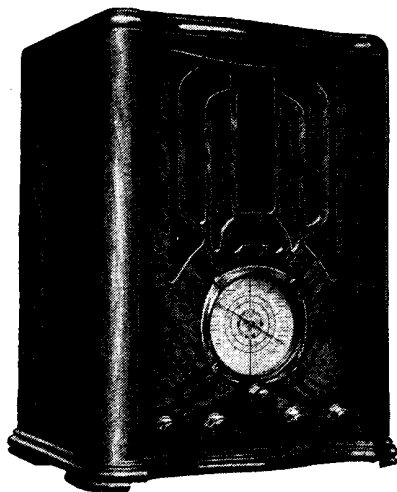


SERVICE ENGINEER

FERGUSON MODEL 378 UNIVERSAL



This Ferguson receiver is supplied by Universal Radio Distributors Ltd.

CIRCUIT.—A seven-valve superhet for operation on either A.C. or D.C. mains and working on long, medium and two short wavebands.

An inductively coupled band-pass filter couples the aerial to the grid of V1, an H.F. pentode, on medium and long waves. On the short wave ranges a single tuned circuit comes into operation.

A further set of inductively coupled coils is used to pass the signal to V2, the frequency changer, a tuned circuit being used on short waves as before.

Coupling to V3, an H.F. pentode, is

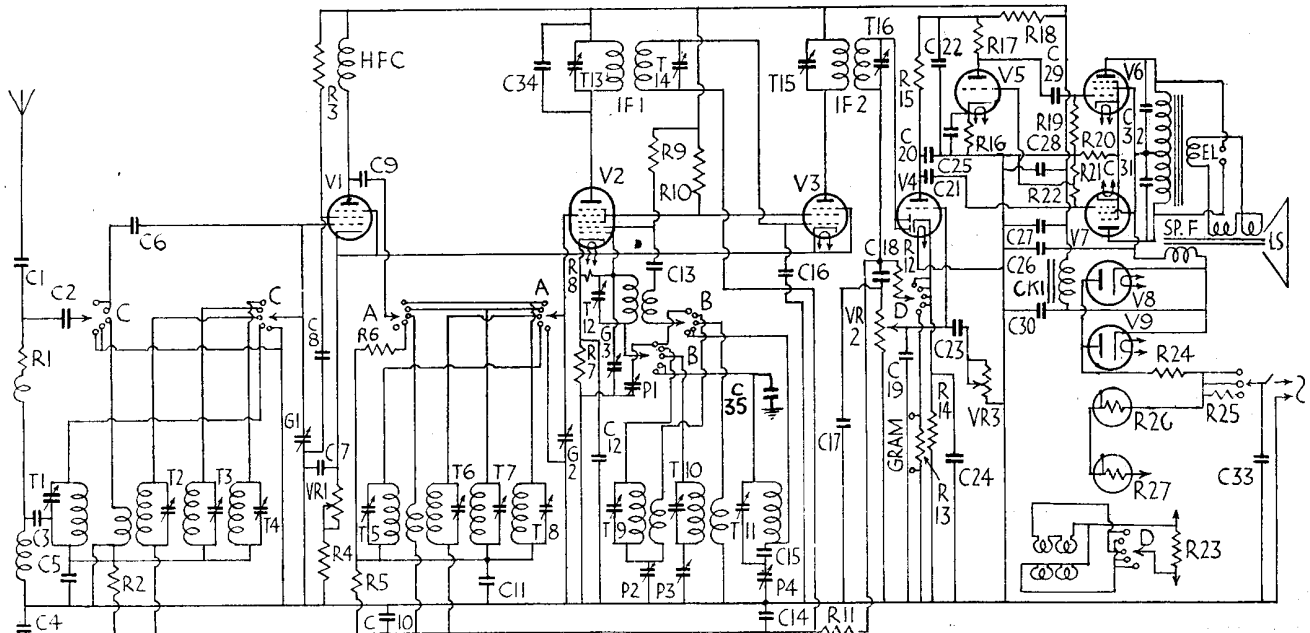
through an I.F. transformer, tuned to 465 kc. A second I.F. transformer is used to couple this valve to V4, a double diode triode.

The diodes of V4 are strapped and used for both demodulation and A.V.C., the bias generated being fed to the preceding valves in the orthodox manner.

