I am old-fashioned (and observant) enough to believe that local fog *does* affect short-wave reception. I don't think any other purely local weather condition has any effect, but I invariably find short-wave stations above the average level on a foggy night.

Agreements, contradictions or brickbats on the above statement will be cordially welcomed.

Single-Valve Work.

My one and only single-valver has left my bench for the present. I have not deposed it by a brighter and better set, but have simply sent it to a friend who has never before tasted the joys of single-valve short-wave work. Perhaps I shall be able to get him to write his experiences with it for the benefit of my readers.

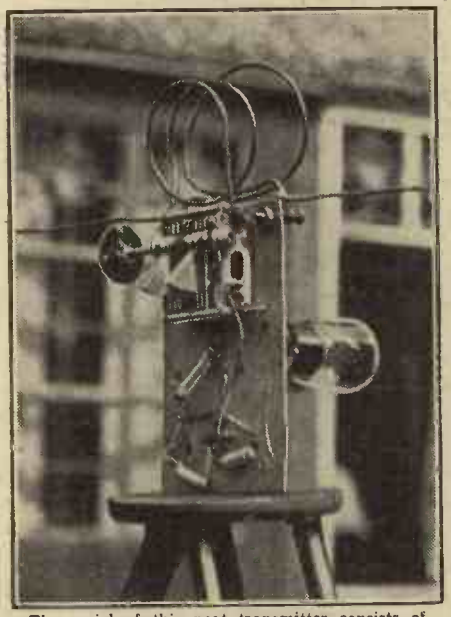
For three whole days I have been without a short-wave receiver of any kind. I have been re-building the whole of my station, and the transmitter, being the biggest job, had to come first. The result is that, pro tem., I am equipped with quite a nice transmitter but no receiver whatever.

The new receiver is going to *contain* two valves, but I shrewdly suspect that only one will be in use most of the time. It is being built in an iron box, as I want to do rather more in the way of screening than I have attempted before.

The circuit will consist of a screen-grid detector, resistance or choke-coupled to an output triode. Provision will be made for coupling the detector to the headphones through a specially wound transformer. I have great hopes of this scheme, because an S.G. detector certainly does gain over a triode in the matter of efficiency.

I have just built a single-valve broadcast receiver, which feeds into my "standard" L.F. amplifier-cum-radiogram-cum-modulator. Nothing like making these L.F. stages work overtime!

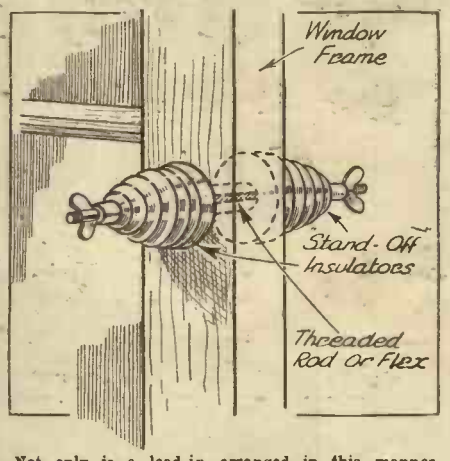
FOR FIVE METRES



The aerial of this neat transmitter consists of rods about four feet long projecting from either side of the coils. The apparatus is mounted on a tripod to facilitate tests on directional effects.

AN EFFICIENT LEAD-IN

WHERE something more efficient than the ordinary small lead-in tube is wanted it is a good plan to drill a hole of about ½-inch diameter in the window frame and to mount on either side of it a small "stand-off" insulator. The screws in the tops of the two insulators are connected by a stout piece of insulated flex, or they may be removed and a single length of 2 B. A. threaded rod used.



Not only is a lead-in arranged in this manner electrically good, but it is very pleasing in appearance.

BLOCK BATTERIES SUCCESS

IF any firm deserves success it is Block Batteries, Limited. At the 1933 radio exhibitions wireless enthusiasts were delighted to see that the problem of H.T. accumulator design had been tackled in a big way by the provision of the new Block plate-less accumulator. The response which constructors made to this bold challenge, a response which has necessitated a complete revision of the Block Company's plans, is due entirely to the hard work and complete confidence of this new firm.

Twelve months ago Block accumulators were an unknown quantity as far as the public was concerned. Last month the Mayor of Barking pressed a switch which set in motion the machinery and summoned the employees of a fine new factory devoted entirely to the manufacture of Block accumulators. This is triumph indeed for a new firm entering upon life at a time when so many firms are feeling the effects of trade depression.

Block Batteries undoubtedly fill a pressing need. The new factory is thoroughly equipped in every way to cope with the volume of business which has been created over the last few months.

The Mayor of Barking suggested, in his speech opening the new factory, that his successors would probably be called upon regularly each year to open the latest extension to Block Batteries works. If this is so, then to Mr. Sudlow, managing director of the firm, will be due most of the credit.

THE "CHRONICLE WIRELESS ANNUAL"

THE excellent work done for radio by the "Manchester Evening Chronicle" was most clearly demonstrated during the Northern Radio Exhibition which finished last week.

And not the least excellent part of this work is the issue every year of the "Chronicle Wireless Annual," the eleventh issue of which is now on sale at the price of 1s. Almost 200 pages, packed with information of all kinds, comprise this new edition, which contains, in addition to technical articles written by leading research engineers in the radio trade, full details and diagrams for building more than a dozen complete receivers and units. These range from a home-made trickle charger and a Class B adaptor to a six-valve superhet and a Class B radiogram.

The general articles include discussions on aerials, interference, quality, television, batteries and short-wave work, while one of the most useful features is a complete list of the principal European broadcasters, with the new wavelengths which come into force next year.

The "Chronicle Wireless Annual" is, without any doubt, the best manual of its kind, and constructors who expend a shilling on its purchase will get their money's worth over and over again.

P. C.

S.T. 500 DE LUXE KIT

£5.12.6

"ACE" De Luxe Specification

		£	s.	d.
2	Colvern S.T.500 matched coils		8	0
*2	J.B. NEW TYPE STRAIGHT LINE SLOW-MOTION DIALS WITH ILLUMINATED SHADOW-TUNING DEVICE		15	0
*2	POLAR No. 4 LOG AIR-SPACED TUNING CONDENSERS, ·0005-mfd.		8	0
3	Graham Farish "Litlos" bakelite log-midline condensers, ·0005-mfd.		6	0
1	Graham Farish "Litlos" differential condenser, ·0001-mfd.		2	0
1	Polar differential condenser, ·0005-mfd.		3	0
2	J.B. baseboard condensers, ·0001 and ·00005-mfd.		2	0
1	Wearite "BJ" Class B transformer for B21 valve		8	6
*1	R.I. SPECIAL "NEW HYPERMU" TRANSFORMER		15	6
1	Graham Farish binocular screened H.F. choke		4	6
2	W.B. 4-pin valve holders		1	0
1	W.B. universal S.G. valve holder		1	0
1	Graham Farish 7-pin Class B valve holder		1	3
1	Wearite HFPJ screened midget reaction H.F. choke		2	0
1	Erie 1-meg. grid leak		1	0
2	Erie 5,000-ohms resistances		2	0
2	Erie 10,000-ohms resistances		2	0
1	Erie 250-ohms resistance		1	0
1	Dubilier fixed condenser, type BS, 2-mfd.		2	6
2	Dubilier fixed condensers, type BS, 1-mfd.		4	0
2	Dubilier fixed condensers, tubular type, ·005-mfd.		2	6
1	Dubilier fixed condenser, tubular type, ·0005-mfd.		1	0
1	Dubilier fixed condenser, type 665 mica, ·00005-mfd.			6
*2	BULGIN TOGGLE TYPE WAVE-CHANGE SWITCHES		2	6
1	Bulgin toggle type on/off switch		1	3
1	"ACE" S.T.500 baseboard with foil		1	0
1	"ACE" S.T.500 aluminium screen		1	6
*1	"ACE" S.T.500 WALNUT PANEL, DRILLED TO SPECIFICATION		5	6
1	"ACE" S.T.500 terminal strip, drilled to specification		1	0
1	S.T.500 set of Belling-Lee terminals, battery plugs and anode connector		3	6
*2	SPARE J.B. CONDENSER KNOBS FOR MATCHING UP PANEL		1	0
	Wire, flex, screws, etc.			11
	S.T.500 blueprint and constructional details		Gratis	
1	Bracket for ·0005 condenser			3
	"ACE" S.T.500 DE LUXE KIT "A"	£5	12	6
4	B.V.A. valves to specification	£2	5	3
	"ACE" S.T.500 DE LUXE KIT "B"	£7	17	9

NOTE.—A Class B output choke is **NOT REQUIRED** with the "ACE" S.T.500 DE LUXE kit if used with a **Class B moving-coil speaker.** A Wearite "B Mag" Class B output matching choke, price **11/-**, should be ordered in addition if any other type of speaker is used.

