Section S – WHEELS AND TYRES – ALL MODELS

INDEX

LIST OF ILLUSTRATIONS

Tyre pressures

Maximum tyre life and performance will only be obtained if the tyres are maintained at the correct pressures. See chart below:

		Normal				Emergency soft			
		Load under 550 lb. (250 kg)		Load over 550 lb. (250 kg)		Load under 550 lb. (250 kg)		Load over 550 lb. (250 kg)	
88 models		Front	Rear	Front	Rear	Front	Rear	Front	Rear
Avon or Dunlop 6.00 x 16.00	lb/sq.in.	25	25	25	30	15	15	15	20
	kg/cm²	1,7	1,7	1,7	2,1	1,0	1,0	1,0	1,4
Avon or Dunlop 7.00 x 16.00	lb/sq.in.	25	25	25	30	15	15	15	20
	kg/cm²	1,7	1,7	1,7	2,1	1,0	1,0	1,0	1,4
Avon or Dunlop 7.50 x 16.00	lb/sq.in.	25	25	25	30	15	15	15	20
	kg/cm²	1,7	1,7	1,7	2,1	1,0	1,0	1,0	1,4
Michelin XY 7.50 x 16.00	lb/sq.in.	15	15	15	22	10	10	10	16
	kg/cm²	1,0	1,0	1,0	1,5	0,7	0,7	0,7	1,1
109 models									
Avon or Dunlop 7.50 x 16.00	lb/sq.in.	25	25	25	36	12	12	15	24
	kg/cm²	1,7	1,7	1,7	2,5	0,8	0,8	1,0	1,6
Michelin XY 7.50 x 16.00	lb/sq.in.	20	20	20	35	15	15	15	28
	kg/cm²	1,4	1,4	1,4	2,4	1,0	1,0	1,0	1,9

Pressures should be checked and adjusted monthly, paying attention to the following points:

1. Whenever possible, check the tyres cold, as the pressure is about 2 lb. (0,1 Kg) higher at running temperature.
2. Always replace the valve caps, as they form a positive seal on the valves.
3. Any unusual pressure loss (in excess of 1 to 3 lb. (0,05 to 0,20 kg) per month) should be investigated and corrected.
4. Always check the spare wheel, so that it is ready for use at any time.
5. At the same time, remove embedded flints, etc., from the tyre treads with the aid of a penknife or similar tool. Clean off any oil or grease on the tyres, using petrol sparingly.

Tyre treads

When cross-country tyres are used, they must be fitted with the V in the tread pattern pointing forwards at the top of the wheel, to ensure maximum grip and efficient tread cleaning when operating on soft ground. For this reason it may be found necessary to reverse the spare tyre on its wheel (dependent on which side it is to be fitted) when putting it into service.

Changing tyre positions

In the interests of tyre mileage and even wear, it is recommended that the wheels are changed round every 3,000 miles (5.000 Km) as follows:

Spare to left-hand front; left-hand front to left-hand rear; left-hand rear to right-hand front; right-hand front to right-hand rear and right-hand rear to spare.

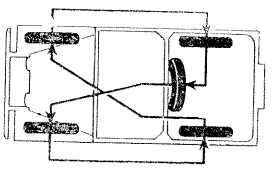


Fig. S-1—Changing wheel positions

Factors affecting tyre life

1. Incorrect tyre pressures.
2. High average speeds.
3. Harsh acceleration.
4. Frequent hard braking.
5. Warm, dry climatic conditions.
6. Poor road surfaces.
7. Impact fractures caused by striking a kerb or loose brick, etc.
8. Incorrect front wheel alignment. Alignment should be checked periodically.

Tyre and inner tube repairs

Minor tyre injuries such as from nails, require no attention other than removal of the object, but more severe tread or wall cuts require vulcanised repairs.

Avoid the use of gaiters or liners except as a temporary expedient. As "Butyl" synthetic tubes are used, all repairs must be vulcanised.

Tyres

Well base rims (*Standard on all models*)

To remove **Operation S/2**

1. Remove the valve cap and core (extractor provided in tool kit) and deflate the tyre.
2. Press each bead in turn off its seating. Insert a lever at the valve position and, while pulling on this lever, press the bead into the well, diametrically opposite the valve.
3. Insert a second lever close to the first and prise the bead over the wheel rim. Continue round the bead in small steps until it is completely off the rim.
4. Remove the inner tube and pull the second bead over the rim.

