CONTROL OF SELECTIVITY—See page 315

A NEWNES PUBLICATION

Edited by F. J. CAMM

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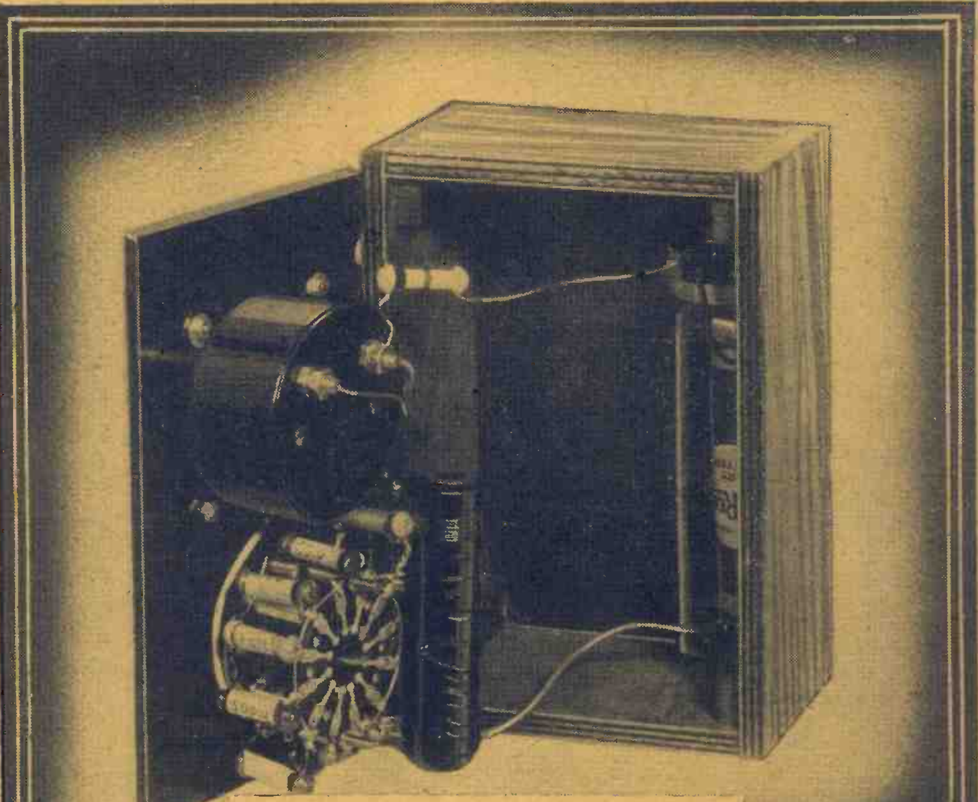
Practical Wireless and PRACTICAL TELEVISION

4D.

EVERY WEDNESDAY

June 29th, 1940.

Contents



A TWELVE-RANGE TEST-METER

Practical Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS	Date of Issue	No. of Blueprint
CRYSTAL SETS		
Blueprints, 6d. each.		
1937 Crystal Receiver	—	PW71
The "Junior" Crystal Set ..	27.8.38	PW94
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
All-Wave Unipen (Pentode) ..	—	PW31A
Beginners' One-valver	19.2.38	PW85
The "Pyramid" One-valver (HF Pen)	27.8.38	PW93
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The Signet Two (D & LF) ..	24.9.38	PW76
Three-valve : Blueprints, 1s. each.		
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Sixty Shilling Three (D, 2 LF (RC & Trans))	—	PW34A
Leader Three (SG, D, Pow) ..	—	PW35
Summit Three (HF Pen, D, Pen)	—	PW37
All Pentode Three (HF Pen, D (Pen), Pen)	29.5.37	PW39
Hall-Mark Three (SG, D, Pow) ..	—	PW41
Hall-Mark Cadet (D, LF, Pen (RC))	16.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (Pen), Pen) (All-Wave Three)	13.4.35	PW49
Cameo Midget Three (D, 2 LF (Trans))	—	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	—	PW53
Battery All-Wave Three (D, 2 LF (RC))	—	PW55
The Monitor (HF Pen, D, Pen) ..	—	PW61
The Tutor Three (HF Pen, D, Pen)	21.3.36	PW62
The Centaur Three (SG, D, P) ..	14.8.37	PW64
F. J. Camm's Record All-Wave Three (HF Pen, D, Pen) ..	31.10.36	PW69
The "Colt" All-Wave Three (D, 2 LF (RC & Trans)) ..	18.2.39	PW72
The "Rapide" Straight 3 (D, 2 LF (RC & Trans)) ..	4.12.37	PW82
F. J. Camm's Oracle All-Wave Three (HF, Det., Pen) ..	28.8.37	PW78
1938 "Triband" All-Wave Three (HF Pen, D, Pen) ..	22.1.38	PW84
F. J. Camm's "Sprite" Three (HF Pen, D, Tet)	26.3.38	PW87
The "Hurricane" All-Wave Three (SG, D (Pen), Pen) ..	30.4.38	PW89
F. J. Camm's "Push-Button" Three (HF Pen, D (Pen), Tet)	3.9.38	PW92
Four-valve : Blueprints, 1s. each.		
Sonotone Four (SG, D, LF, P) ..	1.5.37	PW4
Fury Four (2 SG, D, Pen) ..	8.5.37	PW11
Beta Universal Four (SG, D, LF, Cl. B)	—	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B) ..	—	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push-Pull)	—	PW46
F. J. Camm's "Limit" All-Wave Four (HF Pen, D, LF, P) ..	26.9.36	PW67
"Acme" All-Wave 4 (HF Pen, D (Pen), LF, Cl. B)	12.2.38	PW83
The "Admiral" Four (HF Pen, HF Pen, D, Pen (RC))	3.9.38	PW90
Mains Operated		
Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (Pen), Pen) ..	—	PW18
A.C.-D.C. Two (SG, Pow) ..	—	PW31
Selectone A.C. Radiogram Two (D, Pow)	—	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, DDT, Pen)	—	PW23
D.C. Ace (SG, D, Pen)	—	PW25
A.C. Three (SG, D, Pen)	—	PW29
A.C. Leader (HF Pen, D, Pow) ..	7.1.39	PW35C
D.C. Premier (HF Pen, D, Pen)	—	PW35B
Unique (HF Pen, D (Pen), Pen) ..	—	PW36A
Armada Mains Three (HF Pen, D, Pen)	—	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	—	PW50
"All-Wave" A.C. Three (D, 2 LF (RC))	—	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen) ..	—	PW56
Mains Record All-Wave 3 (HF Pen, D, Pen)	—	PW70
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	—	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	—	PW47

SUPERHETS.		
Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three-valve) ..	5.6.37	PW40
F. J. Camm's 2-valve Superhet ..	—	PW52
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (Three-valve) ..	—	PW43
D.C. £5 Superhet (Three-valve) ..	—	PW42
Universal £5 Superhet (Three-valve)	—	PW44
F. J. Camm's A.C. Superhet 4 ..	—	PW59
F. J. Camm's Universal £4 Superhet 4	—	PW60
"Qualitone" Universal Four ..	16.1.37	PW73
Four-valve : Double-sided Blueprint, 1s. 6d.		
Push Button 4, Battery Model .. / Push Button 4, A.C. Mains Model .. }	22.10.38	PW95
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
Simple S.W. One-valver	23.12.39	PW88
Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	—	PW38A
The "Fleet" Short-wave Two (D (HF Pen), Pen)	27.8.38	PW91
Three-valve : Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Pow)	—	PW30A
The Prefect 3 (D, 2 LF (RC and Trans))	—	PW63
The Band-Spread S.W. Three (HF Pen, D (Pen), Pen) ..	1.10.38	PW68
PORTABLES.		
Three-valve : Blueprints, 1s. each.		
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) ..	—	PW65
Parvo Flyweight Midget Portable (SG, D, Pen)	3.6.39	PW77
Four-valve : Blueprint, 1s.		
"Imp" Portable 4 (D, LF, LF (Pen))	—	PW86
MISCELLANEOUS		
Blueprint, 1s.		
S.W. Converter-Adapter (1 valve)	—	PW48A
AMATEUR WIRELESS AND WIRELESS MAGAZINE		
CRYSTAL SETS.		
Blueprints, 6d. each.		
Four-station Crystal Set	23.7.38	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450
STRAIGHT SETS. Battery Operated.		
One-valve : Blueprint, 1s.		
B.B.C. Special One-valver ..	—	AW387
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans) ..	—	AW388
Full-volume Two (SG det, Pen) ..	—	AW392
Lucerne Minor (D, Pen)	—	AW426
A Modern Two-valver	—	WM409
Three-valve : Blueprints, 1s. each.		
£5 5s. S.G.3 (SG, D, Trans) ..	—	AW412
Lucerne Ranger (SG, D, Trans) ..	—	AW422
£5 5s. Three: De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
Transportable Three (SG, D, Pen)	—	WM271
Simple-Tune Three (SG, D, Pen) ..	June '33	WM327
Economy-Pentode Three (SG, D, Pen)	Oct. '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans) ..	Mar. '34	WM354
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
PTP Three (Pen, D, Pen) ..	—	WM389
Certainty Three (SG, D, Pen) ..	—	WM393
Minitube Three (SG, D, Trans) ..	Oct. '35	WM396
All-Wave Winning Three (SG, D, Pen)	—	WM400
Four-valve : Blueprints, 1s. 6d. each.		
65s. Four (SG, D, RC, Trans) ..	—	AW370
2HF Four (2 SG, D, Pen) ..	—	AW421
Self-contained Four (SG, D, LF, Class B)	Aug. '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2 LF)	Feb. '35	WM381
The H.K. Four (SG, SG, D, Pen)	—	WM384
The Auto Straight Four (HF Pen, HF Pen, DDT, Pen) ..	Apr. '36	WM404
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2 HF, D, RC, Trans)	—	WM320
Class B Quadradyne (2 SG, D, LF, Class B)	—	WM344
New Class B Five (2 SG, D, LF, Class B)	—	WM340

These Blueprints are drawn full size.

Copies of appropriate issues containing descriptions of these sets can in some cases be supplied at the following prices *which are additional to the cost of the Blueprint*. A dash before the Blueprint Number indicates that the issue is out of print.

Practical Wireless (issues dated prior to June 1st, 1940) 4d. Post Paid
" " (Issues dated June 1st, 1940, and after) 5d. Post Paid
Amateur Wireless .. .. 4d. " "
Wireless Magazine .. .. 1/4 " "

The index letters which precede the Blueprint Number indicate the periodical in which the description appears: Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the blueprint, and the issue (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Consoelectric Two (D, Pen) A.C.	—	AW403
Economy A.C. Two (D, Trans) A.C.	—	WM286
Unicorn A.C.-D.C. Two (D, Pen)	—	WM394
Three-valve : Blueprints, 1s. each.		
Home Lover's New All-Electric Three (SG, D, Trans) A.C. ..	—	AW383
Mantovani A.C. Three (HF, Pen, D, Pen)	—	WM374
£15 15s. 1936 A.C. Radiogram (HF, D, Pen)	Jan. '36	WM401
Four-valve : Blueprints, 1s. 6d. each.		
All Metal Four (2 SG, D, Pen) ..	July '33	WM329
Harris' Jubilee Radiogram (HF Pen, D, LF, P)	May '35	WM386
SUPERHETS.		
Battery Sets : Blueprints, 1s. 6d. each.		
Modern Super Senior	—	WM375
'Varsity Four	Oct. '35	WM395
The Request All-Waver	June '36	WM407
1935 Super-Five Battery (Superhet)	—	WM379
Mains Sets : Blueprints, 1s. 6d. each.		
Heptode Super Three A.C. ..	May '34	WM359
"W.M." Radiogram Super A.C.	—	WM366
PORTABLES.		
Four-valve : Blueprints, 1s. 6d. each.		
Holiday Portable (SG, D, LF, Class B)	—	AW393
Family Portable (HF, D, RC, Trans)	—	AW447
Two HF Portable (2 SG, D, QP21)	—	WM363
Tyers Portable (SG, D, 2 Trans)	—	WM367
SHORT-WAVE SETS. Battery Operated.		
One-valve : Blueprints, 1s. each.		
S.W. One-valver for America ..	15.10.38	AW429
Rome Short-Waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Ultra-Short Battery Two (SG, det, Pen)	Feb. '36	WM402
Home-made Coil Two (D, Pen)	—	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen) ..	30.6.34	AW438
The Carrier Short-waver (SG, D, P)	July '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World-beater (HF Pen, D, RC, Trans) ..	—	AW436
Empire Short-waver (SG, D, RC, Trans)	—	WM313
Standard Four-valve Short-waver (SG, D, LF, P)	22.7.39	WM383
Superhet : Blueprint, 1s. 6d.		
Simplified Short-wave Super ..	Nov. '35	WM397
Mains Operated.		
Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	13.1.40	AW453
"W.M." Long-wave Converter ..	—	WM380
Three-valve : Blueprint, 1s.		
Emigrator (SG, D, Pen) A.C. ..	—	WM352
Four-valve : Blueprint, 1s. 6d.		
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) ..	—	WM391
MISCELLANEOUS.		
S.W. One-valve Converter (Price 6d.)	—	AW329
Enthusiast's Power Amplifier (1/6)	—	WM387
Listener's 5-watt A.C. Amplifier (1/6)	—	WM392
Radio Unit (2v.) for WM392 (1/-)	Nov. '35	WM398
Harris Electrogram battery amplifier (1/-)	—	WM399
De Luxe Concert A.C. Electrogram (1/-)	Mar. '36	WM403
New style Short-wave Adapter (1/-)	—	WM388
Trickle Charger (6d.)	—	AW462
Short-wave Adapter (1/-) ..	—	AW456
Superhet Converter (1/-) ..	—	AW457
B.L.D.L.C. Short-wave Converter (1/-)	May '36	WM405
Wilson Tone Master (1/-) ..	June '36	WM406
The W.M. A.C. Short-wave Converter (1/-)	—	WM408

Practical and Wireless

* PRACTICAL TELEVISION *

EVERY WEDNESDAY

Vol. XVI. No. 406. June 29th, 1940.

EDITED BY F. J. CAMM

Staff: W. J. DELANEY, FRANK PRESTON, H. J. BARTON CHAPPLE, B.Sc.

ROUND THE WORLD OF WIRELESS

Simplified Valves

THE beginner may justly be excused some doubts concerning the wisdom of manufacturers supplying such a wide range of valves. In the early days there were only a few types, and they were easily distinguished by references to indicate their main application. With improvements in circuit design various novel types of valve were introduced, many of which have ceased to exist, but a number are still in existence. To add to the confusion the various makers use different references so that it is not a simple matter to decide a given alternative. In America this has been overcome by using a common reference for all types, irrespective of the maker. Thus there is an R.C.A. 45, or a Raytheon 45 or a Sylvania 45, and it is only necessary in a specification to quote a type 45 and the constructor can use any make he desires with the knowledge that it will have the correct specification. Readers will remember recently an attempt to simplify matters in this country by the introduction of a special valve to suit any stage in a receiver, but it is obvious that there is a growing need for a simplification in the valve classification, either by a limitation in types or a standardisation in reference numbers. In this issue we give details of a proposal which has been made by the British Institution of Radio Engineers on the subject.

Literary Productions

THE B.B.C. announces that on July 8th the first instalment of a serial version of "Rupert of Hentzau" will be broadcast in the Home Service. It has been adapted from Anthony Hope's book by Hugh Stewart. Charles Mason will play Rupert; Edana Romney Princess Flavia; Sebastian Shaw doubles the King and Rudolph Rassendyll, Frederick Lloyd is Colonel Sapt and Ronald Simpson Fritz von Tarlenheim. On July 11th, in the Children's Hour, "The Prisoner of Zenda" in a new adaptation by Barbara Sligh will have the first of a series of weekly episodes.

College Rhythm

THE Three College Boys, who are students at a Glasgow Medical School and who, instead of working, sing their way through college, will take part in a short variety programme on June 28th, with Harry Carmichael and Dave Goldberg (guitar). While on holiday in France, they gave a guest concert with the Quintette of the Hot Club of France, and their performance earned congratulations and a magnum of champagne from two celebrities present, Adèle Astaire and Cole Porter.

Au Drapeau

A REVIVAL of the programme called "Au Drapeau," which was broadcast at the end of April, will be produced by Denis Johnston on June 29th. It consists of a "review" of the French Army and listeners will hear a portrayal of something of the spirit and tradition behind the army and how it is run and maintained both in peace and war.

Gloria Brent, the attractive singer who is often heard on the air with various famous bands.

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The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Old Favourite, New Name

GIVEN the title "Nippit Fit and Clippit Fit," few people would say they had even heard of the story. Yet it is really one of the most famous tales in the world, for this is the Scottish version of Cinderella, which has been retold by March Syke and will be read by Christine at the beginning of the Children's Hour on June 27th. For Sassenachs "Nippit Fit and Clippit Fit" may be literally translated as "Nipped Foot and Clipped Foot," which explains the whole story. In the same programme, another of Helen Drever's "Songs of the Clans" will be heard. This time she is dealing with Clan Scott, another of those which do not belong purely to the Highlands of Scotland. It includes some of the best songs and stories of the Scottish Border country, including "Blue Bonnets over the Border" and the story of "Muckle Mou'ed Meg."

Oscar Rabin and His Romany Dance Band

OSCAR RABIN and his Romany Dance Band will be the "Band of the Week" beginning June 30th, and it is hoped that all the regular solo vocalists will be heard, including Harry Davies, Beryl Davies, Diane, and Garry Gowan; and that Eddie Palmer will play the novachord.

"Three in a Bar"

A MYSTERY play entitled "Three in a Bar," to be broadcast on June 27th, has for its setting an old-fashioned public-house bar parlour. A mock trial, arranged by three customers in the parlour, leads to the apprehension of a murderer, who is "caught out," by the clever cross-questioning of a police inspector and a police sergeant in disguise. The play is written by Peter Franklin and will be produced by Peter Creswell.