KIT "A" £5.12.6

KIT "B" £7.17.9

NOTE THESE SPECIAL FEATURES UNIQUE TO THE "ACE" DE LUXE S.T.500 KIT.

*1. Modern type straight line illuminated tuning dials as used in all the latest models of manufactured receivers, giving simplified tuning combined with tasteful appearance.
*2. All panel knobs match the walnut panel.
*3. Super efficient type L.F. transformer for punch and real quality of reproduction.
*4. Latest type low-loss bakelite log condensers.
*5. Toggle switches used throughout to give perfect symmetry of panel layout.
*6. No extra wiring required; simply follow the blueprint.

Trade Supplied—Usual Discounts.

A FREE GIFT AND A STRAIGHT GUARANTEE ON A STRAIGHT SET

Donald P. Marcus, Managing Director of Messrs. Marcus, Overton Radio, Ltd., and originator of the popular S.T.400 and S.T.500 DE LUXE Kits, says:—

I PERSONALLY GUARANTEE . . .

"ACE" DESPATCH. All orders despatched by return post from stock. No annoying delays.

"ACE" QUALITY. Every "ACE" kit is exact to specification given. No substitutions. Study carefully the "ACE" Standard and De Luxe Kits. Every component made by world-famous British manufacturers, and especially chosen for performance and efficiency regardless of price.

"ACE" PERFORMANCE. Every S.T.500 constructed from an "ACE" Kit will give results equal to those obtained by Mr. John Scott-Taggart himself. The De Luxe S.T.500 is absolutely unbeatable for wonderful tone, punch and selectivity.

"ACE" SERVICE. I shall not consider your purchase completed unless your "ACE" S.T.500 gives these results. If you have the slightest cause for complaint when you have built and tried out your "ACE" S.T.500, my **SERVICE DEPARTMENT will put it right free of charge.**

"ACE" FREE GIFT. Every cash purchaser of a complete "ACE" S.T.500 Kit is presented with a "RIGI" S.T.500 constructor's combination tool, value 3/9, free of charge.

"ACE" S.T.500 CONVERSION KIT

containing all necessary components for converting S.T.400 to S.T.500 **35/-**

OR including "Class B" Valve **49/-**

DEMONSTRATIONS The S.T.500 will be demonstated at the offices of Messrs. Marcus, Overton Radio Limited, 62, Borough High Street, London Bridge, S.E.1.

ONE MINUTE FROM LONDON BRIDGE STATION

MARCUS OVERTON

62 Borough High St., London Bridge, S.E.1

To MARCUS, OVERTON RADIO LTD., 62, Borough High St., London Bridge, S.E.1.

Please supply immediately :

"ACE" S.T.500 Standard Kit.....

"ACE" S.T.500 DE LUXE Kit.....

"ACE" S.T.500 CONVERSION KIT.....

for which I enclose £.....

NAME.....

ADDRESS.....

Block letters, please. Cross out Kit not required.

P.W., 21/10/33.

"ACE" Standard Specification

		£	s.	d.
2	Colvern S.T.500 coils		8	0
2	Polar No. 2 slow-motion condensers		13	0
3	Graham Farish "Litlos" ·0005 log midline condensers		6	0
1	Graham Farish "Litlos" ·0001 differential condenser		2	0
1	Graham Farish "Litlos" ·0003 differential condenser		2	0
2	J.B. baseboard pre-set condensers, ·0001 and ·00005-mfd.		2	0
1	Wearite BJ Class B driver transformer for B.21 valve		8	6
1	R.I. L.F. transformer, type DY.33		7	0
1	Graham Farish binocular screened H.F. choke		4	6
2	W.B. 4-pin valve holders		1	0
1	W.B. S.G. valve holder		1	0
1	Graham Farish 7-pin valve holder		1	3
1	Wearite HFPJ screened midget reaction H.F. choke		2	0
1	Erie 1-meg. grid leak		1	0
2	Erie 5,000-ohms resistances		2	0
2	Erie 10,000-ohms resistances		2	0
1	Erie 250-ohms resistance		1	0
1	Dubilier fixed condenser, 2-mfd., type BS		2	6
2	Dubilier fixed condensers, 1-mfd., type BS		4	0
2	Dubilier fixed condensers, ·005-mfd., tubular type		2	6
1	Dubilier fixed condenser, ·0005-mfd., tubular type		1	0
1	Dubilier fixed condenser, ·00005-mfd., type 665 mica			6
2	W.B. 2-point push-pull switches		1	6
1	Bulgin toggle type on-off switch		1	3
1	S.T.500 baseboard with foil		1	0
1	S.T.500 aluminium screen		1	6
1	S.T.500 ebonite panel, drilled to specification		3	0
1	S.T.500 ebonite terminal strip, drilled to specification		1	0
1	Set of Belling-Lee terminals, battery plugs and anode connector		3	6
	Wire, flex, screws, etc.			9
	S.T.500 blueprint and constructional details		Gratis	
1	Bracket for ·0005 condenser			3
	KIT "A"	**£4**	**7**	**6**
4	B.V.A. valves to specification	£2	5	3
	KIT "B"	**£6**	**12**	**9**

NOTE.—A Class B output choke is **NOT REQUIRED** with the "ACE" S.T.500 kit if used with a **Class B moving-coil speaker.**
A Wearite "B Mag" matching choke, price 11/-, should be ordered in addition if any other type of speaker is used.

KIT "A" £4.7.6

KIT "B" £6.12.9

S.T.500 ACCESSORIES

	£	s.	d.
Ever Ready 120-volt Winner H.T. Battery		11	0
Ever Ready 120-volt Popular type H.T. battery		15	6
Ever Ready 9-volt grid bias battery		1	0
Block plateless L.T. accumulator, 80 amp./hrs.		11	6
Block plateless 120-volt wet H.T. accumulator	3	15	0
M.P.R. H.T. eliminator for A.C. mains	2	10	0
M.P.R. H.T. eliminator for D.C. mains	1	10	0
W.B. Microlode moving-coil speaker, type PM4A	2	2	0
Bluespot 99PM moving-coil speaker	2	19	6
Bluespot new model 33 pick-up with self-contained volume control	1	15	0
Belling-Lee unit pick-up with self-contained volume control, model C	1	15	0
Garrard No. 30 double spring gramophone turntable	1	5	0
"ACE" standard table model cabinet		17	6
"ACE" De Luxe model table cabinet in solid oak	1	15	0
"ACE" Standard consolette cabinet, upright or horizontal type	1	10	0
"ACE" De Luxe consolette cabinet in solid oak with beautiful antique finish	2	2	0

S.T. 500 STANDARD KIT

£4.7.6

Trade Supplied—Usual Discounts.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but 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 Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

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 reception. 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 specialties described may be the subjects 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

ADDING A HIGH-FREQUENCY AMPLIFIER UNIT.

J. J. (Whitby, Yorks.).—"My old detector-and-L.F. is very good indeed on quality, and ropes in the Continental stations wonderfully for two valves. I suppose I ought to be satisfied, but I have an idea that I should like to hot it up with one more valve as high-frequency amplifier.

"So far I have looked in vain for a high-frequency amplifier unit that is specially recommended for such a set. Have you recently given details of a suitable design, in small cabinet, to stand between set and aerial, using same H.T. and L.T. ?

"I think H.F. instead of extra L.F. amplification is required, because there is plenty of volume at present for a smallish house. In fact, I suppose I should only need the extra stage in when receiving from distant stations, which at present are of insufficient strength to be enjoyable.