To refit **Operation S/4**

1. Place the cover over the wheel and press the lower bead over the rim edge into the well.
2. Inflate the inner tube until it is just rounded out, dust with French chalk, and insert it in the cover, with the white spots near the cover bead coinciding with the black spots on the tube.
3. Press the upper bead into the well diametrically opposite the valve and lever the bead over the rim edge.
4. Push the valve inwards to ensure that the tube is not trapped under the bead, pull it back and inflate the tyre.
5. Check the concentricity of the fitting line on the cover and the top of the wheel flange. Deflate the tube completely and re-inflate to the correct pressure, to relieve any strains in the tube.

Divided wheels (*fitted as optional equipment on 88 models*)

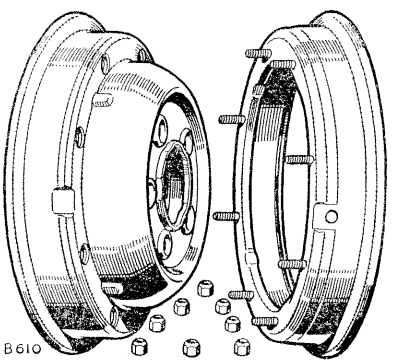


Fig. S-2—Divided wheel

To remove **Operation S/6**

Do not touch the nuts securing the two halves of the wheel together before the tyre is deflated or serious personal injury may result.

1. Remove the valve cap and core to deflate the tyre.
2. Press each bead in turn away from the flange, using levers and working round the tyre in small steps. Two or three circuits of the tyre may be necessary to free the beads completely.
3. Slacken and remove the clamping nuts. Remove the upper half of the wheel. Push the valve through the lower half of the wheel and remove the cover and tube.

To refit **Operation S/8**

1. Thoroughly examine the cover for nails, flints, etc., and ensure that no loose objects have been left inside. Clean the wheel rim flanges and seatings.
2. Inflate the inner tube until it is just rounded out, dust with French chalk and insert it in the cover with the white spots near the cover bead coinciding with the black spots on the tube.
3. Fit the protection flap, starting at the valve position. Make sure that the edges of the flap are not turned over inside the cover and that it lies centrally between the beads. See that the flap fits closely against the tube round the valve.
4. Lay the studded half of the wheel on the floor or bench with the studs pointing upwards. Fit the cover over the wheel and thread the valve through the hole, making sure that it points downwards.
5. Fit the other half of the wheel and tighten the clamping nuts lightly. Finally tighten the nuts in the sequence illustrated. Check that the valve is free and inflate the tyre to the recommended pressure.

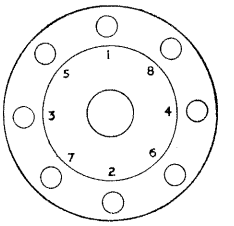


Fig. S-3—
Tightening sequence

Wheel and tyre

To balance **Operation S/10**

Wheel and tyre units are accurately balanced on initial assembly with the aid of small weights secured to the inner side of the wheel slot flanges by means of set bolts. In the interests of smooth riding and even tyre wear, it is advantageous to check the balance whenever a tyre is refitted, on suitable proprietary equipment.

DEFECT LOCATION

(Symptom, Cause and Remedy)

A—EXCESSIVE WEAR ON FRONT TYRES

1. Tyres under-inflated—*Refer to "Recommended Tyre Pressures".*
2. Tyre positions not changed regularly—*Change every* 3,000 *miles* (5.000 *Km*)
3. Incorrect toe-in—*Section G.*
4. Harsh or unnecessary use of brakes—*In the hands of the operator.*
5. Incorrectly adjusted brakes—*Section H.*
6. Eccentric brake drum—*Section H.*
7. Front wheels or tyres out of balance—*Rebalance the wheel assembly.*

B—RATTLES FROM FRONT WHEELS

1. Loose wheel bearings—*Adjust and examine for damage. Section F.*
2. Broken wheel bearings—*Renew. Section F.*
3. Brake shoes or anchor plate loose—*Check and retighten. Section H.*

C—SQUEAKS FROM FRONT WHEELS

1. Wheel stud nuts loose—*Examine studs for damage and tighten.*
2. Lack of lubrication to front wheel bearings—*See Section F.*
3. Front wheel bearings adjusted too tightly—*Adjust and examine for damage.*
4. Damaged front wheel bearings—*Renew. Section F.*

D—OTHER NOISES FROM THE FRONT WHEELS

1. Variation in tread surface due to patch or damage—*Renew outer cover.*
2. Type or condition of tyre tread giving a noise similar to gear growl—*Renew with tyres of the recommended type.*
3. Under-inflated tyres also giving a noise similar to gear growl—*Inflate to the pressures recommended.*
4. Foreign body embedded in tyre—*Extract the embedded matter and repair the tyre as necessary.*
5. Wear in differential—*Section F.*

