

THE GRAMOPHONE UNIT

SPECIFICATION

CHANGER UNIT:	Garrard RC65 or RC65A
MOTOR (incl. in unit):	Garrard, Type D16
VOLTAGE RATING OF MOTOR:	100–130 volts and 200– 250 volts; 40–60 c/s, a.c. only
PICK-UP	Murphy moving coil
GRAMOPHONE NEEDLES:	H.M.V. "Silent Stylus" or Columbia "99".

Note: The unit differs from the standard Garrard production in the following details:

The Garrard pick-up head has been replaced by the Murphy pick-up head.

A special insulated screened pick-up lead and an additional earth lead, replace the Garrard pick-up lead. The screening is connected to the receiver chassis, not true earth—but the motor-board and pick-up assembly are connected to true earth.

The Garrard two-way tag panel is replaced by a three-way panel on the RC65, but on the RC65A a single tag panel has been fitted and the remaining leads are joined to the muting switch.

The two types of record changers used may be distinguished by the maker's name plate on the record platform mechanism.

Some RC65 units incorporate a pick-up muting switch. All RC65A units include a pick-up muting switch and a "stop" mechanism that has been modified to return the pick-up arm to its rest when the "Stop-Start-Reject" knob is moved to "Stop".

Some RC65A units are fitted with a pick-up drop restricting bracket to protect the turntable felt if the unit is operated without records.

OPERATION

Operating the record changer unit. The following notes are taken from the Operating Instructions for this receiver. The Garrard record changer which is fitted will play up to eight records, 10 in. and 12 in. in diameter, mixed in any order.

If the pick-up is not on its rest, support it if necessary, switch the receiver "on" and move the left-hand control knob to the "Start-Reject" position. The pick-up will then automatically return there. **Never attempt to put the pick-up on its rest by hand.**

Lift the overarm, and place the records on the record spindle, with the edge of the lowest record supported on the record platform. Then lower the overarm so that it rests on the top record.

Start the mechanism by moving the left-hand control knob to the "Start-Reject" position; it will continue to operate until all the records on the spindle have been transferred to the turntable; the pick-up will then return to its rest. **Never start the changer unless there is a record on the turntable or record spindle.**

To reject a record, move the left-hand knob to the "Start-Reject" position.

To stop the changer at any time, move this control knob to the "Stop" position. See the notes on page 28.

Records on the record spindle may be removed after raising the overarm. The overarm should be raised and the record spindle lifted out in order to remove records on the turntable. The spindle should then be replaced with the sloping portion towards the record platform.

Note. Single 10 in. records may be played by placing them on the record spindle, depressing the overarm, and operating the control knob as described above. For non-standard records (less than 10 in. and one at a time only), the following procedure may be used. Place the record on the turntable and move the control knob to "Start". Support the pick-up lightly by hand while the mechanism is operating automatically, and when the pick-up is completely free, lower the needle carefully on to the outside groove on the record. If a "run-off" groove is not cut in the record, move the "Stop-Start-Reject" knob to "Start" at the end of the record. For records larger than 10 in. the record pawl must be depressed in addition to the above.

Needles. The pick-up is intended for use with the miniature type of needles only, such as the H.M.V. "Silent Stylus" or Columbia "99".

To insert a new needle, the pick-up head may be twisted through 180 degrees in an anti-clockwise direction, or the pick-up arm may be lifted up. The needle can then be placed in the needle aperture where it will be held by the magnet. The shape of the aperture ensures that the needle takes up its

proper position when it touches a record. Never refit a partly worn needle, or move a needle while it is in the pick-up, as it will cause excessive record wear.

If the needle is inserted while the pick-up arm is raised, care should be taken when lowering the arm. If the arm is dropped on to a record the needle will be forced into the moving coil assembly, causing irreparable damage.

DESCRIPTION OF MECHANISM

Basically, the unit has two conditions of operation, (a) free running; (b) changing cycle.

(a) **Free running.** This is the condition which exists when a record has commenced playing.

(b) **Changing cycle.** This operation begins on the completion of a record, and includes the several independent functions which will be described in detail later.

The essential difference between the two modes indicated above are that in (a) the motor only applies drive to the main record spindle, while in (b) a subsidiary spindle is also engaged which rotates a system of cams, producing the sequence of events which ensure the introduction of the next record.

As the free running condition is relatively simple, attention is principally directed to "Changer Operation" which will now be given detailed treatment.

Changer operation. Initially this action is introduced by the movement of the "Stop-Start-Reject" knob to the "Start-Reject" position. This has the effect of coupling the subsidiary shaft to the cam assembly, thus providing drive to the changer mechanism. On completion of the first record a friction clutch simulates the function of the "Stop-Start-Reject" knob and is responsible for originating the later changer sequences. Following the playing of the first record, therefore, the change to the succeeding record is commenced quite automatically, and the changer mechanism is said to be "trip" operated. This trip, by virtue of its spontaneous reaction, permits the progressive change from one record to another throughout the entire eight records without further manual attention of any kind.

A record changer must perform three main functions: first, it must place a record on the turntable; second, it must place the pick-up precisely on the outside grooves of the record; third, it must return the pick-up to its rest in order to permit the placing of a further record on the turntable.

The operation may be followed by turning the cam shaft (Fig. 21) in an anti-clockwise direction with the aid of a large screwdriver inserted in the slotted end. Reviewing the action from the condition where the pick-up is on the rest, the following sequence may be observed.

(a) **Record dropping.** On rotation of the cam shaft the record platform is seen to move outward, with respect to the turntable, stop, then reverse direction. As the record platform moves inwards, the small projection on the platform termed the *record pawl* contacts the edge of the lowest record and pushes it over the shoulder of the record spindle on to the turntable.

Thus the first requirement of placing the record on the turntable has been accomplished and, for the present, it is sufficient to note that this action has been dependent on the movement of the record platform.

(b) **Operation of the pick-up arm.** The pick-up arm is then observed to lift from the rest, move inward to the start of the record and be lowered on to the outside grooves. If the player is power driven, as opposed to hand-turned, the "free running" condition will now ensue and the record will proceed to play. During playing the cam mechanism, which operates the changer action, is disengaged and remains so until the pick-up reaches the final grooves of the record, when the more rapid travel of the pick-up towards the centre actuates the trip mechanism originating a further changer sequence. The pick-up is then raised from the record, swung back to the rest and lowered. It should be noted that the operation of the pick-up arm has been dependent on motive forces applied to its captive end and these forces, which are derived from interaction between springs and a plunger, will be detailed later with reference to the appropriate diagrams.

The action repeats on the dropping of a further record by the record platform, when replacement of the pick-up on the outside grooves occurs, followed by the "free running" condition, the actuation of the trip mechanism, and consequent origination of a further changing sequence. The operation of the player is therefore comprised of the repetition of an essentially similar series of events as the eight records are progressively played. An additional refinement involves the ability to discriminate between 10 in. and 12 in. records and to ensure the placing of the pick-up precisely in the outer grooves, independent of record size. This will be considered in more detail when the normal operation has been fully described.

