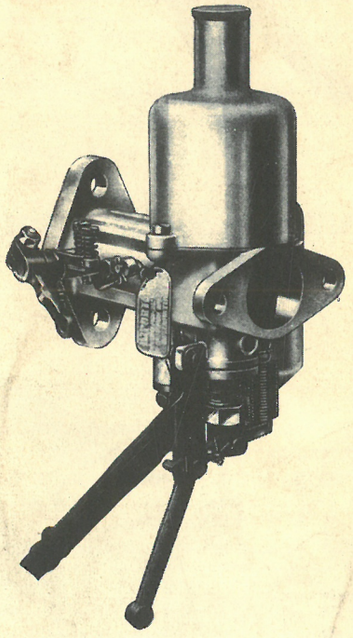
KARBURATORER



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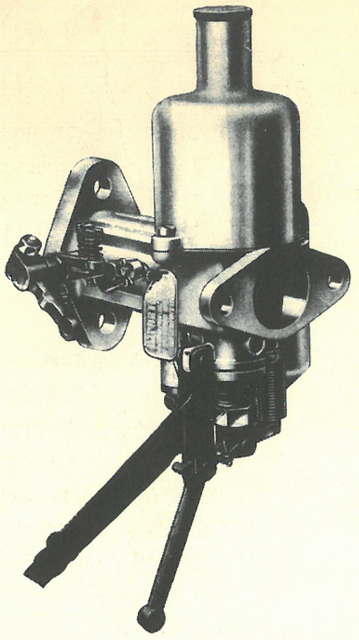
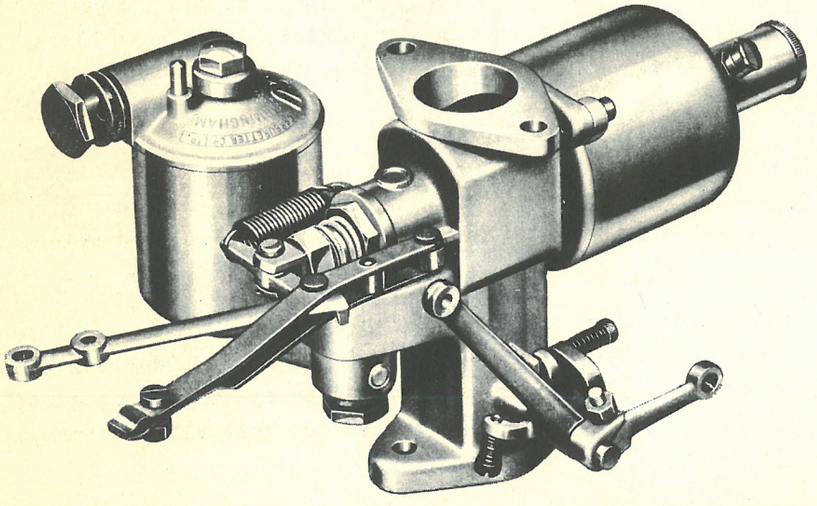


SU karburator, almindelig type



SU karburator, down draught

SECTION FF

THE OVERDRIVE UNIT

GENERAL DESCRIPTION

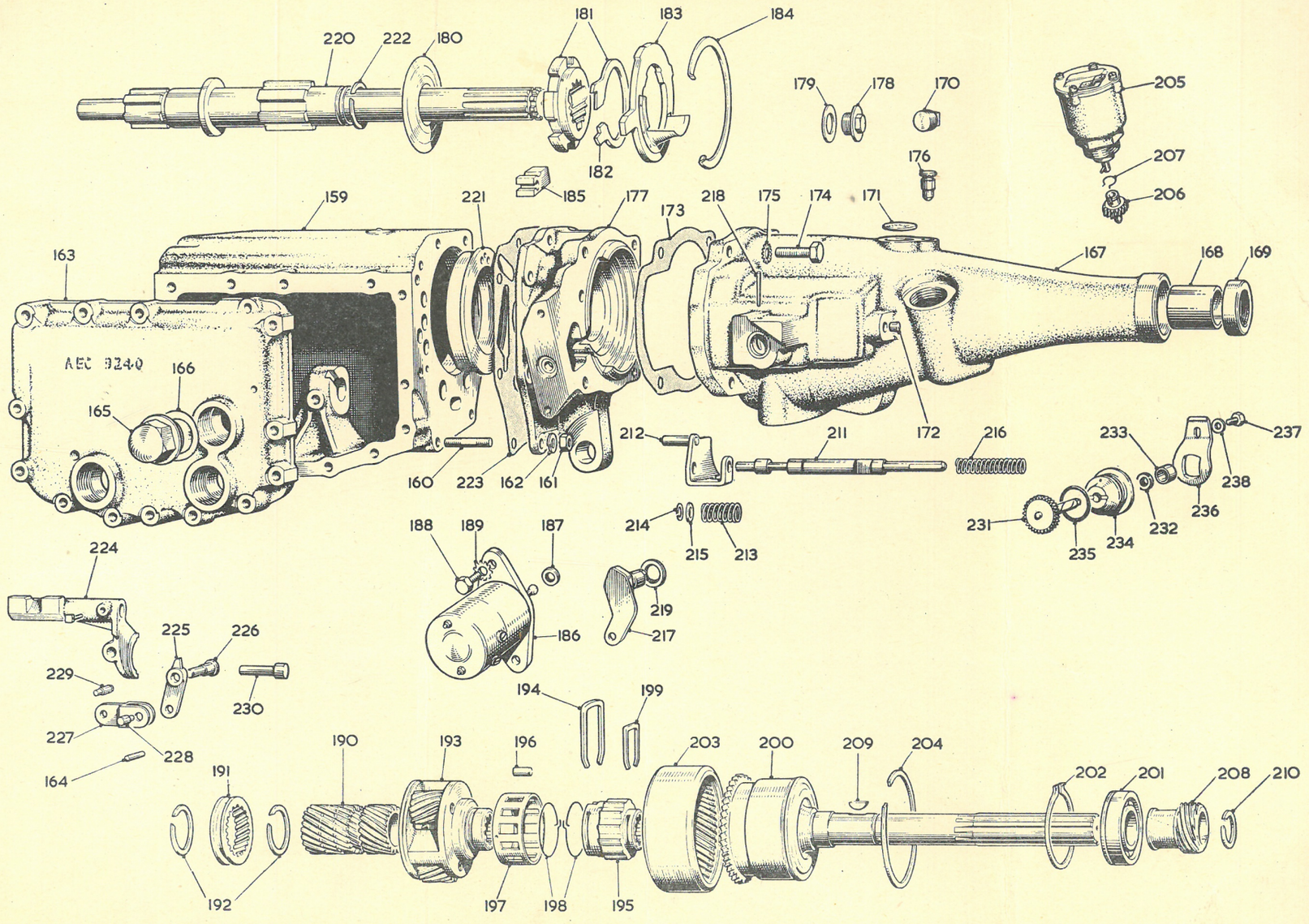
The purpose of an overdrive is to provide a higher gear ratio than normal top gear, permitting fast cruising speeds at lower engine revolutions. The same effect could be obtained by using a higher rear axle ratio, but this would affect all gears alike, the car would be sluggish in acceleration, and require excessive gear changing. The overdrive equipped car has all the acceleration and hill-climbing power of the normal car, plus the advantage of an extra-high gear to be used when required. The Borg-Warner overdrive is the result of over 20 years' development, and six million of these units have been produced for use in the United States of America. The unit consists, essentially, of an epicyclic gear train in which the input shaft rotates at only 70 per cent. of the speed of the output shaft. This means that when running in overdrive the engine travels only 70 per cent. as fast as it would if the same road speed were maintained in direct top gear. With this reduction in engine speed the riding sensation in the car is that of continuously coasting downhill. Engine wear, oil and petrol consumption are all reduced with a cash saving which can quickly repay the extra cost of the unit.

OPERATING PRINCIPLES

The overdrive unit consists of a train of epicyclic gears and a free-wheel. The sun gear " A " (Fig. FF.1) is splined to the control plate " B ", and both sun gear and control plate are free to revolve around the input shaft " C ". The pinion cage " D " and the free-wheel hub " E " are splined to the input shaft. When in direct drive, the drive is through the rollers " F " to the output-shaft " G ", and the whole gear train, including the sun gear and control plate, rotates as one unit. If the power is taken off the input shaft, causing it to slow down, the output shaft, driven now by the propeller shaft, continues running at the same speed as before. The ring gear on the output shaft, which is now rotating faster than the planet carrier, turns the planet pinions " J " which react against the sun gear, causing the sun gear to turn more slowly. As the difference in shaft speeds increases, so the sun gear turns more and more slowly until at a point when the input shaft is turning at 70 per cent. of the speed of the output shaft, the sun gear stands still.