E—OVERHEATING OF FRONT WHEEL BEARINGS

1. Insufficient lubricant—*See Section F.*
2. Use of a poor quality or incorrect grade of lubricant—*Replenish.*
3. Front wheel bearings adjusted too tightly—*The end-float in the front hub bearings must be correct. Adjust and examine for damage. Section F.*
4. Damaged front wheel bearings—*Renew. Section F.*
5. Heat transfer from brake drums due to dragging brakes —*Adjust. Section H.*
6. Excessive use of the brakes—*In the hands of the operator.*
7. Foreign matter in the bearings—*Clean and renew bearings.*

F—EXCESSIVE WEAR ON REAR TYRES

1. Under-inflated tyres—*Refer to "Recommended Tyre Pressures".*
2. Rear wheels out of alignment—*Check that the rear spring centre dowel is not sheared. Check for a broken rear spring main leaf. Check for a damaged chassis frame. Rectify.*
3. Rear wheel run-out or wobble—*Check for loose wheel nuts. Check for a damaged wheel or incorrectly fitted tyres. Rectify.*
4. Harsh and unnecessary use of brakes or high speed driving —*In the hands of the operator.*
5. Wheels or tyres out of balance—*Rectify.*

G—REAR WHEEL NOISE

1. Wheel hub nuts or drum studs loose—*Rectify.*
2. Interference of brake drum with brake shoes—*Check the shoes for damage or warping and rectify. Check the brake drum for scoring. Rectify or renew.*
3. Brake back plate loose—*Rectify. Check shoes and drum for damage.*
4. Type or condition of tyre tread—*Renew with suitable tyres.*
5. Wear in the differential—*Section E.*

Section T — EXTRA EQUIPMENT — ALL MODELS

INDEX

LIST OF ILLUSTRATIONS

Centre power take-off

To fit **Operation T/2**

Early type selector

1. Remove the centre inspection panel from the seat box.
2. Remove the top cover plate complete with joint washer from the transfer casing.
3. Remove the mainshaft rear bearing housing assembly and joint washer from the rear of the transfer casing.

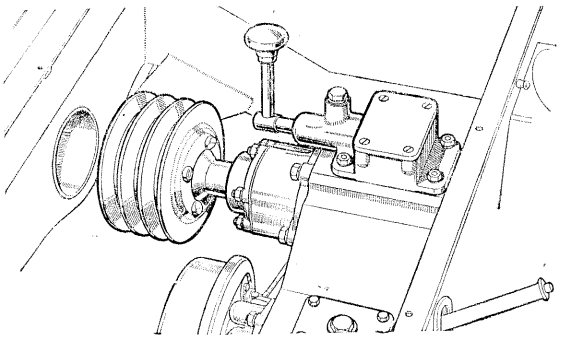


Fig. T-1—Installation of centre power take-off unit, early type

4. Fit the power take-off drive unit assembly and joint washer to the rear of the transfer casing with the oil drain hole in the housing at the bottom.

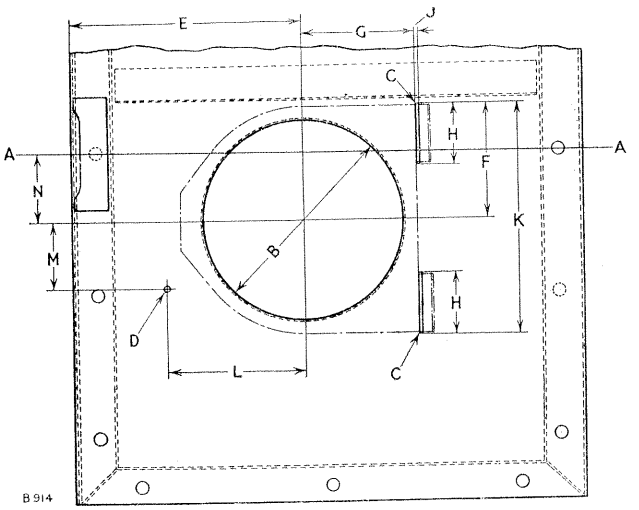


Fig. T-2—Cutting and drilling seat box centre inspection panel, early type

AA—Centre line of body.
B—7 in. (177 mm).
C—Two slots as shown.
D—One hole .204 in. (5 mm).
E—7 15/16 in. (201 mm).
F—4 1/32 in. (104 mm).
G—4 in. (101 mm).
H—2 1/16 in. (52 mm).
J—1/8 in. (3 mm).
K—8 1/16 in. (205 mm).
L—4 3/4 in. (120 mm).
M—2 1/4 in. (57 mm).
N—2 1/2 in. (63 mm).