The volume control, VR2, operates by varying the input to the grid of V4. Tone

| RESISTANCES | | |
|-------------|-----------------------------|---------|
| R. | Purpose. | Ohms. |
| 1 | Aerial series | 2,500 |
| 2 | V1 A.V.C. decoupling | 500,000 |
| 3 | V1 screen decoupling | 100,000 |
| 4 | V1 and V3 cathode bias | 200 |
| 5 | V2 A.V.C. decoupling | 500,000 |
| 6 | Long-wave anode shunt | 50,000 |
| 7 | V2 cathode bias | 500 |
| 8 | V2 osc. anode load | 50,000 |
| 9 | V2 osc. grid leak | 25,000 |
| 10 | V2 and V3 screen decoupling | 50,000 |
| 11 | V3 A.V.C. decoupling | 250,000 |
| 12 | Diode load | 250,000 |
| 13 | Pick-up shunt | 25,000 |
| 14 | V4 cathode bias | 10,000 |
| 15 | V4 anode load | 250,000 |
| 16 | V5 cathode bias | 100,000 |
| 17 | V5 anode load | 250,000 |
| 18 | V5 anode decoupling | 10,000 |
| 19 | V6 grid leak | 500,000 |
| 20 | V6 and V7 cathode bias | 300 |
| 21 | V7 grid leak ptr. | 50,000 |
| 22 | V7 grid leak ptr. | 500,000 |
| 23 | Dial light shunt | 50 |
| 24 | Voltage dropper | 500 |
| 25 | Voltage dropper | 1,000 |
| 26 | Voltage dropper | 185 |
| 27 | Voltage dropper | 185 |

| CONDENSERS | | |
|------------|-----------------------------|---------|
| C. | Purpose. | Mfds. |
| 1 | Aerial isolating | .01 |
| 2 | Aerial feed | .00025 |
| 3 | Long-wave aerial feed | .01 |
| 4 | Chassis isolating | .01 |
| 5 | V1 A.V.C. decoupling | .002 |
| 6 | V1 grid (s. waves) | .00005 |
| 7 | V1 cathode bias shunt | .1 |
| 8 | V1 screen decoupling | .1 |
| 9 | H.F. coupling | .00025 |
| 10 | V2 A.V.C. decoupling | .1 |
| 11 | V2 A.V.C. decoupling | .002 |
| 12 | V2 cathode bias shunt | .1 |
| 13 | V2 osc. anode feed | .00025 |
| 14 | V3 A.V.C. decoupling | .1 |
| 15 | Long-wave osc. padding | .00025 |
| 16 | V2 and V3 screen decoupling | .1 |
| 17 | H.F. by-pass | .00025 |
| 18 | L.F. coupling | .01 |
| 19 | H.F. by-pass | .00025 |
| 20 | V4 anode decoupling | .001 |
| 21 | L.F. coupling | .01 |
| 22 | V4 and V5 anode decoupling | .1 |
| 23 | Tone control | .01 |
| 24 | V4 cathode bias shunt | .25 |
| 25 | V5 cathode bias shunt | 5 |
| 26 | H.T. smoothing | 20 |
| 27 | H.T. smoothing | 20 |
| 28 | H.T. shunt | .1 |
| 29 | L.F. coupling | .01 |
| 30 | H.T. smoothing | 20 |
| 31 | Pentode compensating | .002 |
| 32 | Pentode compensating | .002 |
| 33 | Mains suppressor | .01 |
| 34 | I.F. shunt | .00005 |
| 35 | L.W. osc. trim. | .000025 |



The circuit of the A.C.-D.C. Model 378 by Ferguson. Following the two barretters, the valves are connected in this order: V9, V8, V7, V6, V1, V2, V3, V5, V4, and so to earth. Pilot lamps are connected between V6 and V1.

FERGUSON 378 UNIVERSAL

is also controlled in the grid circuit by VR3.

The L.F. output of V4 is fed to V5 and V7, through a resistance and capacity stage. V7 is an output pentode, and V5 a phase changer, which feeds V6, another output pentode, via a further resistance and capacity stage. The two output pentodes, V6 and V7, are in resistance coupled paraphrase push-pull and feed the moving coil speaker through a push-pull output transformer.

VR1 is the sensitivity control, and works by varying the bias applied to the cathodes of V1 and V3.

Mains equipment consists of two half-wave rectifiers, two barretters, in the form of valves, electrolytic condensers, and the speaker field.

Special Notes.—There are four dial lamps fixed to the dial assembly by spring clips. They are rated at 6 volts .3 amp.

