NUMBER 150

'TRADER' SERVICE SHEETS

PYE T20

TRANSPORTABLE A.C. SUPERHET

THE Pye T20 receiver is a transportable 4-valve (plus rectifier) A.C. superhet with a self-contained frame aerial. Features in the specification are a sensitivity control which enables a form of Q.A.V.C. to be obtained, and a neon visual tuning indicator of the variable length type. Two chassis are employed, one carrying the main receiver components and valves, and the other the power unit.

CIRCUIT DESCRIPTION

Tuned frame aerial input by **L2, L3** and **C28** to variable-mu pentode signal frequency amplifier (**V1, Mazda metallised AC/VP1**). Provision for coupling external aerial and earth system by small winding **L1.** Pre-set variable resistance **R6** in **V1** cathode circuit operates as sensitivity control by varying fixed G.B. applied. Switch **S2** opens on L.W. and connects **R7** in circuit, thus decreasing sensitivity.

Choke-fed tuned-grid coupling by **L4, C5, L6** and **C31** to triode-pentode frequency changer valve (**V2, Mazda metallised AC/TP**) operating with cathode injection. Triode section forms separate oscillator with anode coils **L8, L9** tuned by **C34**; trimming by **C32** (L.W.) and **C33** (M.W.); tracking by shaped plates; coupling coil **L7** in common cathode circuit.

Neon visual tuning indicator **T.I.** in **V2** pentode anode H.T. feed circuit.

Single variable-mu H.F. pentode intermediate frequency amplifier (**V3, Mazda metallised AC/VP1**) operating with tuned-primary tuned-secondary transformer couplings **C35, L10, L11, C36** and **C37, L12, L13, C38.**

Intermediate frequency 127 KC/S.

Diode second detector is part of double diode output pentode valve (**V4, Mazda AC2/PenDD**). Audio-frequency component in rectified output is developed across load resistance **R25** and passed via coupling condenser **C19,** manual volume control **R26,** and I.F. stopper **R27** to C.G. of pentode section. I.F. filtering by choke **L14** and condensers **C17, C18.** Variable tone control in pentode anode circuit by R.C. filter **R28, C20.**