5. Fit the power take-off selector assembly and joint washer to the top face of the transfer casing; ensure that the selector fork engages with the dog clutch on the drive shaft.
6. Mark out and cut one hole 7 in. (177 mm) diameter and two slots 1/8 in. (3 mm) wide and 2 1/16 in. (52 mm) long, and drill one hole .204 in. (5 mm) diameter in the panel as illustrated in Fig. T-2.
7. Rivet the cover retaining clip to the panel by means of the rivet and the plain washer, which should be placed between the clip and the panel. Engage the tongues of the cover in the slots cut in the panel.
8. Replace the seat box inspection panel.

Late type selector

9. Remove the centre seat panel and the seat retaining bollard.
10. Mark off the heel board as illustrated and drill a 3/4 in. (18 mm) dia. hole. Fit a grommet to the hole, then replace the bollard.

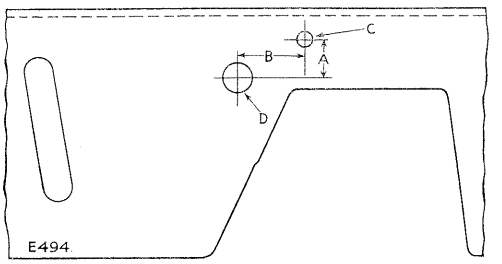


Fig. T-3—Drilling the heel board, late type selector

A—1.187 in. (30 mm)
B—1.968 in. (50 mm)
C—Hole for seat strap retaining bolt
D—3/4 in. (19 mm) diameter hole.

11. Remove the mainshaft rear bearing housing assembly and the joint washer from the rear of the transfer box casing. Remove the top cover plate and joint washer complete from the transfer box casing.
12. Remove the bearing housing fixing stud from the L.H. side top corner on the transfer box casing.
13. Fit the power take-off assembly and joint washer to the rear of the transfer casing with the oil drain hole in the housing at the bottom.
14. Secure the power take-off unit in position, using the new stud supplied in place of the one removed at item 12.
15. Fit the selector unit and joint washer to the top face of the transfer box casing, and ensure that the selector fork engages the dog.
16. Attach the link rod to the operating lever before fitting to the selector unit, using a clevis pin, spring and split pin. If fitted, remove the knob and locknut from the link rod.
17. Pass the link rod and lever through the grommeted hole in the heel board and attach the lever to the selector shaft on the selector unit, and to the stud on the transfer box casing. Use a locknut on the stud. Refit the knob, and secure with a locknut to the link rod.