The extension speaker connections are taken from the primary of the output transformer. An extra speaker should have its own matching transformer.

Removing Chassis.—Remove the knobs from the front of the cabinet (grub screws) and four bolts from underneath. The chassis may then be removed to the extent of the speaker leads which are plugged into a socket on the back of the chassis and may be removed if desired. The plug must, however, be in place during a test under working conditions as the

speaker field forms part of the smoothing equipment.

ALIGNMENT NOTES

Connect a modulated oscillator, tuned to 465 kc., to the grid of V3, and an output meter with large series condenser to the external speaker terminals. Adjust T16 and T15 for maximum reading on the output meter.

Transfer the oscillator lead to the grid cap of V2 and accurately adjust T13, T14, T15 and T16, for maximum reading.

Padding (All Waves).—The padding condensers should be adjusted after completing the I.F. adjustments. These condensers are P1, P2, P3 and P4.

A high-frequency buzzer should be connected in the aerial circuit and the padders adjusted for maximum output on each band with the gang condensers fully meshed.

Long Waves.—Inject a signal of 1,200 metres from a modulated oscillator to the aerial and earth terminals. Tune it in and adjust T11 for maximum output. Then adjust T5 and T1 for maximum output. With the buzzer, and the tuning condenser at maximum, adjust P4.

Return to 1,200 metres and repeat ad-

Below are chassis layouts of the Ferguson 378 Universal. The tinted one is the top view.

| VALVE READINGS | | | | | |
|---|--------------------------------|------------|--------|------|--|
| No signal. Volume maximum. 200 volt A.C. mains. | | | | | |
| V. | Type. | Electrode. | Volts. | Ma. | |
| 1 | All National Union. 6D6 (6) | Anode | 215 | 4.6 | |
| | | Screen | 60 | 1.3 | |
| 2 | 6A7 (7) | Anode | 210 | 1.6 | |
| | | Screen | 70 | 2.2 | |
| 3 | 6D6 (6) | Osc. anode | 135 | 2.25 | |
| | | Anode | 210 | 4.5 | |
| 4 | 75 (6) | Screen | 70 | 1.2 | |
| | | Anode | 50 | .15 | |
| 5 | 76 (5) | Anode | 50 | .55 | |
| | | Anode | 125 | 20 | |
| 6 | 42 (6) | Screen | 130 | 6.25 | |
| | | Anode | 125 | 20 | |
| 7 | 42 (6) | Screen | 130 | 6.25 | |
| | | Anode | 125 | 20 | |
| 8 and 9 | 12Z3 (4) | Cathode | 220 | — | |

justments of T11, T5 and T1, finishing off by again repadding.

Medium and Short Waves.—The above procedure should be followed on medium waves and on the two short wavebands, the tune points and the trimmers being as follows:—


Medium Waves. 250 metres. T10, T6, T2 and P3.

Short Wave 2. 34 metres. T9, T7, T3 and P2.

Short Wave 1. 15.5 metres. T12, T8, T4 and P1.

While adjusting T12, two peaks will be found. The one nearer minimum capacity is the correct.

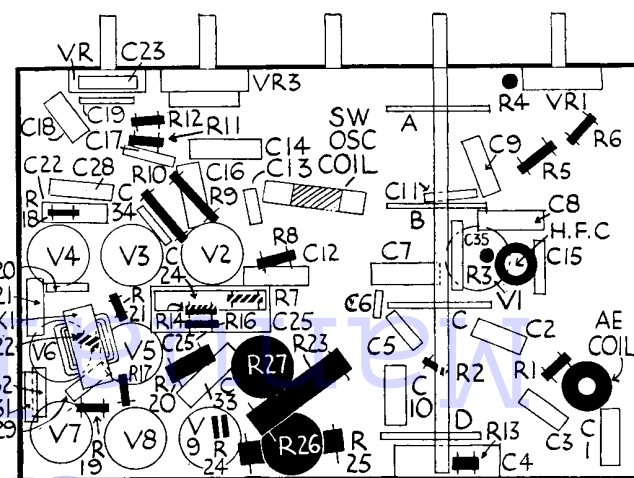
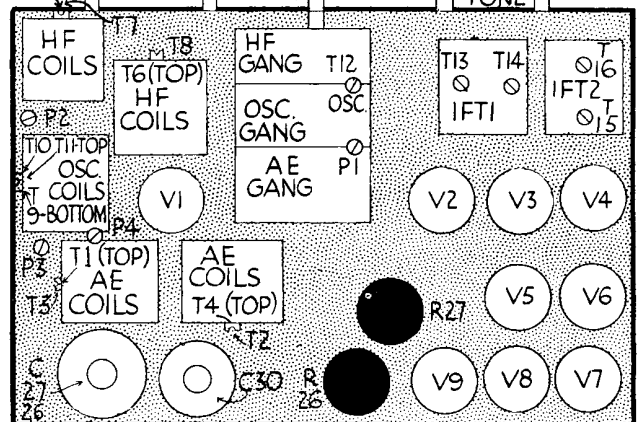
WESTON SUPER OSCILLATOR