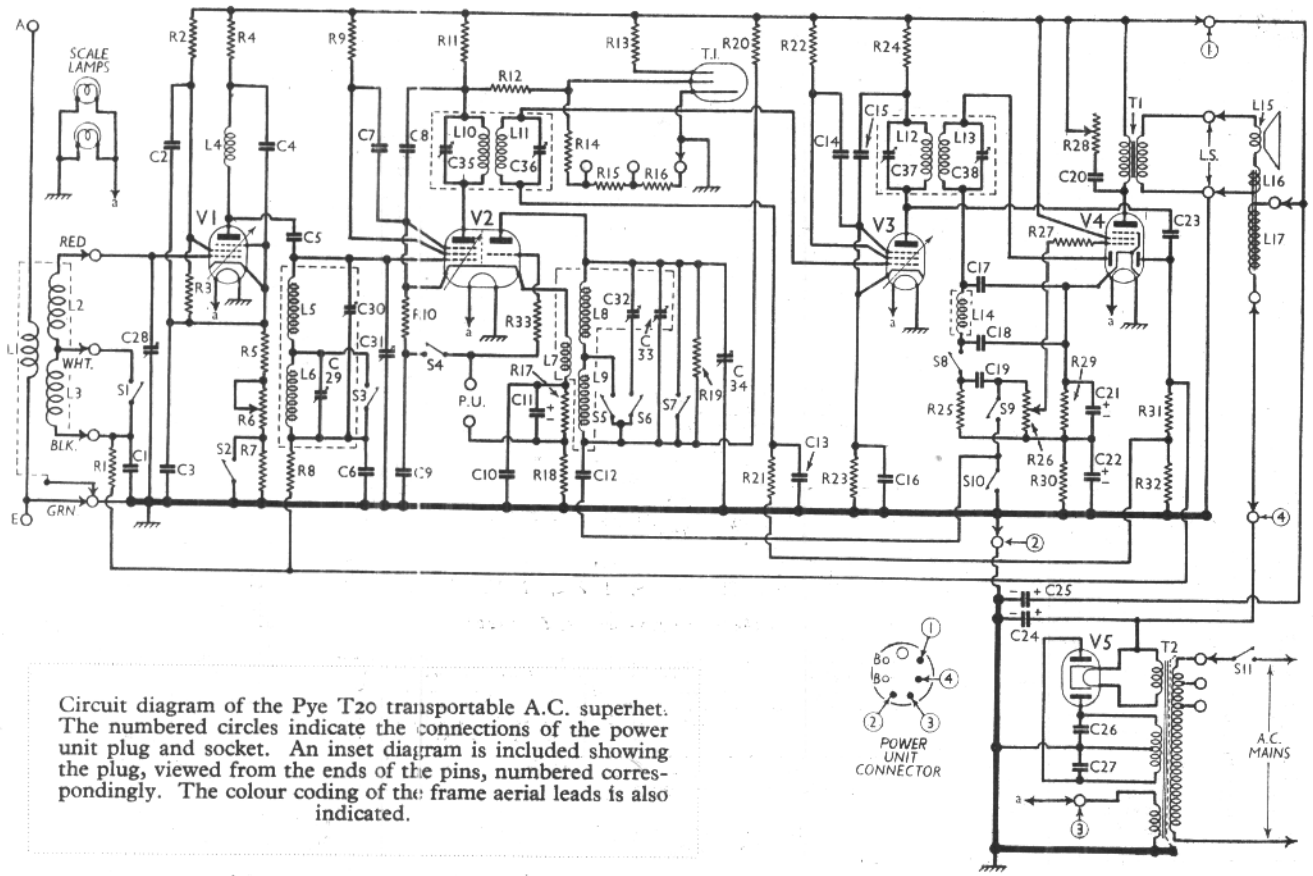
Second diode of **V4,** fed from **V3** via **C23** provides D.C. potential which is developed across **R31, R32** and fed back through decoupling circuits as G.B. to H.F., F.C. and I.F. valves, giving automatic volume control. Delay voltage is obtained from drop along **V4** cathode resistances **R29, R30.** Slight negative potential is applied to **V4** signal diode in order to provide a degree of inter-station noise suppression.

H.T. current is supplied by I.H.C. full-wave rectifying valve (**V5, Ever Ready A11B**). Smoothing by speaker field coil **L17** and dry electrolytic condensers **C24, C25.**

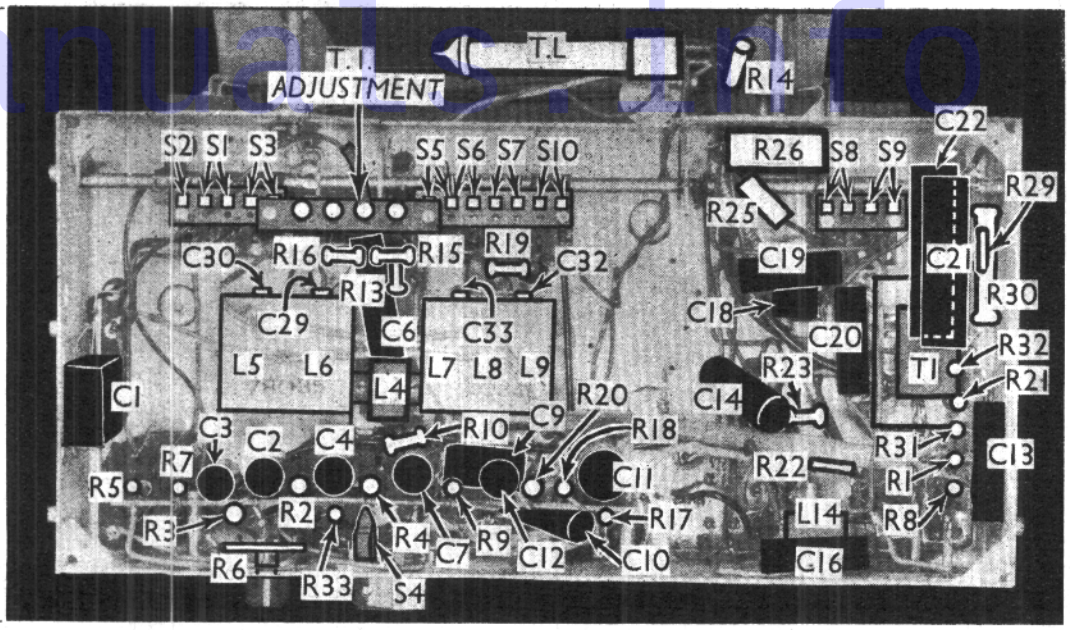
Provision for connection of gramophone pick-up in C.G. circuit of **V2** triode section, which, on gramophone, operates as L.F. amplifier R.C. coupled to pentode section of **V4. R20** functions as anode load, and condenser **C12** as coupling to volume control **R26.**

