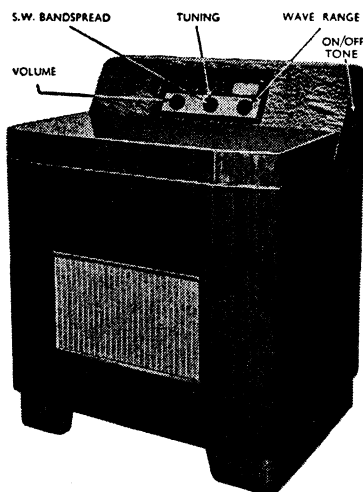


A104R

A104R



AUTOMATIC RADIO-GRAMPHONE

MAINS SUPPLY:	200 to 250 volts A.C., 50-60 cycles
WAVE RANGES:	S. 15.8 to 53 metres M. 190 to 550 metres L. 1000 to 2000 metres
INTERMEDIATE FREQUENCY:	465 Kc/s
VALVES:	Mazda or Ediswan: TH4I, VP4I, HL4I, DD PEN45, UU6
PILOT LAMPS:	Two 6.2 volt, 0.3 Amp, miniature screw
SPEECH COIL IMPEDANCE:	3 ohms
TOTAL WEIGHT:	125 lbs
CABINET DIMENSIONS:	37½" high, 30" wide, 22¼" deep
CONSUMPTION:	65 watts plus about 25 watts when gramophone motor is running
RECORD CHANGER:	Garrard RC60/H16 for eight 10" or 12" records, mixed
PICK-UP:	"Connoisseur" special low impedance miniature moving iron type

GENERAL ASSEMBLY

The Chassis. The chassis is basically the same as that used in the Table Model (A104), and it is mounted on two brackets which are screwed to the sides of the cabinet. A small sub-chassis is mounted below the main chassis and carries the additional components required for gramophone reproduction.

The pick-up connections from the motor-board are made by a pair of twisted leads to the P.U. sockets on the chassis. It is important that these leads are plugged into the correct sockets, as one of them is the earth lead from the motor-board, and hum will be experienced if they are reversed. The small hum-bucking coil is connected in series with the earth lead, to cancel out hum pick-up. This coil is under a small presspahn cover, and it may be necessary to adjust it; normally the coil axis will be approximately vertical, but if the minimum hum position occurs with the coil axis horizontal, the connections to the pick-up head should be reversed.

The pick-up transformer comprises two similar units, in order to neutralize hum picked up from the mains transformer. It is important that, if the connections to these transformers are removed, they should be replaced in their original positions.

Hum may be also induced into the pick-up circuits if the connections to the choke L19 are reversed.

To remove the small chassis it is only necessary to remove the Radiogram control knob (under lid) and the two 4 BA nuts holding the assembly to the cabinet; this

chassis is connected to the main chassis by five wires, but it can be serviced quite easily without unsoldering these.

To take out the main receiver chassis, the L.S. and P.U. plugs must be removed, and also the two motor leads which are connected to the tags marked "MAINS" on the mains transformer; the small chassis must then be removed as described above. The control knobs and chassis fixing screws should then be removed, and the chassis can be withdrawn.

The Loudspeaker. The 10 in. P.M. loudspeaker is mounted on the baffle board in the usual manner, and the leads are brought out from the front of the baffle unit to a spring clip at the top of the cabinet and the L.S. sockets on the chassis. The loudspeaker is enclosed in a special corrugated cardboard baffle box, called the Murphy Acoustic Resistance; the function of this unit is to absorb as much of the backward radiation as possible, and so reduce resonance effects. The quality of reproduction will be spoilt if this unit is not in position. If it is necessary to remove it, for access to the speaker, the four fixing nuts at the front, and two nuts and bolts at the rear, should be unscrewed.

The Lid Stays. The lid stays are mounted so that their action is staggered. If a new cabinet is fitted, it is important that the stays are mounted correctly. It is suggested that the fixing positions are carefully noted before the stays are removed from the cabinet which is to be replaced.

THE GRAMOPHONE UNIT

The Pick-up. This is a miniature moving iron type, of low impedance, with a good frequency response and small record wear.

If any fault develops in the pick-up head it should be returned to Murphy Radio Ltd for inspection and repair. **It should not be dismantled** without proper equipment. As an indication of the damage which is likely to be done if the magnet is removed and then replaced, the sensitivity will drop at least 3 db., even though care has been taken when dismantling and re-assembling. The pick-up is removed by taking out the securing screw on the pick-up arm, and removing the small plugs which are on the pick-up wires from the sockets on the screened lead.

NOTE: For transit purposes the motor-board is secured to the cabinet by two wood screws. It is important that these should be removed before installing one of these instruments. One of them will be seen to the right of the front motor-board fixing bolt; the other is under the turntable to the front and left of the rear fixing bolt. When these securing screws have been removed the whole motor-board floats on spring mountings; this is necessary to prevent acoustic feed-back. The turntable should, of course, be level. The wood screws must be used if it is subsequently

necessary to move the instrument as, if the motor-board is not secure, damage will be caused to the cabinet. The heads of these screws are painted red.

Operating the Changer. The following notes are taken from the operating instructions for this receiver. The Garrard RC60 record changer, which is fitted, will play up to eight records, 10" or 12" diameter, mixed in any order.

Before placing these in position see that the pick-up is at the side of the turntable. If it is not, move the right-hand control (marked "stop", "start", and "reject") to "start", when the mechanism will come into operation and the pick-up will return to its rest position.

To put the needle into the pick-up head, twist round the whole head, so that the needle socket is uppermost; the needle can then be dropped into place. The pick-up is designed for miniature needles and suitable types are the H.M.V. "Silent Stylus", Columbia 99 and those made by the manufacturers of the Connoisseur Pick-up. The needle is not clamped and seems in fact quite loose, but it is held firmly in the pick-up when it is in contact with the record, due to the specially shaped needle holder. The needle should not be moved in the pick-up until it is finally removed and discarded.

If several records are to be played, place the spindle in position with the sloping part leaning towards the record platform. Lift the over-arm and place any number up to eight records on the spindle, with their lower edges on the platform. Then lower the overarm.

Move the right-hand control to "start". The motor should start and the changer operate. When the last record has been played, the mechanism will automatically stop, but the receiver will not be switched off.