H.F. range 100 kilocycles to 25 modulated or unmodulated.
 All ranges attenuate to below 1 Mic.V.
 Stray fields reduced to 1 Mic.V.
 Plug-in range coils eliminate switch contacts and prevent intercoil interference.
 Long dial and hairline anti-parallax cursor permit accurate adjustment.
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T5 TOP | SENSITIVITY | WC | TUNE | SWITCH TONE | VOLUME



FERGUSON 378 UNIVERSAL

Seven-valve, plus two rectifiers, four-waveband superhet for operation from AC or DC mains with provision for high resistance extra loudspeaker and pickup. Service and Spares by TEI Service, 55, Blossom Street, Manchester, 4.

THE chief features of the HF and IF circuits are practically identical with those employed in the Ferguson Model 378 AC reviewed opposite. The principal difference occurs in the supply circuits for HT and heater current.

HT is derived from the mains via two half-wave rectifiers V8, V9 in parallel. One HT supply circuit is via the speaker field and smoothing condensers C26 and C30 to the anode circuits of the output valves V6, V7, while a second HT feed is arranged via the smoothing choke CK1 and condensers C27 and C30 to all the other anode circuits.

The loudspeaker incorporates a hum-

bucking coil, but it should be noted that as in the AC model the extra loudspeaker sockets are across the primary of the output transformer and are therefore "live." Extra loudspeaker wiring should, therefore, be well insulated, or isolated by means of blocking condensers, and the extra loudspeaker must incorporate its own matching transformer.

The heater supply is obtained from the mains through barretters R26 and R27, all valve heaters being in series. The pilot lamps are arranged across a shunt R23, and are switched in or out of circuit on the various wavebands by means of contacts on the wavechange switch as in the AC model.

The mains input is HF filtered by C33.

GANGING

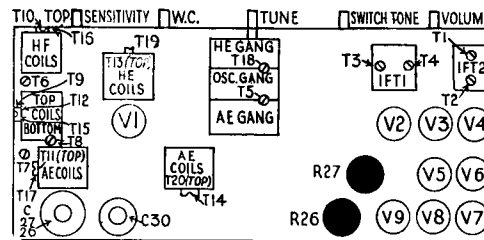
IF Circuits.—Connect a modulated oscillator, tuned to 465 kc, to the grid of V3, and an output meter with large series condenser to the external speaker terminals. Adjust T1 and T2 for maximum reading on the output meter.

Transfer the oscillator lead to the grid cap of V2 and accurately adjust T3, T4, T2 and T1 for maximum reading.

Padding (all waves).—The padding condensers should be adjusted after completing the IF adjustments. These condensers are T5, T6, T7 and T8.

A high-frequency buzzer should be connected in the aerial circuit and the

The chassis layout diagram for the AC-DC version of the Ferguson model 378. Trimmer positions are indicated.



padding adjusted for maximum output on each band with the gang condensers fully meshed.

LW Band.—Inject a signal of 1,200 metres from a modulated oscillator to the aerial and earth terminals. Tune it in and adjust T9 for maximum output. Then adjust T10 and T11 for maximum output. With the buzzer, and the tuning condenser at maximum, adjust T8.

Return to 1,200 metres and repeat adjustments of T9, T10 and T11, finishing off by again repadding.

MW and SW Bands.—The above procedure should be followed on medium waves and on the two short wavebands, the tune points and the trimmers being as follows:—

MW.—250 metres. T12, T13, T14 and T7.

SW 2.—34 metres. T15, T16, T17 and T6.

SW 1.—15.5 metres. T18, T19, T20 and T5.

While adjusting T18 two peaks will be found. The one nearer minimum capacity is the correct.