If the input shaft turns more slowly than 70 per cent. of the speed of the output shaft, the sun gear will start

THE OVERDRIVE COMPONENTS



KEY TO THE OVERDRIVE COMPONENTS

No.	Description
159.	Case—gearbox.
160.	Stud—overdrive.
161.	Nut—stud.
162.	Washer—spring—stud.
163.	Cover—gearbox side.
164.	Dowel—cover.
165.	Cover—access hole.
166.	Washer—access hole cover.
167.	Housing—overdrive assembly.
168.	Bush.
169.	Seal—oil.
170.	Plug—filler and drain.
171.	Plug—bearing circlip access hole.
172.	Plug—lock-up rail hole.
173.	Gasket—housing to adaptor plate.
174.	Screw—housing to adaptor plate.
175.	Washer—shakeproof—housing screw.
176.	Breather—gearbox.
177.	Adaptor plate—housing to gearbox.
178.	Plug assembly—screwed.
179.	Washer—screwed plug.
180.	Baffle—oil.
181.	Plate assembly—blocker ring and control.
182.	Ring—blocker.
183.	Cover plate and oil chute assembly.
184.	Circlip—cover-plate.
185.	Pawl—overdrive.
186.	Solenoid assembly—pawl operating.
187.	Seal—oil—pawl rod.
188.	Bolt—solenoid to adaptor plate.
189.	Washer—shakeproof—solenoid bolt.
190.	Sun-gear.
191.	Collar—shifter.
192.	Circlip—collar.
193.	Cage assembly—pinion.
194.	Clip—pinion cage retainer.
195.	Cam—free wheel.
196.	Roller.
197.	Cage—roller.
198.	Spring—roller case.
199.	Clip—cam to mainshaft.
200.	Output shaft assembly.
201.	Bearing—output shaft.
202.	Circlip—bearing.
203.	Ring-gear.
204.	Circlip—gear to output shaft.
205.	Governor assembly.
206.	Pinion—governor.
207.	Clip—pinion to governor.
208.	Gear—governor and speedometer.
209.	Key—gear to output shaft.
210.	Circlip—gear to output shaft.
211.	Rail—shift.
212.	Fork assembly—shifter.
213.	Spring—lock-up rail.
214.	" C " washer—lock-up rail.
215.	Washer—cup—" C " washer.
216.	Spring—retractor—lock-up rail.
217.	Shaft assembly—control.
218.	Taper pinshaft retaining.
219.	Seal—oil.
220.	Mainshaft—gearbox.
221.	Housing—bearing.
222.	Circlip—small—bearing.
223.	Gasket—overdrive to gearbox.
224.	Fork—striking—reverse.
225.	Lever—overdrive shift rail operating.
226.	Pin—lever fulcrum.
227.	Fork—lever to reverse striking fork connecting.
228.	Pin—fork swivel.
229.	Pin—fork operating.
230.	Extension piece—shift rail.
231.	Pinion—speedometer.
232.	Seal—oil—pinion.
233.	Retainer—oil seal.
234.	Bush—pinion.
235.	Seal—oil—bush.
236.	Clip—bush retaining.
237.	Bolt—clip to overdrive housing.
238.	Washer—plain—clip bolt.

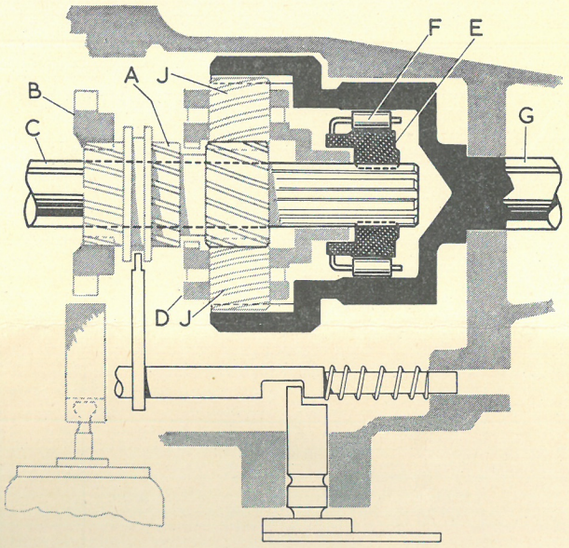


Fig. FF.1.
When driven in free-wheel direct drive the gears, shown in feint line, are carried round bodily with the input shaft. All of the torque is passed through the roller clutch.

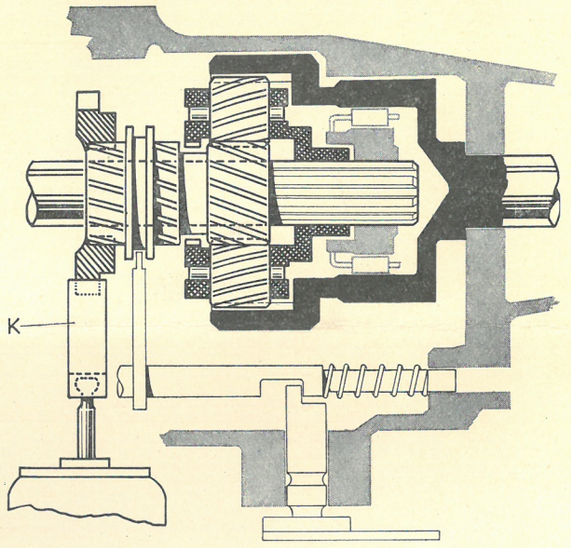


Fig. FF.2.
In overdrive, the pawl is engaged with the control plate, and locks the sun gear. The gears are driving and the free-wheel is being overrun.

to turn backwards. At the moment that the sun gear and its control plate stand still, they may be locked to the casing by inserting the steel pawl " K " (see Fig. FF.2) into a notch on the outer circumference of the control plate. The sun gear, no longer free to turn, forces the planet pinions to rotate when power is applied to turn the input shaft and planet cage. The ring gear and output shaft will be increased in speed, or overdriven in the ratio of 7 to 10. (See Figs. FF.2 and FF.3.)

Since the free-wheel will not transmit a reverse drive it is necessary for the mechanism to be locked whenever it is desired to reverse the car. The engagement of reverse gear automatically ensures this by moving the sun gear rearwards, so that the lock-up teeth on the sun gear engage in similar teeth on the planet carrier (see Fig. FF.4). Locking-up by kicking down the accelerator pedal to the floor-boards momentarily and simultaneously pulling out the overdrive control handle, also enables the car to use the engine as a brake when descending steep hills.

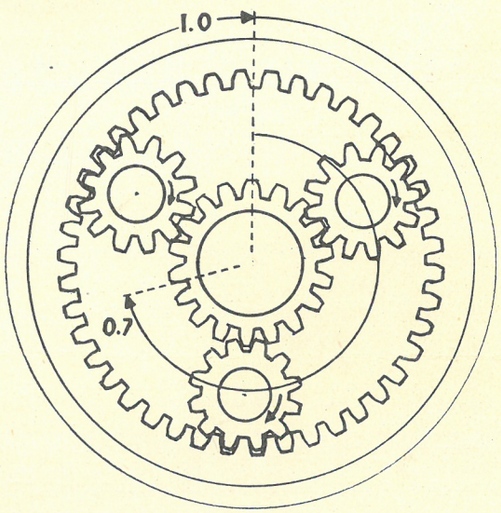


Fig. FF.3.
As the planet cage is turned, the ring gear and planet pinions are carried bodily round with it. The planets, however, are forced by the stationary sun gear to turn also on their own axles, and this rotation in turn over-drives the ring gear. For every 0·7 turn of the planet cage the ring gear will make one complete revolution.

DRIVING WITH OVERDRIVE

When the car is being driven below 30 m.p.h., the direct drive is used, making available the acceleration so desirable at lower speeds. As the car speed increases above 30 m.p.h. the overdrive unit will automatically change into the overdrive ratio, but only when the driver desires no further acceleration; when consciously or subconsciously he lifts his foot from the accelerator, the change will be completed. Thereafter, the overdrive remains in action until the car speed falls below 27 m.p.h., when overdrive is released. At high speeds, while operating in overdrive, the driver may require additional acceleration, beyond that

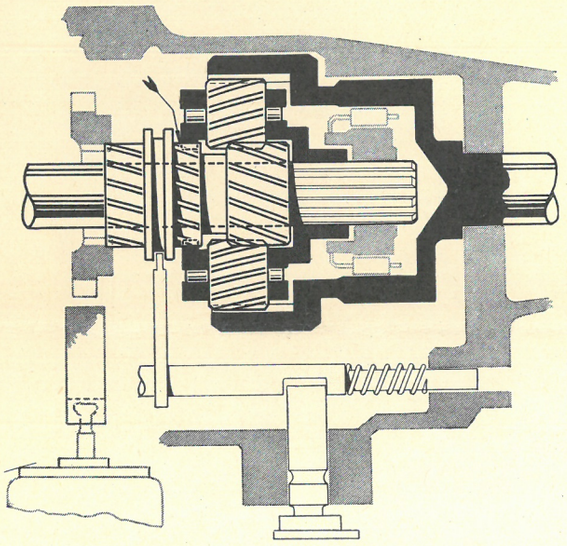


Fig. FF.4.
By moving the sun gear backwards with the control lever, the teeth on the sun gear have locked into the teeth on the planet cage, see arrow. Everything is rotating together without any free-wheel action.

available by opening the throttle wide. His natural impulse is to press the accelerator further, and by pressing it down until it depresses the switch button beneath the pedal it releases the overdrive, making available the full acceleration of direct drive. The direct drive is maintained as long as the full acceleration is required; when the driver no longer requires it he simply lifts his foot right off the accelerator momentarily, and overdrive is resumed. If the driver so desires he may retain the direct drive indefinitely by maintaining a small amount of throttle opening. When driving in city traffic a further advantage is to be had from the overdrive. If the speed in any gear exceeds 30 m.p.h. overdrive can be engaged, thus it is possible to accelerate to 30 m.p.h. in third gear, change automatically into overdriven third gear by momentarily closing the throttle, and continue accelerating in overdrive third, equal approximately to normal top gear. By simply kicking down the accelerator to the floorboards, momentarily, third gear is instantly and automatically regained for acceleration if the throttle is held open. Most of the benefits of automatic transmission are thus available without the expense of a completely automatic transmission system.