To remove the records, raise the overarm and pull out the spindle. To reject a record, move the right-hand control to the "reject" position. The changer can be stopped by moving the right-hand knob to the "stop" position. The reject mechanism is connected to the start and stop mechanism and if the changer is switched off by this control while playing a record, the pick-up will return to the rest position when the motor is switched on again.

No small spindle is provided for playing single records, and these should be played as for a number.

Record Changer Mechanism. The following notes will explain how the changer operates, and the function of the principle parts, shown in the photographs (Figs. 1, 2, and 3, pages 4 and 5). The operation can be followed, by turning the cam assembly spindle in an anti-clockwise direction, with the aid of a large screw-driver inserted in the end of the spindle.

A record changer has to perform three main functions; first, it must place a record on the turntable; second, it must place the pick-up on to the outside grooves of the record; third, it must return the pick-up to its rest after playing. This changer must also determine the size of the record to be played, so that the pick-up may drop in the appropriate position.

When the pick-up is in contact with the record, the changing sequence may be regarded as being in the half way stage, but it is proposed to describe the operation from this point, as the changer mechanism is then out of operation, and the only function of the motor is to rotate the turntable.

The well-known friction clutch forms the basis of the trip mechanism which puts the changer operation in motion. The pick-up is connected by a link A (Fig. 1), to the friction clutch B, which in turn steadily moves the trip lever C into the path of the striker, and so long as the movement is gradual, the trip lever is pushed back out of the way with each rotation of the turntable. If the movement of the pick-up is rapid, however, due to the needle running into the run-off groove at the centre of the record, the trip lever is engaged by the striker on the turntable spindle, and it releases a pawl D (Fig. 2) which is on the cam assembly. This pawl then engages with the ratchet wheel which is on the motor, and couples the cam assembly to the motor, thus putting the changer mechanism into operation.

The pawl D is lifted off the ratchet wheel by either of two catches; one is connected to the lever which is interlocked with the trip lever, and it holds the pawl off the ratchet wheel while the record is being played, and operates as described above; the other can be seen in the

photographs, marked T, and on the conclusion of the last record this catch is moved so that the pawl is lifted off the ratchet when the pick-up is at rest.

There are three cams on the assembly. The nearest one to the motor is a die-casting and it actuates the record platform by means of two links; the next cam similarly operates the pick-up in a lateral direction; and the end one determines the height of the pick-up, lifting it off the record and dropping it on to the rest, or on to the next record, whichever is required.

The Pick-up Return Mechanism. As soon as the cam assembly commences to revolve, the lever E (Fig. 3) which follows the end cam, is moved, and depresses the pick-up spindle by means of the collar, thus lifting the pick-up from the record.

The lever F which follows the second cam is then moved, and pushes the lever H, attached to the pick-up, to the side; at the same time the end cam lowers the pick-up on to the rest. Simultaneously the link A resets the friction clutch mechanism. This is the position the cam assembly takes at the end of a sequence of playings. Another lever G catches on to one of the two studs on the inner face of the second cam and prevents the assembly from turning backwards or vibrating due to the action of the pawl spring and the ratchet wheel. The first of these studs operates as the mechanism comes in to the "rest" position when the pick-up arm is on the rest. The second operates as the mechanism reaches the "free" position, when the pick-up drops on to the record.

The Record Dropping Mechanism. Further rotation of the assembly from the rest position operates the record platform levers. At this point in the cycle of operations the cam follower K (Fig. 3) is in contact with the edge of the die cast cam. As the follower reaches the channel in the outer face of the cam it drops, due to the tension spring L, moving the record platform outwards. If a ten-inch record is on the platform a latch on the platform comes into contact with the stop at the rear of the platform. The cam follower then continues to ride on the outer edge of the cam, and the platform is thus moved inwards, so that the latch pushes the record off the shoulder of the record spindle, to drop on to the turntable. A 12-inch record holds this latch down so that it clears the stop and allows the platform to move further backwards due to the spring L. The follower then takes the groove in the side of the cam, thus moving the platform back until the latch will clear the edge of the record. The platform is then moved inwards, and the latch pushes the record off the shoulder on the spindle, as with a 10-inch record.

The lever M linked to the record platform is actuated by a cam follower N on the motor side of the die cast cam. As the record is pushed off the record spindle on to the turntable, this lever tilts the platform downwards so that it will be clear of the next record to be played. The platform is then pulled back into position for the next record change by the lever and raised again to complete the operation. This inward pushing, and downward and backward resetting movement takes place similarly for 10-inch or 12-inch records.