Return of "Crime Magazine"

AFTER more than a month in which to take stock, "Crime Magazine" will return to the Home Service and Forces programmes on July 2nd, but at a slightly later hour in the evening. It is expected that practically all the features which were included at the end of the first series will be retained. Ex-Detective Inspector Jack Henry, late of New Scotland Yard, will again be heard in a further series of adventures based on incidents of real life; Billy Milton will appear in "Meet the Arrow," a series of detective occasions written by Ernest Dudley; and Bill Maclurg will again be in charge of the feature.

Suggested Valve Standardisation

Some Interesting Proposals which Have Been Put Forward by the British Institution of Radio Engineers

THERE have been many suggestions in the past for a standardisation and limitation in the number of valve types. Many interesting schemes have been formulated, and the standardisation committee of the British Institution of Radio Engineers have recently published a report which has been submitted to the Ministry of Supply, Ministry of Labour and the Service departments regarding a scheme proposed by Mr. J. A. Sargrove. It is claimed by the B.I.R.E. that adoption of the proposals set out would enable the Radio Industry to:

1. **Satisfy home demand**
 but
2. **Increase export trade.**
3. **Make available for other important industries many highly-skilled technicians such as tool makers and jig and tool designers.**
4. **Save a considerable amount of raw material which is now absorbed unnecessarily.**
5. **Make good some of the loss of essential import material.**
6. **Alleviate difficulty in Radio Servicing.**

It should be noted that the first step towards achieving the ideal is the immediate all-round adoption of the existing range of 6.3 volt 0.3 amp. valves. This range, including its higher voltage companion types, consists of a mere twenty types as against the formidable list of types at present available, which approaches 1,000 different types.

The scheme in its final form is essentially based around five specific types of valves, as follows:

Type "A"

This is a screened triode-hexode of the type in which the first grid of the hexode is common with the triode-grid, having an indirectly-heated cathode and a 6.3 volt 0.3 amp. heater.

In addition to its customary use as a frequency changer, such a valve can also be used as an R.F. variable-mu amplifier; a variable-mu I.F. amplifier and diode for A.V.C.; as a demodulator diode and as a controlled variable-mu A.F. amplifier, tetrode or triode; as a two-input circuit mixer and, of course, also as any constituent part of the above combinations.

Type "B"

A universal output tetrode valve of the type capable of working at 100 screen voltage having an indirectly-heated cathode with a 25-volt 0.3 amp. heater.

Type "C"

A two-system rectifier of the type in which all electrodes are brought out separately, having indirectly-heated cathodes with a 25-volt 0.3 amp. heater.

Receivers designed on the use of these three types could equal any receiver at present available. In fact, a set incorporating Types "A," "B" and "C" would result in a greater all-round advantage—at a lower cost to the manufacturer and consumer.

Such features as automatic inter-station noise suppression, automatic volume control, post demodulator, automatic volume level maintainer, would, with the incorporation of these three types, be included without difficulty, thereby proving of sales advantage in the home and export field.

The scheme envisages all receivers as A.C./D.C. supply types, thus entirely eliminating the need for mains transformers and, in the case of the smaller sets, also eliminating the smoothing choke, thereby saving a considerable amount of high-quality transformer (or Swedish) iron and copper (former important source—Belgium).

Adoption of these three types would, it is estimated, solve 70 to 80 per cent. of the market requirements for radio receivers.

Type "D"

A battery valve type, analogous to Type "A," having 1.5 volt 0.05 amp. filament. Its functions are identical to Type "A."

Type "E"

Analogous to Type "B," but having a centre-tapped 2.8 volt 0.05 amp. filament.

Types "D" and "E" can be used to fulfil the majority of requirements outside the field of utility of Types "A," "B" and "C," but two or three of the additional existing 1.5 valves would also be required in the initial stages of the scheme.

The ultimate national production of the proposed five types of valves would actually aid the valve manufacturing industry by ultimately eliminating "frozen" stocks of diverse types while similarly aiding production on the restricted amount of material now available, for home and particularly export trade.

This is important in view of the following essential imports:

Pure nickel: Scandinavia and U.S.A.
Pure molybdenum: main sources U.S.A.

Eliminating two hundred odd types of glass bulb shapes which, owing to cut-off supplies from Belgium and Czechoslovakia, are at present being manufactured in this country, to the detriment of other glassware export.

A Summary of Discussion of the Objections to Mr. J. A. Sargrove's Proposals

1. The standardised component parts suggested do not affect the ultimate performance of receivers or impose limits on the design of specialised receivers; the resultant performance of the suggested design can be confirmed by *independent* and qualified Radio Engineers.

2. The scheme will provide the Radio Manufacturer and Designer with an adequate but limited number of components.

3. The technical objection that certain specialised apparatus will still require specialised types of valves is undeniable, but does not materially affect the scheme, since of the ten to twelve million radio receiver valves absorbed by the Radio Receiver Industry, well over 80 per cent. are used in sets in which the five specified types of valves could be satisfactorily used. The other 20 per cent. is made up of Replacement Valve business which, if the above proposed scheme is put into effect, could be easily satisfied for the next eighteen months to two years from the *existing* available stocks of diverse types.

4. The specialised types of valves manufactured have always been less than 10 per cent. of the normal Receiver Valve business, and the adoption of the scheme put forward will undoubtedly expedite production of the specialised types which may still be required for the Defence Departments, the B.B.C. and the G.P.O.

Summary

Consideration and development of these proposals by a technical committee representing the industry will undoubtedly contribute to our occupying a more influential position in the world market both now and after the war.

For The Beginner

The Differential Condenser

A Description of This Special Type of Variable Condenser and Its Various Circuit Applications

IT is sometimes noted that a specification includes a "differential" condenser—generally for reaction purposes. In view of the rather infrequent use of this type of component certain amateurs are not quite clear as to its special design and application, although the fact that it has three sets of plates in comparison with the usual two sets of moving and fixed vanes, may be known. Fig. 1 shows the theoretical symbol and the general form of construction of the differential condenser and it will be seen that, from the theoretical point of view, it is really two condensers in series. There are two sets of fixed vanes mounted exactly opposite each other, and the spindle carries a set of moving vanes of standard shape and arranged in the same manner as on a normal variable condenser. The moving vanes are semi-circular in shape, so that when the spindle is half-way through its total arc of rotation each set of fixed vanes has an equal section of the moving vanes intermeshed with it. Thus each separate condenser (considering them as two in series) will be of equal value which at the mid point will be half the maximum value. This position is indicated in Fig. 2. It will be obvious from this that as the capacity of one condenser is increased that of the other is decreased, the balance between the two sections being maintained.

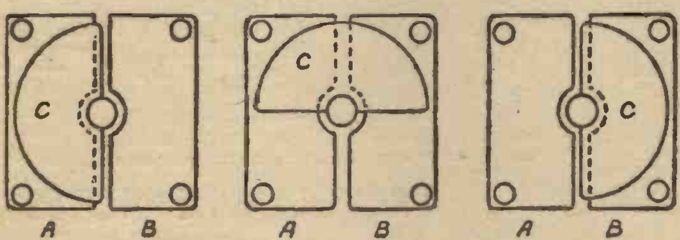

Fig. 2.—Plan of the vanes of a differential condenser, showing three different settings of the condenser.

Now there are several uses to which a differential condenser may be put, but we will deal first with its most common application, namely, its use as a reaction control.

By-passing the H.F. Currents

For many years now the standard method of controlling reaction has been by using a reaction coil with a fixed number of turns of wire and fixed coupling, and to vary the current through this by connecting it in series with a variable condenser. This method is illustrated in Fig. 3. However, as shown here, it has certain drawbacks. The most obvious is that when the reaction condenser is set at a minimum there is no easy path for the H.F. component of the anode current of the detector valve.

The anode current of the detector valve may be considered as consisting of three separate parts. There is the steady direct current from the high-tension supply, the rectifier speech current, and the amplified H.F. impulses. It is the last-named which are used for reaction purposes. They are fed back by means of the reaction coil, and superimposed on the input current. Now, apart from its use for reaction purposes, this H.F. part of the anode current is not really wanted. If it finds its way to the grid of the next valve it will cause distortion and possibly actual howling. Again, if it is allowed to pass on round the anode circuit when an H.F. stage is used before the detector, then it is possible for it to cause undesirable back coupling through the medium of the common impedance of the H.T. source.

The usual thing to do with this unwanted current is to impede its progress by including an H.F. choke in the anode circuit of the detector immediately following the anode itself, as shown in Fig. 3. This choke acts as a barrier, and prevents its travelling farther than the anode of the valve. However, the choke is not in itself sufficient, and the "unwanted current" may be strong enough to force through this barrier unless some alternative path is provided. In Fig. 3 this alternative path is through the reaction coil and reaction condenser to the filament. It is indicated by the arrows. Now when the reaction control is "turned on fully," that is, when the reaction condenser is set somewhere near its maximum capacity, this path offers a very easy exit, but when the reaction condenser is set to its minimum position it presents a very high impedance, and the "unwanted current" has no escape.

This is where the differential condenser comes in. It is connected as in Fig. 4. Now a moment's consideration shows us that whatever the setting of this condenser the by-pass effect is always constant. When the condenser is in the "full-on" position then the H.F. currents travel from the anode via the reaction coil, the fixed vanes A, and the moving vanes C, to the filament, as shown by the arrows in the left-hand diagram in Fig. 4. When the reaction is "turned-off" then the path of the H.F. impulses is from the anode to the fixed vanes B, thence via C, to the filament. In any intermediate position the currents follow a divided path—partly through the reaction coil and A C, and partly through the path B C.

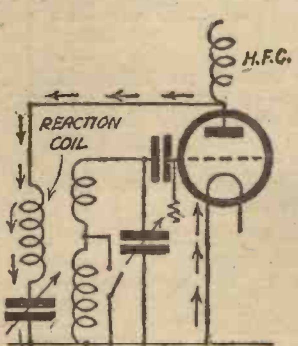

Fig. 3.—The orthodox method of controlling reaction, using an ordinary variable condenser.

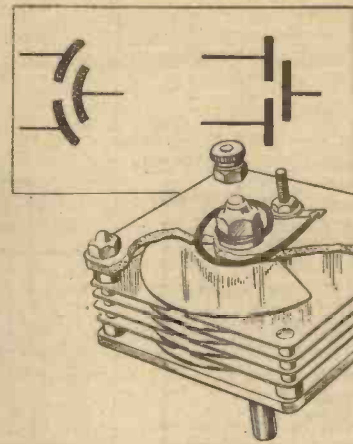

Fig. 1.—The elements of a differential condenser. Above, two ways of representing a differential condenser diagrammatically.

High Note Cut Off

It may be argued that if the only drawback to the ordinary reaction condenser is that it does not provide an alternative path for the H.F. component when it is set at zero, then a fixed condenser between anode and filament, as in Fig. 5, is all that is needed. Admittedly, this often provides a solution of the problem if the value of the fixed condenser is carefully chosen, but even so it has not quite the same advantages as the differential method. For one thing, the value of the fixed condenser must be sufficiently large to by-pass the H.F. current when the reaction condenser is at zero. However, this value may be *too* large when a reaction condenser is all in, for the total value of the by-pass condenser and the reaction condenser may be such as to by-pass some of the higher audio-frequencies and thus mar reproduction by loss of the higher notes. It is also found in practice that the use of the differential condenser provides a smoother control of reaction. It certainly provides a greater *range* of control than an ordinary condenser of equivalent value used in conjunction with a by-pass condenser, for when the differential is in the "full-on" position, nearly 100 per cent. of the current passes through the reaction coil, while when it is in the "off" position practically all of the current passes direct to the

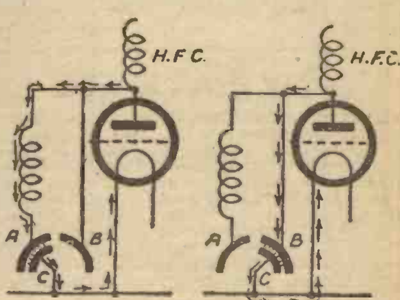

Fig. 4.—Showing the connection and the working of a differential reaction condenser.

(Continued on next page).

THE DIFFERENTIAL CONDENSER

(Continued from previous page).

filament via B C (see Fig. 4), and only the smallest fraction (due to the minimum capacity between A and C) passes through the reaction coil. This is an advantage with some circuits. For instance, with some multi-range coils there is considerable difference necessary in the setting of the reaction condenser on one wave-band compared with another.

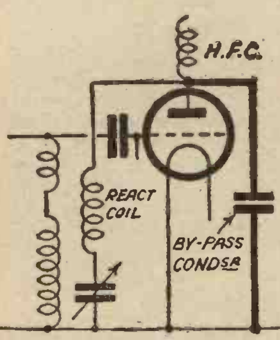

Fig. 5.—The use of a by-pass condenser. See text.

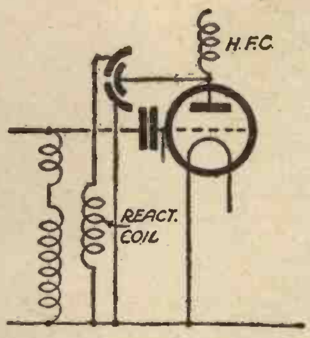

Fig. 6.—Alternative connections for a differential reaction condenser.

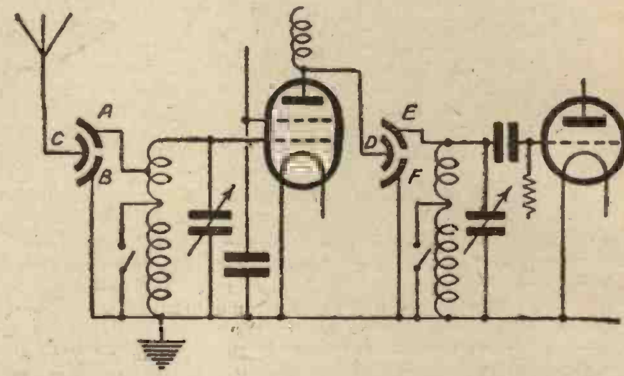

Fig. 7.—Differential condensers used as volume and selectivity controls.

The "Differential" as a Volume Control

The connection for a differential reaction condenser, shown in Fig. 4, is not the only possible arrangement. Another version is shown in Fig. 6. Differential condensers are also used for a variety of other purposes besides reaction control. One of the best known is as a volume control which works by varying the aerial input. The circuit is shown in Fig. 7. When the moving vanes of the condenser are completely interleaved with the fixed vanes marked A, then the input to the tuning coil is at a maximum and loudest signals result. As the moving vanes are rotated towards the other set of fixed vanes, so the input via C A is reduced and at the same time the aerial currents find an alternative path direct to earth via C – B.

This type of volume control has the advantage that it is very simple, noiseless in operation, and covers a large range, it being possible to cut down the most powerful stations to a whisper. Its disadvantages are, firstly, that even at the full volume setting there is some slight reduction of input owing to the fact that there is still a small minimum capacity existing between C and B. Secondly, that variation of the control means slight variation in the wavelength of the aerial circuit, so that when the volume control is operated it may be necessary to readjust the aerial tuning condenser. If this latter is ganged this will naturally be impossible. Incidentally, with this form of volume control the selectivity will be increased as the volume is reduced.

A similar use for a differential condenser is as a variable coupling between the H.F. valve and the following grid coil in a tuned-grid circuit. This is also shown in Fig. 7. The condenser used as a variable coupler is represented at D E F. Here the action is precisely similar to that of the differential condenser A B C. In the same way that A B C controls the input to the first valve, so D E F controls that to the next valve (in this case the detector). In practice it is hardly necessary to include both devices in the one circuit, as in Fig. 7, as more than sufficient control can usually be obtained with either one or the other. The variable coupler, however, is sometimes used, in conjunction with an ordinary pre-set or variable condenser, in series with the aerial as an additional selectivity control.

LATEST PATENT NEWS

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NEW PATENTS

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Latest Patent Applications.

9819.—Cole, Ltd., E. K., and Kennedy, F. W. O.—Tuning mechanism for radio-receivers. June 5th.

9841.—Hazeltine Corporation.—Television systems. June 5th.

9703.—Philips Lamps, Ltd. — Wireless receiving-sets. June 3rd.

9471.—Standard Telephones and Cables, Ltd.—Generation and transmission of radio waves. (Cognate with 9470.) May 30th.

9470.—Standard Telephones and Cables, Ltd.—Generation and transmission of radio waves. May 30th.

9472.—Standard Telephones and Cables, Ltd.—Generation and transmission of radio waves. (Cognate with 9470.) May 30th.

Specifications Published.

521637.—Radioakt.-Ges. D. S. Loewe. —Deflection of cathode-ray beams.

521710.—Kolster-Brandes, Ltd., and Arnold, J.—Remote-control systems, particularly for radio-receivers.

521711.—Kolster-Brandes, Ltd., and Beatty, W. A.—Antenna systems and supporting structures.

521714.—Standard Telephones and Cables, Ltd., Terry, R. St. G., and Beard, J. R.—Electromagnetic relay switching devices, particularly for radio equipments.

521809.—Philco Radio and Television Corporation.—Method of assembling and welding loud-speaker parts.

521808.—Philco Radio and Television Corporation.—Loudspeakers of the electrodynamic type, and methods of assembly thereof.

521810.—Philco Radio and Television Corporation. — Sound - reproducing devices.

521811.—Philco Radio and Television Corporation.—Loudspeakers.

521872.—Kolster-Brandes, Ltd., and Brigham, C. E.—Thermionic valve circuits.

521873.—Television and picture-transmission systems.

