

The Wireless Constructor

Vol. XV.

FEBRUARY 1933.

No. 76.

RAPID CONSTRUCTION GUIDE

S.T. 300 INTO S.T. 400

Every detail described

**JOHN SCOTT-
TAGGART**

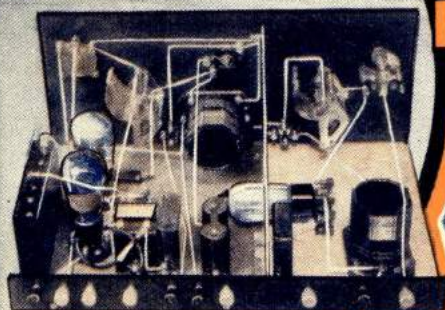
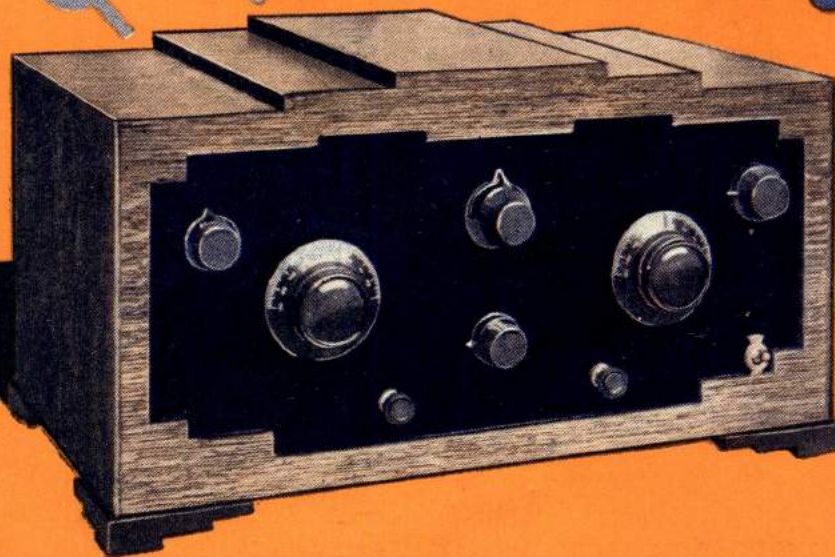
also contributes

**"THE CIRCUIT THAT WAS
TOO GOOD TO PUBLISH!"**

**Secrets of the
Automatic Reaction
Equaliser**

FROM MY ARMCHAIR

**'S.T. 400' Questions
Answered**



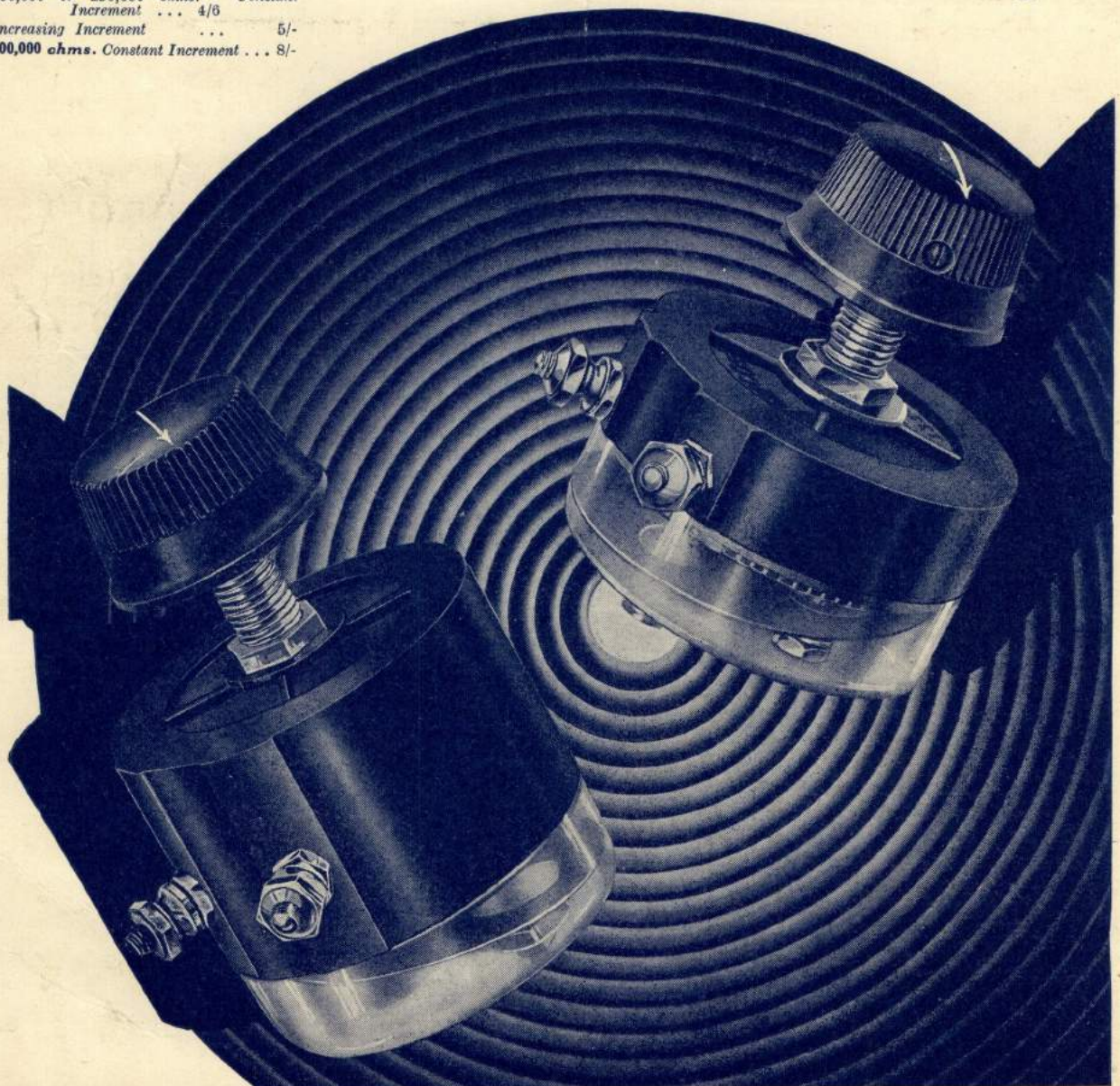
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As some of the arrangements and specialities described in this Journal may be the subject of Letters Patent the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

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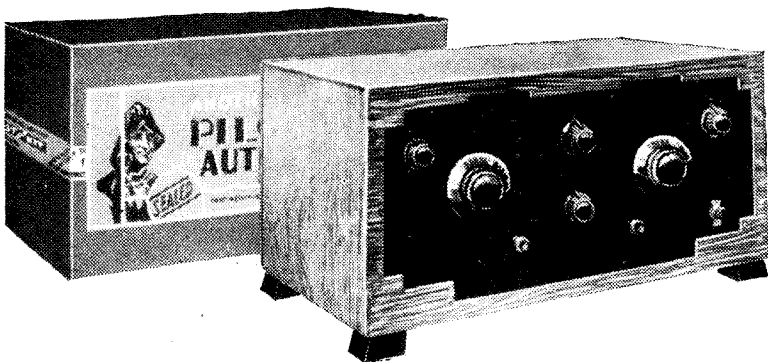
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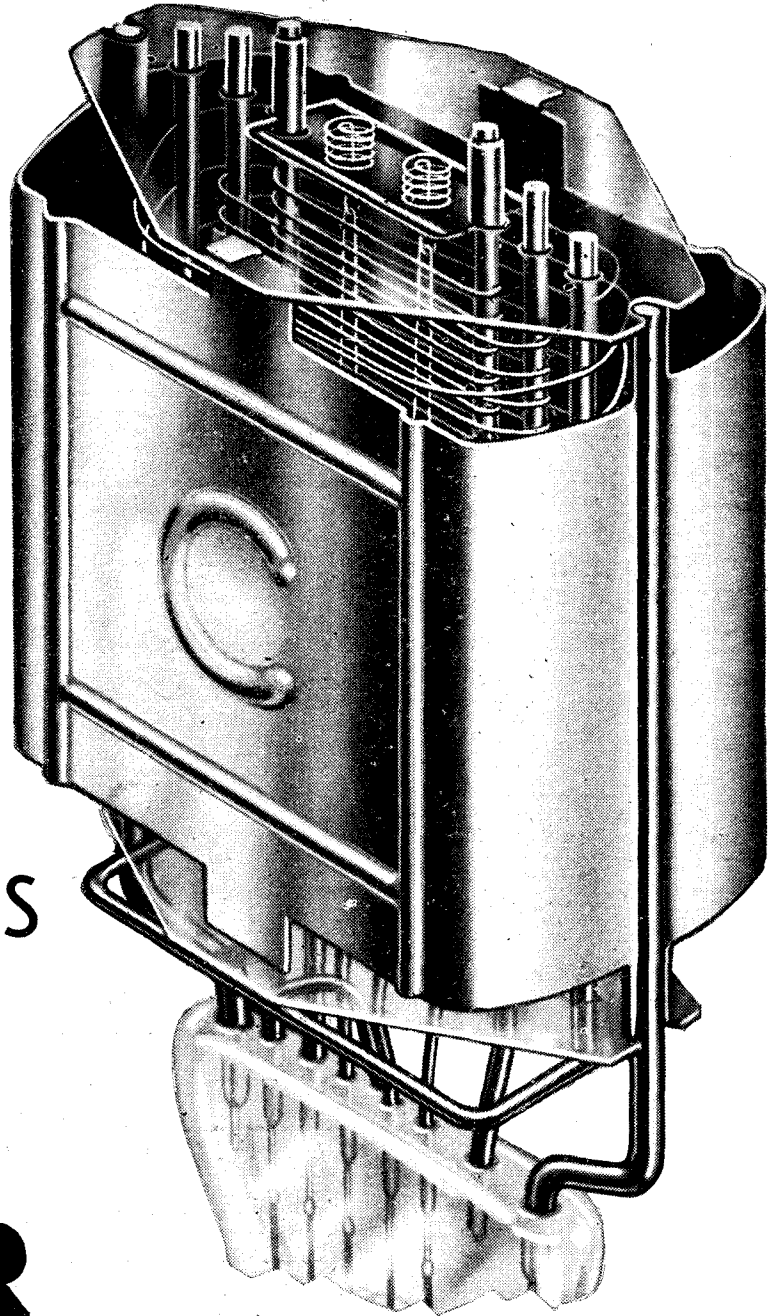
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The WIRELESS CONSTRUCTOR

The EDITOR'S CHAT

"Too Good to Publish"—"S.T." Bows to Pressure—Human-Interest Photographs

READERS OF THE WIRELESS CONSTRUCTOR will remember that some time ago Mr. John Scott-Taggart announced that he had been working on a circuit which was "too good to publish." Apparently many readers of this journal developed an insatiable curiosity as a result of this rather mysterious paragraph, and for some time past letters have been flowing into the editorial offices demanding more details.

Reproducing Results

As Mr. Scott-Taggart points out in his very interesting article in this issue: "The Circuit that was Too Good to Publish," many readers wanted to know how any circuit could be too good to publish and, furthermore, why Mr. Scott-Taggart should flatter himself that he could get special results which ordinary readers would be unable to obtain.

Well, Mr. Scott-Taggart has bowed to pressure of public opinion, and in this issue you will find an answer to all the queries you raised regarding the mysterious circuit. There is no doubt that Mr. Scott-Taggart was quite right when he said that the circuit he had been working on was too good to publish; in other words, a circuit may be so good that it is possible for it to produce very valuable results, but it can be duplicated by only a very small number of people who build up a set from the circuit.

The Chief Fact

Anyway, the main point is, as Mr. Scott-Taggart points out, that this mysterious circuit of his has no merits which the "S.T.400" does not possess—and that, I think, is the chief fact about all the interest which has been aroused.

Mr. Scott-Taggart has a word to say about Editors in his popular

feature, "From My Armchair"; and, in particular, I think he is having a little dig at the Editor of THE WIRELESS CONSTRUCTOR. It is quite true that some time ago I received a letter from a reader which included the following paragraph:

"When you publish 'S.T.'s' next big set we would like to have photographs of him sitting in his bath, digging in the garden, and shaving with an electric razor."

Well, I should like to oblige, because "S.T." has such a personality that it is only natural readers should want to know more about him from the personal point of view. When a man produces sets like the "Solo-dyne," the "S.T.100," the "S.T.300," and the "S.T.400"—each one a winner in the real sense of the word—

it is only natural that readers should say, "What sort of a man is this 'S.T.'?" "Does he shave?" "Is he a vegetarian?"—and so on, and so on.

Off Duty Poses

And so, when I received this rather humorous letter from one of my correspondents, asking for more photographs of Mr. Scott-Taggart, in various off-duty poses, I forwarded the letter to him, and asked him what he was going to do about it. "S.T.," however, states in his Armchair notes this month that the whole trouble about Editors is that they will insist upon articles being illustrated by human-interest photographs.

Well, that's true, and Mr. Scott-Taggart must pay the penalty of arousing so much interest among thousands and thousands of readers of THE WIRELESS CONSTRUCTOR.

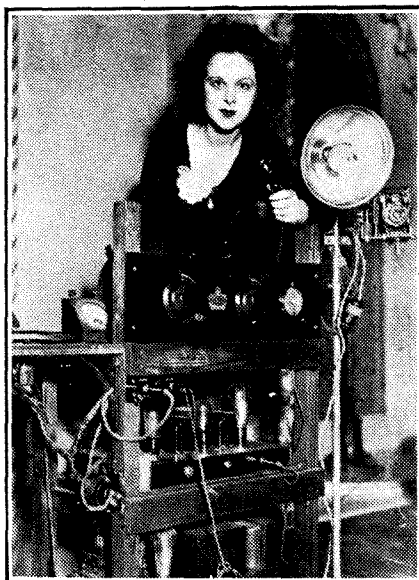
So far, I have not succeeded in obtaining a photograph of him shaving with an electric razor, or any other type of razor; nor have I dared to suggest that I might send a photographer along one day to get a snap of him in his bath. Anyway, readers who find their curiosity becoming almost too much for them—and, judging by the letters I am getting, there appear to be thousands of them—will have to trust me to do what I can and as soon as I can.

What Matters Most

But Mr. Scott-Taggart with his 'plane is rather elusive these days; one day he will be in the office attending a technical conference, and the next he will be flying over the Welsh mountains, or taking a trip to John o' Groats.

The main thing is, however, that he does find time to write some brilliant articles for THE WIRELESS CONSTRUCTOR—and, please note, *exclusively* for THE WIRELESS CONSTRUCTOR.

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Some details about unusual radio faults and some suggestions that may help you to better radio reception.

By P. R. BIRD

The Mystery Voice

THIS is the season of the year when most people find no difficulty at all in raking up an excuse to "throw a party." And quite a number of readers have raised questions about faking wireless entertainment at these gay functions.

For the benefit of those who have not tried anything of the sort, it may be as well to explain that most outfits capable of loudspeaker results can be made to produce a mysterious voice by means of a little judicious re-wiring and wangling. The idea is to use the low-frequency amplification to magnify speech from another room in the house, and if some witty commentator is available there, his unexpected remarks about the rest of the company can be very funny indeed.

Concealing a small loudspeaker inside a bran-tub or behind a curtain is one stunt, but there are many variations possible once the central idea of a private indoor "broadcast" is made practicable.

In general, all that is necessary for this is to disconnect the plate circuit of the detector valve from its L.F. coupling and join instead a "microphone"—which can consist of a telephone or loudspeaker—across L.F. coupling. Words spoken into the "microphone" are then handed on for L.F. amplification and emerge from the main loudspeaker in the ordinary way.

In cases where an L.F. transformer is employed for coupling the detector's plate circuit, the "microphone"

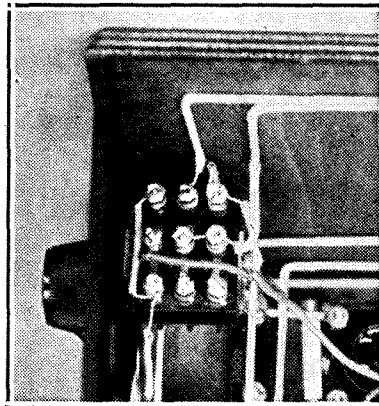
can be a loudspeaker connected to the (previously disconnected) primary terminals, all other connections being as before, and only the L.F. stages coming into use.

But a word of caution. Unless the foregoing brief instructions are clearly understood, and the set owner is confident of carrying them out safely, the stunt is best left alone. It would be a bad start to 1933 to blow a couple of valves before January was out!

Whispers and Whistles

We all know that this monetary mix-up, international debt difficulty, and income-tax insistence, are very hard to bear. But poor old G. L., of Bournemouth, had more than these

WHEN WIRING SWITCHES



As there is usually a bunch of wiring round a switch, it is always advisable to overhaul its mechanical action and tighten nuts or contacts a little, if necessary, before it is mounted. It is very difficult to do so afterwards.

to worry about. For he had spent his hard earnings on an S.G., det. and L.F. which could only do two things—whisper and whistle.

He had expected scores of stations and infinite variety of entertainment.

And all he got were elusive asides and ear-piercing oscillation. He tested components, checked wiring, sat up late, and broke all his good resolutions about bad language before he discovered the fault, which he explains as follows:

"The ganged tuning condenser had several terminals, and I had linked up to the moving vanes and framework O.K. But where I went astray was to put the lead from S.G. grid and coil to the nearest insulated terminal on the gang. And that, I found, was only connected to its trimmer condenser, and not to the main plates at all!

"No wonder I didn't get anything worth hearing! And now I have found that foolish mistake I pass it on in

HOW IS YOUR SET BEHAVING NOW?

If you are troubled by a radio problem, remember that "The Wireless Constructor" Technical Queries Department is fully equipped to help you.

Full details of the service, including scale of charges, can be obtained on application to the Technical Queries Department, "The Wireless Constructor," Fleetway House, Farringdon Street, London, E.C.4.

SEND A POSTCARD, on receipt of which the necessary application form will be sent by return.

LONDON READERS, PLEASE NOTE. Application should not be made by telephone, or in person at Fleetway House or Tallis House.

case any other CONSTRUCTOR reader has had the same difficulty."

When the Valve Cap Gets Loose

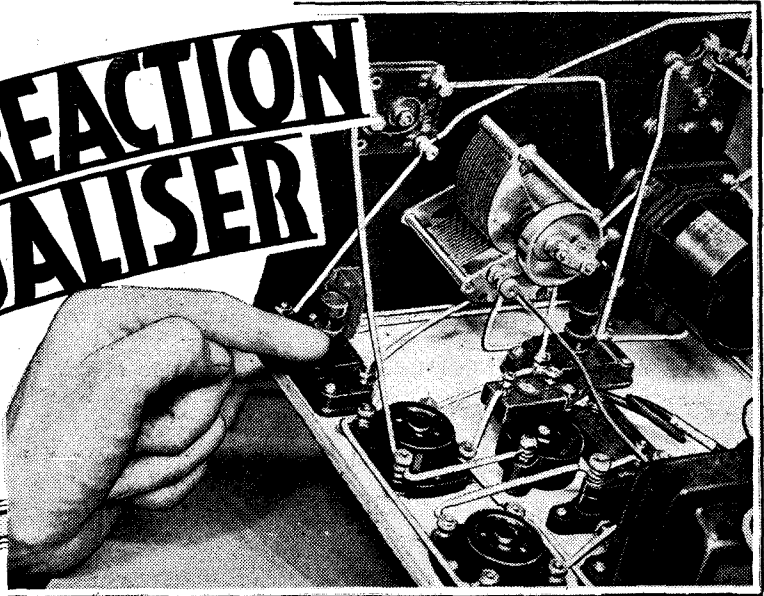
"The cap on my S.G. valve is loose on the bulb," writes a concerned Portsmouth reader, and as this same trouble has been continually cropping up in letters lately, a word about it may set many doubts at rest.

In most cases the coming loose will do no harm at all provided the connection is not subjected to strain or vibration. Connect up carefully and leave alone is, therefore, a good motto in such cases, and the valve will work just as well as ever, unless the loose top gets another strain.

Seccotine or similar strong adhesive may be resorted to by those who wish to fix the cap to the bulb again, but the usual objection to such procedure is that the repair cannot be expected to be as strong as before, and some further damage may be done while executing it.

The SECRETS of the AUTOMATIC REACTION EQUALISER

By
**John
Scott-Taggart**
F.Inst P. A.M.I.E.E



REACTION may once have been an accidental discovery. Even to-day we still obtain reaction effects "accidentally."

Do we like accidental reaction? Sometimes yes and sometimes no. It may give a certain set with certain valves and certain voltages a certain liveliness.

Inherent Reaction

But try to duplicate those results with an apparently identical receiver and you may either lose your accidental reaction or get too much (with resultant oscillation).

In every radio receiver having a tuned circuit connected to the grid and another tuned circuit associated with the anode of an S.G. valve you will get some inherent reaction.

If proper fully controlled reaction is to be obtained we must keep the inherent reaction well suppressed. In the "S.T.400" a reduction of anode coupling (i.e. a turning of the differential anode coupler knob to the left) will reduce inherent reaction. Likewise, a reduction in the value of the selectivity range adjuster preset (turning knob out, i.e. anti-clockwise) will keep the set perfectly stable under every possible combination of H.T. voltages and valves.

Manufacturers' Difficulties

With the set stable we can then deliberately and scientifically apply intentional and fully controlled reaction to either the anode circuit or both aerial and anode circuit.

Unfortunately, reaction as ordinarily applied requires increasing as we go up the tuning condenser. Even a change of one division upwards

calls for a tiny increase of reaction if the set is to remain as sensitive and selective as before.

This is a nuisance, and several attempts have been made to overcome the defect, but even factory-built sets have funkled the difficulties.

A set which requires more reaction as one tunes to the higher wavelengths shows up its defects most when one "goes back," i.e. tunes in to a lower wavelength. The reaction for that wavelength is now too much and the set bursts into oscillation.

In this article you will find a lucid explanation of the principles behind automatic reaction equalisation and of its many advantages now made available to all in the "S.T.400." There are also some practical pointers for all users of this receiver.

The ideal is to have a set in which the reaction is automatically the same from top to bottom of the scale. Whether one goes up or down the reaction remains perfectly constant, i.e. a certain distance off the oscillation point.

The system of reaction equalisation in the "S.T.400" aims to do this. The solution, as I explained in the original "S.T.400" article, is not perfect, but it represents a very definite step in the right direction. The cost is low (two shillings or less for the whole reaction equaliser), the scheme is completely self-acting and—except at the extreme ends of the dial—gives a large measure of constant reaction.

Reaction equalisation, however, does not mean fixed reaction. That is another ideal which is not likely to be

realised on a mass scale, because valves and H.T. voltages not only vary widely, but are varying from minute to minute and second to second!

Completely Automatic

Reaction equalisation, therefore, does not dispense with the need for a reaction adjusting knob which will govern the "distance off oscillation," to use a phrase which conveys at once the amount of reaction in use.

The obvious way to equalise reaction over the whole dial is to gang the tuned circuit condenser and the reaction condenser. Thus "increasing" the condenser will increase the reaction. The correct adjustment of reaction by this method is likely to intimidate the average man, and for the "S.T.400" I preferred a completely automatic method.

The principle of it is briefly this: Two paths are provided for the reaction current. One is through the reaction coil, where it does good; and the other is through a resistance and condenser, where it is wasted.

Providing Two Paths

In the accompanying figure is sketched a general theoretical arrangement of a valve providing reaction for its grid circuit. The H.F. reaction currents pass through the reaction coil L and also through resistance R (1,500 ohms in the "S.T.400") and the preset condenser C (-0003-mfd. maximum).

The condenser and resistance act as a leakage shunt. They by-pass reaction, and the more they by-pass the less is there to "ginger-up" the tuned circuit.

How to Obtain the Correct Adjustment

The condenser C will offer a higher degree of opposition to the lower frequencies (corresponding to longer waves). The result is that as we increase the main tuning condenser to tune-in the longer wavelengths, the H.F. reaction currents (which are identical in frequency to the received signals) will prefer to go through L rather than through C. Hence, more reaction—which is what we want.

Diverging Current

If, however, shorter waves are being received (i.e. at the bottom end of the tuning condenser), the reaction currents will be of higher frequency, and will tend to prefer going through the condenser C than the reaction coil L. This results in a reduction of reaction effect—which, again, is what we want.

The resistance R, by itself, would also have a discriminating effect against the higher frequencies, which would prefer R to the coil L whose reactance (i.e. degree of opposition) rises with frequency, while R remains constant.

It is thus a question of reaction currents distributing themselves between two parallel circuits. There is no sudden switching over from one to the other, but a gradual diverting of current from the useful reaction coil L to the waste-pipe R C as the frequency rises.

By adjusting the preset C correctly, we can get the maximum reaction with the tuning dial about half-way (around 90° on 180° scale). That is my recommendation for the "S.T. 400." With this adjustment a reasonably equal amount of reaction is obtained over the dial except at the far ends, when an increase of reaction is necessary.

Adjustment Methods

You can obtain the correct adjustment by any one of the following methods:

(1) Adjust set to receive medium waves, with reaction distributor at zero (left) and anode coupler at normal. Unscrew (i.e. turn anti-clockwise) equaliser knob as far as possible without it coming out. Your set is now virtually without an equaliser and more reaction is necessary as you go up the dials. Now screw up the equaliser knob tightly (without straining the condenser).

You will now need more reaction on the master reaction knob. You will now find that the set is very much more difficult to make oscillate at the bottom end of the dial (a reversal of what you have been accustomed to).

Between these extreme points you will find, by unscrewing equaliser knob a few turns at a time, that a most suitable point is reached for reaction equalisation. (Remember when tightening preset lock-nut to prevent preset knob from turning, otherwise tightening the lock-nut will alter adjustment.)

An Obvious Remedy

After all alterations to preset, take away your hand from preset knob. Do not try adjusting with your hand on the knob.

[If you cannot get enough reaction when receiving the shortest wave stations, it will be due to (a) too much negative bias on detector valve

Adjust equaliser preset to about half-way (very approximately). Set anode tuning condenser to about half-way. Bring up master reaction until set just oscillates (you will hear muffled plonk; experienced readers will know when set is oscillating).

Patch of Oscillation

Now move anode tuning condenser above and below half-way, and note where oscillation stops on each side. Narrow the spread of oscillation as much as possible by cautious decreases in master reaction. The portion of dial over which oscillation occurs may be thus narrowed down to twenty or thirty degrees.

Where this patch of oscillation occurs governs the adjustment of the equaliser knob. It should occur round about half-way. If it occurs higher up the dial you should unscrew the equaliser preset knob in stages until the patch occurs half-way.

If the patch of oscillation occurs lower than half-way on the dial you should screw up the preset (i.e. increase its capacity) in stages until the patch occurs half-way.

[Always keep the patch as narrow as possible. Too much master reaction will make the set oscillate over too much of the dial.]

The Simple Way

(3) Carry out test (2), but with aerial wavechange switch out, and tuning-in with both circuits. If desired, the aerial may be disconnected. The experienced reader will know that as the aerial circuit is brought into tune, master reaction will need to be less.

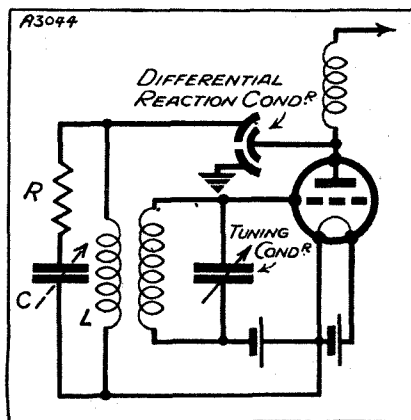
For the average reader, the best thing to do is simply to adjust preset to minimum (knob screwed out). In this condition you cannot possibly do any harm. Then give the knob a turn at a time until you get the equalising effect.

The only harm you can do in any case with the equaliser is to be unable to get full reaction at the bottom end of the dial. That fault is immediately remedied by unscrewing the preset knob a few turns.

After all settings of the equaliser, you use the master reaction in just the ordinary way to get reaction on signals.

J. S.-T.

PARALLEL PATHS

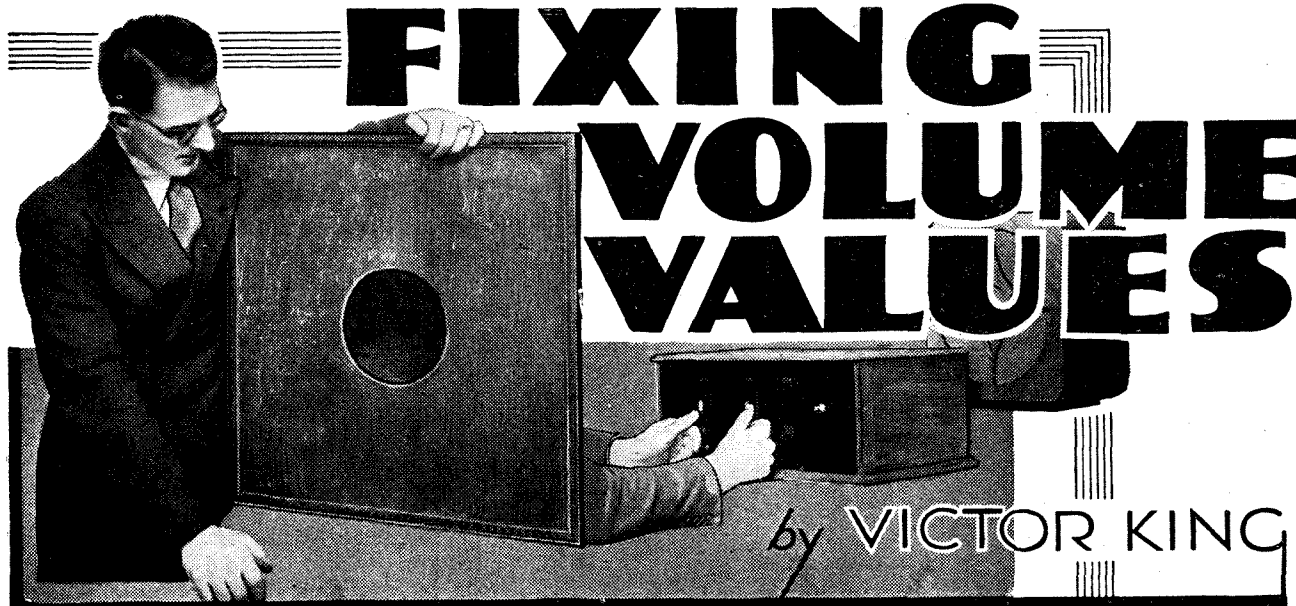


The currents fed back from the plate of the valve divide themselves between the reaction coil L and the resistance-capacity path R C.

grid, or (b) not enough H.T. on detector valve anode, or (c) you have screwed up the equaliser knob too far; the remedy in the latter case is obviously to turn the knob anti-clockwise.]

(2) This is for experienced wireless users: Push in aerial wavechange switch (i.e. long-wave position). Set aerial tuning condenser full in (180°).

Set anode coupler to normal (vertical). Set distributor to zero (i.e. all reaction on anode coil). Set master reaction to zero. Pull out anode wavechange switch (i.e. medium-wave reception position).



THE interlocking process in a set is one of the most fascinating aspects of radio though, at times, it can be somewhat exasperating. In a previous article I clearly showed that tone and volume controls are bound together with unbreakable links.

But on that occasion I dealt in detail with the effect of tone adjustments on volume. In this article I am going to discuss the other side of the picture.

Rough Standards

Volume to the average listener is a rather nebulous factor. If his set has a volume control he will work this as a kind of throttle, and the rough and ready nature of his standards are indicated by such phrases as "Too loud," "Too soft," or "Just right," which can be heard anywhere and at any time a receiver is being handled.

You realise how rough and ready these standards may be when you compare in terms of decibels the outputs of a six-watt amplifier giving "just right" results and a "too loud" 300 milliwatt. In actual fact, there may be a greater volume of sound emitted by the former.

Listen to the Band

Tone has entered the lists to confuse the issue. The smaller outfit sounds louder because its output is seriously distorted. It is a psychological effect.

But however perfect the set or amplifier, and however great its maximum undistorted output, it is impossible to maintain an equal tonal balance at all volume levels unless very special steps are taken.

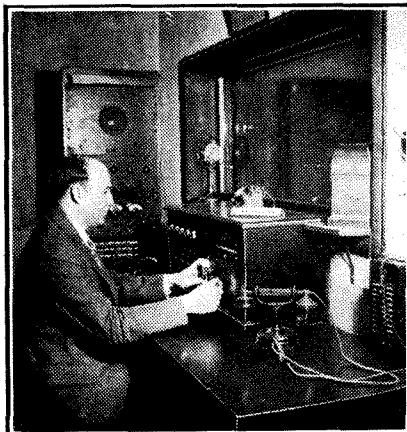
The human ear is not a "straight-line" receiver, but its sensitivity varies at different frequencies. It is often misled about volume by a change in tone, and our popular contributor explains how this and many other factors enter into the question of realistic reproduction.

The moment the volume control is adjusted the tone values will be changed. The reason for this is that the human ear is not a "straight-line" receiver. Its sensitivity varies at different frequencies.

It is most sensitive to the middle frequencies and least sensitive to high and low notes. Therefore, as the volume falls, so are low notes and high notes in increasing numbers dropped below the minimum points for audibility.

The effect is often illustrated by the seaside band analogy. You are asked

A SOUND CENSOR



Before ever the listener takes a hand in fixing volume values, the balance and control expert at the studio imposes maximum and minimum intensities.

to walk away from the bandstand and note how the low notes diminish until at some distance all that is left is a thin medley of reedy high notes. It is deduced from this that the low notes, and the low notes only, are clipped off.

Common Mistakes

The mistake lies in regarding the remaining notes as "high" in the real sense. In actual fact, both high and low frequencies go off almost equally and leave a middle band of from about two hundred to two thousand five hundred cycles.

Only too many of us (I freely admit my own inclusion) add to general error by constantly referring to high and low notes. If one thinks of a note one's mind at once jumps to the piano keyboard. And while two thousand five hundred cycles may represent a very high musical note, it is not in the strict sense a very high audio-frequency.

Six, seven, or eight thousand or more cycles per second are the kinds of frequency one means when the term "very high notes" is used, though, as I have indicated, no music is scored with notes of that order. Up in the region of those frequencies lie the harmonics, but, of course, these are most important items.

Did You Know?

I wonder how many of you know the frequency of the time pips broadcast by the B.B.C.? Would you call those piping notes high frequencies? As a matter of fact, they are almost "low," for they are only 256 cycles. Think of the piercing whistle of the errand boy. Are those high notes?

Fixing Volume Values—continued

They probably do not touch five hundred cycles at the highest points of their upward glissandos!

A Cunning Scheme

Some inventors working on the seaside bandstand theory have suggested that as a volume control is adjusted to give lower volume, so, by means of a ganged tone control, should the bass be amplified in order to maintain a correct balance. But such schemes take no account of high-frequency loss.

A quite correct method has been evolved by an American concern. Instead of a simple bass lift they introduce a suppression of middle

in conjunction with the reaction adjustment. Why the reaction adjustment? I can hear some of you saying. Well, because that is your second tone control. The more reaction you apply the greater will be the low-note/high-note ratio. In other words, reaction tends to reduce the high frequencies and, at the same time, increase the low notes. Don't forget the last point.

Perfect Radio

So, as you turn down the volume control you can increase the proportion of low notes by bringing up the reaction, and strengthen the diminishing high notes (frequencies, if you

were, then the set is selective. Selectivity, in short, is self-evident in a set.

But the same thing cannot, by the biggest stretch of imagination, be said, even in part, of tone.

Some people might like to have knobs on their sets which could provide any degree of frequency distortion by the turning of knobs; make brass instruments "mellow," and put files on the pedal notes of the organ to order.