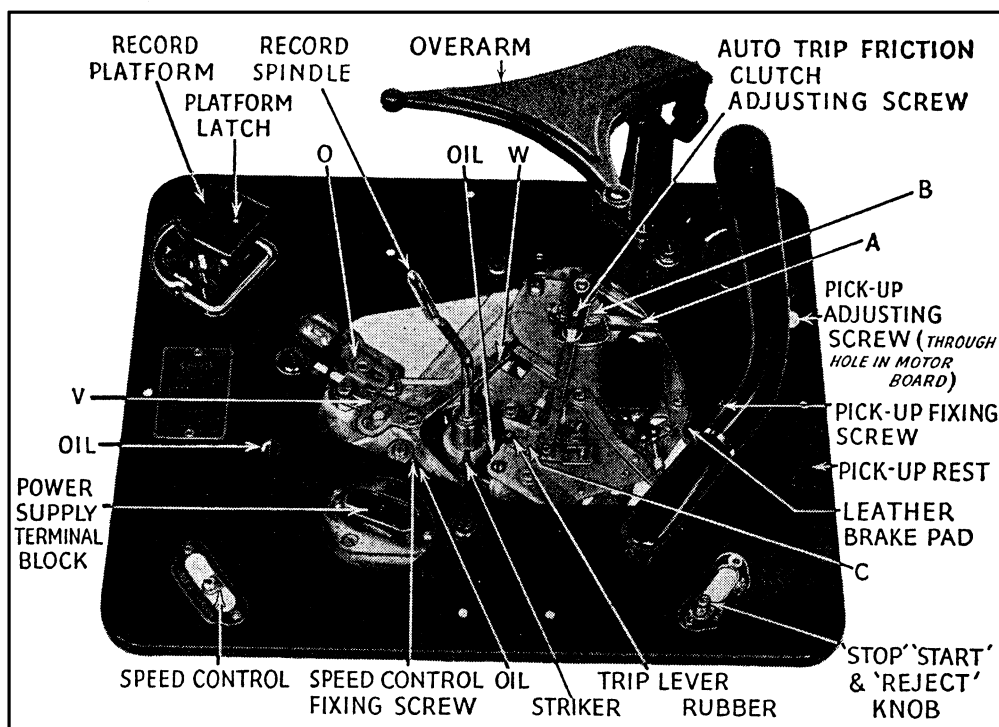


Fig. 1

A series of levers V.O.W. (Fig. 1) and P.J.H. (Fig. 2) connects the record platform with the pick-up arm, and controls the dropping position of the pick-up. It will be seen that the lever H is rigidly connected to the pick-up arm whereas the shaped lever J is free of the arm, but is held to the lever H by a tension spring. While the pick-up is brought from the free position to the rest position by the levers F & H, the levers J & H move back together with the pick-up arm until the movement of the lever J is arrested by the pin on the end of the lever P. The spring is therefore under tension in the rest position, but as the drum is rotated further, the second cam and follower F allows the lever H carrying the pick-up arm to move over due to the spring until the levers H and J are in contact.

The follower F slides along the cam face and out of contact with H, leaving the pick-up arm unguided, except by the friction of the pad on lever E. At the same time, the end cam and follower E allows the pick-up to drop on to the record.

It follows that the dropping position for the pick-up is determined by the position at which the lever J is arrested, and this is controlled by the train of levers P.V.O.W. connected to the record platform. The forward movement of the platform is transmitted through the levers V.O.W. to swing the lever P towards the pick-up arm pillar, so that the pin locates in the first right-angled recess of the lever J. If the pin remains in this position—as it does when a 10-inch record is played—

the pick-up head will drop on to the edge of a 10-inch record. When a 12-inch record is played the record platform moves right back—as previously described—transmitting a pull to the lever chain causing the lever P to move away from the pick-up arm pillar, so that the pin locates with the second recess in the lever J, allowing the arm to drop in the 12-inch position. A fine adjustment for the dropping position is provided by setting the pin in the lever H in an eccentric bush (which is rotated by the pick-up adjusting screw).

The stop mechanism consists of the small lever upon which the switch contact and the turntable brake are mounted (Fig. 1). It is pushed towards the switch, thus releasing the brake and switching on the changer, by the movement of the “start” lever, but it is pulled away by a spring which is connected to the pivoted lever, which can be seen in Fig. 1. The “start-stop” control trips this lever when it is moved to “stop”, and the motor circuit is broken.

A spring-loaded catch R (Fig. 3), operated by a stud on the die cast cam, will also operate the stop mechanism, but for the cranked lever S, which prevents the lever associated with the catch from moving. This cranked lever is shifted by a push-rod which can be seen at the front of the overarm bracket, and it is moved by the lowest half-inch of movement of the overarm. The overarm normally holds the records firmly on to the shoulder of the record spindle, but after the last record has been played the overarm moves sufficiently