Printed copies of the full Published Specifications only, may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

PROGRAMME NOTES

"Up The Poll!"

ALLAN MACKINNON and Jack House, pioneers in writing for radio in Scotland, have resumed partnership and collaborated in what they have described as a "Mass Observation Musical Comedy," to be broadcast on June 27th. It is called "Up the Poll," and deals with events in a country whose happy people astonish the world. Nothing ever goes wrong in Morania, where the Government, having studied public opinion surveys and American magazines, employs a firm of professional public pulse-holders to find out what the country wants. Thus the king is able to make perfect laws, because of the so-called infallibility of the percentage polls. But, as the listener will find out, everything in the garden is not quite as lovely as that. Allan MacKinnon is well known in the film world, having been jointly responsible with another Scot, Roger MacDougall, for the scripts of "This Man is News" and "This Man in Paris."

Denmark

A FEATURE telling listeners in this country of the peaceful life which was led by the people of Denmark right up to the eve of the German invasion on April 8th, 1940, will be broadcast on June 27th. The programme will consist of four scenes and will be performed by members of the B.B.C. Repertory Company. The story has been written by Marianne Helweg and her father, J. H. Helweg, and will be produced by Laurence Gilliam.

ON YOUR WAVELENGTH

By Thermion

Aliens and Radio

A GOOD deal of publicity has been given to the official announcement that some hundreds of aliens were engaged by the B.B.C. A considerable amount of resentment has also been aroused at this revelation, and also parliamentary criticism has been raised against the employment by the B.B.C. of aliens. Naturally, I have received a very large post on this problem, and the questions which readers ask I am unable to answer. For example, one reader wants to know why foreigners are employed in the *British* Broadcasting Corporation; they want to know whether these foreigners are of such calibre that there is no Englishman of equal ability. Is is necessary to have a foreign-sounding name before the B.B.C. will employ you? Why are not all foreigners turfed out of the B.B.C. now that we are at war? Especially, why are not all Germans and Italians turfed out and interned? And so on and so on! As I have said, I cannot answer these questions. There are many Germans employed in England, and some of them have been in this country for many years. We may assume that they are friendly, but I wonder what would happen in the unlikely event of the Germans arriving here? We cannot afford to take the slightest risk. A German cannot change his nationality any more than the leopard can change its spots. I wonder whether there are any Englishmen employed in the German Broadcasting Stations? I wonder, indeed, whether any foreigners short of Haw-Haw, and Lady Hee-Hee, are employed there? I will wager not.

One would imagine that this is a most elementary matter concerning which we should not take the slightest risk. I hope that by the time you read these words something drastic will have been done.

A.R.P. Receivers

ALTHOUGH appeals have been made for radio apparatus for the use of A.R.P. staffs, etc., dealers can also help in this connection. A trade paper recently quoted a case where the members of a post had overcome the difficulty of obtaining a receiver. The members, especially of the A.F.S., work in many cases in shifts of 12 hours, and some form of radio is essential not only to pass away the time but also for the reception of news. The article goes on to say:

"Who provided the radio?" I asked the leading fireman at the sector to which I am attached.

"We did," he replied. "As it took the authorities a long time to realise we must have something to make waiting tolerable, we clubbed up, 2d. per man per week, to raise the money for the set you are now listening to. One of us signed a document and agreed to collect the coppers and pay the dealer.

"Then the full-time crews were assisted by part-time men, and they got the benefit of our set. We put it to the A.F.S. officers that they should provide the radio. They agreed, took over our agreement and are now making the payments.

"There is now no need for crews to buy their own radio sets for the sectors. Arrangements for the installation of radio are made by the authorities."

Observe how the initiative came from the lower ranks. What can be done in one place, a big city with hundreds of sector posts, can be done in other places.

Limitation of Supplies

UNDER the Limitation of Supplies (Miscellaneous), Order, 1940, many articles are restricted as to supply for the home market. These restrictions apply to a miscellany, such as candelabra, pendants, lanterns, bowls and reflectors, musical instruments, such as gramophones, radio gramophones, pianolas, and accessories for such instruments, excluding wireless receiving sets, sound amplification wireless apparatus, music strings (!) and loudspeakers. It also includes gramophone records, and the idea is, I suppose, to conserve supplies of material for war, and for export purposes.

Our Roll of Merit

Our Readers on Active Service—Second List.
Home addresses only are given.

W. L. Bicknell
(Searchlight Detachment),
38, Albion Road, Westcliff-on-Sea, Essex.

C. J. Robinson
(Private, Infantry),
Bury St. Edmunds, Suffolk.

A. Johnstone
(L/Cpl., Searchlight Unit),
nr. Boston, Lincs.

E. Cusack
(R.N.),
Portsmouth.

E. Howgate
(Sapper, R.E.),
Walsingham.

J. M. Whendon
(Lieut., R.N.),
Gosport, Hants.

W. G. Webb
(Sapper, R.E.),
Hornsey, N.8.

D. Coney
(A.C., R.A.F.),
5, Spa Street, Lincoln.

The New Station

SO at long last a Midland town is to have its own transmitting station, which will include fixed and mobile transmitters. It is not stated as to when the construction will begin, but the Home Office urges an early installation, so that it can be used in connection with the capture of criminals, as well as for the dissemination of war news. It is said that the equipment will cost £2,500.

Our Roll of Merit

A FURTHER list of names is published this week. I want to make this list as complete as possible, so if you are serving the country in any way I hope you will write to me letting me know your name, home address, military number, and unit, adding a few words as to how you are faring. It is only right that this journal should set on record the names of its readers who are serving the country.

Those readers who have already written to me from France and other countries state that in spite of the bitter struggle in which they are engaged, they are having this journal sent to them each week, and it provides them with a pleasant relaxation from fighting.

No Sooner Said . . .

A FORMATION of six Fighter Command Hurricanes was on patrol recently over the sea off the south coast of England. Suddenly the leader spotted a German Henschel aircraft 2,000 to 3,000 feet below. He spoke into his radio-telephone, addressing one of his accompanying pilots.

"Hello. There is a Hun below you. Go and deal with it."

The Hurricane pilot to whom the radio message was given left the formation and dived down without a word. He went straight at the Nazi aircraft below, pressed his gun button to send a few hundred rounds of ammunition into it, and saw it go down in flames to the sea.

He then climbed back to rejoin his flight.

Again the Squadron Leader's radio-telephone spoke.

"Hello. Hello. Did you get my message? Repeat, did you get my message? Over to you."

Back came the laconic reply from the successful pilot: "Your message received. Your message received . . . and understood. Over to you."

"The Radio Training Manual"

ALL readers who have reserved copies of the "Radio Training Manual" should apply for their copies according to the instructions immediately. In these days of paper shortage it may not be found possible to reprint it. This book has already played an important part in the war effort in helping to train radio operators, so claim your copies before it is too late.

Comment, Chat and Criticism

Outline of Musical History–6

A Brief Sketch of the Life and Works of Beethoven, by Our Music Critic, MAURICE REEVE

WE have now arrived at the greatest name in all musical history.

Ludwig van Beethoven, who was born in 1770, and died in 1827.

As with Shakespeare, Leonardo da Vinci, Dickens, or any other supreme genius, we do not say that any one of them is the greatest master of his craft merely because we prefer his work to that of his fellow craftsmen. Nor do we award him the crown of supremacy because a majority prefers it to any other master's. No, it is far from being a matter of personal taste or prejudice. But rather do we award it for what he did for his art than for any collection of works he may have given it. And of Beethoven it can truly be said that he contributed more ideas to music and laid down more laws for musicians to obey than any other composer. Like Napoleon, whom he admired so much for a time, he was a legislator and statesman, philosopher and pedagogue; as well as the fashioner of wonderful compositions.

Many others have written wonderful works, but they have not exerted influence on others' thought to anything like the same extent.

He made instrumental music supreme and proved that it could work miracles without the extraneous aids of words, acting or scenery. He is the supreme classicist, and completed the work of Haydn and Mozart, to whom his debts should not be overlooked.

Symphony and Sonata

He took the symphony of his two great predecessors on to the heights where it still remains. He perfected the sonata. But whereas he was succeeded by at least one great symphonist, no one has as yet approached him in his supremacy in the latter genre. In writing sonatas his methods were entirely different from those of anyone else, and in his own greatest examples he makes use of every phase of musical self-expression. Whole movements are written, for example, in variation or fugal form. Marvellous tonal contrasts and modulations are to be heard throughout the collection, more particularly in his choice of keys for the second subject.

But it was in his revolutionary uses of rhythm that Beethoven showed the most astounding originality, and in which he most widely opened the path for his successors. In such examples as the D Minor and F Minor sonatas, and the Seventh Symphony, his handling of it marked the commencement of a new era.

He also developed the minuet and trio into the monumental scherzo, and, here again, his own creations have never been rivalled. He removed all the "padding" from a symphonic work, which even the greatest examples of Haydn and Mozart suffered from to some extent. And he finally removed the rough edges from the form. He also invented the coda.

Three Periods

Beethoven's music is easily divisible into three marked periods. He was always striving and seeking after something new: something he felt the form he was working in needed for its completion and consummation. The last of his scherzos, from the Ninth Symphony, and the last of the piano sonatas are clear cases.

The three periods of his creative genius might not inappropriately be termed the "student," the "master," and the "visionary." The first ends with the Second Symphony, and includes the first twenty sonatas, the six quartets Op. 18, the C Minor piano and violin sonata, and the first two piano concertos, etc. All these works clearly foreshadowed the mighty masterpieces that were to come, and established their author as the most original composer of the day. At the same time they prove his acknowledgements to his masters and predecessors; the influence of Haydn in particular is very evident. Side by side with daring innovations and a constant spirit of empiricism is a most catholic regard for his antecedents.

The second is truly a cataclysm of stupendous works. Never were prophecies more fully borne out. Symphonies 3 to 8, the Archduke Trio, Fidelio, the Waldstein, Appassionata and Kreutzer sonatas, the forth and fifth piano concertos, and the one for violin, the Rassoumowsky quartets, the Leonora overtures, and scores of other works. An unrivalled output—the period covers about twelve years—which embraces a range of thought and a universality of musical expression that no other master can rival.

The third period clearly shows the master with his thoughts stretching out into the future and into another life. Struck with deafness and racked with pain and disillusionment, his mind is seeking the peace and tranquillity that this world so signally failed to give him, whilst his message is being conveyed to generations yet unborn, but far more likely to heed the prophet and seer than the living teacher.

Closing Years

The works of the closing years of his life take on a diffuseness and speculative character, and are an ethereal and visionary quality. If they can be charged with being less incisive and terse than their immediate forerunners, and to be too abstract and disquisitious, they are among the most sublime and imaginative works in all music, and over a hundred years acquaintance with them have not been sufficient to plumb their profound depths and extract their wealth.

The Ninth Symphony, the Missa Solemnis, the last five piano sonatas, the last six quartets, the Diabelli Variations, etc., are among the masterpieces of this last period.

The briefest sketch of Beethoven's life can serve as a conclusion to this article. He was the son of the third generation of a musical family that had settled in Bonn. His father and grandfather were both dissolute drunkards, though good musicians, especially the latter, who was employed at the Electoral Court. Young Ludwig was cruelly overworked at his musical studies, and on his father's death found himself responsible for his mother and a numerous family.

He was a wonderful improviser, and on his first visit to Vienna in 1787 Mozart, greatest of all musical phenomena, was amazed at his inventiveness and brilliance. This hard and bitter childhood and youth brought him up against life's realities very early, and this fact unquestionably did more than anything else to impart that ruthless and uncompromising character that is the feature of all his work.

Haydn, then the doyen of musicians, also thought very highly of him. Consequently the Elector sent him to Vienna to study with the composer of "The Creation." But they did not get on very well together: young Beethoven's empirical and ardent nature frequently coming into contact with the older man's resting on his laurels, and more contented philosophy. As an example may be cited the incident when Beethoven dedicated the three sonatas, Op. 2, to his master. When it was suggested that the dedication should be made to read "to my master Joseph Haydn," the reply was terse and to the point. "Why, Haydn didn't teach me anything!"

As a Pianist

He then studied with Albretsburger, and proved himself a brilliant pianist in many concerts. He had the good fortune to meet most of the leading figures of the aristocracy, and men like the Archduke Rudolph, Prince Lobkowitz, Count Waldstein, and Prince Rassoumowsky, were faithful patrons.

But the shadow of his future deafness now appeared and warned him of what fate was holding in store. Because of it he had to abandon his pianistic activities. It is doubtful whether, even at this early period, he could hear much of what was played. But, during most of his third period it has been established that he couldn't hear anything, and the authentic story of his conducting his Seventh Symphony at a benefit concert and having to be turned round to face the audience as he couldn't hear their tumultuous applause is typical of the state he was in.

A worthless brother, apparently typical of the strain, died and left a boy for whom Ludwig developed the most extraordinary fondness. He took sole charge of him, and the story, far too long to be told here, is one of the most tragic pages in the master's life.

It must be admitted that he showed an inherited liking for intoxicants, but the wonderful nobility and fortitude of his character, coupled with his slavish devotion to his art, generally kept it well in check.

His death reads like a page from Greek tragedy. Blind at the last as well as stone deaf, racked with pain and in the direst poverty, he was buried during a snowstorm amidst every sign of public grief and homage. Among the pall bearers—all notable musicians—was Schubert. On the way home they stopped for some refreshment, and Schubert—then 29—raised his glass "to the next one of us to go." He it turned out to be—two years later!

Control of Selectivity and Quality

Some Simple Methods of Obtaining Better Reception of the Two B.B.C. Programmes, by Eliminating the Need for Very Sharp Tuning

by The Experimenters

SINCE reception is now largely confined to the two B.B.C. programmes, put out by what are virtually "local" stations, it is often possible to improve the quality of reproduction without any sacrifice in other directions. When a receiver is used for bringing in a large number of programmes the question of selectivity is very important. And as most readers are aware, selectivity and quality seldom go well together. This is because, if tuning is sharpened, there is bound to be a certain amount of cutting of the higher audio frequencies.

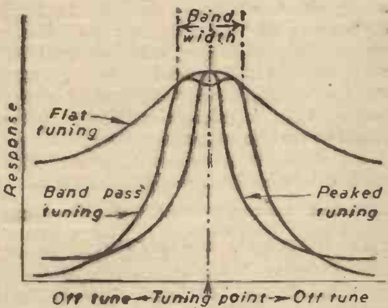


Fig. 1.—These familiar curves show the effect of using different tuning systems. When tuning is flat a wide audio-frequency range is covered, but interference is probable; with peaked tuning the reverse is the case; band-pass allows quality to be combined with selectivity.

Broader Tuning

To improve the response to these higher frequencies it is necessary to broaden the tuning by one of many methods. One of the simplest is by connecting the aerial directly to the top of the first tuning coil; another is by making the coupling between the aerial and grid windings (when there is a separate aerial winding) closer. These methods, and others which are similar in effect, are seldom desirable, since they merely make the set respond to a wider range of frequencies, the response gradually diminishing from the resonance point. Band-pass tuning provides a far more effective and efficient means of extending the response, since with it the response is practically uniform over a range of, say, 12 kc/s, but falls rapidly beyond this. The point is shown by the two familiar diagrams in Fig. 1.

Increasing Band Width

Although band-pass tuning was very popular a few years ago, it is not used very extensively to-day. When it is, the frequency band covered is generally restricted to 9 kc/s or less. In present conditions it is often possible to cover a wider range without running the risk of interference or "side-band splash." The method of increasing the band-width depends upon the particular form of band-pass circuit employed. When "bottom-capacity" coupling is employed, as shown in Fig. 2, it is necessary only to *reduce* the capacity of the coupling condenser. Thus, if the condenser in use has a capacity of .05 mfd, it may be worth while to replace this by one of about .02 mfd.

If a few fixed condensers of between .01 and .05 mfd. are available it is worth while to try them all. When the two most suitable capacities have been found (one for selectivity and one for quality) it is a good plan to fit a single-pole change-over switch for them, as also shown in Fig. 2. Thus, one position of the switch can be described as the "selectivity" position and the other as "quality."

Other Filters

The general method described is often applicable to modified forms of band-pass filter, such as those of the "mixed" type with which both capacity and inductance coupling is used. In that case the chief difference is that the condenser has a lower capacity. It is seldom satisfactory to modify the coupling coils in circuits of this kind, unless the tuners are home-made, in which case a few experiments can easily be made.

When a single-circuit aerial tuner is employed—this is generally made to tune as sharply as possible—it is often a fairly simple matter to convert it to a band-pass arrangement by employing the circuit shown in Fig. 3. An extra coil is required, which must be exactly the same as that originally used alone, and also a small variable condenser to provide "top-capacity" coupling. The additional coil must be tuned, and this can best be arranged by replacing the single condenser by a two-gang type, or by ganging another similar condenser with it, when this is possible. With many condensers ganging cannot easily be arranged, due to the fact that the spindle does not project from the base; when it does, a coupling collar of the self-aligning type can easily be used to join two condensers together.

"Top-capacity" Coupling

It is possible to use two separate condensers, but tuning is not always easy when that is done, and if both are not set accurately quality may be impaired rather than improved. A .0001-mfd. differential

(Continued on next page)

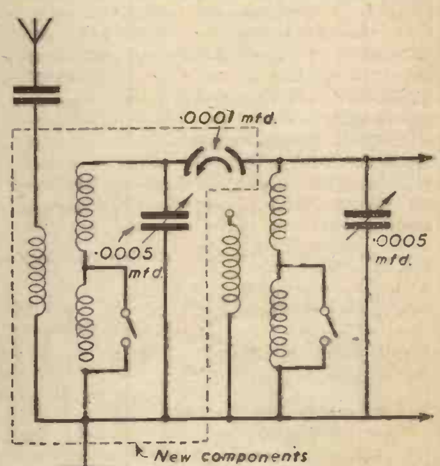


Fig. 3.—A simple form of "top capacity" band-pass coupling by adding a second tuning circuit and small coupling condenser.