Necessary Compromises

But I think the majority would prefer to have a set capable of automatically giving the best tone in all conditions. Can this be done? Not at present, I fear. But the necessary compromises to achieve moderately good results are, I consider, better than leaving the listener to struggle about among the frequencies with knobs that could give exceedingly fine results, but are not likely to, for the simple reason that the operator cannot know how to apply them to the best advantage.

An Illustration

You don't believe me? Well, let me give you an illustration. Supposing someone is talking on the radio, and you have a tone-control knob to hand.

Turn that knob this way and that way, and vary the volume too, if you like, and note how the speaker's voice will change.

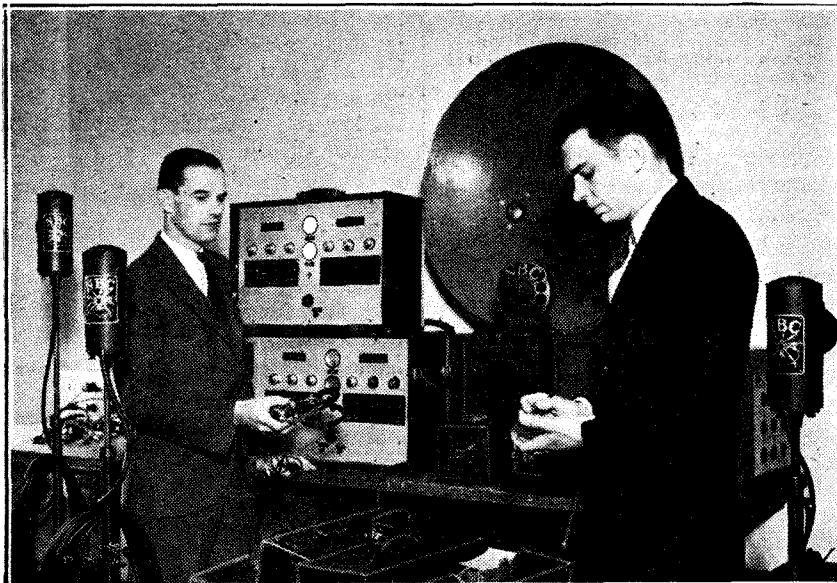
"Of course it will change," I hear you saying. "That is because I am playing about with the tone and volume adjustments." But if you haven't actually heard that speaker in the flesh, how on earth are you to know whether you have correct tone adjustment or not? You say you can put the tone control at "normal," see that there is no reaction, and then you must be right.

Volume Level

No, not necessarily. Quite apart from loudspeaker or set deficiencies, you have still the question of volume level to reckon with.

Volume level; that was what I set out with as my goal, and now I find I have already used up my ration of words. But it is a fascinating and important subject, as I hope you will all agree, so, maybe, I will return to it on some future occasion.

THE SEARCH FOR TONAL PERFECTION



These American radio engineers have been experimenting with parabolic microphones, which enable them to "focus" on one particular area, thus bringing out certain instruments with special clearness during concert and operatic relays.

frequencies. Very cunning. It is effected by a tuned filter working in conjunction with the volume control.

As the volume is reduced, so are the middle frequencies correspondingly diminished. This is the same as bringing up the low and high frequencies as the general volume level drops.

The Desired End

You on your ordinary three- or four-valve set cannot do this, but if you have a tone control of the transformer-potentiometer type you can do a little juggling which may bring you somewhere near the desired end.

Use your tone and volume controls

(prefer the word) by plying the tone control.

Mind you, I am not greatly in favour of "wangles" of this nature. That is on principle, not because they don't work. My vision of perfect radio has no place for multitudinous adjustments for tone and volume. I don't mind 'em for selectivity and such like, because selectivity, for example, is something you can grip on to.

Self-Evident Selectivity

Anyone can quickly discover whether or not a set is selective. If two stations crowd in together, the set is not sufficiently selective. If the stations simply fall apart, as it

S.T. 400



Questions Answered

WHAT are the most probable faults to look for in an "S.T.400" which doesn't work?

Wrongly wired, old or unsuitable valves, coils with dry joints or reversed reaction windings, dud spaghetti, faulty presets, reversed differentials (see note elsewhere), bad connections, especially to wander-plugs, badly fitted wander-plugs, old and dud grid-bias battery, faulty .006 coupling condenser (fatal), old presets which have become "stuck" and are probably unsuitable anyway, valve pins fitting badly in faulty valve holders, dirty contacts on wavechange switches (try shorting each switch with wire), wrong grid bias for last three valves (highly probable cause of distortion or excessive H.T. current), faulty 1-meg. grid resistance (only stable types of proved merit appeared in my list of components).

How can I test a preset?

Connect it across the terminals of the aerial tuning condenser and note its effect (when at maximum) on tuning-in to a station such as North Regional. You should have to come down on the tuning condenser to near the bottom end of the dial.

To test minimum, unscrew knob of preset as far as possible (without it coming out) and then try effect on tuning (when in parallel with tuning condenser). This test is best carried out on a low wavelength station, e.g. London National or Trieste. If you have an Ormond condenser and one of their catalogues giving curves, you can actually measure approximately the maximum and minimum of the preset.

I think your double-channel scheme a wash-out. As I turn up the distributor, signals go weaker. You may be putting reaction on to the aerial circuit, but you are taking it off the anode circuit.

The symptom is quite normal. You certainly are robbing the anode circuit and, as you say, it may have been doing more good on the anode circuit. But what you have obviously failed to do is to increase the master reaction. Since you are now feeding two circuits, this emphatically should be done. An alteration in the distributor will normally call for a change in the master reaction.

Of course, if you get a falling-off in signals, and if slight re-tuning on the two main tuning condensers and an increase in master reaction fails to

No design ever produced has resulted in 100% success by every builder. Usually some very small fault stands between failure and complete success. There is very little chance to go wrong on the "S.T.400," but in the accompanying questions and answers Mr. John Scott-Taggart will put back on the right road those few who may, through their own fault or not, have strayed from the path that leads to complete success.

put things right, I should diagnose a reversed reaction winding on the aerial coil.

Are the values of decoupling condensers and spaghetti critical?

The object of the 50,000-ohm resistance and the 2-mfd. condenser is to stop motor-boating, i.e. a bubbling or popping sound due to low-frequency oscillation. This full decoupling of the detector valve is essential if a Hypernik transformer is employed, and if a mains unit is employed.

If a battery is used for H.T., the decoupling need not be so good and much lower values of spaghetti (e.g. 20,000 ohms) may be employed. Actually, although the set has been designed for universal use on either batteries or mains units, it may in some circumstances be advantageous to reduce the 50,000-ohm resistance with an H.T. battery in use. All the letters published, however, refer to

tests with the values given, and H.T. voltage from 105 to 120 volts.

As regards the first L.F. decoupling values (20,000 ohms and 2 mfd.), you can try 1 mfd. instead of 2 mfd. on battery sets. The amount of any decoupling on a set depends partly on the transformer—a point not usually mentioned.

The Hypernik has a very good low note response, and therefore requires more decoupling than most transformers. The Ferranti A.F.5, however, is a special case, and goes still lower, and a 3-mfd. (instead of a 2-mfd.) is required next to the screen for decoupling the detector valve when using a cheap mains unit. A 1-mfd. can be connected in parallel with the 2-mfd.

I get motor-boating on my "S.T.400." What can I do to stop it.

A genuine case is very improbable. (The same noise may be due to intermittent H.F. oscillation; look for a bad connection and dud grid resistance.)

You should follow my instructions re joining H.T.2 and H.T.3 together, and then connecting H.T.3 to the intermediate voltage tapping (not maximum one) on mains unit.

Also try changing over the second and third valves in the set. This advice is worth trying out by all "S.T.400" users just as an experiment. Better results may be obtained in some cases. In extreme cases—not within my experience—a 3-mfd. or 4-mfd. condenser for detector decoupling would solve the difficulty.

A loud humming or singing noise interferes with reception. It starts feebly, but builds up, and I am powerless to stop it.

This is due to mechanical low-frequency reaction, and is, in nine cases out of ten, due to microphony. The detector valve is usually guilty, and the makers should be asked to

replace it, if so. (It is, however, sometimes due to vibration of condenser vanes, etc.)

A perfectly satisfactory cure, usually, is to place the loudspeaker in a suitable position so that its sound waves do not impinge on the set. Try moving the speaker.

It is very difficult to get sufficient reaction on my "S.T.400." What might be the causes?

(1) Reaction equaliser preset screwed down too much, i.e. too much capacity. The leaves may even be stuck down, in which case unscrewing knob would not improve matters. Try disconnecting altogether if all other suggestions are no good. (2) Insufficient H.T. on detector valve. (3) Too much negative bias on detector valve, i.e. G.B.—I. (4) Anode coil reaction coil reversed. (5) Badly soldered joint on a coil, i.e. a "dry joint" (there is usually too much solder on the tag, a suspicious symptom).

As regards insufficient H.T. on the detector valve, even when full 120 volts is applied, the remedy on sets working off an H.T. battery is to reduce the value of the 50,000-ohm spaghetti. The only disadvantage of this is that although a little more reaction is obtained, the real cause may lie unremedied.

The anode circuit does not tune. What can be the reason?

Faulty wiring, bad connections, dry joints on coils, faulty coils (e.g. a complete "dis"), faulty wavechange switch (resulting in anode circuit being on "long" when aerial circuit is on "medium" waves).

My "S.T.400" oscillates continuously with reaction dis-

tributor at zero (full left) and master reaction at zero (full left).

Obviously a case of reversed leads to one or other of the reaction differentials. Special tests for this are given elsewhere in this issue. If the originally used makes were employed the quite natural error could not have arisen. Reversed working simply means that "zero" will be "full right" instead of "full left."

A manufacturer is announcing "S.T.400" coils and states that aerial and anode coils are identical. Should this be so?

No. Both the tuned circuit windings and the reaction coils are quite different. Any reader who departs from the original list of alternative components does so entirely at his own risk. All coils in that list have been tested by my own hands, ears and eyes, and no components of any kind have been approved since the

"S.T.400" number except Telsen "S.T.400" coils.

Three-quarters of the troubles experienced by constructors of sets described in wireless journals, is that either the articles are not carefully read, or unsuitable makes of components are used. Sorry to have to rub this in.

On turning the — differential (this applies to any one of them), I get loud clicks. What shall I do?

For heaven's sake, switch off! You may, if it is the master reaction differential, be shorting your H.T. The differential should be taken off, tested, and if faulty sent to makers.

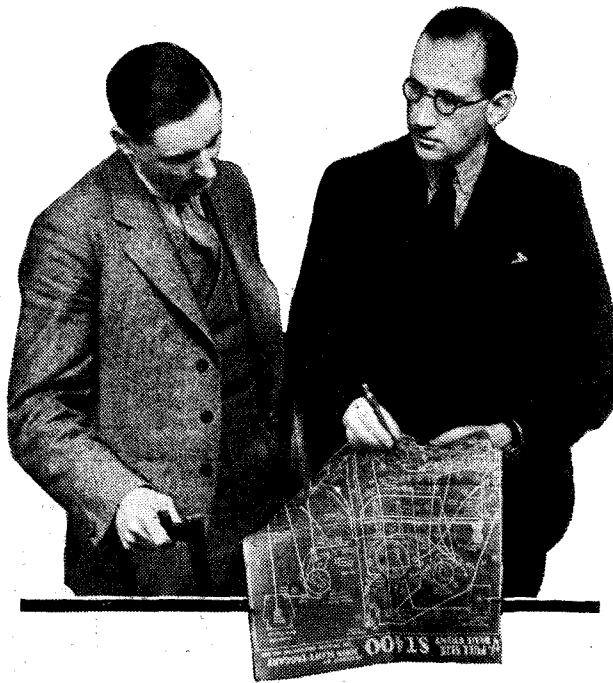
The quality of reproduction is poor. What can be the cause?

Wrong bias on one or other of the last three valves, inadequate H.T. (120 volts is the minimum for loud output), use of L.F. transformer not in specified list (I am fussy about L.F. transformers), leaky coupling .006-mfd. condenser, faulty grid resistance, bad contacts (especially grid-bias plugs), faulty grid-bias battery, faulty spaghetti, old or partially dud or unspecified valves, overloading of speaker or valves.

If too much bass is experienced, try a .002-mfd. or .001-mfd. coupling condenser in place of the .006 mfd.

The commonest cause of bad quality will be the loudspeaker. Never in the history of radio have there been so many cheap poor quality speakers (mostly of permanent magnet type) put out by highly responsible firms.

The quality given by the "S.T.400" on a good (by which I do not mean expensive) speaker is excellent—as all demonstratees on my tour have testified.



TESTING YOUR "S.T.400" DIFFERENTIALS

Three easily-applied tests.

If you have used other differentials than those actually used on the "S.T.400" set described, the tuning instructions may be different. For example, the anode coupler may give most selectivity when full right instead of when "full left" as on the original set. Likewise, the master reaction knob may have to be turned anti-clockwise (to the left) to increase reaction. The reaction distributor may also work the opposite way.

If a control works the opposite way it may cause a lot of confusion, although if the user understands what he is doing the results will be just as

good. My recommendation, however, is to turn the erring differential the other way round before connecting the leads. The connections to the fixed vanes will thus be reversed. The alternative is simply to reverse the leads to the fixed plates.

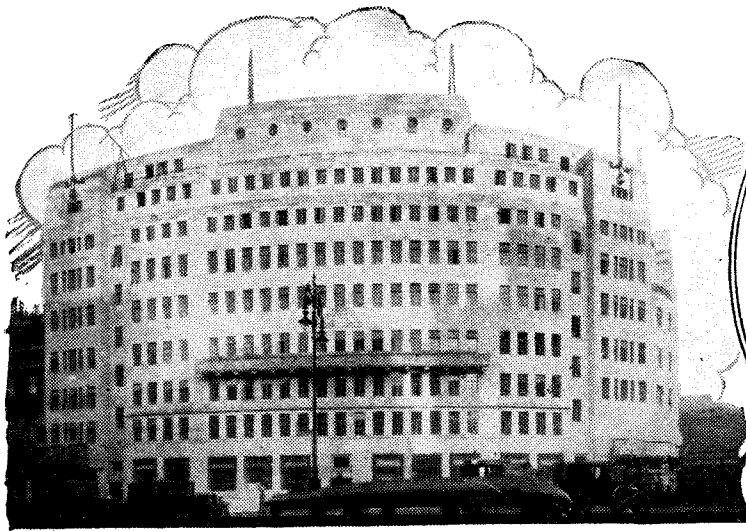
It may, however, be difficult if all the differentials are of different make

to the ones actually used in the set, to know which one is giving reverse effects. One method is to look down the edge and watch the position of the rotating vanes and then compare the fixed plates connections with the circuit published last month (issue dated January).

I have, however, evolved the following three tests. The set should at the start be in full working order on medium waves, and connected to aerial, earth, and batteries.

(1) *To Test Master Reaction:* Set distributor full left and anode coupler

(Please turn to page 314)



B.B.C. NEWS

Topical notes regarding British Broadcasting Stations and their Programmes.

By Our
Special Correspondent

Prospects for 1933

So far as its domestic affairs are concerned, the chief event for the B.B.C. this year will be the opening of the high-power West Regional station at Watchet, in Somerset.

There have been some difficulties in construction, and I do not expect that the station will be operating under service conditions before the second or third week of April. Then, also, there is still the uncertainty of whether it will have the double programme service which other regional stations have been developing. Still, whatever happens, there will be an exclusive regional service endeavouring to reflect South Wales and the West of England.

There is no hope of its reaching North Wales adequately, but the B.B.C. has kept this limitation in mind in its plans for the new Daventry at Droitwich. I understand that the signals from Droitwich, being emitted on higher aerials and with much greater power than is the case at Daventry, will penetrate efficiently most of the valleys of North Wales. Moreover, the B.B.C. is planning to give a larger proportion than at present of distinctively Welsh material from Droitwich.

Programme Personalities

The ebb and flow of effective programme personalities continue from year to year. As 1933 settles into its stride, it is well to recall those who are gaining ground as a result of direct meritorious performance, combining brains with hard work.

First of all, on the Programmes side, John Watt more than holds his own; in fact, his only risk is

that he is too successful. Mr. Harding also maintains his reputation for original and effective production. Mr. Mase, Dr. Boulton's executive, steadily gains ground through persistent endeavour and intelligent direction.

On the Talks side, Mr. Lionel Fielden deserves praise, and Mr. Holt, the News Editor, more than deserves such credit as he has received. Mr. Hely-Hutchinson moves from strength to strength in quality of achievement, if not in recognition.

On the administrative side of programmes, Mr. Lindsay Wellington stands out. He has managed by some

wizardry to add to a job already difficult and oppressive (arranging contrasts), the function of liaison and intermediary between London and the Provinces.

The newcomer, John Kettelwell, has definitely made good in the Children's Hour, but it remains to be seen whether in 1933 he can stand the pace.

Regional Orchestras

The gallant effort of the nonets at Regional headquarters, although appreciated at their right value by their listening public, has hardly survived the test of comparison with

A RADIOGRAM EXPERT WHO HOLDS RECORDS



Meet Mr. Tom Payne, of Newcastle-upon-Tyne, the veteran walker who holds the non-stop record for 24 hours. He is at present "running" a radio business.

B.B.C. News—continued

the larger orchestras which they superseded at the time of the financial crisis in 1931.

There is necessarily a limited repertoire and also a thinness which contrasts violently with the full-blooded performances from London studios. My impression is that before the end of this year we shall all welcome the first stage of reversion to the saner and better policy of maintaining full-blown music at all the Regional centres.

Dominion Programme Material

The B.B.C. has not so far shown anxiety to include, in its Empire service, programme material originating overseas, thus making the Empire service truly representative. I accept the assurance of Broadcasting House that this is not an accidental oversight, nor the result of calculated policy.

It seems that the cost of the lines and the wireless links would fall for the most part on the B.B.C., which is already burdened with the whole of the capital charge and current expenditure connected with the Empire service.

It is not fair to expect the B.B.C. to extend these considerable commitments, at least at this stage. Overseas Dominions and Colonies

TO TOUR THE WORLD



Mr. Malcolm Frost, of the B.B.C., who is making a world tour in connection with the new Empire Broadcast Service, saying good-bye before he left by air.

which may be inclined to complain of the exclusively United Kingdom character of these Empire transmissions should realise that the only way they can achieve their laudable object of composite Empire programmes is through active financial partnership.

Captain Eckersley Again?

Having taken Australia and the

United States by storm, Captain Peter Eckersley should be induced to return in some capacity to the B.B.C., if only to give them the advantage of those things which he regards as supremely good in the New World.

In his 1927 visit to the United States, Captain Eckersley had no doubt of the immense superiority of the British system of broadcasting, and he was so definite in his views, as declared publicly, that umbrage was taken by our American cousins. This time, however, he discovered that the American system had not only caught up to the British, but outdistanced it in freshness, originality and quality.

Categorical statements to this effect were published in interviews with Captain Eckersley throughout the United States. If the B.B.C. were wise, they would invite Captain Eckersley to return to the microphone in a series of special programmes designed and carried through by him in an attempt to adjust the alleged adverse balance.

Advertisements on the New Daventry

As the cost of the Empire broadcasting service inevitably expands, as there is no prospect of contributions from overseas, and as the enemies of the B.B.C. in Parliament grow more restive about both the legality and the desirability of diverting licence revenue for this purpose, serious consideration is being given to the proposal that the sponsored system of programmes should be applied to the new short-wave Daventry.

It is not suggested that there should be an imitation of the American system of indiscriminate competitive commercial publicity, but rather that United Kingdom industries as a whole should be given the opportunity of providing programmes which would be not only of first-class entertainment value to listeners overseas, but also an indirect and valuable advertisement of United Kingdom enterprise and products. For instance, the heavy steel industry, the shipping industry, the railways and holiday resorts, each would form a unit for the common good.

My view is that in this direction lies the only practical solution of

(Please turn to page 318.)

FROM MUSIC HALL TO BROADCAST STUDIO



This is Hayden Coffin, the famous old-time music-hall artiste, in the B.B.C. studio, broadcasting some of his old hits accompanied by the chorus. Older listeners will remember his stage appearances with pleasant memories.

THERE is not much to say about long-distance long-wave work this month, because it has been so uniformly good that reception above the 1,000-metre mark has been unexciting. If you wanted any ordinary programme that the long-wave section of your set was capable of delivering, you simply tuned for it—and there you were! (At least, nearly always, for, of course, exceptions would be likely to occur if you had been boasting about the reliability of any particular foreign transmission! And I must admit that Lahti still eludes my aerial!)

* * *

One long-wave change that is worthy of note, however, was Leningrad's relinquishment of 1,000 metres to Moscow. Leningrad has gone down to 875.5 metres, I hear; but this is such an in-between wavelength that ordinary sets will not cover it. And as Leningrad's programme was seldom worth listening to, as a programme, I don't fancy many people will miss him from 1,000 metres.

* * *

Another development of the past few weeks has been the confirmation by the Madrid Conference of a long wavelength for Luxembourg, the much-talked-of "advertising station."

We have heard so much in the past about Luxembourg's high-power that



Practical notes on what stations to look for and how to get the foreigners that are coming over well.

nothing but his stentorian appearance from the loudspeaker will resurrect much interest in this station. And at the time of writing he has failed to shake my loudspeaker, although I believe tests are being carried out.

Down on medium wavelengths conditions have been particularly interesting. Apart from fading and an occasional atmospheric, one had the impression that listeners' luck was absolutely right in—plenty of stations, not too many heterodynes, and tremendous punch behind even the distant stations.

* * *

At the top of the dial Riga has been in form—not tremendously loud, but often quite receivable, on 525 metres. Considering the distance, some 1,000

miles, this is going some for a low-powered Latvian.

By the way, there used to be a popular limerick about a young lady of Riga, who went for a ride on a tiger. It was a misleading limerick, because the young lady of Riga pronounces the name of the station not "Ri-ga" to rhyme with tiger, but as "Re-ga."

* * *

Other interesting medium-wave items have been Toulouse's tests of his new 60-kilowatt, and the new Munich station on 533 metres. Toulouse is certainly a big noise, but seemed liable to fade a lot.

Fécamp provided a surprise by getting on to his allotted wavelength—223 metres. But whether this was a flash in the pan or a change of heart only 1933 can tell us!

GREAT advances have been made in the design and construction of variable condensers just lately, and now that ganged condensers are increasingly popular the need for good workmanship and sound construction is greater than ever.

One sign of the times is disclosed by Wingrove & Rogers, Ltd.—of "Polar Condensers" fame—in their statement that for the third time in four years they have made extensive additions to their plant and machinery! Good hearing in these days! And the reason is to be seen in the firm's new catalogue which displays extremely attractive lines at strongly competitive prices. It can be obtained by any WIRELESS CONSTRUCTOR reader on application to Wingrove & Rogers, Ltd., Arundel Chambers, 188-9, Strand, London, W.C.2.

H.T. From the L.T. Accumulator

Readers who have been intrigued by the idea of supplying high-tension current from a low-tension accumulator will be glad to know that the Milnes Radio Company have issued a booklet on the subject.

POINTS FOR PURCHASERS

Interesting details from manufacturers about recent trade activities.

It is called "A Reservoir of H.T. Current," and can be obtained, together with technical data sheet, by any reader of THE WIRELESS CONSTRUCTOR from the above-named company. The address is Cottingley Bridge, Bingley, Yorks.

"Akrite" Instead

We have been informed by Ward & Goldstone, Ltd., that the name "Ultrite" as applied to their eleven-strand aerial has been withdrawn owing to a similarity of title used by another firm.

The Ward & Goldstone aerial remains the same as ever in quality and finish, but its name is now "Akrite."

Constructing Mains Unit

If you have a hankering after the above fascinating pursuit you will be interested to know that "T.C.C." has just prepared a book dealing with

the successful design and construction of units. And you will hardly need to be told that the initials "T.C.C." stand for Telegraph Condenser Co., Ltd.—the firm which makes the condenser in the green case. The address is Wales Farm Road, North Acton, London, W.3, and inquiries are invited from any wireless constructor—that's you!

Short-Wave Adaptors

So popular have these devices become that Burne Jones & Co., Ltd., now have four models—one for ordinary British and one for ordinary American valves, and also for sets using S.G.'s as detectors in both types. Each is suitable for battery or A.C. set, and the price, 39s. 6d., includes a 40/80-metre coil.

An "Atlas" Revision

If you have been tempted by the "Atlas" sets you will like to know that the deposit and easy term payments have been revised.

The "Atlas Two" for A.C. mains is now £1 down, and 12 monthly payments of 18s. 6d. Or the battery model is £1 down and 12 monthly payments of 11s. each. Cash prices are unaltered.

CONVERT YOUR

S.T. 300

Every Detail Explained in
**RAPID CONVERSION
GUIDE**

THOSE who compare the "S.T.400" and "S.T.300" closely will realise that I have designed the new set with a very careful eye to making the older set convertible into the new.

I doubt if there has ever been such an opportunity for existing users of a set to employ so profitably practically every part of their set in the building of a receiver involving entirely new principles.

Even the same panel, terminal strip and screen may be used again. The same anode coil is used, while the aerial coil is simply converted by the constructor himself in accordance with instructions given below and in the "S.T.400" number (December).

A small reproduction of the original "S.T.300" blueprint is given for the benefit of those who may have lost their copies.

Coil Modifications

The new components required are given in a separate list, but it is to be noted that although the "S.T.400" aerial coil may be bought separately from several manufacturers, it is an easy matter to convert the "S.T.300" aerial coil, except perhaps for the soldering of the wires to the tags attached to the terminals on the moulded former. (It is assumed, of course, that the "S.T.300" aerial coil has the spare terminals available, as has the Colvern coil.) The latter firm, incidentally, will convert for 2s. any "S.T.300" aerial coil handed to a dealer or sent direct to them (properly packed and with your name

and address on a label attached to a terminal.)

Decoupling Considerations

My original "S.T.400" design was arranged so as to be a universal model capable of being used on A.C. mains units. If H.T. batteries are used, there is not the same need for "decoupling," and since you already have a 1-mfd. fixed condenser on the L.F. side of the "S.T.300," you could use this instead of the 2-mfd. condenser farthest from the screen on the

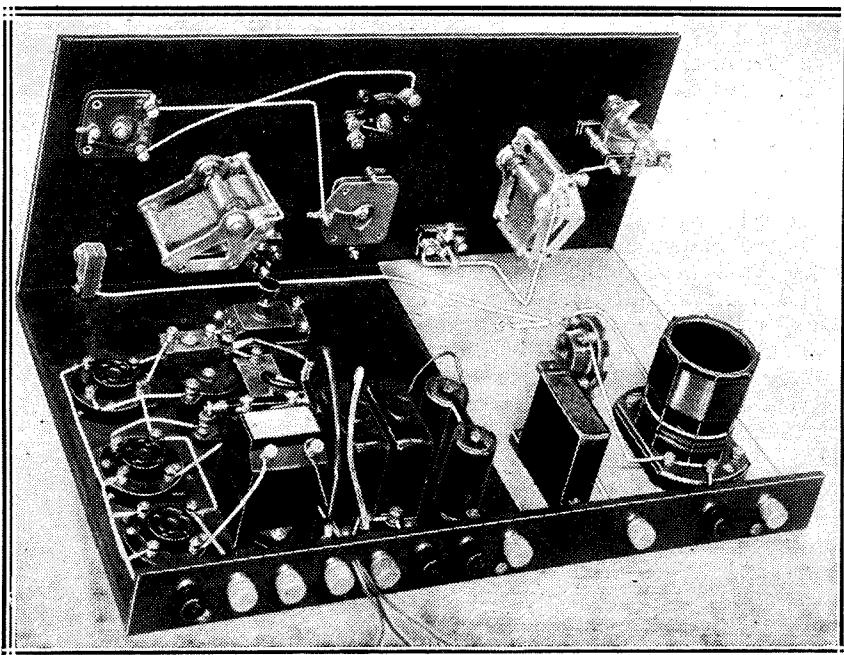
"S.T.400." This would save you buying an extra 2-mfd.

(If you have a spare 1-mfd., you could also try it in place of the other 2-mfd. condenser.)

Those of you who may have bought a conversion or re-builder's kit of parts need not, however, feel that one of the 2-mfd. condensers was superfluous. It is really better to decouple generously, even when H.T. batteries are used.

The 50,000-ohm spaghetti is capable of being replaced by a lower value

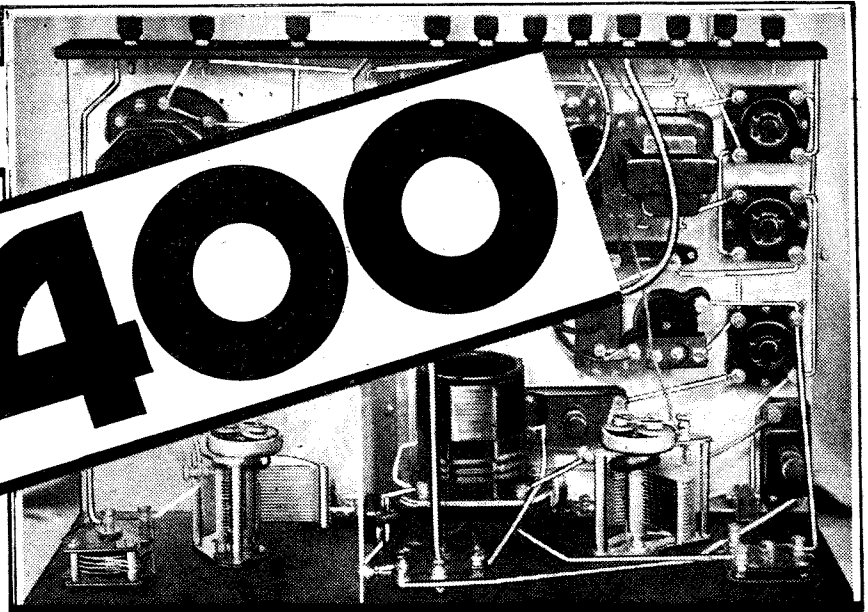
STAGE 1:—HOW YOUR SET WILL LOOK



You will find reference to this photograph in the Rapid Conversion Guide.

INTO

S.T.400



BY JOHN SCOTT-TAGGART, F.INST.P.,^CA.M.I.E.E.

if an H.T. battery is used; possibly you may have a 20,000-ohm spaghetti on hand; if so, I suggest you try it.

As regards valves, I advise you to try what you've got first. I myself used a Cossor 210 Det. as the detector valve on my tour. The first valve (the S.G.) was sometimes a Cossor S.G.220, sometimes a Mullard P.M.12A, and on some of the tests a Mullard P.M.12—the type of valve many "S.T.300" users will have. The third valve was a P.M.2DX., and the last a P.M.202.

I give these in answer to many requests, but I have had equally good results with other makers' valves. The only valve which one might expect to be at all critical is the detector.

Avoid Overloading

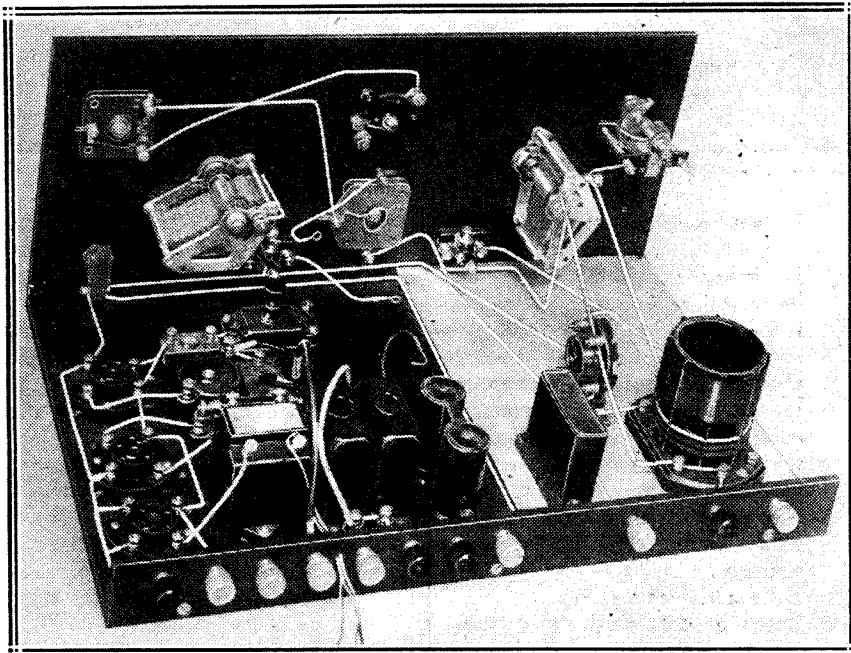
Those who have the "S.T.300" list of valves will be able to use them on the converted "S.T.400." If the S.G. valve is of the P.M.12 type (i.e. less "efficient" than the P.M.12A, S.G.220, etc.), I advise tightening up the selectivity range adjuster knob to maximum.

If you use the small power type of valve—e.g. P.M.2A, etc.—do not expect louder results on strong signals than you got with your "S.T.300." But you *will* get much louder results on what were *weaker* signals; and, of course, you will get greater selectivity.

Above all things, avoid "overloading"—a terrible temptation when you have four valves bursting to "punch it out." Keep the aerial coupler sufficiently anti-clockwise (i.e. "out") to prevent overloading.

I need hardly remind you to read everything I write on the "S.T.400." You may easily obtain a hint which just applies to your needs. And now to get on with the job:

STAGE 2:—MORE NEW LEADS IN PLACE



When you reach this stage in converting, check your set with this photograph.

RAPID CONVERSION GUIDE

Step by Step and Wire by Wire.

- (a) Remove wires (48), (47), (46), (45), (44), (43), (42) from "S.T.300." [These wires may be found in the "S.T.300" blue print (see small reproduction on page 277).] Put on one side and label for future use wires (48), (46), (43).
- (b) Remove screen. Drill extra hole in it and prepare extra notch as per "S.T.400" screen sketch.
- (c) Remove (41), (40), (39), (38), (37), (36).
- (d) Unscrew anode coil fixing screws and lay aside the anode coil complete with pillars.
- (e) Remove (35), (34), (33). Put aside and label (33) for future use.

Changing a Magnificent Three-Valve Set—

- (f) Remove panel.
- (g) Remove wires (32), (31), (30), (29).
- (h) Remove knob and dial of anode tuning condenser. Remove anode tuning condenser.
- (i) Drill hole for reaction distributor differential ($\cdot 00035$ mfd. or $\cdot 0003$ mfd.).
- (j) Fit reaction distributor, leaving off knob.
- (k) Remove the $\cdot 00015$ -mfd. reaction differential and fit in its place a $\cdot 0003$ -mfd. master reaction differential, leaving off knob.
- (l) Turn spindles of the two reaction differentials as far anti-clockwise as possible (looking from the front). Fit knobs with pointers pointing horizontally to the left.
- (m) Drill hole for toggle switch. Fit toggle switch.
- (n) Refit anode tuning condenser, noting that its angle is different. Its position should be noted on the layout diagram.
- (o) Turn anode tuning condenser spindle as far anti-clockwise as possible, i.e. vanes out. Fit dial with its zero opposite scratch mark on panel. (The scratch is best made vertically above spindle hole.)
- (p) Remove wires (27), (26), (25), (24), (23), (22), (21). Remove G.B. wander-plugs from wires (26) and (27) and put these plugs aside for later use. Wires (25), (22), which is a spaghetti, and (21) are also put aside and labelled for later use.
- (q) Remove wires (19), (18), (17), (16), (15), (14), (13), (12), (11), (10), (9), (8), (7), (6), (5), (4), putting (7) and (6) and 1-megohm leak aside for later use.
- (r) Remove wire (1), screwing down 1 mfd. condenser.
- (s) Remove aerial coil. Cut slots and fit extra winding or buy new "S.T.400" aerial coil. If your "S.T.300" aerial coil is of Colvern type as specified in the "S.T.300" you can take it to your dealer who will charge 2s. for having it converted by Colvern's into an "S.T.400" aerial coil.