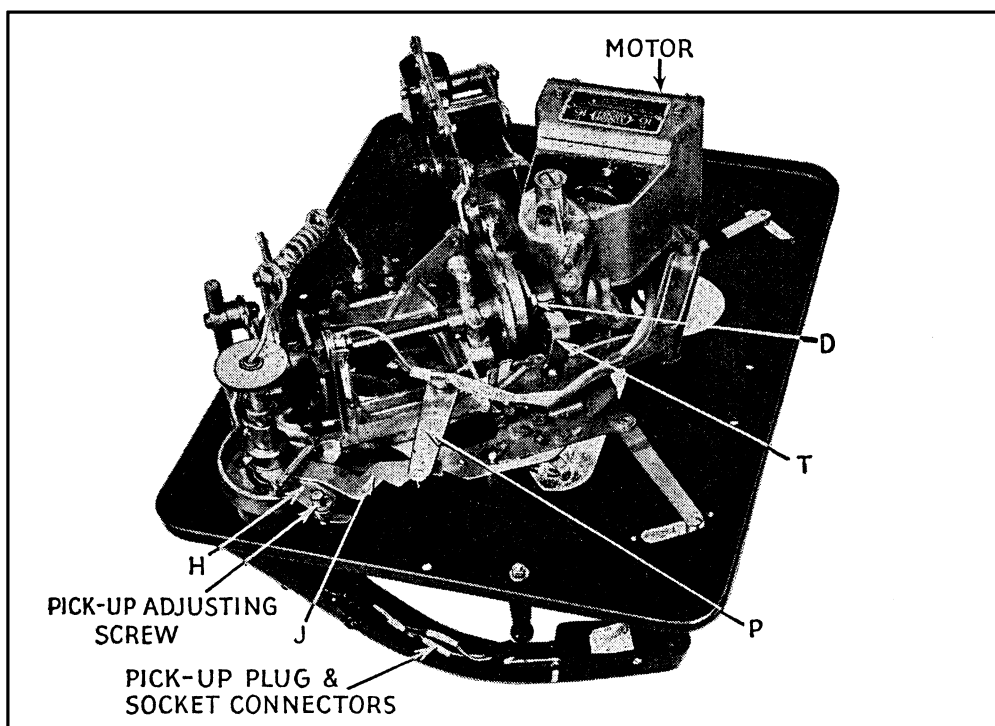


Fig. 2

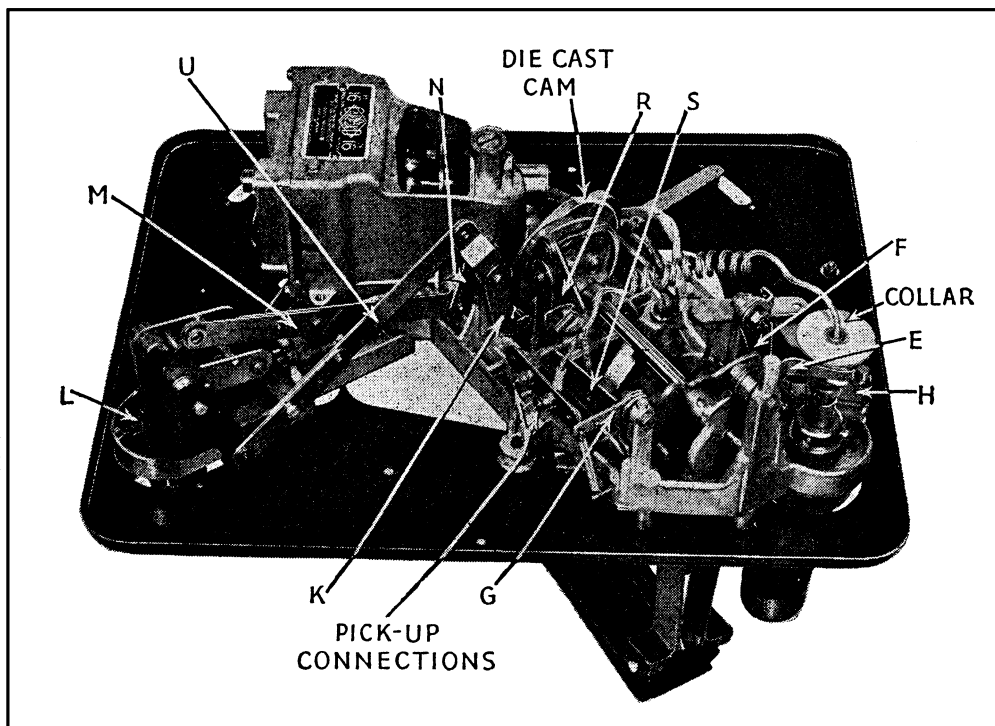


Fig. 3

to operate the push-rod. The changer will then stop at the end of the record, after the pick-up has been returned to its rest.

The "start", "stop", and "reject" lever is connected to the switch contact as described above, and when it is moved to the right the changer is switched on. This control is also directly connected to the trip mechanism, and the pawl catches are released whenever it is moved in order to start or reject a record; the cam assembly is then immediately coupled to the motor, and the sequence of events described above commences. Thus the "start" lever also acts as the reject lever, and if the changer has been stopped at any point the changer mechanism is coupled up so that on switching on again the pick-up is automatically returned to its rest.

Note that it is necessary to have the turntable in position when checking the operation of the changer with the motor running, because the flywheel effect helps to overcome the resistance of the cams and followers at some points in the changer sequence.

Lubrication. The motor requires oiling at intervals depending on the amount of use it has had. When the turntable is removed the three oil holes are accessible. A few drops of good quality thin oil, such as that produced by Garrard, are sufficient.

Speed Setting. Due to the wide voltage range of the motor it may be necessary on some power supplies to make a small re-adjustment of the speed indicator, so that the speed of the turntable is 78 r.p.m. when the speed adjusting lever is central on the scale. A stroboscopic speed indicator disc should be placed on the turntable and viewed under a lamp connected to the A.C. supply, and the speed should be adjusted so that the bars on the disc appear to be stationary. If adjustment is necessary, remove the turntable, carefully loosen the screw holding the indicator to the vertical brake shaft, move the indicator to the centre of its travel, and tighten the screw. The speed should still be correct, but it should be checked. Most stroboscopic discs are printed on one side for use with 50 cycle mains, and on the other, either for 60 cycle mains or for 80 r.p.m.

The Motor. If the motor fails to start, check the power supply and see that it is reaching the motor terminals. Next examine the terminal block and see that the leads and screws are tight; also examine the switch contacts, clean and adjust if necessary.

It is essential to use only good quality thin oil on the motor bearings. If a thick oil has been used to lubricate the motor bearings, the motor may appear weak or will not start. It will then be necessary to dismantle the motor and clean away all traces of the thick oil.

Should the motor get too hot, first see that the current consumption of the motor does not exceed 0.11 amp. If readings much in excess of this figure are obtained the complete record changer should be returned to Murphy Radio for examination.

Wavery or watery reproduction from records is often due to dry governor pads. These should be saturated with oil.

To cure governor rattle, put a little thick oil on the shaft where the governor sleeve slides.

Removing Motor. If the motor has to be removed from the changer, disconnect the switch leads from the switch and remove the clips holding the leads; then remove the four motor fixing screws and the motor can be withdrawn.

Pick-up Dropping Position. The pick-up arm is adjusted so that the needle comes on to 10-inch records in a 9 $\frac{1}{8}$ in. diameter circle, and 12-inch records in a 11 $\frac{1}{8}$ in. circle. These positions were arrived at after checking a very wide selection of records of various makes. There may be a few records whose track starts further from the centre, and in these cases the needle may alight on the record a few grooves from the start. If the pick-up drop was set for such records it would not be suitable for average records.

Should the dropping position of the pick-up require adjustment the pick-up adjusting screw—accessible through a hole in the unit plate (Fig. 1)—should be turned with the changer in its start position; that is with the pick-up arm on its rest. The screw should be turned to the right or left, as required; a quarter turn either way will give the maximum adjustment.

Pick-up Height. This can be adjusted if necessary by removing the screw in the collar at the bottom of the pick-up arm lifting spindle and turning the collar, whilst holding the spindle. Replace the screw and tighten after adjustment.

Caution. When making any adjustments to the pick-up arm, it should never on any account be forced into position. If the turntable is turned by hand it should not be turned backwards, and it should never be forced. It is possible, when turning the table too vigorously by hand, to cause the worm drive on the motor to seize up; when this occurs, permanent damage may be done if pressure is still applied, but if it is released, no harm will have been done.

If the pick-up does not run into the grooves after being lowered on to the record, see that the motor board is level, by adjusting, if necessary the spring mounting fixing bolts. Also make sure that the flexible wire leading to the pick-up is not twisted or held in such a way as to prevent the pick-up moving freely; also see that the associated levers are free.

The Auto-Trip Mechanism. The satisfactory operation of the changer depends upon the working of the auto-trip. Occasional adjustment of the friction spring may therefore be necessary.

If, at the end of the record, the auto-trip fails to operate, first see that the record has a run-off groove at the centre, as only records with run-off grooves can be played automatically on record changers. If the record is in order, increase the tension of the friction spring by turning the friction adjusting screw (Fig. 1) in an anti-clockwise direction; about half a turn is all that should be required. This screw is accessible on removing the turntable.

If the changer operates before the end of a record, or a bumping or tapping noise is audible, first examine the

trip lever rubber, and if it is worn, give it half a turn to present a new surface to the striker. If badly worn, it should be replaced. If the trip lever rubber is in good condition, reduce the tension of the friction spring by giving the auto-trip friction adjusting screw half a turn in a clockwise direction.