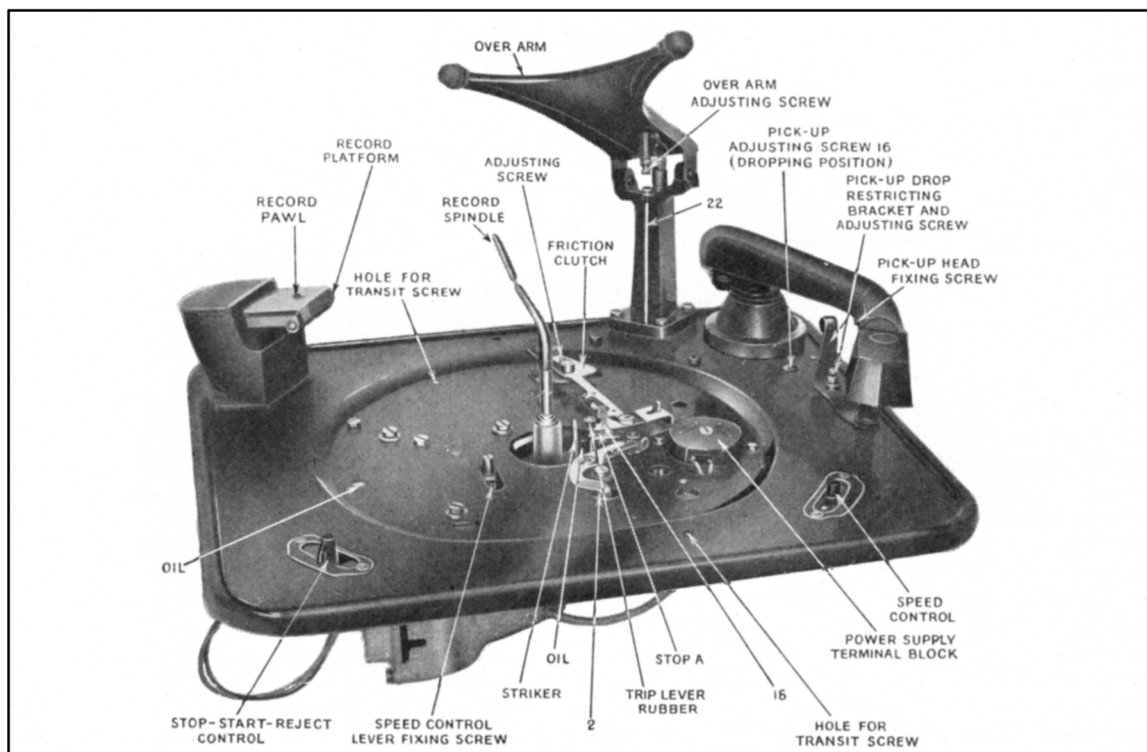


Fig. 19. TOP VIEW OF RC65A RECORD CHANGER

On completion of the eight records it is necessary to stop the motor and the changer mechanism automatically. This is another function of the overarm, which was holding records on the shoulder of the record spindle at the proper angle for dropping.

The changer action is dependent on the mechanical inter-relation of the following parts.

- (a) The driving mechanism.
- (b) The stops controlling the drive to the cam shaft and auto-stop mechanism.
- (c) Cam assembly X.
- (d) Record platform and record dropping mechanism.
- (e) Pick-up arm and associated levers.
- (f) The automatic trip mechanism.
- (g) The switch mechanism.
- (h) The auto-stop mechanism.
- (i) The "Stop-Start-Reject" knob.
- (j) Record discrimination.

A detailed description of the action follows under these heads, reference being made to the appropriate diagrams and photographs. For the best understanding of the following, it is recommended that the previous general description and the form of operation outlined there, be borne in mind.

(a) **The driving mechanism (Fig. 20).** The subsidiary shaft on the motor carries a ratchet wheel. A pawl 1 mounted on cam assembly X is spring loaded to engage with this ratchet wheel, thus coupling the sub-

sidary shaft to the cam assembly X, applying drive to it, and effecting consequent rotation of the cam shaft. During rotation the end of this pawl, remote from the spring, may encounter one of two stops. When this occurs, the pawl will disengage from the ratchet wheel, the coupling between the subsidiary shaft and cam assembly X will be removed, and the cam shaft will cease to rotate. From the previous description it will be apparent that this was the action which caused the "free running" or playing condition. It is now necessary to investigate the nature and function of these stops.

(b) **The stops controlling the drive to the cam shaft and auto-stopping mechanism (Figs. 19 and 20).** Of these there are two, A and B.

Stop A. This is situated above the motor-board and is visible on removing the turntable. It is spring loaded to engage pawl 1 on the cam assembly X. Reference to Figure 22 in conjunction with Figure 19 will indicate that stop A is controlled by the "Stop-Start-Reject" knob via lever 2 or alternatively by the trip mechanism.

Moving the "Stop-Start-Reject" knob to "Start" can be seen from Figure 22 to apply leverage via link 3 to lever 2, this lever is thus made to bear on stop A overcoming its spring loading, disengaging the control exercised on pawl 1, and permitting drive to be applied to the cam shaft via cam assembly X. This is the initial action which ensures the drive to the changer mechanism.

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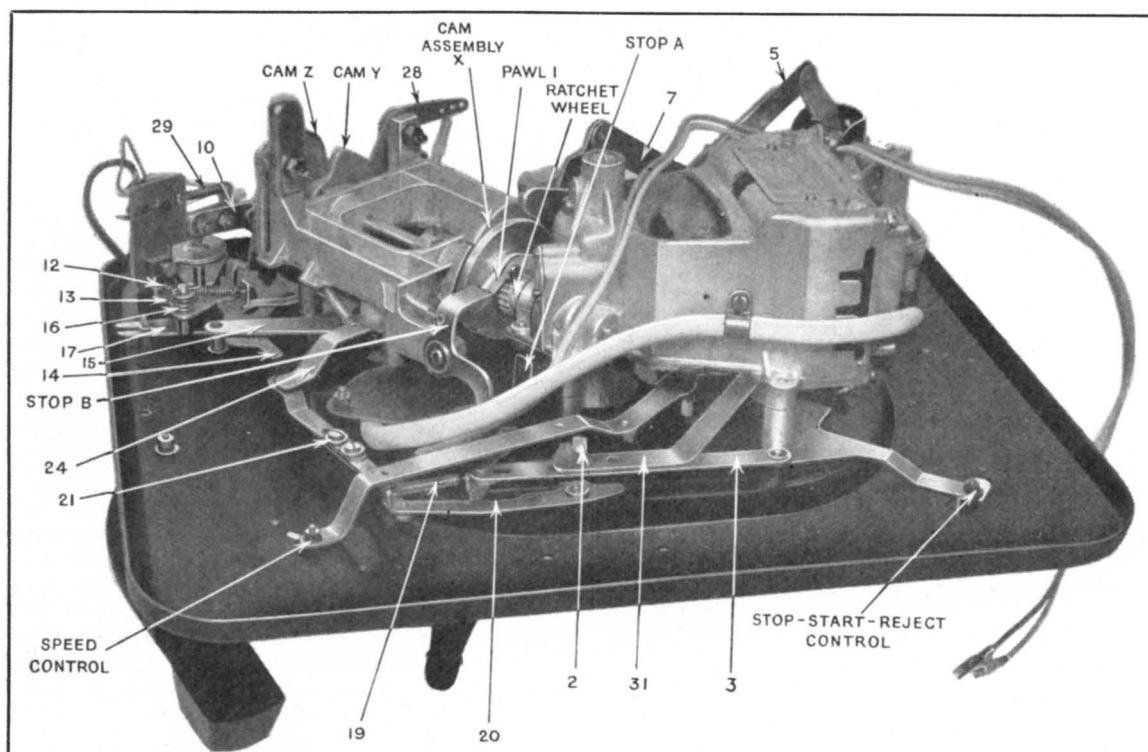


Fig. 20. CONTROL LEVERS, AND MOTOR MECHANISM (RC65A)

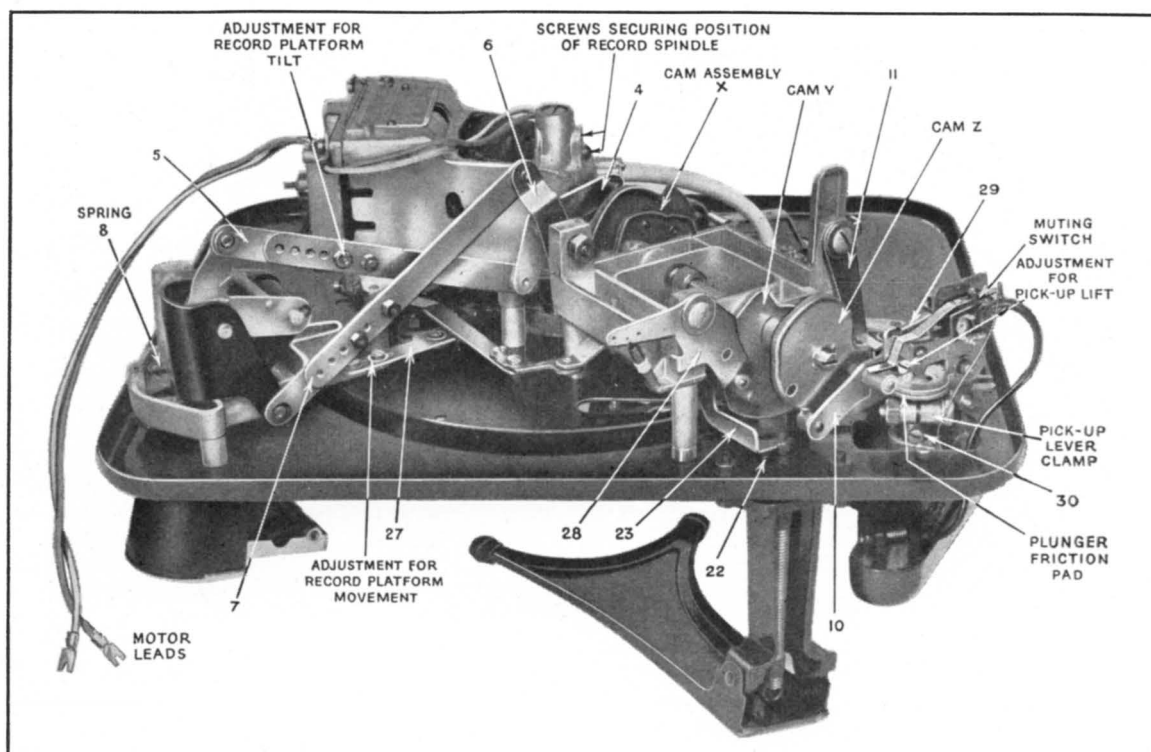


Fig. 21. RECORD PLATFORM, AND PICK-UP MECHANISMS (RC65A)