If you do the simple job yourself, note the following: $14\frac{3}{4}$ turns of 36 S.W.G. single-silk-covered wire form a new winding between the medium-wave and long-wave windings. This single

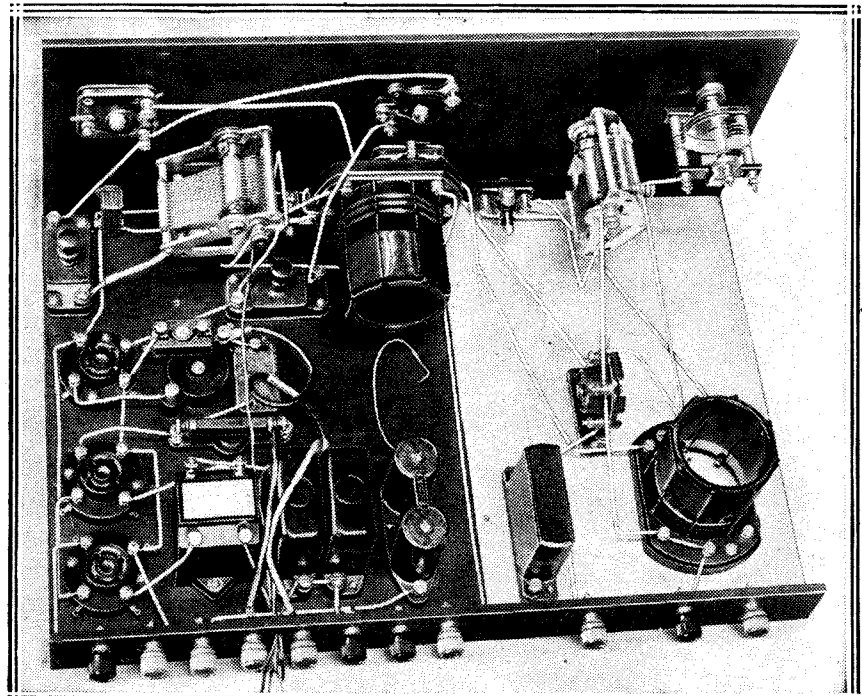
hank is wound in the same position on the former of the aerial coil, as is the reaction winding on the anode coil former, i.e. in a slot exactly the same distance above the long-wave winding slots.

The new winding starts from No. 1 terminal and is wound in a clockwise direction looking from the top of the coil, and ends at No. 6 terminal. The direction of the winding is vitally important, of course, as it is a reaction coil. (If your "S.T.300" aerial coil

choke, L.F. transformer, 1 mfd. condenser on L.F. side of set, S.G. choke.

- (v) With aid of "S.T.400" blueprint mark fixing holes for baseboard components, with exception of L.F. transformer, valve holders, 1-megohm resistance holder; the fixing holes for these components are marked by placing them over the corresponding components shown on the blueprint, noting especially from this month's layout diagram the terminal position of the valve holders.

STAGE 3:—WITH ANODE COIL FIXED



At this stage of the wiring you are well on the way with the conversion. Note that the anode coil is now mounted.

- is not of Colvern make, you may get the reaction coil wound in wrong direction. This may be tested as follows: When set is finished and with anode coupler at normal, turn distributor so that *all* the reaction current is passed through aerial reaction coil; increase master reaction from zero; the set should oscillate; if it does not, then the aerial reaction coil is probably wound the wrong way round.)
- (t) Refit aerial coil.
- (u) Remove $\cdot 0001$ -mfd. grid condenser, detector valve holder, and output valve holder, reaction
- (w) Remove H.T.+3 terminal. Replace it by an H.T.+4 terminal (wire (20) still remaining in place).
- (x) Remove H.T.+2 terminal.
- (y) Drill holes in terminal strip for new positions of H.T.+2 and H.T.+3 (see drawing). Fit loosely terminals H.T.+2 and H.T.+3.
- (z) Fit S.G. choke, two 2-mfd. condensers (see note in main article), L.F. transformer, three valve holders, reaction choke, Graham Farish $\cdot 006$ -mfd., 1-megohm resistance holder, selectivity range adjuster preset $\cdot 0003$ -mfd. (N.B.—Reaction equaliser preset $\cdot 0003$ -mfd. is not fitted at

—Into an Even Finer Four-Valver

this stage, nor should the 1-megohm resistance be inserted in the holder.)

(za) Wire baseboard components with stiffish insulated wire (bell-wire or one of the advertised varieties). To save the reader time and trouble I have numbered the wires in their most convenient order for connecting.

The numbers from now on refer to the "S.T.400" conversion drawings in this issue (and correspond to equivalent connections on the "S.T.400" blueprint). Reasons for adhering to my order are not given, but you will find them out if you depart from it!

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

It is important to tick off the numbers on this list after completing each connection. No terminals should be *finally* tightened until all its wires (consult drawings) are in place. Once certain, tighten firmly.

(N.B.—Valve-holder filament terminals are marked F on actual valve holders, but are marked -F or +F to assist readers to follow them.)

1. Already wired. It goes from screening-grid terminal A of W.B. valve holder to 1-mfd. condenser (terminal farthest from strip).
2. Already wired. It goes from 1-mfd. condenser (terminal farthest from strip) to H.T. + 1 terminal on strip.
3. Using what was wire (7) in "S.T.300," connect earth terminal on strip to aerial coil terminal No. 5.
4. Aerial coil terminal No. 5 to aerial coil terminal No. 6.
5. Aerial coil terminal No. 6 to upper terminal F on W.B. valve holder, shown as -F in drawings.
6. Using what was wire (6) in "S.T.300," connect aerial coil terminal No. 2 to normal grid terminal marked G on W.B. valve holder.
7. Valve holder V_2 filament negative terminal -F (i.e. filament terminal farthest from baseboard

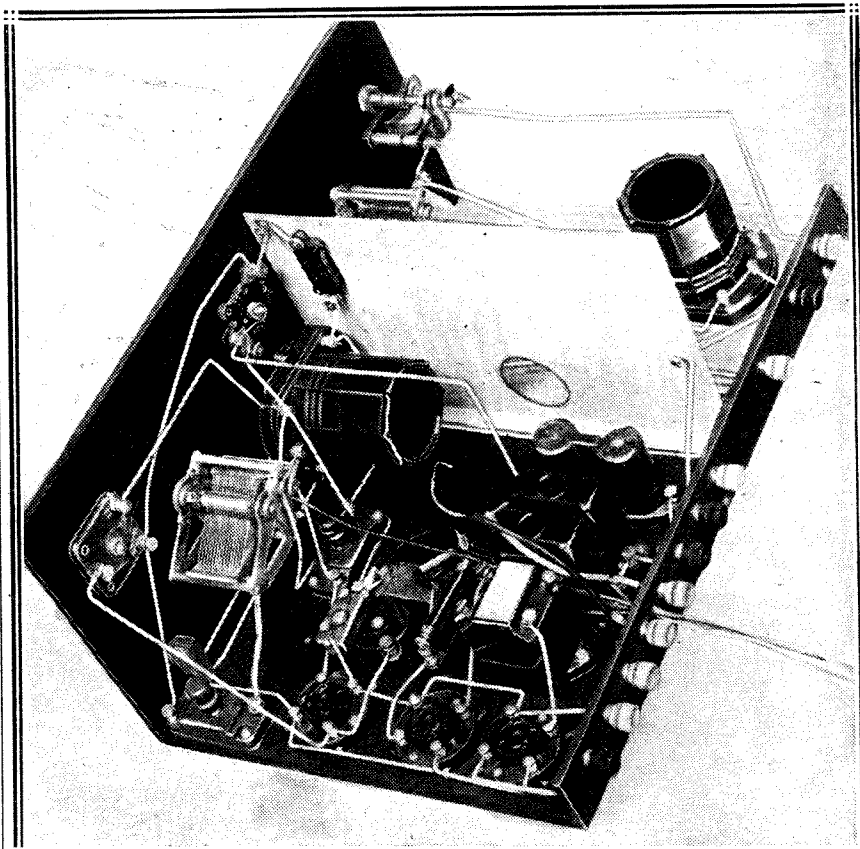
edge) to valve holder V_3 filament negative terminal -F (farthest from baseboard edge).

8. Valve holder V_3 filament negative -F (farthest from baseboard edge) to valve holder V_4 filament negative -F (farthest from baseboard edge).
9. Valve holder V_4 filament negative -F (farthest from baseboard edge) to H.T.— on strip.
10. H.T.— on strip to L.T.— on strip.
11. Valve holder V_2 filament positive +F (nearest baseboard edge) to

15. 2-mfd. (terminal nearest strip) to other 2-mfd. (terminal near strip).
16. 2-mfd. nearest S.G. choke has its terminal nearest strip connected to H.T.— on strip.
17. Valve holder V_4 grid marked G to G on Niclet L.F. transformer.
18. Valve holder V_3 anode, marked A to P on Niclet.

(N.B.—The terminal positions on Niclet are different from those on Hypernik shown in original "S.T.400" blueprint, so make certain wires (18) and (19) go to terminals specified.)

"S.T.400"—THE CONVERSION COMPLETED



This is the final stage and shows your "S.T.300" when it has been completely converted into an "S.T.400."

12. Valve holder V_3 filament positive +F (nearest baseboard edge) to valve holder V_4 filament positive +F (nearest baseboard edge).
13. Already wired. It goes from L.S.+ on strip to H.T.+4 on strip.
14. Using what was wire (21) on "S.T.300," connect H.T.+4 on strip to S.G. choke (terminal nearest strip).
19. H.T.+ on Niclet to terminal (farthest from strip) on 2-mfd. condenser nearest the Niclet.
20. Terminal (farthest from strip) on 2-mfd. (nearest transformer) via the 20,000-ohm spaghetti formerly on "S.T.300," to H.T.+3 terminal on strip.
21. H.T.+2 terminal on strip via 50,000-ohm spaghetti to terminal (farthest from strip) on 2-mfd. (nearest S.G. choke).

It Will Not Cost You Much

22. .006-mfd. Graham Farish (terminal farthest from strip) to reaction choke (terminal farthest from strip).
23. Reaction choke (farthest from strip) via 60,000-ohm spaghetti to terminal (farthest from strip) on 2-mfd. nearest S.G. choke.
24. Reaction choke (terminal farthest from strip) to .0003-mfd. condenser. (The Goltone .0003-mfd. used has metal straps at each end. One is used in present case as the connection to reaction choke terminal; the other strap

to nearest terminal on selectivity range adjuster .0003-mfd. preset.

27. Valve holder V_3 grid (marked G) to nearest terminal on 1-megohm resistance holder, bending wire upwards to clear wire (7) by quarter of an inch.
28. Resistance holder (terminal nearest the valve holders) to Graham-Farish .006-mfd. (terminal nearest strip).
29. Valve holder V_2 anode (marked A) to reaction choke (terminal nearest strip), bending wire up-

connected to anode terminal on S.G. valve.

32. This is a single insulated flex about 9 in. long. First connect the G.B.+ wander-plug from the "S.T.300" to one end. Then thread other end through hole between H.T.+2 and H.T.+3 on strip and connect to terminal (nearest strip) on 2-mfd. (nearest transformer).

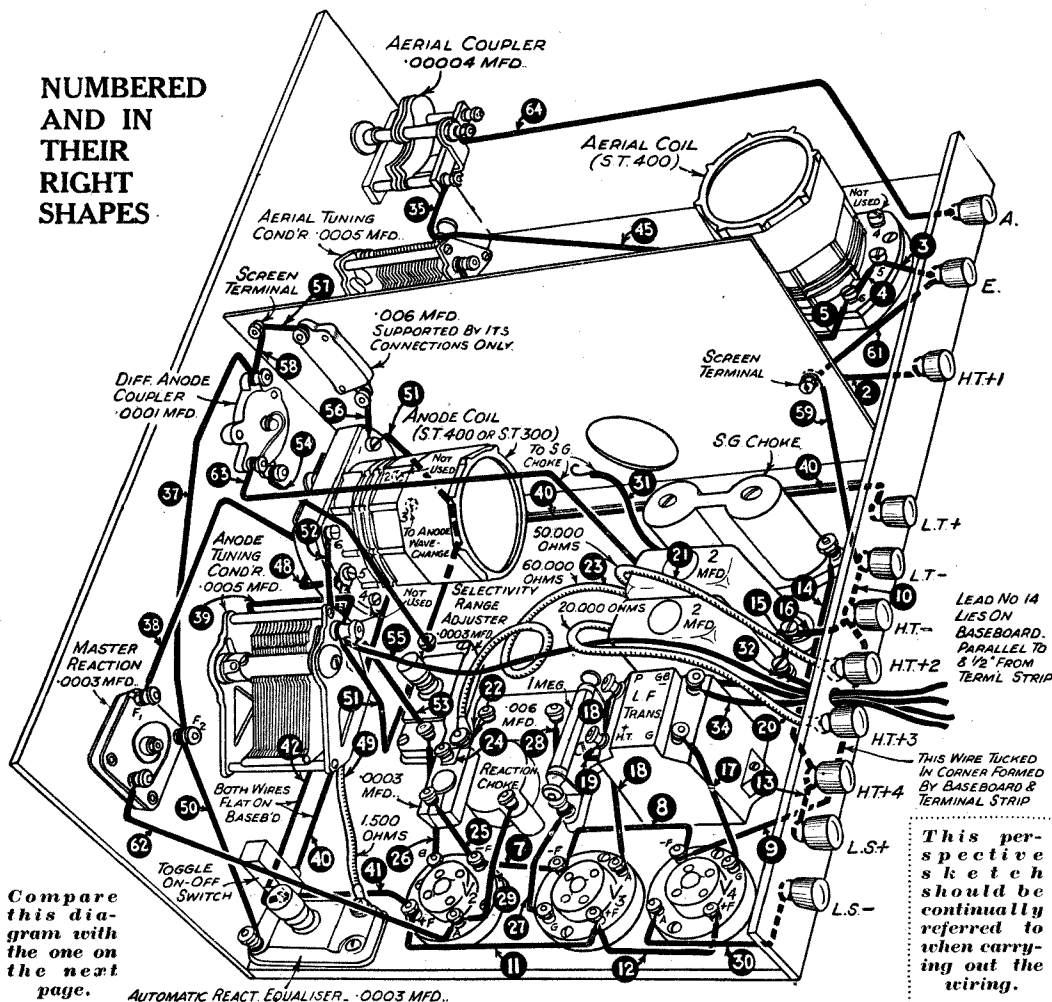
33. This is a single insulated flex about 12 in. long. First connect a G.B.-2 wander-plug to one end. Then thread other end

through hole in strip and, passing it between transformer and adjacent 2-mfd. condenser, connect it to 1-megohm resistance holder (terminal farthest from valve holders). Flex (33) passes underneath (19).

34. This is a single, insulated flex, about 10½ in. long. First connect a G.B.-3 wander-plug to one end. Then thread other end through hole in strip and connect to G.B.- on Niclet transformer.

- (zb) Fit 1-megohm resistance in holder.

NUMBERED AND IN THEIR RIGHT SHAPES



Compare this diagram with the one on the next page.

AUTOMATIC REACT. EQUALISER. .0003 MFD.

This perspective sketch should be continually referred to when carrying out the wiring.

WIRE PANEL COMPONENTS AS FOLLOWS:

25. Other side of .0003-mfd. to valve holder V_2 filament negative -F (terminal farthest from baseboard edge).
26. Valve holder V_2 grid (marked G)

wards to clear wire (7) by quarter of an inch.

30. L.S.- on strip to valve holder V_4 anode (marked A).
31. Connect one end of the bit of flex that was (25) on the "S.T.300" to S.G. choke (terminal farthest from strip). When set is finished, free end is

vanes, i.e. terminal on side in case of Ormond).

36. Aerial tuning condenser (moving vanes, i.e. terminal at end) to aerial push-pull wavechange switch (terminal nearest anode wavechange switch).
37. Master reaction .0003-mfd. differential (lower set fixed vanes, i.e.

It Will Not Take You Long

EXTRA COMPONENTS REQUIRED FOR THE CONVERSION

- 1 .006-mfd. fixed condenser (Dubilier 670, or T.C.C., Lissen, Telsen, Bulgin).
- 1 .006-mfd. fixed condenser (Graham Farish, or T.C.C., Lissen, Telsen, Dubilier 670, Bulgin).
- 1 .0003-mfd. fixed condenser (Goltone, or T.C.C., Dubilier, Telsen, Graham Farish, Lissen, Bulgin, Ferranti).
- 2 2-mfd. condensers (Igranic, or T.C.C., Telsen, Dubilier, Ferranti, Forno, Lissen, Helsby, Sovereign). (See article before deciding to buy condensers.)
- 1 60,000-ohm spaghetti (Lewcos, or Graham Farish, Varley, Magnum, Telsen, Bulgin, Sovereign).
- 1 50,000-ohm spaghetti (Igranic, or Lewcos, Magnum, Varley, Graham Farish, Telsen, Bulgin, Sovereign).
- 1 1,500-ohm spaghetti (Igranic, or Graham Farish, Lewcos, Varley, Magnum, Telsen, Sovereign, Bulgin).
- 2 Preset condensers, .0003-mfd. maximum (Telsen or Goltone). (These

- makes are chosen for their low minimum capacities.)
- 1 Toggle switch (on-off) (Bulgin S.80, or Claude Lyons B.A.T., Igranic, Wearite). (Any 2-pt. switch may be used if radiogram switching is desired—a Wearite I.23 is recommended; see last month's issue for details.)
- 1 .00035-mfd. differential (Lotus .00035-mfd. M.D.35, or .0003-mfd. of following: Graham Farish, Polar, Magnum, Telsen, J.B., Bulgin). (There is no technical merit in .00035-mfd. over .0003-mfd.)
- 1 .0003-mfd. differential (Polar, or Graham Farish, Magnum, Telsen, Lotus (.00035-mfd.), J.B., Bulgin). Wander plugs: G.B.—2, G.B.—3. I advise types which can fit into each other, and therefore it may be desirable to get a G.B.—1 also. (Clix or Belling-Lee.) (The former makes a special dual plug.)
- H.T. wander-plug, H.T.+4 (Belling-Lee, or Clix, Bulgin, Eelex, etc.).

- 1 Resistance holder to hold Graham Farish 1-megohm leak (Graham Farish).
- 1 Valve holder (4-pin) (Lotus V.H.K., or Benjamin Vibroholder, Graham Farish, Telsen, W.B., Bulgin, Tunewell, Ferranti, Ready Radio).
- 1 Terminal, H.T.+4 (Belling-Lee type R, or Bulgin, Clix, Eelex, Igranic, etc.).
- 2 Spade terminals, L.T.+ , L.T.— (if desired) (Belling-Lee).
- 1 S.G. anode connector (if desired) (Belling-Lee).

N.B.—In the article it is suggested that a .0003-mfd. preset be tried across the Niclet L.F. transformer secondary. A preset of Telsen or Goltone manufacture should be used. This preset is not included in above list, as it is optional.

The aerial coil should be of "S.T.400" type or existing "S.T.300" aerial coils may be converted by the reader himself with great ease.

terminal marked F_2 on Polar) to anode coupler .0001-mfd. differential (one set fixed vanes, terminal nearest aerial coupler; this applies to old Telsen model .0001 mfd. as used in original "S.T.300").

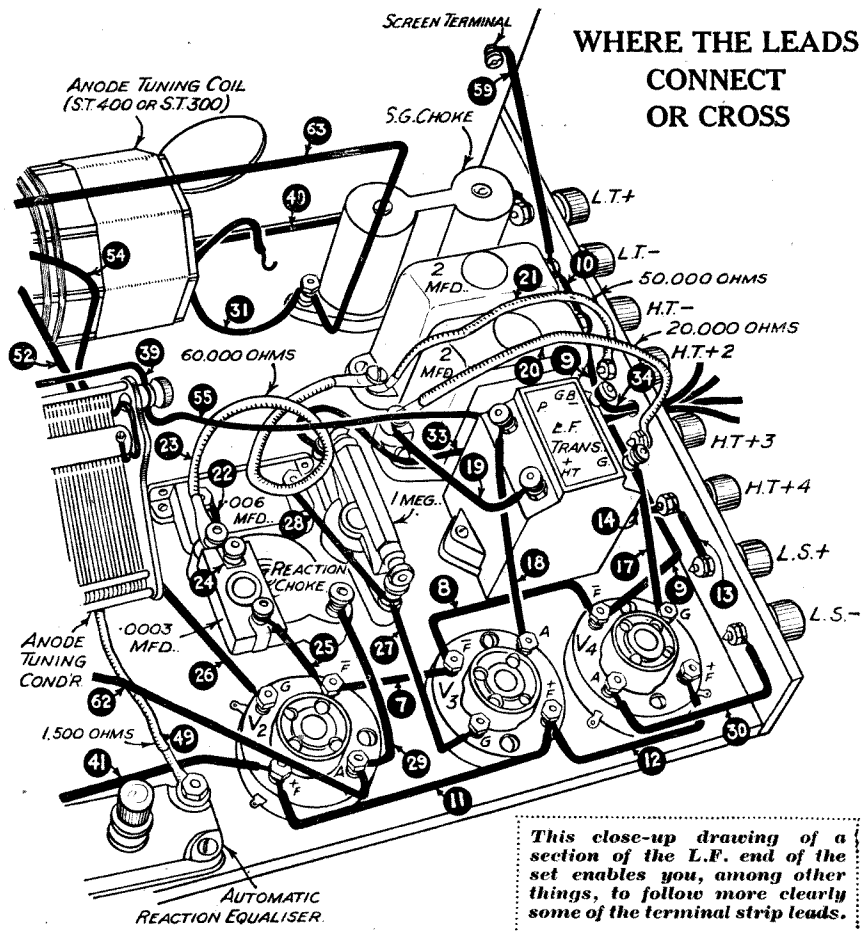
- 38. Master reaction .0003-mfd. differential (upper set fixed vanes, i.e. terminal F_1 on Polar) to distributor .00035 mfd. (moving vanes, i.e. terminal to which pigtail is connected and which is nearest anode tuning condenser).
- 39. Anode wavechange switch (terminal nearest on-off toggle switch) to anode tuning condenser (moving vanes, i.e. terminal at end).
- (zc) 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.: (42) from S.G. valve-holder filament positive +F (lower filament terminal on W.B. valve holder); this wire will leave toggle, go round behind toggle, and then run along baseboard close to the panel until the screen is passed. Also prepare (41) for valve-holder V_2 filament positive terminal nearest baseboard edge), noticing where automatic reaction (qualiser) preset will come. Also prepare (40) from L.T.+ on strip; this wire runs along base-

board and half an inch away from panel until it turns off near screen.

The general shape of these

three wires is obtainable from diagrams.

Connect end of last wire (40) to toggle (terminal nearest



WHERE THE LEADS CONNECT OR CROSS

Step By Step From Set To Set—

push-pull switches); other end of this wire is not connected until panel is fixed.

FIX PANEL TO BASEBOARD with three screws. Under no circumstances use countersunk screws unless holes have been

countersunk, otherwise panel will split.

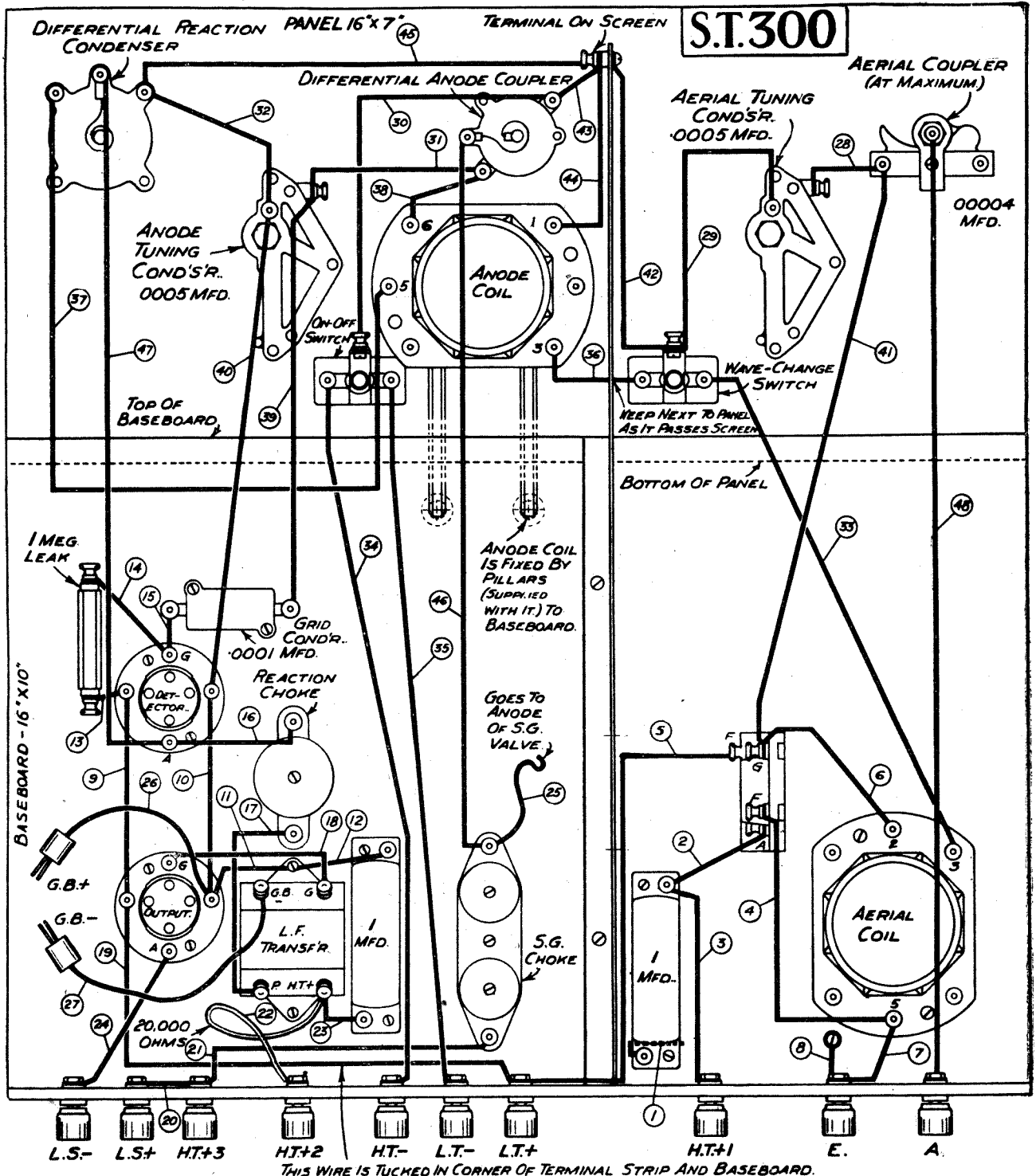
Photo No. 1 shows how set looks at this stage.

(zd) Carry out following wiring:

40. Toggle switch (terminal nearest push-pull switches) to L.T.+ on strip. The toggle switch end of

this wire has been already connected. This wire, as described above, runs along baseboard and close to panel.

41. Toggle switch (terminal nearest baseboard edge) to valve holder V_2 filament positive +F (terminal nearest baseboard edge).

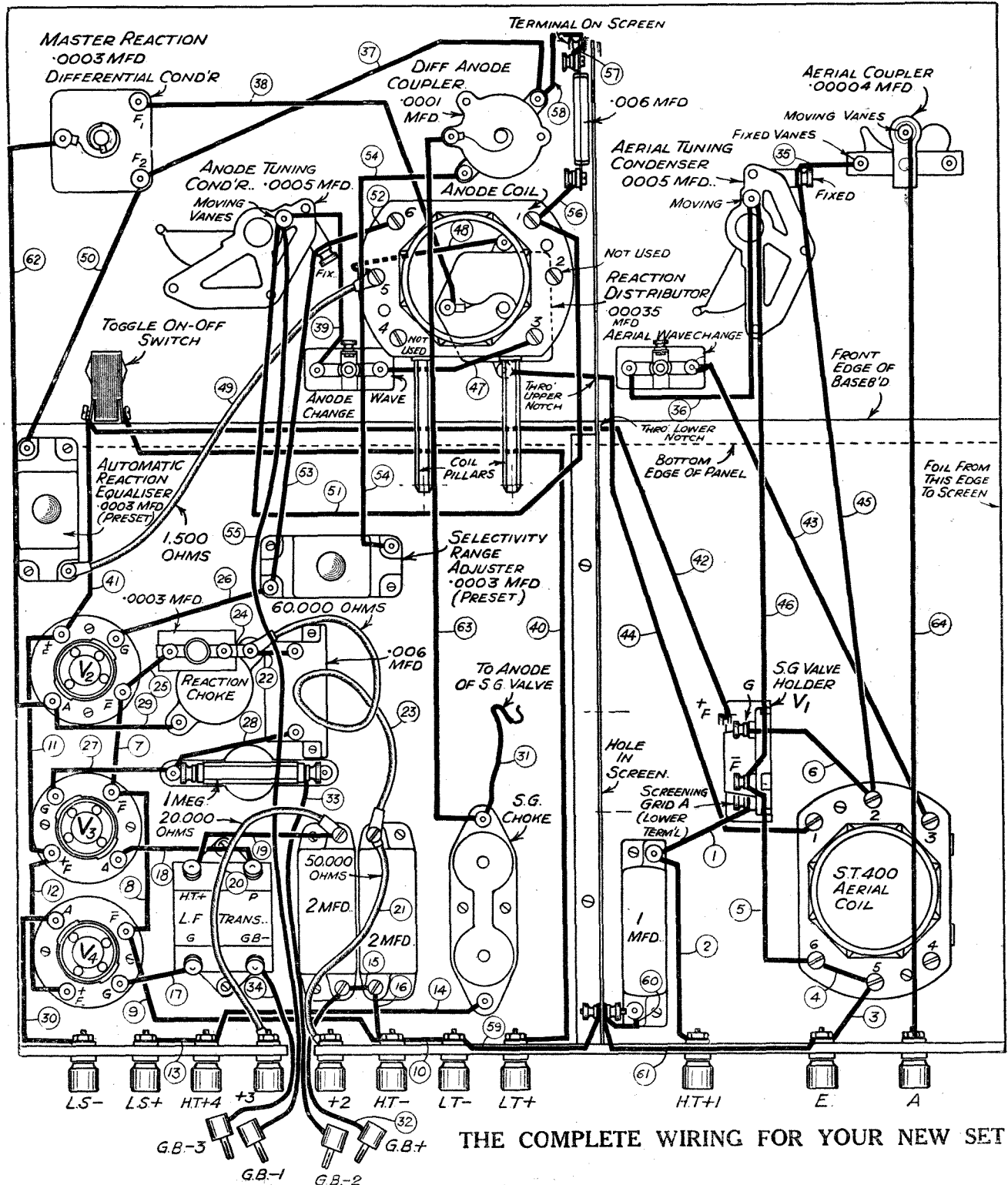


—and Every Lead is Numbered for You

42. Toggle switch (terminal nearest baseboard edge) to S.G. valve-holder filament positive +F (lower filament terminal F on W.B. valve holder).
This wire leaves toggle, goes

round behind toggle, and then along baseboard, keeping close to panel; after passing through lower notch in screen, it goes in a straight line to lower terminal F on W.B. valve holder.

43. Using what was (33) on "S.T.300," connect aerial wave-change switch (lower terminal nearest aerial tuning condenser) to aerial coil (terminal No. 3). Note that in case of both



Taking Final Steps in Conversion

push-pull three-point switches, they are used only as two-point switches, the upper terminal in each case being unused.

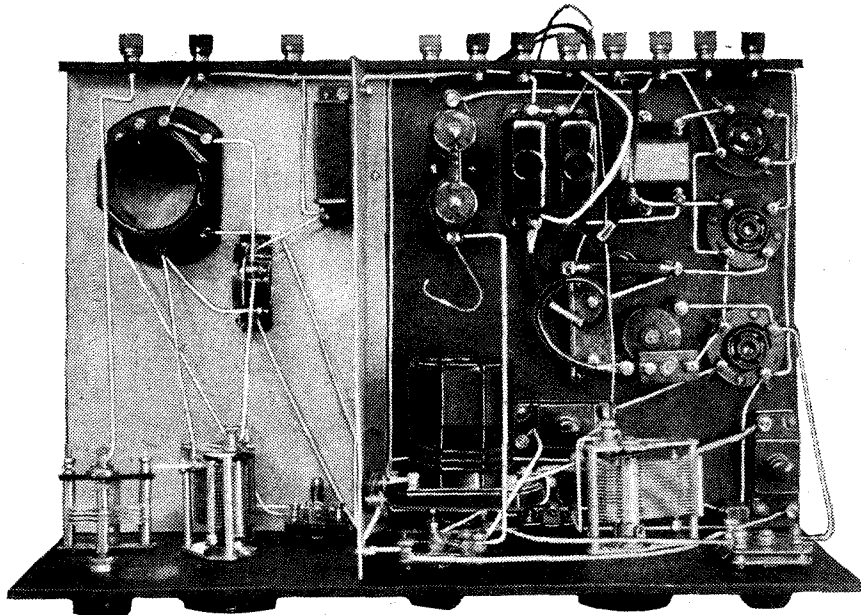
44. Reaction distributor -00035 differential (lower fixed vanes, i.e. bottom terminal) to aerial coil (terminal No. 1). This wire must be kept close to panel, where it will later pass through upper notch in screen. The wire will keep about half an inch above earth sheet. It must not sag on to it.
45. Aerial tuning condenser fixed vanes (i.e. terminal on side in case of Ormond) to aerial coil (terminal No. 2).
46. Aerial tuning condenser moving vanes (terminal at end) to S.G. valve holder (negative filament terminal -F, i.e. upper filament terminal F on W.B. valve holder).
- (ze) Take a 4-in. length of insulated

and (48) are for subsequent connection to anode coil. The reader is referred to original "S.T.400" article which contains a sketch of the wires.

Photo No. 2 shows set at this stage. Note the wires which will go to coil.

- (zg) Fix anode coil in position, letting wire (47) pass between its pillars.
47. Anode wavechange switch (terminal nearest reaction distributor) to anode coil (terminal No. 3). The connection to the wavechange switch has already been made, and the free end, after passing between pillars, is joined to terminal No. 3.
48. Reaction distributor (upper set fixed vanes, i.e. top terminal) to anode coil (terminal No. 5). The distributor end of this wire has already been connected.

AN "AERIAL" VIEW OF THE COMPLETED WIRING



This is how the receiver will appear to you as you bend over it from the front with it on the table.

wire, bare and loop its ends; attach one end to anode wavechange switch (terminal nearest reaction distributor); this wire is numbered (47) on diagrams.

- (zf) Take a 4½-in. length of insulated wire, bare and loop its ends; attach one end to reaction distributor (upper set fixed vanes, i.e. top terminal); this wire is numbered (48).

N.B.—Both above wires (47)

- (zh) Fit automatic reaction equaliser (-0003-mfd. preset).

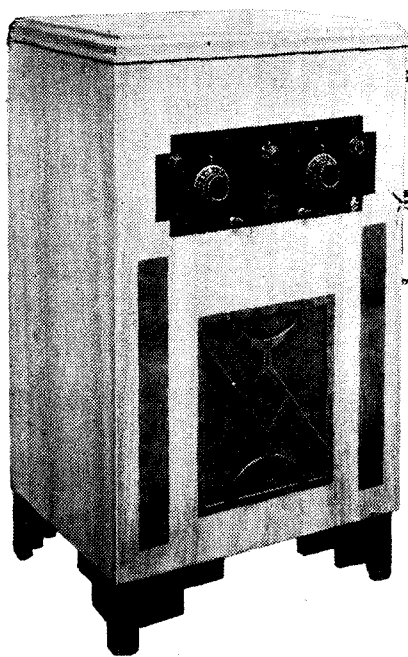
49. Anode coil (terminal No. 5) via 1,500-ohm spaghetti to automatic reaction equaliser preset (terminal farthest from panel). Spaghetti is right length with components actually used. If too short, an extension wire may be added, but should be joined to spaghetti by a small nut and bolt to ensure perfect contact.