Free-wheel

Another point that the driver will appreciate is the reduced use of the clutch pedal made possible by the free-wheel action of the overdrive when in direct drive. Below 27 m.p.h. it is possible to change gear without touching the clutch pedal. Above this speed (the cutting out speed of the automatic governor) it is necessary to use the clutch in the orthodox manner, but, since most gear changing is done when the vehicle is travelling below 27 m.p.h., the advantage gained is considerable. The clutch must of course be released when the car is being started from a stand still, or is being brought to a stop.

Driver's Control

Only one driver's control is fitted, and this consists of a handle which pulls a cable to lock the free-wheel, so that the engine braking is available for descending hills. To lock-up, the driver must ensure that the engine is pulling and that overdrive is not engaged, by kicking down the accelerator pedal to the floorboards momentarily and simultaneously pulling out the overdrive control. Any attempt to lock-up when the engine is not pulling or when overdrive is engaged will produce results similar to a " missed " gear change.

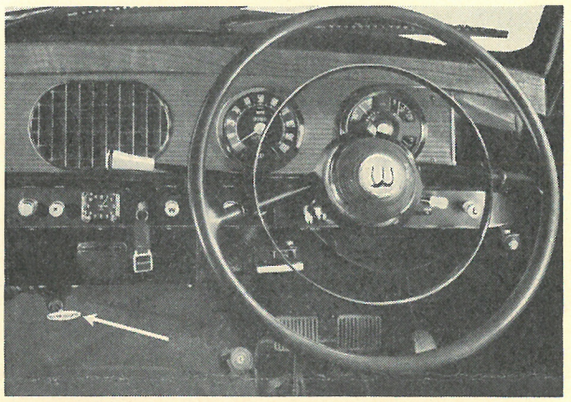


Fig. FF.5.
Driver's overdrive control.

Section FF.1

MECHANICAL OPERATION

Free-wheeling—Direct Drive

The gearbox mainshaft " A " (Fig. FF.6) extends through the sun gear " B " and is splined into the planet pinion cage " C " and roller clutch hub " D ". The latter has 12 cam surfaces, and 12 steel rollers located against the cams by a cage and spring. When a driving torque is applied to the roller clutch hub by the mainshaft, the rollers are forced outwards into a wedging contact with the outer race (see A in Fig. FF.7). In this condition all the overdrive gears and

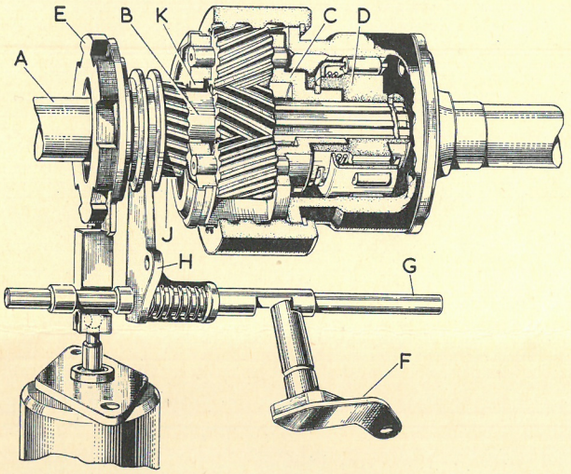


Fig. FF.6.
Sectional drawing of the overdrive.

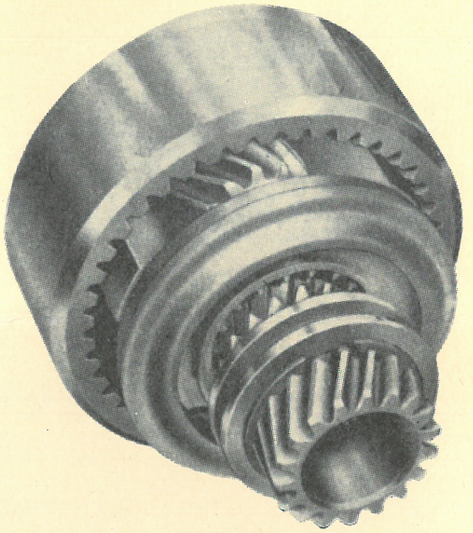


Fig. FF.8.
The gear train.

their directly associated control parts revolve together as a unit. On the other hand, if the throttle is closed, removing the driving force, the rollers release their wedging contact (see B, Fig. FF.7), permitting the car to coast with the mainshaft, pinion cage and engine turning at a slower speed than the ring gear output shaft and propeller shaft. Under such conditions the ring gear, as it rotates around the planet pinion cage, will cause the planet pinions to rotate, and they in turn react against the sun gear to make it turn more slowly than the planet cage. In fact, the sun gear may turn forward, stand still or turn backwards, depending solely upon the relative speeds of the mainshaft and the output shaft. If the mainshaft is turning at exactly 70 per cent. of the speed of the output shaft, the sun gear will stand still; if the mainshaft speed is faster than this the sun gear will turn forward; if it is slower the sun gear will turn backward.

Overdrive

To engage overdrive it is necessary to hold the sun gear against rotation. This is done by inserting a steel pawl into one of the notches in the sun gear control plate " E " which is splined on to the sun gear (see

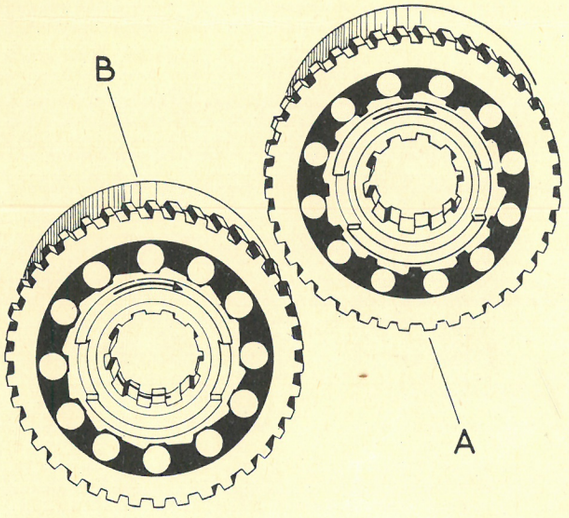


Fig. FF.7.
Free-wheel action.

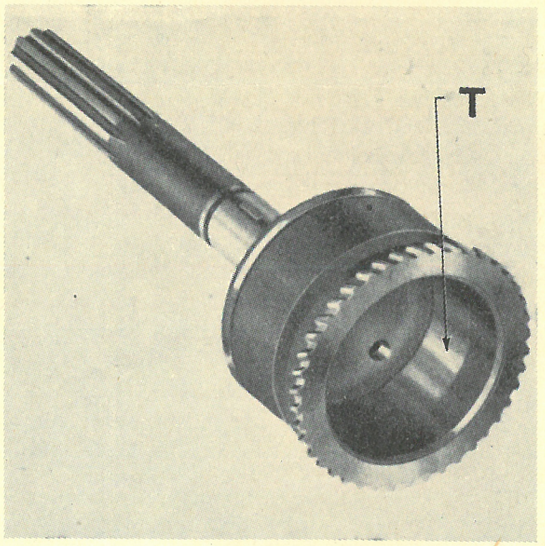


Fig. FF.9.
The output shaft. **Note.**—the outer race "T" of the free-wheel.

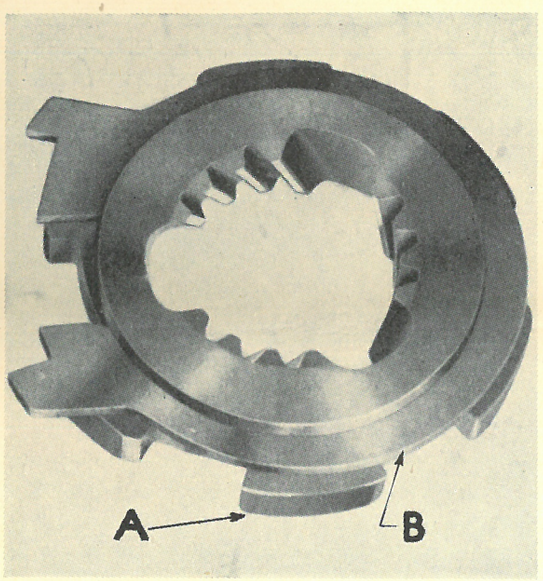


Fig. FF.10.
Control plate and blocker ring.