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 C.G. decoupling	510,000
R2	V1 S.G. H.T. feed potential divider.	15,000
R3		30,000
R4	V1 anode decoupling	10,000
R5	V1 fixed G.B. resistance ..	300
R6	Sensitivity control	2,000
R7	V1 fixed G.B. resistance (L.W.)	800
R8	V2 pent. C.G. decoupling ..	510,000
R9	V2 S.G. H.T. feed	25,000
R10	V2 osc. C.G. resistance ..	110,000
R11	V2 pent. anode decoupling ..	18,000
R12	T.I. anode feed	100,000
R13	T.I. tickler feed	2,100,000



Circuit diagram of the Pye T20 transportable A.C. superhet. The numbered circles indicate the connections of the power unit plug and socket. An inset diagram is included showing the plug, viewed from the ends of the pins, numbered correspondingly. The colour coding of the frame aerial leads is also indicated.



Under - chassis view. Note the tuning indicator adjustment. All the switches are clearly marked. S4 is a jack switch operated by the pick-up plug. The trimmers C29, C30, C32 and C33 are operated through the sides of their respective coil units.

RESISTANCES (*Continued*)		Values (ohms)
R14	T.I. adjustment resistances	250,000
R15		150,000
R16		500,000
R17	V2 fixed G.B. resistances	250
R18		750
R19	V2 osc. tuning circuit shunt	40,000
R20	V2 osc. anode decoupling	100,000
R21	V3 C.G. decoupling	510,000
R22	V3 S.G. H.T. feed	25,000
R23	V3 fixed G.B. resistance	500
R24	V3 anode decoupling	5,000
R25	V4 signal diode load	260,000
R26	Manual volume control	250,000
R27	V4 pentode C.G. I.F. stopper	26,000
R28	Variable tone control	25,000
R29	V4 G.B. and A.V.C. delay voltage resistances	140
R30		750
R31	V4 A.V.C. diode load	510,000
R32		260,000
R33	V2 osc. C.G. circuit stabiliser	2,100

CONDENSERS		Values (μF)
C1	V1 C.G. decoupling	0·5
C2	V1 S.G. by-pass	0·1
C3	V1 cathode by-pass	0·1
C4	V1 anode decoupling	0·1
C5	V1 to V2 H.F. coupling	0·000025
C6	V2 pent. C.G. decoupling	0·1
C7	V2 pent. S.G. by-pass	0·1
C8	V2 pent.-anode decoupling	0·1
C9	V2 osc. C.G. condenser	0·0002
C10	V2 cathode by-pass	0·1
C11*	P.U. G.B. circuit by-pass	25·0
C12	V2 osc. anode decoupling	0·1
C13	V3 C.G. decoupling	0·1
C14	V3 S.G. by-pass	0·1
C15	V3 anode decoupling	0·1
C16	V3 cathode by-pass	0·1
C17	I.F. by-passes	0·0001
C18		0·0002
C19	L.F. coupling to V4 pent.	0·1
C20	Part of T.C. filter	0·025
C21*	V4 cathode by-passes	50·0
C22*		20·0
C23	V4 A.V.C. diode coupling	0·0002
C24*	H.T. smoothing	8·0
C25*		16·0
C26	V5 anode H.F. by-passes	0·001
C27		0·001
C28†	Frame aerial tuning	—
C29‡	F.C. C.G. circuit L.W. trimmer	—
C30‡	F.C. C.G. circuit M.W. trimmer	—
C31†	F.C. C.G. circuit tuning	—
C32‡	Osc. circuit L.W. trimmer	—
C33‡	Osc. circuit M.W. trimmer	—
C34†	Osc. circuit tuning	—
C35‡	1st I.F. trans. pri. tuning	—
C36‡	1st I.F. trans. sec. tuning	—
C37‡	2nd I.F. trans. pri. tuning	—
C38‡	2nd I.F. trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