50. Automatic reaction equaliser preset (terminal nearest panel) to master reaction differential (lower set fixed vanes, i.e. bottom terminal marked F₂ on Polar).
51. Anode coil (terminal No. 1) to anode tuning condenser moving vanes (terminal at end). This wire (see drawings) drops vertically from terminal No. 1 to baseboard, bulging outwards to clear terminals No. 2 and No. 3; then proceeds parallel to panel along baseboard; immediately after passing selectivity range adjuster, it rises diagonally and then bends to run close to end-plate of anode tuning condenser.
52. Anode coil (terminal No. 6) to anode tuning condenser fixed vanes (terminal on side).
53. Anode tuning condenser fixed vanes (terminal on side) to selectivity range adjuster preset (terminal nearest toggle switch).
54. Selectivity range adjuster preset (terminal nearest anode coil) to anode coupler differential fixed vanes (bottom terminal). This wire starts at preset terminal, travels for one-eighth of an inch only in direction of preset knob, then rises vertically; after rising 3½ inches, it travels almost horizontally to the bottom terminal on differential anode coupler.
55. This is a single insulated flex about 15 in. long. First connect a G.B.—1 wander-plug to one end. Then thread other end through hole in terminal strip, and, passing it between transformer and the adjacent 2-mfd. condenser, connect it to anode tuning condenser moving vanes (i.e. terminal at end). This wire must not be allowed to sag on to reaction choke.
- (zj) Give earth sheet and vertical screen a rub with emery when they will come in contact with each other. Do not blow dust away, but wipe carefully. Clean also round terminal holes in screen and fit with terminals.

Photo No. 3 shows the set at this stage.

NOW FIX VERTICAL SCREEN seeing that wire (42) goes through lower notch next panel, and that wire (44) goes through the upper.

(Please turn to page 314)



The "PILOT" S.T.400 KIT

Builders of the "S.T.400" will save themselves quite a lot of bother in collecting together the parts for their sets by obtaining them as a kit. When desired, the handsome cabinet illustrated in the heading of this article on the "Pilot" Author's Kit is available for housing the receiver.

THE law of supply and demand is an old one. And with radio, as with everything else, the successful retailer is he who can anticipate the stocks he will require to meet a forthcoming demand.

But who is there, even in his most optimistic moments, who could possibly have foreseen that the publication of the long-awaited "S.T.400" would have resulted in such a phenomenal demand for parts as has turned out to be the case?

An Endless Stream

Literally, from Land's End to John o' Groats the "S.T.400" is the main topic of conversation in the retailers' shops. "I want a set of parts to build the 'S.T.400.'" "I want the parts to convert my 'S.T.300.'" One after another—an endless stream of enthusiastic constructors.

And what is the result?

Few are the constructors who will depart from Mr. Scott-Taggart's original specification, or from the equally satisfactory alternatives that he has approved. Readers know that the discrimination of the designer is in their interests, and they will not be put off by any amount of assurances that the "so-and-so" make will do.

Demands of Constructors

Those are the wise readers. Those are the readers who can with confidence look forward to results equal to those given by the original set.

But who is there, after having read the last issue of the CONSTRUCTOR, that is content to wait patiently for the replenishment of supplies in those

cases where the phenomenal demand has resulted in a temporary exhaustion of stocks?

What, then, is to be done about it?

Were it only for the purposes of meeting instantly the demands of enthusiastic constructors, one could have nothing but praise for the kit idea.

But a modern kit is representative of very much more than just a collection of the appropriate parts. It is

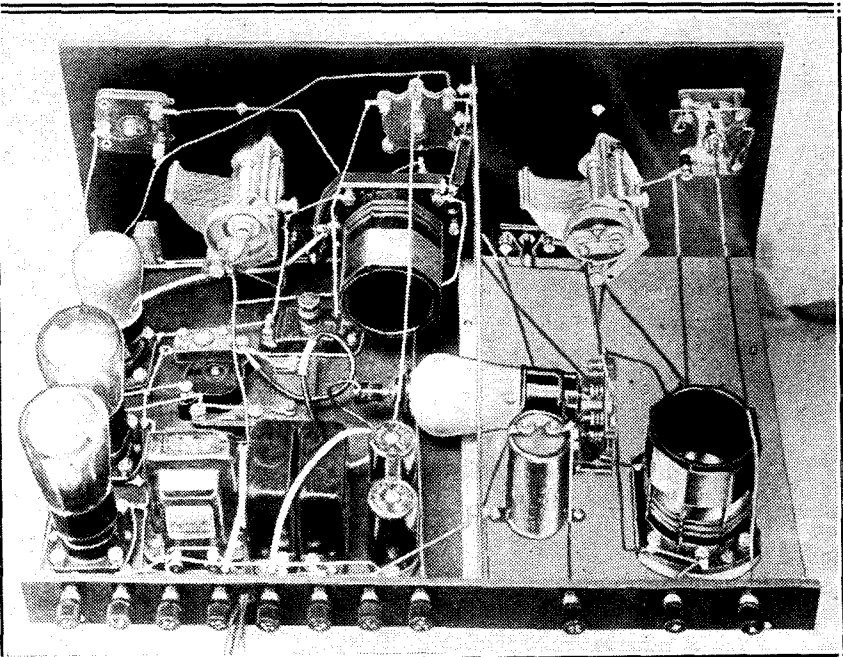
constructor service brought down to a fine art.

Take the case of the "Pilot" Author's Kit for the "S.T.400." What do you find when you open up the sealed carton in which it is sent to you?

Constructional Advantages

First and foremost, a complete set of parts to the exact specification of the author. That means that your completed receiver will tally in every

ENABLES YOU TO BUILD TO SPECIFICATION



One of the advantages of a "Pilot" Kit is that the exact makes of parts as used in the original receiver are provided. Thus the constructor is assured that he is building his set exactly in accordance with Mr. Scott-Taggart's instructions.

The "Pilot" "S.T.400" Kit—continued

essential respect with the actual set illustrated in these pages last month. It also means that you can work from the original blue print to limits within a fraction of an inch.

But now let us come a step nearer home and consider the constructional advantages of the kit. Take, for instance, the question of the panel.

The Panel is Drilled

To many readers, the task of drilling a panel is a sheer delight. That is because they have not only suitable tools, but the ability to do it. But there are others to whom a drill is a menace and to whom, alas, at times it is apt to be the means of spoiling a piece of ebonite.

But with the prospects upon completion of the set of listening to the results such as are given by the "S.T.400," the advantages of a ready-drilled panel will be appreciated by everybody.

In the "Pilot" Author's Kit the panel is ready-drilled for you. Moreover, it is drilled accurately to take the parts that are supplied with it, so that the

first part of the construction resorts itself into a straightforward job of assembly that anyone can undertake.

Not that that is the sole advantage of the kit from the constructional point of view.

The non-standardisation of the sizes of fixing holes in the various components used is apt to prove a trifle irksome when it comes to obtaining suitable screws with which to secure them. But the trouble of finding, or of otherwise obtaining, suitable screws is completely eliminated when you build from a kit, for an adequate supply of the appropriate sizes is included.

Then consider for a moment the baseboard and the advantage of having the metal foil all ready fixed in position and in a way which tends to prevent any curling. Such is the state of the baseboard supplied with the "Pilot" Kit.

Guaranteed Kit

The kit, as supplied, is complete to the extent of having ready-drilled terminal strips and matched knobs

for all panel components. The careful attention to details is exemplified in the provision of flex with which to make the grid-bias connections.

Over and above that the would-be constructor has the added confidence of knowing that the kit of parts for the "S.T.400" as supplied by the Peto-Scott Company is guaranteed for a period of twelve months from the date of purchase.

With the exception of a reference to the fact that a full-size blue print and a copy of the "S.T.400" issue of THE WIRELESS CONSTRUCTOR is supplied free with every kit, that is the "Pilot" Author's Kit for the "S.T. 400."

Low Price

One more thing remains to be added, and that concerns the price.

With the advantages accruing from the use of a kit, it might logically be imagined that the price is proportionately higher. In point of fact, that is not so.

The kit of parts—with ready-drilled panel and terminal strips, and the other constructional aids—costs not a penny more than the bare cost of the parts, and it is sent carriage paid.

Kit "A," which is a kit of specified parts, less valves and cabinet, costs £4 15s., which is the exact cost of the parts used in the original set. On hire-purchase terms it can be obtained for a first payment of 8s. 9d., the balance being payable in eleven monthly instalments of the same amount.

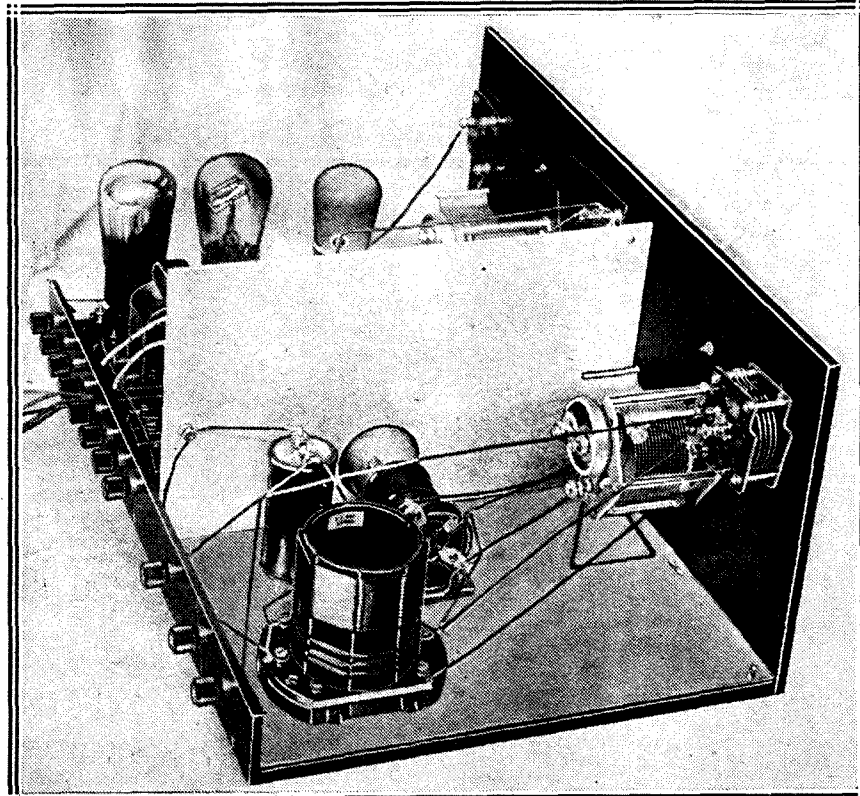
The cash price of the kit, with valves but less cabinet, which is known as Kit "B," is £6 14s. 3d. Here, again, a no-deposit H.P. system of twelve monthly payments of 12s. 3d. is available for those who prefer it.

Aerial Tested

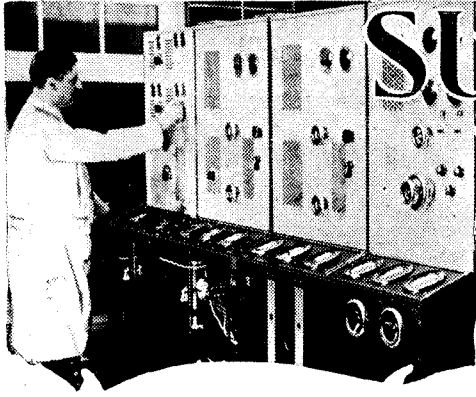
For those who do not possess a suitable cabinet, Kit "C"—which includes the specified kit, the valves and cabinet—is the one that will most appeal. The cash price of Kit "C" is £7 11s. 3d., or it can be had for twelve monthly payments of 14s.

Just as a concluding note, it may be of interest to mention that the Peto-Scott Company are also supplying the finished instrument, aerial tested and with valves and cabinet, for the inclusive price of £9 12s. 6d. Batteries, of course, are not included in this price.

YOUR SET WILL LOOK JUST LIKE THIS



When building from a Kit Set you have the advantage of everything needed being to hand just when it is wanted. What is more, you can be certain that it is of just the right type, and you do not have to bother to check up to see that the parts are as specified.



SUPER-POWER on 7 METRES

BY DR. ALFRED GRADENWITZ

Details of an extremely powerful transmitter for broadcasting on very high frequencies which is intended for use in Germany for the regular transmission of music, speech and television.

THE new ultra-short-wave transmitter of the Telefunken people, which is for the first regular ultra-short-wave broadcasting service, constitutes one of the most remarkable achievements ever recorded in wireless. The extraordinary high frequency of this transmitter, viz., 43 million cycles, corresponding to a wavelength of 7 metres, did not previously allow the antenna output being raised beyond about 3 kilowatts.

For Television

In fact, so far, the largest ultra-short-wave transmitter in Germany, by means of which interesting broadcasting tests were carried out, had to be content with an output of $1\frac{1}{2}$ kilowatts, which, of course, was amply sufficient in the case of acoustic broadcasting, i.e. the transmission of speech and music within a given city area, in connection with which a range of modulation of 10,000 cycles is made use of.

However, in the present case, the future development of television had to be taken into account, the new transmitter being destined not only for acoustic broadcasting, but—largely—for television tests.

Special Valves

The surprisingly high antenna output of 15 kilowatts, as recorded at the Telefunken Testing Laboratories, could only be secured by a thorough reconstruction of the various pieces of apparatus, beginning with valves. In fact, new ultra-short-wave valves of a special water-cooled type, having an electronic emission of 10 amperes, were developed, and two such valves operated at a direct current tension of 6,000 volts were provided in the terminal stage of the transmitter. In spite of their relatively large dimensions it was possible to reduce the wavelength to 6 metres by making proper use of stray capacities and cutting the

length of conductors down to a minimum.

The transmitter is by no means an impromptu combination for laboratory purposes, but has been developed down to the minutest detail like a standard long- or short-wave transmitter and, even outwardly, is of very compact design.

The transmitter comprises seven stages and has been equipped with crystal control for securing the desirable constancy of frequencies. The crystal wave is 56 metres, and is in three doubling and amplifying stages cut down to the 7-metre wave, the frequency thus being raised to eight times the initial figure. The first four transmitter stages have been equipped with special screen-grid valves of particularly low control power and small internal capacity.

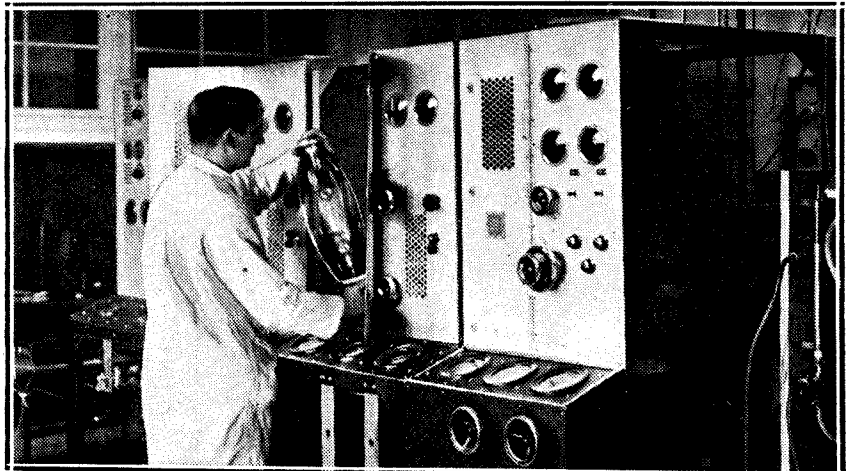
to 10,000 cycles). Special means have, of course, been provided for eliminating distortion as far as possible. In the case of television the modulator at the grid end may be operated in a resistance amplifier arrangement, when it will be suitable for frequencies up to 300,000 cycles.

Wide Frequency Range

The transmitter further comprises a modulation measuring instrument, a listening and checking arrangement, as well as the broadcast amplifier and the modulator for both acoustic and visual (television) broadcasting. The base carrying the transmitter proper comprises the usual control handles for controlling the machinery and necessary measuring instruments.

Operation of this transmitter is quite as simple as that of a standard

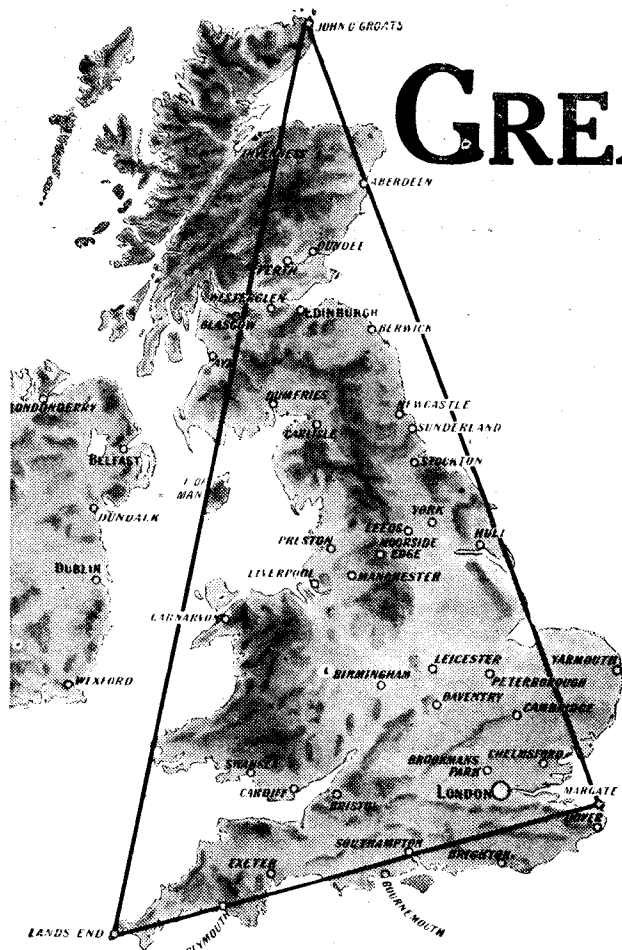
BUILT ON WELL-ESTABLISHED HIGH-POWER LINES



One of the giant valves of the 15-kilowatt 7-metre German-made transmitter being carefully fitted into place by an engineer. There are seven stages in all, including the frequency doubling ones.

The transmitter is modulated in the last stage but one, by acting upon the grid bias of the valves; the resistance amplifier designed to serve as modulator comprises a transformer at the grid end for the range of acoustic broadcasting (30

short- or long-wave transmitter of the latest design. Another interesting feature is that the transmitter has been designed to serve for the whole interval of waves between 6 and 8 metres, without any exchange of coils or condensers.



GREAT BRITAIN'S

Once again, Sir, I must congratulate you for giving the public such a wonderful set.

Yours faithfully,
W. J. EMMETT.

Clarence Road,
Nunthorpe S.O., Yorks.

"WOULDN'T EXCHANGE IT FOR AN ALL-MAINS 7-VALVE SUPERHET."

Sir,—I have often wondered, when reading from time to time in the various wireless journals, etc., reports on sets published and designed for the home constructor, what were the qualifications (theoretical or practical) of the persons reporting, and what degree of proficiency was required in assembling the various sets. As I think these are two important points, perhaps my experiences with your "S.T.400" might prove to be of interest.

Firstly, then, I am by no means possessed of any special qualifications as a constructor of sets, having, during the last ten years, assembled only four sets (an "S.T.100" and three four-valve sets), and do not profess to be an expert knob-twiddler; in short, I may be classed as an "ordinary listener."

On Friday last I obtained an "A" kit from Messrs. Peto-Scott, Ltd., and by Monday the set was ready for a try-out, the time taken being a few odd half-hours and hours here and there before and after working hours.

Within fifteen seconds of turning on the current I was receiving stations at better strength and quality than ever previously.

The valves I used were P.M.12, 210H.F., 210L.F., and 215, all of which had already been in use for more than two years, and none of which is metallised as recommended. Although the number of knobs looks alarming at first sight, I experienced no difficulty in their use, their effect being easily discernible.

The constructional part of the business not only presented no difficulties, but with the aid of the special guide proved to be ridiculously easy.

In short, to anyone who is hesitating about "risking it" I can sincerely and confidently say, "Get one!"

I might say that some friends have a 7-valve all-mains superhet of well-known British make, but I wouldn't exchange theirs for mine, good though theirs undoubtedly is!

Yours faithfully,
ARTHUR N. HYDE.

1, Manville Road,
Balham,
London, S.W.17.

"56 STATIONS FIRST NIGHT BY BOY OF 14 YEARS!"

Sir,—I have now had your "S.T.400" set built for three days, and I wish to congratulate you on your wonderful piece of work. I am only a boy of fourteen, but already

Station Road,
Helmsley, York.

"QUALITY EXCELLENT—VOLUME ENORMOUS—EASY TO CONTROL—SELECTIVITY WONDERFUL."

Sir,—Allow me to congratulate you on designing such an excellent set as the "S.T.400."

I may say that I have made receivers of all types, including your "S.T.300" (an excellent three-valve receiver), but have never had results to compare with the "S.T.400."

The quality of reproduction is excellent, and the volume on all stations enormous. I find the set very easy to control and selectivity wonderful.

I shall only be too pleased to demonstrate this wonderful set to anyone in this district, for the "S.T.400" is the finest set I have yet heard.

Yours faithfully,
DIGBY FRANK.

16, Kempton Road,
East Ham, London.

"PRINCIPAL FOREIGNERS ON 2 FT. OF AERIAL!"

Sir,—I have just built your "S.T.400," and I would like you to know how delighted I am with it. I have already your "S.T.300" working, and although it is a wonderful set, the "S.T.400" beats it.

I have tried the set in various parts of London, all with the same results—*very good*. **Only last night I received all the principal foreign stations on only 2 ft. of indoor aerial in one of the most congested parts of London, i.e. Zone A.**

VERDICT ON THE

S.T. 400

I have built several sets, and I've never known one so easy to construct as this. I think this must be because of your very full point-to-point wiring description.

Even at this age I think I am able to tell a good set when I see one, and this surely is the most marvellous set I have ever heard or seen.

The first night when I had made it I logged 56 stations, the next night I brought this total up to 63, and I expect by the time this letter reaches you the total will be even larger. My aerial is very short, and all the stations I logged I brought in on the loudspeaker. It is not only the great range and power of this set which astonishes me, but also its wonderful fidelity of tone.

Yours truly,

E. A. PYKE.

17, Lansdale Street,
Peel Green, Manchester.

"SOMETHING FROM SOMEWHERE ANY TIME OF DAY OR NIGHT"

Sir,—Having built your "S.T.400" set, I thought it was only right that I should let you know something about same, and after reading in THE WIRELESS CONSTRUCTOR that you would like to hear, I now write to you.

May I say that I have built many a set before this one and have scrapped them all, but this I'm going to keep. Any time of day or night something is on from somewhere I never heard before.

I have already had a lot of people in to hear it, and they cannot very well get up to go home!

Yours very faithfully,

JOHN O. GRIFFITHS.

Brooklands,
Leigh, Worcester.

"MOST POWERFUL 'FOUR' EVER HANDLED"

Sir,—I have now converted my "S.T.300" to "S.T.400," and had no trouble in preparing and winding the extra coil on the aerial former. It is quite easy to cut slots with a fine jeweller's saw and break the pieces out with round-nose pliers, also to drill two holes for the ends of the winding to pass through to solder to terminal tags Nos. 1 and 6.

The "S.T.400" is the most powerful "Four" I have ever handled.

The test here is to get Cardiff, which is quite easy on the "S.T.400," but not so on the "S.T.300," or even on my six-valve superhet.

Yours truly,

ARTHUR J. LUCY, M.I.Mech.E.

56, Woodbine Street, Cross Lane,
Salford, Manchester.

"98 STATIONS—VOLUME MARVELLOUS—RANGE INCREDIBLE"

Sir,—Having just converted my "S.T.300" into the "400," it is as you said in the December WIRELESS

And here are more—the enthusiastic letters from constructors who have actually built and operated Mr. Scott-Taggart's new receiver.

What more convincing proof of the "S.T.400's" success could there be than the experiences recounted in these pages?

CONSTRUCTOR, like moving into a larger house. Well, that house is furnished well!

The volume is marvellous, and the range is most incredible. The finest set I have ever heard or made.

My aerial is only a very poor indoor one (70 ft.), and my earth is 20 ft., but for all that I can log 98 stations at perfect volume and clarity!

I sincerely hope that Chorlton-cum-Hardy builds it!

Thanking you for such a perfect set. I am using a pentode, and I can tell you the set is going to do some advertising for you and THE WIRELESS CONSTRUCTOR.

Yours faithfully,

H. H. PUGH.

Station House,
Shuebrook South,
Shuebrook, nr. Mansfield.

"BEST OF 50 SETS"

Sir,—I have converted my "***" into your "S.T.400," and I know you will appreciate my results after four hours' work, which it took me to make the alteration.

I was quite satisfied with the "***," but seeing your "S.T.400," I was so taken up with your account, I decided to build the "S.T.400" at a cost of £2 for the alterations.

The result has been worth six times the extra cost. I have taken "The Wireless Constructor" since the first number and have built over 50 sets described in "The Wireless Constructor," but this is the best I have ever built or heard before.

The volume is tremendous, and the clarity excellent. I have never experienced in all the sets I have made such good reception. Within an hour of connecting-up I had identified 52 stations on medium wave and 5 on long wave, and the reaction was as smooth as could be.

Yours faithfully,

J. J. SEWELL.

21, South Street,
Walsall, Staffs.

"AMAZING—QUALITY IRREPROACHABLE—WONDERFUL SELECTIVITY"

Sir,—I have never written to a wireless periodical

"There Has Never Been Anything Like It Before!"

before in all the ten years I have been constructing sets; but on this occasion I feel I have got to say something about the "S.T.400." I built the "S.T.300" last February and found it to be marvellous, as three-valve sets go, and upon the details of the "S.T.400" being published I got busy studying the data from all angles, and all the time something kept telling me to change over—until, at last, I could not resist the temptation, and my "S.T.400" came into being!

I have had the set going a week now, and to say that it is amazing is certainly putting it mild. I don't think any words can describe it. The outstanding point to me is its wonderful selectivity.

I can separate the Midland Regional from Radio Suisse Romande as easy as shelling peas, with perfect silence between, a thing I could not do here on the "S.T.300"—at least not completely.

The flexibility of the set is truly wonderful; you get a station that is only a whisper, then a slight adjustment of the controls and up she comes roaring at you! With the use of the outdoor aerial I find that volume is still too much on the National, even with the aerial and anode couplers hard over to the left, so I have had to resort to a 10-ft. length of cotton-covered wire across the kitchen—and even with this I can tune about twenty stations at more than ample volume!

Quality, too, is irreproachable; in fact, to try and praise this set—well, I'll say it cannot be put into words.

In the meantime, I can only say to all wireless constructors, "Build the 'S.T.400,' and you will never regret it."

Thanking you, sir, for a masterpiece in wireless sets,
Yours faithfully,

W. M. TAYLOR.

7, Highfield Square,
Old Swan, Liverpool.

"NEVER STRUCK ANYTHING LIKE IT IN TWELVE YEARS."

Sir,—A line to offer to you my modest but *very* sincere congratulations on your latest and greatest achievement—the "S.T.400."

The CONSTRUCTOR came out on the Tuesday, and on the following Saturday I had converted my "S.T.300," and had the "400" working.

The only way I can describe the results, is that it is not only wonderful and amazing, but absolutely "weird."

No matter where one sets the dial, one cannot help but pick up a station.

One thing I must explain, to show my appreciation of the set, is that during the past twelve years or so I have wired up and tested *numerous* different sets and circuits, but have never yet struck anything in any way like this before, either as regards volume, number of stations—and last, but not least, *tone*!

On Sunday morning last I tried it out at 11.30 to 12.30 (midday) and logged seventeen stations on the medium waveband and eight on the long waveband—and, bear in mind, in *broad daylight*!

On Saturday, at 12.15 midnight, I just tried it out casually, and imagine my surprise when, according to the dial readings, the *volume* and clearness with which

the station came in I thought I was "on" Fécamp—and then, to my surprise and delight, the announcement came from an American station!

Well, all I can say about it is that I was so astounded at the ease of picking it up that I thought it must be a freak of reception, so I tried it out again on the Sunday and Monday, and had no difficulty in picking up three Americans, loud enough to be heard on the speaker!

On Tuesday morning (12.45 a.m.) we sat listening to a vaudeville from one of these same American stations, with as much volume, clearness, and ease as listening to the Midland Regional station.

I think it is quite safe to say that there has never been anything like it on the market before, even in six- or seven-valve sets, and it leaves most of the proprietary five-valve sets years behind the times.

You are at liberty to make *any use* of this letter. If there are any "doubting Thomases" who would like to "hear before believing," just ask them to drop me a line and arrange to test my set out.

Once again thanking you for an amazing and wonderful receiver,

Yours faithfully,
T. BRATTON.

315, Harborne Grove,
Harborne, Birmingham.

"EVERY STATION IN EUROPE."

Sir,—Many thanks for the "S.T.400." I assembled this fine set during the week-end following the December issue of THE WIRELESS CONSTRUCTOR, and have since given the set a thorough test.

I am using a 75-ft. outdoor aerial, about 28 ft. high, with a bank of 140 volts wet H.T. accumulators, valves being Mullard P.M.12, Cossor 210Det., Mullard P.M.2 D.X., Cossor 230 X.P.

I have received every medium-wave station in Europe worth hearing. The long waves have been wonderful.

The "bag" includes Leningrad, Oslo, Kalundborg, Reykjavik, Moscow T.U., Motala, Warsaw, Eiffel Tower, Moscow O.K., Berlin K.W., Daventry Nat., Radio Paris, Lahti, Huizen, and Kaunas.

Kaunas and Lahti I had never previously heard in this district, neither had I heard a set separate Berlin K.W. from Daventry as does the "S.T.400."

On Saturday evening, December 3rd, I tried the set out for distance work, between 12.30 and 2.30 a.m. On Sunday, December 4th, I received the following U.S.A. stations: Philadelphia (Columbia) W C A U, 47, 40. Atlantic City (Columbia) W P G, 58, 60. Springfield (Westinghouse) W B Z, 76, 76. New York (Columbia) W A B C, 100, 90.

These four I identified from the announcements, checking up afterwards by a wavelength list. I have given the dial readings, but, of course, these would vary with different coupler settings. I also received two or three more Americans at speaker strength, but could not identify them—although one, I think, was Hartford, W T I C.

I may add that I built the "S.T.300" in March. It was easily the best three-valve set I have heard, but I could not resist the temptation to convert to the "S.T.400."

(Please turn to page 312.)



A PRACTICAL MAN'S CORNER

By R. W. HALLOWS, M.A.

Into these pages, month by month, our contributor packs a wealth of practical information and advice on constructional work. The regular reader of this "Corner" cannot help picking up a more or less complete training in radio workshop practice, while every month there are wrinkles to read, gadgets to make or hints to help you.

SOLDERING is rather out of fashion nowadays amongst those who build their own sets, but the really handy man will always go in for it since he knows what a valuable aid it is. The new hand at wireless, too, will be well advised to try his hand at soldering—and to discover how easy a business it is if only he bears in mind the slogan: Hot iron, clean iron, clean "work."

Money-Saving Repairs

There are still quite a number of first-rate components which can be used only by the aid of soldering since they are not provided with terminals. But perhaps the most valuable aspect of soldering is the way in which it enables you to repair components which otherwise would

be pitted at the point to be of any further service as it stands.

This is just the thing for the job. With a hacksaw, cut off the tapered business end of the old bit, and drill a $\frac{1}{4}$ -in. hole into the face thus made. Cut off a piece of $\frac{1}{4}$ -in. copper rod, $1\frac{1}{2}$ in. in length and drive it into the hole.

Should it be rather a loose fit, tighten it up by hammering the bit round it. Taper off the end of the rod to screwdriver shape, tin the point and the job is done.

A little iron of this kind is far more serviceable than one consisting simply of a length of $\frac{1}{4}$ -in. rod. The reason is that the rather massive original bit retains heat much longer than does a mere length of thin rod.

Another good point is, that when

flexible copper wire, and I expect that a good many readers have had similar experiences. The bother is, that no matter how careful you are about greasing the terminals and the ends of the leads, acid fumes from the cells are apt to play havoc with the fine wires.

Accumulator Connections

Here is a recent instance. A set suddenly became appallingly noisy and investigations showed that variations in L.T. current were taking place. Though the bared ends of the wires were in good condition, it was found after careful examination that acid fumes had penetrated through a crack in the rubber covering some inches away and had eaten through most of the fine strands.

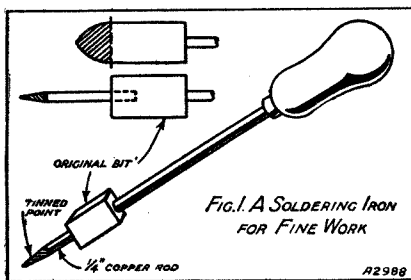


FIG. 1. A SOLDERING IRON FOR FINE WORK

USEFUL TO KNOW

A soldering iron for joining fine wires can be made out of an old "iron" and a small piece of copper rod assembled as indicated in the diagram to the left.

On the right is illustrated a method of making "quick" connections to the accumulator by means of lead wire joined to the ordinary leads.

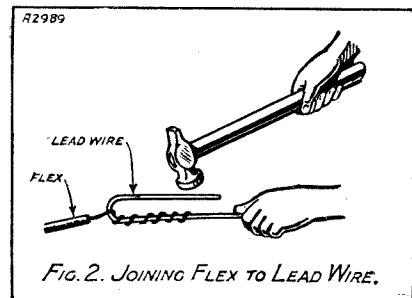


FIG. 2. JOINING FLEX TO LEAD WIRE.

probably find their way into the dustbin.

For repair purposes a rather small iron is often required, and in Fig. 1 you will find illustrated a very useful one that can be made in a few minutes.

Probably there is knocking about somewhere in your workshop an old soldering iron whose bit is too badly

heating up the iron the tinned point need not be in the flame at all. Whether a small bunsen burner or a spirit lamp is used, its flame is kept under the original bit, and the tinned end of the protruding point remains beautifully clean.

At one time or another I have had a certain amount of trouble with accumulator connections made of

There is one metal—lead—which is unaffected by sulphuric acid, but lead wire is hardly suitable for the making of complete battery leads. It can, though, be used to make fume- and acid-proof ends for these leads.

For these end-pieces, which should be about 8 in. in length, lead wire of No. 16, or rather heavier gauge

A Practical Man's Corner—continued

is suitable. Fig. 2 shows how the flex is joined on to them. Bare and unstrand about 2 in. of the flex and wrap it tightly round the lead wire, starting about an inch from the end of the latter. Bend this end over, as shown in the drawing, and then beat it well down with a light hammer.

Grease the joint thoroughly, then slip on a length of stout systoflex, as shown in Fig. 3. Bind this tightly on to the covering of the flex with thread. The length of the systoflex sleeve should be such that 2 in. of the lead wire protrude. Bind the sleeve again on to the lead wire and then shape the end of the latter, as shown in the drawing, so as to form a "spade" for connection to the L.T. battery terminals.

Similar end-pieces can be made for flex leads running to an accumulator high-tension battery. Formerly there was a difficulty here, since there were no wander-plugs that could be fitted easily to the ends of solid lead wire. Plugs of the Belling-Lee type adapt themselves readily to the purpose. Push the lead wire through the hole in the side of the plug's insulating cap, double it over with a pair of pliers and screw in the brass portion of the plug.

Magnetising Screwdrivers

I have called attention previously to the usefulness of the magnetised screwdriver as part of the practical man's tool equipment. For fixing down components to a baseboard I always make use of Nettlefold's steel screws with an electrolytically deposited copper covering. The most useful sizes are $\frac{1}{8}$ -in. No. 4 and $\frac{3}{16}$ -in. No. 2. A well magnetised screwdriver will hold either size so firmly that it can be inserted without trouble into any awkward corner.

Such screwdrivers can be purchased, but there is no reason why anybody who wishes to do so should not do his own magnetising. The loudspeaker, whether of the balanced-armature or of the moving-coil type, contains a powerful magnet, and if a screwdriver is rubbed gently over one of the poles of a "U" magnet, or the base of a pot magnet, the desired result is soon obtained.