"I should like your frank opinion as to whether it is worth incurring the extra expense just for an amplifier or whether it would be better to build a new set altogether."

In our opinion, your best plan would be to build a new three-valver—S.G., detector and L.F.—incorporating as many of your components as possible. (This should be a large proportion of them.)

Although you might, instead, fit an H.F. amplifier as suggested, we have not described such a unit recently, and we feel that whilst you are about it there are more advantages in complete rebuilding.

An up-to-date three-valver set will revolutionise your ideas of good reception and give you a variety of entertainment incomparably better than your present outfit is capable of providing.

To modernise just the H.F. end, in unit form, would doubtless effect a big improvement on the present results, but it would cost very little more to "go the whole hog" and completely rebuild. This would be much neater and more efficient, and we are sure that the improved appearance and reception would make you feel you had done the right thing.

H.T. FROM D.C. MAINS FOR A SHORT-WAVE SET.

P. D. (Liverpool).—"Having found H.T. from the direct-current mains much more to my liking than batteries for ordinary wavelengths, I am surprised that it is regarded with suspicion for short-wave reception with 'phones.

"Is there any danger from the tingling ears one may get when the 'phone band touches them ? And could it not be overcome by a filter-choke arrangement ?"

(*Continued on page* 306.)

"P.W." PANELS, No. 140.—OSLO.

Norway's famous long-waver works on 1083 metres, with a power of 60 kilowatts. It is generally well received in this country, though subject to weak periods.

* * *

Oslo opens with the call "Hallo ! Hallo ! Oslo her" and closes down with "Godnat" (Good-night), themes from the Norwegian National Anthem being used as opening and closing airs.

* * *

Distance from London, 715 miles. Man announcer.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 304.)

All cases of "live" loudspeakers or 'phones due to D.C. mains H.T. can easily be overcome by proper circuit arrangements. Such tingling should not be tolerated either from 'phones, tuning controls, metal panel or loudspeaker, because, though not actually dangerous in itself, it shows that the set does not comply with the I.E.E. regulations regarding safe installation.

It is therefore not because the mains H.T. is *unsafe* that one often sees the batteries preferred. The objection is generally on the grounds that battery H.T. can be *perfectly* silent, whilst there is often some difficulty in getting the very last trace of hum removed from an H.T. mains supply.

Even the smallest residual murmur, which would not be noticeable on ordinary wavelengths, is a nuisance when very long-range reception is attempted upon short waves, so batteries and a perfectly silent background are often preferable to the provision of extra smoothing for a mains unit H.T. supply.

ADAPTING H.T. MAINS UNIT FOR POTENTIOMETER-FED S.G. TAPPING.

A. C. (Leeds).—"On the new set is an H.T.+1 terminal which needs 75 volts for the S.G. tapping. There is no 75-volt plug on the mains unit.

"As the unit will supply up to 25 milliamps and the set will take less than 20, I could get the H.T. from it if it had the tapping arranged for. H.T.+4 on the mains unit gives 150 volts, and it was suggested that I could cut this down with resistances to give 75 volts.

"Please say, if this is O.K., what value the resistances must be and exactly how to connect to set. There is no room for extra wiring, etc., inside the set, but there is ample space outside the terminal board, where the wires from the unit below (in small compartment) come through.

"A final point. I suppose I should have said 'potentiometer' instead of 'resistance,' because it says 'it is essential that H.T.+1 should be fed from a separate S.G. tapping (potentiometer type) on the eliminator'."

You can arrange two ordinary fixed resistances to give a potentiometer-feed effect as follows:

Connect one end of one resistance to the H.T.+4 terminal on the set. Join the other end of this resistance to the H.T.+1 terminal.

Also connect one end of the second resistance to the set's H.T.+1 terminal. Its remaining terminal goes to the set's H.T. negative terminal.

When these resistances have been added there is no need for any other H.T. lead to the H.T.+1 terminal, as the connection is made through the resistances.

You will require two resistances of equal value, and this can be either 25,000 or 30,000 ohms. The resistances should be of the type rated to carry 3 or 4 milliamps safely, so don't use cheap spaghettis.

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its 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 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 by 'phone or in person at Fleetway House or Tallis House.

ADDING DECOUPLING.

H. T. F. (Swindon, Wilts.).—"At present H.T.+2 terminal goes to the H.T.+ on L.F. transformer, and H.T.+3 goes to the L.S.+. "How can I put in decoupling?"

A resistance of about 25,000 ohms should be joined between the H.T.+ terminal of the transformer and the H.T.+2 terminal, the wire which formerly joined these points being removed, of course. A 2-mfd. condenser must also be joined up, one terminal to H.T.+ of the transformer and the other terminal to H.T.−.

THE EFFECT OF A GRID RESISTANCE UPON THE BIAS VOLTAGE.

F. K. (Bournemouth).—"To get rid of the distortion it is suggested that I need a resistance wired between the grid terminal and the grid wiring, which has proved successful in a similar case I know of. But I am afraid of doing that, because in my case there is a 600-ohm resistance between cathode and transformer to provide grid bias.

"Surely if I put in another resistance I shall get more grid bias than I want, and that in turn will ruin quality quite as much or more than at present.

"I am itching to try it, but will not do so unless you say it is O.K."

Try it, by all means, as the effect you fear is an imaginary one.

Your 600-ohm resistance has a grid-biasing voltage developed across it *because it is in the anode current circuit*, where a comparatively large current is flowing all the time the set is in action.

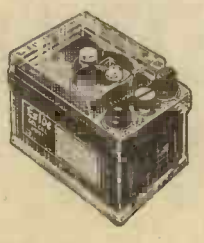
The added resistance would be in the *grid* circuit, and under ordinary (Class A) amplifying conditions there is virtually no current whatever in this circuit. Voltage is proportional to the product of resistance and current, so you will see that there will be no voltage developed if there is no current flowing.

"MODERNISING 'THE COMET.'"

"Comet" owners who read the "Modernising" article in our October 7th issue may have noticed that the aerial coil shown in the diagram on page 160 appears to have its "E." and "R.E." terminals reversed. As they are connected together via the earth terminal, this does not matter in the least, but on the actual coil unit "E." will be the upper terminal, and vice versa.

The Navy's Wireless Battery!

The Battery chosen by the Senior Service, and relied on in 9 out of 10 British ships, is the Battery that you, too, should have, to bring to your own fireside the pleasures of perfect radio.



Exide

BATTERIES

EXIDE UNSPILLABLE BATTERIES

There is an Exide Unspillable L.T. Battery, in both free acid and jelly acid types, to suit every portable set. Prices from 5/-

For Wireless H.T. get Drydex—the dry battery by Exide

Obtainable from Exide Service Stations and all reputable dealers. Exide Batteries, Exide Works, Clifton Junction, near Manchester. Branches: London, Manchester, Birmingham, Bristol, Glasgow, Dublin and Belfast

R 39

S.T.500
BEFORE YOU BUILD—
READ THIS FIRST

I WANT to warn you! Some constructors refuse to leave the burden of responsibility on the shoulders of the designer. They want to redesign the set to suit their purse, their ideas, their cabinet, their existing components, and the opinion of the "man at the shop." I implore *you* not to do so.

There is nothing specially critical in the set, but unless *you* are prepared to accept full responsibility I advise you to keep to my component list; I prefer you to build a duplicate of my own set, but realise that this is an ideal.

Use the Specified Parts.

Alternative components are given and are often as good as the original, but avoid doubtful apparatus which has not been personally tested by myself. On every big set I have designed, scores of unscrupulous dealers have fobbed off totally unsuitable components, valves or accessories on to their innocent dupes.

The usual reason given is that the parts are "difficult to get," unobtainable, out of stock, etc. If you swallow this yarn I cannot be responsible for the results. If you are tempted by price considerations, the fault is wholly yours.

I ask you to check your proposed choice against my own list of components in this article and to trust to my judgment. Remember that every "S.T.500" kit does not necessarily include even the alternative components in my list; there is a real danger here, and the responsibility for substitution becomes the manufacturer's and not mine.

The components which are most important are the transformers, the S.G. choke, the coils (if you only knew what trouble unapproved coils have given!), the resistors and condensers. I honestly think you will regret false economy in these cases.