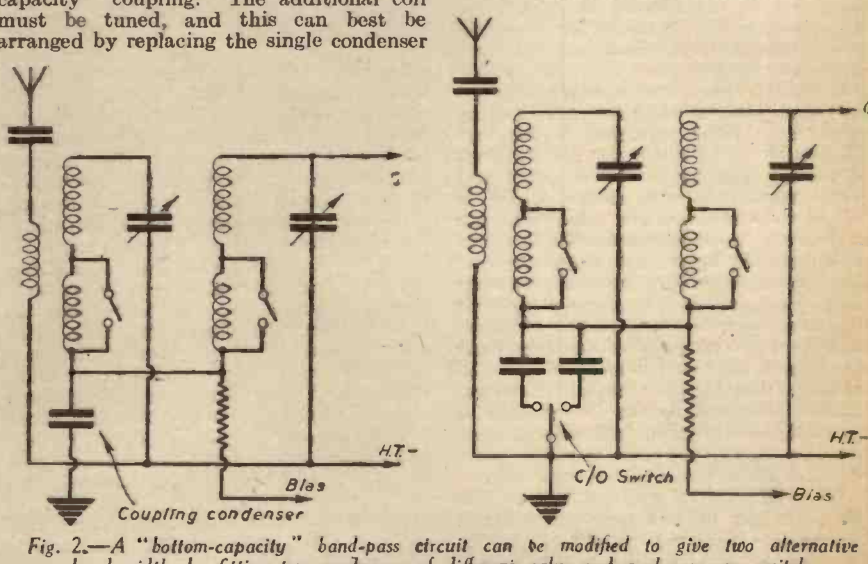


Fig. 2.—A "bottom-capacity" band-pass circuit can be modified to give two alternative band widths by fitting two condensers of different value and a change-over switch.

CONTROL OF SELECTIVITY AND QUALITY

(*Continued from previous page*)

condenser is shown in Fig. 3 for coupling the top ends of the two coils together. This is convenient since, by making connection to the two sets of fixed vanes only, the maximum effective capacity is reduced to .00005 mfd. and the minimum to a very low figure. As an alternative to this a neutralising condenser may be used if one of these can be found in the junk box.

In any case it is necessary to adjust the "top-capacity" condenser so that the widest possible frequency band is covered consistent with the elimination of interference. The higher the capacity the closer the coupling and the wider the band. When using a differential condenser the highest capacity is produced by setting the knob to the midway position—so that the moving vanes are half in mesh with both sets of fixed vanes. Movement of the spindle in either direction from this point reduces the coupling capacity.

Superhet Tuning

In the case of a superhet the input tuning circuit can be modified, if necessary, in one of the ways already described. But many modern superhets do not use band-pass tuning and selectivity is governed largely by the I.F. transformers. As most readers are aware, an I.F. transformer can be said to constitute a form of band-pass filter, and selectivity may be varied by altering the degree of coupling between the primary and secondary windings. Thus, if the two coils are moved closer together tuning is broadened, and *vice versa*. Sometimes it will be found convenient to move one of the windings on the central pillar; by bringing the windings closer together the response band is made wider.

When the primary and secondary coils are fixed it may be unwise to attempt any alteration of this kind, since the component may be damaged. Instead, one good plan is to connect a pre-set condenser between the anode and grid terminals as shown in Fig. 4. A condenser of .0005-mfd. maximum capacity is shown, but a .001-mfd. component is better in some cases; this depends largely upon the particular component. It might be considered better to use a fully-variable condenser of either the bakelite or air-dielectric type, so that selectivity can be under full control from the panel. If this method is adopted it will be best to screen the condenser, earthing the screen. A small aluminium box can be used, taking great care that it is properly insulated from the condenser itself. It is not necessary to provide variable selectivity on more than one I.F. transformer, and opinions differ as to whether the control should be on the first or the last. We prefer to have it on the first, for then the others can be made to tune fairly broadly without running much risk of introducing interference. Those who wish to experiment can try making each transformer adjustable in turn.

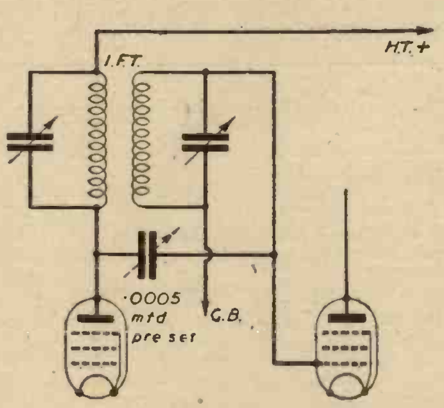


Fig. 4.—"Top-capacity" coupling applied to an I.F. transformer.

Another I.F.T. Modification

Another method of making I.F. transformers to provide variable selectivity is to place a small winding between primary and secondary. This should have about 25 turns, and a 50,000-ohm variable resistor should be connected between its ends; apart from this, the winding is not electrically connected to any other component. When the resistor is set to a high value the tertiary winding, as it is called, serves as a means of coupling, but the coupling effect is reduced as it is gradually "short-circuited" by reducing the effective value of the parallel resistor. Should this method be applied to an existing transformer it will generally be found best to separate the windings slightly before adding the tertiary winding, to prevent the coupling from becoming too close. Here again there is scope for experiment.

B.L.D.L. The British Long-Distance Listeners' Club

THE absence of amateur transmitters from the air in many countries has made a considerable difference to the activities of members, and in many cases also has, we are afraid, led to a reduction in interest. There are, of course, still plenty of commercial stations which can be received and, although these are using very much higher power than amateurs, they do afford some fields for experiment. Amateurs are still working in U.S.A. and although certain parts of this continent are easily received, experiments in selectivity may be carried out at suitable times, with just these stations as a guide. One of the difficulties in using American amateur transmitters for test purposes is that owing to the different restrictions applying in that country and to the apparatus and money which is available to the amateurs, some elaborate aerial arrays are being used. These are of the directional type and when working European amateurs they used to beam their signal, which, of course, gives a stronger signal here, with a small output of power and if it was not possible to hear what type of aerial they were using, you might be misled into thinking your receiver was extra-efficient. However, at the present time, a very good test is to listen to these amateurs, and note when they are working other Americans in a different part of the continent and on reference to a map you will be able to see whether or not they are using a beam aerial which is non-directional to this part of the world, which would, of course, be equivalent to the use of an ordinary aerial and thus give you some guide as to reception conditions.

One Valve Sets

A MEMBER has asked us if we can recommend a one-valve set capable of "phenomenal" results. This is rather a sweeping request, and as we have pointed out in other columns of this paper from time to time, the so-called "super" and other types of receivers are generally very tricky to get going, although undoubtedly when properly working they do give results exceeding those normally expected from the number of valves in use. The modern double type of valve lends itself, however, to many circuits, and a special American-type valve was introduced some time ago to facilitate the design of such receivers. It consisted of a triode and S.G. valve in one envelope and the characteristics are such that it is possible to construct a detector L.F. receiver with the single valve. This operates with a 1.4 volt filament, and is a straightforward circuit, although a similar arrangement could also be made up round a standard Class B valve using one triode as detector and one as L.F. Reflex circuits and similar arrangements are not generally found worth while to-day, but we shall be glad to hear from any members who have experimented with this particular type of receiver with really reliable and worthwhile results.

Signal Strength Measurements

A MEMBER recently constructed a communication type receiver and now raises a point concerning the use of a signal strength or "S" meter. This is quite a common fitment on many commercial communication sets and this member raises the problem as to its utility. As he points out, it is really just as arbitrary as the ordinary "R" code used by amateurs without a meter and as we pointed out some time ago in these pages, there is no standardisation at the moment of signal strengths. The "S" meter is usually merely an anode current meter and shows only the comparison between different signals and thus the user has first to decide what will be R9, and gauge the remaining values according to the scale of his meter. Even when a receiver is fitted with such a meter calibrated in R values, the readings are of little use to the transmitter whose reception you are reporting unless he knows the receiver and the type of output it gives, or is familiar with any other reports you may have made on the same receiver. The only satisfactory signal strength meter is that which measures the actual incoming H.F. or, alternatively, measures the audio output against the aerial input, and this is not such a simple problem.

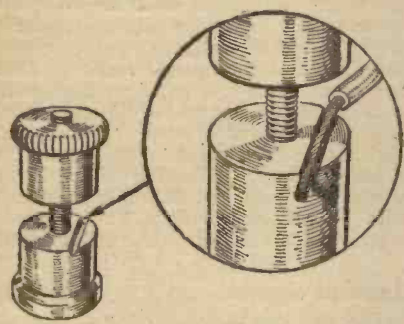
Contacts Wanted

RICKMANSWORTH—Member 6426, 39, Malvern Way, Croxley Green, Rickmansworth, Herts. (This member wishes to get in touch with a reader, about 17, interested in learning morse.)

Practical Hints

Fixing Wire Under Terminals

I USUALLY find when fixing flex wire under terminals that it is either squeezed out of the sides, or else a strand somehow



A simple dodge for clamping wire under terminals.

gets loose and jams the terminal head before it is properly screwed down. To avoid this I filed a groove in the terminal shank, as shown in the sketch, and after twisting the flex wire I placed it in the groove and screwed down the head. Instead of being pushed out, the wire is just pressed into the groove and held fast.—J. T. WHITELEY (Northampton).

Fixed Condenser Tips

WHEN it is required to ascertain the capacity of a condenser of a fairly small value, a simple method is to connect it across one of your tuning condensers and note the reduction necessary to tune-in a known station. This difference will indicate, after a little experience with this method, the capacity which the fixed condenser bears in relation to the tuning condenser in question.

When testing a disconnected mains set in which large smoothing condensers are used, it is very advisable to short-circuit such components before interfering with any of the wiring, otherwise there will be the possibility of a nasty shock being obtained by the charge held by the condenser.—E. BOLTON (Derby).

Home-recording

AFTER making several poor attempts at home-recording I have at last succeeded in making a record indistinguishable from a commercial product. I have found several essential features which I now give for the benefit of others who may have proved unsuccessful in their attempts. I scrapped a pentode output stage, as I found that one main difficulty was matching the cutting head to the output stage. A triode valve is not so critical for matching and thus simplifies this part of the circuit. Next I *had* to use a signal level or output meter. Without this all guesses were right out, but by using this and adjusting for volume as the sound came along I was able to control matters so as always to avoid overloading and also to keep up the level for good cutting. By the usual attention to L.F. circuits and components I have now got a recorder which I am proud of.—T. WARREN (Richmond).

THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best hint submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Practical Hints." DO NOT enclose Queries with your hints.

SPECIAL NOTICE

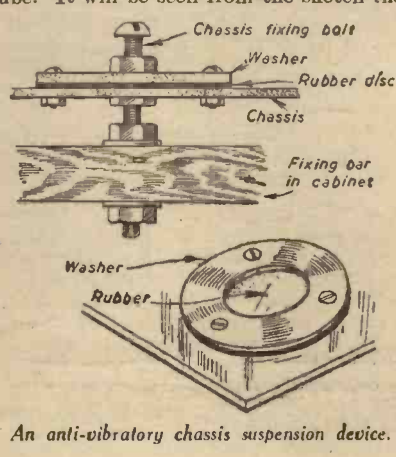
All hints must be accompanied by the coupon cut from page 328.

A Static Screen

I RECENTLY wished to fit a Faraday or static screen between an aerial and grid coil, but could not make a suitable arrangement. The following idea, however, enabled me to make a screen which really reduces static on my communications receiver, and is easy to wind. Over a solid former of a diameter suitable to fit between primary and secondary I laid a thin strip of copper foil. Across this I wound a coil of bare, thin tinned copper wire. When completed, solder was run across the turns where they crossed the coil, and then the turns were all cut through just above the foil. A slight tension on the wire before winding ensured that the turns "stayed put," and the shield was then carefully inserted between the two coils with perfect results.—P. RAKS (Gloucester).

A Chassis Suspension Device

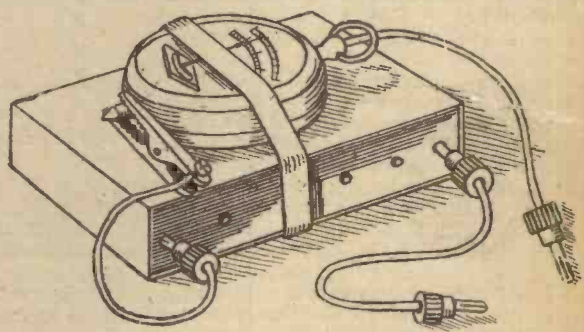
FOR this simple anti-vibratory chassis suspension device the parts required are 12 nuts and bolts, four washers, and a piece of rubber from an old car inner tube. It will be seen from the sketch that the bolt which is fixed to the cabinet supports the chassis by contact with the rubber disc only. The chassis, therefore, is hung on the rubber discs, one in each corner of the chassis.—J. RATCLIFFE (Yatesbury).



An anti-vibratory chassis suspension device.

A Simple Circuit Tester

MANY amateurs use a watch-pattern voltmeter for checking their accumulators and dry batteries, and such a meter can be made into a handy tester for tracing faults and checking over the wiring of a new set. The voltmeter is simply laid on the side of a grid-bias battery, and a stout rubber band is used to hold them together, as shown in the accompanying sketch. The positive terminal of the meter is connected by means of a crocodile clip and a piece of flex to the positive socket of the battery, and a flex lead is plugged into the other end of the battery. This simple tester comes in handy for checking a suspected short circuit in the high-tension winding. It is much better to disconnect the H.T. and test with the meter in series with the small battery than to try to locate the leakage of the H.T.



An easily contrived circuit tester.

supply by using the meter alone. Ordinary tests for continuity can be carried out with this simple combination quickly and effectively.—L. WINGROVE (Pinner).

Selective Band-pass Filter

A Description of Two Interesting Circuits

IN order to increase the adjacent channel selectivity of a band-pass filter it is known to employ low-resistance channel frequencies. Such circuits are, however, liable to prove costly in view of the high-efficiency conductances which have to be used, and consequently the possibilities of feedback to reduce the losses of less costly components are worthy of examination.

This subject has recently been under review in the R.C.A. Laboratories, and the following is an account of some of the circuits used and the results obtained.

Broadly considered, the networks of Figs. 1 and 3 include two acceptor circuits, C_1L_1 and C_4L_4, tuned to the centre of the desired frequency band, and two rejector circuits, C_2L_2 and C_3L_3 (Fig. 1), tuned respectively on the opposite sides of the pass band. As indicated by the curve of Fig. 2, this well-known circuit gives a flat top or three slight peaks with steep sides in the pass band part of the frequency-amplitude characteristic. With high-loss reactors or with a narrow pass band, the shoulders of this characteristic tend to droop. Regeneration of the rejector circuits C_2L_2 and C_3L_3 functions to maintain the desired flat pass band characteristic irrespective of the reactor losses and the pass band width.

The network of Fig. 1 includes an electron discharge amplifier 10 which is provided with input terminals 11-12 and with output terminals 13-14 coupled through reactor-capacitor units C_1L_1 and C_4L_4 to the input terminals 15-16 of an amplifier 17. A resistor R_1 of the order of 100,000 ohms may be connected in shunt to the reactor L_1 for reducing the centre peak of the curve of Fig. 2 to about the same height as the other two peaks, and a resistor R_2, which may be smaller than the resistor R_1, may be connected in shunt to the reactor L_4.

Interposed between the acceptor or coupling units C_1L_1 and C_4L_4, and connected in shunt to the main signal channel are the low-frequency filter or rejector C_2L_2 and the high-frequency filter or rejector C_3L_3. Regeneration of the low-frequency rejector C_2L_2 is effected by means including an amplifier 19 provided (1) with an input circuit including a cathode-lead resistor 20-21 and a grid-leak resistor 22 connected in shunt to the capacitor C_2 and (2) with an output circuit including the resistor 20-21, a suitable plate voltage source and a feedback coil L_5 which is inductively coupled to the reactor L_2. Regeneration of the high-frequency rejector C_3L_3 is likewise effected by means including an amplifier 23 having in its input circuit a cathode lead resistor 25-26 and a grid-leak resistor 24 which is connected in shunt to the capacitor C_3, and in its output circuit the resistor 25-26, a plate voltage source and a feedback coil L_6 inductively coupled to the reactor L_3.

Tickler Coils

It will be noted that regeneration is effected through the tickler coils L_5 and L_6, in the usual manner, except that the regenerative effect is stabilised by the cathode lead resistors 20-21 and 25-26. The lower terminals of these stabilising resistors are subjected to a negative potential such as -32 volts for neutralising the D.C. drop of the resistor and maintaining a normal voltage of about -3 volts on the feedback amplifier cathodes.

The cathode lead resistor 20-21, for example, has a stabilising influence in two ways. First, any change in the plate voltage or mutual conductance of the feedback valve results in a compensating change

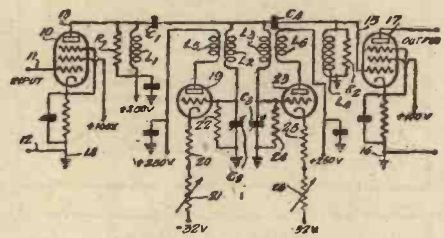


Fig. 1 (Above).—A filter stage network, incorporating shunt rejector circuits.