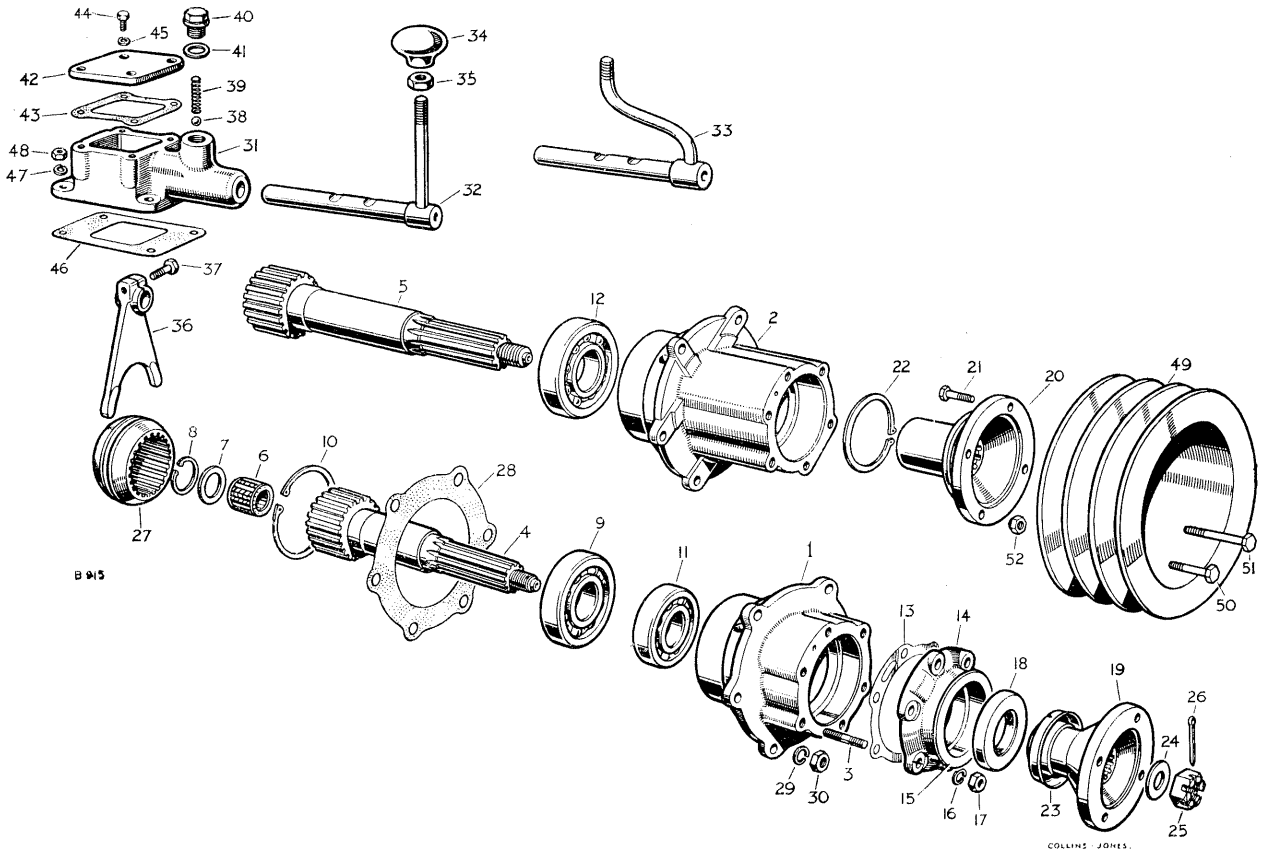


Fig. T-4—Layout of gearbox drive unit and centre pulley (early type illustrated)

1 Housing assembly for drive bearing
2 Housing assembly for drive bearing (heavy duty)
3 Stud for oil seal housing
4 Shaft for P.T.O. drive
5 Shaft for P.T.O. drive (heavy duty)
6 Bearing for gearbox mainshaft
7 Retaining plate for bearing
8 Circlip fixing retaining plate
9 Bearing for drive shaft, front
10 Circlip, bearing to housing
11 Bearing for drive shaft, rear
12 Bearing for drive shaft, rear (heavy duty)
13 Shim for bearing
14 Housing for oil seal
15 Mudshield for housing
16–17 Fixings for oil seal housing
18 Oil seal for drive shaft
19 Flange for P.T.O. drive shaft
20 Flange for P.T.O. drive shaft } Heavy duty
21 Bolt for flange
22 Circlip retaining bolts
23 Mudshield for flange
24–26 Fixings for flange
27 Dog clutch for P.T.O. shaft
28 Joint washer for housing
29–30 Fixings for housing
31 Housing for P.T.O. selector
32 Selector shaft and rod for P.T.O.
33 Selector shaft for rod and P.T.O. (heavy duty)
34 Knob for rod
35 Locknut for knob
36 Fork for selector shaft
37 Set bolt fixing fork to shaft
38 Steel ball } For selector shaft
39 Spring
40 Plug for spring
41 Joint washer for plug
42 Cover plate for housing
43 Joint washer for plate
44–45 Fixings for plate
46 Joint washer for housing
47–48 Fixings for housing
49 Pulley for centre power take-off
50–52 Fixings for pulley

18. Check for free movement of the control and lock the locknut on the stud about which the operating lever pivots. Replace the seat panel.

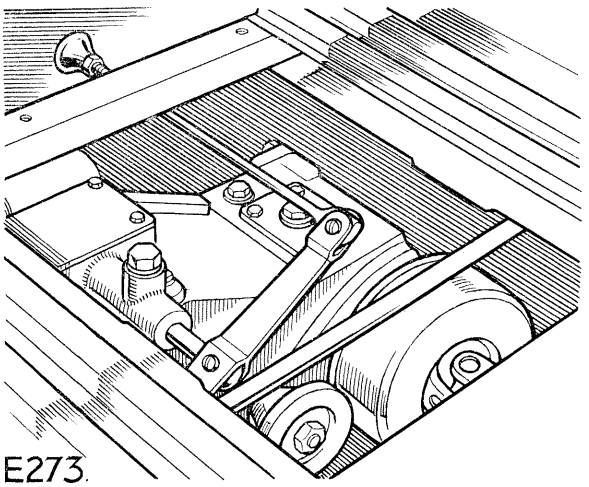


Fig. T-5—Installation of centre power take-off unit, late type selector

2 litre petrol models

The centre power take-off must only be used in conjunction with an engine governor. Operation T/16.

To overhaul **Operation T/4**

1. Remove the centre inspection panel from the seat box.
2. Slacken the adjustment and remove the driving belts; identify the belts so that they may be replaced in their original grooves.
3. Withdraw the driving pulley from the drive shaft flange.
4. Remove the selector assembly complete with a joint washer from the top of the transfer casing.
5. Remove the drive unit complete with a joint washer and dog clutch from the rear face of the transfer casing.