I should mention, by the way, that in order to avoid brittleness, screwdrivers are usually made of rather soft steel, and they therefore do not

retain their magnetic properties indefinitely. Every now and then the screwdriver should be given a "touch up" on the loudspeaker magnet in order to keep it up to the mark.

I must admit that there are times when the magnetised screwdriver is a perfect nuisance. It insists upon holding on to screws in the most annoying way just when you want it to

magnetising a screwdriver or before you undertake any job in connection with a loudspeaker. I can testify from bitter experience that watches are not improved by being magnetised.

Decoupling Condensers

It is as well to keep an eye on the paper dielectric decoupling condensers in your set, especially if they are old ones that have given long service.

So much trouble may be caused by a defective decoupling condenser that it is a wise precaution to subject old ones to certain simple tests before they are used again.

When testing out we want to make sure (a) that the condenser will not pass direct current, and (b) that it will pass alternating current.

Fig. 4 shows two simple tests to make sure of these points. That illustrated at A shows whether the condenser is or is not leaking as regards direct current.

The milliammeter is connected up between one pole of the high-tension battery and one of the condenser terminals. The other condenser terminal is taken straight to the other pole of the battery.

A Test for A.C.

On making connection the milliammeter's needle should kick, showing that the condenser is charging up. It should then immediately return to zero, for if it records a steady reading the condenser is leaky.

The second part of the test for paper dielectric condensers may consist in disconnecting both leads from the high-tension battery, taking care not to touch them together, and leaving their ends lying for ten minutes or so upon some non-conductive surface.

At the end of that time the ends may be touched together, and if the condenser is in first-rate condition the milliammeter will kick once more.

The second test, to prove that there is a path for A.C. through the condenser, is shown at B in Fig. 4. The negative pole of a single cell is connected to one of the primary terminals of a low-frequency transformer, either the loudspeaker or a pair of telephones being connected across the secondary terminals.

A flex lead (marked X in the drawing) attached to the positive pole in the cell is now touched against the unoccupied primary terminal. Loud clicks should occur at every touch.

A "STOP AND PASS" TEST

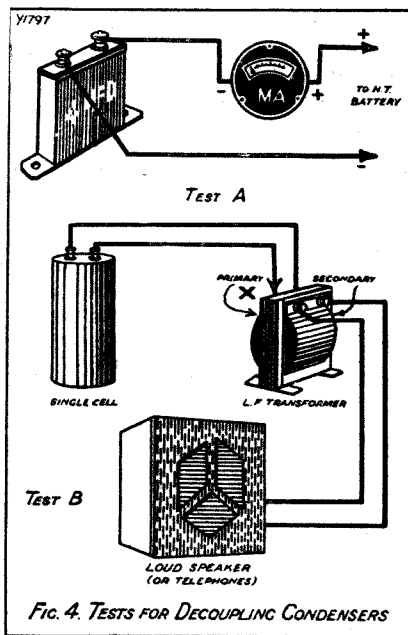


FIG. 4. TESTS FOR DECOUPLING CONDENSERS

Large paper condensers should be tested in two ways: A, for ensuring that there is no leak to D.C. currents and, B, to make certain that the condenser will pass alternating current.

drop them. There are two simple remedies. The first is to use brass screws for the job in hand; the second is to demagnetise the screwdriver, which is rapidly accomplished by gentle hammering.

One other tip by the way: Take off your wristwatch before you start

SLIP ON SYSTOFLEX

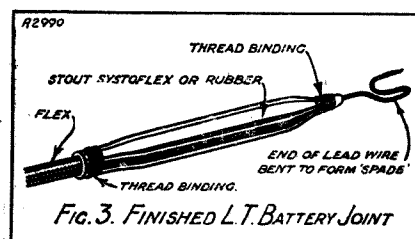
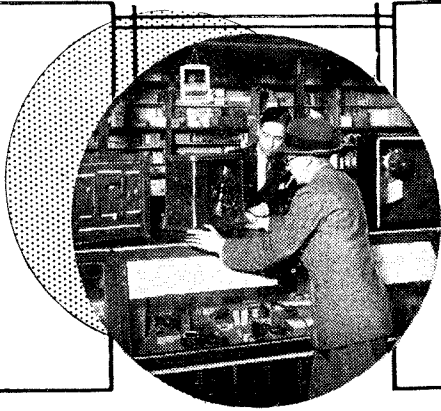


FIG. 3. FINISHED L.T. BATTERY JOINT
The acid-proof accumulator connection described in the text is finished off with a length of systoflex bound in place by thread.

**AS WE
FIND
THEM**



**NEW
APPARATUS
TESTED**

The B.T.H. Loudspeaker

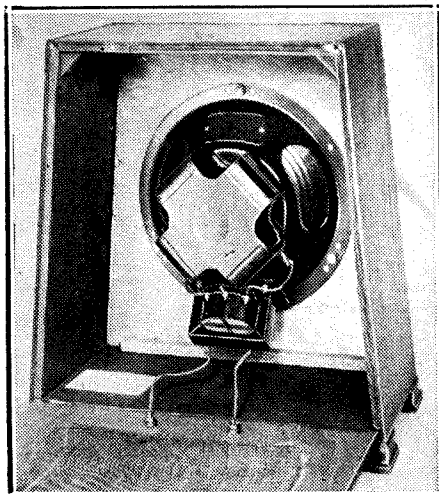
THE famous B.T.H. R.K. loudspeaker is a pioneer among the moving coils. Some years ago when the Rice-Kellogg reproducer first arrived on the British market the listening public were amazed at the remarkable fidelity given by this new speaker.

Since then many improvements have been made, and the prices of the various models have been brought within reach of practically everyone.

For instance, what better value for money can anyone want than that represented by the R.K. "Minor"? This model is listed at 57s. 6d. complete in a fumed-oak cabinet, or in walnut at 63s. The cabinets are particularly well made, and have an ornamental fountain grille with an old-gold corded background.

We have recently had the opportunity of testing an R.K. "Minor" of the permanent magnet type, the magnets being of cobalt steel. The corrugated cone (in this case 7 in. in diameter) common to all R.K. models is used.

**COMPLETE WITH
TRANSFORMER**



Under this heading we publish reviews of apparatus submitted by radio manufacturers and traders for examination and test in "The Wireless Constructor" laboratories.

Since the moving coil is of the low-resistance type (D.C. resistance 4 ohms, nominal impedance 7.5 ohms), it is necessary to insert a transformer of suitable ratio in the output circuit of the receiver, and the "Minor" is equipped with the requisite instrument mounted on the chassis frame.

A number of different ratios is available by connecting up to the alternative terminals on the transformer, these ratios covering the range of Mazda valves, including both pentodes and power valves of the indirectly-heated and battery types.

The B.T.H. "Minor" is capable of handling up to 2 watts input, and ranks among the very best of the present-day moving coils.

In our tests we found the sensitivity to be above the average for this class of speaker, and the reproduction well up to the high standard one associates with the B.T.H. range.

The bass notes appear in their true perspective, and this without sacrificing the treble and upper musical frequencies, while the speaking voice comes through clearly and crisply.

A Clix "S.T.400" Kit

One can never accuse the Clix people of not moving with the times. Whenever there is a sudden demand for a special type of terminal, wander-plug or connector, this firm is always ready to supply it.

The B.T.H. "Minor" is a sensitive moving-coil speaker of the permanent magnet type. On the right is a front view showing the attractive cabinet, and on the left the inside of the cabinet, illustrating the speaker and its input transformer.

And there is this to be said about Clix products—they are essentially practical and bear the hallmark of class.

When the "S.T.400" was about to be described, Mr. Scott-Taggart voiced the opinion that a double grid-bias plug would still further add to the simplicity of his great new set.

So a suitable Clix plug was instantly forthcoming. Moreover, there is a Clix "S.T.400" kit available for constructors at the competitive figure of 4s.

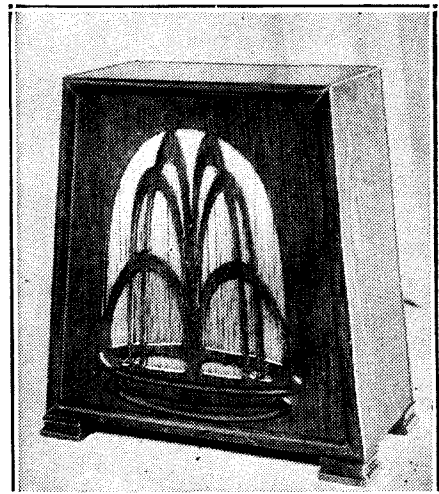
The kit comprises 3 dual wander-plugs, 9 "Master" wander-plugs, and 11 insulated terminals. Every item is nicely engraved and the kit can be thoroughly recommended.

British General Components

The British General Manufacturing Company, Ltd., Brockley Works, London, S.E.4, have sent us a number of their latest components, including tuning coils and transformers.

While we have not as yet completed the whole of our tests, we are able to state that our results so far have been of a very satisfactory nature.

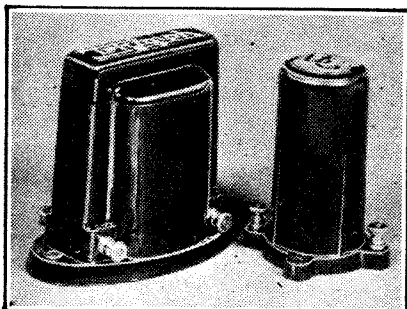
PLEASING IN APPEARANCE



As We Find Them—continued

Among the components range is an L.F. transformer which retails at the extremely moderate price of 5s. This instrument has a turns ratio of 3.5:1, and when used in conjunction with a valve of medium A.C. resistance, the frequency response and amplification are surprisingly good.

FOR CONSTRUCTORS



The British General "Triumph" L.F. transformer and an H.F. choke made by the same firm. The transformer has a turns ratio of 3.5:1 and the choke a very high inductance together with a low distributed capacity.

There is also an H.F. choke priced at 5s. 6d. which the makers claim to have an inductance of 128,000 microhenries, a self-capacity as low as 4.5 mmfd., and a D.C. resistance of 400 ohms.

These figures render the choke suitable for parallel-feed H.F. circuits in addition to its other uses, and we found that it functioned very well both for reaction purposes and also in a shunt-fed S.G. stage.

The winding is enclosed in a strong moulded case. It is unquestionably a good proposition.

Incidentally, the British General concern markets a useful "ganging" device which will probably appeal to constructors who are of an experimental turn of mind. For 2s. 6d. you are provided with a couple of stout brackets, together with an adjustable rod and two clamps with which two separate condensers can be "ganged" and operated by one control. A handy "gadget" for experimenters.

B.T.H. "Minor" Pick-Up

The B.T.H. "Minor" pick-up has been re-designed for 1933 and now incorporates a 10,000-ohm volume control fitted into the base of the tone-arm pillar.

Those who have carried out much work with gramophone amplifiers will appreciate this point. A volume control is a necessity, and the proper

position for it is across the pick-up itself.

If the control is included in the design as part and parcel of the pick-up, so much the better.

The "Minor" pick-up has an excellent frequency response which extends from 70 to 5,000 cycles, and there is a lift up at the bass end to compensate for the recording losses at the lower frequencies.

The makers state that the output at approximately 1,000 cycles (using an H.M.V. full-tone needle) is 0.5 volt, and the fact that the pick-up is sensitive was confirmed by our tests.

The tone-arm and pick-up casing are moulded in one piece.

To Prevent Noises

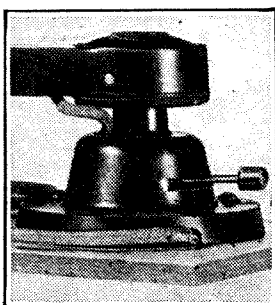
Realising that the modern gramophone motor is often electrically driven, the makers have mounted the magnetic system on an earthed plate to screen it from any stray fields which might produce induction noises, and the connecting leads are also enclosed in a flexible metal casing.

There are three connecting tags to this pick-up, two for joining up to the pick-up terminals on the set (or turntable terminal board). The third lead is connected to an earthed point on the amplifier.

Each pick-up is sent out complete with a template for fixing, and at the very moderate price of 25s. it is a component which will undoubtedly exercise a wide appeal.

The sensitivity is sufficient to ensure satisfactory volume when used in conjunction with two amplifying stages, the volume control functions smoothly and noiselessly, and we could detect no undesirable resonances or peaks over the frequency range covered.

COMPLETE WITH VOLUME CONTROL AND EARTHING CONNECTION



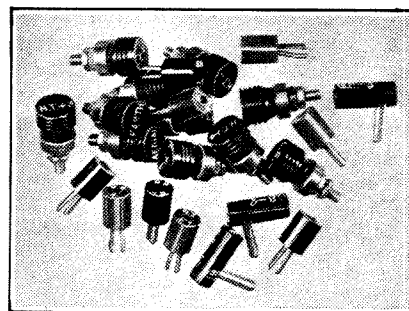
The B.T.H. "Minor" Pick-up incorporates a volume control in the base of the tone-arm pillar. A close-up of this control can be seen in the left-hand photograph. A third lead is also embodied for earthing the magnet system and preventing interference.

A "Goltone" Plug

Suppose you want to connect a lamp to a mains socket. How will you do it? Messrs. Ward & Goldstone, of Pendleton, Manchester, can solve the problem for you. This firm markets a very practical lampholder plug.

One end is inserted in the mains socket, while the other end takes either

A CLIX TERMINAL KIT

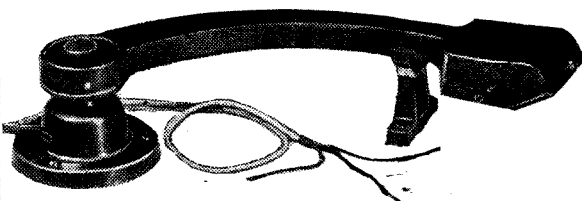


This special Clix Kit contains all the terminals and battery plugs necessary in order to make a first-class job of the "S.T.400."

a lamp or an adaptor to which a length of flex and a lamp are joined. It is a well-finished little fitment, having a variety of uses.

"Rotorite" Crystal

One hears little about crystal sets these days, but there must still be a large number of these receivers in existence. Crystal-set users will therefore be interested in the new crystal substitute offered by Messrs. Ward & Goldstone, which takes the form of a moulded tablet. A big advantage is that the tablet is sensitive over the whole of its surface—hence there is no need to search for the best "spot." The price is 6d. per tablet.



CONVERT YOUR S.T.300

with the

READY RADIO

S.T.400 REBUILDER'S KIT

Containing full set of chosen components for converting your set in the easiest and most efficient manner.

Everything you require, to the last screw to convert your S.T.300 to the correct S.T.400; with full instructions and many useful hints by Mr. G. P. Kendall, B.Sc.

35/-

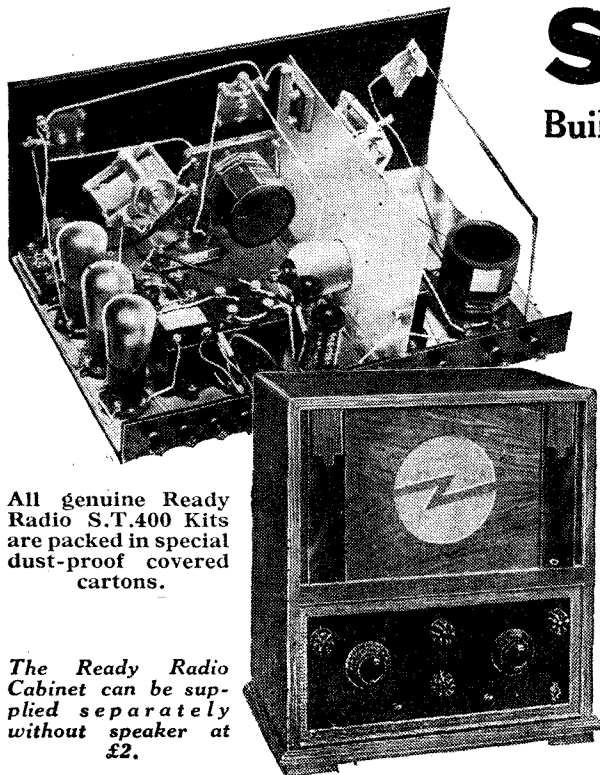
A rebate of 2/- off his old S.T.300 Aerial Coil will be allowed to all purchasers of the Ready Radio S.T.400 Rebuilder's Kit.

From all good radio dealers or order direct.

★ ★ ★ ★ ★ ★ ★

S.T.400 KITS

Build your S.T.400 with the Ready Radio Kit



All genuine Ready Radio S.T.400 Kits are packed in special dust-proof covered cartons.

The Ready Radio Cabinet can be supplied separately without speaker at £2.

Read what Mr. John Scott-Taggart says: "With reference to my S.T.400 Receiver, described in the current issue of 'The Wireless Constructor,' I have received for test from Messrs. Ready Radio Ltd. a kit of parts in accordance with the circuit. This kit has been tested and has proved entirely satisfactory."

The Ready Radio Kit is absolutely complete down to the last screw and contains panel (ready cut and drilled) baseboard and Jiffilinx Or deposit of 9/6 and 11 monthly payments of 9/9

£4.17.6

MODEL A

Complete Kit with four specified valves and walnut Cabinet fitted with Moving-Coil Speaker.

£10.10.0

Or deposit of 20/- and 11 monthly payments of 21/-

MODEL B

Complete Kit with four specified valves.

£6.16.9

Or deposit of 12/6 and 11 monthly payments of 13/9

Full-size blueprint, full-size photo-plan and easy build wiring chart with free copy of "Wireless Constructor," containing full instructions, free with every Ready Radio Kit.

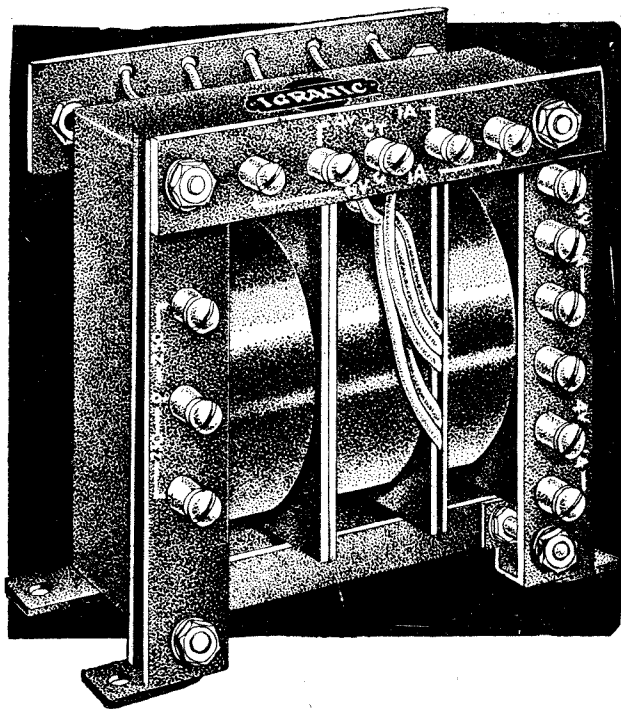
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Telephone: Lee Green 5678.
Telegrams: Readirad, Blackvil, London. W.C.5

INSIST ON A GENUINE READY RADIO KIT

IGRANIC COMPONENTS WILL BE THE MAKING OF YOUR SET



IGRANIC MAINS TRANSFORMER

The increased popularity of all-electric radio has resulted in a demand for mains components of unquestioned reliability. Igranic answer the demand with products that are built to the highest standards of quality and efficiency. The Igranic Mains Transformer is shown on this page. The primary windings are so arranged that it can be connected to any standard 50-cycle A.C. mains supply of from 200 to 250 volts. The input terminals, mounted upon paxolin boards, are clearly marked in 10-volt steps from 200 to 250 volts. The output terminals are also mounted upon a paxolin board and marked with their respective outputs as follows:—

- Sec. 1 4 volts 3 amps., centre tapped.
- Sec. 2 6 volts or 4 volts 1 amp., centre tapped.
- Sec. 3 4 volts 2 amps., centre tapped.
- Sec. 4 250-0-250 volts.

PRICE **27/6**

● Write to-day for fully illustrated Catalogue No. J.1230 of complete new range of Igranic Quality Components.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.A.



CVS-53

AND NOW FOR THE CABINET

PLACE YOUR "S.T.400"

in this superb piece of furniture

THE "WHITEHALL de Luxe" Cabinet

Built of solid, choice figured OAK. Its non-resonance adds to the fidelity of tone given by your speaker. The fret is backed with old-gold silk gauze.

Make your "S.T.400" a self-contained receiver, as fine to look upon as it is to hear.

Ask your dealer for

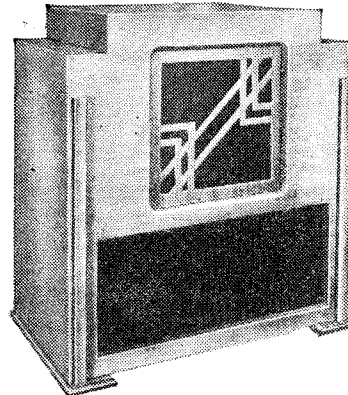
THE "WHITEHALL de Luxe" Cabinet

30/- CASH or C.O.D. Carriage Paid.

or

8/9 DOWN and 3 payments of 8/9 each.

If any difficulty in getting immediate delivery, communicate with us.



Read this specification:—

THE "WHITEHALL DE LUXE"

A quality cabinet built of solid selected figured OAK. Fret and detachable back of special ply-wood to match. Inside measurements: 16 in. wide, 11 in. deep, 17½ in. high.

THE MYERS-HUNT CABINET Co., 7, Austin Street, Shoreditch, London, E.2.

Telephone: Bishopsgate 3037 & 4928.

SPECIFIED
for the **S.T.400**

COMBINED PICK-UP AND TONE-ARM
22/6

Embodying many refinements which are the outcome of careful research, the British Radiophone Combined Pick-Up and Tone-Arm reproduces voice and music with utmost fidelity.

This component is cased in moulded bakelite, finished in black or brown, and objectionable resonances are eliminated owing to its robust construction and careful design.

The output shows an ample degree of sensitivity, is crisp and free from coloration and needle scratch. Perhaps the most important feature of this remarkably efficient component is the head, which, being fixed, eliminates lost motion and rattle.

Because the head is fixed at the correct angle, record wear is minimised, and light damping and good tracking is ensured. Full fitting instructions included.



A "rest" for the British Radiophone Pick-Up can be supplied. Price 1/6 each.

Finished in Brown or Black.

THE BRITISH RADIOPHONE, LTD. ALDWYCH HOUSE, ALDWYCH, W.C.2.

RADIOPHONE



AH! Monday morning—rude-letter day! Nearly all the ferocious letters I get come on a Monday.

Now, what's all this one about. It is written in a pleasing, almost loving, hand, and on the most delicately-tinted blue paper.

Where are my glasses? Now for it!

20, Selvaige Place,
Rosyth, Scotland.

Sir.—As per your request, I am giving you MY opinion of the "S.T.400."

Personally, I consider it a wash-out, and the same opinion applies to the "S.T.300."

Yours faithfully (?),

D. M. FINCHAM.

There are trimmings to the letter, some talk of smelling a rat, and reading all the guff concerning this "wonderful" set. There is a note to the effect: "I *would* be surprised if this were published!"

Pleased to Surprise

I am always pleased to surprise.

Now, what's this next letter?

Old Trafford? Henrietta Street? Surely that address is familiar. Of course, it is our old hairdresser friend.

Sir,—You may be interested to know my experience with the "S.T.400."

I certainly am, but I wish this were Tuesday morning! This gentleman, I should explain, wrote us a most interesting letter about the "S.T.400," in which he explained that he was

unofficial adviser to scores. Apparently, while shaving his customers, he discusses razor-sharp tuning instead of sneeringly asking them if they shave themselves (as my barber does).

Such Possibilities

The idea of a wireless-talking hairdresser opened up such possibilities that I even wondered whether the best way of popularising a new set might not be to demonstrate it to a mass meeting of hairdressers.

However, what does he say about the "400"?

"Monday morning—rude-letter day!" says Mr. Scott-Taggart, as he opens the pile of envelopes beside his plate and takes the contents over to his famous armchair.

And so readers' letters, rude and otherwise, have this month proved a lively source of inspiration to "S.T." for his eagerly anticipated chat with constructors.

Well, it did wonderfully well; medium-wave stations in broad daylight, both loud and clear—not one, but a fine selection; on the long waves I also had splendid results. I made the set in my shop (hairdresser's), and, of course, did it between attending to customers. It took me two days to make and there were plenty looking at it. One customer made his "S.T.300" into a "400," and he tells me it is a wonder; he lives in Manchester. Another gent who calls when in Manchester has just completed the "S.T.400"; he is delighted with it; the performance is wonderful; he lives in London.

Well, my sigh of relief could almost have been heard in Higher Broughton, where my friend carries on his tonsorial profession. I feel he could turn all Lancashire against the set if he wished.

Personal recommendation counts for a very great deal, and I am very grateful to anyone who spreads the news of any satisfactory results with my designs.

Offer to Demonstrate

The letter from Old Trafford appears elsewhere in this issue, and the writer now gives his name with an offer to demonstrate to other amateurs (by appointment).

These offers by readers are extraordinarily kind, and I am always glad to publish them. It would be a magnificent scheme if successful builders of my sets would permit others to hear them. Of course, any such demonstrations are not necessarily final, because I naturally have no personal knowledge of whether the set is up to scratch or being properly worked.

Here's another letter:

1, Manville Road,
Balham, S.W.17.

Sir,—I have now had your "S.T.400" built for three days, and I wish to congratulate you on your wonderful piece of work. I am only a boy of 14, and this surely is the most marvellous set I have heard or seen. The first night when I had made it I logged 56 stations; the next night I brought this total up to 63.

"Anxious to Receive a Few Well-Aimed Brickbats"

Surely this can't be Monday. It must be Tuesday. By the way, this letter from young E. A. Pyke is a record for a youthful constructor of one of my sets. Can anyone beat it?

I recently wrote about an elderly gentleman of 70 years who built the "S.T.300," but a Kentish farmer, 77 years old, thinks the other is merely a kid at the game.

The Eldest Builder

I guarantee that no reader can beat 77 for an actual constructor.

Anyone who imagines that wireless is solely a young man's hobby is completely off the mark. There seems to be no age limit. Very few girls and women go in for it, though. Although I used to correspond once with a duchess who used to build my sets. She was pretty good at it, too—for a duchess.

The late Earl Russell, as some of you will remember, was a keen wireless experimenter. He had a good, engaging style of writing, and I got him to contribute a weekly feature for a wireless paper which I edited.

The feature was called "From My Armchair." I only recalled that the title was the same as my own monthly effusion when looking up some of my old numbers.

However, there's no patent on the idea of an armchair.

Talking of patents, reminds me how valuable the technical press is in publishing ideas and so preventing inventors obtaining valid patents for methods in common use. "Prior publication" of an idea or circuit will invalidate a patent.

"Prior Publication"

In this country it has been possible to obtain a patent for an invention which might have been fully described in a magazine. Provided it was not *previously patented*, a patent might be granted for an old idea. But in an action for infringement, the defendant can successfully plead "prior publication."

As a consultant specialising in wireless inventions, I have taken part in, or been formally asked to take part in, nearly all the leading wireless cases

of the last ten years, and this question of "prior publication" has figured in each.

A week ago I was approached by the Radio Corporation of America, the greatest radio concern in the world, to see whether I would act as expert witness for them in a patent law suit in the States. Some months ago I was invited by Philips—the biggest lamp, valve, and radio manufacturers in Europe—to act as their expert in an action between the Marconi Company and themselves. In both cases, "prior publication" figured prominently.

The average amateur is not aware

However, let's get back to my letters.

A Triangular Robin

London, W.1.

Sir,—We, the undersigned, have been regular readers of THE WIRELESS CONSTRUCTOR. Your present ("S.T.400") issue is the worst yet. We thought we were buying a book for the constructor and not a picture-gallery of Mr. Scott-Taggart.

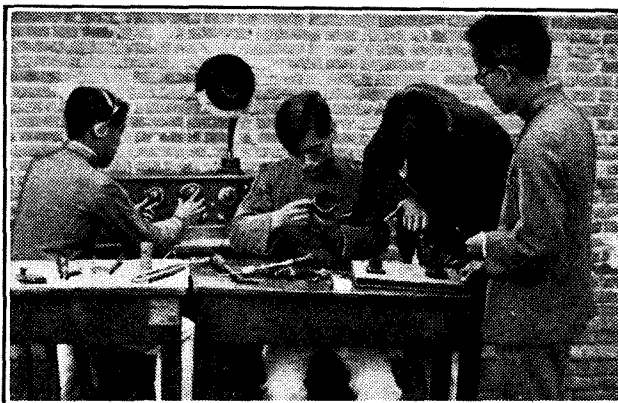
Yours very disgusted,

R. H. NORTHAM.

F. L. LE FRANK.

J. H. LE FRANK.

CONSTRUCTORS OF THE EAST



The Chinese, always a race of clever craftsmen, have not taken to set-building with great enthusiasm.

of the legal battles over inventions which are continually being fought behind the scenes. And yet every set purchaser is affected in some way. Valve prices, set royalties, speaker royalties, all affect the radio listener.

All these cases are usually dependent on the answer to the question: "Who was the first inventor?" It is often a highly complicated business, but the press carries out an extremely useful function in promulgating new ideas.

The average engineer, however, is very reticent, almost secretive. If not independent of individual firms, he has to be "discreet," even though progress calls for full publication of all ideas and results as soon as possible.

Technical Staffs

That is why the wireless papers have had to build up their own technical and experimental staffs, or else, as in my case, obtain the services of a consultant who is independent of any manufacturing concern.

Well, that's "Frank" enough for me.

This triangular robin concludes with the challenge: "P.S.—We imagine you will not publish this!!!"

Well, you see, I have done so!!!!

And why not? The Editor passed it to me with the scribbled words, "Any remarks?" I returned it with the reply: "I agree with them entirely."

Now, we'll see what the Editor does. Incidentally he has received another letter which reads: "When you publish "S.T.'s" next big set we should like to have photographs of him sitting in his bath, digging in the garden, and shaving with an electric razor."

"I Should Like to Say . . ."

Of course, the whole trouble is that editors simply *will* insist on articles being illustrated by "human interest" photographs. And, quaintly enough, I am considered, for some unknown reason, to be of human interest. Hence pictures of me at John o' Groats, Hull, Land's End—and so forth.

I tried to look different at each place—and appear to have succeeded admirably.

One reader writes: "You are no Gladys Cooper."

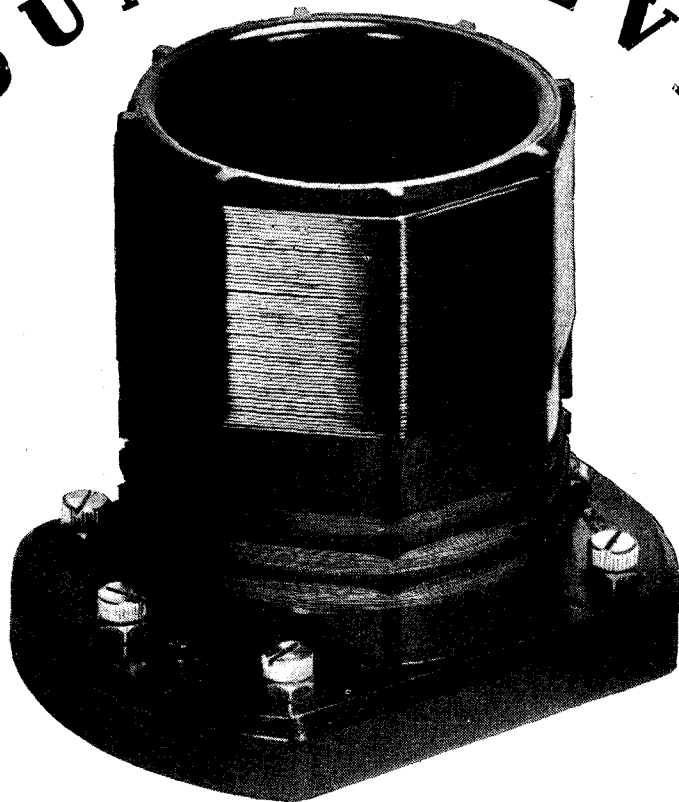
Is that fair?

Even if you did not have my photograph, you'd have someone else's, and you probably wouldn't be much better off.

All the same, I should like to say this to all Sunday letter writers: "No

DON'T TAKE ANY RISK!

BUILD AROUND COLVERN COILS



COLVERN COILS give maximum performance . . . They are guaranteed to be identical to those employed by Mr. Scott-Taggart in his original receiver.

TYPE S.T.400 COILS - - 9/10 per pair.

Send for Radio List No. 10.

COLVERN LIMITED

MAWNEYS ROAD

ROMFORD, ESSEX.

"Husbands Now Have a New Excuse"

matter how abusive you are or how critical, your letters are carefully digested. No letter is tossed aside."

So many of you imagine that I am likely to be unresponsive or insensitive. Nothing is farther from the truth. I welcome any criticism which will help me to produce better sets for you. As a firm believer that a designer and his public should co-operate, I am only too anxious to receive a few well-aimed brickbats.

Grocer—Not Grouser

In no other field is a designer so soon found out or a journal so quickly discredited as in wireless. Nemesis in seven-leagued boots will overtake the incompetent and the over-confident.

And now here is a letter from Wolverhampton.

I am a grocer, not a grouser. I built your "S.T.400" on Sunday. I do hope you will forgive me for mutilating your design, but I had also an "S.T.300" adaptor on hand, so built the whole lot on to one panel, making it a five-valve set. Anyhow, ALL stations come in full L.S. strength clear of interference. It slices the stations clear of each other like my bacon machine slices bacon—to order.

When I've mastered all controls I shall try it out with my short-wave superhet converter.

What a lovely time you will have tuning it. But why not tack a television receiver on the end? It will look bare without.

An Enthusiast's Enterprise

As a matter of fact, this man frightens me. I'm pretty brazen when it comes to knobs, but this enthusiast's enterprise cowers me. A large number of readers, however, have converted the "S.T.300" into a four-valver by putting a similar S.G. differential anode coupling stage in front of it. The reports have all been good.

In my considered opinion, to have to tune three circuits separately is too much of a good thing. The complication of an extra tuned circuit is very serious, and quite different from the extra controls on the "S.T.400," which can be set at normal or zero.

I sometimes wonder whether "tuning" will disappear altogether and we shall have a selector switch

which enables us to receive any station on a given list *perfectly*.

The "relay" system for providing homes with wireless would do it, the programmes coming from central super receivers. (You would first have to provide the latter!) Or perhaps wireless might be abolished and we would receive everything by land-line. After all, radio is only a convenient and cheap way of communicating programmes.

I doubt, however, if wireless will ever be displaced. Distribution costs for a wide variety of programmes would probably be very high. Meanwhile, sets are getting cheaper to buy or build.

"S.T." says:—

"The idea of a wireless-talking hairdresser opened up such possibilities that I even wondered whether the best way of popularising a new set might not be to demonstrate it to a mass meeting of hairdressers."

"Personal recommendation counts for a very great deal, and I am very grateful to anyone who spreads the news of any satisfactory results with my designs."

"In my considered opinion, to have to tune three circuits separately is too much of a good thing."

"I doubt if wireless will ever be displaced."

I was discussing television with a leading authority the other day. He expressed the belief that television *might* reach us via the relay system and not direct. A house would simply have a cathode-ray oscillograph or projector, while a central wireless receiver would pick up the television signals (on, say, 7 metres) and feed a given area by land-line.

Eight Years to Arrive

He gave television eight years to arrive—and he has always been a sceptic. My own views are based on cynical rather than technical grounds. Television must—and will—overcome all technical obstacles because there will be money in it. A vast amount of money, too.

Television has gone off like a damp squib. But some day it will go with a bang.

Talking about television reminds

me that I promised the results of the Newcastle "television machine" reading of my character. I must ask you to wait for the thrilling revelations. There's no space in this issue.