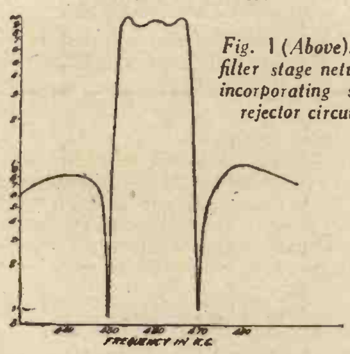


Fig. 2.—Frequency amplitude characteristic curve.

in the grid bias potential of the valve and, as a result, the valve mutual inductance varies but slightly. In addition, this small change in the effective valve characteristic is further reduced by the action of the resistor at radio frequency. When a radio-frequency voltage is applied to the grid, a voltage appears upon the cathode of the same phase, and almost equal amplitude. The true input to the valve is the difference between the grid and cathode voltages, and a radio frequency plate current flows, due to this difference voltage. This plate current is used for regeneration through the tickler L_5 or L_6.

If the mutual conductance of the valve should decrease, a smaller voltage will appear on the cathode. Hence the difference between grid and cathode voltages is greater, giving a larger input voltage to the valve. Thus it can be seen that the variation in plate current is a very much smaller percentage than the variation in valve characteristic. Thus the cathode resistor is the means of stabilising the amplification of the valve, and such amplification is then used as a means of applying regeneration to the rejector circuit. While a fixed coupling is shown between the plate and grid coils, and regeneration is adjusted to a critical value by adjusting the cathode resistor section 21 and 26, the same result could be obtained with a fixed cathode resistor and a variable tickler adjustment.

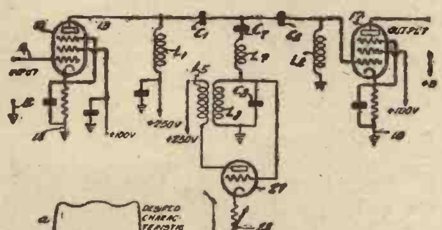


Fig. 3 (Above)—A modified network including a shunt circuit.

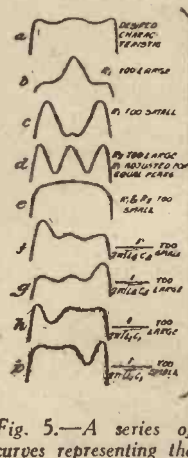


Fig. 5.—A series of curves representing the shapes of band-pass characteristics.

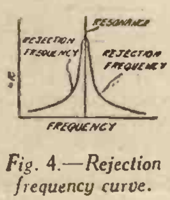


Fig. 4.—Rejection frequency curve.

Modified System

The modified network of Fig. 3 differs from that of Fig. 1 in that the two shunt rejector circuits C_2L_2 and C_3L_3 are replaced by a shunt circuit which includes a capacitor C_7 and a reactor L_7 connected in series with the parallel connected capacitor C_8 and reactor L_8. In this modification, the parallel resonant circuit is regenerated through means including a single amplifier 27, a cathode lead resistor 28, and the tickler coil L_5 which is inductively coupled to the reactor L_8.

When the effective series resistance of C_8L_8 is slightly negative, the negative resistance component of this parallel resonant circuit is as indicated by the curve of Fig. 4. At the rejection frequencies, C_7L_7, C_8 and L_8 form a series resonant combination and the effective series negative resistance of C_8 L_8 should equal the resistance of C_7L_7. Oscillation does not occur because of the grid and plate coil resistances. In the pass band, the entire rejector circuit L_1-C_1-L_2-C_2 has a negative effective resistance, but suitable adjustment of the grid and plate circuit losses results in a flat pass band.

Lining up the Rejectors

In lining up a single stage filter such as that of Fig. 1, a signal generator is connected to the grid of the amplifier valve and a valve voltmeter is connected to the output of the filter. The first operation is to line up the rejectors for maximum attenuation at the rejection frequencies. This involves adjusting both tuning and regeneration for maximum attenuation. The two acceptor circuits L_1C_1 and L_2C_2 are then tuned for maximum response in the centre of the pass band. Alignment may be found easier if less than optimum damping is used for this preliminary tuning adjustment. A head and shoulders curve will then be obtained in the pass band. The steps involved in correcting this to the desired shape are indicated in Fig. 5.

In this figure, a series of curves are plotted. Each curve represents a possible shape of the pass band characteristic. (The relative height of one curve to another is of no significance here.) The top curve is assumed to be the desired one. The other curves are obtained when one or more circuit constants have inaccurate values as indicated on the figure.

QUICK-FIRE SERVICING

Practical Hints which Will Enable a Set that has Developed Valve Failures to be Rapidly Serviced

THE object of these notes is to give hints which will enable a set which has developed a "usual" type of fault, e.g., valve failure, to be serviced in as quick a time as it takes to read this article, and certainly quicker than it takes to write it.

The first thing to do when confronted with a receiver for service is to endeavour to diagnose the complaint. If the receiver is "dead" to radio signals, will the L.F. side operate from a pick-up? Is a faint hum present? Spend a few moments' thought as to the probable cause of the complaint. It will always repay you.

For routine testing a good A.C./D.C. test set is essential. Set about the job methodically, and measure anode and screen voltages first, commencing with the rectifier valves.

Measure the H.T. voltage at the point X (Fig. 1). Low volts will indicate: (1) a faulty rectifier; (2) a faulty mains transformer; or (3) a heavy current drain on the rectifier due to excessive leakage or breakdown of a condenser.

Measure the rectifier anode voltage (A.C.) between "M" and chassis, and "N" and chassis, if the first test has shown low volts. Disconnect the smoothing condenser at "X" and measure volts between "X" and chassis. If voltage is O.K., reconnect condenser and disconnect the other smoothing condenser at point "Y." If volts are O.K. reconnect and measure volts drop across the speaker field. Knowing the resistance of the field, the current flowing can quickly be calculated from Ohm's Law and checked against the normal current taken by the valves used in the receiver. A much higher current would most likely indicate a condenser breakdown in an earlier stage of the set.

If, as a result of disconnecting one of the smoothing condensers, the voltage becomes normal, a loud hum will become audible, and it may not even then be possible to get the receiver to work at all. In such a case, the introduction of a new smoothing condenser will remove the hum and the set will work normally.

Mains Receivers

In the case of mains receivers, it always pays to make thorough tests of the rectifier valve, and smoothing condensers, before proceeding any further. Without wishing to indicate anything detrimental against electrolytic condensers (they are really excellent when properly used), it is interesting to note that four out of the last six sets I have serviced have had smoothing condenser breakdowns. Usually it has been found that the condenser has been worked right up to its maximum voltage, and in some cases over, and has either been totally enclosed or else placed too near a valve and has, therefore, been subjected to undue heat treatment.

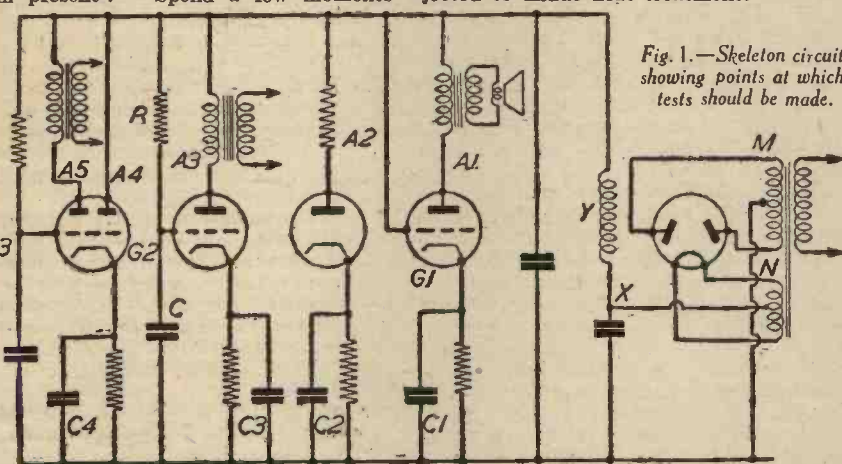


Fig. 1.—Skeleton circuit showing points at which tests should be made.

Now proceed to measure the anode and screen voltages at A1, A2, A3, A4, A5, G1, G2 and G3, commencing with the output valve. Also, measure the voltage drop across each decoupling resistance and, from Ohm's Law, calculate the current passed, and thence check up the anode and screen consumption of the valves against the valve manufacturers' published data and curves.

For example, if the volts drop across the resistance R (10,000 ohms) is 150 volts, it is obvious that the current flowing through the resistance is 15 mA. Supposing that the normal screen current of the valve with 100 volts applied is only 6 mA, it is quite probable that the excess current is caused by a leaky decoupling condenser C, and this should be disconnected. If the current resumes normal proportions, a new condenser is the obvious cure.

The next thing is to measure the bias across the cathode resistances C1, C2, C3 and C4, and from these values can be calculated, again from Ohm's Law, the total current taken by each valve.

You should now have enough data to check the operation of all the valves in the receiver, and their associated components, and in all probability one of the tests will have cleared the fault by showing "no volts" or "heavy current." Don't expect, however, to get your readings to agree exactly with the published data on the valves being used. They should be reasonably accurate, however, say between ± 10 per cent. of normal.

"No Volts"

In the case of "no volts," the obvious thing is to work back to the main H.T. line until a voltage reading is obtained. If, for example, volts are found on one side of a resistance and not on the other, remove the resistance and test it. If the resistance appears in order or is even replaced by another and a "no volts" reading is still obtained, it is probable that the decoupling condenser is faulty and short-circuiting the H.T. supply at this point. The decoupling resistance would prevent a full short-circuit on the main H.T. supply, but it is quite probable that the resistance would become very hot.

During these voltage tests, don't jump to a hasty conclusion. If a wrong reading is obtained, consider the probable cause of the fault and proceed systematically.

An example of the use of deduction is shown in Fig. 2, which is the skeleton circuit of the L.F. portion of a commercial radiogram. The fault was distortion and low volume on both radio and gramophone, and this meant that the fault, or at least a fault, existed in the L.F. side of the receiver. Anode volts were found to be within a few per cent. of normal, and the cathode volts were then measured.

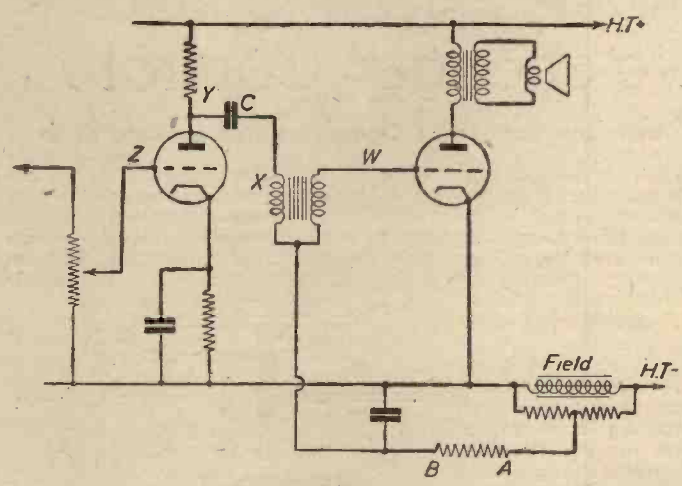


Fig. 2.—Output stages of a receiver to illustrate the use of deduction from meter tests.

Bias for the output valve was derived from a potentiometer across the loudspeaker field winding in the H.T. negative lead, and a voltmeter between point "A," and the chassis, gave a negative reading. On connecting the meter between point "B" and chassis, i.e., on the other side of the

(Continued on next page.)

QUICK-FIRE SERVICING

(Continued from previous page)

G.B. decoupling resistance, a reading of several volts *positive* was obtained.

Consideration of the probable cause of the complaint, and an examination of the theoretical circuit, suggested that the coupling condenser C was leaky, and allowing a positive H.T voltage to appear on the grid of the output valve. The insertion of a milliammeter in the circuit in series with condenser C showed that nearly 10 mA was flowing through the condenser. On examining the condenser it was found to be an electrolytic variety, and it was learnt that this had been put in when the set was serviced on a previous occasion. Removal of the condenser and its substitution by a paper one, cured the trouble, although the positive voltage on the grid had caused the emission of the output valve to drop.

We will presume that after taking these readings, all voltages and currents have been found to be reasonably normal and that the fault cannot be located.

Interjecting Signals

The next step is to inject a modulated L.F. signal into the L.F. stages, commencing again with the output valve, and working back to the grid of the first L.F. valve. A pick-up will do for this. Provided that a condenser is fitted in series with the pick-up or oscillator leads, it is quite permissible to inject the signal into the anode as well as the grid circuits. Referring again to Fig. 2, the pick-up or oscillator should be connected to each of the points W, X, Y, Z in turn through a 1 mfd. condenser. In the case referred to above, the fault would have been immediately located at the point W, but had the primary of the transformer been connected to chassis instead of to the secondary and H.T. negative, point "W" would have been shown up O.K. and the fault not located until the pick-up was connected to the primary side of the L.F. transformer.

If the fault cannot be found in the L.F. portion of the receiver, an H.F. or I.F. signal must be injected into each H.F. or I.F. stage in turn.

When carrying out any of the above tests, remove the aerial, set the volume control to maximum, switch the receiver to long waves and rotate the tuning condenser to maximum capacity.

There are two fairly common faults which will not be located by simple voltage tests and which can be found without the use of an oscillator. One is a faulty diode or A.V.C. circuit, and the other is failure of the frequency valve to oscillate.

The simplest way to test the diode and A.V.C. circuit is to connect a milliammeter in the anode lead of one of the controlled valves (keep the meter leads a short as possible and always connect the meter between the decoupling resistance and the main H.T. supply. Never connect it between anode and the I.F. transformer.)

Keep the aerial and earth connected to the receiver and rotate the tuning condenser very slowly. As a signal is tuned in, the current should decrease if the H.F., I.F., detector and A.V.C. circuits are in order.

In a superhet receiver the oscillator section of the frequency changer is quite a frequent source of trouble. If the oscillator fails, no I.F. signal will be reproduced, but in some cases the oscillator may only fail on certain wavebands, or parts of a waveband.

The oscillator voltage should remain fairly constant over the whole of the waveband, although it may vary for different wavebands. For instance, on S.W. bands, the oscillator anode voltage is often increased. The quickest method of checking an oscillator is to insert a milliammeter in series with the oscillator anode, between the voltage dropping resistance and the main H.T. line, and note the reading. Short-circuit the oscillator tuning condenser, or connect a large fixed capacity condenser across it. A change of oscillator anode current, which may arise or fall depending on the type of oscillator in use, should occur. If no change occurs, the oscillator is not functioning.

In the case of partial failure, this will be shown up by tuning the set through the various wavebands and noting if a sudden change in current consumption occurs at any point or points, indicating that the valve is going in and out of oscillation at this point. Don't confuse this with a gradual change, for no oscillator will give a constant reading over the whole of all the wavebands.

Final Hints

Here are a few hints, which are the result of actual experience, and which may help the reader when called in to service a receiver:

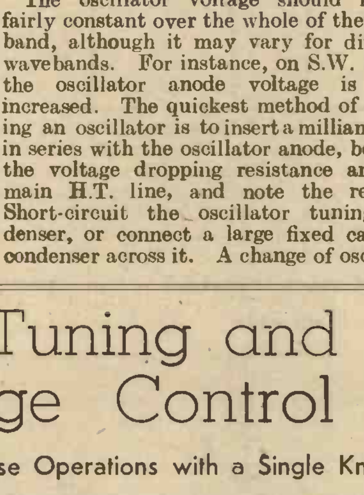
1. Always make sure that the aerial has not been inadvertently disconnected.
2. In the case of a battery receiver, make sure that none of the battery leads have been pulled out or inserted in the wrong positions.
3. The quickest way to estimate whether a valve is likely to be the cause of the trouble, especially where readings cannot be obtained without removing the set from its cabinet, is to measure the voltage drop across the speaker field. These terminals are easily accessible and the current consumption of the receiver can be quickly calculated from Ohm's Law.
4. If the H.T. supply appears to be at fault, examine the smoothing condensers first. Disconnect each one of them in turn until a voltage reading is obtained. Ignore the increased hum for the time being. It will be immediately reduced as soon as the smoothing condensers are reconnected, or new ones substituted.

Combined Tuning and Wave-change Control

A Method of Controlling Both These Operations with a Single Knob

MANY proposals have heretofore been made for improvements in the control of radio receivers. It has already been proposed, for example, to reduce the number of controls by making one control perform two or more operations, or to reduce the space occupied by arranging two or more controls concentrically.

The accompanying sketch shows a simple arrangement whereby both the tuning indicator and the wave-change switch can be actuated by means of a single control knob. The control is shown in section, and the wave-change switch 1 is provided with a spindle 2 arranged in a bearing 3 which is secured to the chassis 4. The end of the spindle 2 is provided with a circumferential groove 5 for a purpose which will be described later. A hollow control spindle 6 is rotatably mounted on the wave-change switch spindle 2, as shown, and is provided with a control knob 7. The spindle 6 is held to the shaft 2 by means of a pin 8 which projects into the groove 5, and thus allows a limited amount of axial movement between the two shafts. The end of the control spindle remote from the knob is provided with one member 9 of a clutch, and the other member 10 of the clutch is rigidly secured to the wave-change switch spindle 2. The members 9, 10 are biased apart by a spring 11. The hollow



Section of the single-knob control device described in the text.

control 6 is provided with a circumferential recess 12 round which a cord from a pulley associated with the tuning condenser may be wrapped.

Operation

In operation, rotation of the control knob 7 will cause the hollow spindle 6 to rotate round the wave-change spindle 2 and operate the tuning indicator through a cord drive. When it is desired to change the wave-band the control knob 7 is displaced axially to bring the clutch members together, and then rotated so that both the wave-change switch and the tuning indicator are moved together; as soon as the correct wave-band has been found the axial pressure upon the control should be removed so that a further rotation causes only the tuning indicator to operate. It is inadvisable to secure the driving cord positively to the hollow spindle 6 so as to avoid unnecessary strain upon the cord if the control should be manipulated for changing the wave-band switch when the tuning indicator is in a limiting position.