Record Platform Adjustment. The platform is set to accommodate records of average dimensions. Occasionally, records may be found outside the normal limits, and the platform can be adjusted to take them. This should only apply where certain non-British records are used consistently.

To control the platform movement are two adjustable links, M and U, each of which is fitted with two screws. One link M with its pivot at the bottom of the platform lever, controls the platform lift, whilst the other U controls the distance the platform moves inwards. It is this latter link which can be adjusted to accept records differing from the normal in diameter. To do this, loosen the screw furthest from the platform, and remove the other screw. Now refit this screw in an adjacent hole—nearer the platform to lengthen the link and increase the inward movement of the platform, further from the platform to shorten the link and increase the outward movement of the platform. The permissible adjustment is one hole on either side of the existing position. Finally, tighten up the first screw on the link.

Replacing the Pick-up. First mark the connections, and remove the pins connected to the pick-up from the screened lead connector; slacken off the pick-up fixing screw, which is shown in the photograph, and twist the pick-up. It can then be withdrawn.

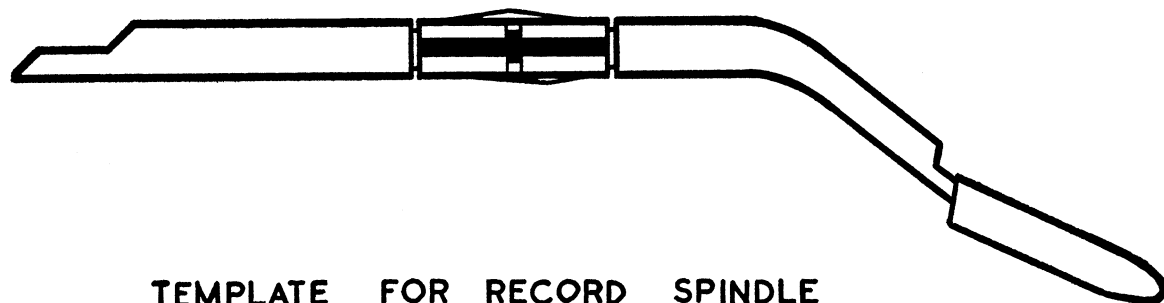
When replacing the pick-up, push it into the pick-up arm, twist it into the correct position, and tighten the fixing screw. Then reconnect the screened lead as it was originally.

If a new pick-up is fitted, the connections of which have not been marked, try the effect of changing them; increased hum will be heard if the connections are incorrect.

The Screened Lead. To remove this it is first necessary to remove the connectors to pass the lead through the control spindle. After this has been done the lead can be pulled away and unsoldered from the tag panel.

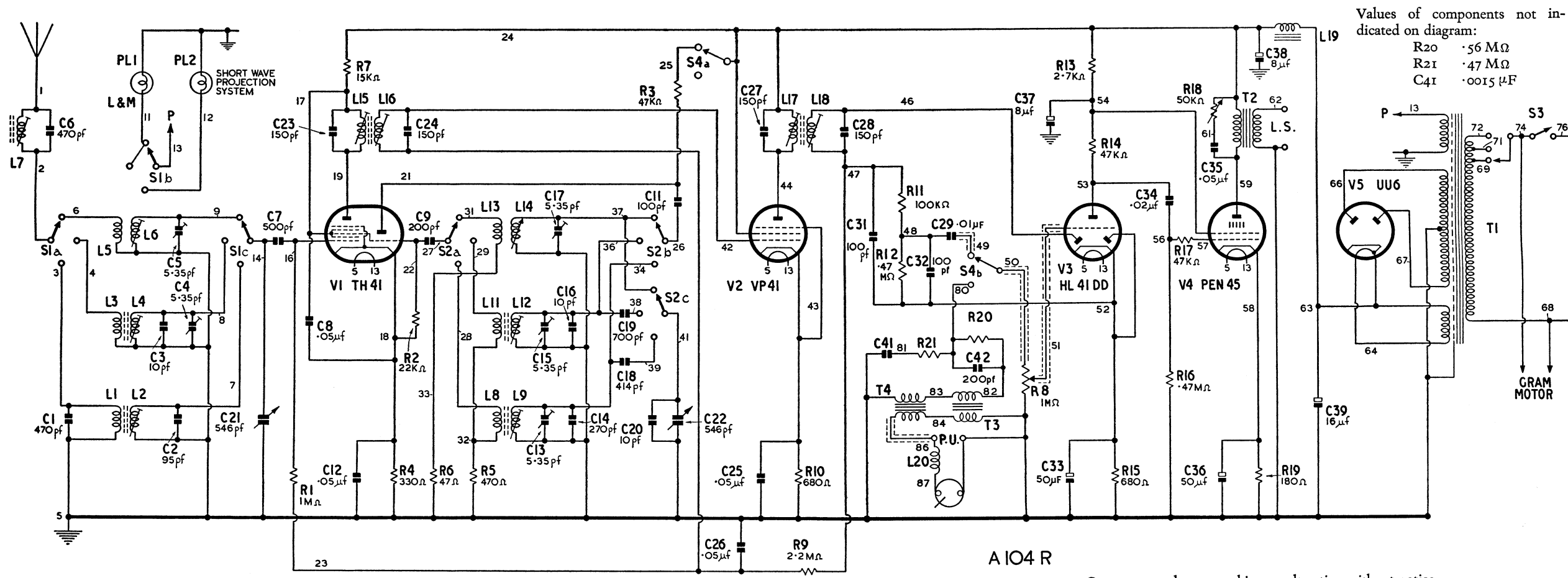
The replacement lead consists of a 27-inch length of single screened lead which can be obtained from Murphy Radio. It will be easier to replace if the pick-up arm has been removed, but this is not essential. It should be threaded through the control spindle and led above the pick-up arm pivot, and the connectors should be soldered to the ends. The other end of the lead should be coiled so that the pick-up movement is left as free as possible, and it should then be connected to the tag panel, the screen being taken to the left-hand terminal when looking at the rear of the record changer.

The Pick-up Assembly and Main Spindle. The pick-up assembly is pivoted by two sets of ball bearings, and it will not normally be necessary to dismantle it. If it has to be dismantled, the pick-up adjusting screw may need to be reset after assembly, and the changer should also be tested to see if any adjustments are required. Care should be taken not to lose any of the balls (there are 15 in each race).