Sixteen-Foot Bass

I have received an interesting letter from an F.R.C.O. and A.R.C.M. who has built the "S.T.300" but uses an ambitious mains-driven output circuit. He says:

I want quality first, and adequate 16-ft. bass, or what we organists call pedal "flue" tone, a real foundational bass which no orchestral double basses can ever approach.

It certainly sounds good.

Another letter is from a reader who says that at the local hostelry ("The Pheasant") they have installed one of my sets. He tells me that husbands now have a new excuse: "Just going to have a look at 'S.T.'s' new set."

I get some curious gifts from readers. At Land's End I had pressed into my hand a copy of "Why Has Capitalism Failed?" The person who presented this gift was the wife of a demonstratee—and she told me she was head of the Communist party at Land's End.

At John o' Groats, by an extraordinary coincidence, I also demonstrated the "S.T.400" to the head of the revolutionary party of the district. Only a week before he had written to the local paper saying how his party would grind the faces of somebody or another. (I had an uncomfortable feeling that my own would be amongst those ground; which, incidentally, would remove all offence to the Frank people—see above.)

Quite Revolutionary

However, the man at John o' Groats thought the "S.T.400" quite revolutionary, so it was in accordance with his party principles.

I have the Land's End booklet by my side, but have not read it. I have no politics myself. "Why Has Capitalism Failed?" I have been too busy to find out.

The most extraordinary gift, however, was another booklet from a reader in Birmingham. On the cover is printed:

HELL. What is it? Who are there? Can they get out?

I'm afraid I am also too busy at present to find that out.

Direct Radio

159 BORO HIGH STREET LONDON BRIDGE

We have sold more "S.T.400" Kits than other distributors

WHY? BECAUSE Discriminating Set Designers insist on Direct Radio Specifications

"S.T.400" STANDARD MODEL

1 R.I. "Hypermite" L.F. transformer ...	£ 12 6
1 J.B. aerial coupler, -0004-mfd.	4 0
2 Colvern S.T.400 coils	9 10
2 Ormond -0005-mfd. variable condensers, type R.493	15 0
1 Polar -0003-mfd. differential condenser	3 0
1 Lotus -00035 or Polar -0003-mfd. differential condenser	3 0
1 Ready Radio -0001-mfd. differential condenser	2 6
2 Telsen -0003-mfd. pre-set condensers ...	3 0
3 Valve holders ...	1 6
1 W.B. Universal valve holder	1 0
2 Ready Radio 2-pt. switches ...	1 8
1 Telsen binocular choke	5 0
1 Ready Radio Standard H.F. choke ...	1 6
1 T.C.C. -0003-mfd. fixed condenser, type "S"	1 3
1 T.C.C. -006-mfd. fixed condenser, type "S"	2 0
1 Dubilier -006-mfd. fixed condenser, type 670	1 6
2 T.C.C. 2-mfd. fixed condensers, type 50	7 8
1 Dubilier 1-mfd. fixed condenser, type 9200	2 9
1 Dubilier 1-meg. grid leak with holder ...	1 4
1 Ierapic 1,500-ohm spaghetti resistance	6
1 Lewcos 50,000-ohm spaghetti resistance	1 6
1 Lewcos 20,000-ohm spaghetti resistance	1 6
1 Lewcos 60,000-ohm spaghetti resistance	1 6
1 Bulgin toggle switch, type S.80	1 6
11 Belling-Lee terminals: HT+, HT-, HT+2, HT-2, HT+4, HT-4, LT+, LT-, LS+, LS-, A. E. ...	2 3
1 Screen and foil ...	3 0
1 Panel, drilled ...	4 6
1 Terminal strip, drilled	1 3
1 "Easyfix" baseboard	9
Wire, flex, plugs, etc.	1 6
1 Valves to specification: Mullard PM12A or Cossor SG220; Mullard PM111 or Cossor 210 Det. Metalised; Mullard PM2DX, Mullard PM2A ...	1 19 3
1 "159" cabinet ...	1 1 0
1 Calibrator, No charge.	
	£7 19 9

KIT Model 1

(less valves and cabinet) **£4:19:6**
Or 12 equal monthly payments of **9s. 3d.**

KIT Model 2

(with valves less cabinet) **£6:18:9**
Or 12 equal monthly payments of **13s.**

KIT Model 3

(with valves and cabinet) **£7:19:9**
Or 12 equal monthly payments of **15s.**

S.T.400 ACCESSORIES

1 Siemens 120-volt H.T. battery	£ s. d.
1 Siemens 9-volt G.B. battery	13 6
1 Oldham 0-50 accumulator ...	1 0
1 Epoch Twentieth Century permanent magnet moving-coil speaker with input transformer	1 15 0
1 Blue Spot 44R magnetic type speaker in oak cabinet ...	2 12 6
1 Atlas A.C. 244 mains unit ...	2 19 6
1 Atlas A.K.260 mains unit, with trickle charger ...	4 10 0
1 Atlas D.C. 15/25 for D.C. mains ...	1 19 6
1 Cop aerial lead-in and lighting arrester ...	2 6
1 Selectanet indoor aerial ...	2 6
1 Selectanet earth ...	1 6

OFFICIAL DEMONSTRATION

The "S.T.400" Battery and Mains Models will be demonstrated daily at 159, Borough High Street, London Bridge, S.E.1. Come and hear the amazing results for yourself.

S.T.400 De Luxe Radiogram Cabinet, £3.10.0.
S.T.400 De Luxe Radiogram Kit, including all components, Radiogram Switch, Valves, Epoch A2 Dance Orchestra Loud Speaker, Collaro Double Spring Automatic Gramo. Motor, Bowyer-Lowe AFD Mark III Pick-up Volume Control and Bulgin Needle Cup, and De Luxe Radiogram Cabinet, **£18.0.0.** Deposit **£3.10.0.**, and 11 monthly payments of **30s.**
Any combination of kit and accessories can be supplied. Let us know your requirements and ask for prices and special terms.

CASH, C.O.D., AND EASY PAYMENT ORDER FORM

To: Direct Radio Ltd., 159, Borough High Street, London, S.E.1.

Please dispatch to me at once the following goods

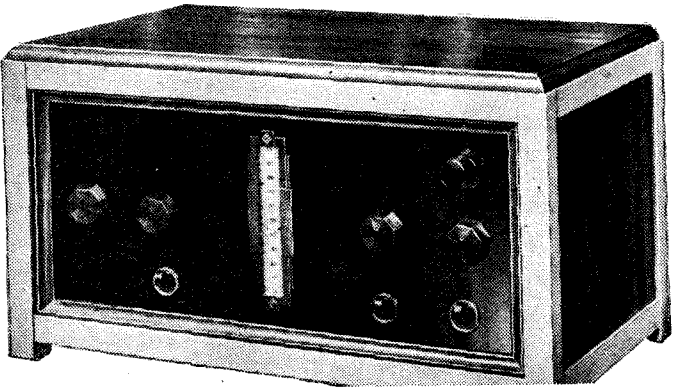
(a) I enclose
for which (b) I will pay on delivery (Cross out line) £
(c) I enclose first payment of (not applicable) £

NAME

ADDRESS

W.Cons. Feb.

"S.T.400" DE LUXE MODEL.
Obtainable only from the official Distributors—DIRECT RADIO, LONDON BRIDGE.



SPECIAL FEATURES

1. Greatly improved and modernised panel layout.
2. Illuminated dials.
3. Side-by-side tuning dial indicators.
4. Slow motion differential control.
5. Simplified tuning ensuring easy station searching and calibration.
6. Modern type walnut toggle switches throughout.
7. Modern design walnut cabinet with beautiful walnut grained ebonite panel.
8. Super-power output giving maximum volume without distortion.
9. All components exhaustively tested and especially chosen to give record results.
10. NO complications in wiring involved.

"S.T.400" DE LUXE SPECIFICATION

1 R.I. "Hypermite" transformer	£ s. d.
1 J.B. -0004 aerial coupler ...	12 6
2 Colvern S.T.400 coils ...	4 0
2 Ormond No. 6 log condensers, -0005-mfd. ...	9 10
1 Simplicon slow-motion illuminated double full vision scale type FVW ...	12 6
1 Ormond No. 6 log condensers, -0005-mfd. ...	8 0
1 Polar -0003-mfd. slow-motion differential condenser	6 6
1 Lotus -00035-mfd. differential condenser	3 0
1 Ready Radio -0001-mfd. differential condenser	2 6
3 Valve holders ...	1 6
1 S.G. type valve holder ...	1 0
3 Becker walnut toggle type 2-pt. switches, No. 480	5 6
1 Telsen binocular S.G. choke ...	5 0
1 Ready Radio Standard H.F. choke	1 6
1 T.C.C. -0003-mfd. condenser, type "S" ...	1 3
1 T.C.C. -006-mfd. condenser, type "S" ...	2 0
1 Dubilier -006-mfd. condenser, type 670	1 6
2 T.C.C. 2-mfd. condensers, type 50	7 8
1 Dubilier 1-mfd. condenser, type 9200	2 9
1 Dubilier 1-meg. grid leak and holder ...	1 6
1 Ierapic 1,500-ohm spaghetti resistance	1 0
1 Lewcos 50,000-ohm spaghetti resistance	1 6
1 Lewcos 20,000-ohm spaghetti resistance	1 6
1 Lewcos 60,000-ohm spaghetti resistance	1 6
1 Bulgin toggle switch, type S.80	1 6
11 Belling-Lee terminals: HT+, HT-, HT+2, HT-2, HT+4, HT-4, LT+, LT-, LS+, LS-, A. E. ...	2 3
1 Screen and foil ...	3 0
1 Panel, drilled ...	4 6
1 Terminal strip, drilled	1 3
1 "Easyfix" baseboard	9
Wire, flex, plugs, etc.	1 6
1 Valves to specification: Mullard PM12A or Cossor SG220; Mullard PM111 or Cossor 210 Det. Metalised; Mullard PM2DX, Mullard PM2A ...	1 19 3
1 "159" cabinet ...	1 1 0
1 Calibrator station under No charge.	
	£9 2 0

*Exclusive features which make your "S.T.400" De Luxe far superior to ordinary kits in appearance and performance.

"S.T.400" DE LUXE ACCESSORIES

Siemens 120-v. power H.T. Bat. £ s. d.	
Oldham 0-75 accumulator ...	1 4 0
Epoch A2 dance orchestra permanent magnet moving-coil loud speaker with Multi-Ratio input transformer ...	3 3 0
Oldham 120-v. Wet H.T. accumulator, 5500 m/a hour capacity	4 1 0
Atlas A.C. 300 super mains unit, giving H.T., L.T. and G.B. ...	6 10 0
Bowyer-Lowe A.E.D. Mark III. pick-up ...	1 10 0

KIT No. 1 (less valves and cabinet) £5:15:0	KIT No. 2 (with valves, less cabinet) £7:17:0	KIT No. 3 (with valves and cabinet) £9:2:0
or 12 equal monthly payments of 10/9	or 12 equal monthly payments of 14/6	or 12 equal monthly payments of 16/6
KIT No. 4 (with valves and special "159" S.T.400 De Luxe Consolette cabinet and Epoch A2 Dance Orchestra Speaker) £12:15:0	or 12 equal monthly payments of £1:4:0	

A.C. MAINS MODEL. Complete Kit of components for Set and Power Pack with 5 Mains Valves: Mullard D.W.2, Mullard 847B, 2 Mullard 354V, and 1 Mazda PP3/250. PRICE £15.15.0 complete, or 12 monthly payments of 29/6.

THE MONTH ON SHORT-WAVES

All the latest news about this interesting band.

BBRITAIN again rules the "waves"! For long enough I have felt that we have been sadly behind the times in our provisions for short-wave broadcasting, and I must confess that there is a keen sense of satisfaction in the knowledge that at last we have an installation that is absolutely second to none.

Hearty Congratulations

The new Empire station at Daventry is a credit to the resourcefulness and ingenuity of British radio engineers, and I feel that I should be sadly lacking in my duty if I failed on behalf of "our gang" to offer hearty congratulations to the B.B.C. for their enterprise in promoting such an ambitious scheme.

After all, it is fascinating for us to be able to listen to short-wave transmissions from all over the world, but how much more satisfying it is in so

doing to be conscious all that time of the fact that we can offer an even better service in exchange!

From the point of view of programmes, of course, the great new Empire station will mean nothing to us; in fact, it is extremely doubtful whether many of us will hear anything of it at all. But that is a minor point, for in any case I understand that the bulk of the programme material will be drawn from our own local stations, so that there can be no possible regrets in those districts where the new station is inaudible.

The Mighty Voice

But the inauguration of a British Empire transmitter with a mighty voice that will reach to the far corners of the earth will increase our fellowship overseas tremendously, and it is for that reason that I want this month to extend to all new-comers a hearty

welcome to join our CONSTRUCTOR Short-Wave Circle. And perhaps I had better add that there is no "sub," and that the only qualifications necessary are (a) a lively interest in short-wave reception, and (b) an occasional report of conditions in your own locality. So next month I am going to look forward to a record mail from overseas.

Now concerning the past month and short-wave conditions in this country, it is gratifying to be able to record a considerable improvement on almost all wavelengths. So far as my own results are concerned, the stations below 25 metres are still not exactly stunning, but it is significant that one or two of my long-lost favourites are beginning to trickle back again, and that is sufficient to tell me that "things is 'appening."

Reports, Please!

Incidentally, in this connection, for a reason which may ultimately interest you all, I especially ask for reports this month from all parts of the country. I am particularly anxious to determine the wavelength that provides the most consistent service at this time of the year between the hours of 8 and 10 in the evening, and for that reason reports should be based on observations over a period. But may I ask that reports be sent not later than February 6th, please?

G. T. K.

You cannot get a quart out of a pint measure. I don't know whether that is a recognised proverb or not, but it will serve my purpose very well just now. In radio parlance it means you cannot get 500 milliwatts out of a 150-milliwatt power valve.

I am referring to undistorted output, of course. If the users of portables realised that the volume from them was not meant to be ever so great, there would be even more satisfaction obtained from them than there is.

Because a portable has four or five valves, listeners naturally think that it should be louder than, say, a two-valve ordinary set. What they forget is that the ordinary set may use super-capacity batteries and have quite a giant output valve.

Bigger—and Better

While on the subject of portables, if you often make use of yours as a "fixture" indoors, why not use a large accumulator with it, especially if you cannot get your batteries charged very conveniently?

"ON THE GRID"

Portable output—Larger accumulator—Simply solved—Unheard cracks.

The larger accumulator will last much longer at a charge, and it will not matter if it does not fit in the case. Just lengthen the leads to it and stand it alongside.

An Easy One

You often read of the puzzling troubles that someone or other has to solve for a friend—radio troubles, I mean. I have described some of my own cases in these notes. Now I am going to tell you about the simplest I have ever had, although it considerably worried my friend who is non-technical.

The set was a three-valve with S.G. and one L.F. The trouble was horribly bad quality and not enough volume. The solution was that one end of the detector's grid leak was

not making contact with its clip, although it was near enough to it to look almost as though it were properly in place.

I came across a cracked record the other day which plays as perfectly via my pick-up as though it were a new one. Perhaps readers have also experienced this effect, but it is the first time I have noticed it.

The crack is there all right, for not only can it be seen, but the pick-up thumps quite loudly as it passes it, but no sound of it comes through on the speaker. The reason is not far to seek.

Up and Down

Impulses from the pick-up depend upon sideways movements of the needle, up and down ones not playing any part. It so happens, then, that this crack has caused the two edges to move away from one another in an up-and-down direction, but there has been no movement between them sideways. No doubt the fact that the crack does not extend right to the edge of the record accounts for this.

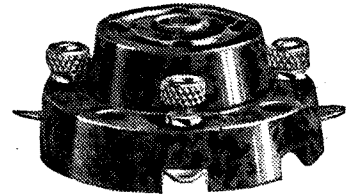
A. S. C.

SCOTT-TAGGART recommends GRAHAM FARISH PRODUCTS for the S.T.400

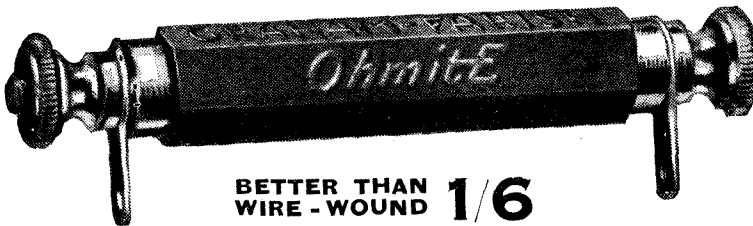
GRAHAM FARISH RIGID VALVE HOLDERS

S.T.400 requires Three 4-pin type.

These Valve Holders have exceptionally low-loss moulded bases, the insulating material between sockets being reduced to a minimum. Contacts are of phosphor bronze, sturdy in design.



4-pin type **6D.** 5-pin type **8D.**



BETTER THAN WIRE - WOUND **1/6**

GRAHAM FARISH OHMITE RESISTANCES

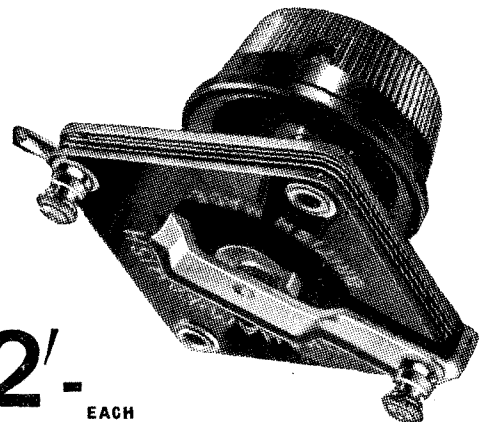
S.T.400 requires One 1 meg.

The popular and efficient resistances for all general purposes. All values 300 ohms to 5 megohms.

GRAHAM FARISH LIT-LOS SOLID DIELECTRIC VARIABLE CONDENSERS

S.T.400 requires Two .0003 & One .0001 Differential Types

Compact in size and efficient in design, with accurately gauged bakelite dielectrics and solid brass pigtail connection to moving vanes. All capacities up to .0005 mfd. in tuning reaction and differential types. One-hole fixing; supplied complete with terminals.



2/- EACH

Obtainable through all Radio Dealers or post free from Sole Manufacturers:

GRAHAM FARISH LTD., MASONS HILL, BROMLEY, KENT.

Export Office: 11/12, FENCHURCH STREET, LONDON, E.C.3

SEND FOR ILLUSTRATED CATALOGUE.



IT'S NO USE BUILDING S.T.400 unless you earth it efficiently—fit FILT—the earth Scott-Taggart recommends exclusively.

"THE CIRCUIT THAT WAS TOO GOOD TO PUBLISH"

By JOHN SCOTT-TAGGART.

In his "Armchair Notes" some time ago, Mr. Scott-Taggart mentioned a circuit that he considered too tricky to embody in a set design for general use. But readers showed such a great interest in this "mysterious circuit" that Mr. Scott-Taggart has decided to publish it after all.

SOME months ago I announced that I had been working on a circuit which was "too good to publish."

This hint, which was given in my monthly "Armchair Notes," aroused a great deal of interest or, at least, curiosity. For I received a great many letters from readers who wanted to know—

- (a) How could a circuit be too good to publish?
 - (b) Why should I flatter myself that I could get special results which readers would be unable to obtain?
 - (c) What, anyway, was the circuit?
- Well, here's the whole story:

A circuit can be too good for the following reason: It is possible to produce certain very valuable results which could only be reproduced by a small fraction of those who built up the circuit.

Ten Years Ago

In other words, the circuit can be too tricky; but this trickiness does not only refer to the skill of the operator, but to the apparatus used.

It often occurs in experimental work that, provided exactly the same apparatus is used, the same valves and the same voltages, another person can reproduce the same results.

But if other apparatus is employed, then poor results will be obtained. Those who built the "S.T.100" nearly ten years ago will recall that it only worked properly with a certain make of L.F. transformer. In fact, for the first three months I received nothing but abusive letters because the set wouldn't work!

Tamed and Harnessed

Then all of a sudden everyone got their sets right—and the receiver proved a great success.

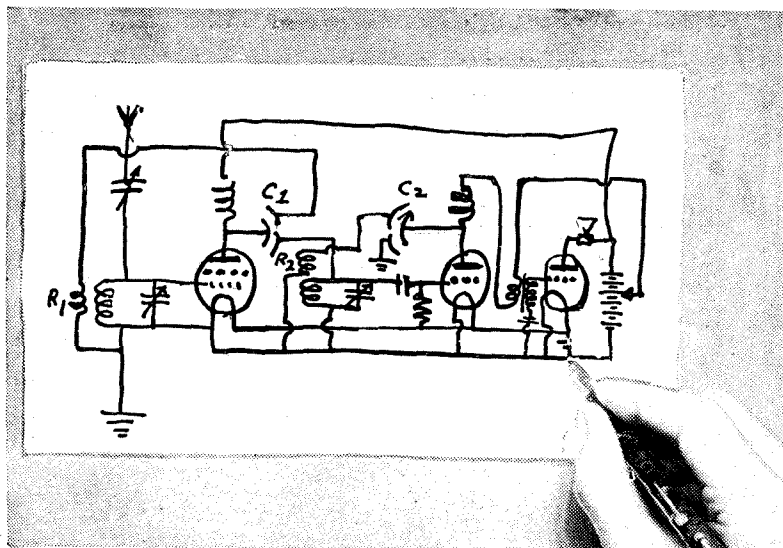
The "S.T.100" circuit was, in a sense, "too good to publish." It was not 100 per cent fool-proof. But since I have never regarded wireless constructors as 100 per cent fools,

I did not hesitate to publish that circuit in 1923.

But working the "S.T.100" was child's play compared with the circuit on this page, which, while it gives good results, is not at all suitable for general consumption.

Nevertheless, although it is strong meat, I give it as a possibly interesting step in the evolution of the "S.T.400" receiver. For the circuit which was "too good to publish" involved principles which I tamed and harnessed and finally incorporated in my latest set.

NO MERITS WHICH THE "S.T.400" DOES NOT POSSESS



If you look at the circuit on this page you will find that the first valve is an S.G. amplifier, the second a detector, and the last valve constitutes the output stage. Differential anode coupling is incorporated, and double-channel reaction is used.

The idea I had was this: Why not employ some of the H.F. currents from the anode circuit of the S.G. valve to ginger up the aerial circuit, thereby improving selectivity and signal strength?

On the "S.T.300" the H.F. currents fed both sets of fixed plates of the differential anode coupler, when the latter was in intermediate posi-

tions. Instead of passing some of the currents to earth, why not pass it through a reaction coil (shown as R_1) coupled to the aerial coil?

I therefore did this, having also in mind the fact that as greater selectivity was obtained with the anode coupler, so would the reaction on the aerial circuit increase—a desirable feature, since "inherent reaction" decreases with low anode couplings.

I at once saw, however, that the aerial reaction would have to be separately variable, and so I used a reaction coil which could be rotated inside the aerial coil.

Tricky Conglomeration

The aerial circuit, therefore, derives its reaction from the screen-grid valve, while the tuned-anode circuit derives its reaction from the detector valve. The "S.T.400" was developed from these experiments (which also included the trial of a reaction coil in the screen-grid circuit), but a gulf separates the two arrangements as regards ease of handling.

Here is the circuit — just as Mr. Scott-Taggart originally drew it.

The circuit I give now has no merits which the "S.T.400" does not possess. It is, in fact, a tricky conglomeration, but it may be interesting to readers as a step in the evolution of an essentially practical development.

MORE GRAHAM FARISH

Products recommended by

SCOTT - TAGGART

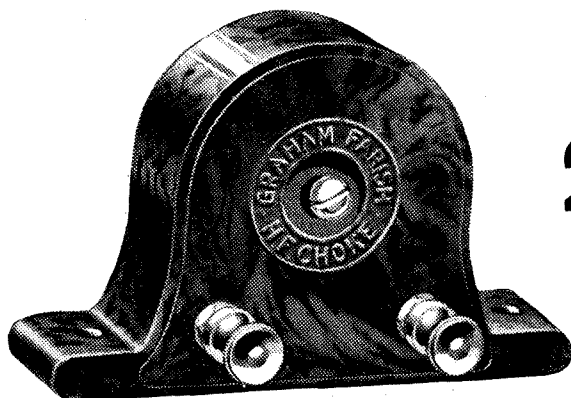
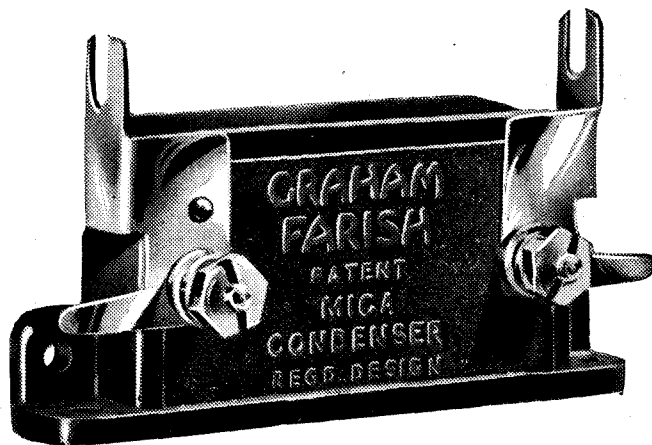
for the S.T. 400

GRAHAM FARISH
FIXED
CONDENSERS

S.T. 400 requires Two .006.

In a complete range of capacities, upright or flat mounting. Every condenser is tested on 750 volts D.C. The capacities are accurate within fine limits, and every condenser can be thoroughly relied upon.

.00005 mfd. to **1/-** .005 mfd. to **1/6**
.004 mfd.



GRAHAM FARISH
**FLEXIBLE
RESISTANCE LINKS**

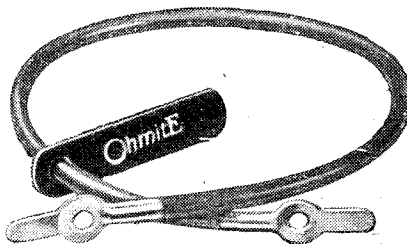
S.T. 400 requires One each of the following sizes: 1,500, 50,000, 20,000, 60,000.

Nickel Chrome wire wound, accurate and well within their ratings.

2/- EACH

GRAHAM FARISH
'SNAP'
H.F. CHOKE

Of new design, wound to give high impedance on long and medium wave-bands. Has small self-capacity with large inductance. Totally enclosed in moulded case.



All sizes from 1,000 ohms to 25,000 ohms. **1/-** All sizes from 25,000 ohms to 100,000 ohms. **1/6**

Obtainable through all Radio Dealers or post free from Sole Manufacturers:

GRAHAM FARISH LTD., MASONS HILL, BROMLEY, KENT.

Export Office: 11/12, FENCHURCH STREET, LONDON, E.C.3

SEND FOR ILLUSTRATED CATALOGUE.



IT'S NO USE BUILDING S.T.400 unless you earth it efficiently—fit FILT—the earth Scott-Taggart recommends exclusively.

Recommended and approved by Mr. John Scott-Taggart for the S.T.400

Only by using components of unquestioned reliability can you get the best from your S.T.400—every component has got to pull its weight. That is why Mr. John Scott-Taggart has approved and recommended the use of T.C.C. Condensers. With a backing of 25 years' specialised research—with a reputation for downright reliability—you can put T.C.C. into your set in the assurance that they will do their job efficiently and continuously—you know that they are working as the designer intended. Insist on the "condenser in the green case" and get results "as per specification."

THE CORRECT T.C.C. CONDENSERS

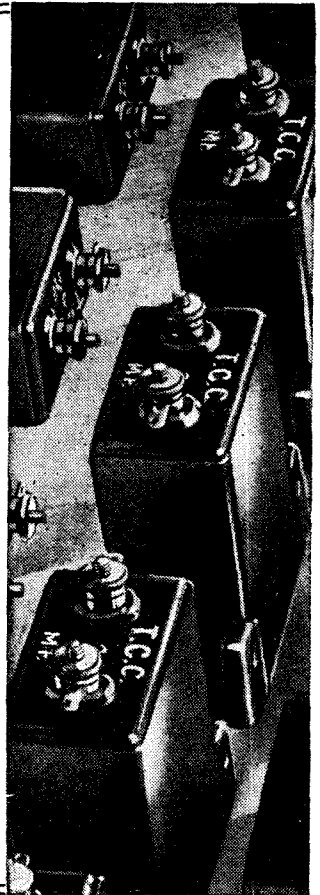
Here are the correct T.C.C. Condensers for the S.T.400. Make a note for your shopping list. If you are buying a complete Ready Radio kit you will find T.C.C. used throughout—all approved by Mr. John Scott-Taggart.

2 — 2 mfd.	Type 50	3/10 each
1 — 1 mfd.	Type 50	2/10
2 — .006 mfd.	Type S	2/- each
1 — .003 mfd.	Type M	1/-

T.C.C.

ALL-BRITISH
CONDENSERS

THE TELEGRAPH CONDENSER COMPANY, LIMITED
WALES FARM ROAD N. ACTON, W.3

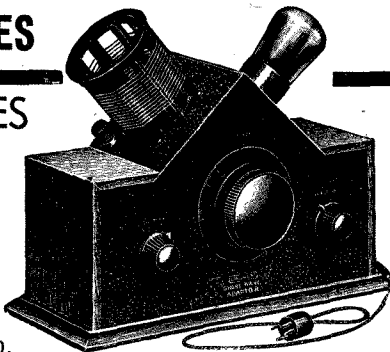


2223

ADAPT YOUR S.T.400 TO SHORT WAVES

18/80 METRES

Mr. Scott-Taggart says: "The Set is particularly suitable for giving Loudspeaker results when used in conjunction with a Short-Wave Adaptor"



Model T. is recommended for the S.T. 300 and S.T. 400.

Three other models are also available as follows:

Model T.A. For sets using American valves.

Model T.S.G. For sets using British S. G. valves as detectors.

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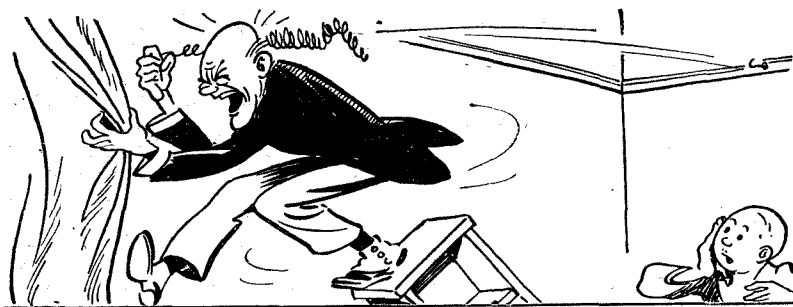
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HOW TO OBTAIN BETTER RADIO

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PRICE ONE SHILLING



In Lighter Vein

By Wireless Wayfarer

As the reader well knows, it is the rarest thing for anything to go wrong with a job when the Professor and I have undertaken to see it through. Everyone, though, has his unlucky days, and there are times when little hitches occur here and there in the carrying out of our best-planned and best-intentioned work. As an instance of one such out-of-the-way happening, let me recount briefly what befell us recently.

"I am sure," remarked the Professor as we sat smoking in his den, "that you will join me in giving our dear Miss Worple a little offering."

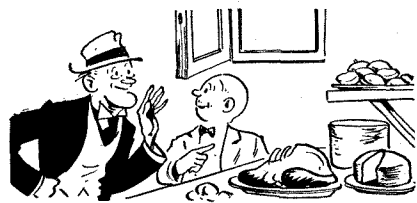
Indoor Collectors

Wearily I turned my pockets inside out.

"Perfectly," smiled the Professor; "but this is going to cost neither of us anything save the labour that we will both so gladly furnish."

It is a curious thing that the mention of work has always made me cold all over, ever since childhood's days. I became positively goosey.

ENSURING EFFICIENCY



"—for good work the workmen shall be well nourished."

Seeing my distress, the Professor went on hastily:

"A really interesting job," he explained. "Miss Worple has long been telling me how much she hates her outdoor aerial and how she would love to have indoor collectors. I have all the material here. She is away from home for the day. Let us prepare a glad surprise for her on her return."

With a sigh I heaved myself out of my deep chair. The Professor picked up a carpenter's bass, which, he said,

With the best of intentions Professor Goop and Wayfarer planned to give Miss Worple a surprise. The element of surprise was certainly not absent, but Miss Worple may be forgiven if she failed to appreciate their good intentions.

contained all the necessary tools and things, and we set forth upon our mission of love.

The house was shut up, but we were able to effect an entry through the larder window. The sight of half a roast fowl and other good fare reminded us that it was some time since we had fed, and for good work to be done it is, of course, essential that the workmen shall be well nourished. There was just enough upon the shelves to ensure that we were.

The Professor thought that we had better make a start in the drawing-room.

From his bag he produced one of those spring aerial things, which he thought would make the neatest of neat jobs. Under his instructions I mounted a step-ladder and drove a hook in the wall farthest from the window. I attached one end of the spring business to this.

An Aerial Stunt

The Professor then took the step-ladder and put another hook in just above the window. Coming back he took the end of the aerial and walked with it slowly across the room. The thing seemed to be stretching a good deal and I was instructed to keep a careful eye upon it to see that it was not unduly strained.

The Professor carefully mounted the steps once more and then drew the loop towards the hook.

"Will she do it?" he inquired.

"Yes, just; if you're careful."

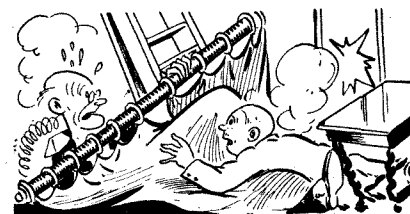
He had barely got the loop over his hook when my startled eyes saw that the first hook was leaving its moorings. My cry of warning was frozen in my throat as the thing shot out

like a catapult and caught him whack upon his shining dome.

Semi-stunned, the Professor swayed upon the ladder and clutched at the curtains for support. The ladder flew from beneath him, and for an aching moment he hung suspended 'twixt heaven and earth.

Then, with a welkin-rending crash, he descended upon Miss Worple's Chippendale writing-table, which collapsed beneath him. I rushed to

A NASTY TRICK



"I rushed to rescue him, but my foot caught in the hearthrug."

rescue him from the mass of curtains in which he was enveloped, but my foot caught in the hearthrug, and in trying to save myself I clutched at a plant stand, which promptly discharged a large pot of tulips through the glazed doors of the china cabinet.

"I think," remarked the Professor, when he was feeling a little better, "that we had better leave the drawing-room for the moment and put up a picture-rail aerial in the dining-room. Nothing can go wrong so long as we are just using plain wire. It has no nasty tricks, and doesn't fly at you and hit you on the head."

Taking a Look Round

While the Professor was engaged in looking round the dining-room so as to plan out the course of his aerial, I investigated the sideboard.

"How thoughtful of Miss Worple," I exclaimed. "She must have guessed that we should be doing our good deed in her absence and it may have occurred to her that we might suffer some little accident calling for a restorative.

"She has, in fact, left a whole decanter of port specially for us." It

In Lighter Vein—continued

was jolly good port, too, and by the time that we had finished it the Professor and I felt that there was nothing in the way of aerials that we were not prepared to tackle.

We fixed up our supporting brackets without any mishap and then began the business of running out the wire. The Professor wanted the step-ladder in one corner of the room, so he suggested that I should stand on the mantelpiece and guide the wire along as he pulled it through.

Kink Trouble

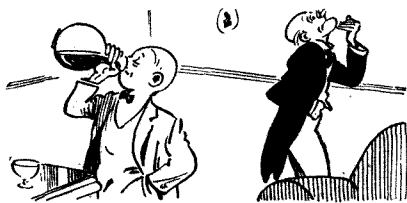
I never can make out why some people like to have silly little fiddly chairs in their rooms. The first one that I used as a stepping-stone towards the mantelpiece just fell to pieces the moment that I placed a foot upon it. The only thing to do was to move the table up to the fireplace and to use it as a mounting block. Thanks to the hobnails in my boots, I was saved from skidding upon its polished surface. With an agile spring I arrived upon the mantelpiece and reached up towards the picture rail.

"Ease her through," called the Professor. "She doesn't seem to come somehow when I pull."