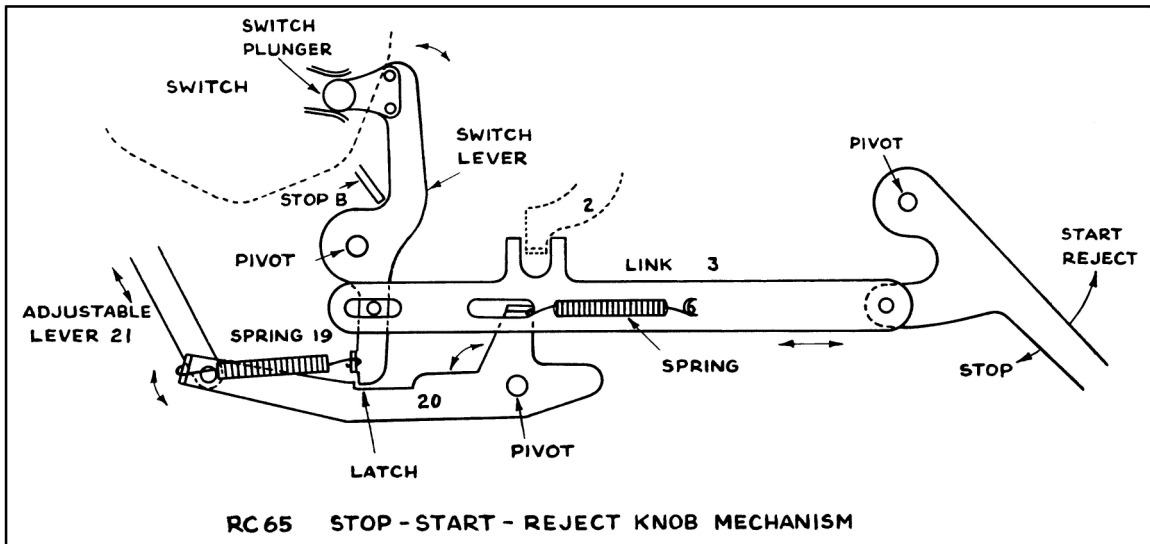


Fig. 22

ism required to drop the first record, and swing the pick-up from the rest position to be lowered on to the first grooves of the record.

The primary stage of the changing operation is completed when the pick-up has been lowered on to the record, and at this point *stop A* again encounters *pawl 1*

and disconnects the cam shaft from the motor. The "free-running" condition then ensues. On completion of the record, *stop A* is again caused to release its control on *pawl 1*, which under the influence of its loading spring, is once more able to engage the ratchet wheel on the motor and apply drive to the cam shaft, thus originating the

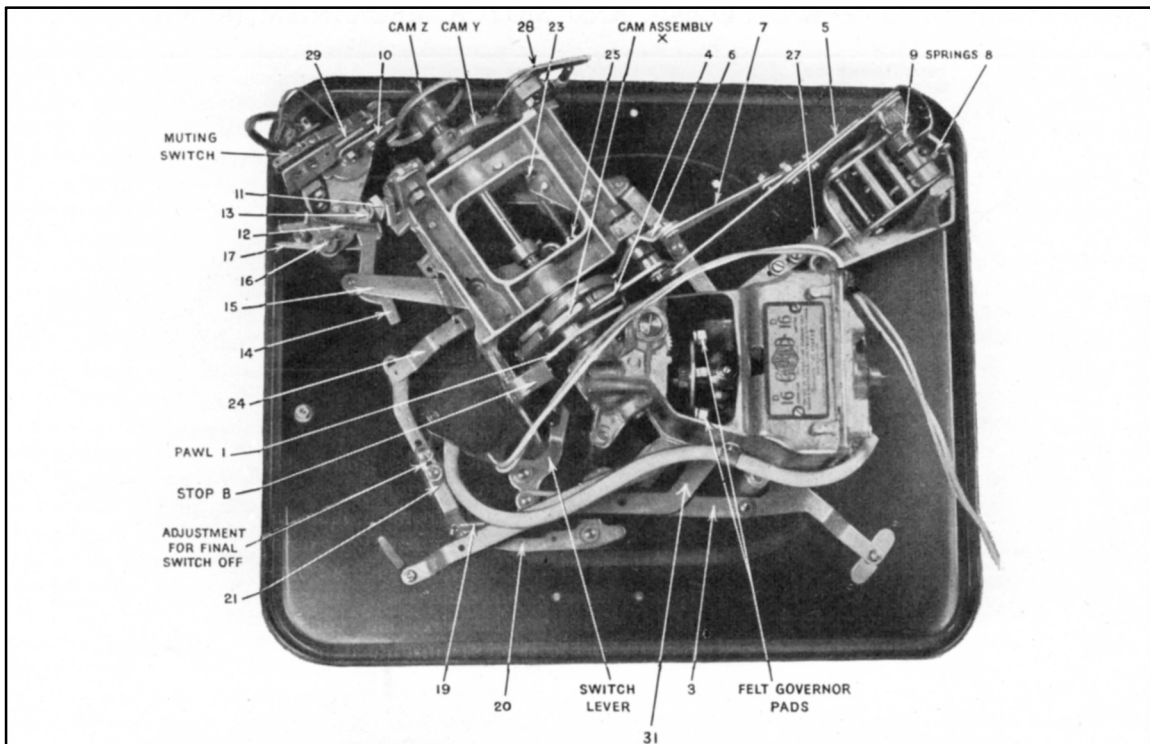


Fig. 23. GENERAL UNDERNEATH VIEW OF AN RC65A RECORD CHANGER

changing operation for the succeeding record. It should be noted that this latter release of the control exercised on *pawl 1* by *stop A* is effected by the trip mechanism which will be described later under the appropriate title.

Stop B. The function of this stop is to disconnect the cam shaft from the motor, after the last record has been played and the motor automatically switched off. *Stop B* is spring loaded, and is mounted on a projection on the casting which carries the cam shaft. It is visible in the Figures 20, 22, and 23, where *stop B* is seen to be spring loaded to bear on the *switch lever* which is connected by *link 3* to the "Stop-Start-Reject" lever. The *switch lever* maintains *stop B* in a position clear of *pawl 1* against the tension of the loading spring, whilst the record player is switched on, thus permitting *pawl 1* to engage the ratchet wheel and hence apply drive to the cam shaft. From the instant of starting, therefore, by movement of the "Stop-Start-Reject" knob to the "Start" position, *stop B* is deflected by the *switch lever* and remains dormant until the entire eight records have been played. Operation occurs when the automatic stopping mechanism removes the control exercised by the *switch lever*, allowing the loading spring to interpose *stop B* in the path of *pawl 1*, thus removing the drive from the cam shaft. It should be remembered that the operation of *pawl 1* at the end of each individual record is performed by *stop A* as explained above.

(c) **Cam assembly X.** This assembly is responsible for the operation of the record platform in its function of dropping the succeeding records on to the turntable. It is a composite unit and actually consists of three cam faces. Upon these faces the ends of two levers are made to bear, and these suitably terminated levers are called "cam followers". *Cam follower 4* (Fig. 21), in conjunction with the die cast cam, controls the tilting of the record platform via *link 5*. The significance of this tilting will become apparent when the record dropping action has been described.

A further essential of the record-dropping action is that the record platform should have the ability to move backward and forward. This movement is determined by one or the other of two cams on *cam assembly X*. Examination of this part of the assembly will disclose that there is an inner and outer cam, the one mounted within the other. The inner cam is seen to provide a complete path for the *cam follower 6*, whilst the outer cam affords an alternative path during approximately one-third of a complete rotation of the cam shaft. The reason for the two cams is directly related to the need for the unit to accommodate both 12 in. and 10 in. records, the cam follower being caused to adopt the path of the inner cam during 12 in. record operation, and the path of the outer cam during 10 in. operation. The selection of either path is controlled by the *record pawl* on the record platform, and will be fully described under the heading "record discrimination". However, it is worthy of note that the cam selected provides the required degree of forward and

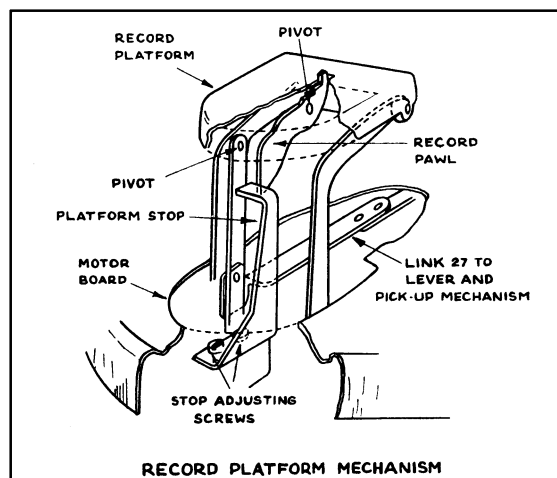


Fig. 24

backward movement of the record platform, appropriate to the size of record to be played at any instant.