VALVE READINGS

| V | Type | Electrodes | Volts | Ma |
|---------|------|------------|-------|------|
| 1 | 6D6 | Anode | 215 | 4.6 |
| | | Screen | 60 | 1.3 |
| 2 | 6A7 | Anode | 210 | 1.6 |
| | | Osc. anode | 135 | 2.25 |
| 3 | 6D6 | Screen | 70 | 2.2 |
| | | Anode | 210 | 4.5 |
| 4 | 75 | Screen | 70 | 1.2 |
| | | Anode | 50 | .15 |
| 5 | 76 | Anode | 50 | .55 |
| | | Screen | 125 | 20 |
| 6 | 42 | Anode | 130 | 6.25 |
| | | Screen | 125 | 20 |
| 7 | 42 | Anode | 125 | 20 |
| | | Screen | 130 | 6.25 |
| 8 and 9 | 12Z3 | Cathode | 220 | — |

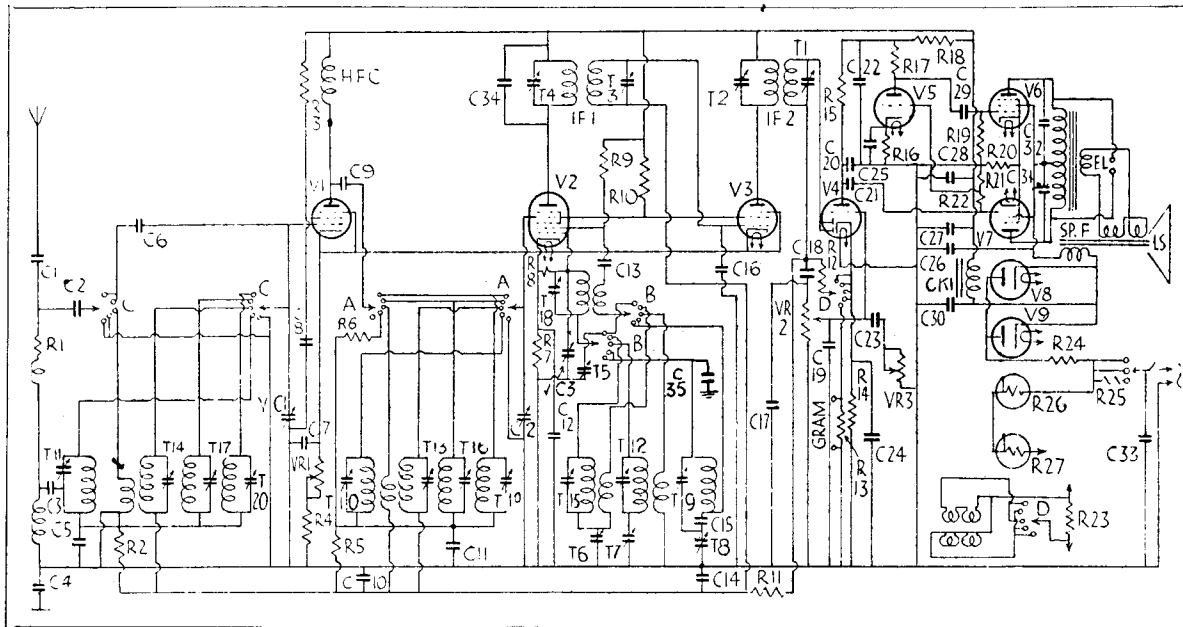
Pilot lamps 6v, .3 amps.

RESISTANCES

| R | Ohms | R | Ohms |
|----|---------|----|---------|
| 1 | 2,500 | 15 | 250,000 |
| 2 | 500,000 | 16 | 100,000 |
| 3 | 100,000 | 17 | 250,000 |
| 4 | 200 | 18 | 10,000 |
| 5 | 500,000 | 19 | 500,000 |
| 6 | 50,000 | 20 | 300 |
| 7 | 500 | 21 | 50,000 |
| 8 | 50,000 | 22 | 500,000 |
| 9 | 25,000 | 23 | 50 |
| 10 | 50,000 | 24 | 50 |
| 11 | 250,000 | 25 | 1,000 |
| 12 | 250,000 | 26 | 185 |
| 13 | 25,000 | 27 | 185 |
| 14 | 10,000 | | |