Home-made Remote Control

A Useful Device Made from Odds and Ends

A VERY fascinating hobby is the control of various pieces of apparatus by means of distant-operated switches, and the details given in last week's issue of one reader's attempts in this direction will no doubt arouse a desire to carry out similar schemes in the homes of many experimenters. Although it is possible to purchase ready-made relays or similar devices, there is much more interest in making up your own apparatus, and the following details which were given by us some years ago are therefore reprinted for those who wish to make up a similar type of instrument. Although of very simple construction, the device is the result of considerable experiment.

A special feature is that, unlike most other controls, it consumes *no current* while the set is in use, and gives a positive on-off contact. The action is similar to a G.P.O. line relay and sounder, and complicated, unreliable clock actions, etc., are avoided. The parts required are two electric bell bobbins (complete), about 18in. of ½in. springy brass strip 1/32in. thick, two small iron or steel cycle bolts (as used for fixing mudguards), two 2BA brass bolts ⅝in. long with two nuts on each, five terminals, seven ⅜in. wood screws and a piece of wood for base 3 by 4in. by about ½in. thick. The bell bobbins are best bought if an old bell is not to hand. In the latter case two small iron or steel bolts will serve as cores.

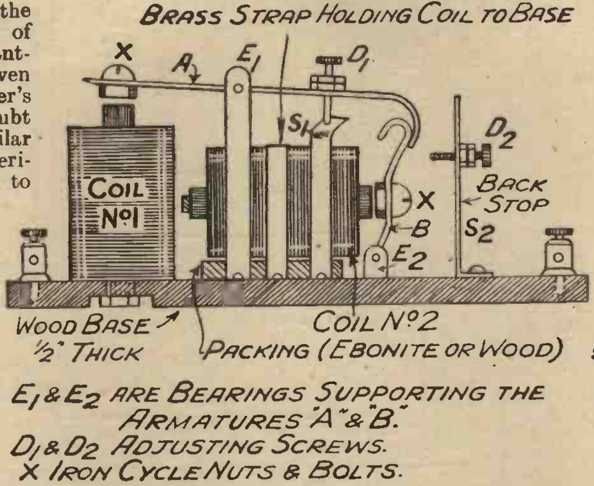


Fig. 1.—Completed relay showing armature "B" attracted, and relay in closed position after No. 2 coil has been momentarily energised. L.T. circuit is then closed and L.T. current then flows up the bottom armature to top armature through bearings to set.

Details of Construction

First drill a hole through the base as shown (Fig. 1), and mount No. 1 coil upright by means of the nut on the core end. It will be necessary to recess the bottom of base a little so that the nut will be flush. Coil No. 2 is then mounted horizontally on a small piece of 3/16in. wood or ebonite, and is secured to base by a metal strap (cut out of the brass strip), and two of the small wood screws. The armatures, bearing supports, and stops are next cut to size out of the strip and the holes drilled.

Solder the 1in. nails to the armatures, as shown in Fig. 2, and fit the iron cycle bolts. Cut the bolts off flush with face of nuts and give the nuts a thin film of solder—this secures them further and also prevents them "sticking" to the magnet cores. Fit the 2BA bolts in position and solder the *bottom* nut only on each. Bend the armatures, stops and bearings to approximately the shapes shown in Figs. 3 to 7, then assemble the top armature and bearings first. See that the iron nuts on armatures are directly opposite the magnet (coil) cores. Fix the terminals and connect up as in Fig. 8. Before testing it will be advisable to explain the action of the relay.

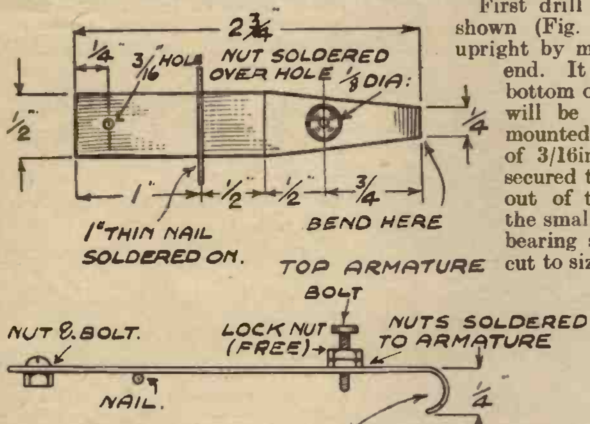


Fig. 2.—Details of top armature.

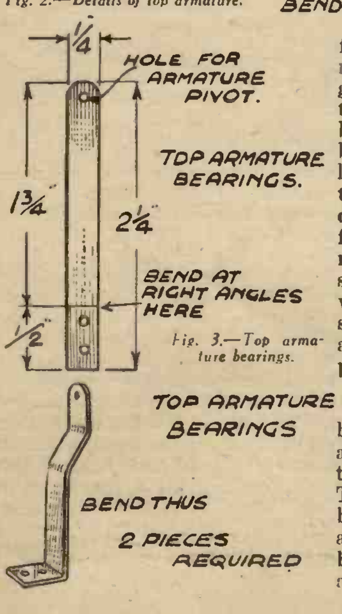


Fig. 3.—Top armature bearings.

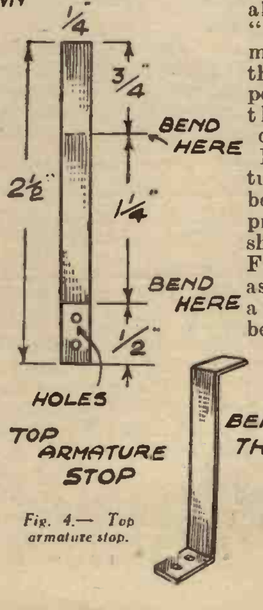


Fig. 4.— Top armature stop.

How the Relay Operates

The relay operates on each coil separately, the normal position of relay, when not in use, being shown in Fig. 10. It will be seen that both armatures are so balanced that they normally rest on the "stops." When a current is passed through coil No. 2 the bottom armature is attracted to the core, and in doing so knocks against the top armature and lifts it up. The top armature acts as a kind of latch, and *immediately* drops back over the bottom armature, and effectively locks it when properly adjusted. This action takes place instantaneously.

On sending a current through coil No. 1, the *top* armature is attracted to core of No. 1 coil and releases the bottom armature, which falls by its own weight back to its stop.

It will be seen that only a momentary current is needed to operate the relay. The operating circuit is quite distinct and separate from the low-tension circuit of the

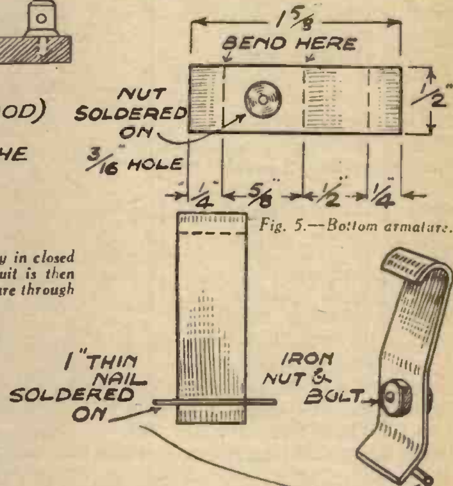


Fig. 5.—Bottom armature.

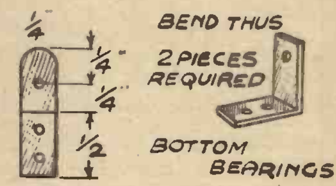


Fig. 7.—Details of bottom bearings.

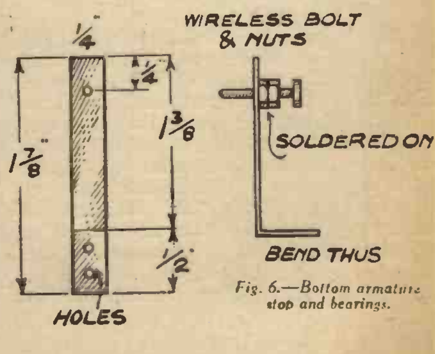
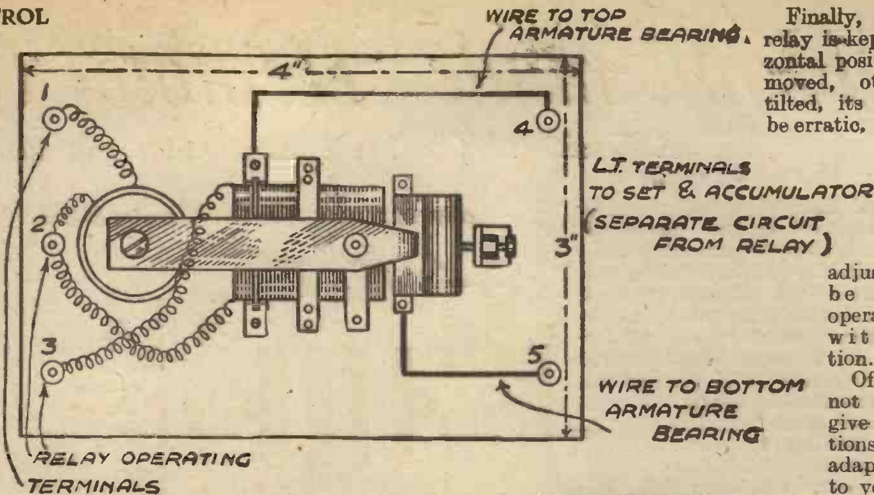


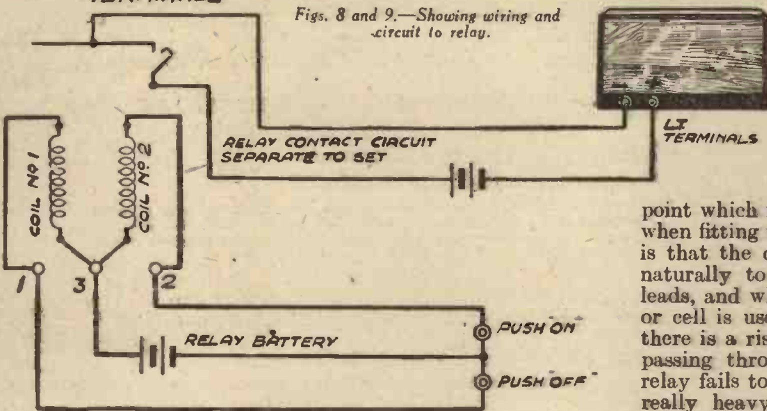
Fig. 6.—Bottom armature stop and bearings.

HOME-MADE REMOTE CONTROL

(Continued from previous page)

set which it throws on and off. The L.T. circuit is from one of the two terminals (see Fig. 8) to bottom armature, bearings, through bottom armature along top armature (wherein contact), down top armature bearings and out to other L.T. terminal on relay base. To test the relay *before* using (as is advisable), connect temporarily one end of a battery to terminal 3. Touch terminal 2 and bottom armature should be attracted as explained. On touching terminal 1 the top armature should be attracted, thereby releasing the bottom armature.





Figs. 8 and 9.—Showing wiring and circuit to relay.

Simple Adjustments

A certain amount of adjustment will be necessary on both armatures to get smooth working, but this will not be difficult as they are made of springy brass. For operating the relay 3 volts will usually suffice (or a flashlamp battery), but up to 6 volts can be used, especially if there is a long length of wire to the control pushes.

Two ordinary bell-pushes are used for operating. One push is used to switch the set off and the other to switch it on The pushes should be mounted on an oblong switch block, and may be of different colours or simply marked with panel transfers, but this is, of course, optional. Any number of control points, with two pushes at each point, may be used. Three wires are necessary to each point. Both relay and operating battery should be as near to the wireless set as is possible to keep the low-tension wiring on the set as short as possible.

Finally, see that the relay is kept in a horizontal position and not moved, otherwise, if tilted, its working will be erratic. A neat wood casing can be made to house the relay if desired. If properly adjusted it will be found to operate efficiently without attention.

Of course, it is not necessary to give any instructions as to how to adapt this control to your own particular receiver, as there are so many different arrangements which may be made up, and these depend, naturally, on the type of receiver which is in use, and what form of reproduction is used, i.e., 'phones or loudspeaker. There is one point which must always be borne in mind when fitting up this form of relay, and that is that the current which operates it has naturally to pass through the extension leads, and when only a very small battery or cell is used to operate the mechanism there is a risk of such a loss of current in passing through the long leads that the relay fails to operate. Therefore, obtain a really heavy extension lead—one of the multiple leads sold by Messrs. Bulgin especially for the purpose is admirable—and try to avoid a heavy loss through the leads by using large-capacity batteries or, alternatively, one of the smaller types of accumulator.

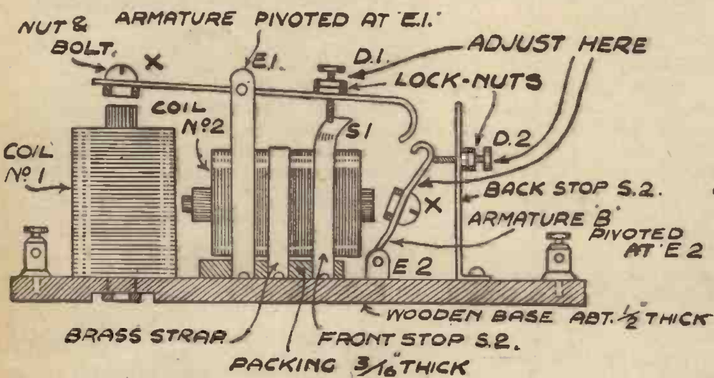


Fig. 11.—Relay in normal position—note top armature, resting on stop, as also bottom armature. No coils energised.

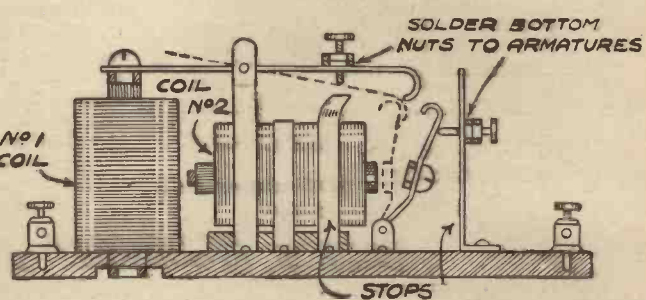


Fig. 10.—Showing top armature in action at the moment of energising No. 1 coil. The armature is clear of its stop for a moment, and this frees the bottom armature which is shown dropped clear by its own weight. The dotted lines show the previous position of the armatures. Top armature drops back on to its stop after being momentarily energised.

"The Man Who Wrote 'The Maid of the Mountains'"

MOST people are familiar with the melodies which ran through that musical-comedy success of the last war, "The Maid of the Mountains," but how many know anything about its composer, H. Fraser-Simson, who is, in fact, one of the most versatile and successful of British theatre composers? The life and work of "The Man who Wrote 'The Maid of the Mountains,'" will be the subject of a musical biography to be broadcast in the Home Service programme on June 28th. Compiled by M. Willson Disher, Gordon McConnel and Gwen Williams, this programme will give a picture of an exceedingly versatile musician who has created not only popular but musicianly scores for musical comedy, revues and ballet. Many listeners will recall Fraser-Simson's settings of the Christopher Robin verses by A. A. Milne.

The singers will include Joan Cross, Dennis Noble and Billie Baker, supported by the B.B.C. Theatre Chorus and Theatre Orchestra, conducted by Stanford Robinson.

BROADCAST ITEMS

Film Festival (4): "Babes in Arms"

THE fourth production in the Summer Film Festival will be a revival of the radio version of "Babes in Arms," which was regarded at the time as a model in intelligent compression for broadcasting purposes. It will be heard on July 1st. Of recent film music scores of this type this is surely one of the most attractive—which is hardly surprising when it is remembered that Richard Rodgers and Lorenz Hart were responsible for it. The haunting "Where or When" and the high-spirited "Good Morning" are regarded as excellent examples of the present trend in popular music, particularly the former.

Why "Y" Working?

Further Notes on Dipole Aerials, by H. J. BARTON CHAPPLE, B.Sc.

THERE are no doubt many newcomers to radio, both in the Services and outside, who are called upon to work with dipole aerials for the first time. Furthermore, it is possible that some of the pre-war transmitting folk who used certain types of feeder and aerial systems did so without thoroughly appreciating their real significance when it came to the question of why certain steps were taken. The notes which follow have been prepared with the object of clarifying an important point in so far as it applies to a twin-wire matched impedance feeder system which has been found to be very suitable for use with push-pull transmitters, and is really a continuation of the data and description furnished in PRACTICAL WIRELESS dated June 1st, pages 239 and 240. The success of this complete aerial system may be said to depend primarily on certain physical dimensions, which must be correct for the particular operating frequency allocated for the installation. These are shown as X, Y and Z in Fig. 1, and when this has been erected correctly it is only necessary to determine the right load conditions by suitably adjusting the coil taps at the transmitter.

Proper Matching

The aerial is a dipole, erected either horizontally or vertically as required, and this is fed by a twin-wire open feeder. In the June 1st issue, referred to above, it was shown that the maximum current conditions occurred at the centre of the aerial, but feeder connection is not made directly at that point. As will be seen

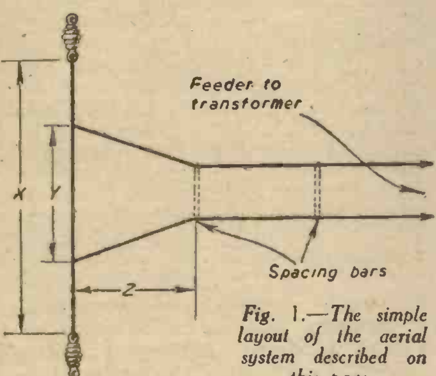


Fig. 1.—The simple layout of the aerial system described on this page.

from Fig. 1, the feeder is made to diverge for a distance Z before the junction is made. This is for the purpose of introducing an exact impedance match between the aerial and the twin wire feeder termination. This ensures a maximum transfer of power, and also eliminates any radiation from the feeders themselves. This matching question is an important one, and must be accepted at this stage; further details concerning its working will be dealt with in a subsequent issue.