(d) **Record platform and record dropping.** In the previous general description of the changer operation, record dropping was described as a function of the record platform. Reference should now be made to Figure 24 which portrays the record platform mechanism, and also to Figures 21 and 23 in order that the more detailed description of the action may be followed.

As indicated under the heading "cam assembly X", the various movements of the record platform are effected by the *cam followers 6* and *4* (Fig. 21), which are varyingly displaced by the characteristic shapes of the cam surfaces. This drive is transmitted to the record platform by means of the *links 7* and *5*. The record platform is spring loaded in a backward and downward direction by *springs 8* and *9*, hence the movement of the record platform is determined by the balance of these two opposing forces.

After the cam shaft has turned through a few degrees, *cam follower 6* and *link 7* are eased, due to the shape of the cam surface. This allows the record platform to be pulled slightly backward under the influence of *spring 8* until it is halted by the tail of the *record pawl* encountering the *platform stop* (Fig. 24). On further rotation, the *cam follower 6* bears on a sector of the cam which is shaped to reverse the force applied via *link 7*. Hence a pull is now transmitted by *link 7* drawing the record platform against the influence of *spring 8*, until the top of the *record pawl* contacts the lowest record and pushes it over the shoulder of the record spindle.

When the limit of the forward motion has been reached, the cam surface again eases the control exercised via *link 7*. The record platform is thus permitted to be drawn backwards once more, by *spring 8*, until the tail of the *record pawl* again encounters the *platform stop*. During this backward movement, *cam follower 4* and *link 5* effect a simultaneous downward tilting of the

record platform front. At the end of the backward movement, the downward tilting is reversed, and the platform returns to its normal alignment.

The above description has assumed that only 10 in. records are being played. The operation with both 10 in. and 12 in. records, and the additional functions of the *cam assembly X* will be treated under "record discrimination".

(e) **Pick-up arm and associated levers.** As already outlined in the general description, moving the "Stop-Start-Reject" knob to the "Start" position is followed by the pick-up arm lifting off the rest, moving inward to the start of the record and then being lowered on to the outside grooves. Then, it will be remembered, "free running" ensues until, at the end of the record, the trip mechanism is actuated, coupling is effected to the subsidiary motor shaft, and the changer mechanism is re-

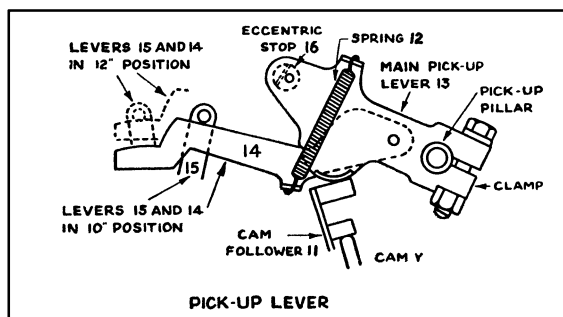


Fig. 25

started. The pick-up arm is then lifted from the record, swung back to the rest and lowered. The sequence may be repeated as long as there are records on the spindle, up to a total of eight times.

Throughout the description that follows, reference should be made to Figure 25, and to the photographs of the underside of the motor-board.

The motive force to effect vertical and lateral movement of the pick-up arm is derived from the specially shaped *cams Y* and *Z*, which are rotated when the motor is coupled to the cam shaft during changer operation.

Cam Z is responsible for the vertical movement of the pick-up arm. It transmits its thrust via *cam follower 10*, which is a simple lever, spring loaded to follow the contour of *cam Z*. On the application of thrust to *cam follower 10*, it bears upon a friction pad, which raises a plunger passing up the centre of the pick-up pillar. This plunger, while being free to move vertically, is arranged to turn with the pick-up pillar.

Lateral movement of the pick-up arm is provided by *cam Y* acting against *spring 12*. From Figure 25 and Figure 21 the *main pick-up lever 13* is seen to be clamped to the pick-up pillar. *Cam Y* acting on *cam follower 11*, which bears upon the projection on the *main pick-up lever 13*, provides a force on one side. A force on the other side is provided by the action of *spring 12*.

The pick-up lever is of composite construction, em-

bodily the *main pick-up lever 13* already referred to, and a *secondary lever 14* pivoted upon it. The purpose of the *lever 14* is to ensure that the pick-up head is in the proper position to be lowered on to the first grooves of a record irrespective of whether it is 10 in. or 12 in. in diameter.

Lever 14 is seen to bear against the stud on *lever 15* in either one of two alternative positions. The position depends on the size of the record, and is selected by the control exercised on *lever 15* by the record platform. This occurs via a series of links located under the cam unit.

When the pick-up is on its rest, *cam Y* and *cam follower 11* have pushed *lever 13* to the limit of its travel (the position shown in Figure 25). *Lever 14* is held in either the 10 in. or 12 in. position by the stud on *lever 15* and *spring 12* is seen to be extended. This is the maximum influence of the force due to *cam Y*, which is so shaped that on further rotation of the cam shaft the pressure is eased on *cam follower 11*. This permits *spring 12* to contract, providing the force which moves *lever 13* in the reverse direction. This turns the pick-up pillar and swings the pick-up arm towards the record. During this action, *lever 14* is still held against the stud on *lever 15* under the influence of *spring 12* and forms the fulcrum on which *lever 13* acts. The turning of the pick-up ceases when the eccentric stop 16 meets the edge of the *lever 14*, as then the travel of *lever 13* is arrested. Hence by means of stop 16, the precise lowering position has been established, and it only remains for *cam Z* to effect the vertical lowering which introduces the pick-up head on to the outer grooves of the record. Eccentric stop 16 is capable of slight adjustment, and thereby the precise lowering position may be determined. (Stop 16 is the pick-up adjusting screw in Figure 19.)

Examination of *lever 14* and the location of the stop on *lever 15* for either 10 in. or 12 in. operation (Fig. 25) discloses that, in the 10 in. position, *lever 14* is held so as to permit greater travel of *lever 13*, before stop 16 arrests it, compared with the 12 in. position. Hence a lowering position has been selected for 10 in. operation which will occur some little distance nearer the centre of the turntable than will be the case for a 12 in. record. This is, of course, the desired condition, and it should be remembered that the actual selection of the position the stop on *lever 15* assumes on *lever 14*, is controlled by the record platform via the links located under the cam unit.

On completion of a record, *cam Z*, via *cam follower 10*, raises the pick-up arm from the inner grooves of the record. Meanwhile, *cam Y* bears upon *cam follower 11* and pushes *lever 13* to its full extent, *spring 12* is extended and it only remains for *cam Z*, via *cam follower 10*, to effect lowering of the pick-up arm on to the rest and the sequence has been completed.

(f) **The automatic trip mechanism.** Reference has been made in the general description to the "trip mechanism", and its function of the application of drive to the cam shaft, on the completion of each record.

The well-known friction clutch forms the basis of the mechanism and is located on the top side of the motor-board. It is connected to the pick-up by *link 17* (Figs. 20 and 23), which is located under the motor-board, and which bears upon a vertical pillar attached to *lever 13*. Hence *link 17* follows the movement of *lever 13*, and consequently that of the pick-up arm itself.

The top portion of the friction clutch is connected by a link to *lever 18* (Fig. 19) and so the movement, which the clutch derives from *lever 13*, is applied via the link and causes *lever 18* to move steadily toward the turntable spindle. Attached to this spindle, and arranged to rotate with it, is a collar which carries a projection, termed the *striker*. As *lever 18* is moved steadily toward the centre, therefore, it is interposed in the path of the *striker*. So long as the movement of *lever 18* is gradual it is simply deflected by the *striker*, on each rotation of the turntable. However, when the movement of the pick-up is rapid due to the run-off groove at the centre of the record, the *lever 18* engages with the *striker*. As *lever 18* is pivoted at the centre and has a projection at one end linking with *stop A*, the thrust obtained from the *striker* causes *lever 18* to operate *stop A*. This releases *pawl 1*, permitting coupling between the motor and the cam shaft, thus setting the changer mechanism in operation.