CONDENSERS

| C | Mfds | C | Mfds |
|----|--------|----|---------|
| 1 | .01 | 19 | .00025 |
| 2 | .00025 | 20 | .001 |
| 3 | .01 | 21 | .01 |
| 4 | .01 | 22 | .1 |
| 5 | .002 | 23 | .01 |
| 6 | .00005 | 24 | .25 |
| 7 | .1 | 25 | 5 |
| 8 | .1 | 26 | 20 |
| 9 | .00025 | 27 | 20 |
| 10 | .1 | 28 | .1 |
| 11 | .002 | 29 | .01 |
| 12 | .1 | 30 | 20 |
| 13 | .00025 | 31 | .002 |
| 14 | .1 | 32 | .002 |
| 15 | .00025 | 33 | .01 |
| 16 | .1 | 34 | .00005 |
| 17 | .00025 | 35 | .000025 |
| 18 | .01 | | |



SERVICE CASE-BOOK

Continued from page vi

conds are correctly fitted and the tensioning springs not over-tight.

In the Philips model 525U it will be found that if the drive wheel is too far in on the condenser spindle, the latter is drawn forward, so causing the moving vanes to foul the fixed ones.

IN the HMV 418 range a troublesome fault is sometimes experienced. If signals fail and the LF side is found to be OK and voltages on both the HF and LF sides are correct, try by-passing the condenser at the lower (or earthy) end of the IF coils by another condenser of .1 mfd or so.

This condenser gives trouble in a number of these models, and in the first case was only located by using the oscillograph. The slightest change in circuit conditions (such as testing with a meter) was sometimes enough to restore the set temporarily.

IN the condenser mentioned above the following was found to be the cause of the breakdown: The end caps were soldered to thin strips of foil, and these were in surface contact with the foil electrodes. Both the foils appeared to make good contact with their electrodes, and when the condenser was tried in a tester it appeared perfect.

The tester was of the audio-frequency type supplying a considerable LF voltage compared to the HF voltage normally applied in use.

Recourse was had to the microscope, and under this one foil showed a very slight film of wax or wax-like substance, and it was assumed that this was the cause of the trouble. Probably this "coat" was sufficient to offer a considerable resistance to the small IF voltages in the set, and, at times, due to local causes, the resistance increased to such an extent that the signals were cut off almost entirely.

WHEN loudspeakers develop on certain notes a rattle which appears to be a resonance in the cone, try the effect of painting the outside of the cone near the suspension with shellac.

The writer has fixed a number in this way, and the tone is not noticeably affected if the shellac is allowed to dry in small patches before continuing with next application until results are achieved.

F. DAY-LEWIS.

MODELS 801, 804 Continued

output does not incorporate a feed condenser) and adjust T1, T2, T3 and T4 for maximum output.

SW Band.—Switch receiver to SW and adjust pointer to 15 megacycles. Inject a 15 megacycles signal into the aerial socket and adjust T5 and T6 for maximum output. Inject and tune in a 6 megacycles signal and adjust T7 while rocking gang to obtain maximum output. Retrim at 15 megacycles.

MW Band.—Inject and tune in a 1200 kc signal and adjust T8 and T9 for maximum output.

Inject and tune in a 580 kc signal and adjust T10 for maximum output while rocking gang.

Check over T8 and T9 adjustments.

LW Band.—Inject and tune in a 240kc signal and adjust T11, T12, for maximum output.

Inject and tune in a 145 kc signal and adjust T13 for maximum output while rocking gang.

Readjust T11 and T12 if necessary.

VALVE READINGS

| V | Type | Electrode | Volts | Ma. |
|---|-------|------------|-------|-----|
| 1 | 6A8G | Anode | 240 | 5.2 |
| | | Osc. anode | 138 | 3.1 |
| | | Screen | 90 | 3.4 |
| | | Cathode | 1.8 | — |
| 2 | 6U7G | Anode | 240 | 7.2 |
| | | Screen | 90 | 2.1 |
| | | Cathode | 2.2 | — |
| 3 | 6Q7G | Anode | 115 | .4 |
| | | Grid | 2.3 | — |
| 4 | 6V6G | Anode | 220 | 35 |
| | | Screen | 240 | 3.2 |
| 5 | 25Z6G | Cathode | 12 | — |
| | | Cathode | 340 | — |

Pilot lamps 6-8v, .3 amps MBC.

Above voltages apply when the smoothed HT measures 240v with a 1,000 opv meter, receiver switched to MW, gang fully meshed, A and E shorted and vol control at minimum.

Motor Field Winding

WHEN replacing the field coils on small electric motors after rewinding, be very careful to see that the turns are in the same direction as formerly and that the connections are the same. If not the motor will run slow and fail to turn a record when the pickup is in position. If in any doubt, change the connections to one field coil.