The transmission line has a certain characteristic surge impedance which has been shown to depend upon the size and spacing of the conductors comprising it—see formula on page 240—and when the proper adjustment of the line is made at the radio frequency employed then it will act as a pure resistance joined across the output of the transmitter's last stage. It will be found in practice that for most commercial purposes the dimensions of the feeder line are chosen so that it provides a characteristic impedance of 600 ohms.

Surges

When the whole system is correctly balanced, each of the twin wire feeders is at an equal but opposite potential to the other, and in consequence radiation from the lines is neutralised. If this condition is not achieved, that is, if phasing and matching is not accomplished, then all the power will not be delivered to the dipole aerial for radiation into space, and the remainder will surge backward and forward along the line causing reflections, and so upsetting the efficiency of the installation. Under correct working conditions, however, the only loss should be the I^2R losses, which is quite negligible.

Useful Formula

The form of connection between feeder lines and aerial shown in Fig. 1 is generally referred to as Y-matching, and if the formulæ which follow are used correctly, each installation should be capable of providing maximum radiation at the wavelength or frequency selected. The first item is naturally the length of the aerial itself, and in this case a small reducing factor k has to be introduced to allow for the fact that the aerial cannot be erected in free space. This factor will vary according to the diameter of the wire employed for the aerial, the factor becoming larger the thinner the wire. In addition, slight changes in k have to be made according to the frequency employed. For frequencies below 3,000 kilocycles, k can be taken as 0.96; between 3,000 and 28,000 as 0.95; and above 28,000 as 0.94. Reverting to Fig. 1, therefore, we have the length of the dipole X given by

$$X = \frac{150{,}000k}{f} \text{ metres}$$

where f the frequency of operation is expressed in kilocycles. That is to say, for a 2 metre system the aerial length would be 0.94 metres. If it is desired to express X in feet, then it is only necessary to introduce a simple conversion factor and we have

$$X = \frac{492{,}000k}{f} \text{ feet}$$

The next important dimension concerns the coupling between the aerial itself, and the diverging lines of the twin feeder cable, and in Fig. 1 this is shown as Y. Here, again, a reducing factor has to be introduced which changes slightly according to the frequency of operation. Calling this k_1 we have k_1 is 0.25 for frequencies below 3,000 kilocycles; 0.24 for frequencies between 3,000 and 28,000 kilocycles and 0.23 for frequencies above 28,000 kilocycles. The length Y now becomes

$$Y = \frac{150{,}000k_1}{f} \text{ metres}$$

where f is in kilocycles or

$$Y = \frac{492{,}000k_1}{f} \text{ feet}$$

The final item now refers to the length Z of the diverging section of the feeder connection and this is given by the formula:

$$Z = \frac{45{,}000}{f} \text{ metres}$$

where f is in kilocycles as before or

$$Z = \frac{147{,}600}{f} \text{ feet.}$$

These simple equations only hold good for those installations where the characteristic impedance of the twin wire feeder line is 600 ohms, but as was mentioned earlier this is the standard worked to in the majority of the Service and commercial installations. If, therefore, this figure is substituted in the formula given on page 240 (June 1st issue), it will be found that the distance between the wires of the twin feeder is nearly 200 times the radius of the wire used for the feeders. That is to say, if No. 6 gauge copper wire was used for the transmission line, then since the radius of this wire is 0.08in. the distance between the wire centres for the twin run would be approximately 16in.

An Example

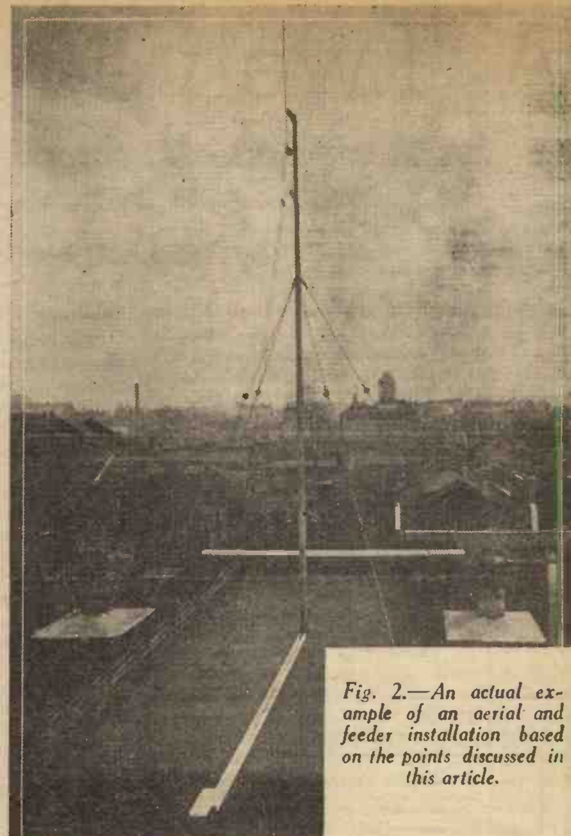


Fig. 2.—An actual example of an aerial and feeder installation based on the points discussed in this article.

As an indication to readers of an actual dipole aerial erection with a Y matched twin wire open feeder, reference can be made to Fig. 2. This shows a dipole secured by an arm at the top of a mast, which in turn is guyed to a high flat roof on the top of a building. The feeder cables are held apart by insulating distance pieces of the appropriate length, and are connected to the aerial proper at an exact distance based on calculations using the three preceding formulæ.

A Twelve-range Test-meter

A Home-made All-purpose Instrument with Single Switch Control

By W. J. DELANEY

MOST readers are now aware that an all-purpose tester may be made up round a single range milliammeter. It is usual to use a meter with a full-scale deflection of 1 mA. for this purpose, and to increase the current reading various resistances are shunted across it. To enable voltages to be read, resistances are connected in series with it, and for the reading of actual resistance values a small voltage is included in series. The basis of all these tests is that the meter passes a current up to the maximum indicated on the meter, and by including additional

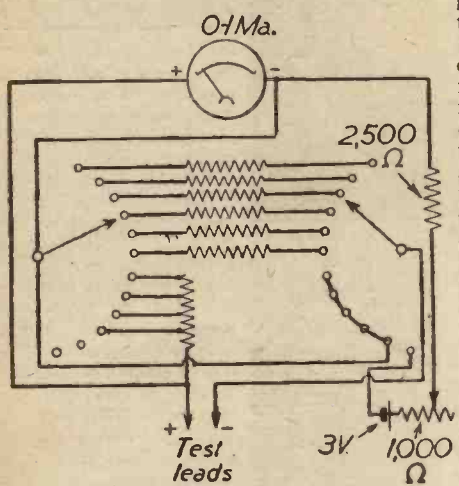


Fig. 1.—Theoretical circuit of the 12-range meter.

components inside the meter case, and choosing these properly, indications may be provided so that instead of taking the meter reading for, say, .5 mA., this may represent 50 volts. For the benefit of new readers, the idea works out as follows: The meter will have an internal value, usually of 50 or 100 ohms. Any meter may be used, but the actual current range should not be greater than 1 mA. Suppose that we use a meter with a resistance of 100 ohms, and connect across it a resistance of 100 ohms. This means that if a small voltage is applied through a circuit so that a current of 1 mA. flows, this will divide and flow equally through the meter and the extra 100 ohms resistance, and accordingly the meter needle will only rise half-way up the scale. If the scale is calibrated, this would mean that the meter would indicate .5 mA., but we suggested that the meter had been connected to a circuit through which 1mA. was flowing, and therefore, our meter indication is only half of the true current. In other words, we have multiplied the scale by 2 by shunting the meter with a resistance equivalent to the meter resistance. If we shunt the meter with a resistance of such a value that only one-tenth of the current flows through the meter and nine-tenths through the shunt resistance, the meter scale will be multiplied by 10, and so on.

Voltage Readings

The above explanation shows how the meter may be made to read various current ranges merely by switching in suitable shunt resistances. To enable a voltage reading to be obtained, for which purpose the meter has to be joined in parallel with the supply or circuit, some form of limiting resistance must be included, also in series, so that the total current flowing through the meter does not exceed 1 mA. Suppose we wish to make the needle indicate 10 volts when it points to 1 on the scale (that is, at full-scale deflection). Ohms Law gives us the rule that 1 mA. will flow through a resistance of 10,000 ohms when 10 volts are applied (current equals voltage divided by resistance). Therefore, if our meter is 100 ohms and we connect a resistance of 9,900 ohms in series and then connect the two across a 1-volt supply the needle would rise to 1 on the scale and thus we have obtained our desired range. This may be extended up to any desired voltage range, although if, for instance, we wish the meter to read 1,000 volts, we need not use a resistance of 999,900 ohms, as the percentage error would be so small that we could use a standard component of 1,000,000 ohms with little margin of error on the scale. The use of the meter for measuring resistances is carried out in a similar manner, including a small cell inside the instrument so that this is connected in series when a resistance is being measured, and calibrating our scale in resistance values in ohms, according to the current flowing. Usually, a home-made meter is arranged to cover only one range of resistance values, external batteries then being added to give multiples of the resistance range as required.

A Typical Sample

The following constructional details will give an idea of the lines to be followed in making an all-purpose meter, the main

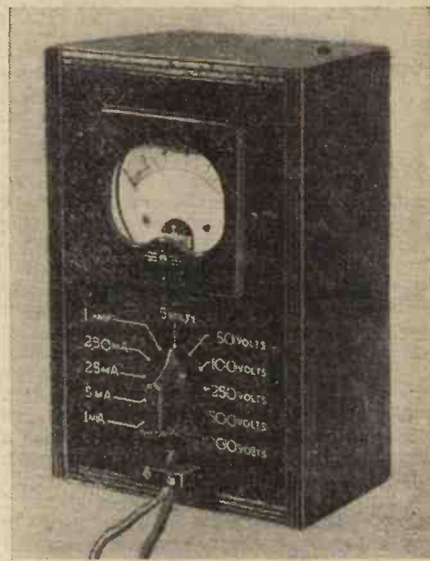


Fig. 3.—The finished instrument in its home-made case.

difference between the average home-made instrument and a commercial meter being in the selection of the appropriate ranges. Usually, the home-made instrument is provided with plugs and sockets, whereas the commercial instrument has a single control with multi-switch unit for the same purpose, and by adopting this method of construction the use of the meter is greatly simplified, and a more professional finish is obtained. In the sample illustrated, a double-band 12-contact switch was used, this being manufactured by A. B. Metal Products, Ltd., and may be obtained from B.T.S. The meter used was supplied by Premier Supply Stores and has an internal resistance of 50 ohms. We understand, however, that these are no longer available, but many readers may have one of these on hand and wish to make the instrument. On the other hand, for those who have an instrument of 100 ohms or who obtain one of that value, we give below a table of the necessary shunt and series resistances for various current and

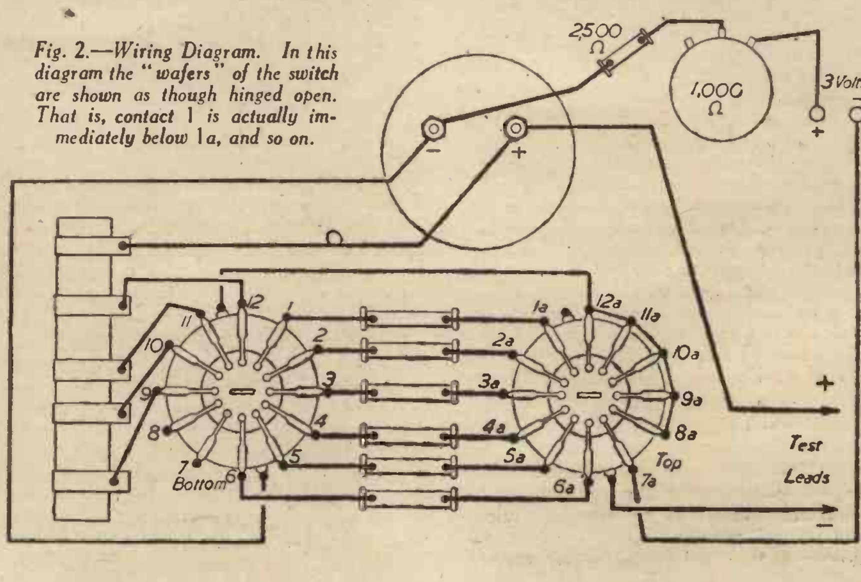
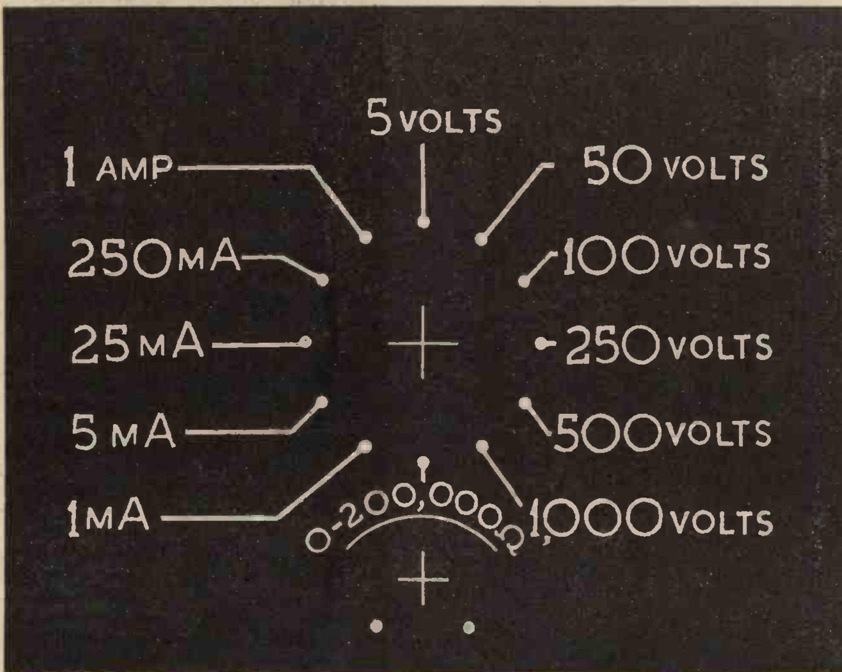


Fig. 2.—Wiring Diagram. In this diagram the "wafers" of the switch are shown as though hinged open. That is, contact 1 is actually immediately below 1a, and so on.

voltage ranges. From these the appropriate values may be chosen to give any desired range. Incidentally, Premier Radio can supply a ready-wound shunt resistance for a 50-ohm 1 mA. meter which will give readings of 5mA., 25mA., 250mA., and 1 amp. The wiring of the shunt and series resistances to the two-bank switch for the different ranges is shown in Fig. 2, and it will be seen that when set to the "Resistance" range, a battery and variable resistance is included in circuit, in addition to a fixed resistance. These are essential additions. When a small battery is included in series with the meter, a given range will be provided, but as the battery becomes discharged the reading will vary and thus a scale could not be accurately calibrated. Therefore, if a moderately low-value resistance is included in series, this may be adjusted to compensate for the varying voltage of the battery. In the original instrument this resistance has a total rating of 1,000 ohms, and it is included on a small bracket inside the box, with a hole at the top through which a small screwdriver may be inserted for a zero setting. The normal spindle is cut down to about ½in. in length and is then slotted by means of a thick-bladed hack-saw or two blades mounted side by side on a hack-saw frame. The battery used was a standard No. 8 torch cell, a small section of the bottom of the box (home-made) being cut out, and two spring contacts being made from the brass strips taken from a disused flashlamp battery. A sliding metal lid was provided with a keyhole and hinged to facilitate replacement when desired. To obtain the zero setting the two test leads are short-circuited, and the screwdriver inserted in the hole and the needle adjusted to read an exact zero. With a 50-ohm meter, a 1,000-ohm variable and a fixed value of 2,500 ohms, the meter scale will read from 0 to 200,000 ohms.



This dial indicator may be cut out and stuck on the panel. Copies on art paper may be obtained from this office for 3d.

Test Prods

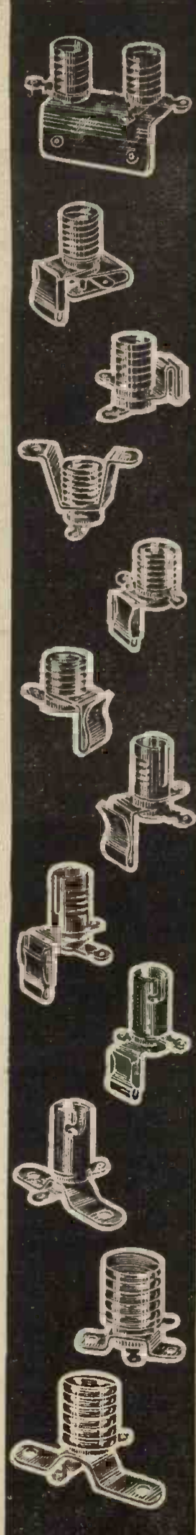
The test leads are ordinary red-and-black flex connected as shown to indicate correct polarity. This is most important and must be preserved to avoid damaging the meter. At the end of the leads, sockets are soldered, and these are made to take crocodile clips or other methods of obtaining contact at the points of a circuit which are to be tested. Alternatively, the Bulgin test prods may be used. As the meter in question was intended to be used for charging purposes (on the 1 amp. range), clips had to be used to maintain constant contact, but this is a point which may be left to the individual constructor. For accuracy, the series resistances should be specially selected and most manufacturers can supply these specially at a slight extra charge. These are incidentally also obtainable from Premier Radio, guaranteed 2%+.