The pick-up is then moved to the rest, and the next record dropped on to the turntable as previously described. Thus the trip mechanism ensures that the changer will proceed automatically throughout the playing of the eight records, unless the "Stop-Start-Reject" knob is operated. If this knob is moved to the "Stop" position, then the entire mechanism will, in the RC65, be stopped, but in the RC65A it will continue to run until the pick-up is returned to its rest. On both units if the knob is moved to the "Start-Reject" position, however, the action of the trip is simulated by means of *lever 2*, and rejection of the record which had been playing, occurs.

(g) **The switch mechanism.** Reference should be made to Figure 22. The switch lever is arranged to introduce the switch plunger between the switch contacts, thus completing the supply to the motor. These contacts are located under the Paxolin plate on the underside of the power supply terminal block. The *switch lever* is spring loaded to the "off" position by *stop B*, *spring 19*, and the switch contacts; it is connected to the "Stop-Start-Reject" lever by *link 3*. *Lever 20* is pivoted as shown in Figure 22, and has a latch cut on its edge adjacent to the *switch lever*. On moving the "Stop-Start-Reject" lever to the "Start" position, a pull is exerted on the *switch lever* via *link 3*. This effects lateral movement of the tail of the *switch lever*, against *spring 19*. However, *spring 19* also ensures that *lever 20* bears against the tail of the *switch lever*, and so causes the *switch lever* to follow the edge of *lever 20* while the pull via *link 3* is being exerted. Thus the tail of the *switch lever* is eventually captured by the latch, where it

is held by the tension of *spring 19*. Meanwhile, the opposite end of the *switch lever*, moving on the pivot, has introduced the *switch plunger* between the switch contacts, at the same time causing the deflection of "Stop B" from the path of *pawl 1*, as previously dealt with in the description headed "Stop B". The connection of

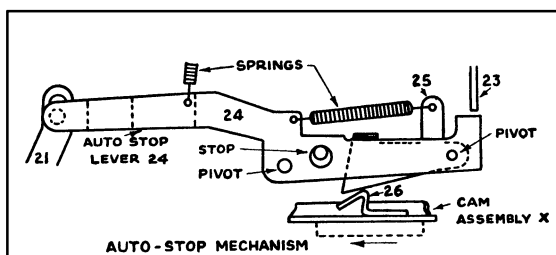


Fig. 26

lever 20 to the auto-stop mechanism by *lever 21* is also indicated in Figure 22, and it is appropriate here to note how a thrust on *lever 21* would deflect *lever 20*, liberate the tail of the *switch lever*, switch off the motor, and at the same time interpose *stop B* in the path of *pawl 1*, thus effecting removal of drive from the cam shaft.

(h) **The auto-stop mechanism.** Reference should be made to Figure 26. The operation of the auto-stop mechanism is initiated by the overarm. This occurs when the overarm falls to its lowest extent, a condition that arises when there are no records on the spindle. In Figure 19 a spring loaded *rod 22* may be seen, parallel to the pillar supporting the overarm. Beneath the overarm is a projection into which the overarm adjusting screw is secured. In the lowest position of the overarm this adjusting screw comes in contact with *rod 22*, depressing it and starting the action of the auto-stop mechanism as follows.

When *rod 22* is depressed it causes *lever 23* (Figs. 26 and 21) to be lifted from *lever 24* (Fig. 26). As can be seen from the diagram, *lever 24* carries a spring loaded secondary *lever 25*, which can be pushed aside by *trigger 26* on the side of *cam assembly X*, so long as *lever 24* is restrained by *lever 23*. This contact of the *trigger 26* on *lever 25* is arranged to coincide with the return of the pick-up to its rest.

When the overarm depresses *rod 22*, however, *lever 24* is freed, and *trigger 26* is able to deflect the tail of *lever 24*. It should be noted that the spring loading of *lever 25* is sufficient to ensure *levers 24* and *25* acting as one unit, after the restraint of *lever 23* has been removed. This movement of the tail of *lever 24* applies thrust via *link 21* deflecting *lever 20* (Fig. 22) so releasing the latch and liberating the tail of the *switch lever*. The *switch lever*, then controlled by *spring 19*, withdraws the *switch plunger* and interposes *stop B* in the path of *pawl 1*, thereby switching off the motor and removing drive from the changer mechanism. The reason for breaking the coupling between the changer mechanism and the

motor, even when the motor is switched off, is to prevent the operation of the changer mechanism if the turntable rotates, or is rotated, either by momentum or by hand. On the RC65A, *lever 23* is also operated by the "Stop-Start-Reject" knob when it is moved into the "Stop" position. See following paragraph.

(i) **The "Stop-Start-Reject" knob.—Starting.** Reference should be made to Figure 22. When it is desired to start the changer, the "Stop-Start-Reject" knob is moved to the "Start" position. This pulls on *link 3*, which deflects the *switch lever* until its tail is made captive by the latch on *lever 20*. The motor switch is closed, *stop B* is deflected from the path of *pawl 1*, and drive is applied to the cam shaft.

Rejection. When the changer is playing a record, movement of the "Stop-Start-Reject" knob to "Start-Reject", applies pull to *link 3* which via *lever 2* deflects *stop A*. This permits *pawl 1* to engage the ratchet wheel on the motor, thereby applying drive to the changer mechanism. By this means it is possible to simulate the conditions which exist when the trip mechanism is actuated on completion of a record. Thus rejection of a record may be effected at any stage of its playing.

Stopping—RC65. If the changer is playing and the "Stop-Start-Reject" knob is moved to "Stop", *link 3*

pushes *lever 20* and releases the latch. This liberates the *switch lever* and the switch plunger is withdrawn due to the cumulative effect of the *spring 19*, *stop B*, and the switch contacts.

RC65A. (Fig. 27). If the changer is playing and the "Stop-Start-Reject" knob is moved to "Stop", *link 3* does not move *lever 20*. Instead *lever 31* deflects *lever 2*, thus releasing *stop A* and *pawl 1*, applying drive to the cam shaft. Additionally, *lever 23* is operated through *levers 32* and *33*. This releases *lever 24*, so that *trigger 26* on *cam assembly X* moves *lever 24*, *link 21*, and *lever 20*, thus releasing the *switch lever*. The motor is switched off, therefore, when the pick-up is returned to its rest.

(j) **Record discrimination.** This changer has the ability to discriminate between 10 in. and 12 in. records, adjusting the record platform to accommodate them, and at the same time determining the lowering position of the pick-up head according to either size of record.

The discriminating action is best reviewed by considering what occurs when a 10 in. record has been playing and a 12 in. record is resting on the record platform. The edge of the larger record depresses the tip of the *record pawl* (Fig. 24). This has the effect of pivoting the pawl so that the tail rises clear of the *platform stop* when the initial changing action commences. The plat-