The coils can be tested for correct connections by passing a current from a dry cell or accumulator through them and testing for polarity of the magnet poles. In a two-pole machine the opposite poles should have different polarity and a small compass will indicate if this is the case.—F. D-L.

FERGUSON 802, 805

Six-valve, plus rectifier and CR tuning indicator, superhet, with push-pull output. Manual tuning with press-button wavechange and radio-gram. switches. For operation from AC or DC mains, 200-250 v. The 802 is a table model and the 805 a radiogram.

THESE models employ a similar chassis and circuit to those in the Models 801-804 reviewed elsewhere in this issue. The essential differences are, the addition of a cathode ray tuning indicator and a push-pull output.

From the accompanying circuit diagram it will be seen that the cathode ray tuning indicator is designated V5 and its control grid is fed from the grid circuit end of R5, which is the AVC line to V2.

To feed the push-pull output the LF output from the anode circuit of V3 is split into two channels. One feeds direct via C29 to one of the output pentodes, V7, while the other channel is taken via C20 to a potential divider R19, R20, which cuts down the signal fed to the grid of the phase reversal valve, V4, and thus

compensates for the extra amplification of this valve.

The output from V4 is resistance capacity coupled by R24 and C26 to the grid of the second pentode output valve, V6.

Anode instability suppressors, R28 R 29, are connected in the anode circuit of V6 and V7, and extra loudspeaker sockets for a high impedance speaker are provided across the primary of the output transformer L14, L15.

Ganging is same as with 801.

CONDENSERS

| C | Mfd | C | Mfd |
|----|----------|----|--------|
| 1 | .0005 | 16 | .0001 |
| 2 | .0001 | 17 | .1 |
| 3 | .1 | 18 | .01 |
| 4 | 20 mmfd. | 19 | .00025 |
| 5 | .004 | 20 | .01 |
| 6 | .1 | 21 | .25 |
| 7 | .00025 | 22 | .00025 |
| 8 | .1 | 23 | .25 |
| 9 | .1 | 24 | .5 |
| 10 | .00025 | 25 | .25 |
| 11 | .1 | 26 | .01 |
| 12 | .00025 | 27 | .16 |
| 13 | .00025 | 28 | .16 |
| 14 | .02 | 29 | .01 |
| 15 | .02 | | |

WINDINGS

| L | Ohms | L | Ohms |
|---|------|---------|------|
| 1 | 20 | 10 | 9 |
| 2 | 17 | 11 | 11 |
| 3 | 3 | 12 | 9 |
| 4 | .1 | 13 | 12 |
| 5 | 5 | 14 | 330 |
| 6 | 3 | 15 | .5 |
| 7 | 1 | 16 | 2 |
| 8 | .1 | 17 | 230 |
| 9 | .5 | Pickup* | 2000 |

* Model 805 Radiogram.

VALVE READINGS

| V | Type | Electrodes | Volts | Ma. |
|---|------|------------|-------|-----|
| 1 | 6A8G | Anode | 245 | 4.7 |
| | | Osc anode | 140 | 2.5 |
| | | Screen | 93 | 3.8 |
| | | Cathode | 2 | — |
| 2 | 6U7G | Anode | 245 | 6.8 |
| | | Screen | 93 | 1.8 |
| | | Cathode | 2 | — |
| 3 | 6Q7G | Anode | 118 | .4 |
| | | Grid | 2.2 | — |
| 4 | 6C5G | Anode | 50 | .8 |
| | | Anode | 245 | — |
| 5 | 6G5 | Anode | 238 | 27 |
| | | Screen | 245 | 1.5 |
| 7 | 6V6G | Cathode | 15 | — |
| | | Cathode | 340 | — |

Pilot lamps 6-8v, .3 amps MBC.
Voltages measured with a 1,000opv meter, A and E shorted, vol control at minimum, gang maximum capacity on MW.