Fig. FF.6). The pawl is pushed into engagement by a spring-loaded stem in the plunger on the solenoid. It is of course essential that the engagement of the plunger is synchronised to the exact instant that the sun gear and control plate stand still. Around the hub of the control plate " A " is a blocker ring " B " (see Fig. FF.10). The blocker ring is free to rotate around the control plate, but being a tight fit, frictional drag resists turning. When assembled in the overdrive, the blocker ring " B ", by its frictional drag upon the hub of the control plate " A " is rotated into such a position as to latch the steel pawl " C " (see Fig. FF.11) against inward movement. When the car road speed reaches 30 m.p.h. the contacts of a centrifugal governor switch close, acting through an electrical control circuit to energise the solenoid. The solenoid sets up a spring pressure against the pawl, tending to push it into engagement, a movement which is prevented by the blocker ring.

To effect the change into overdrive, momentarily close the throttle, whereupon the roller clutch releases and the engine slows down. At the same time the sun gear also slows down more rapidly, and when the engine speed has fallen by 30 per cent. the sun gear stands still, and then reverses its rotation. Upon the instant of reversal, the blocker ring, moved by its frictional drive from the control plate hub, also rotates slightly in the reverse direction and releases the pawl which snaps forward into the first notch of the backward rotating control plate (see Fig. FF.12). The extreme rapidity of this action ensures that the control plate cannot rotate backward more than one-third turn at the most; usually it will be less. This engagement, at nearly perfect synchronism, accounts for the smooth action of the control. Once engaged, under conditions of normal driving, the overdrive remains in action until the road speed falls to 27 m.p.h. when the governor contacts open, releasing the solenoid which withdraws the pawl (if the throttle is closed) whereupon the condition of free-wheeling drive is resumed. If the throttle is still open when the solenoid releases, the driving torque " pinches " the pawl to prevent it withdrawing; the moment the throttle is closed, the pawl is released and free-wheel direct drive is resumed.

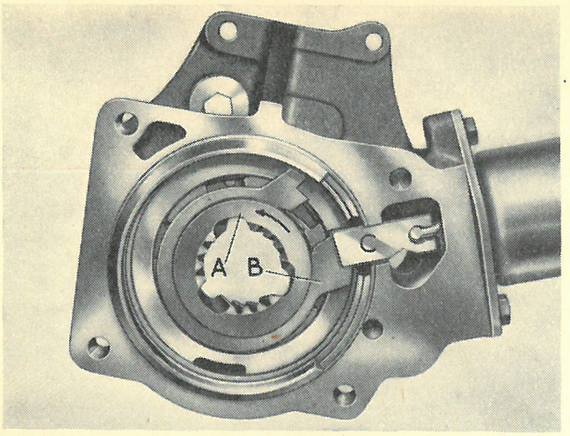


Fig. FF.11.
Pawl before engagement. As the control plate rotates, see arrow, the blocker ring latches the pawl against forward movement.

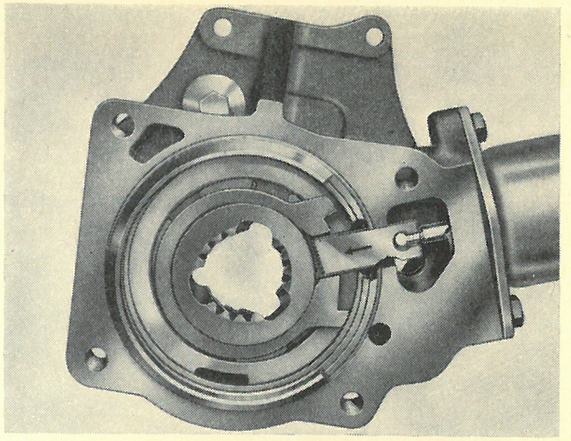


Fig. FF.12.
Pawl engaged. The control plate has reversed its rotation just sufficiently to unlatch the spring-loaded pawl, which has snapped forward and locked the control plate.

Kickdown (Driver Controlled Downshift)

When overdrive is engaged the engine is turning at only 70 per cent. of its speed when in direct drive. This reduces the power available (except at very high car speeds) and although this reduced power is usually sufficient for all purposes, there are times, as in overtaking, when it is desirable to return to direct drive, for more power, without reducing the car speed to the point where the overdrive would normally cut out. Under such circumstances the driver merely presses the accelerator pedal beyond the normal wide open position, and the overdrive immediately returns to normal free-wheeling direct drive. This is accomplished by means of a kickdown switch which is mounted on a bracket near the accelerator pedal, and is actuated by the accelerator pedal. The kickdown switch " K " has two sets of contacts, " A " and " B " (see Fig. FF.13). During the normal accelerator

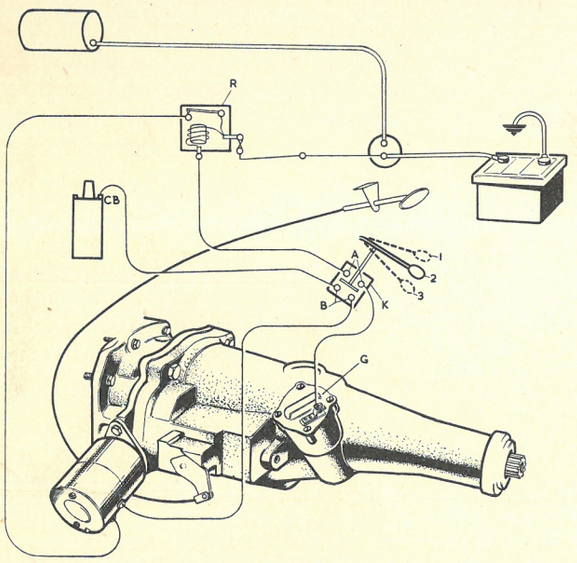


Fig. FF.13.
Diagram of control arrangements.

pedal travel between positions 1 and 2 the contacts " A " are closed, and complete the circuit from the windings of relay " R " to earth by way of the centrifugal governor " G ". So long as the kickdown contacts " A " and the governor contacts are closed, the relay contacts will also close, supplying electric current to operate the solenoid and hold the pawl in engagement with the sun gear control plate. When the accelerator is opened wide to position 3, the contacts " A " will be opened, breaking the circuit and de-energising the solenoid, the outer spring of which urges the pawl toward release. Due to the fact that the engine is driving the car through the overdrive gear train, the pawl is pinched by the torque reaction on the sun gear control plate and cannot withdraw until the driving torque is removed. Further depression of the accelerator beyond position 2 which is wide open, to position 3, the kickdown position, closes contacts " B " on the kickdown switch, completing the circuit from the ignition contact breaker terminal " CB " on the ignition coil to number 6 on the solenoid which is connected to earth. This immediately interrupts the engine torque allowing the pawl to snap out of engagement, and this movement opens the earthing contact which is connected to number 6 terminal, restoring the ignition. This entire action occurs with such rapidity that not more than 3 or 4 cylinder explosions are missed. When the driver raises his foot slightly from the accelerator pedal, the normal position of the kickdown switch is restored, thus re-energising the solenoid, but the pawl cannot re-engage until the throttle is closed momentarily to cause the engine to slow down sufficiently to reverse the rotation of the sun gear.

Locked-up

Although the normal procedure is to operate the unit as already described, taking advantage of the free-wheeling and the overdrive, there are times, as when descending a steep hill, when it is desirable to use the engine as a brake. Under such circumstances the overdrive dash control is pulled out, swinging the control lever " F " (Fig. FF.6) forward, thus moving the shift rail " G " and shift fork " H " backwards, moving the sun gear so that the lock-up teeth " J " will engage with the corresponding teeth " K " on the pinion cage. This causes the entire group of working parts to revolve as a unit, duplicating in all respects the action of the conventional gearbox. Obviously the sun gear must be revolving at the same speed as the planet cage before the lock-up teeth can be engaged, therefore, if the car is in motion it is necessary to open the throttle to ensure that all the parts revolve together. If the overdrive is engaged it must be released by kicking down the accelerator, and pulling the overdrive dash control at the same time. Thereafter the car will have a conventional drive until the driver chooses to push the overdrive dash control in, which may be done at any time. **In actual practice, since the driver may not be aware if he is in overdrive or not, it is good practice always to kick down the accelerator when locking-up with the car on the move.**

The driving technique when a quick lock-up is required for descending a steep hill, is to tread the accelerator right to the floorboard, pulling the overdrive dash control out simultaneously, and then release the accelerator; the change will be effected so

quickly as to be almost imperceptible to the occupants of the car and, as the engine will not respond to such a lightning jab of the accelerator, no speed will be gained.

Since the roller clutch cannot transmit reverse drive, it is necessary to lock-up whenever it is desired to reverse the car. This is done automatically whenever reverse gear is selected by the gearbox reverse-shift mechanism which pushes the lock-up shift rail to the rear independently of the overdrive dash control.

Section FF.2

THE OVERDRIVE ELECTRICAL CIRCUIT

While the mechanical structure of the overdrive, as just described, may be considered the working part of the combination, its automatic action is controlled entirely by an electrical control system. This system which is connected to the ignition circuit, consists of a relay, a solenoid, a centrifugal governor and a kick-down switch. At low car speeds the electrical control system is inactive. Whenever the car reaches 30 m.p.h. in any gear, the contacts of the centrifugal governor close. This earths the winding of the relay causing the relay contacts to close. Electrical current is then passed to the solenoid (terminal No. 4), energising the windings of the solenoid causing the solenoid plunger to move, compressing the outer spring " A " and inner spring " B " (see Fig. FF.14).