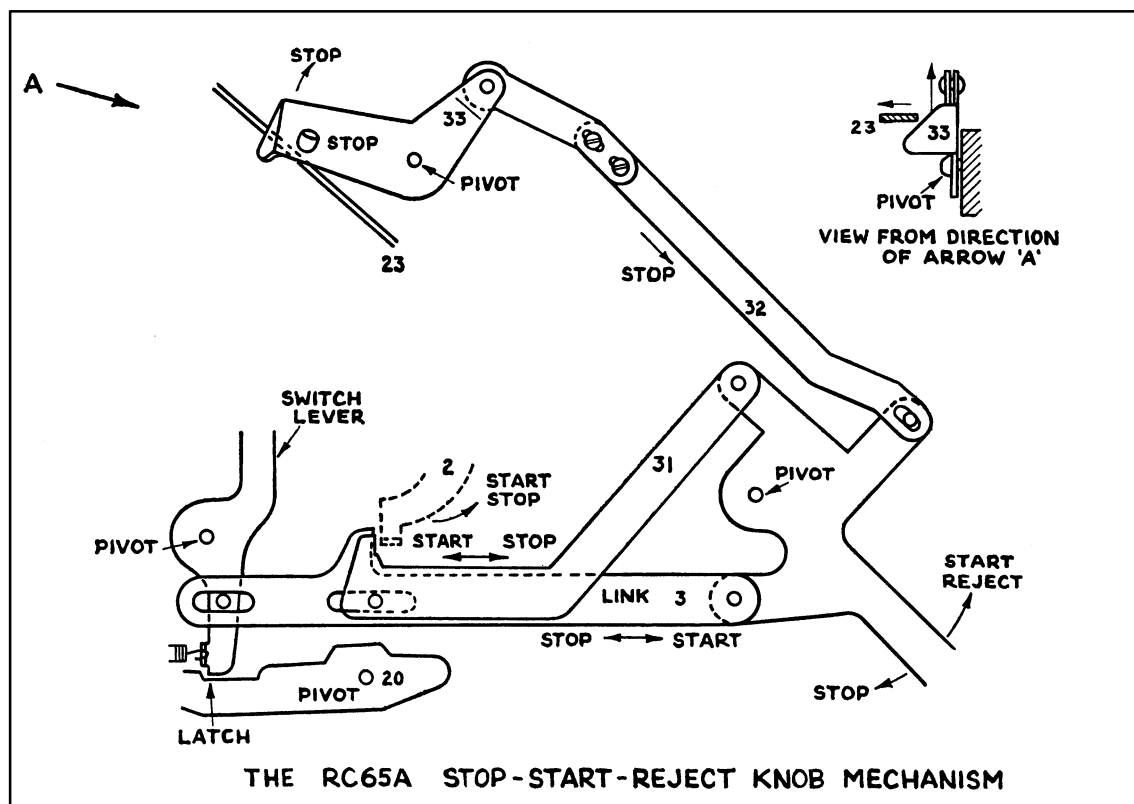


Fig. 27

form will then move right back without tilting under the influence of *spring 8* (Fig. 23), and *cam follower 6* will move inwards so that it rests on the inner cam of *cam assembly X*. Reference to the alternative paths which *cam follower 6* may adopt, was made under the description of *cam assembly X*. The inner cam provides a longer surface of contact for *cam follower 6* to bear on, and being eccentric, produces a relatively greater backward and forward movement of the record platform.

When *cam follower 6* comes to rest on the inner cam, as described above, rotation of the *cam assembly X* pulls the record platform inward by means of *cam follower 6* and *link 7*. This causes the *record pawl* to contact the edge of the record and push it over the shoulder of the spindle on to the turntable.

After the record has dropped, the platform continues to move inwards, but at the same time the forward edge is lowered so that it will pass underneath the edge of any 10 in. record that may be on the spindle.

This tilting is produced by *cam follower 4* and the die cast cam on *cam assembly X*.

At the end of the inward traverse, the record platform resumes its normal slope.

When the platform has moved backward for a 12 in. record, *link 27* (Figs. 23 and 24) which is connected to it, sets the position of *lever 15* (Figs. 23 and 25). This is effected via the system of links, referred to previously, located between the cam unit and the motor-board. As already mentioned under the heading "pick-up arm and associated levers", the position of *lever 15* relative to the secondary *lever 14*, determines the point at which the pick-up will be lowered. As the first joint of the system of links consists of a pin in a slot, the linkage is only moved when there is a change in record size. The backward movement of the pin in the slot, under the influence of the backward moving record platform, is then sufficient to effect coupling to the system of links and alter the position of *lever 15*.

It should be noted that unless the succeeding record causes the record pawl to be depressed, the movement following a 12 in. record will set *lever 15* as for a 10 in. record.

The foregoing completes the description of the changer operation, but attention is drawn to the following additional points.

Repeating a record. From the descriptions provided, it will be understood that if the overarm is raised, the rod and lever do not release the auto-stop lever and a single

10 in. record may be repeated indefinitely. It is pointed out, however, that a 12 in. record cannot be repeated in this manner unless the record pawl is kept depressed.

Stop 28. A further point to note is the function of *stop 28* (Fig. 21). Mention has been made on several occasions of the function of *stop A*; how on encountering *pawl 1*, it has the effect of disconnecting the cam shaft from the motor. It will be remembered that this pawl is normally spring loaded to engage the ratchet wheel. When the pawl is disengaged from the ratchet wheel by *stop A*, the loading spring tends to turn the cam assembly backwards. To remove the possibility of a continuous engaging and disengaging action, *stop 28* is arranged to prevent the cam shaft from turning in a reverse direction by engaging with one of the pegs on *cam Y*.

The muting switch. A muting switch is connected across the pick-up coil connections on all RC65A and some RC65 units. It normally short-circuits the p.u. coil excepting when the arm has been lowered on to a record. An insulated bush attached to *cam follower 10* opens the switch whenever the pick-up is lowered into the playing position. The usual method of testing the gramophone by "flicking" the needle whilst the pick-up is on its rest cannot be used on these units.

The leads from the p.u. transformer are connected to the two ends of the contact springs, the braiding of the lead is connected to the small additional tag, and the earth lead is attached to the soldering tag on the fixing screw. (Fig. 28.)

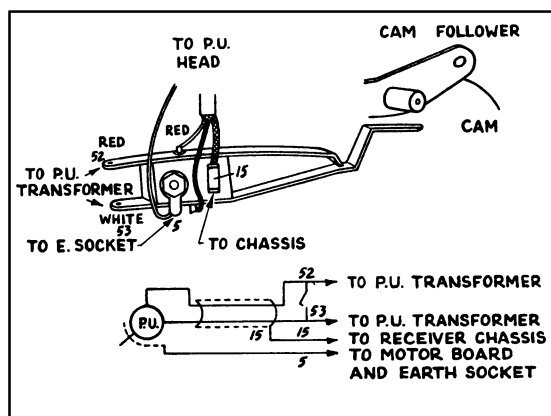


Fig. 28

MECHANICAL NOTES (RECORD CHANGER UNIT)

The following information, and that given on page 33 will prove useful in rectifying any faults that may develop. Further information will be gladly given by Murphy Radio Service Department, or by the Garrard Engineering & Manufacturing Co. Ltd, Technical Service Department, Newcastle Street, Swindon.

Inspection. A cursory inspection of the changer mechanism can be made whilst it is in position in the receiver, if the front panel of the cabinet is lowered, and the fibre back is removed. For a detailed inspection or for most adjustments, the unit must be removed from the cabinet.

The pick-up drop restricting bracket. If the pick-up is lowered on to the turntable when there is no record on it, the fabric may be damaged. To prevent this, an adjustable bracket is fitted beneath the pick-up rest on later RC65A units. With a 10 in. record on the turntable, and the pick-up needle resting in the outer groove, the bracket should be adjusted so that its upper edge is $\frac{1}{4}$ in. below the outer edge of the pick-up arm.

The motor. The D16 motor is a governor-controlled induction motor for use on a.c. mains only. It embodies a dual voltage range, viz. 100/130 and 200/250 volts, 40/60 cycles. The current taken by the motor may be measured in one of the motor leads to the power pack and should not exceed 0.11 amps on the high voltage range and 0.22 amps on the low voltage range at 50 cycles, and 0.24 amps on the low range of 60 cycles.

Should it be necessary to remove the motor from the record changer, the following procedure is suggested. Disconnect the leads from the motor switch, remove the clips holding the leads, then on withdrawing the motor fixing screws, the motor may be removed. It is important that, on withdrawing the motor, careful note be taken of how the divided speed control lever parts in two, so that it may be re-assembled correctly when the motor is replaced. In disconnecting the leads from the motor switch, both covers of the terminal block should be removed. When loosening the terminal nuts attention should be paid to the position of the links and leads.

Refitting the motor should be effected as follows. First re-connect the speed control lever, then hold the motor in position with the spacers in place between the motor and motor-board, finally inserting and tightening the fixing screws.

The motor is then properly replaced and it only remains to re-connect the leads to the switch and fit the clips into position.

Motor voltage adjustment. The choice of either voltage range is effected by alteration of the links on the motor terminal block. This block is located underneath the turntable and has a bakelite cover. The link adjustments required are shown in Fig. 14 on page 14, and these must be appropriately connected for either the Home or Export models. See also "The Export Model", page 14.

Motor lubrication. The bearings are specially designed to retain the lubrication applied to them and, consequently, oiling is only necessary at intervals determined by the length of time the record changer is used. Access to the oil holes is achieved by removing the turntable, and a drop of thin lubricating oil is all that is necessary.

On no account should thick oil be used for the motor bearings.

The pick-up. Although quite robust, the Murphy moving coil pick-up may be damaged if it is permitted to drop on to a record; for this reason we recommend that the head is rotated when inserting a new needle, and not lifted upon its pivot at the rear.

The pick-up head is fitted with three plugs of the Garrard type to which the sockets on the ends of the pick-up leads are connected. These are finally insulated with short lengths of sleeving. One lead is the earth connection of the pick-up mounting plate, and the other two leads are the pick-up connections.

To remove the pick-up head, disconnect the plug and socket connections, referred to above, unscrew the pick-up fixing screw, and withdraw the pick-up head. Care should be taken to ensure that the spring clips, which hold the leads within the pick-up arm, do not spring out when disconnecting the leads. These springs are self-retaining and are simply pushed into position.