Note not to buy an output choke if you propose—an extremely excellent plan—to invest in a Class B moving-coil speaker. Models are made by most firms, but I strongly advise you to choose by hearing. There are some shocking cheap moving-coil speakers. Buy the best model you can afford from my list of manufacturers.

You save at least 8s. 6d. on the set if you buy a speaker which has additional terminals for Class B.

Class B and Driver Valves.

The "S.T.500" uses B21 and LP2 valves for Class B and driver. The B21 differs from other Class B valves, but if you use a different ratio transformer and no bias on the grids and use the right driver other Class B valves could be used. The set is, however, designed primarily for the B21.

The "S.T.500" anode coil is identical to the "S.T.300" and "S.T.400" anode coils. The "S.T.500" aerial coil is the same as the "S.T.400" aerial coil. It consists of the "S.T.300" aerial coil with a reaction winding added. You can wind it yourself (I will tell you how, next week) or you can buy the "S.T.400" aerial coil only.

I have no objection to you trying your existing components in the set. But, unless you are careful, you may use the wrong values, etc. Of existing components I am most suspicious of grid leaks, presets, spaghettis and the L.F. transformer. All these are liable to be faulty, except for the transformer, which I list as doubtful because it *may* be of inferior make. I now use open presets exclusively and firmly discourage others.

Look to Your Earth.

See that your earth is as good as possible. Don't take it on trust. Go and look at it. If you intend to use the "S.T.500" for radiogram purposes (it is ideal for records) buy a Wearite I23 switch, instead of the toggle. More details later. On general grounds buy a double- or triple-capacity H.T. battery. The "S.T.500" will use the current extremely economically. The S.G. and detector valves may be metallised, but this is not essential.

(*Continued on page* 310.)

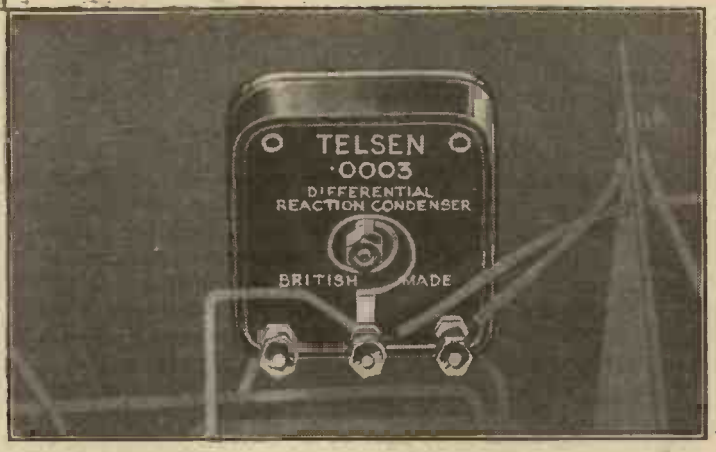
TELSEN
DIFFERENTIAL CONDENSER

Specified by Mr. JOHN SCOTT-TAGGART

for the P.W.

"S.T. 500"

Illustration below shows the position occupied by the new Telsen Differential Condenser in the built-up S.T.500.



MR. JOHN SCOTT-TAGGART'S choice of the new Telsen Differential Condenser is an eloquent tribute to its lasting efficiency. Any possibility of deviation from the stated capacity is prevented by the entire elimination of end-play (positive contact being made by a flexible pig-tail) the effective life of the component being enormously increased, and the occurrence of 'rustling' noises due to grit being prevented, by the dust-proof bakelite case which now encloses the entire unit. Yet, in spite of these valuable improvements, there has been no increase in price

2/-

(Capacities ·0003, ·00015, ·0001)

TELSEN COVER EVERY CONDENSER REQUIREMENT

TELSEN TRIPLE GANG CONDENSER 17/6	TELSEN CONDENSER UNIT 7/6	TELSEN TWIN GANG CONDENSER 12/6	TELSEN VARIABLE CONDENSER 2/6 & 3/6	TELSEN TUNING CONDENSER 2/-	TELSEN AERIAL SERIES CONDENSER 2/-	TELSEN REACTION CONDENSER 1/9 & 2/-

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

S.T.500: BEFORE YOU BUILD

(*Continued from page 308.*)

A last word: please do not use in the "S.T.500" a suspected component which may have caused your last set to fail. It is almost unnecessary to add that L.T. and H.T. should be O.K. and your valves in first-rate order. Nearly all the notes here given apply to every design for the constructor. Forgive me if I have been rather dogmatic.

J. S.-T.

SOME TIPS FOR CONSTRUCTORS

Efficient Control—Good Joints—Using a Fuse—Making Speaker Frets.

REACTION ON THE SHORT WAVES.

A SHORT-WAVE set depends entirely on the smoothness of its reaction control for its efficiency. If the reaction is at all "ploppy" it is impossible to receive any but the strongest of stations. Consequently it is essential to find some cure for this trouble if the set is to give of its best.

It is generally advised to adjust the high tension voltage on the detector valve to obtain the best results, but this does not always put matters right. There is a very simple thing to try, and that is to increase the value of the grid leak to about 5 megohms. This usually makes a vast difference to the smoothness of the reaction. A. S.

A WOODWORK HINT.

TO ensure stability in woodwork the craftsman usually fixes the joints and corners with glue, in addition to screws, but to make a firm joint it must be remembered that the wood requires a certain amount of attention before applying the glue.

Actually, if the fixing is carried out in a cold workshop the glue is liable to become hard and lose its adhesive property before the joints are firmly in position. With this in mind it is advisable slightly to warm the pieces of wood before the glue is applied, although if this is done by means of a fire great care should be taken not to overheat, otherwise splitting is possible. A. W. Y.

COMPLETE FUSE PROTECTION.

A FUSE in the H.T. negative lead provides a fair degree of safety for the valves in the set if a wrong connection is made, and also for the H.T. battery if a short circuit occurs. The best position for this fuse is as close to the negative socket of the H.T. battery as possible, and consequently one of the wander-plugs with incorporated fuse is ideal.

But where two or more H.T. positive taps are employed it is not impossible for trouble to arise from the section of the H.T. battery between two of these, particularly if experiments in varying the circuit are tried.

Complete protection is provided by using one of the wander-fuses for each positive tap as well as for the negative. But as these wander-fuses are usually marked negative, care should be taken to remark them. A. S. C.

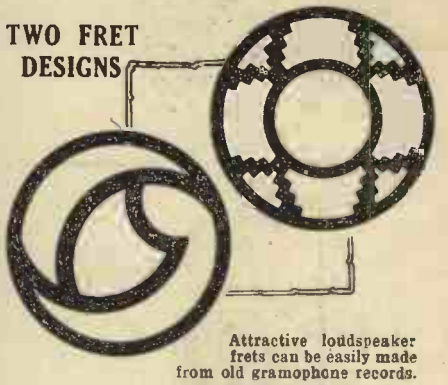
A NEW USE FOR OLD RECORDS.

THERE are many uses for old gramophone records in the constructor's workshop, as you have probably found out. One will come in useful, for instance, as a loudspeaker fret. Two simple designs are shown.

Almost needless to say, a black fret will tone in contrast with any cabinet colour. And it is surprising how effective the groove markings make a fret look.

On one of the most beautiful frets of this kind I have seen the grooves were filled up with various blending shades of brown sealing wax to match a walnut cabinet.

W. W.



Attractive loudspeaker frets can be easily made from old gramophone records.

Heres how...

. . . to make a real success of your S.T.500

Make your S.T.500 the success it was meant to be. A set that will be a credit both to yourself and the designer.

Amplion components are reliable and low in cost. Choose your parts from the range given here and you won't be disappointed.

Compare prices and you'll find that in addition to quality, Amplion also means Economy.

The Amplion S.T.500 matched coils, illustrated have been specially designed for this circuit and are fully tested. Illustrated is a choice of 3 speakers each provided with a universal transformer for correct matching to your valve.