Upon completion of the plunger travel, the contact " T " opens to disconnect the heavy traction-coil winding, leaving the lighter holding coil energised. In this position the stem of the plunger has not moved, because it is held by the pawl, which in turn is prevented from moving by the blocker ring, as already described. When the driver closes the throttle, which causes slowing down of the sun gear to reversal point, the pawl is urged forward by the plunger stem " P " which is acted upon by the pressure of the inner spring " B " (see Fig. FF.14).

When the road speed falls to 27 m.p.h. the governor contacts open, releasing the relay and opening the solenoid circuit, whereupon the outer spring " A " withdraws the pawl from engagement. If, owing to the torque reaction, the pawl is pinched by the sun gear control plate, the spring " A " will not be able to withdraw the pawl. It will be noted in Fig. FF.14 that the inward movement of the plunger closes contact " E " connecting the number 6 terminal to earth. When the kickdown switch is operated, the ignition coil contact breaker terminal, which is connected to the number 6 terminal of the solenoid, will be short-circuited to earth, interrupting the engine torque and releasing the pawl, whereupon the outer spring " A " reasserts itself, withdrawing the pawl and opening contact " E " to restore the ignition. This action occurs with such rapidity that not more than 3 or 4 cylinder explosions are missed.

Section FF.3

TRACING AND CORRECTING OVERDRIVE TROUBLE

Should any trouble arise, it is far more likely to be in the electric control circuit than within the unit

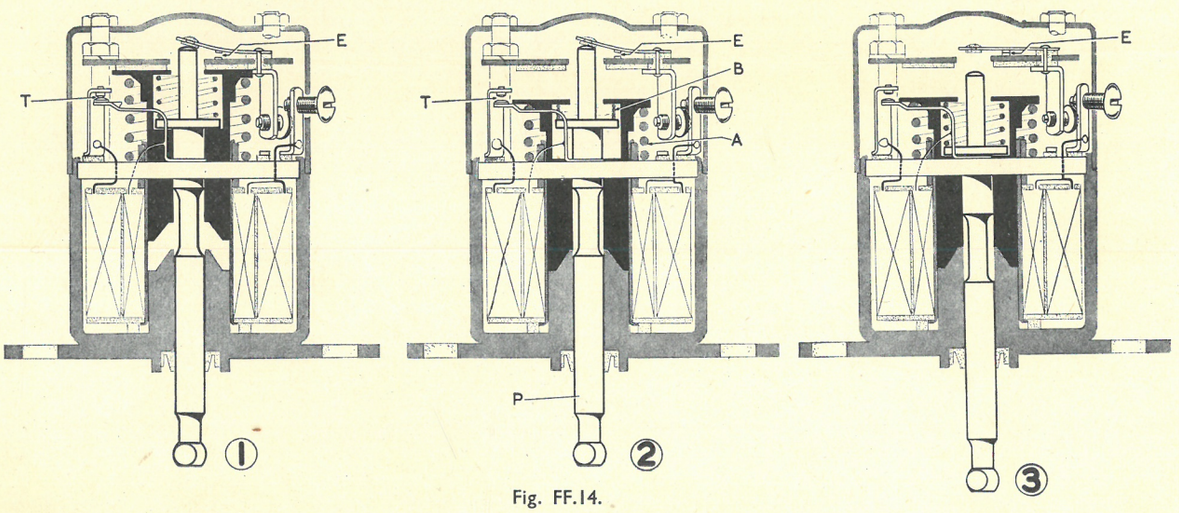


Fig. FF.14.

Sectional drawings of solenoid showing :—

1. At rest with earthing contacts " E " open and traction coil contacts " T " closed.
2. Energised, with both inner and outer springs compressed, contacts " T " and " E " open: note that plunger " P " is still in the same position as at 1.
3. Plunger has moved forward, contacts " E " are now closed.

itself. The more likely causes have been listed first in each section, and the electrical and other tests which can be carried out externally should be carefully checked before starting to dismantle the unit.

Overdrive does not Engage

Electrical Tests

E1. Earth the "Th. Sw." terminal of the relay. If the relay does not click, inspect the fuse, and replace if necessary. If the fuse is good, check with a test lamp at the fuse clips. If the lamp will not light at the fuse clips check the wiring between the "A1" terminal on the main fuse block and the "Ign." terminal on the overdrive relay. If the lamp lights at the fuse clips and the relay does not click when "Th. Sw." terminal is earthed then the relay is faulty and must be replaced. When the relay clicks, the solenoid should also click. If it does not click, follow tests E4 and E5 below. If both the relay and solenoid click—

E2. Earth the two "A" terminals of the throttle (kickdown) switch in turn. If no click results it indicates defective wire or terminal connections between the throttle switch and the relay. If a click results from earthing one "A" terminal but not the other, it indicates a faulty kickdown switch. The position of the throttle switch must be so adjusted, by means of the two clamp nuts which secure it to the bracket, that the accelerator pedal gives a full movement of the switch plunger before the accelerator pedal strikes the floor. The throttle rods must be adjusted so that the throttle becomes fully open just as the pedal touches the switch plunger. Occasionally the large clamp nuts may be overtightened causing the switch plunger to stick. This can usually be remedied by loosening the upper of the two nuts. If a click results as the two terminals are grounded in turn—

E3. Earth the governor terminal. If no click results it indicates defective wire or terminal connections between the governor and the throttle kickdown switch. If the relay clicks when the governor terminal is earthed, replace the governor, unless after removal the governor drive pinion is found to be defective.

E4. If when carrying out test E1, the relay clicks but the solenoid does not, remove the wire from the "Sol." terminal of the relay and replace with the

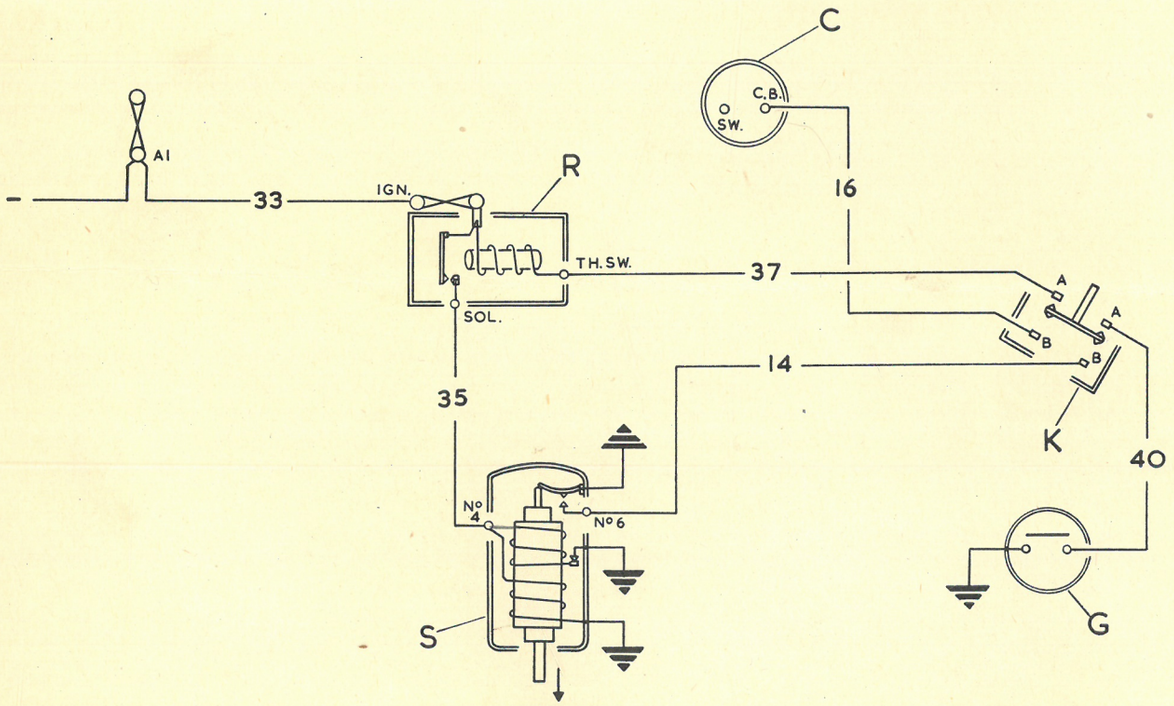


Fig. FF.15.
Wiring diagram of the overdrive electrical circuit with colour coding.

C = Ignition coil.
G = Centrifugal governor.
K = Kickdown switch.
R = Relay.
S = Solenoid.

14. White with purple.
16. White with black.
33. Brown.
35. Brown with yellow.
37. Brown with white.
40. Brown with black.

test lamp. If the test lamp does not light when the relay clicks, renew the relay. If it does light—

E5. Replace the wire to the "Sol." terminal of the relay, and remove the other end of the wire from No. 4 terminal of the solenoid and connect the wire to the test lamp. Close the relay as before. If the lamp does not light it indicates a defective wire, if it does light it indicates a defective solenoid or connections. Remove the solenoid cover, examine the contacts, clean if necessary, reconnect and test again for clicks before discarding the solenoid.