SHUNT RESISTANCES

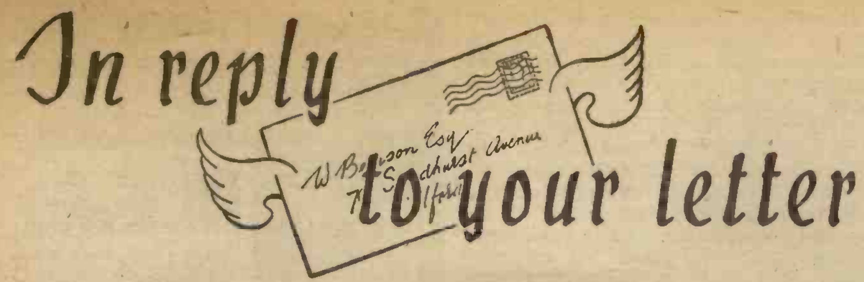
Multiplying Factor	Resistance in Ohms
2	100
3	50
4	33.33
5	25
6	20
8	14.29
10	11.11
20	5.26
30	3.45
40	2.56
50	2.04
60	1.695
80	1.266
100	1.010
200	0.503
300	0.334
400	0.251
500	0.200
600	0.167
800	0.125
1,000	0.100

SERIES RESISTANCES

Voltage Range Desired	Resistance in Ohms
2 volts	1,900
3 „	2,900
5 „	4,900
10 „	9,900
15 „	15,000
20 „	20,000
30 „	30,000
50 „	50,000
100 „	100,000
150 „	150,000
200 „	200,000
300 „	300,000
500 „	500,000
1,000 „	1,000,000



In reply to your letter



Mains Transformer Connection

"I have removed a mains transformer from a commercial set and there is one little thing which puzzles me in its connection. There are two heater windings, one centre-tapped and one not. I know the set used 6.3 volt valves and should be glad to know how to use these two windings in the set, in the absence of the centre-tapping. The large H.T. winding is centre-tapped as usual."—M. P. (Gainsboro').

IN many commercial receivers the rectifier heater winding is not centre-tapped, the H.T. positive line being taken from one side of the filament or heater. This is apparently the case in your component, the centre-tapped low-voltage winding being intended for the valves in the receiver. This arrangement works quite satisfactorily and on many receivers there is little difference from the point of view of hum when the centre-tap is used. The main reason for dispensing with the tapping is, of course, one of economy.

Damaged Valve

"I was recently overhauling my set and in thinking the valve pins were not making good contact I tried to improve matters by opening the pins with a penknife. I am afraid that I have damaged one of the valves as the set won't work now, and in a test there is no anode current in the valve. The pins are not simple slotted ones, but bowed slightly on the sides and I had a bit of a job to get the knife blade in. Do you think I have done anything to damage the valve?"—B. T. (Blackburn, Lancs).

THERE is a possibility that you have severed the leading-out wire inside one of the pins. Absence of anode current would indicate that it is an anode or filament leg and a continuity test on the filament will enable you to ascertain which is broken. In the case of the filament leads having gone it will be necessary to replace both as it will be found that you will have to try and pull out the lead from the leg and if you attack the wrong one you are bound to break it and thus will have to do both. The slot should be opened as much as possible and the thin wire "fished for" with a crochet hook or similar implement. When located and pulled out a length of bare thin copper wire should be soldered on to the end and the solder at the base of the pin heated and shaken off to leave the hole clear. The wire will then have to be pushed through and pulled straight, when it may be soldered to the point of the pin and excess solder cleaned off. Do not try to remove the pin from the base of the valve.

Midget Receiver

"I wish to make up a very small battery midget capable of pocket use. Will two valves give me the desired result and, if so, what types would you advise, especially as I wish to keep batteries to a minimum? I should also like some recommendation as to a suitable circuit for strict portability."—G. F. (N.W.5).

WE would suggest a two-valver, which will give ample volume with a small built-in frame for headphone use at low H.T. voltage. The Hivac XD and XL valves will be found quite suitable, with transformer coupling. One of the small 45-volt H.T. batteries used for deaf-aids may be employed with a dry accumulator or dry cell. The frame could be wound in the lid of the box, assuming a box about 8in. by 5in. About 40 turns of wire would be needed for the medium-waveband, tapping this for reaction. The most suitable point for the tap would have to be found by experiment. A Bulgin midget transformer could be used for coupling, with the small tubular fixed condensers, etc., to make quite a neat set.

RULES

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.
(5) Grant interviews to querists.

A stamped addressed envelope must be enclosed for the reply. All sketches and drawings which are sent to us should bear the name and address of the sender.

Requests for Blueprints must not be enclosed with queries as they are dealt with by a separate department.

Send your queries to the Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. The Coupon must be enclosed with every query.

Doublet Aerial Feeds

"I am using one of the 'J' type aerials which was originally used by a well-known local transmitter. I am utilising it in conjunction with my commercial communications 8-valver and I am wondering if I can improve on the flex feeders I am now using with this type of aerial. Could you give me your recommendations as to the most effective way of coupling this to my set?"—V. G. T. (Boston).

ALTHOUGH good results are obtainable with twisted feeders used with the aerial mentioned by you, the losses are actually far higher than with any other type of transmission line. The same results apply to both transmitting and receiving aerials and we suggest that you use a properly spaced pair of feeders, coupling these to your receiver either through a small coupling coil or with a tuned matched input circuit.

L.F. Instability

"I recently assembled some parts into a straight four-valve set which, although it works well on mike and pick-up, gives a bad howl on radio. I made several modifications to the layout and screening, but I find that the output is low on the mike circuit and the howl cannot be removed. This leads me to suspect the L.F. section of the receiver and I wonder if you can suggest any likely cause of the trouble. I might mention that I have carried out all the usual tests for instability and have amply decoupled everything and seen to correct working voltages and values."—L. D. S. (Brockley).

A FORM of trouble sometimes experienced in the L.F. section of a receiver or in small P.A. apparatus is that of instability due to the L.F. volume control. This type of component is generally provided with a metal case over the element, and we have met a number of cases where the trouble can only be overcome by earthing this screening cover. Its exact cause cannot easily be discovered, but the trouble is by no means rare and our own A.R.P. equipment installed in this building had to have the control earthed in this manner in order to obtain maximum gain and complete stability. We suggest, therefore, that you try this in your case.

H.T. Battery Resistance

"I was looking through some elementary wireless articles recently and I see that decoupling has to be included in a battery set in order to avoid trouble due to a run-down H.T. battery. This seems rather incongruous to me as surely when the battery is new there is more H.T. and the trouble would thus be more intense with a new battery. Why, therefore, do you have to adopt the procedure mentioned to guard against a low-voltage battery?"—K. E. (Cambridge).

YOU have overlooked the fact that the trouble is due to the fact that without decoupling components H.F. currents will have to pass through the battery to earth. A new battery has a very low H.F. resistance and consequently offers little barrier to the H.F. which is thus effectively earthed. On the other hand as the battery becomes discharged, although the voltage is reduced the internal resistance of the battery increases and thus offers opposition to the flow of H.F. This takes the easier path to earth offered in other parts of the circuit and accordingly troubles arise. By including decoupling resistances in the anode circuits and providing a by-pass condenser to earth, the H.F. is prevented from getting to the battery and therefore, although of high resistance, it does not affect stability. Obviously, however, the reduced voltage, coupled with the fact that resistances are in the anode circuit, will result in poor reception due to lack of H.T. on the actual anode and therefore the battery should not be used when the voltage drops to a certain level—dependent upon the circuit and the characteristics of the valves in use.

REPLIES IN BRIEF

The following replies to queries are given in abbreviated form either because of non-compliance with our rules, or because the point raised is not of general interest.

J. A. W. (Wolverhampton). Your sketch is quite incorrect. You have apparently applied 230 volts to the filament! The 230 volt winding must be joined to the anodes, with the centre tap to earth (H.T.—). The filament is fed from a separate low-voltage winding, and the centre tap is H.T.

G. E. (Bromwich). The valve is not suitable. You must use a Class B type driver in that circuit.

J. S. C. (Glasgow). The aerial is quite suitable, but use a pre-set or small variable condenser in series with the lead-in.

The coupon on page 328 must be attached to every query

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Radio Service Manual

SIR,—With reference to the "Service Manual," I once read this book through prior to purchase and found it the most intriguing and interesting publication on modern radio I've ever read, gripping one from beginning to end so much so I intend to read it through again, hence my desire for a copy. Whilst being sufficiently technical it does help one to see daylight by its very practical text and illustrations, and it is certainly a refresher for those who like myself managed to keep up with early advances in radio, but who in later years, through work and other factors, have let the study slide. As evidence of my present request for another book, I may say that it has renewed my interest in radio and the study of it.

Wishing your publications every success and many recommendations which I, personally, shall gladly add to.—J. E. EASTELLE (Dagenham).

A Satisfied Prize-winner

SIR,—I wish to thank you for the book "Sixty Tested Wireless Circuits," awarded me for solving a recent problem.

It will be very useful for quick reference, as I am constantly making up sets of one kind or another for experiment or for friends.

I have been a constant reader of PRACTICAL WIRELESS from No. 1, and have all the volumes roughly bound for reference.

I look forward to my copy each week, and thoroughly digest its contents, even the advertisements, and hope it may continue to flourish for many years to come.—D. HAY (London, W.).

Suggested Club for Huddersfield

SIR,—I have been a reader of PRACTICAL WIRELESS for the past two years, and have found it a great help on numerous occasions. The formation of a local short-wave club appeals to me, and if any readers in the district are interested I shall be glad if they will please write to me or call.

Regarding the controversy that is going on between the 0-v-1 men and those who support the more elaborate communications receivers, may I add that I listened in with an 0-v-1 and was able to receive all the stations worked by local amateurs, who all use 5-7 valve superhets.—J. HAWKINS (Huddersfield).

A DX Log from Bristol

SIR,—I enclose a short log which may interest other readers. The stations were received during the last three weeks on a simple det. and L.F. arrangement using a 60ft. vertical aerial:

WRUL, WGEA, WRUW, WCBX, WNBI, WPIT, WHAM, WFIL, W1JFG, W1ABQ, W1FH, W4CYU, W1DQ, LY1S, CR6AF, and XGOY.—H. S. THAYER (Bristol).

Prize Problems

PROBLEM No. 406

MELVYN has a two-valve set (battery operated) in which an S.G. valve was used as detector, and the tuning was effected by means of a band-pass pair of coils. He decided that the introduction of a variable-mu valve would be an improvement and accordingly obtained such a valve, fitting the standard form of volume control, namely a potentiometer across a biasing battery, with the arm of the control connected to the lower end of the grid coil with by-pass condenser to earth. He found, however, that instead of varying volume this control introduced serious distortion. Why was this? Three books will be awarded for the first three correct solutions opened. Will entrants please name their preference for a prize, selected from the list on page 310. Entries should be addressed to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 406 in the top left-hand corner and must be posted to reach this office not later than the first post on Monday, July 1st, 1940.

Solution to Problem No. 405

The trouble in Abbott's receiver was an open-circuited by-pass condenser in the cathode-circuit of the output valve. At weak or normal volumes this would have little effect, but at large volumes the effect of a bias resistor without H.F. by-pass would result in distortion and a limiting effect which would reduce volume.

The following three readers successfully solved Problem No. 404, and books have accordingly been forwarded to them:

R. C. Evans, Station House, Llangefni.
E. T. Lascelles, 3, Church Avenue, Aintree, Liverpool, 9.
K. Pitman, 31, Elmtree Road, Pitsea, Essex.

FROM THE TEST BENCH

Screwdriver Blades

MANY constructors find that screw heads become badly damaged when tightening or loosening screws or bolts, and this is invariably due to the fact that the screwdriver blade is wrongly cut. It should not, contrary to general impressions, be sharpened. If possible, the blade should be parallel-sided and the tip should be filed flat. That is, a cross section of the blade should show a rectangle. Unfortunately, this will mean that it will only fit certain slots, and this is generally overcome by making a very slight taper on the blade, but where much constructional work is undertaken it will pay to have several screwdrivers with varying thicknesses of blade, if neatness is to be preserved.

PATENTS AND TRADE MARKS

Any of our readers requiring information and advice respecting Patents, Trade Marks or Designs, should apply to Messrs. Rayner and Co., Patent Agents, of Bank Chambers, 29, Southampton Buildings, London, W.C.2, who will give free advice to readers mentioning this paper.

Classified Advertisements

ADVERTISEMENTS are accepted for these columns at the rate of 2d. per word (minimnm charge 2/- each paragraph). Series discounts of 5 per cent. for 13, 10 per cent. for 26 and 15 per cent. for 52 insertions are allowed. All advertisements must be prepaid.

EACH paragraph will commence with the first word printed in bold face capitals. Additional words in bold face capitals are charged at 4d. per word.

ALL communications should be addressed to the Advertisement Manager, "Practical Wireless," Tower House, Southampton Street, London, W.C.2.

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A CABINET for every radio purpose. Surplus cabinets (undrilled) from noted makers. We have hundreds in stock (no catalogues). Send measurements of chassis, etc., and say what kind of cabinet required. Stamp for reply. Inspection invited.
H. L. SMITH AND CO., LTD., 289, Edgware Road, W.2. Tel.: Pad. 5891.

LITERATURE

NEW Edition. American Amateur Relay League Handbook. 500 pages of up-to-the-minute technical information, 7/-, post 6d. 1940 Jones Handbook; approximately 700 pages dealing with every aspect of Short-wave Radio, 8/6, post 6d.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

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LOUDSPEAKER repairs, British, American, any make. 24-hour service, moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen Street, London, N.1.

REPAIRS to moving coil speakers. Cones/coils fitted or rewound. Fields altered or wound. Prices quoted, including eliminators. Pick-ups and speaker transformers rewound, 4/6. Trade invited. Guaranteed satisfaction. Prompt service.
L.S. Repair Service, 5, Balham Grove, London, S.W.12. Battersea 1321.

MISCELLANEOUS

STAMPS.—50 Italy 8d.; 25 Bulgaria 8d.—Harrowven, 224, King Street, Norwich.

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MORSE TRAINING

WIRELESS Code Courses. "Book of Facts" Free.—Candler System Co. (L.O.), 121, Kingsway, London, W.C.2.

NEW CHASSIS

ARMSTRONG Co. recommending the following economically priced Radio Chassis for good quality reproduction.
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Armstrong Co. have many other models of equal interest, please write for catalogue, 6d. Post Free. Armstrong Manufacturing Co., Warlters Rd., Holloway, London, N.5.

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FREE ADVICE BUREAU

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This coupon is available until July 6th 1940, and must accompany all Queries and Hints.

PRACTICAL WIRELESS, 29/6/1940.

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WEBB'S Radio Map of the World enables you to locate any station heard. Size 40" by 30" 2 colour heavy Art Paper, 4/6, post 6d. Limited supply on Linen, 10/6, post 6d. WEBB'S Radio Globe—superb 12" full-colour model. Radio prefixes, zones, etc. Heavy oxydised mount. Post Paid. 27/6.—Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089.

RECEIVERS AND COMPONENTS

BANKRUPT Bargains. Brand new 1939/40 models, well-known best makes, makers' sealed cartons, with guarantees, at less 30%-40% below listed prices; also Midgets, portables. Send 2½d. stamp for lists.—Radio Bargains, Dept. P.W., 261-3, Lichfield Road, Aston, Birmingham.

COULPHONE Radio, 22, Grimshaw Lane, Ormskirk. All goods previously advertised still available. Special offer. Cosmocord Series III. Crystal pick-ups, 18/6. Stamp for lists.

VAUXHALL.—All goods previously advertised are still available; send now for latest price list, free.—Vauxhall Utilities, 163A, Strand, W.C.2.

DENCO.—Ultra low loss S.W. components, receivers, polystyrene insulation. Send 2d. for Catalogue.—Warwick Road, Clacton, Essex.

RADIO CLEARANCE, LTD. See last week's issue for full list of bargains.
RADIO CLEARANCE, LTD., 63, High Holborn, London, W.C.1. Holborn 4361.

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ALL Guaranteed. Postage Extra.
5/- Parcel of useful Components, comprising Condensers, Resistances, Volume Controls, Wire, Circuits, etc. Value 25/-. 5/- per parcel.
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21/- Small Trader's Parcel of Components. 150 Articles comprising all types Condensers, Valve Holders, Resistances, Chokes, Coils, Wire, etc. Value 85/-, 21/- the parcel.
5/- 100 Wire-end Resistances, assorted capacities. ½ and 1 watt, 5/- per 100.
ORMOND Loud-speaker Units, 2/6. Crystal Sets, 5/6; Westectors Type W2, 2/6; Crystal Detectors, 2/-; Crystals, 6d.; Marconi V24 Valves, 9d. "P.O." Microphones on Stand, for use with any receiver, 5/-; Telsen W349 Iron-core Midget D.R. Coils 5/6; Morse Tapping Keys, 3/-; Buzzers, 1/6.
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SOUTHERN Radio, 46, Lisle Street, London, W.C. Gerrard 6653.

PHILLIPS Transformers 250-0-250 v., 90 m.a., 8/6 each. Type 83 American Rectifiers 6/- each. Yaxley 5-blade Switches 2/9. Surplus Components in 5lb. boxes, comprising Switches, Volume Controls, Resistances, etc., 4/- each, post free. All other lines previously advertised still available.—London Central Radio, 23, Lisle Street, London, W.C.2. Gerrard 2969.

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RADIOGRAM, good tone and working order, also all-wave table receiver. Must be good and reasonable price.—Roberts, Rural Structures, Amersham.

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TUITION

PRACTICAL Postal Courses, radio television, test equipment design, trade-test coaching for R.A.F. posts, I.P.R.E. and I.W.T. exams.; booklet free.—Secretary, I.P.R.E., 3, Shirley Road, London, W.4.

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