"Half a tick," I panted, reaching out to full arm's stretch to straighten out a kink. "I say, I don't think this mantelpiece is awfully secure."

"Don't be a fool," snapped the Professor. "Stand on the very edge and pull outwards and I am sure that the wire will come."

AN OPPORTUNE DISCOVERY



"While the Professor was engaged in looking round, I investigated the side-board."

I moved an inch or two backwards. Then with an awful earthquake noise the mantelpiece simply came out by the roots. Trying to save myself, I sprang for the picture-rail, but this came away in my hand. In a moment the marble mantelpiece, a large ormolu clock, two statuettes, half a dozen oil paintings and myself were lying in a tangled mess upon the carpet.

The Professor rushed to my aid and pulled me out from the debris. Luckily I was more shaken than hurt, but Miss Worple had apparently not foreseen a second casualty, for search as we would we could find no more first-aid decanters.

In the Attic

"I think," sighed the Professor, "that Miss Worple and her maid would probably like to dust the dining-room a little before we continue our work there. I know, though, that she is a bad sleeper and that she keeps a wireless set beside her bed. Let us now arrange an aerial for her bedroom."

After inspecting this room we decided that by far the best aerial would be a number of parallel wires suspended between spreaders in the attic above.

There was a trapdoor in the bathroom ceiling which clearly gave access to this attic, and through this we duly climbed with the aid of the step-ladder. We had plenty of wire, and we took with us a pair of wooden coat hangers, which are just the things for spreaders.

After a little prospecting we satisfied ourselves that we were immediately above the bedroom, and the work went forward. Putting up an aerial in an attic is the easiest possible job, so long as you remember to walk only on the joists. The Professor and I reminded one another of this necessary proceeding. In fact, we kept on reminding each other about it.

The Mains Aerial

"Mind you stay on that joist," I called, as I moved away from him, paying out the wire.

"The same to you with knobs on," snarled the Professor.

This uncalled-for remark must have thrown me out of my stride, for next instant I stepped into the void, or perhaps I should rather say that my step created a void. Luckily Miss Worple's bed lay beneath to break my fall. It must have been a very springy one, for I bounced off it on to the washstand, which fell flat with a horrible clatter of crockery.

"Anyhow," said the Professor, when we were feeling a little better, "there's one room left that we can make a job of."

"Which one is that?" I inquired, removing part of a soap-dish from the turn-up of my trousers.

"The dear lady's boudoir. For that I have contrived a very special mains aerial. It plugs into a lighting socket at one end and at the other end are two wires which go to the aerial and earth terminals. I've spent all my spare time recently in putting it together, and I can assure you that it is the very last word in mains aerials."

LUCKY CHANCE



"Luckily Miss Worple's bed lay beneath to break my fall."

We went along to the boudoir, and from his bass the Professor uncoiled his mains aerial. We duly attached the two protruding wires to the aerial and earth terminals of Miss Worple's bijou boudoir set. Then the Professor inserted the plug into the socket on the skirting board and switched on.

There was a blinding flash, and every light in the house went out.

"And we had planned such a jolly surprise for Miss Worple," sighed the Professor, as we sat licking our wounds (metaphorically, of course) in his den a little later.

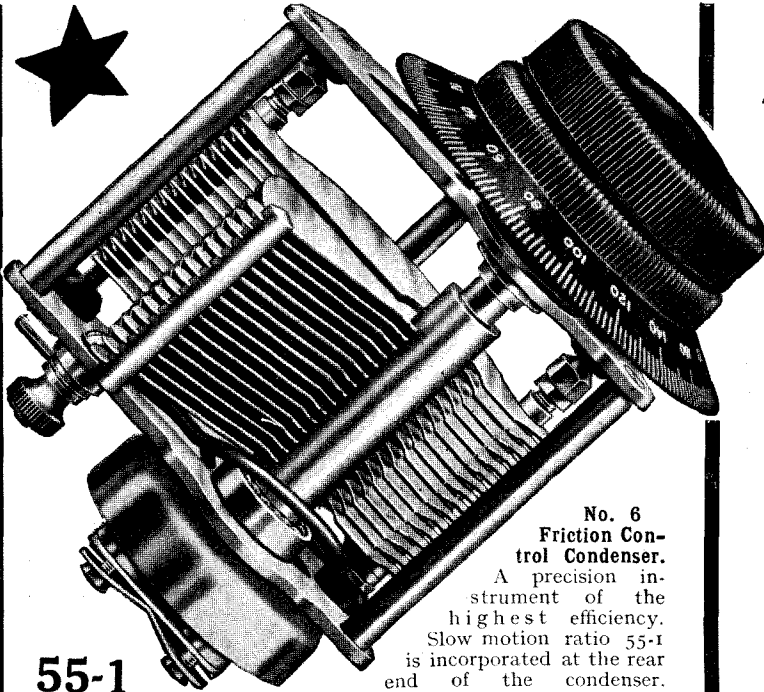
"She'll have her surprise all right," I murmured.

* **SEE THEY'RE EARTHED** *
* **A Tip in Time.** *

"Potted" or "canned" coils are used nowadays in the construction of most wireless receiving sets. The screening pots prevent interaction and ensure satisfactory working only if they are well and truly earthed, and it sometimes happens that this is not the case, though to the eye all may appear to be well.

The electrical connection between the pot and the metal base into which it fits may in reality be of a rather chancy nature. In sensitive sets I often find it an advantage to provide each screening can with a terminal of its own, and to connect this directly to earth by means of a short piece of flex.

R. W. H.



Ensure the Success of your S.T. 400

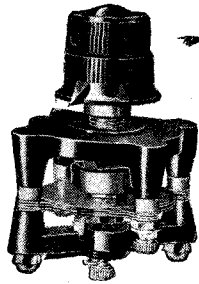
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No. 6 Friction Control Condenser.
A precision instrument of the highest efficiency. Slow motion ratio 55-1 is incorporated at the rear end of the condenser.

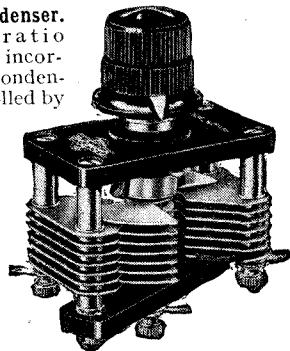
Complete with 2½-inch dial and slow-motion knob.

Cat. No.	R/491	Capacity	·00025	Price	7/6
"	R/492	"	·00035	"	7/6
"	R/493	"	·0005	"	7/6



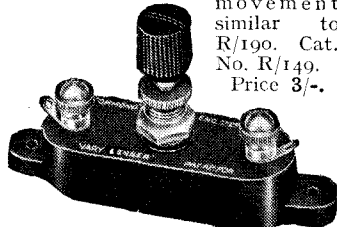
Differential Condenser.
Slow-motion ratio approx. 9-1 is incorporated in the condenser and is controlled by the upper knob, direct drive being obtained on the lower knob.

Cat. No. R/190. Capacity ·0003 each half. Price 3/-.
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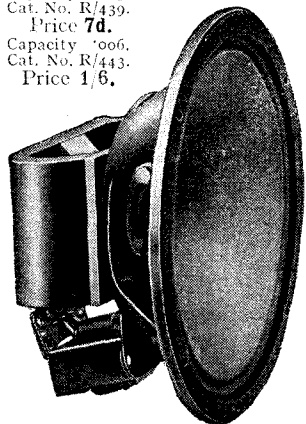
Midget Condenser.
For use as aerial coupler may be connected in series or use one half only. Incorporating a slow motion movement similar to R/190. Cat. No. R/149. Price 3/-.
Cat. No. R/193. Capacity ·0003. Price 2/-.
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Fixed Condensers.
Designed for extreme accuracy and ease of mounting.



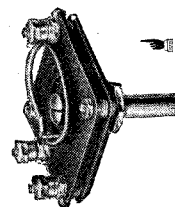
Vary Condenser (pre-set).
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P.M. Moving Coil Chassis.
Gives an excellent response throughout the frequency range and is supplied complete with input transformer.

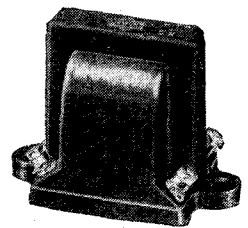


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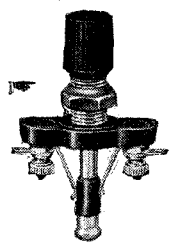


L.F. Transformer.
A highly efficient Transformer. Walnut Bakelite finish with connections clearly indicated. Cat. No. R/531. Price 7/6.

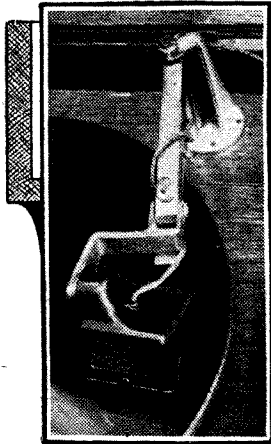
Toggle Switch.
A perfectly insulated quick make-and-break switch. Cat. No. R/330. Price 1/3.



Push Pull Switch.
Moulded bakelite former. Complete with terminals and soldering tags. Cat. No. R/323. Price 1/3.



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PICK-UP HINTS AND TIPS

Some interesting notes on various practical aspects of radiogram reproduction.

By A. BOSWELL

"MY set is all right on radio, but on the pick-up—well—"
A common enough complaint, no doubt largely because the cause can be such a wide variety of things, but common all the same. To many it would seem that if everything is O.K. on radio, pick-up results must be quite all right, because, after all, they reason, are not the same stages in use?

That is true enough—they are; but the snag lies in the fact that they are in use in a different way. A different way which requires certain alterations in many cases if everything is to be satisfactory.

Detector as Amplifier

Let's take first of all the case of a set in which the detector valve is used as the initial amplifier. There you have your first case of the same valve working in a different way.

What is more, it is a very different way. When receiving radio it is detecting signals, and when working on the pick-up it is performing the duties of an amplifier.

In the first case, unless it is being used as an anode-bend detector, it will not have grid bias applied to it. But as an amplifier it is highly necessary for negative bias to be employed, and provision for this should be made when the set is switched over from radio to record.

Even amplification cannot be obtained unless this bias is applied. Usually $1\frac{1}{2}$ volts tapped from the ordinary L.F. G.B. battery is ample.

Increase H.T.

Pick-ups these days are very sensitive, and can apply quite a considerable voltage to the first valve, and, as you know, the voltage that a valve will handle without being overloaded depends to a large extent upon the H.T. that is applied to its anode. For this reason it is a highly desirable

practice to increase the high-tension for the detector to the maximum available when going over to pick-up. Just think how poor an amplifier a detector without grid bias—and with the low voltage often necessary to obtain smooth reaction control applied to its anode—would be!

Another trouble that is likely to arise when the detector is used as the first L.F., in the case of a set with

case of a mains receiver, and ordinary braided flex such as is often used for heater wiring is ideal for the purpose.

Another prolific cause of distortion can occur when either the L.F. valves alone, or the detector as well, are used for pick-up work. It concerns the question of volume control.

When the volume control used for radio also serves for pick-up work it usually comes after the first valve used as amplifier for record reproduction. As already mentioned, modern pick-ups are very sensitive, and the result is that overloading of the first amplifier may easily take place.

Cutting "Edge"

For this reason it is always desirable to have a volume control of the potentiometer type connected directly across the pick-up, and preferably mounted on the turntable board. In this way overloading of all valves can be avoided.

Some of the latest pick-ups have a volume control already fitted in the tone-arm pillar, in which case a separate volume control is not necessary.

Edgy shrillness is the subject of complaint with pick-ups very often, although it may not be appearing on radio reception. The cause is largely due to the lack of bass on records and the peaking in the upper frequencies of the pick-up itself.

The simple expedient of fixed condensers across the pick-up is one remedy, the value varying largely with the particular pick-up in use and the amount of edginess that it is wished to remove.

A convenient way to apply the condenser is in series with a variable resistance, so that by varying the resistance the effective by-pass of the condenser can be altered. Here again the value will depend upon circumstances.

The use of a tone-compensating transformer in one of the L.F. stages, is another effective method.

Accommodating "Peaks"

As a concluding "remark" it should be pointed out that it is quite normal for a given power valve with a given H.T. not to be able to handle so much volume from a pick-up as it is able when the set is working on radio. The reason is that in the former case the peaks are likely to be of a much greater value than in the latter. Therefore it is advisable to be satisfied with a smaller volume when working on pick-up, if it is necessary to work the valve in the output stage near its maximum.

RECORDS WORTH CONSIDERING

When I Was Twenty-one.	Broadcast
Charlie Higgins	Broadcast
We Just Couldn't Say Good-bye.	Broadcast
The Rhythm Rascals	Broadcast
Famous Waltzes of the World.	Broadcast
Alfred Bere's Orchestra	Broadcast
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You Loving Me.	Columbia
Albert Sandler	Columbia
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Pomp and Circumstance.	H.M.V.
B.B.C. Symphony Orchestra	H.M.V.
Snacks in Bars.	H.M.V.
New Mayfair Orchestra	H.M.V.

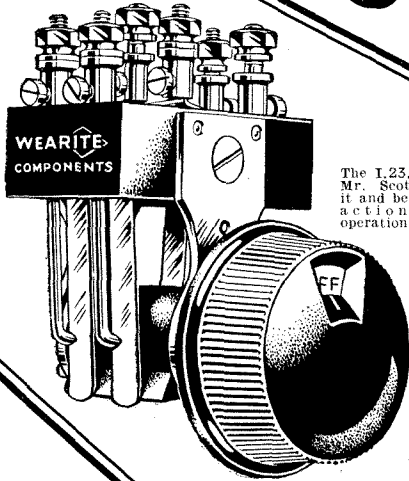
two ordinary L.F. stages, is low-frequency instability. Such trouble is then largely due to the fact that three L.F. stages are in use.

The most helpful remedy is to insert extra decoupling in the detector's circuit if this has not already got it, or alternatively in what is normally the first amplifier's anode circuit. Also when an L.F. transformer is used between the pick-up and the input to the first valve, it is worth trying the effect of dispensing with it.

Finally, there is the suggestion of screening the leads from the pick-up to the set and the earthing of the pick-up arm and casing. The first is most likely to prove beneficial in the

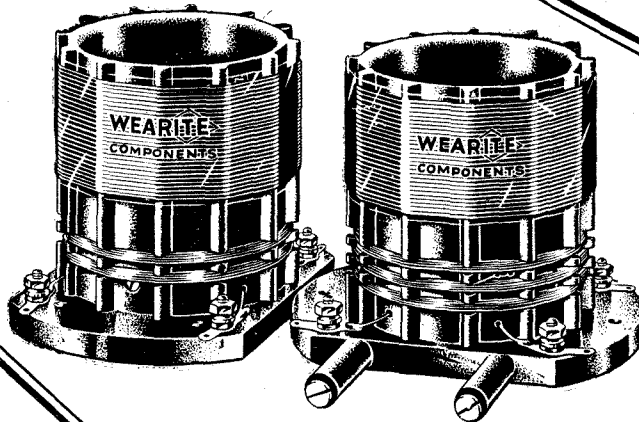
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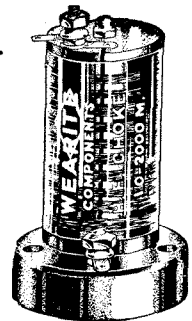
Here are the Wearite S.T.400 coils—matched and tested against the "S.T." Standard and approved by Mr. Scott-Taggart. Price

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The Wearite S.G. Choke (H.F.O.) that efficiently covers a 10-2,000 metre waveband. Price

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USE THESE WEARITE PARTS

	Price each
1 5-pin and 2 4-pin Valve Holders (S.1)	1/3
2 2-pt. Switches (G.S.P.)	1/-
1 S.G. Choke (H.F.O.)	6/6
1 Reaction Choke (H.F.P.) Screened	3/6
1 Toggle Switch (G.S.S.)	1/6
1 3-pole D.T. Switch (I.23)	4/-
1 S.T.400 Screen 1/9, and Foil 6d.	

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Hyper-Sensitive Valve

SEÑOR GUSTAVO MONTEAVARO is being hailed as the inventor of what is claimed to be a hyper-sensitive wireless valve, and with it programmes are said to be obtainable from almost any wireless station in the world. It is further claimed that, with a single valve set using the new valve, the set becomes as powerful as an ordinary three-valver.

Special Messages

At a dinner given in the inventor's honour the other day at the Spanish Club, London, special messages were

broadcast from the low-power station at San Sebastian, in Spain, and other places. They were picked up clearly after the dinner with a one-valve set using Señor Monteavaro's new invention. Not much has appeared in the press about this new valve, but from the demonstration we witnessed the other day it is likely that more will be heard of it in the near future.

How Deep is the Sea?

The new Marconi Echometer is an ultra-sensitive sound apparatus which registers every second the exact depth of the sea. This ingenious apparatus was fitted on a ship which has recently completed her trials off the coast of Gambier, near Rio de Oro, in West Africa. During the trials, the Echometer revealed many errors in the existing charts of the ocean beds,

and also the presence of several shifting sandbanks. It is expected that the Echometer will in due course be fitted to many ships travelling in dangerous and faultily-chartered waters.

A Big Surprise

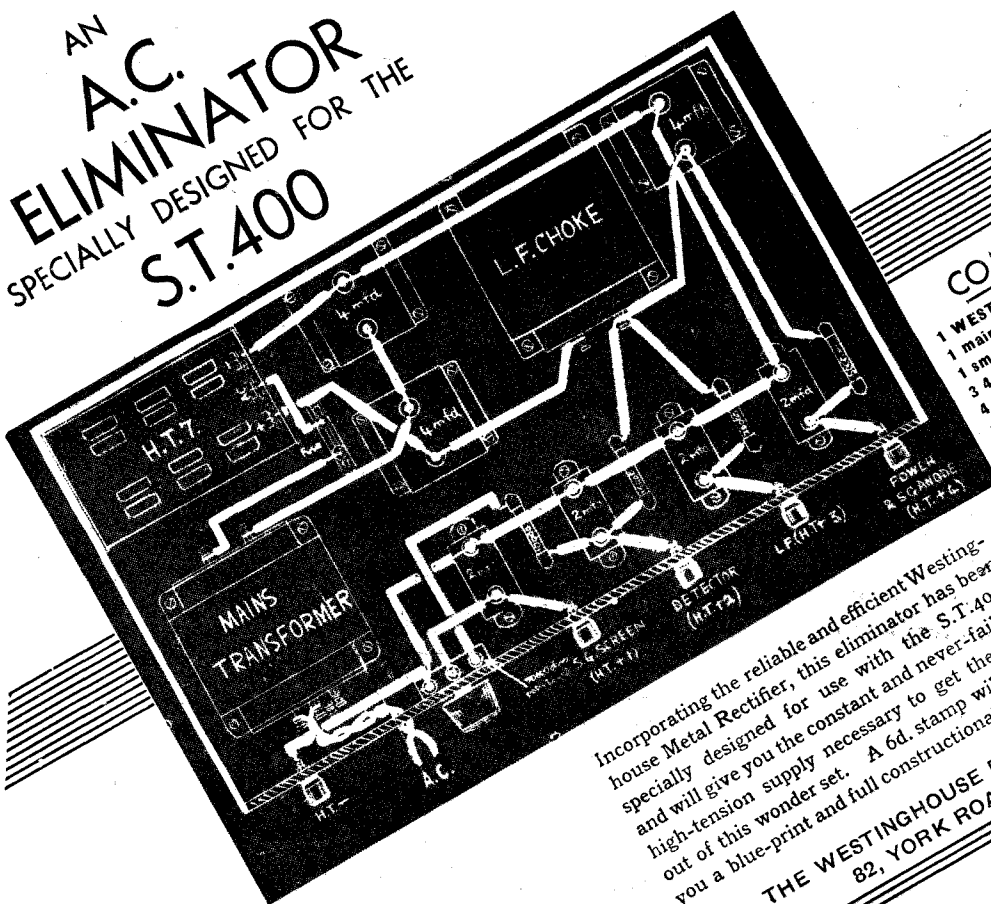
It must have come as a big surprise to many listeners when the changes in the B.B.C. Board were announced that Lady Snowden was not re-appointed as a Governor. The music-loving public will hear this news with regret, for no one has done more for the B.B.C.'s musical endeavours than Lady Snowden, and the decision of the Prime Minister not to recommend her reappointment is deeply regretted.

Mrs. Hamilton

The appointment of Mrs. Mary Agnes Hamilton as a Governor of the B.B.C. gives Sir John Reith a colleague who—in the words of the "Aberdeen Press and Journal"—in a rather roundabout way shares his associations with the North-East. Although Mrs. Hamilton was not born in Aberdeen, she lived there as a child when her father, the late Professor Adamson, was there for two years as

(Continued on page 310)

AN
**A.C.
ELIMINATOR**
SPECIALLY DESIGNED FOR THE
S.T. 400



COMPONENTS REQUIRED

- 1 WESTINGHOUSE METAL RECTIFIER STYLE H.T.7.
- 1 mains transformer.
- 1 smoothing choke.
- 3 4-mfd. condensers.
- 4 2-mfd. condensers.
- 1 5,000-ohm resistance.
- 1 15,000-ohm resistance.
- 1 20,000-ohm resistance.
- 1 10,000-ohm potentiometer.
- 1 50,000-ohm potentiometer.
- Connecting wire, fuse, etc.

Incorporating the reliable and efficient Westinghouse Metal Rectifier, this eliminator has been specially designed for use with the S.T. 400; and will give you the constant and never-failing high-tension supply necessary to get the best out of this wonder set. A 6d. stamp will bring you a blue-print and full constructional details.

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SPECIFIED COMPONENTS

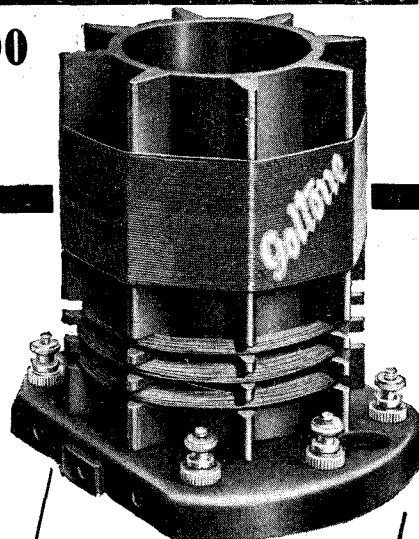
The outstanding performance and excellency in finish of "GOLTONE" COMPONENTS leads to their specification in all the leading Radio Journals, including "THE WIRELESS CONSTRUCTOR."
Obtainable from all first-class Radio Stores. Refuse Substitutes. If any difficulty, write direct. Large illustrated Radio Catalogue sent Post Free on request.

ALSO SPECIFIED FOR THE S.T.400.

- "GOLTONE" Pre-set Condenser, Type J, R15/84, 1/- each.
- "GOLTONE" Radio Earth Tube, R29/300, 2/9 each.
- "GOLTONE" Super H.F. Choke, suitable for the above-mentioned circuit, R3/46, 4/6 each.

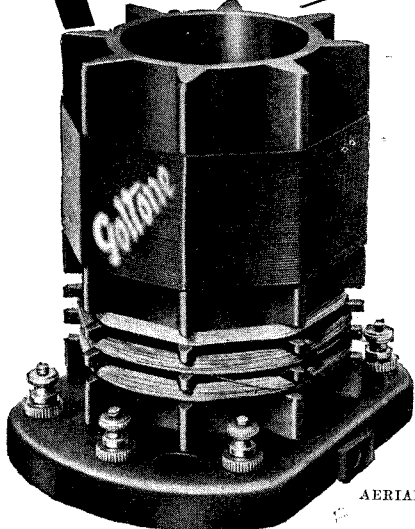
OTHER "GOLTONE" PARTS ENTIRELY SUITED FOR THE ABOVE RECEIVER:

- 1 Grand L.F. Transformer, 3 $\frac{1}{2}$:1 ratio.
- 3 4-socket Valve Holders.
- 1 Universal Valve Holder.
- 2 2-Point Push-pull Switches.
- 1 Binocular H.F. Choke.
- 1 .0003-mfd. Fixed Condenser.
- 1 Long Grid Leak with Holder.
- 1 20,000-ohms Spaghetti Resistance.
- 1 1,500-ohms Spaghetti Resistance.
- 1 50,000-ohms Spaghetti Resistance.
- 1 60,000-ohms Spaghetti Resistance.
- 1 Terminals.
- 1 Panel, 16" x 7" x 3/16".
- 5 Engraved Wander Plugs, 2 Spade Terminals.
- 1 Terminal Strip, 16" x 1 $\frac{1}{2}$ " x 3/16".
- 1 Tinned Copper Wire and Sleeve, or Lacoline Covered Connecting Wire.

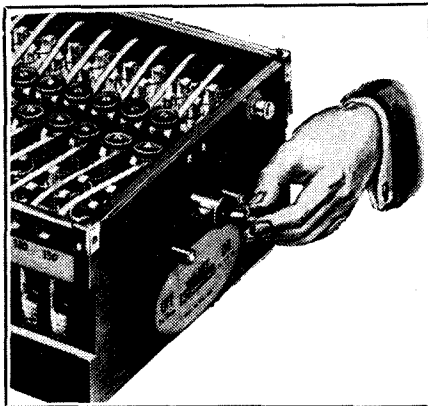


"GOLTONE" S.T.400 COILS are wound on Extremely Low Loss Ribbed Ebonite Formers, exactly to designer's specification. Top slot of aerial coil is wound with White Silk Covered Wire.

"GOLTONE" S.T.400 COILS ARE TESTED AND FULLY APPROVED by Mr. John Scott-Taggart. Price 8/- per pair. Aerial Coil also supplied separately 4/- each.



AERIAL.



JUST TURN THE SWITCH AND THE

The Paper for the Boy of To-day?

Such is MODERN BOY. Its every issue is brimful of thrilling stories and articles on the very latest Invention, Adventure, Hobbies, etc. It is the paper for the youth of to-day. Buy it regularly.

MODERN BOY

Every Saturday - - 2D.

Prices in U.K.
90 v. £2. 18.
120 v. £3. 14.
150 v. £4. 14.
Electrolyte extra

MILNES H.T. SUPPLY UNIT

RECHARGES AUTOMATICALLY FROM THE L.T. ACCUMULATOR

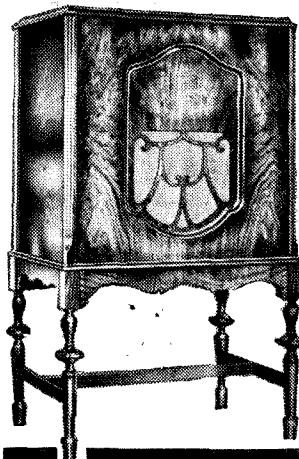
Its everlasting nickel-iron cells cannot be harmed by overcharging or neglect, and hold their charge indefinitely. Its alkaline electrolyte does not creep or corrode wires and terminals. The Milnes Unit actually improves with use. The older it gets, the more efficient it becomes. It gives the full power and dependability of the mains without their ripple and hum. It gives the purity and steadiness of dry batteries without their expense. Costs no more to run than an extra valve. Send coupon for full particulars.

MILNES RADIO CO., Victoria Works, Church Street, BINGLEY.

Please send full particulars of the Milnes H.T. Unit.

Name.....
Address.....
W.I.

Keir Dawson - Bradford.



BETTER—CAMCO Cabinets

THE CAMCO 'LINCOLN.' A perfect example of cabinet craftsmanship. Designed to avoid all resonance. For housing all mains and battery sets. PRICE £5 17s. 6d. in walnut.

Send coupon for FREE catalogue giving particulars of Camco Cabinets and see them in our showrooms open 9.15 to 5.45 (Sat. 2.30).



Carrington Manufacturing Co. Ltd., Showroom: 24, Hatton Garden, London, E.C.1.
Phone: Holborn 8202.
Works: S. Croydon.

Post in 4d. envelope.

Name.....
Address.....
6wc.....

OUR NEWS BULLETIN

—continued from page 308

Professor of Logic before he went to Glasgow.

Literary Work

Mrs. Hamilton has written a eulogistic book about the Prime Minister, Mr. Ramsay MacDonald, a murder thriller, and a translation of a German book about Mary Queen of Scots.

Another Step

Writing of Scotland reminds us that Glasgow's 100,000th wireless licence was purchased towards the end of December.

Biggest B.B.C. Station

It is reported that a site at Wychbold, a little village near Droitwich in Worcestershire, has been chosen by the B.B.C. for the new broadcasting station which will eventually replace the Daventry long-wave transmitter and the Midland Regional transmitter. It is expected that work will be started as soon as possible. The new station, when it is ready, will be the biggest and most powerful of all the B.B.C. transmitters.

Ban on Broadcasting

As we go to press with this issue of THE WIRELESS CONSTRUCTOR, there is a hectic controversy raging concerning the attitude of Mr. George Black, of the General Theatres Corporation, regarding the clause in variety artistes' contracts giving the G.T.C. power to ban them from broadcasting. At the moment there seems to be some sort of a deadlock. It appears the G.T.C. have revived the old boggy that broadcasting is harmful to the interests of legitimate variety concerns. It is a pity this boggy has been revived, for it is certainly a very stupid one.

Most Popular Artiste

The other evening we went to a cinema and were regaled before the big film with an entertainment by various B.B.C. stars, including Miss Elsie Carlisle. Now, Miss Elsie Carlisle is very well known to wireless listeners, and there is no doubt that—her excellent performance taken for granted—she has created for herself a large and affectionate wireless public. She was easily the most popular of the artistes appearing at the cinema that evening, and was recalled time after time by an audience clamorous for more.

No Detrimental Effect

Broadcasting can help the popularity of a variety artiste to a very great degree; while, on the other hand, the occasional appearance of a well-known variety artiste before the microphone cannot in any way be proved to diminish the popularity of that artiste on the legitimate stage.

It Can't Be!

Is it seriously suggested that because Miss Gracie Fields occasionally broadcasts, her box-office draw is diminished when she appears at the Palladium or some other famous house of variety?

Making a Stand

So far, only one well-known artiste has kicked against the ban, and we feel we must congratulate Mr. Norman Long on deciding that he will continue to broadcast when invited by the B.B.C., and if necessary will sever his connection with the General Theatres Corporation rather than give up his broadcasting work.

We Can But Hope

Let us hope this silly controversy will end very shortly, and that the

(Continued on page 312)

IDEAL FOR THE "WIRELESS CONSTRUCTOR" "S.T. 400."



This OSBORN Radio Cabinet

Model No. 300. Unique Futuristic Super Table Model, 2 ft. high x 1 ft. 7 in. wide x 12 in. deep. Will take a panel 18 in. x 8 in. or smaller. Ample room for speaker and batteries. Any size hole in baffle board cut free.

Machine ready to assemble. Oak, 15/-; Mahogany, £1.0.0. Walnut - £1.5.0. Assembled ready to polish. Oak, £1.5.0. Mahogany, £1.10.0. Walnut - £1.15.0. Assembled and polished. Oak, £1.15.0. Mahogany, £2.0.0. Walnut - £2.5.0.

WRITE FOR FREE CATALOGUE.

ALL MODELS CARRIAGE PAID.

CHAS. A. OSBORN, Dept. C,
Regent Works, ARLINGTON ST., LONDON, N.1.
Telephone: Clerkenwell 5095.
Showrooms: 21, Essex Road, Islington. N.1.
Telephone: Clerkenwell 5634.

Osborn Super Acoustic Baffle Board prevents 90 per cent speaker worry. Any size hole cut free. Guaranteed no vibration. 18" x 18", 3/-; 24" x 24", 5/-; 30" x 30", 8/-; 36" x 36", 11/3. Carr. Paid U.K. Send for Free Sample.

TRADE YOUR OLD SET FOR A BRAND NEW S.T.400 KIT

BEST ALLOWANCE ON YOUR PRESENT SET

Fill in and send us the coupon below, and we shall be pleased to quote you highest allowance by return.

MAIL ORDER ONLY—NO CALLERS

To
NEW Times SALES CO. 56, Ludgate Hill, E.C.4.
ESTABLISHED 1924

Dear Sirs,
I enclose herewith full particulars of my present set for which I wish to receive your highest allowance in part exchange for the items below marked with a cross.

<input type="checkbox"/>	NEW TIMES SALES S.T.400 KIT	-	-	£3 15 0
<input type="checkbox"/>	PETO - SCOTT PILOT AUTHOR S.T.400 KIT	-	-	£4 15 0
<input type="checkbox"/>	READY RADIO S.T.400 KIT	-	-	£4 19 6
<input type="checkbox"/>	DIRECT RADIO S.T.400 KIT	-	-	£5 15 0
<input type="checkbox"/>	SET OF 4 SPECIFIED VALVES FOR S.T.400	-	-	£1 19 3
<input type="checkbox"/>	NEW TIMES SALES S.T.400 CABINET	-	-	17 0
<input type="checkbox"/>	PETO-SCOTT S.T.400 CABINET	-	-	17 0
<input type="checkbox"/>	DIRECT RADIO SPECIAL "159" CABINET FOR S.T. 400	-	-	£1 1 0

(Mark a cross against the items you require.)

NAME.....
ADDRESS.....
W.C.2/33.....

THE World's Best Stories!



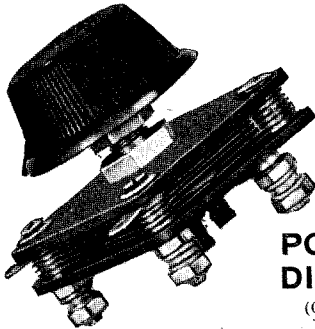
The ARGOSY offers a splendid variety of really first-class fiction. Every story sets a standard of excellence, for the policy of this magazine is to print those stories which are indisputably great, and written by acknowledged masters of the past and present day.

The ARGOSY MAGAZINE

At all Newsagents. Monthly, 1/-

YOU'LL NEED THESE POLAR CONDENSERS TO CONVERT YOUR S.T. 300 TO THE S.T. 400

WHEN you convert your S.T. 300 to its modern counterpart be certain—use proven components. Mr. Scott-Taggart has repeatedly recommended Polar condensers—he knows of their unfailing reliability—of the vital part they play in a set's performance. Follow his lead and insist on Polar—one and all "star" performers. Here are the condensers you require.

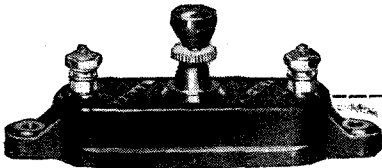


POLAR DIFFERENTIAL

(One '0003 mfd. and one '00035 mfd. required).

Soundly built condensers of finest materials. Fitted with insulated spindle. (Also in '0001 and '00015 mfd.)

Price **3/-**



POLAR PRESET

(two '0003 mfd. required.)

Robustly made, smooth in operation—complete with lock nut. Housed in well-finished bakelite case. (Also in '0001; '0002 and '0005 mfd.)

Price **1/6**

Polar Condensers are obtainable from all Dealers. Write for complete catalogue "C".

POLAR Condensers for the S.T. 400

2 Polar No. 2 S M '0005 mfd.	Price, each	6/6
1 Polar Reaction No. 4 '00004 mfd.	Price	3/9
1 Polar Differential '0003 mfd.	Price	3/-
1 Polar Differential '00035 mfd.	Price	3/-
1 Polar Differential '0001	Price	3/-
2 Polar Preset '0003 mfd.	Price, each	1/6

POLAR CONDENSERS



WINGROVE & ROGERS LTD.
188-9, STRAND, W.C.2 POLAR WORKS, LIVERPOOL

H.T.

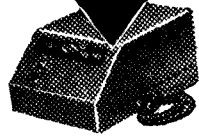
for your set
for less than

1/

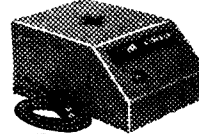
A
YEAR

10/-

DOWN
AND BALANCE
IN EASY
MONTHLY
PAYMENTS



D.C. 15/25. H.T. for 3-4 Valve Sets from D.C. Mains. 39/6 Cash.



A.K. 22. H.T. and L.T. for 2-3 Valve Sets from A.C. Mains. 77/6 Cash.