Amplion "Audiola" 9" Cone. Price 49/6

Amplion "M.C.22" 7" Cone. Price 39/6

Amplion "Sonette" 5¼" Cone. Price 27/6

Amplion "B" driver transformer in a choice of 3 ratios—1 : 1, 1·5 : 1 and 2 : 1. Price 9/6. The Output Choke is available in a choice of ratios—1 : 1, 1·5 : 1, and 3 : 1—suitable for matching all valves to existing loud-speakers. Price 9/6. Amplion Screened Choke with special earthing terminal to prevent interaction. Price 3/6.

Amplion S.T.500 Matched Coils Price 8/- the pair

AMPLION

AMPLION (1932) LTD., 82/84, Rosoman Street, E.C.1.

THE LISTENER'S NOTEBOOK

(Continued from page 296.)

I would like to have every Saturday evening a special bulletin for football results given at the earliest possible moment after they are available. After all, football is our national winter game, claiming thousands of devotees.

* * *

I haven't lost interest in the "Anywhere for a News Story" yarns yet. On the contrary, I find it increasing with every new story. Col. Lionel James had a good story to tell—as his predecessors had—and he told it just as well.

* * *

Last week it was Binnie Hale from the stage broadcasting for the first time. This week it is Margaret Bannerman, and I hope we shall hear them both again very soon. How beautifully Margaret Bannerman's words came through, and all with the greatest ease! Of the four songs, I liked "I wasn't quite sure" best.

* * *

Ronald Frankau is better than ever. He is certainly the best entertainer the B.B.C. has.

* * *

Elizabeth Pollock does a very clever act. Unfortunately, she reminded me of Florence Desmond, whom I hate to think of delighting American audiences when she might be here.

* * *

This variety, which included Danny Malone and The Moderniques, was one of the most distinguished varieties ever put on the Regional.

H.T. BATTERY ECONOMY

IT is quite probable that you find the lower tappings on your high-tension battery deteriorate first. The voltages between, say, negative and sixty tend to drop off more quickly than the voltages between sixty and maximum.

This is more often than not due to the fact that the lower half of the battery is called upon to supply slightly more current than the other half. The actual difference depends upon the type of circuit, the tappings made on the battery, and the valves, etc.

NEXT WEEK:

JOHN SCOTT-TAGGART

will contribute another long and fascinating article on the

S.T.500

☼ ☼ ☼

Tell your friends about our Special Supplement for Beginners—

"RADIO STEP-BY-STEP."

Next week's "P.W." will contain a long instalment of this lucid and valuable guide for the newcomer to radio.

It is as well, therefore, where two batteries are used in series, to change them round occasionally so that the load is more evenly distributed.

This may mean quite a few weeks' extra service.

H. C.

WHEN YOU BROADCAST

By JOAN INGLESANT

I FEEL that I am not wrong in saying that you who play the pianoforte often dream of the great day when you will be playing before a microphone, knowing that beyond it the great world is listening to your rendition.

I know that in my climb upwards my thoughts turned towards that ambition, and the nearer I came to it the more I realised that the purchase of expensive music took deep inroads into my meagre resources.

The modern pianist need not have the worry that then I had, for to-day he has at his command a new work entitled "Master Melodies of the World." It is edited by Mark Hambourg, and each week it will contain nine masterpiece melodies, full-music size.

Here you will find Chopin, Mendelssohn, Wagner, Schumann, Schubert, Liszt, Rubinstein, indeed all the great ones of the world of music they adorned.

For one shilling expended each week for nine pieces, at the close of the publication the pianist will have one of the most complete collections of musical gems ever offered to the public.

What is more, a master pianist has selected them for you—a pianist who has studied his audiences and who knows what they want.

TELSEN

BINOCULAR H.F CHOKE

Specified by Mr. JOHN SCOTT-TAGGART

for the P.W. "S.T. 500"

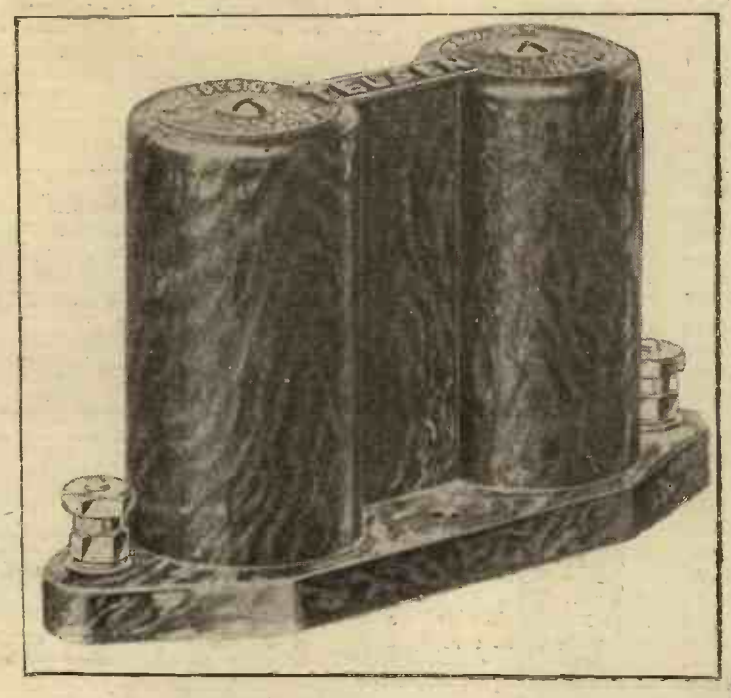
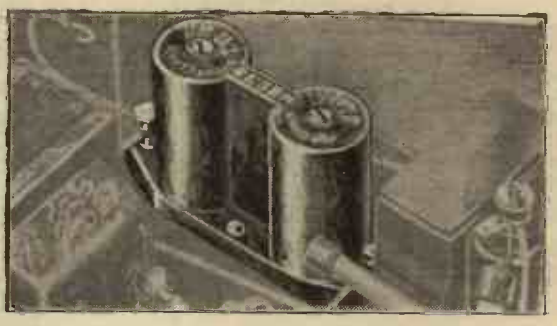
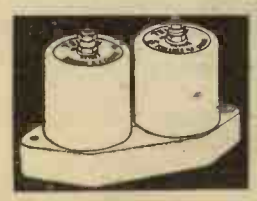


Illustration below shows the position occupied by the Telsen Binocular H.F. Choke in the built-up 'S.T. 500.

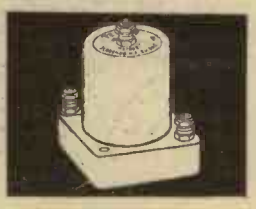


EXPERT designer and home constructor alike concur in their choice of the Telsen Binocular Choke where lasting efficiency at low cost is the first requirement. Its external field is negligible, with a very low self-capacity, while its inductance is as high as 180,000 micro-henries - - - - - - - - **3/6**

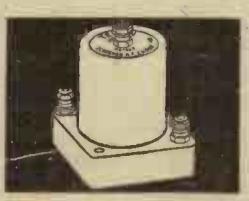
TELSEN COVER EVERY H.F. CHOKE REQUIREMENT



TELSEN ALL-WAVE SCREENED H.F. CHOKE - - - - 4/6



TELSEN STANDARD SCREENED H.F. CHOKE - - - - 2/6



TELSEN SHORT WAVE SCREENED H.F. CHOKE - - - - 3/-

TELSEN STANDARD H.F. CHOKE - - 1/6

TELSEN SHORT WAVE H.F. CHOKE - - 2/6

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD. ASTON, BIRMINGHAM

THE S.T.500 CIRCUIT

(Continued from page 287.)

would be impaired; distortion would be likely, and the handling of the reaction controls would be less smooth. Greediness at the anode coupler will produce H.F. indigestion. But it represents a very useful reserve when the incoming signal is weak, due to an indoor aerial, daylight reception or the weak power of the station itself.

Associated with the anode coupler is a preset ·0001-mfd. condenser, called the **selectivity range adjuster.** This is not critical of adjustment, but serves chiefly to bring up signal strength on S.G. valves which are below par; this is done by increasing the capacity by screwing the top plate down.

A Luxury Adjustment.

By decreasing this capacity the maximum selectivity of the anode circuit is increased somewhat, but at the expense of signal strength.