TEMPLATE FOR RECORD SPINDLE

The Record Spindle: A possible cause of faulty dropping is a bent spindle. Check this against the diagram, and correct if necessary. The sleeve should be oiled occasionally to prevent squeaking.



TYPICAL COIL RESISTANCES (20% TOLERANCE)

COILS	L1	L2	L3	L4	L5	L6	L7	L8	L9	L11	L12	L13	L14	L15	L16	L17	L18	L19	T1 H.T. Sec.	T1 Prim.	T2 Prim.	T2 Sec.	P.U. Transformers		Pick-up
																							Prim.	Sec.	
OHMS	24	14	0.5	2.2	—	—	2.5	0.6	1.8	0.5	1.3	—	—	5.5	5.5	5.5	5.5	265	145 + 150	24 + 3 + 3	280	0.2	150	2	27

THE CORD DRIVES

GENERAL NOTES. Remove chassis from cabinet, the scale and I.F. valve (V2) from chassis, and set the gang capacitor at minimum. With the S.W. coil slug fully out, the drives will be in the general position shown in the diagram. The cord now used on all drives is the standard thin cord (a plaited and waxed Italian hemp cord) obtainable from Murphy Radio Ltd.

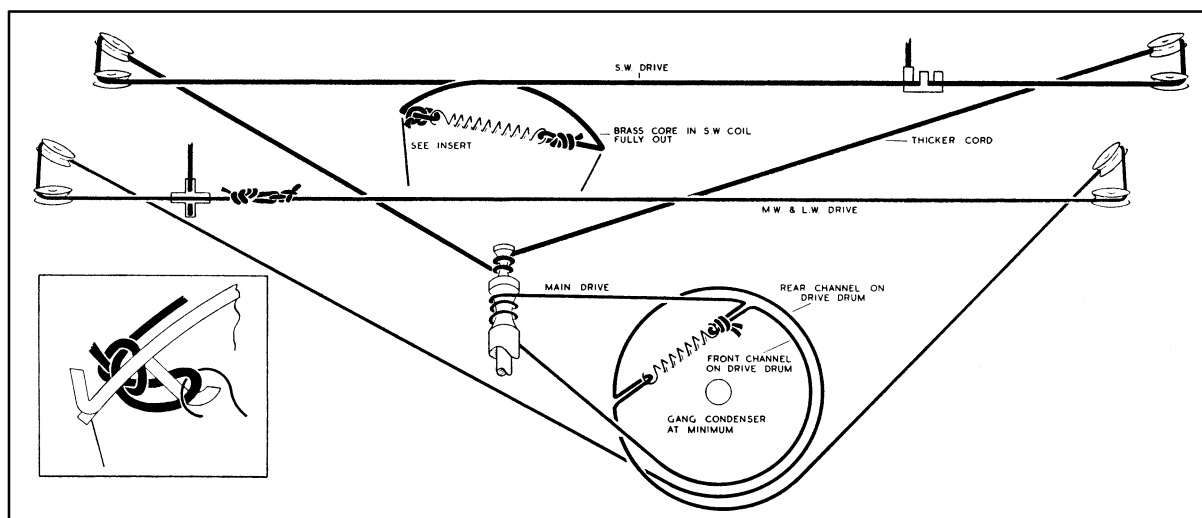
The S.W. scale must also be removed in order to replace the main and pointer cord drives. It must be very carefully handled as any marks, fingerprints, etc., are magnified and show clearly on the short-wave screen.

The Main Drive. Obtain a length of approximately 2 feet of drive cord and securely tie the spring on to one end. Pass the other end through the hole in the front groove on the drive drum, from the inside, and then two and a half times round the main control spindle in an anti-clockwise direction, and so round the drive drum in the front groove, as shown in the diagram, finishing again near the hole. Pass the end through the hole again and tie to the same end of the spring, so that there is less than $\frac{1}{4}$ " of slack cord inside the drive drum. Note that there is no tension on this drive until the pointer cord has been fitted.

The Pointer Drive. Turn the ganged capacitor about half way to maximum so that the hole in the rear groove is accessible. Obtain a length of approximately $4\frac{1}{2}$ feet of drive cord, double it at the centre, and pass the doubled end through the hole in the rear groove on the drive drum and hook on to the spring. See that the cord is not twisted and pass the right-hand end round the drive drum in the rear groove in a clockwise direction, then round the left hand pulleys. Tie a loop on this end and anchor it on to the right hand edge of the S.W. quadrant, which should be moved over to the left. Pull

the other end to take up the slack and pass it round the groove in a clockwise direction, round the right-hand pulleys and under the dial lamp lead. Release the loop from the S.W. quadrant and pass the other end through it and then pull tight so that the spring is extended to $1\frac{1}{2}$ inches, and knot securely. A small pair of pliers to hold the loop will enable this to be more easily accomplished. Turn the control and see that the cord is lying evenly in the drum groove and on the control spindle, and turn the gang capacitor to maximum position. The pointer can now be placed on the cord so that it will line up with the L.F. end of the scales when in position; a rough setting can be made by placing the pointer $\frac{1}{8}$ " to the left of the bend in the reflector. It can be finally clamped into position after the scale has been refixed. Check operation of the drive and see that there is no tendency to slip. Replace the S.W. scale on the drive drum, so that the cross at the centre is in alignment with the gang spindle and the 52 metre mark is correctly aligned at maximum capacity.

Short-Wave Drive. Set the S.W. quadrant so that the brass slug is fully out of the coil, then place the spring on the hook on the left-hand side. Make a slip knot on the end of a length of drive cord approximately $3\frac{1}{2}$ feet long, and place it also on the hook and pull tight. Bring the other end round the top of the quadrant, under the dial lamp wire, to the right-hand pulleys, then under the optical system bracket, and round the S.W. drive spindle twice, as shown in the diagram, then round the left-hand pulleys, behind the other end of the cord on the quadrant, and back to the spring. Pass this end through the loose end of the spring, pull tight so that the spring is extended to 1 inch, and secure firmly. Hook the pointer on to the cord, as shown, and slide it along the cord to its correct position.



All Drives. Replace main scale and clamps, and see that at maximum gang capacity the main pointer is just visible at the L.F. ends of the scales. If necessary, move the pointer slightly, then finally clamp it tightly on to the cord.