THE OLYMPIA BALLOT WINNERS

Why pay at least 50/- a year for quickly exhausted dry batteries? Get your H.T. from the mains with an "ATLAS" Unit for less than a shilling a year. There's a model for every receiver, fitted in a few minutes without alterations to set or valves. Ask your dealer for a demonstration to-day, and insist on "ATLAS," the Expert's choice and winners of the "Wireless World" Olympia Ballots. No others can give such a reserve of hum-free power.

Manufactured and Guaranteed for 12 months by H. CLARKE & CO. (M/CR), LTD., PATRICROFT, MANCHESTER. LONDON: Bush House, W.C.2. Glasgow: The G.E.S. Co., Ltd., 38 Oswald Street.

"CLARKE'S" ATLAS MAINS UNITS

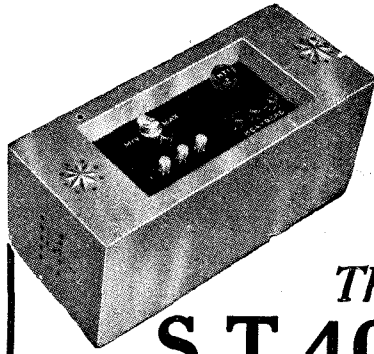
**POST
NOW!**

Messrs. H. Clarke & Co. (M/cr), Ltd., George St., Patricroft, Manchester. Please send full details of the complete range of "ATLAS" Mains Units.

NAME.....

ADDRESS.....

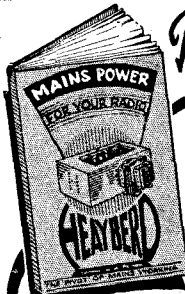
57/2.....



The S.T.400

will give you the finest results if you run it with power from a Heayberd Mains Unit. Perfectly smoothed. Good outputs. Chosen components. Westinghouse Rectifier. All Heayberd Mains Units are produced by specialists. Mr. Scott-Taggart recommends this unit for the "S.T.400."

M.W.1 MAINS UNIT
 Alternative Outputs:
 30 ma. at 150v. or
 50 ma. at 200v.
 Tappings: 40/120v.
 Var. S.G., 175v. and
 200v. fixed (Max.).
 Price .. 127/6



Post Coupon for Heayberd handbook on Mains Working

I enclose 3d. stamps for New Handbook of Mains Equipment. Packed with Technical Tips, Service Hints and diagrams

Mr. _____
 Address _____

W. Cons. 2
F.C. HEAYBERD & Co.
 10 FINSBURY STREET, LONDON, E.C.2
 One minute from Moorgate Str

RADIO SUPPLIES

Send your list of Radio needs for our quotation—Kits, Parts, Sets, etc. Everything in Radio stocked; prompt delivery. 7 days approval. Catalogue free. Taylor and standard Wet H.T. replacements stocked.
C. TAYLOR, 57, Studley Rd., Stockwell, London.

Famous Maker's Offer! **£5** Radio-Gram CABINET for **65/-**
7 DAYS' FREE TRIAL (OR 10/- MONTHLY.)
 Polished Oak and Piano built! the acoustic Tone brings a fine thrill. Makers to (Radio Press, B.B.C., 3,000 clientele).
 Other Models 35/- to £15. Photographs and List FREE.
PICKETTS Piano-Tone Cabinets, (C.W.) Albion Road, Bezzleyheath
FOR "S.T.400" PICKETTS CABINETS
 As Recommended by John Scott-Taggart.

PLEASE be sure to mention "Wireless Constructor" when communicating with Advertisers. THANKS!

OUR NEWS BULLETIN

—continued from page 310

B.B.C. officials and the G.T.C. officials will realise that both can help each other to a very great degree.

No Licence Instalments

A suggestion was made a little while ago that instalment cards for the purchase of wireless licences might be issued, but it is now decided that they will not be, and so any possibility of paying your licence fee quarterly or half-yearly has been knocked on the head by the Postmaster-General. It has been pointed out that as there are nearly five million licences in force, the work in connection with the renewal of these licences is already very heavy, and the issue of licences to be paid for quarterly or half-yearly would double and even quadruple the labour.

RADIO'S POWER OUTPUT
The performance of the average receiver is not a model of efficiency.

THE efficiency of a radio set is rather disappointing, compared to some machinery efficiency. Let us take, for example, a standard three-valve all-mains set and estimate its maximum efficiency.

Assuming that the plate voltage in each case is 200 volts and that the S.G. valve takes 5 m.a., the detector valve 3 m.a. and the output valve 22 m.a., the total anode current will be 30 m.a., or 6 watts. The heater current will be 3 amps. at 4 volts, or 12 watts, making a total of 18 watts. The maximum undistorted output from this combination will be of the order of 800 milliwatts. Disregarding the losses in the mains transformer, the overall efficiency, therefore, becomes :

$$\frac{0.8}{18} \text{ say, } 4.5 \text{ per cent.}$$

Loudspeaker Losses

Nor is this the whole tale, there is still the loudspeaker to be taken into account. From a power point of view it is probably an over-estimate to put this at 5 per cent, but let it pass at that. The overall efficiency of the combined set and speaker, therefore, becomes: 4.5×0.05 per cent, or, roughly, 0.2 per cent! To put it in a different form, the above set would run 50 hours for one unit of electricity, whereas were it 100 per cent efficient it would run continuously, twenty-four hours a day, three years for the same expenditure!

GREAT BRITAIN'S VERDICT ON THE "S.T.400"

—continued from page 286

May I again express my appreciation and thanks for two fine sets and wish you and THE WIRELESS CONSTRUCTOR every success in the future.

Yours faithfully,

C. G. SIMS.

P.S.—The tone, using a Blue Spot 100U, is a beautiful mellow one, bringing out the bass.

75, Henrietta Street,
 Old Trafford, Manchester.

"THE 'ST.400' IS THE GOODS"

Sir,—You may be interested to know my experience with the "S.T.400."

Well, it took me a long time to make up my mind to take to pieces the "S.T.300." But I did, and followed out your guide of construction. My advice to all is to keep to the guide for every wiring. I got it in the cabinet last Tuesday, and it went straight away.

Well, it did *wonderfully well*. Medium-wave stations in broad daylight, both loud and clear; not one, but a fine selection—all foreign. On the long waves I also had splendid results.

I made the set in my shop (hairdresser's)—and, of course, did it between attending to customers. It took me two days to make, and there were plenty looking at it and inquiring. My shop is in H. Broughton, but my home is in Old Trafford.

These are the reports I have had up to now: One customer made his "S.T.300" into a "400," and he tells me it is a *wonder*; he lives in Manchester. Another gentleman, who calls when in Manchester, has just completed the "S.T.400." He is delighted with it; the performance is wonderful; he lives in London.

Let me tell all who have the "S.T.300" (if funds will allow) to make it an "S.T.400"; stick to the wiring guide and it will work and prove itself.

A real good family set (proved by my wife), a set that *will* bring in the stations with a clearness of tone and volume which, whoever makes it, will be proud of.

When pulling down the "S.T.300" it was like breaking up a friendship, but the "S.T.400" *is the goods!*

I don't get home till late, and one half-day holiday; but if anyone in our district would like to hear it, they

(Continued on page 313)

GREAT BRITAIN'S VERDICT ON THE "S.T.400"

—continued from page 312

can by appointment. I will only be too pleased.

Yours faithfully,
JOHN WM. SMITH.

1, Nelson Street,
Preston, Lancs.

"MOST WONDERFUL SET"

Sir,—I must write and express my gratitude to you for designing the wonderful "S.T.400."

I am not going to fill a whole page about its capabilities; there is no need. I will just sum up in a few brief words:

Selectivity is perfect (thanks to the knobs!). Quality of reproduction and tone splendid. Range and power unbelievable. In fact, I did not think it possible to receive the results I am receiving under my conditions, which I may say are anything but good. A most wonderful set.

Yours truly,
C. M. BINKET.

* **A TIGHTENING TIP** *
* A cure for an annoying mechanical *
* fault which most constructors *
* have encountered. *

An annoying thing in some wireless components is to be found in the use of knobs of bakelite or other moulded material fixed by means of set screws with no metal seating

The material itself is so soft that it is difficult to tighten down the screw properly in the first instance, and later on a stripped female thread is more than likely to occur. Knobs are not the only offenders; I have had quite expensive condenser dials which were fixed in the same evil way.

What is to be done when it is found that the set screw has stripped? The set screws are usually of 4 B.A. size, and if the hole has become somewhat enlarged, as is usually the case, a $\frac{3}{16}$ -in. Whitworth tap can be used to cut a new thread.

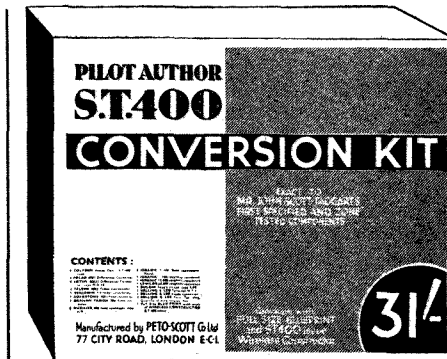
If the tap is too tight to fit, do not try to force it or you will most certainly split the moulding. Instead, enlarge the hole slightly by drilling. Then insert a new $\frac{3}{16}$ -in. Whitworth set screw.

Of course, this method represents a palliative rather than a cure, for the original source of the trouble is still present and it is liable to recur.

R. W. H.

S.T.400

CONVERT YOUR S.T.300 TO JOHN SCOTT-TAGGART'S LATEST RECEIVER



In Sealed Carton containing only ZONE-TESTED PARTS exactly as First Specified by Mr. John Scott-Taggart. Complete with FREE FULL-SIZE BLUEPRINT and copy of "Wireless Constructor" S.T.400 Issue. WE ALLOW YOU 2/- ON YOUR OLD S.T. 300 COLVERN AERIAL COIL

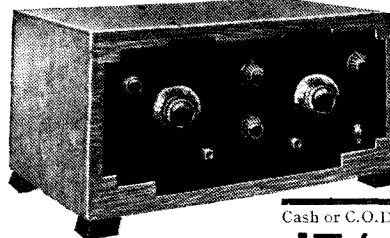
CONTENTS

	s.	d.
1 COLVERN S.T.400 Aerial Coil	5	0
1 POLAR 0003 Differential Condenser	3	0
1 LOTUS 00035 Differential Condenser, type M.D.55	3	0
2 TELSEN 0003 Preset Condensers	3	0
1 BENJAMIN Vibroder Valve Holder	10	0
1 GOLTONE 0003 Fixed Condenser	5	0
1 GRAHAM PARISH 006 Fixed Condenser	1	6
1 DUBILIER 006 Fixed Condenser, type 670	1	6
2 IGRANIC 2-mfd. Fixed Condensers	5	6
1 IGRANIC 1,500 Spaghetti Resistance	6	0
1 IGRANIC 50,000 Spaghetti Resistance	1	0
1 LEWCOS 60,000 Spaghetti Resistance	1	6
1 BULGIN Toggle Switch, type S.80	1	6
1 BELLING & LEE Terminal H.T.4	2	1
1 BELLING & LEE Anode Connector	6	0
1 BELLING & LEE Twin Tap Plug	1	6
Quantity of Wires, Screws, Flux	1	6
1 FULL-SIZE BLUE PRINT WITH COPY OF "WIRELESS CONSTRUCTOR" S.T.400 Issue

CASH or C.O.D. **31/-**
Carriage Paid

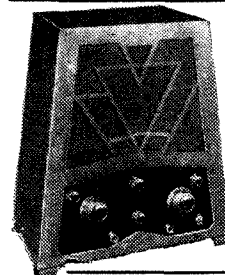
Or Send 29/- only with old COLVERN S.T.300 Aerial Coil

S.T.400 CABINETS OAK TABLE MODEL



Figured hand French-polished oak Table Model Cabinet designed especially to make an attractive housing for the S.T.400. **17/-** Carriage Paid

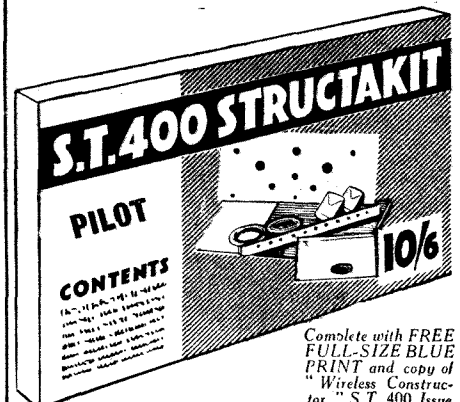
OAK CONSOLETTTE MODEL



Specially designed for the S.T.400. Constructed of hand French-polished oak with attractive silk covered vignette complete with battery shelf and speaker compartments.

CASH or C.O.D. **25/-**
Carriage Paid

S.T.400 PANEL ASSEMBLY



CONTAINS 'Red Triangle' Black Panel 16" x 7" x $\frac{3}{16}$ ", ready drilled; 'Red Triangle' Terminal Strip 16" x 1 $\frac{1}{2}$ " x $\frac{3}{16}$ ", ready drilled; Peto-Scott non-warping laminated Base-board 16" x 10", with Aluminium Foil ready mounted. Ready Drilled Aluminium Screen 10" x 6" and all necessary screws, wires and nuts to build complete PANEL ASSEMBLY for S.T. 400. **10/6**

PETO-SCOTT CO. LTD. 77 City Rd. London, E.C.1. Telephone: Clerkenwell 9406/7
West End Showrooms: 62 High Holborn, London, W.C.2. Telephone: Holborn 3248

Dear Sirs,—Please send me CASH/C.O.D.....
PILOT AUTHOR S.T.400 CONVERSION KIT 31s. 0d. PILOT S.T.400 STRUCTAKIT 10s. 6d.
S.T. 400 TABLE CABINET - - - - 17s. 0d. S.T.400 CONSOLETTTE CABINET 25s. 0d.

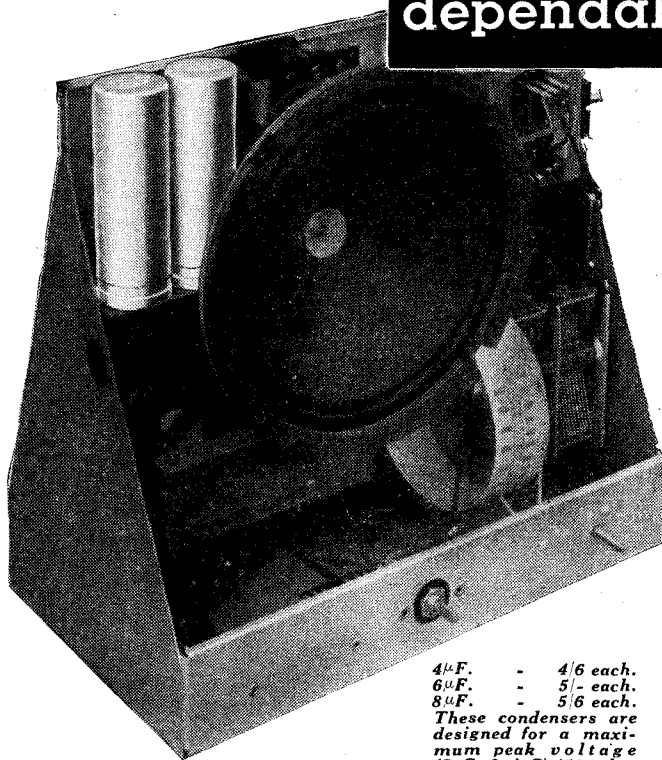
for which I enclose £.....s.....d. CASH

NAME.....

ADDRESS..... W.C.a/33.

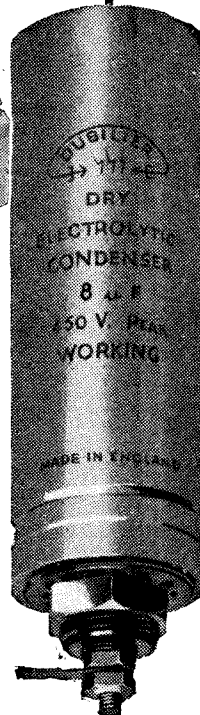


**Dubilier
Condensers
chosen by
KOLSTER-
BRANDES
for
dependability**



4 μ F. - 4/6 each.
6 μ F. - 5/- each.
8 μ F. - 5/6 each.
These condensers are
designed for a maximum
peak voltage
(D.C. & A.C) 450 volts.

The well-known firm of Kolster-Brandes exercise great care in the selection of the condensers used in their Receivers. The fact that they are using Dubilier condensers in ever increasing quantities is sufficient proof of their dependability and consistent performance. Whatever type of condenser you require, you will find it in the Dubilier range. The Dubilier dry electrolytic condenser illustrated above is designed for use as a smoothing condenser in mains radio apparatus.



**DUBILIER
CONDENSERS**

E.5.

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

**CONVERT YOUR "S.T.300"
INTO "S.T.400"**

—continued from page 280

- If necessary, slack off terminal strip strip fixing screws while getting screen into position.
56. Anode coil (terminal No. 1) to .006-mfd. (Dubilier), which is supported by wires connected to it.
 57. Other side of .006-mfd. to upper corner terminal in screen.
 58. Using what was wire (43) in "S.T.300," connect anode coupler differential (fixed vanes terminal nearest screen) to upper corner terminal in screen.
 59. L.T. — on strip to screen terminal near strip. (This wire goes straight between the points it connects.)
 60. 1-mfd. condenser (terminal nearest terminal strip) to screen terminal near strip. (Note that this screen terminal has connections to it on each side of the screen.)
 61. Earth terminal of set (on strip) to screen terminal nearest strip. This wire goes straight between the terminals it connects.
 62. Master reaction moving vanes (i.e. terminal to which pigtail is connected) to valve holder V₂ anode terminal marked A.
 63. Using what was (46) on "S.T.300," connect S.G. choke (terminal nearest panel) to anode coupler differential moving vanes (i.e. terminal to which pigtail is connected).
 64. Using what was (48) on "S.T.300," connect aerial terminal of set (i.e. A on strip) to aerial coupler moving vanes (middle terminal, if J.B. coupler is used).

THIS COMPLETES THE
"S.T.400."

J. S.-T.

**TESTING YOUR "S.T.400"
DIFFERENTIALS**

—continued from page 268

half-way. Master reaction now should increase reaction as it is turned clockwise.

If set oscillates with master reaction full left as well as full right (an extremely unlikely event), unscrew selectivity range adjuster until it stops; then repeat test.

(2) To Test Anode Coupler: Having made master reaction correct, set

(Continued on page 315)

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TESTING YOUR "S.T.400" DIFFERENTIALS

—continued from page 314—

master reaction full left (zero) and distributor full left. Try altering anode coupler.

A movement to left should weaken an incoming signal, while a movement to the right should increase it. (In each case re-tune on anode tuning condenser.)

(3) *To Test Reaction Distributor:* Having made master reaction and anode coupler work correctly, switch aerial circuit to long waves and set anode coupler full left (i.e. zero). Turn distributor to "full right." If oscillation is obtainable on anode circuit when master reaction is increased, then distributor is O.K.

If, however, distributor knob has to be turned to left before oscillation is obtainable with master reaction, this indicates distributor fixed plates connections need reversing.

J. S. T.

 * **SOME NOTES ON** *
 * **"DEAD SPOTS"** *
 * *Interesting details for the* *
 * *puzzled short-wave worker.* *

NEXT to hand-capacity and "threshold howl," I suppose the most annoying trouble met with on short-wave receivers is that of "dead spots." Everyone must know the symptoms: as one rotates the tuning dial one suddenly comes to a patch (perhaps only a few degrees in width) over which the set either refuses to oscillate or needs much more reaction than the normal amount.

The Brighter Side

If some signals that one wants to receive are inside this patch, or, still more awkward, on the edge of it, considerable trouble is experienced in tuning them in at all.

The procedure becomes something like this: Advance the tuning control two degrees; set stops oscillating. Increase reaction control; wavelength now too high. Bring back tuning control one degree; set now oscillating viciously. Reduce reaction control again; everything goes dead. *And so on!*

Let us look on the brighter side of things. Fortunately, no one need

(Continued on page 316)

Tune in on this



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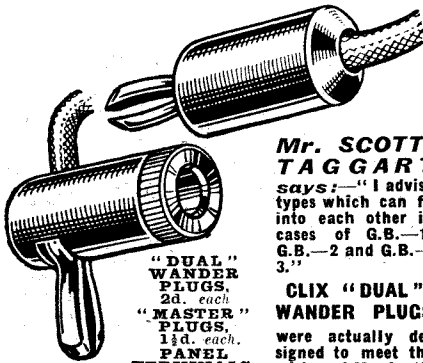
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SOME NOTES ON "DEAD SPOTS"

—continued from page 315

put up with "dead spots" of this kind, as they are easily prevented from causing any serious trouble.

They are generally of three kinds: Those caused by the aerial and its tuning circuit, those caused by the reaction control, and those due to H.F. chokes. If you remove your aerial from a short-wave receiver and just leave the lead-in dangling near the aerial terminal, you should be able to find its natural wavelength. This is done just by carefully tuning through the whole range of the set until you find a very sharp "dead spot" at which the set goes in and out of oscillation with a click. In this position the aerial is acting as an absorption wavemeter; removing the dangling lead-in will also remove the dead spot.

Caused by the Aerial

This simple experiment shows how easily dead spots are caused by the aerial. When it is coupled up to the set—either by the popular capacity-coupling or by means of an untuned coil—this spot will still be present, but will, of course, have shifted to another place. Furthermore, replicas of it may appear at harmonics of the natural wavelength of the aerial.

Those of us who transmit frequently use aerials 20 or 10 metres long, and we find dead spots cropping up in the very bands on which we want to listen most, unless we are careful in the design of our coupling circuits.

Here, then, is the first "golden rule." If you use inductive coupling, choose by experiment a coupling coil of such a size that the worst dead spot from the aerial comes in a place where it will not matter much. If you use capacity-coupling (which is not always advisable for short waves), alter the length of your aerial until the same thing happens.

Reaction Coil Size

Of course, the spot may already be on some "odd" wavelength, like 35 metres, where it is not likely to worry you. If you are keen on amateur work, you will want to keep 20, 40 and 80 metres clear; if broadcast claims most of your attention, the waves to watch are 19, 25, 30-32 and 45-50 metres.

If, however, you find some dead spots that are not altered by playing with the aerial circuits you may be sure that they are caused either by

the reaction coil or by an H.F. choke. The reaction coil is the most likely cause of the trouble.

Here, again, the cure is obvious: Use a different size of coil. The trouble is *always* worst when the reaction coil is larger than the grid coil, a state of affairs, incidentally, which should never be necessary. Obviously, if the reaction coil is kept smaller than the grid coil, its natural wavelength will be well below the tuning range, particularly as the grid coil always has an appreciable amount of capacity in parallel with it, even at the bottom end of the tuning scale.

Screened-Grid Stage

If you cannot make your set oscillate with a small reaction coil, there is something wrong. Either you are trying to work with too small a reaction condenser, your aerial coupling is too tight, or your H.F. choke is not doing its job. I am assuming, of course, that your H.T. voltage is reasonable, and that your detector valve is above reproach and equipped with suitable grid leak and condenser.

A small reaction coil very tightly coupled to the grid coil is always better than a large coil stuck an inch and a half away!

Now for some random remarks which may prove useful. *The cure par excellence* for "aerial dead spots" is the use of a screened-grid stage in front of the detector. This completely "decouples" the aerial from the detector, and renders dead spots impossible. It also stops all troubles that arise from a swinging aerial in windy weather.

Wind Your Own!

H.F. choke trouble is easily overcome by winding your own chokes on the "cut-and-dry" method. As a rule, however, you will find 60 turns of wire on a boiling-tube 1 in. in diameter makes a very useful and efficient choke for the short-wave bands.

If you come across dead spots that are unaffected by any alterations, look outside the set for them. In case this seems too obvious, let me mention that an unused indoor aerial may make a very fine absorption wavemeter, even if it is not very near the set! Similarly, another short-wave set, out of use, but standing on the bench near the proper set, may have dire effects upon tuning!

Loops in the wiring of the set itself may cause troubles of a similar kind. It is well worth while to use copper foil underneath the baseboard.

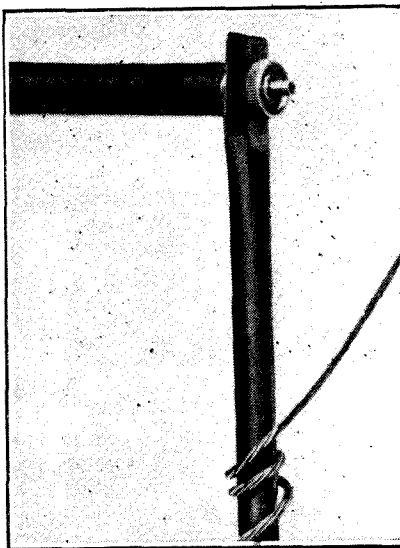
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THE lead-in system illustrated in the accompanying "close-up" photograph, simple as it may appear to be, is yet a very efficient one for use in wet weather.

As will be evident from a glance or two at the illustration, a short length of brass tubing ($\frac{3}{16}$ in. in diameter) is hammered flat at one end, drilled, and then made to fit on to an ordinary ebonite lead-in tube passing through a wall or window-frame.

The aerial down-lead is pushed

KEEPING IT DRY



After being twisted round the tube, the lead-in passes up inside it.

up the tube, and the end of the latter is flattened down over it, thus providing a tight electrical connection.

To avoid any strain on the down-lead, the latter is wrapped two or three times round the brass tube before it makes its entrance into the tube.

The Rain Runs Off

The brass tube, with the aerial down-lead attached, hangs downwards from the window-frame lead-in tube. Thus in these circumstances any water trickling down the down-lead wire will tend to run off the brass tube. It will certainly not trickle along the ebonite lead-in tube, as is so often the case.

Of course, if the very best job is to be made of the above construction the brass tube should be soldered (as well as screwed) to the rod running through the ebonite lead-in tube, and also soldered to the down-lead.

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1 Sovereign 50,000-ohm spaghetti resistance ...	1	10
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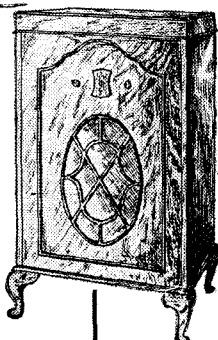
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B.B.C. NEWS

—continued from page 270

the problem of solving permanently the finance of Empire broadcasting. There would be still a predominant admixture of public service broadcasting on the B.B.C. model, but this would be balanced and paid for by suitable dovetailed national industry advertisement after the manner of the make-up of a high-class magazine.

Madrid and After

High expectations of the Madrid Conference were never advanced by me, although they gained currency elsewhere. The result is, as I anticipated, roughly stalemate.

Although the formal Protocol suggested that broadcasting would benefit on the longer wavelengths, the only effect that this has on Great Britain is to remove the danger that existed before of the loss of 5-X X. For the

NEXT MONTH

LOOK OUT FOR

THE

A.G. "S.T.400"

BY

John Scott-Taggart

rest, the best that can be expected by this country is the *status quo*, and there is still a risk of the loss of one of the best of the Regional channels.

Nothing, however, can be decided until the administrations of the European zone meet in May and June to determine the distribution of their share of the new division. A great deal depends, then, on the degree of zeal with which the British Post Office delegates defend the interests of the B.B.C.

A Curious Anomaly

It is a curious anomaly that in this very vital matter of broadcast wavelengths the party chiefly interested—namely, the B.B.C.—has no direct voice in the decisive negotiations, which are left to the Post Office, with its numerous other wavelength preoccupations and interests. This irregularity will be ventilated in Parliament before the critical meeting.

HAVE WE REACHED PERFECTION?
 A review of radio's position and possibilities.

SIXTEEN or so years ago the first important tests in wireless telephony were carried out.

In that time broadcasting, with all its ramifications—technical, commercial, and psychological—has been born and developed and, with no little justification, labelled the eighth wonder of the world. Its sheer mystery, one might almost say "wizardry," captured the imagination of the general public from the very outset.

It is as well, however, to take stock from time to time; to look our achievements and failures squarely in the face. Wireless is still a mystery, but it is also a science, and it is in scientific values that the balance sheet must be prepared.

The credit side needs little chronicling. Broadcasting (and mass reception) is now a *fait accompli*. In this country it has passed from the experimental stage to that of a public company, and from thence has blossomed forth as a State institution.

Technical Excellence

It is now as much a part of our national life as are the roads and the Post Office. We are, in short, supplied with programmes in the same impersonal manner as we receive our water and electricity—fear of the wrath of the Talks Department forbids me adding "and gas."

On the technical side, a modern receiver is capable of supplying an extremely close imitation of the original production, an illusion which is so real that we use the word "reproduction" automatically. The bass clef which eluded us so long is now well within the capacity of any normal loudspeaker.

Mains units have solved the problem of cheap running and, with their inexpensive H.T. supply, have almost reduced overloading out of existence. S.G. valves give us more H.F. amplification than we know how to utilise rightly.

What more could mortal man desire?

But is that the whole tale, and have all the epoch-making discoveries already seen the light? If so, then future progress lies solely in perfecting and elaborating designs we already possess. In sixteen years we

(Continued on page 319)

HAVE WE REACHED PERFECTION?

—continued from page 318

have conceived and within an ace perfected the "eighth wonder of the world."

Or have we? Have we kept straight along the hairline of true progress the whole way, or are we, even now perhaps, barking up the wrong tree? A metaphor as mixed as my own ideas on the subject! Let me try to outline the position as I see it, and leave you to judge for yourself.

Wasteful Waves

For the sake of argument, consider the transmission side of the business first. Immediately we are forced to admit that the waveband now primarily used for broadcasting (the 200-550 m.) is one of the worst possible for that purpose, while the waveband reserved for shipping (the 550-1,100 m.) would be ideal.

Moreover, the ocean service would not suffer in any serious respect by being moved to the lower waveband, since the attenuation of the ground ray, i.e. the one which does not fade, is considerably less over water than over land. In fact, it has been shown that the 200-m. wave has an attenuation over sea not greater than the 2,000-m. wave over land.

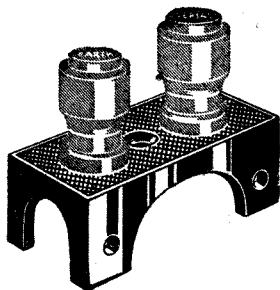
Can it be reasonably said, therefore, that we are using the resources of nature to the best advantage when the waves that are ideal for broadcasting over land are allocated to transmission over sea, especially when those now used for that purpose are superlative?

Moreover, the 200-550-m. waves for over-land transmission are, from a purely scientific point of view, extremely wasteful in energy. They give a relatively poor local service in return for a large output in power, as can be realised by comparing the service area of 5 X X with that of the London National, remembering that they both use the same power.

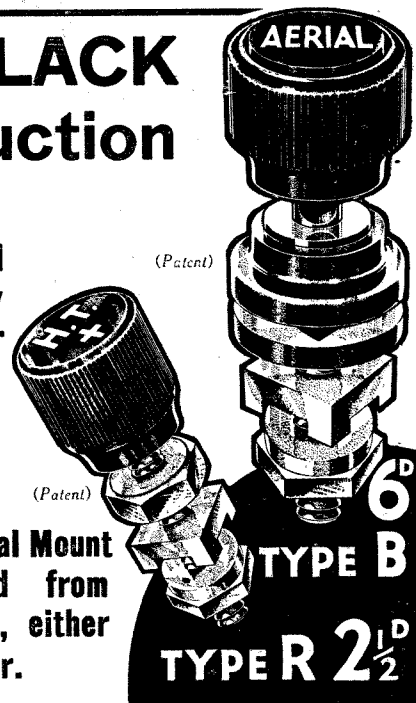
(Continued on page 320)

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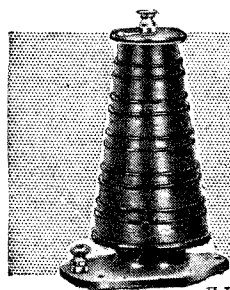
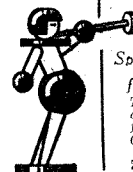
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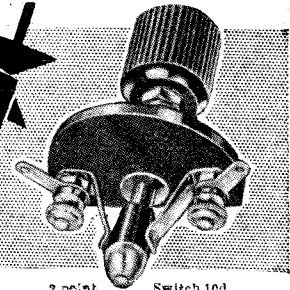
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HAVE WE REACHED PERFECTION?

—continued from page 319.

True, it is not fair to lay this fault at the feet of the broadcasting service, since broadcasting is a relatively new arrival in the wireless field, and had to accept those waves not already in use for other purposes. Nevertheless, we are suffering now in terms of interference, greater running costs, more complicated receivers—with their greater expense and upkeep, through lack of foresight in the early days.

Unfortunately it is an error for which there seems to be no remedy, the cost of giving each service the waveband most suited for it, which at one time would have been negligible, is now prohibitive.

Inefficient Receivers

All the faults, however, are not at the transmitter end. We "ordinary listeners" are not wholly free from blame. These sets of ours in which we take so much pride, are they in truth the acme of perfection we believe them to be?

Now I want to put forward, quite tentatively, the somewhat unusual suggestion that true progress in radio design can only lie along the tested and proved path of efficiency; using that word in the strictly limited "mechanical" sense. This means that the ultimate or, at any rate, ideal receiver will emit from its loud speaker in sound energy 100 per cent of the electrical energy supplied to it.

This conception of the "ideal" receiver seems to have been ignored in the past, possibly because we have been too engrossed in obtaining satisfactory aural results. Nevertheless, it is, or should be, the eventual aim of every machine, and, since it deals in energy, a wireless receiver comes

within the meaning of the word "machine."

Stevenson's "Rocket," for example had an overall efficiency of about 5 per cent. That means that for every 5 lb. of fuel transformed into tractive power, 95 lb. were wasted. A modern locomotive has an efficiency nearing 40 per cent, which in its turn is only half that of a steam turbine.

Electrical machinery as a whole shows a much higher standard in this respect than any other branch of mechanism; generators, motors and transformers over 98 per cent efficient are common practice.

This struggle after efficiency is not just a matter of conserving energy. A

"development" type. The circuits in use to-day are, in principle, the same as those in practice when the B.B.C. first came "on the air."

Looking Ahead!

In those far-off distant days (talking in terms of radio history) we had H.F., detectors, reaction, transformer and resistance-capacity L.F. amplification, and, if my memory serves me right, super-hets and band-passing were known, at least in theory. Our present-day sets are built on the same fundamentals.

This, then, is my answer to the question: "Have we reached perfection?" and to those misguided souls

In next month's "Wireless Constructor"

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perfect motor car, besides using less petrol, would not rattle, over-heat, jolt or smell, and, moreover, it would be absolutely noiseless (since all these are forms of waste).

Valve Improvements

Then, again, this consideration of efficiency points with dramatic force to a possibility which has already received a large amount of publicity, the "cold valve."

Such a valve would immediately increase the set efficiency to three times its present value; remembering the far-reaching effects the invention of the "dull-emitter" valve had upon the trend of design.

After all, the discoveries during the last ten years have been mostly of the

who lament that wireless technique has become stereotyped and uninteresting; that the days of the amateur are gone and forgotten and that in the future mass production will hold the field . . .

From the consideration of contemporary electrical contrivances, an overall efficiency of at least 75 per cent in wireless receivers should be well within the capacity of man's ingenuity and perseverance. If, therefore, the same rate of progress as has held in the past is maintained, i.e. 2 per cent per sixteen years, then THE WIRELESS CONSTRUCTOR will still be as eagerly awaited and have as enthusiastic a band of followers in the year 7915 A.D. as it has to-day!

Verb Sap!

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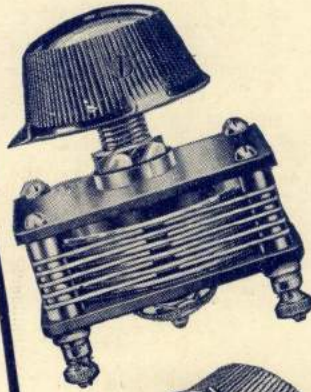
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