The most practical use of this condenser is to widen the scale of the anode coupler. With both reaction condensers at zero the set, with some valves, may oscillate when the anode coupler is near its full right (maximum) position. By reducing the range-adjuster preset any instability can be immediately stopped.

Some inherent reaction in a set is inevitable, but in operating the "S.T.500" it must be kept to a low value so that full play can be given to the properly controlled aerial reaction and anode reaction. The range adjuster, if reduced, will reduce the inherent reaction to as low a value as you like.

An immediate relief of self-oscillation (if it occurs with reaction knobs at zero) is always to turn the anode coupler a little to the left; but the range adjuster can be used and has special advantages where poor and old-type S.G. valves are used.

The range adjuster is best screwed up tight when first using the "S.T.500." It is really an ultra-luxury whose uses can be explained at leisure; even so it resembles the phase-reverser preset in that, once adjusted, it is never touched again. It is not a control.

The anode reaction is obtained by a differential condenser from the detector valve. Selectivity and reaction are improved by using a smaller grid condenser (·00005 mfd.) than is usually employed.

The "Driver."

An intervalve transformer feeds into what readers will recognise is the "driver" valve, which is really a further stage of L.F. The anode circuit of this valve contains the primary of a "driver transformer" which has a double secondary.

The fourth valve of the set is a Class B valve which is really two special three-electrode valves combined in one bulb. Each secondary is connected to a grid, and the connections are such that, when one grid is being made positive by the L.F. signals, the other is being given a negative impulse, and vice versa.

(Continued on page 316.)

ANOTHER ANALOGY

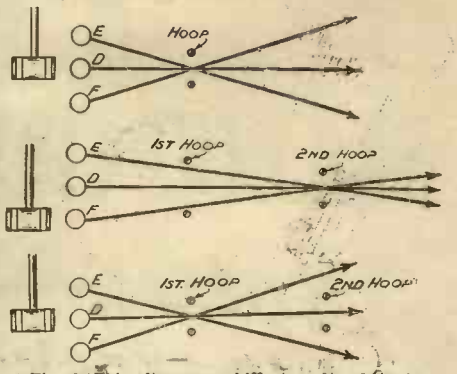


Fig. 6. This diagram, which is referred to in the main article, is for the purpose of explaining the merits of the "two narrow hoops," i.e., two highly-sensitive circuits both with reaction applied. Just as only one player can knock a ball through both hoops if these are narrow, as shown in the bottom diagram, so only the desired station can operate the loudspeaker on the "S.T.500."

RECOMMENDED VALVES.

It is extremely important that readers should match valves and transformers, if the author's Class B specifications are varied. The Class B valve actually used in the set is of the B.21 type, the driver being an L.P.2.

Make	S.G.	Detector	Driver	Class B
Mullard ..	P.M.12A.	P.M.2D.X.	P.M.2A.	P.M.2B.
Cossor	220 S.G.	210 Det.	215P.	220B.
Osram	S.22	H.L.2	L.P.2	B.21
Mazda	S.215B.	H.L.2	P.220	P.D.220
Marconi ..	S.22	H.L.2	L.P.2	B.21

A STARTLING DIFFERENCE

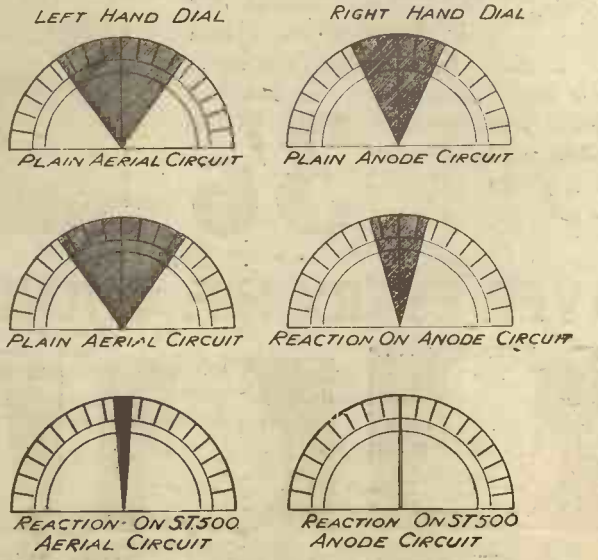


Fig. 7. Here you see the interference or "spread" of a local station on three different sets, as explained in the main article. The first line shows a two-dial circuit with no reaction. The second line shows how reaction improves matters. The last line shows the dials on the "S.T.500." The local becomes restricted to an absolute minimum as regards "spread." How do your dials compare?

THE S.T.500 CIRCUIT

(*Continued from page* 314.)

Each anode circuit has a transformer primary in circuit, the two primaries energising a common secondary which feeds the loudspeaker.

The valves comprising the Class B "valve" really work in turn, operating when their grids are made positive. When this happens grid current will flow, but the driver transformer is so designed that this does not matter.

The fact, however, is important when we have to choose the transformer to go with certain Class B and driver valves. The transformer in the set is to match an L.P.2 driver and B 21 Class B valve which are the valves suggested for these positions.

Selecting the Tappings.

The output transformer is usually of the auto-coupled type and is sometimes called an output choke. Various tappings on it are usually provided to enable the constructor to match his speaker. This simply means trying one or two pairs of terminals to see which connections give best results on your own speaker.

If you buy a Class B moving-coil speaker —which is an excellent plan, but not necessary if you have a good speaker already— you will not need the output choke in this circuit; a suitable transformer will already be in the speaker.

J.S-T.

S.T.500 ACCESSORIES

LOUDSPEAKERS. (See article also.)—Blue Spot, W.B., Rola, R. & A., Epoch, Celestion, G.E.C., Atlas. Marconiphone, H.M.V., Ferranti, Ormond, Magnavox, Amplion. All above should be models suitable for Class B output valve used. In this case no output choke is needed in the set. Speakers only suitable for triode output necessitate the output choke in the set.

BATTERIES.—H.T.: Lissen, Ediswan, G.E.C., Ever Ready, Siemens, Pertrix, Marconiphone, Drydex, Hellesens, or Block H.T. accumulators.
G.B.: Ediswan, Siemens, Ever Ready, Lissen, Pertrix, Marconiphone, Drydex.
L.T.: Block, Lissen, Ediswan, Pertrix, Exide, Oldham.

OPTIONAL AERIAL AND EARTH EQUIPMENT.—Electron Superial, Goltone Akrite, Radiophone "Receptru" down-lead, Bulgin lightning switch, Graham Farish Filt earthing device.

THE MAN BEHIND THE S.T.500

(*Continued from page* 243.)

for two years. Recently his services have been sought in various important patent cases; for example, he was invited, last March, to act as technical adviser and expert witness to Philips (perhaps the greatest valve and radio manufacturers in Europe) in their great patent action with Marconi's. Although he declined, the offer is an indication of his standing in professional radio circles.

As regards his writing activities, more is said elsewhere. He founded "Modern Wireless" and "The Wireless Constructor," and played a vital part in popularising home construction. His first wireless article appeared in the first volume of the

(*Continued on next page.*)

THE MAN BEHIND THE S.T.500

(Continued from previous page.)

first wireless journal in 1914, when he was seventeen years of age. During the war he was engaged in wireless work on the Western Front, received a commission in the field, was the first to use continuous wave sets in action, was mentioned in despatches, and in the final advance in 1918 was awarded the Military Cross for gallantry in maintaining wireless communications under fire. He invented a wireless valve circuit which at the very close of the war was ordered by Colonel Trew to be fitted to every trench set in France.

Shortly after demobilisation he took charge of Government valve manufacture at the works of the Edison Swan Company.

A Splendid Record.

He was elected a Fellow of the Institute of Physics in 1922, and is the only member to have achieved that distinction at his age. He is an A.M.I.E.E., and holds the technical diplomas of various other learned societies. In 1921 and in 1923 he lectured before the British Association for the Advancement of Science. He is one of the two honorary members of the German Radio Society.

His interest in the legal side of inventions culminated in his achievement of high success in the Bar Final examinations. He was called to the Bar in 1928. Although he is qualified as a barrister, he has, so far, preferred to practise as a consulting engineer.