See that the S.W. pointer when moved fully to the left, lines up with the left-hand edge of the S.W. aperture, and check that it also will line up with the right-hand edge; if necessary move the pointer along the cord. Check the optical system and adjust as required.

ADJUSTMENT OF OPTICAL SYSTEM

THE drawing shows the method of optical projection adopted. Illumination from a lamp passes through a condenser lens and then through a translucent scale; the image from the scale is magnified and projected by a second lens on to an inclined mirror which reflects it back on to the frosted short-wave screen.

It is generally advisable to follow the complete setting up procedure described below, although a simplified method, which can sometimes be used, is given on page 14.

1. Check to see that the projection lens is mounted vertically, about $\frac{1}{4}$ inch behind the scale, and the condenser lens is within one-sixteenth of the front of the scale. Rotate the tuning control to see that the condenser lens does not foul the scale at any point.

2. Connect the receiver to the supply mains, switch on to the S.W. band and turn the tuning control fully clockwise.

3. Remove the cover plate from above the S.W. pilot lamp and turn the chassis face downwards. The light beam will be seen as a bright spot on the face of the projector lens. Adjust the lamp position so that the light is centrally placed on the face of the projector lens. It may be necessary to rotate the lamp-holder as well as moving it in a horizontal direction.

4. Rotate the wave-range switch to ensure that the lamp-holder does not foul the switch mechanism.

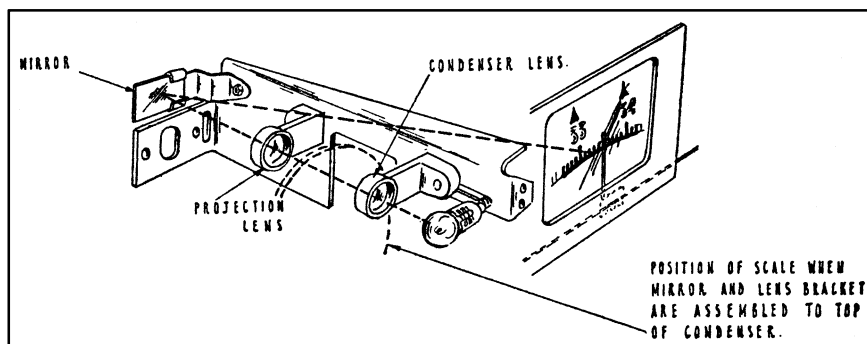
5. Adjust the mirror until the frosted screen aperture is completely filled with light, *i.e.* no dark edges are visible in the aperture. Vertical adjustment is made by rotating the mirror bracket, and horizontal adjustment by turning the screw at the side. It will be noticed that, with the lamp cover plate removed, the pointer mounting is visible on the screen, but this is of no consequence as it is obscured when the cover is replaced.

6. Turn the tuning control until the 31 metre band centre index mark coincides with the aperture index mark.

Adjust the mirror until the tips of these index marks appear to touch. When this is so, there must still be no dark edges visible in the aperture. To achieve this it may be necessary, after slackening off two screws on the rear

end plate of the ganged capacitor and one on the front panel, to rotate slightly the main assembly bracket, in order to align the condenser lens on the scale, then tighten the screws again.

7. Adjust the projector lens to obtain a clear image on the screen. The image must be sharp, *i.e.* correctly



focused over its whole width. Move the lamp away from the condenser lens, if necessary, to obtain this condition.

8. See that there are no peculiar blemishes in the image. They may be due to the following faults:

(a) Blurred, smudgy blemishes can be due to flaws, specks of dust, etc., on: (i) the lamp glass envelope (large round watery smudges will be caused by bubbles of air in the lamp glass, so twist the bulb and holder); (ii) the projector lens; (iii) the mirror (scratches in the mirror).

(b) Sharply defined blemishes can be due to flaws, specks of dust, etc., on (i) the condenser lens; (ii) the scale (small scratches on the scale lettering will show up very clearly).

(c) Scratched paint on the lens holders may cause bands or streaks of light due to reflection from the bright surfaces. Specks of dust, etc., can be removed by a camel hair brush. When other faults occur the offending component must be replaced.

9. Check the magnification as follows: Rotate the main drive until the centre of the 31 metre calibration mark coincides with the left-hand edge of the aperture. The right-hand edge of the aperture must now lie between 33.35 metres and 33.45 metres. If the right-hand edge is above 33.45 metres, the magnification is not great enough and the mirror must be moved back slightly and the image re-focused. Similarly, if the

right-hand edge is below 33.35 metres the magnification is too great and the mirror must be moved forward slightly.

10. See that there is no colour fringing the white lettering on the scale. The presence of colour indicates that the lamp filament is not lying on the axis of the lens system. To remove the colour, the lamp must be moved slightly *towards* the edges of the lettering, or figuring, that are tinged with *red*.

11. Tighten the lens holders and the mirror fixing screws and lock the mirror lateral adjustment without upsetting any of the previous adjustments. Replace the S.W. lamp screen.

12. Turn the main drive until the 51-metre index mark coincides with the aperture index mark. Set the S.W. pointer on the 51-metre scale calibration mark. The pointer now coincides with the aperture index mark. Turn the main drive to its fully clockwise position. The S.W. pointer should now lie between 51.95 metres and 52.05 metres, *i.e.*: within half a smallest division of the 52-metre calibration mark. If necessary, move the S.W. scale very slightly in its clamp, in the opposite direction to which it is desired to move the image.

13. Rotate the scale over its complete range, and see that the base line of the scale does not change its position relative to the tip of the S.W. pointer by more than the height of the smallest calibration marks, *i.e.* the scale line image must remain reasonably steady in the aperture over the whole of its travel.

If the scale image **rises at one end**, turn the scale so that this end is in the aperture and move the scale slightly upwards in its clamp until the effect is removed.

If the scale image **rises in the centre**, set it so that the centre is in the aperture and move the scale slightly upwards in its clamp until the effect is removed.

If the scale image **drops in the centre**, the scale must be moved slightly downwards.

While the above effects are being removed, take care

to maintain the 52 index mark coincident with the aperture index mark, within the limits specified when the drive is fully clockwise.

14. Bump the set gently to check that all components are firmly fixed.

Note:—Great care should be taken of the glass S.W. scale if removed, as any marks or fingerprints show very clearly on the screen.

Although the printing on this scale is protected by a coat of lacquer it is very easily marked, and finger-prints are difficult to remove, so it should be handled by the edges only.