Mechanical Tests

M1. Check that the dash control cable is connected correctly so that when pushed right home at the dash, the lock-up lever on the overdrive is moved all the way back. The lever should be moved all the way to the rear and the cable adjusted so that there is $\frac{1}{4}$ in. (6·35 mm.) free play on the cable at the dash end before the lever starts to move. Incorrect adjustment of the control cable may result in the lock-up rail being moved sufficiently to lock the pawl, resulting in a buzzing noise from the solenoid whenever overdrive engagement is attempted.

M2. Similar symptoms as in M1 can result from misalignment, at assembly, of the overdrive to the gearbox casing, resulting in binding of the overdrive shift rail, so that the retractor spring cannot move the rail fully forward when the dash control is pushed in and the gearbox is not in reverse. Under such conditions the unit may remain fully locked-up. To test for this, select neutral gear, disconnect the dash control wire from the lock-up lever and feel for free forward movement of the lever. If it can be moved freely, that is not against the spring, for more than $\frac{1}{4}$ in. (6·35 mm.) this indicates misalignment. To correct this, loosen the bolts holding the overdrive casing to the adaptor plate, tap the casing gently until a position is found where the rail moves freely, and retighten the bolts.

M3. If on assembly the blocker ring is not correctly positioned, as shown in Fig. FF.12, with the lugs on the blocker ring, one at each side of the pawl, then the pawl will be unable to move forward into engagement with the sun gear control plate. To test for this condition, remove the solenoid cover, pull the dash control knob out and roll the car forward 2 ft. (·61 m.) by hand. Earth the "Th. Sw." terminal of the relay and watch the movement of the centre stem (not the spring) of the solenoid. It should not move more than $\frac{1}{8}$ in. (3·17 mm.) when the solenoid clicks. Then with the relay terminal still earthed, engage low gear, and roll the car forward by hand, watching the solenoid stem at the same time. It should move an additional $\frac{3}{8}$ in. (9·52 mm.) as the pawl engages fully. These two tests indicate proper blocker action, and unless both are met the blocker ring is probably not in the correct position. Dismantling is necessary to correct this fault.

Overdrive does not release

CAUTION: If this condition actually exists, the car will not drive or roll backwards and any attempt to force it may cause serious damage to the overdrive. Also it will probably prove impossible to select reverse gear, and forcibly attempting to do so may damage the selector mechanism.

Electrical Tests

First check if the car will rock backwards by hand with the gears in neutral and the overdrive relay fuse removed. If it will roll forward but not backward follow test E11. If it will roll backward—

E6. Push the dash control knob in. If the relay and solenoid click when the fuse is put out and in, a short circuit to earth is indicated between the relay "Th. Sw." terminal and the governor, or there is a fault within the governor. If the solenoid clicks but not the relay, the relay points are stuck together, and the relay must be renewed. If they do not click go on to test E11.

E7. If the relay and solenoid click in test E6 hold the throttle kickdown switch open, and put the relay fuse out and in; relay and solenoid clicking indicates a short circuit to earth either in the relay, the kickdown switch or the wire between them; follow the tracing procedure in test E8 below. If no clicks occur, an earth is indicated between the kickdown switch and the governor —follow the tracing procedure in test E9 below.

E8. If a click occurs when one terminal but not the other of the kickdown switch is disconnected, it indicates an earth at the terminals, or within the switch, in which case it should be renewed. If no click occurs when either kickdown switch terminal is disconnected, disconnect the wire from the "Th. Sw." terminal of the relay. If a click occurs it indicates an earth on the wire between that point and the kickdown switch.

E9. If no click occurs in test E7 above, disconnect the wire at the governor and if a click occurs, renew the governor. If no click occurs, examine the wire between the kickdown switch and the governor for earthing.

E10. If no click occurs when the wire is disconnected from the "Th. Sw." terminal of the relay, but the relay clicks when the fuse is put out and in the relay is faulty and must be renewed. If the solenoid clicks when the relay fuse is put out and in, but the relay does not click, the relay points are stuck together and the relay must be renewed.

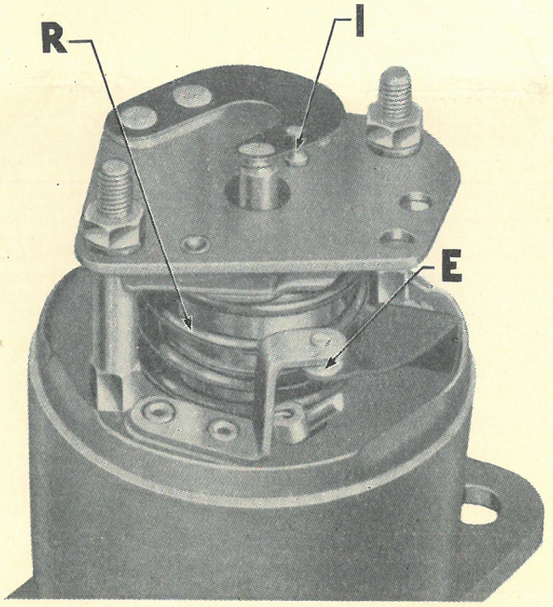


Fig. FF.16.
The solenoid with cover removed. Note the outer spring "R," ignition contacts "I" and energising traction coil contacts "E."

E11. If the solenoid does not click but the relay does when the relay fuse is put out and in, remove the solenoid. If the solenoid can be removed without rotating a quarter turn it indicates that the solenoid has been installed without twisting the bayonet lock end of the stem into engagement with the pawl, thus jamming the pawl permanently into overdrive engagement.

Examine the pawl for free movement within the housing. If the pawl cannot be withdrawn freely from engagement, or if the car cannot be pushed forward by hand in forward gear the unit has probably been damaged internally and must be renewed.

If no such damage is apparent and the solenoid installation appears undamaged the solenoid itself may be sticking.

It is possible that the internal key, which prevents the plunger from turning, has been removed permitting the plunger stem to come out of engagement with the bayonet lock in the pawl.

Will not kickdown from overdrive

E12. Earth the number 6 terminal of the solenoid, and start the engine. Press the kickdown switch stem by hand. If the engine stops, restart and press accelerator quickly to floorboards. If the engine does not stop, incorrect adjustment of the kickdown switch is indicated, and adjustment should be made to the switch position by means of the securing nuts. If the engine does not stop when the kickdown switch is operated and number 6 terminal on the solenoid is earthed, a faulty switch or faulty wiring is indicated. Make sure that the wire from the kickdown switch to the ignition coil is connected to the coil "CB" terminal and NOT to the "Ign." terminal.

If the engine stops when the throttle switch is operated with number 6 terminal on the solenoid earthed, but will not stop without the earthing connection to number 6, remove the solenoid cover and inspect the contacts between number 6 and earth, they should open when the solenoid releases and close when the solenoid is energised and pulls in.

Engine cuts out when kickdown is attempted

E13. With the engine running, press the kickdown switch stem by hand. If the engine stops, disconnect the wire from number 6 terminal at the solenoid. Start the engine and press the kickdown switch again. If the engine stops the wiring between the kickdown switch and number 6 terminal is at fault. If the engine does not stop with this terminal disconnected it indicates a fault on number 6 terminal or the contacts within are not opening when the solenoid releases.

Does not drive unless locked-up

In this event, the probable cause is a broken roller or rollers in the roller clutch (free-wheel). The remedy is the replacement of the entire set of rollers. Another possible cause is a sticking roller cage, or broken cage spring. The cage must move freely to urge the rollers up the cam faces. After very long use small indentations may wear into the cam faces of the roller clutch hub. Renewal of the hub is the only remedy.

Does not release lock-up

This may be caused by an incorrectly connected dash control cable (see test M1) or by the shift rail binding as a result of misalignment (see test M2).

Does not reverse unless dash lock-up control is pulled out

This indicates broken or incorrectly assembled lock-up levers in the main gearbox casing.

Section FF.4

REMOVING AND DISMANTLING

The gearbox and overdrive unit can be fitted to, and removed from, the car by the same routine as for the normal gearbox.

The overdrive and gearbox can each be dismantled separately. The overdrive unit may be removed from the gearbox as an assembly, taking with it the first speed wheel and synchroniser; alternatively, the overdrive housing can be removed, as shown in Fig. FF.18 leaving the adaptor plate and overdrive gears attached to the gearbox.

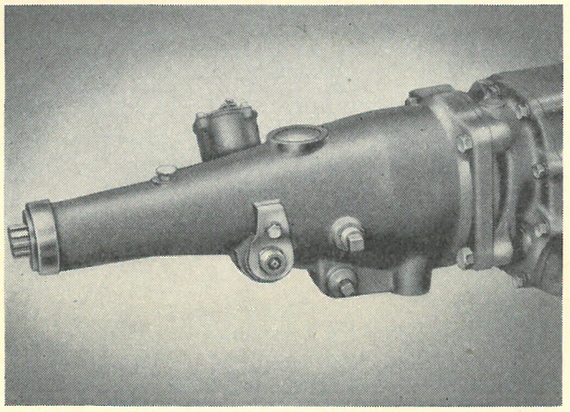


Fig. FF.17.
Right-hand view of overdrive, assembled to gearbox.