RESISTANCES

| R | Ohms | R | Ohms |
|----|---------|----|---------|
| 1 | 10,000 | 20 | 35,000 |
| 2 | 3 meg | 21 | .25 meg |
| 3 | 150 | 22 | .25 meg |
| 4 | .5 meg | 23 | 25 |
| 5 | .5 meg | 24 | .25 meg |
| 6 | .5 meg | 25 | .5 meg |
| 7 | 2,500 | 26 | 300 |
| 8 | 25,000 | 27 | .5 meg |
| 9 | 25,000 | 28 | 100 |
| 10 | 300 | 29 | 100 |
| 11 | .5 meg | 30 | 100 |
| 12 | 25,000 | 31 | 100 |
| 13 | .5 meg | 32 | 90 |
| 14 | .25 meg | 33 | 277 |
| 15 | 50,000 | 34 | 166 |
| 16 | .5 meg | 35 | 290 |
| 17 | 25,000 | 36 | 45 |
| 18 | 100,000 | 37 | 45 |
| 19 | .5 meg | | |

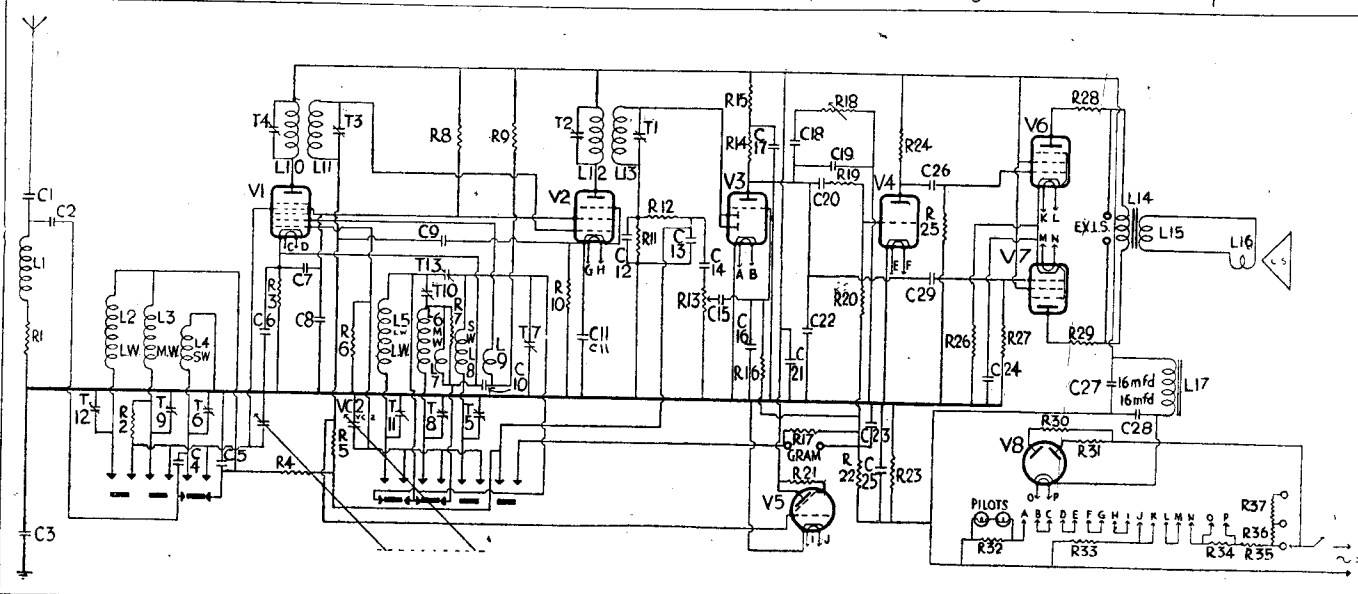
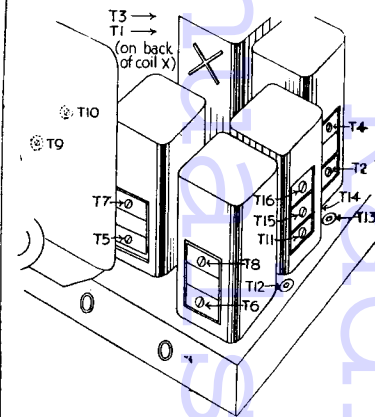
FERGUSON 378

IN the January issue we published service sheets for the Ferguson 378 AC and 378 AC-DC. It appears that the trimmer positions given are not those found in the majority of models.

A revised diagram is given below and the trimmer numbers correspond to those given in the circuit and text for the AC model on page vi of the January issue.

The same instructions apply to AC-DC models and the details given previously for that set should be ignored.

The IF of both AC and AC-DC models is 465 kcs.



In the 802 table model and 805 radiogram there are eight valves against the five of the 801. Push-pull output is provided with a phase reversing input stage. The third additional valve is a CR type tuning indicator.