The double convex lens is the condenser lens, and the plano convex is the projection lens and it should be mounted with the flat side away from the S.W. scale.

Simplified Method. If the bulb has been changed, or moved, the image may be distorted at the edges, or coloured fringes may appear. To rectify these faults, it is not necessary to complete the procedure described above, and this simplified method may be used.

First check that the mirror is in approximately the correct position, and that the S.W. scale is approximately in the centre of the S.W. screen. The condenser lens should be within one sixteenth of an inch from the scale.

Remove the light screen, and the projection lens; turn the gang capacitor so that there is not one of the S.W. bands in focus on the S.W. screen.

Adjust the position of the bulb so that a clearly defined image of the bulb filament can be seen in the centre of the S.W. screen. Lock the bulb in this position.

Replace the projection lens, and the light screen, and adjust the position of the projection lens for a clear image of the S.W. scale on the S.W. screen. There should be no coloured fringes on the edges of the letters and figures, and no distortion at the end of the screen, if this procedure has been carefully carried out.

TRIMMING

BEFORE commencing trimming, see that the main tuning pointer aligns with the index marks at the extreme L.F. end of the scale when the gang capacitor is at maximum capacity, and the stop on the drive drum is against the gang support stop; in this position the S.W. scale should read exactly 52 metres at the S.W. aperture index mark.

Also see that the S.W. coil "slug" is set so that when fully out of the coil, the distance between the edge of the former and the exposed edge of the "slug" is exactly $\frac{3}{8}$ inch, and check to see that the S.W. pointer moves evenly about the centre index mark on the S.W. screen. Then set the S.W. pointer to the centre point on the screen. The setting up of the associated optical system is

described elsewhere, and may be carried out completely independently.

All adjustments are made for maximum reading on an output meter connected to the L.S. sockets (except for the I.F. rejector circuit, which is tuned to minimum as described) with V/C at maximum and the Signal Generator input adjusted to produce the lowest convenient meter reading, which should be 0.5 watts or less.

A screwdriver or 7 B.A. box spanner will be required to adjust the variable inductances.

NOTE.—I.F. Primaries are underneath the chassis and I.F. Secondaries on top of the I.F. coil cans. The oscillator frequency is higher than the signal frequency on all bands.

CIRCUIT	NOTES	SIG. GEN. FREQUENCY	SIG. GEN. TERMIN'TN	CONNECT SIG. GEN. TO	RECEIVER DIAL SETTING	ADJUSTMENTS
I.F.	Unscrew 2nd I.F. Prim. and Sec. cores to fullest extent	465 Kc/s (645 m)	Direct via .1 mfd.	V2 Control Grid	M.W. 550 Metres	2nd I.F. Prim. (L17) 2nd I.F. Sec. (L18) Do NOT READJUST
	Unscrew 1st I.F. Prim. and Sec. cores to fullest extent	465 Kc/s (645 m)	Direct via .1 mfd.	V1 Control Grid	M.W. 550 Metres	1st I.F. Prim. (L15) 1st I.F. Sec. (L16) Do NOT READJUST
I.F. REJECTOR	Trim for MINIMUM reading on output meter	465 Kc/s (645 m)	Dummy Aerial	Aerial Socket	M.W. 550 Metres	I.F. rejector (L7)
L.W.	Repeat these adjustments until there is no further improvement	158 Kc/s (1900 m)	Dummy Aerial	Aerial Socket	L.W. 1900 Metres	L.W. Osc. Coil (L9) for max. L.W. Grid Coil (L2)
		230.8 Kc/s (1300 m)	Dummy Aerial	Aerial Socket	L.W. 1300 Metres	L.W. Osc. Trimmer (C13)
M.W.	Repeat these adjustments until there is no further improvement	600 Kc/s (500 m)	Dummy Aerial	Aerial Socket	M.W. 500 Metres	M.W. Osc. Coil (L12) M.W. Grid Coil (L14)
		1363 Kc/s (220 m)	Dummy Aerial	Aerial Socket	M.W. 220 Metres	M.W. Osc. Trimmer (C15) M.W. Grid Trimmer (C4)
S.W.	Repeat these adjustments until there is no further improvement. Some "pulling" of the oscillator frequency may be noted. To overcome this, retune receiver after each aerial circuit adjustment	7.14 Mc/s (42 m)	Dummy Aerial	Aerial Socket	S.W. 42 Metres	S.W. Osc. Coil (L14) and S.W. Grid Coil (L6). By moving adjustable loop with non-metallic object for maximum output.
		15.25 Mc/s (19.7 m)	Dummy Aerial	Aerial Socket	S.W. 19.7 Metres	S.W. Osc. Trimmer (C17) S.W. Grid Trimmer (C5)

When an aerial filter is fitted this should be tuned for minimum signal on the local broadcast station. Connect on 0-10 voltmeter between V2 cathode and chassis; tune exactly to the local station, and then adjust the filter for maximum voltage reading. It is fitted to the left-hand chassis bracket with the coils towards the ganged capacitor. When ordering please state frequencies required.

Modifications. The following space is intended for use in noting any changes which may be made.

DETAILS OF MODIFICATION	REASON FOR CHANGE
<i>A104R</i> THE CONNOISSEUR PICK-UP WE have been informed by A. R. Sugden & Co. that they are no longer able to repair the special "Connoisseur" pick-up head which they supplied for fitting in the A104R radio-gramophone. We have, therefore, no alternative but to offer our A104R pick-up head (Part No. 49592) as a replacement when "Connoisseur" pick-ups become faulty. The retail price of this pick-up (including purchase tax) is 36s. It is designed for use with the A104R pick-up transformer (Part No. 49979) coded with a yellow spot and the appropriate filter network as shown in the A104R Service Instructions changes sheet published in March 1948. In receivers which have pick-up transformers with other code spots or which are uncoded, a new transformer will be required. The retail price of the transformer (Part No. 49979) is 31s. 6d.	

Faults. The space below is intended for service engineers' own use, so that a record can be kept of faults which occur.

SYMPTOMS	NATURE OF FAULT AND REMEDY
Pick-up fails to lift off rest. Pick-up continues to drop in 12-inch position after a 12-inch record has been played (platform latch not freeing).	Collar out of adjustment (see Fig. 3). Platform latch stop moved so that latch is free in playing position. Adjust by means of the two bolts at base of stop.