OTHER COMPONENTS			Approx. Values (ohms)
L1	External aerial coupling		0·1
L2	Frame aerial windings		1·9
L3			19·8
L4	V1 anode H.F. choke		530·0
L5	F.C. C.G. circuit tuning coils		1·5
L6			4·5
L7	Oscillator reaction coil		0·7
L8	Oscillator tuning coils		1·3
L9			4·7
L10	1st I.F. trans.	Pri.	42·0
L11		Sec.	42·0
L12	2nd I.F. trans.	Pri.	42·0
L13		Sec.	42·0
L14	I.F. filter choke		700·0
L15	Speaker speech coil		1·5
L16	Hum neutralising coil		0·2
L17	Speaker field coil		1,650·0
T1	Output trans.	Pri.	740·0
		Sec.	0·3
T2	Mains trans.	Pri. total	44·0
		Heater sec.	0·1
		Rect. heat. sec.	0·2
		H.T. sec. total	350·0
S1-S3	Waveband switches		—
S5, S6			—
S4, S9	Radio-gram. changeover switches.		—
S10			—
S7, S8	Radio muting switches (gram.)		—
S11	Mains switch		—
T.I.	Neon tuning indicator		—

DISMANTLING THE SET

It should be noted that to gain access to the underside of the main receiver chassis it is only necessary to remove the board covering the base of the cabinet, which is held in place by wood screws. The turntable is not in the centre of the detachable board, so, *when replacing*, care must be taken to ensure that it is in the correct position, i.e., nearer the side of the cabinet containing the power pack chassis.

Removing Chassis.—Remove the four control knobs from their spindles (pull off). Disconnect the leads from the frame aerial by loosening the screws on the chassis terminal board. Pull out the speaker speech coil leads from their sockets and remove the power unit connector from the underside of the power unit. Disconnect the speaker field leads from the speaker (screw terminals). Finally remove the four chassis fixing bolts from the underside of the cabinet and the chassis can be withdrawn. *When replacing*, see that the frame leads are connected correctly as indicated on the plan chassis illustration, the lead from the static screen being taken to the green terminal.

Removing Power Unit.—Withdraw the connector plug from the underside and release the two bolts holding the chassis on its shelf. The power unit can now be removed, but take care not to damage the mains switch.

Removing Speaker.—First remove the connector from the power pack chassis, the two field leads from their terminals, and the speech coil leads from their sockets. Release the 2 B.A. nuts securing the power unit shelf in the cabinet and remove the power unit and shelf together. The speaker can now be removed after the four cheese-headed screws holding it to the sub-baffle have been released. Alternatively the baffle-board may be removed with the speaker by taking off the four 2 B.A. nuts at the corners.

Removing Frame Aerial.—First remove the chassis and the power pack mounting shelf as already described. Now take out the four wood screws holding the frame, first making sure that there are no plugs in the external aerial and earth sockets. Three of the screws are easily visible; the fourth is on the bottom side of the frame nearer the external aerial and earth sockets, and is accessible through a hole in the outer edge of the frame.

VALVE ANALYSIS

Valve voltages and currents listed in the table are those obtained from an average receiver operating with a 235 V 50 c.p.s. mains supply (216-235 V mains transformer tap). The red, white and

(*Continued overleaf*)

PYE T20 (Continued)

black frame aerial terminals were short-circuited, and the receiver controls were set as follows:—wavechange switch at M.W.; gang condenser at minimum capacity; sensitivity control **R6** at maximum (minimum resistance); volume control **R26** at maximum. All voltages were measured on the 1,200V scale of an Avometer, chassis being negative.