Strip the units as follows:—

Selector unit

6. Remove the brass plug and joint washer from the top of the selector housing and lift out the selector spring and ball.

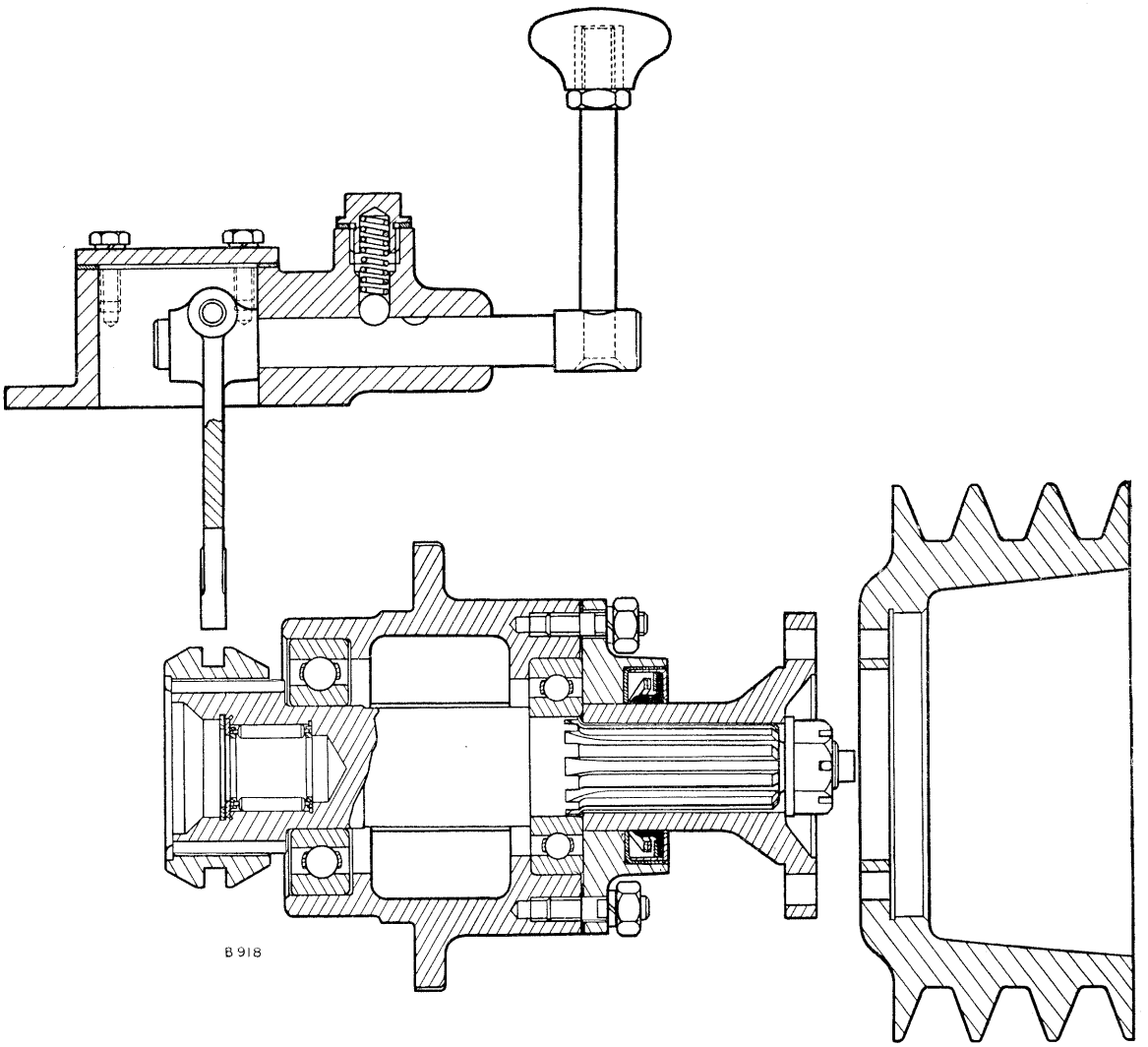


Fig. T-6—Cross-section of gearbox drive unit and centre pulley, (early type illustrated)

7. Remove the housing cover plate and joint washer.
8. Withdraw the shaft and selector fork from the housing.
9. If necessary, remove the knob and locknut from the selector shaft.