The pick-up unit may be removed from the moulded head for inspection when the two fixing screws are taken out. It is attached to the base plate by one of the connecting wires, and must be detached by unsoldering. Care should be taken to prevent any dirt entering the movement when the unit is exposed. It must be stressed **that removal of the magnet will impair its strength and no attempt should, therefore, be made to withdraw this part of the unit, or to effect repair to a damaged unit.** Replacements of the complete pick-up head assembly only, can be supplied by Murphy Radio Service Department.

Inspection of the friction pad on the pick-up plunger is carried out in the following manner. Disconnect *cam follower 10* by removing the nut on the pivot screw, then a spring and plain washer, a brass spacer and tension *spring 29*. This permits access to the plunger friction pad, and thereafter it is only necessary to remove the spring clip and washer from the top of the plunger in order to withdraw it.

A *collar 30*, secured by one screw, is fitted to the pick-up pillar to provide adjustment for the main pick-up ball bearing race. If the bearing is too slack, or too tight, this collar may be moved either up or down the pillar, thereby effecting a correction of whatever condition prevails. Care should be exercised, however, to hold the collar in position when tightening the screw.

Pick-up dropping position. The pick-up arm has been accurately adjusted to ensure that the needle comes on to a 10 in. record $4\frac{1}{8}$ in. from the centre and on to a 12 in. record, $5\frac{1}{8}$ in. from the centre. These positions were decided after examination of a large number of records of various makes.

Occasionally it may be desired to play records other than of normal size, or else the dropping position for average records may require adjustment. In either case this is effected by means of the pick-up adjusting screw, *stop 16*, accessible through a hole in the motor-board (Fig. 19). This should only be turned with the changer in its "Start" position; that is, with the pick-up arm on its rest. A quarter of a turn effects the maximum adjustment obtainable, in either direction. After adjustment, switch on, check the dropping position, and re-adjust if necessary.

It is pointed out that in order to accommodate records not of average size, an adjustment may also be necessary to the record platform; this will be dealt with later under the heading "Record Platform Adjustment".

Pick-up lift. It is essential that the pick-up is capable of lifting sufficiently for the needle to clear the surface of the eighth record on the turntable, on its return to its rest. This adjustment is effected by means of an eccentric screw termed the "adjustment for pick-up lift", it is clearly indicated in the photograph of the underside of the motor-board (Fig. 21).

The adjustment appears as two screw heads on the *cam follower 10*. The larger head is the eccentric adjustment screw, and the other is the locking screw associated with it. To adjust this, first disconnect the mains supply when the pick-up arm is moving back across the record to its rest. Then the two nuts on the backs of the screws should be loosened and the eccentric adjusting screw turned, as necessary, to give the correct height. The maximum adjustment is obtained by one half turn of this screw.

Record platform adjustment. As referred to under the heading "pick-up dropping position", when it is desired to play records other than of normal size, adjustment may also be required to the record platform. This arises from the need to control the distance that the record platform moves forward. The movement of the record platform is performed by two links, each fitted with two screws. *Link 5*, with its pivot at the bottom of the platform, controls the platform tilt, whilst *link 7* controls the distance the platform moves inward.

It is this latter link which requires adjustment to enable the changer to accommodate records which differ from the normal. This is done by loosening the screw further away from the platform and removing the other screw. This screw is then replaced in an adjacent hole according to the adjustment required. If the screw is moved to a hole nearer the platform the inward movement of the platform is increased. Moving the screw in the opposite direction effects increase of the outward movement. The permissible adjustment is one hole on either side of the existing position of the screw.

As already mentioned, *link 5* controls the tilt of the platform. This link is also adjustable, but it is extremely unlikely that it will ever require alteration.

Records failing to drop. If the records fail to drop correctly, it may be due to the record spindle having become bent. This should be ascertained by checking the spindle against the template printed on page 32 and correction should be made, if necessary. Great care must be exercised in doing this as the thin neck of the spindle is easily broken if unduly bent. Should the spindle agree with the template, examination should then be made of the record pawl. This is done by sliding off the nameplate on the record platform cover.

It will be observed that the lower tip of this pawl is arranged to engage with the *platform stop* on the back-

ward movement of the platform during 10 in. record operation (Fig. 24). When a 12 in. record depresses the pawl, however, the lower tip is free to pass over the stop. When the platform is in the playing position, that is, when the changing sequence is completed and a record is being played, there should be a gap of approximately $\frac{1}{8}$ in. between the lower tip of the record pawl and the front of the stop. If this gap is incorrect, the stop can be adjusted by slackening the two securing screws, and moving it backwards or forward as required, finally re-tightening the screws.

Speed regulation. On some power supplies it may be necessary when installing the unit to make a slight re-adjustment of the speed control lever, so that 78 r.p.m. corresponds with the line on the indicator scale.

Using a stroboscopic disc, or a watch with a seconds hand, set the speed to 78 r.p.m. Remove the turntable and carefully release the screw holding the control lever to the vertical brake shaft (Fig. 19). The control lever is now free to be moved without affecting the speed of the turntable, and should be set to the mid-point of the indicator scale. Finally, tighten the screw, replace the turntable, and re-check the speed.

On some changers the screw in question may not be accessible from the top of the motor-board; when this is the case, it may be possible to use a narrow-handled screwdriver beneath the motor-board.

The overarm. When a number of records are on the record spindle and the overarm is lowered upon them, only the pad nearest to the platform should rest on the records. There should be a gap of approximately $\frac{1}{8}$ in. between the surface of the top record and the other pad because that side of the overarm is intended to come into action only during the last changing sequence, when the last record to be played is a 10 in. one. It then prevents the record tipping as the platform moves back leaving the record unsupported.

An adjusting screw beneath the overarm determines the position at which the overarm actuates *rod 22*, effecting release of the auto-stop mechanism. This is normally set so that after the last record has dropped the auto-stop is released by the overarm reaching its lowest position. With incorrect adjustment the record changer may switch off before the records are played, or it may not switch off on completion of the last record. In either event correction is made by alteration of the overarm adjusting screw.

The trip mechanism. Satisfactory operation of the record changer depends upon the proper operation of the auto-trip. Therefore, occasional adjustment of the auto-trip friction spring may be necessary.

At the end of a record, if the auto-trip mechanism fails to function (i.e. the pick-up does not return to its rest but remains at the centre of the record), the following points should be checked. Assuming that the record has a run-off groove, check that *lever 18* (Fig. 19) is clear of

the motor-board as any added friction here will prevent it moving in towards the striker. If *lever 18* is quite free from the motor-board, increase the tension of the friction clutch spring. This is done by turning the adjusting screw anti-clockwise for about half a turn.

Should the changer operation commence before the end of a record, or a bumping or tapping sound be heard, examine the trip lever rubber. If it is slightly worn, give it half a turn in order that a new face may be presented to the striker, but if it is excessively worn, it must be replaced. If the rubber is in good condition, however, the tension of the friction spring should be reduced by giving the adjusting screw half a turn in a clockwise direction.

The record spindle. When correctly inserted in the turntable spindle, the record spindle should lean towards the record platform. If the record spindle is loose or in the wrong position, the two screws at the base of the turntable spindle (Fig. 21) should be slackened. Move the record spindle into its correct position and finally tighten the two screws.

Should an intermittent squeak develop it is probably due to the anti-slip sleeve on the record spindle having become dry and may be cured by the application of a drop of oil between the sleeve and the spindle.

Record discrimination faults. This class of fault is either the outcome of mal-adjustment of the *record pawl*, or of the mechanism which determines the pick-up lowering position.

A type of fault which could arise in transit is a movement of the platform stop too far forward. This may manifest itself in two distinct modes of operation.

Firstly, if the stop is too far forward and in such a

position as to continually arrest the tail of the *record pawl*, even when a 12 in. record rests on the record platform, the following action will occur. The 12 in. record will be unable to depress the pawl, owing to the pawl's inability to clear the stop, and consequently the record platform will not move back into its proper position to accommodate a 12 in. record. This means that the record platform will execute the changer operation appropriate to a 10 in. record, beneath the edge of the 12 in. record. The 12 in. record will not be pushed off the shoulder of the spindle and the pick-up will return from its rest to repeat the 10 in. record previously played. It is worthy of note that the above fault would not be apparent as long as only 10 in. records were being played, but would show itself immediately a 12 in. record was introduced.

Secondly, the stop may have moved too far forward, when the record pawl has been momentarily depressed, making it impossible for the pawl to assume the proper position against the front of the stop, appropriate to 10 in. operation. Under these conditions the changer would play 12 in. records quite efficiently, and the defect would not become apparent until a 10 in. record was introduced. The record platform would be incapable of moving sufficiently far forward to push the 10 in. record from the shoulder of the record spindle and consequently the changer would proceed to repeat the 12 in. record previously played.