If a valve adaptor is used in making measurements, it may be found necessary to stabilise **V1, V2** and **V3** with a 0.1 μF condenser connected between S.G. and cathode, or anode and cathode. The readings given for the triode section of **V2** were taken under oscillating conditions with the valve in its own holder.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 AC/VP1	227	4·0	167	1·2
V2 AC/TP*	177	5·2	233	1·6
V3 AC/VP1	232	7·6	227	1·7
V4 AC2/Pen DD	257	34·0	282	6·8
V5 A11B	350†	—	—	—

* Triode osc. anode 104 V 1·8 mA.
† Each anode, A.C.

GENERAL NOTES

Switches.—**S4** is the pick-up jack switch, at the rear of the chassis, which opens when the pick-up plug is pushed fully home. **S1-S3** and **S5-S10,** the wave-change and gramophone switches, are all beneath the chassis, and are in three units, all ganged together by a rod running right across the chassis.

NOTE.—**S5** and **S6** have one common contact, and **S2** is formed of a single fixed contact blade and a metal contact piece which is connected to chassis.

The table (col. 2) gives the switch positions for the various control settings, O indicating open, and C closed.

Switch	M.W.	L.W.	Gram.
S1	C	O	O
S2	C	O	O
S3	C	O	O
S5	C	O	O
S6	O	C	O
S7	O	O	C
S8	C	C	O
S9	O	O	C
S10	C	C	O

S11 is the Q.M.B. mains switch, fitted to the power pack, and operated through a hole in the side of the cabinet.

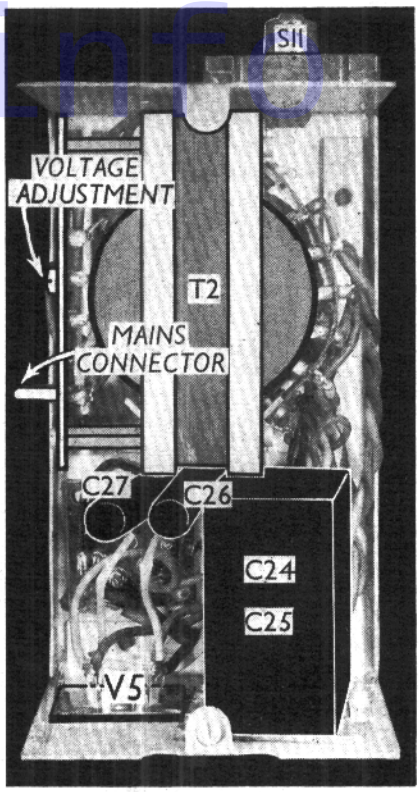
Coils.—**L1- L3** are the frame aerial and external aerial coupling coils. There is a screen round the outside of the frame, attached to the inside of the cabinet, and consisting of a paper strip carrying a number of parallel wires. The ends of these are joined, and provided with a lead and spade tag connected to chassis by the same screw that attaches the green frame lead.

L4 is an H.F. choke, beneath the chassis, while **L5, L6** and **L7-L9** are in two rectangular brass screening boxes beneath the chassis. The I.F. transformers, **L10, L11** and **L12, L13** are in screened units on the chassis deck. These contain the associated trimmers, and also a number of condensers and resistances which are indicated in our plan chassis view, and may be identified by their values.

L14 is an I.F. choke, beneath the chassis.

Scale Lamps.—These are two Ever-Ready M.E.S. types, rated at 6.2 V, 0.3 A.