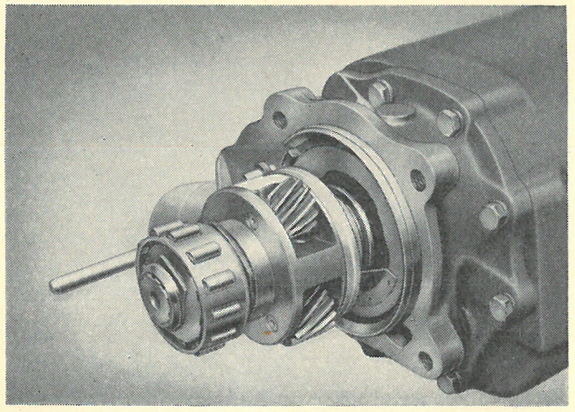


Fig. FF.18.
Overdrive body removed leaving adaptor plate and gears on the gearbox. The clutch rollers are held in position for assembly with a minimum of thick grease.

To remove overdrive housing

1. Remove the governor, using a thin spanner on the hexagonal portion. Do not use a pipe grip on the round body.
2. Drive out the taper pin securing the manual control shaft, and withdraw the control shaft and lever from the housing (see Fig. FF.19).

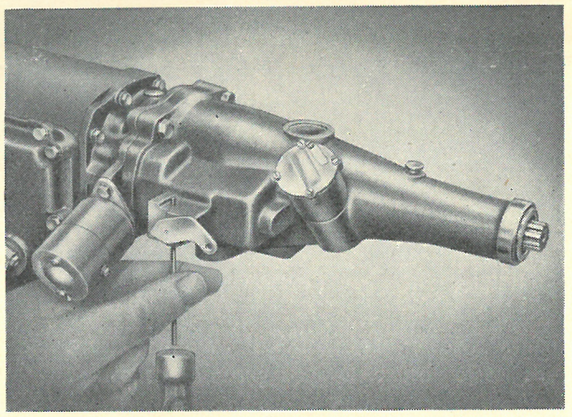


Fig. FF.19.
Removing the taper pin which holds the control lever in place.

3. After removing the four set screws which secure the housing to the adaptor plate, the overdrive housing can be pulled clear. Recover the free-wheel rollers, twelve in all, which will fall out as soon as the casing is pulled back.
4. To remove the output shaft from the housing, take out the expansion plug to obtain access to the circlip, and expand the snap ring with suitable pliers. The shaft and bearing will then tap out easily from the rear (see Fig. FF.20).

   The ring gear and speedometer gear are both secured to the output shaft by snap rings, and can readily be removed.
5. The planet carrier and roller clutch are secured to the end of the gearbox mainshaft by a snap ring, which must be removed as shown in Fig. FF.21, permitting the planet carrier and roller clutch to pull away from the shaft.
6. Another snap ring secures the roller clutch hub to the planet carrier, and is removed as shown in Fig. FF.22.
7. One large snap ring secures the sun gear cover plate, and when removed, the cover plate, blocker ring and control plate, sun gear and pawl may all be lifted out together, leaving the gearbox mainshaft protruding through the adaptor plate.

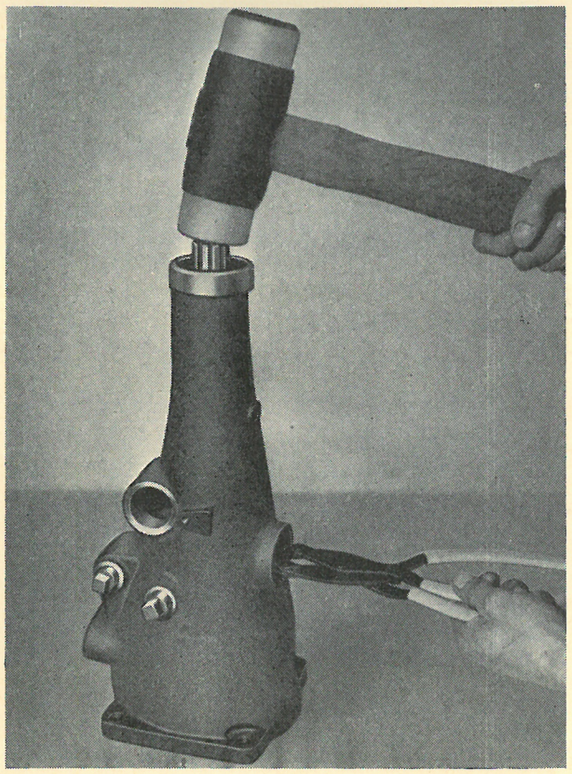


Fig. FF.20.
Removing output shaft. Note use of pliers to expand snap ring in casing.

8. After removal of the adaptor plate, the gearbox mainshaft and bearing can be removed in exactly the same manner as with the normal gearbox.

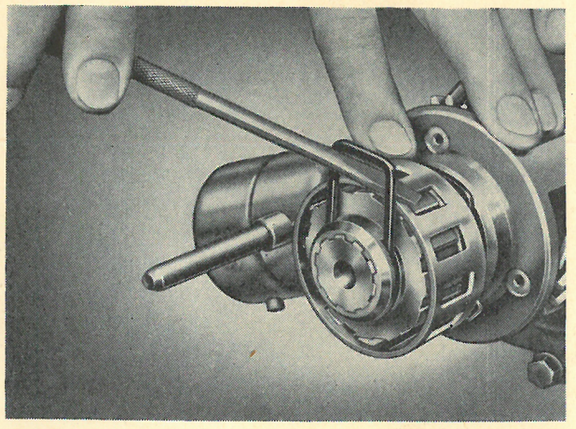


Fig. FF.21.
Prising out the snap ring which holds the free-wheel to the shaft.

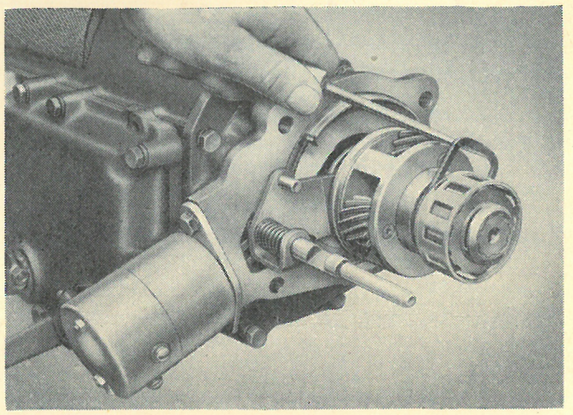


Fig. FF.22.
Prising out the snap ring which holds the free-wheel to the planet cage.

Section FF.5

EXAMINATION AND INSPECTION OF PARTS

After cleaning, examine for visual signs of wear or damage. Carefully examine the roller clutch. If the rollers show any surface markings or flats, they must be renewed as a set. If the inner surface of the outer race shows slight lengthwise indentations, they are normal and do not impair the action of the free-wheel clutch. If any of the twelve flat cam surfaces on the inner member show such markings, it must be renewed.

Test the frictional grip of the blocker ring upon the hub of the sun gear control plate. This grip should be sufficient to set up a frictional drag of 4–6 lb. (1·8–2·7 kg.) when new, which will fall to 1–1½ lb. (·45–·67 kg.) when thoroughly broken in. It is important that the frictional grip of the blocker ring should not cause a resistance exceeding 6 lb. (2·7 kg.). This is measured by holding the control plate in a soft-jawed vice, with a spring-balance hooked into the blocker ring lug, and noting the pull required to rotate the blocker after it has started to move. If the friction is low, the control plate and blocker ring, which are supplied in pairs, should be replaced by new ones (see Fig. FF.23).

Section FF.6

REASSEMBLY

1. Replacement of the output shaft in the housing is an exact reversal of removal. First fit the ball-bearing and speedometer gear to the shaft (**Note:** alternative snap rings, ·086 in., ·089 in.,

·092 in., ·095 in. (2·216 mm., 2·296 mm., 2·372 mm., 2·450 mm.) thick are available to ensure minimum end float), and also the ring gear. Then expand the snap ring in the housing, and

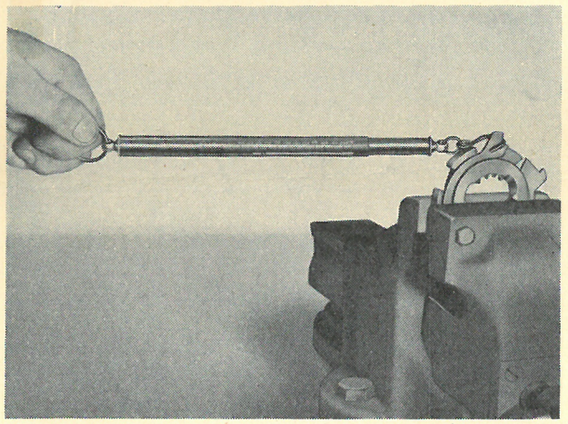


Fig. FF.23.
Testing blocker ring friction with spring balance. The spring balance used here is a common one reading from 0–4 lb.

push the shaft home until the snap ring engages the annular groove in the bearing outer race.