Failure of the pick-up arm to alter its lowering position with change of record size, will again result in efficient playing of only one size of record. When this condition prevails, check that the record platform is in fact operating normally. If so, the defect will be due to the improper operation of *lever 15*, caused by loose screws or mal-adjustment of *link 27*.

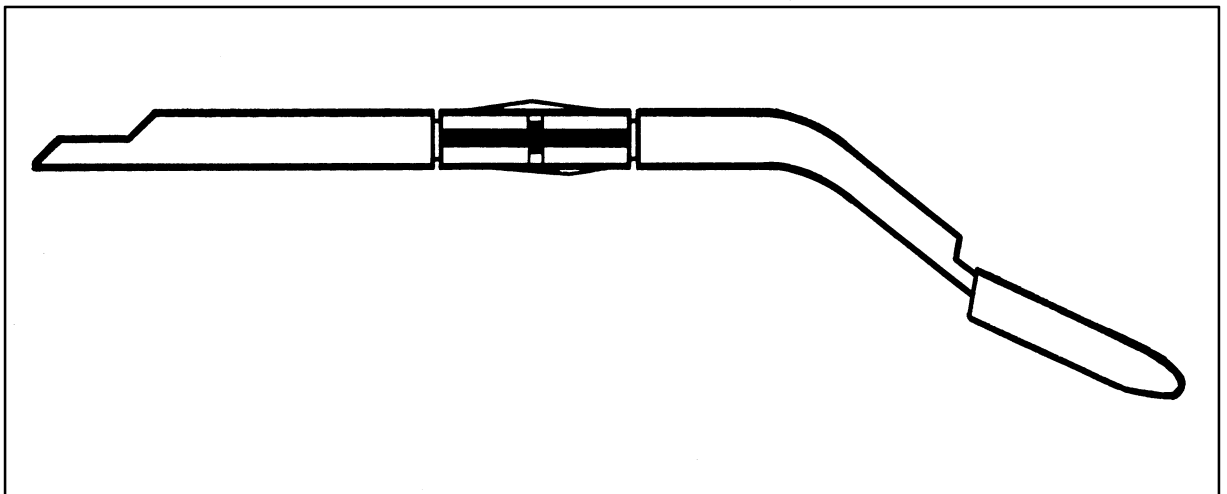


Fig. 29. TEMPLATE FOR RECORD SPINDLE

FAULT FINDING TABLE (RECORD CHANGING UNIT)

The following table should not be considered to be complete, but the faults and symptoms quoted are typical, and may provide guidance in assessing the probable cause of other faults, and also suggest measures to be adopted to effect their remedy.

It is recommended that the description of the mechanism is read because, if the functions of the various levers and cams are understood, the diagnosis of faults may then be approached in a logical manner.

FAULT	ADDITIONAL SYMPTOMS	CAUSE AND CURE
No output when playing records. Will not change from 10 in. to 12 in. records.	Will play 10 in. to the exclusion of 12 in. records or vice versa, but any attempt to play a mixed batch results in repetition of the last record played.	Muting switch contacts not opening. Platform stop too far forward, preventing pawl movement. Move stop back so that the pawl is free. See "Mechanical Notes", page 31.
Will not change from 10 in. to 12 in records.	Record platform operates correctly but pick-up continues to lower as for 10 in. records to the exclusion of 12. in or vice versa.	<i>Lever 15</i> not operating properly. <i>Link 27</i> out of adjustment, or screws loose.
Sometimes drops two records.		Bent spindle, check against template on page 32: replace if necessary. Bent spindle, as above.
Mechanism jams record between platform and record spindle. Faulty record dropping near last record of sequence.	Changer stops, but continues when record is freed.	Bent overarm. See page 31.
Pick-up not dropping on outside grooves of records. Pick-up not being lifted high enough.	Same error on 10 in. and 12 in. records. When the pick-up is moving back to its rest, there is a tendency to scratch the last record.	Pick-up adjusting <i>screw 16</i> or pick-up lever clamp require adjustment. Adjust height by the screw on <i>cam follower 10</i> as described on page 31.
Pick-up head touches the record being played.	Needle too far in holder, and very tight.	Pick-up has been dropped on record, forcing needle into coil former. New pick-up movement is required.
No lateral movement of pick-up arm.	Pick-up arm simply moves up and down but not sideways and is held in the vicinity of the rest.	<i>Lever 14</i> has been moved to the wrong side of <i>stop 15</i> , thus holding <i>lever 13</i> in the rest position.
Changer mechanism fails to work at end of a record.		Record not fitted with run-off groove.
" " "	Records fitted with run-off groove, but <i>stop A</i> not released, therefore cam shaft not revolving.	Motor-board not level. Friction clutch slipping (turn adjusting screw anti-clockwise to increase tension). See that <i>lever 18</i> is quite free to move.
Bumping noise as turntable revolves near end of record.	Changing action otherwise satisfactory.	<i>Friction clutch</i> too tight (turn adjusting screw clockwise to decrease tension). <i>Trip rubber</i> worn (turn round or replace).
Changer functions satisfactorily for first one or two records, but pick-up tends to jump outwards on inner grooves of later records.	Changer action otherwise satisfactory.	<i>Friction clutch</i> too tight. Magnetic attraction between pick-up and turntable holds needle in groove on first one or two records. Turn adjusting screw in a clockwise direction and use minimum friction necessary for satisfactory operation.
Auto-stop fails to operate after the last record on the changer has been played.		<i>Rod 22</i> not being depressed; turn overarm adjusting screw anti-clockwise so that <i>rod 22</i> is depressed when the last record has dropped.
" " "	<i>Rod 22</i> depressed satisfactorily.	<i>Link 21</i> out of adjustment so that the <i>trigger 26</i> (Figs. 26 and 22) does not actuate the latch to release the <i>switch lever</i> .

FAULT	ADDITIONAL SYMPTOMS	CAUSE AND CURE
Switches off before the end of the last record.	Will play several records and then switch off.	<i>Rod 22</i> depressed too early in the sequence. Turn overarm adjusting screw clockwise so that <i>rod 22</i> is depressed only after the last record has dropped.
” ” ”	Tends to switch off after every record.	<i>Link 21</i> out of adjustment so that even the slight movement of <i>lever 24</i> by <i>trigger 26</i> is sufficient to release the <i>switch lever</i> (Figs. 26 and 22).
Will not switch off by the “Stop-Start-Reject” knob.		Check <i>spring 19</i> , and <i>stop B loading spring</i> . Additionally on the RC65A, <i>lever 33</i> is not releasing the auto-stop mechanism. Adjust <i>link 32</i> .
Motor fails to start.	After “Stop-Start-Reject” knob was moved to stop position just previously (RC65 only). After disconnection of the mains supply (RC65 and RC65A).	Probably the changer mechanism was in the middle of operation when stopped and, in the absence of the fly-wheel action of the turntable, the drive is not sufficient to effect rotation of both the turntable and cam shaft. Turn the turntable round by hand until the pick-up is returned to its rest. Check electrical circuit.
Motor weak.	May fail when pick-up is being lifted from record, prior to being moved back to the rest.	Probably due to motor being oiled with thick oil. Clean motor and bearings, and lubricate with thin oil. Check that motor current is not excessive. (See “Mechanical Notes”.) If necessary, replace motor.
Motor rattles.		Probably governor rattle due to sleeve being dry. Lubricate the sleeve with thick oil. Check motor bearings for slackness.
Varying speed.	“Wavy” or “Watery” reproduction.	Dry governor pads, saturate with thin oil.
Movement of record-platform insufficient.		Adjust <i>link 7</i> .
Tilt of platform is insufficient.		Adjust <i>link 5</i> .
Generally poor performance.	Motor-board damaged or bent.	Transit damage due to transit screws not having been used, or changer not level.

PARTS LIST (ELECTRICAL COMPONENTS)

The following abbreviations are used in the table below: p.s.m., protected silvered mica; m.m., moulded mica; tub., paper tubular; elec., electrolytic; w.w., wire wound; W., wattage rating. All resistors are rated at $\frac{1}{4}$ watt unless otherwise stated.

The d.c. resistances quoted for the coil and transformer windings are average figures and should be taken as a general guide only.

PART NO.	CIRCUIT NO.	VALUE	TOLERANCE AND REMARKS	PART NO.	CIRCUIT NO.	VALUE	TOLERANCE AND REMARKS
28015	C1	500pF	20% m.m., 750V.	48563	C6	5-35pF	Triple trimmer unit
28243	C2	470pF	2% p.s.m.		C7	5-35pF	
41419	C3	0.01μF	25% tub. 1000V.		C8	5-35pF	
23673	C4	27pF	10% p.s.m.		C9	0.1μF	
				41404			20% tub. 350V.