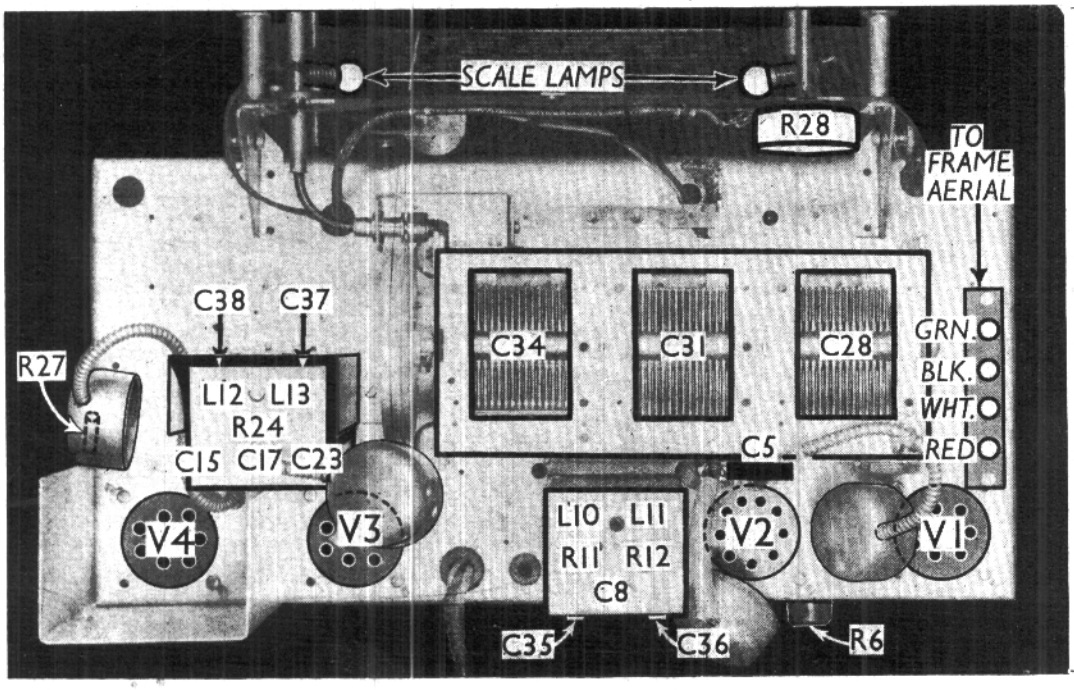
External Speaker.—There is provision for a low resistance external speaker (1.5-2.5 O) at the rear of the chassis. This may be used either alone or, by plugging into the internal speaker socketed plugs, in conjunction with the internal speaker.



Plan view of the power unit.

Condensers C24, C25.—These are two dry electrolytics in a single unit in the power pack. They have a common negative (black) lead. The yellow lead is the positive of **C24** (8μF) and the red the positive of **C25** (16 μF).

Circuit Alignment. — This will be found on page IV this week.



Plan view of the chassis. Note that the I.F. trimmers are at the sides of the screens, and the units also contain a number of additional components. The frame aerial terminals are colour coded. R27 is inside the top cap screen of V4.

MAINTENANCE HINTS & PROBLEMS

Routine Tests : Helpful Gadgets : Unusual Faults

Faulty Soldering Again

I recently had to service a Pye TP/AC receiver, the complaint being that the neighbours had just installed a new set, and every time they switched on it caused our customer's set to start buzzing. Nothing would stop this except switching off for about ten minutes and then switching on again.

When I called the set was working perfectly and after a brief check over, the set next door was switched on, but unfortunately this did not produce the desired (or undesired) buzz ; after trying this two or three times without success, I tried tapping the valves and set, hoping this would cause the trouble to start, but no buzz appeared, so I left the customer another set to carry on with, and took his back to the workshop.

At first it worked quite O.K., but after about two hours a loud buzzing started and continued for about fifteen seconds, then stopped again. The set was left alone and in a few minutes the noise started again, and this time it continued without stopping, completely drowning the programme.

It was then I discovered that, apart from the noise in the speaker, there was also a faint " sparking " sound coming from the mains unit (which in the TP/AC is in a separate compartment above the set).

I removed the mains unit, took off the screening cover and switched on again, and found that by gently prodding the tags on the mains transformer H.T. winding I was able to make the noise start or stop.

Closer investigation showed that the enamelled wires coming from the transformer to the tags had not been cleaned before soldering, and sparking was taking place between the wire and the tag. After these had been cleaned and re-soldered the trouble was completely cured.

A similar fault in another set of the same make and type was found to be due to the same trouble, only in this case it was on the primary side of the transformer.—J. J.

Little Faults—Big Effects

The owner of a Marconiphone 264 receiver complained that when the tuning control was operated he heard a kind of scraping noise in the loud-speaker ; he also stated that the set had previously been attended to by his nephew, " who was a wireless expert and very clever at the job," but in spite of all this a cure had not been effected. The inexpert owner volunteered the suggestion that the condenser vanes were shorting or that there were particles of metal between them. Upon testing the set and operating the tuning control the symptoms did point to condenser vanes rubbing ; the chassis was removed from the cabinet and the rotary vanes of each section were found to be in their normal positions midway between the fixed ones, and not shorting at any position.