Drive unit

10. Slide the dog clutch off the power take-off shaft.
11. Grip the gearbox end of the shaft in a soft-jawed vice; remove the driving flange.
12. Remove the oil seal housing from the drive housing together with shims (if fitted) which should be preserved. Drift out the oil seal from the housing.
13. Remove the unit from the vice. Remove the circlip retaining the drive shaft front bearing; place the protection cap (Part No. 243241) on the threaded portion of the shaft and drive out the shaft from the housing. Drift the rear bearing from the housing.
14. Remove the internal circlip from the bore of the shaft and lift out the plain retaining washer and the gearbox mainshaft bearing.
15. Renew any worn parts and reassemble by reversing the stripping procedure, paying particular attention to the following points:—

Selector unit

16. Assemble by reversing the stripping procedure.

Drive unit

17. The front (large) ball bearing must be a *light drive fit* on the shaft and in the housing.
18. The rear ball bearing must be a *light drive fit* on the shaft and in the housing.
19. The oil seal must be replaced with its knife edge inwards and with the plain face flush with the lower edge of the chamfer in the seal retainer.

    When fitting the retainer to the drive housing, the oil drain slot in the retainer must be in line with the drain hole in the housing.
20. The end-float of the shaft must be adjusted to nil on assembly by means of shims between the oil seal retainer and drive housing; these shims are available .003 in. and .005 in. (0,07 mm and 0,12 mm) thick.
21. The dog clutch must be fitted with its recessed end towards the gearbox.
22. Refit the drive unit. Operation T/2.

Rear power take-off

To fit **Operation T/6**

1. If not already fitted, install the power take-off drive and selector units on the transfer casing. Operation T/2.
2. **88 models:** Secure the propeller shaft to the input flange of the rear take-off unit with the sliding joint at the front.

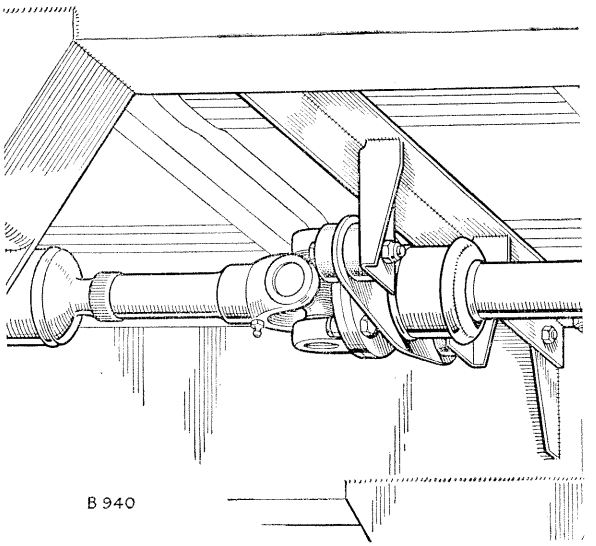


Fig. T-7—
Rear power take-off propeller shaft centre bearing assembly—109 models only

Pass the sliding joint end of the propeller shaft forwards through the holes provided in the rear and centre chassis cross-members. Secure the power take-off unit to the rear cross-member, with the fixings provided.

Secure the front end of the propeller shaft to the flanged drive shaft on the gearbox.

If a centre power take-off pulley is also fitted, four bolts $1\frac{23}{32}$ in. (43 mm) long must be used to secure the propeller shaft.

3. **109 models only.** Secure the cross-member intermediate bearing support to the brackets welded to the chassis side members, using the bolts, spring washers and nuts provided. (Fig. T-7.)

   Pass the universal joint end of the front propeller shaft forward through the hole provided in the centre chassis cross-member, and secure the front end of the shaft to the flanged drive shaft on the gearbox.

   Secure the centre bearing housing to the cross-member intermediate bearing support by means of the rubber bushes, bolts, nuts, plain and spring washers provided.

   When tightened, the rubber bushes on the centre bearing housing are compressed to a length of $1\frac{1}{2}$ in. (38 mm); the bearing housing flange must be adjusted by means of shims which are supplied .048 in. thick, so that it lies centrally in the rubber bushes.

   Secure the rear end of the rear propeller shaft to the input flange of the rear take-off unit, with the sliding joint at the front.

   Pass the sliding joint end of the propeller shaft forward through the holes provided in the rear and No. 5 (front bumper is No. 1 cross-member) cross-members and secure the power take-off unit to the rear cross-member with the fixings provided.