As a set designer his work is too well known to need a reference to it. Many famous sets, from the "S.T.100" onwards, have won him supporters by the hundred thousand. Two of the designs emanating from his laboratories won first prizes in the face of world competition at international exhibitions at New York and Rotterdam.

Here, then, is the background of the man behind the "S.T.500." We believe that there is no one else of his particular experience and international prestige designing for the home constructor to-day.

THE MIRROR OF THE B.B.C.

(Continued from page 294.)

The operetta will be produced in the Concert Hall at Broadcasting House, as was done in the broadcast of the musical play, "Waltz Time." The new variety director seems to know what he wants. We hope he gets it.

Friday, October 27th.—Another "European Dances" programme by the Wireless Military Band. If anything like its predecessors we shall enjoy it.

Saturday, October 28th.—Music-Hall programme by Jack Hylton and his Boys Marie Burke, Charles Heslop, Rupert Hazell and Elsie Day.

"America Calling Again."

Of course, it just had to come after the gigantic success of the first "America Calling" programme, that delightful burlesque on American broadcasting which has undoubtedly been one of the outstanding radio events of this year.

"America Calling Again" is the title and Thursday and Friday, November 16th

(Continued on next page.)

MIRROR OF THE B.B.C.

(Continued from previous page.)

and 17th respectively, the days on which it will be broadcast.

Eddie Pola, who has devised it, will again appear before the microphone as announcer, and Al Bowley will impersonate Bing Crosby, the only part of "America Calling" which is to be included in the next programme.

For the rest, Dave Burns will impersonate Jack Pearl as "Baron Munchausen," America's Dutch dialect comedian who created the expression "Vase you dare, Sharlie?" while the Mills Brothers will be impersonated by the Moderniques.

Burns and Allen will take part in the programme as themselves, and other artistes who will be burlesqued are Al Jolson, Ruth Etting and Sophie Tucker.

For West Regional Listeners.

The first of a number of talks by Welsh Members of Parliament on current events in the House of Commons will be given by Sir William Jenkins, M.P., on Tuesday, October 31st, at 8.15 p.m. The talks are intended primarily for West Regional listeners, and Sir William Jenkins will speak in Welsh.

NEXT WEEK

JOHN SCOTT-TAGGART

will contribute a further long article on the S.T. 500

Order Your Copy Now

A B.B.C. Book.

I stated in a recent issue that a book about the B.B.C., written by Mr. Cleghorn Thomson, Miss Hilda Matheson, and Mr. P. P. Eckersley, might shortly be published. A few days ago, however, Mr. Cleghorn Thomson informed me that, although such a book had "been discussed," it was now certain that no book on the B.B.C. would be done.

I stated that such a book, if written, might offer a frank exposition of all that the authors think is wrong with the B.B.C. and how they would repair it; but Mr. Thomson asks me to make it clear to readers that, even if a volume on the B.B.C. had been written, it would not have been "a book of grievances against the B.B.C."

I never suggested the authors had any "grievances," but I did suggest they had ideas about improving the B.B.C. If they have not, is a very great pity.

OPERATING YOUR "S.T.500"

(Continued from page 285.)

to appropriate terminals. Tighten up the selectivity range adjuster preset (·0001-mfd.) to its maximum position. Unscrew the phase reverser preset ·00005-mfd. until the far end of the top plate is about ⅛ in. up (i.e. the condenser is about a quarter "in"). This value is not at all critical. Connect loudspeaker to set, preferably seeing that speaker is not near the aerial lead-in. The speaker is probably best on

(Continued on page 321.)

OPERATING YOUR "S.T.500"

(*Continued from page* 318.)

the right of the set, and should not face the valves, as a microphony howl could result in a bad case. This, together with other precautionary notes, applies to all sets, and not merely this.

Insert H.T.— plug into negative socket of H.T., which should have a value of 120 volts to get best results. A run-down H.T. is no use for Class B work.

Precautionary Measures.

Insert H.T.+1 (screen of S.G. valve) into 72 volts; H.T.+2 (detector) into 90 volts (this can be adjusted); H.T.+3 into the maximum 120 volts. Ensure that you get no filament burn-outs through a wrongly wired set by a flash-lamp bulb, which is connected in turn across filament terminals of each valve holder, including the S.G. valve holder. If the bulb burns out or does not light at all, there is a fault in the wiring. A voltmeter (reading up to 120 volts) may be used instead.

Switch off toggle. Take out H.T.— plug. Insert S.G. valve (Cossor 220S.G. or equivalent type), connecting flex wire to anode. If S.G. valve is metallised, take great care that its metal covering does not touch S.G. choke terminal (which should be some distance away); the covering may, however, touch vertical screen, as it is connected to earth. Take care that no frayed, bare ends of the flex come into contact with metal covering. See that the S.G. valve is pushed home into its socket.

Insert other three valves. Many sets do not work simply because the valve pins make bad contact. I have used very good valve holders, and this trouble is not likely to arise. The detector valve (Mullard P.M.2DX or similar type) goes in the holder V2 (see blueprint); the driver valve (Marconi or Osram type L.P.2 or other suitable small-power valve) goes in V3; while the B.21 (Osram or Marconi) Class B valve goes in V4.

Replace H.T.— plug in H.T. battery.

Pull out both wavechange switches (you are going to listen to the medium waves first). Set aerial coupler half-way round (pointer vertical).

Getting Your First Programme.

Set anode coupler so that pointer is about vertical; turn aerial-reaction knob full left (anti-clockwise); turn anode-reaction knob full left. Set aerial and anode-tuning condensers half-way. Switch on toggle. Signals will be received and the set may be used for station getting.

Familiarise yourself with your "locals" first. Unless you are a considerable distance away, they will spread considerably. Volume will be immense, but quality excellent. The first thrill may delay further tests; you will want to stop and listen to the rich outpouring of music; probably,

(*Continued on next page.*)

OPERATING YOUR S.T.500

(Continued from previous page.)

however, it will be the fat-stock prices. Even these will sound attractive! Try the effect of the tone control. Rotate to the right to produce a general lowering of tone. Leave full left, looking from the back, during following tests.

Now let us get the hang of the controls. Tune both aerial and anode-tuning condensers until a chosen station is loudest. Move the aerial-coupler knob to the left, retuning slightly on the aerial-tuning condenser. Selectivity is improved and signals are weakened. If you move the aerial-coupler knob over to the right signals will become stronger but selectivity poorer.

You can use the aerial coupler as a volume control, but remember that slight retuning on the aerial-tuning condenser will always be necessary.

The Anode Coupler.

Having learnt the use of the aerial coupler set it once more to vertical. Tune to a station on the two dials. Now turn the anode-coupler knob to the left (anti-clockwise). Retune on the anode-tuning condenser. Signals will be weaker but selectivity has been improved. If you turn the anode coupler more to the right the signals will get louder still, but "spread" will increase.

The anode coupler thus works exactly in the same way as the aerial coupler, but there is an additional effect to be noted. Turning the anode coupler to the right increases the inherent reaction effects in the set, and it *may* oscillate. This is only likely in the far right position of the knob.

The user need not be at all concerned (unless he has altered my design of the set). Turning the anode coupler to the left a little will immediately stop oscillation. Another method, if the set oscillates, is to set the anode coupler full right and reduce the capacity of the range adjuster preset until oscillation stops.

Now try the following reaction experiments. Set the aerial and anode couplers to a low value (to the left of vertical), so that your signal is weak, but properly tuned on the two dials. Now apply anode reaction, moving the anode-reaction knob clockwise (to the right) a little at a time, retuning slightly on the anode tuning condenser as is always done on reaction circuits. All this is perfectly normal, and within the experience of nearly every wireless user.

Testing Double Reaction

Now for the aerial reaction control. Leaving all the other knobs where they were, turn the anode-reaction knob to zero (full left). Bring up the aerial reaction a very little, by turning the aerial-reaction knob slightly to the right. Retune the aerial-tuning condenser slightly.

Signals will be louder and selectivity on the aerial-tuning condenser will be much greater. Increase reaction right up to the point where oscillation begins and note how delightfully smooth and effective it is. This reaction control is just as easy to adjust as ordinary reaction.

Now to test the double reaction—the second great thrill the "S.T.500" offers—

(Continued on next page.)