The " scraping noises " were discovered to be due to the three forked-shape brass springs, one in each condenser section, which are in contact with the condenser spindle, having become greasy and dirty, thereby causing a variable resistance rubbing contact. The springs were gently pulled outwards towards the back of the chassis and then slid out of position, cleaned, and replaced without disconnecting the leads attached to them ; the parts of the spindle against which the springs press were also well cleaned, and this little job eliminated the noises entirely.

* * *

An Ultra 55 on test was found to be working satisfactorily on the long waves, but was unstable and in an oscillating condition on the medium waveband. All tuning coil circuits and connections were checked over and switches cleaned, but without avail. In going over the coils again in search of an obscure dry joint, it was noticed that a screw which should have clamped two halves of a metal screening plate together, and through which the coil former on which the coils were wound was passed, was loose ; tightening this screw and thus securely clamping the two halves of the screen together overcame the instability.

* * *

A Marconiphone 224 gave very weak results and all the circuits seemed to be out of gang, as stations were tuned in at any position but the correct ones on the wavelength scale. Voltages at the output stage were checked over and new valves were tried without improvement. Having eliminated the output stage being a contributory cause of the weak volume, it was decided to check back towards the aerial circuit ; all voltages were correct excepting the oscillator anode of the frequency changer valve, which was very low. The trouble was due to a 100,000 O resistance in that circuit which had increased very much in value. Fitting a new resistance restored the lost volume, and the stations again registered correctly on the scale.

PYE T20 CIRCUIT ALIGNMENT

(See pages VI, VII and VIII for circuit diagram and chassis illustrations.)

Calibration.—To adjust calibration rotate the tuning knob until pointer is at higher wavelength end of scale. With disc drive against stop, release set screw clamping drive drum to condenser spindle and set rotor vanes fully in mesh with stator, then tighten set screw. Pointer should now be located at end of horizontal scale lines, but if not, the scale end-clasps should be released, and the scale plate moved slightly. If further correction is needed, the three screws at the end of the drive should be released and the indicating pointer and its tracer moved while the gang vanes are kept fully in mesh.

I.F. Transformers.—All adjustments should be made with the volume control at maximum and the frame aerial terminals short - circuited. Remove frequency changer **V2** C.G. connection (top cap) and connect a 0.5 MO resistance between cap and chassis. By-pass triode oscillator anode to chassis with a 0.25 μF condenser to stop oscillation. Feed in 127 KC/S signal between chassis and **V2** top cap via 0.002 μF condenser and adjust I.F. trimmer **C38, C37, C36, C35,** in that order, for maximum reading on output meter. A loading resistance of 25,000 O must be employed in view of the band-pass characteristics of the transformers. When tuning the primary of either transformer the resistance is connected across the secondary, and when the secondary is tuned, the load is applied to the primary.

Signal Frequency and Oscillator Circuits.—After the I.F. alignment has been carried out, the by-pass condenser in the oscillator circuit should be removed, also the F.C. resistance (replace top cap connection), and the frame aerial terminals shorting wire. All signal frequency and oscillator adjustments are made with the gang condenser vanes fully out of mesh and with the volume control at maximum, the input signal being kept as low as possible to avoid A.V.C. action.

Connect a 0.5 MO resistance across terminals normally holding red and black frame aerial leads, and, with the wave-change switch set to M.W., feed in a 196 m. (1,530 KC/S) signal via a 0.002 μF condenser to the same two terminals. Adjust M.W. oscillator trimmer **C33** for maximum output, bearing in mind that if more than one peak is obtained, that nearer to *minimum* capacity is correct. Next adjust H.F. M.W. trimmer **C30.** Check calibration at top of scale ; if low, it is fairly certain that **C33** is tuned to incorrect peak.

Set wavechange switch to L.W. and feed in 775 m. (387 KC/S) signal (with gang at minimum capacity as before). Adjust L.W. oscillator trimmer **C32**, and then H.F. trimmer **C29**, both for maximum output. Finally, feed in 846 m. (354 KC/S) signal and re-adjust **C32,** observing in this instance that the correct peak is the one nearer to *maximum* capacity. Do not re-adjust **C29.**