2. Build the gearbox first speed wheel and synchroniser, ball-bearing and distance-pieces on to the gearbox mainshaft, and locate the shaft assembly to the adaptor plate with the snap ring (see Fig. FF.24).
3. Bolt the assembly as described in 2 above to the gearbox, engaging the first- and second-speed gears with the laygear in the normal manner. There is a plug in the adaptor plate

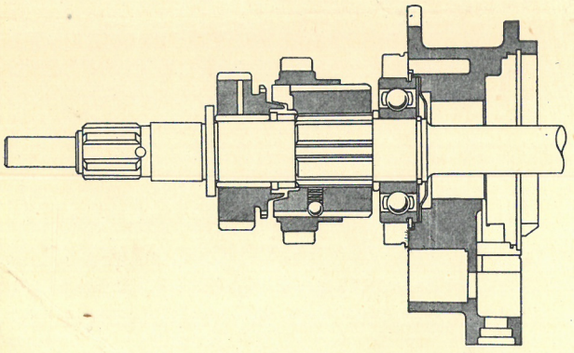


Fig. FF.24.
Mainshaft built up and fitted to the adaptor plate.

which can be removed to give access to the layshaft. Assemble the sun gear control plate, blocker ring, pawl, cover plate and snap ring together in the adaptor plate. Snap rings are available in different thicknesses, ·062 in., ·066 in., ·070 in. (1·59 mm., 1·68 mm., 1·77 mm.), select one to allow minimum free play for the cover plate (see Fig. FF.25).

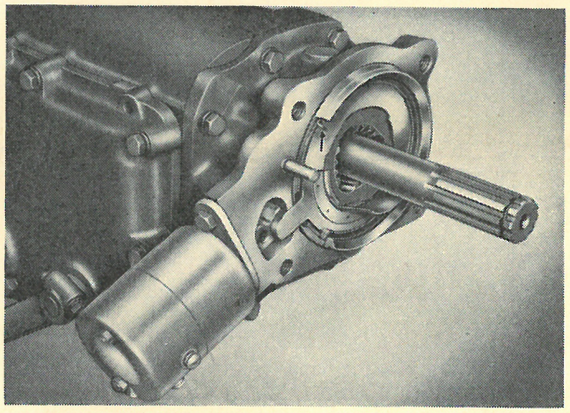


Fig. FF.25.
The snap ring, see arrow, must be selected to ensure minimum end float for the cover plate.

4. Put on the sun gear and shift rail, planet carrier and roller clutch, securing the latter two items with the special snap rings.

   Fix the free-wheel rollers in place with as little thick grease as possible, ensure that the free-wheel cage is not binding on the hub, and that the spring is functioning correctly and turn the free-wheel cage and rollers anti-clockwise to bring the rollers to the lowest position (see Figs. FF.18 and FF.26). The main casing and output shaft can now be put on and bolted up, taking care to see that the shift rail is correctly lined up and free to operate, and refit the governor.

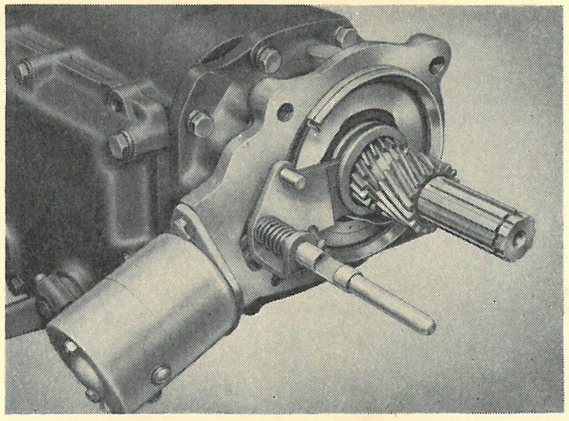
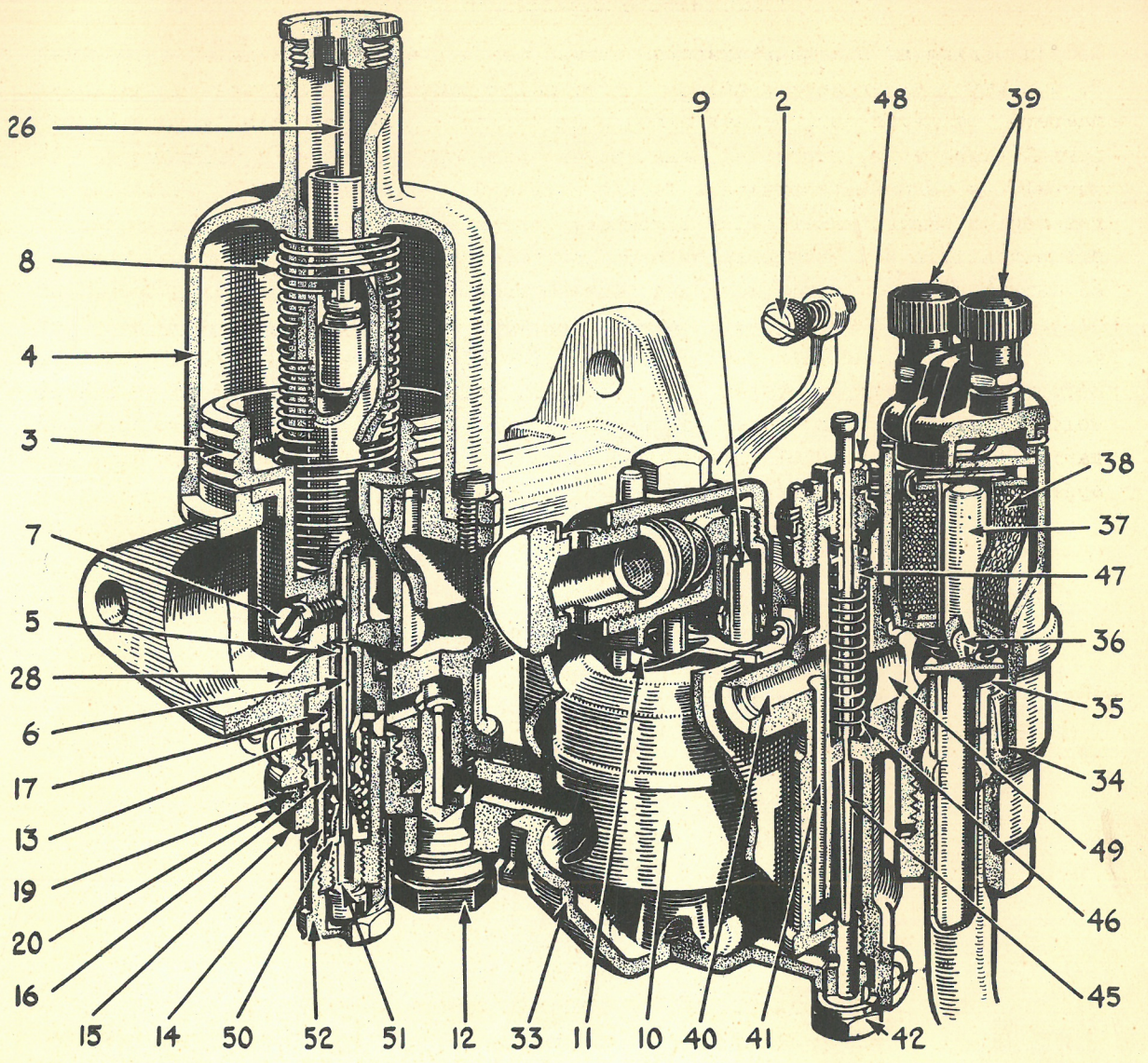


Fig. FF.26.
The overdrive assembled ready for the output shaft.

5. The overdrive when supplied from the factory is built up as an assembly, and includes the gearbox first speed wheel and second speed synchroniser. The assembly, as such, can be built directly onto the gearbox, and does not need to be dismantled. It is built into the main gearbox casing in the same manner as an ordinary mainshaft, and a plug in the adaptor plate can be removed to give access for fitting the gearbox layshaft.

Note.—The overdrive cannot be fitted to gearboxes prior to Car No. 5569 and gearboxes equipped with overdrive cannot be fitted to cars prior to this number.



2. Tomgangsskrue
3. Sugeplade
4. Sugekammer
5. Strålerør
6. Konisk nål
7. Sætskrue til nål
8. Fjeder
9. Nåleventil
10. Svømmer
11. Svømmerarm
12. Skrue til svømmerhus
13. Øverste strålerørsstyr
14. Nederste strålerørsstyr
15. Styreskrue til strålerør
16. Fjeder
17. Pakning
19. Pakning
20. Pakskive
26. Dæmpestempel
28. Venturi
33. Svømmerhus
34. Hus til startkarburator
35. Ventilsæde
36. Ventil
37. Anker
38. Spole
39. Ledningsskruer
40. Luftindsugning
41. Luftkanal
42. Startstrålerør
45. Startnål
46. Fjeder
47. Styr til startnål
48. Indstillelig topskrue
49. Blandingskanal
50. Strålerørsflange
51. Indstillingsskrue
52. Kapselmøtrik

V. N. TRYK