OPERATING YOUR S.T.500

(Continued from previous page.)

the first being the colossal volume and superb quality of music and speech.

Great selectivity is our aim. Set both reaction controls to zero. Set the anode coupler to about 10 o'clock as it were, i.e. a little way off the zero position. Set the aerial coupler to about 9.30 o'clock, i.e. nearly full over to the left and therefore at a small value.

Now tune in to a station on the two main dials. It is useless to use double reaction if the signals are loud. You must weaken them by turning the aerial and anode couplers until signals are tuned in on the dials but *weak*. There may be interference at this stage, but that is what we are going to remove. Apply some anode reaction, re-tuning slightly on the anode circuit. Apply aerial reaction, re-tuning slightly, as usual, on the aerial tuning condenser. Signals will now be full loudspeaker strength and all interference will have disappeared.

Tests on Long Waves.

For daylight reception and when double reaction is principally for increasing signal strength, much greater values of aerial and anode coupling may be used.

During any of the tests, the tone control may be tried, and it will singe off heterodyne whistles which may be experienced on some stations.

Now try the tests on the long waves by pushing in both wave-change switches. All the merits of the controls will be repeated. Those readers who have built the "S.T.300" or "S.T.400" will find that owing to its greater capacity the normal position of the aerial coupler will be more to the left than in the other sets.

In succeeding issues of POPULAR WIRELESS I will deal fully with both simple and de-luxe methods of operating the set. The actual handling is delightfully and perhaps surprisingly simple. And the results will justify the methods up to the hilt.

J. S.-T.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

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

Automatic Volume Control.

THOSE of you who were able to visit this year's exhibitions must have been struck with the number and variety of improvements which have been made to date, and not the least of these must be counted automatic volume control, quiescent push-pull and Class B amplification. We have heard a lot about these during recent months, but at these shows you saw them really in full swing for the first time.

There is no doubt that automatic volume control is an immense advantage, because not only does it get over one of the principal difficulties in tuning in distant or weak stations and the disconcerting effects of fading, but also it removes that sudden

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

jump in volume which you so often get on tuning in.

As most of my readers know, automatic volume control depends in principle on making the high-frequency amplifying part of the set vary in its amplifying power according to the strength of the incoming signals; if the signal is strong the amplification is correspondingly reduced, whilst, vice versa, if the signal is weak the amplification is increased. You will see from this why it is called *automatic* volume control, because it automatically varies according to the strength of the signal.

Applicable To Superhets.

There is just one point which I should like to mention, however, as I think that on this particular point there is a certain amount of misapprehension. Some people think that automatic volume control is applicable to—or, at any rate, useful with—any type of set; but you will see from what I have just said that it is really more particularly intended for use with a very sensitive and powerful set where there is plenty of volume available. In actual practice it is most useful with a superhet receiver or with a receiver of the ordinary type which has at least two stages of high-frequency amplification.

OUR GREAT S.-T. BOOK OFFER.

A UNIQUE CHANCE FOR READERS.

Not only have readers of this week's "P.W." the chance to build the set of the year, but they have the chance of acquiring the radio book of their lives!

You will have read all about the magnificent offer we are making on another page, and if—as you must be since you read "P.W."—you are keenly interested in the fascinating science of radio, you will not want to miss the opportunity of becoming the proud possessor of the most up-to-date and authoritative volume on modern radio reception.

I want to urge you, one and all, to waste no time in carrying out the simple instructions, clearly set out on another page, for acquiring the "Manual of Modern Radio." Fill in the coupon now. And tell your friends about this great offer . . . . an offer which, without exaggeration, may be said to be unique in the history of radio journalism.

THE EDITOR.

As regards the actual principle of the automatic volume control, I think I mentioned this in these Notes some time ago; but as I have had a number of queries on this point it may be as well to refer to it now.

How It Works.

The essence of the whole thing is the multi-mu valve, the amplification of this valve being reduced if the grid-bias voltage is increased, and, of course, vice versa. By the same token the amplification of the valve reaches its maximum value when the grid bias is reduced to zero. If a strong signal comes in, this increases the current in the detector circuit, and this current is then used to produce a grid-bias voltage for the multi-mu valve. You may wonder how the current can be made to produce a voltage, but if you just cast your mind back to Ohm's Law you will realise that the way to make a current produce a voltage is to pass the current through a resistance, when you will get a voltage at the ends of the resistance.

Noises Between Stations.

Before leaving the subject of automatic volume control I should say something about what is sometimes called quiet A.V.C., because the automatic volume control operated on the simple principle mentioned above has one particular disadvantage in that it is not quiet between the stations. If you think about it for a moment you will see (if you have not, in fact, actually experienced it with A.V.C.) that if the set is not tuned to any particular station you will get the full amplification, and so all kinds of background noises will be greatly amplified. This shows itself in practice by a considerable volume of "noises between stations." The same sort of thing occurs on fading signals because the automatic volume control operates in a way to keep the signal at a fairly constant volume level, but in doing so it throws up the background noises sometimes into much greater prominence.

Quiet A.V.C.

For instance, if the background noise is reasonably constant in actual volume and the wanted signal falls to a low value, then the amplification automatically jumps up, bringing the signal back to the required level, but at the same time pushing up the background noise to a much greater volume. If the signal becomes strong and the amplification goes down, the background noise goes down, too. The result of all this is that you get a kind of "surging" of background noise which sometimes becomes extremely unpleasant.

In order to get over all this, quiet automatic volume control was brought in, whereby the circuit does not respond to very weak signals at all. This means that if we choose a minimum signal volume which is greater than the average background noise we can largely eliminate the latter.

Two Effective Methods.

One method of obtaining quiet automatic volume control is to use a pair of biasing resistances connected in the cathode lead of the multi-mu valve. One of these resistances of is variable and is used as a volume control the ordinary type; the other resistance is a fixed one and serves the function of what is sometimes called a "noise suppressor." This fixed resistance is short-circuited by means of a switch, and if the switch is opened so that the noise suppressor is in circuit the grid bias applied to the valve will be fairly large. In these conditions the circuit will not respond to very weak signals, and this is the condition of the circuit when tuning for a station. When, however, the station has been tuned in, the switch can be closed, thereby short-circuiting the noise suppressor resistance and so increasing the volume.

Another quiet A.V.C. system employs an arrangement operating on the low-frequency amplifier and a double-diode detector.

Presentation Book Token 1

Printed and published every Wednesday by the Proprietors, THE AMALGAMATED PRESS, LTD., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., Ludgate Circus, London, E.C.4 (Telephone: City 7261). Registered for transmisson by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum. Abroad (except Canada), 19/6 per annum. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for South Africa: Central News Agency, Ltd. Saturday, October 21st, 1933. S.S.

EKCO Make Battery Set HISTORY

Model B.74

Until August last, EKCO Radio was available only to electrified homes. Then we introduced a Battery Set, Model B74, because we could at last promise all-electric quality with a battery-driven receiver. This model has been sweepingly successful and gives a performance in every way comparable with the traditional EKCO All-Electric standard. Note the many up-to-date features, and then ask your EKCO dealer to demonstrate it to you at home.

13 GNS

OUTSTANDING FEATURES—British and Continental Stations received at full programme strength with unsurpassed fidelity—one knob tuning—**CLASS B OUTPUT** permitting performance equal to all-electric receivers—magnificent bakelite cabinet in two finishes, black with chromium plated fittings or figured walnut—detachable fret, an exclusive feature permitting speaker silk to be changed to match any furnishing scheme—new station scale with names and wavelengths—seven-stage super-het circuit with band-pass tuning—light beam-station indicator—combined on-off switch volume control for radio and gramophone—moving-coil speaker—gramophone pick-up sockets controlled by switch—external speaker connections—unsplashable accumulator—high capacity dry battery.

Walnut finish £13 13s., or by 12 monthly instalments of £1 5s.
(*As illustrated.*)

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ALSO OBTAINABLE—All-electric consolettes identical in external appearance and price incorporating **DELAYED AUTOMATIC VOLUME CONTROL.** Identical chassis for D.C., A.C., and battery operation in handsome walnut console cabinet at 18 gns.

EKCO RADIO

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