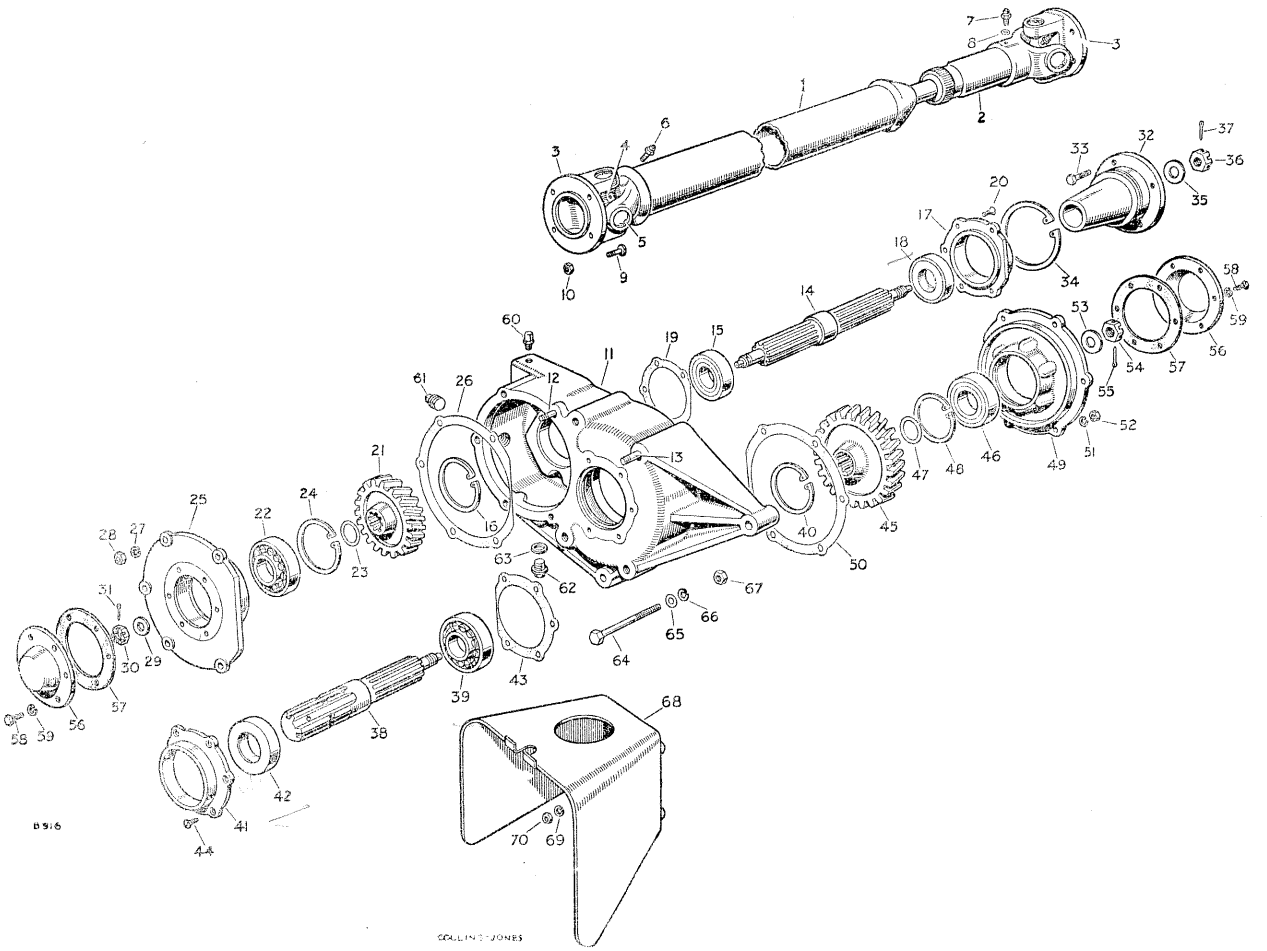


Fig. T-8—Layout of rear power take-off unit

1 Propeller shaft, P.T.O. drive
2 Splined end } For propeller
3 Flange } shaft
4 Journal complete for propeller shaft
5 Circlip for journal
6 Grease nipple for journal
7 Grease nipple for propeller shaft, .250" (6 mm) dia.
8 Washer for nipple
9–10 Fixings for propeller shaft
11 Housing assembly for P.T.O.
12 Stud for bearing housing
13 Stud for pulley housing or guard
14 Input shaft for P.T.O.
15 Bearing for input shaft, front
16 Circlip, bearing to housing
17 Retainer for oil seal } For input
18 Oil seal } shaft
19 Joint washer for retainer
20 Screw fixing retainer
21 Gear wheel, 20 teeth
22 Bearing for input shaft, rear
23 Shim for rear input shaft bearing
24 Circlip, bearing to housing
25 Housing for rear input shaft bearing
26 Joint washer for rear bearing housing
27–28 Fixings for bearing housing
29–31 Fixings for rear bearing
32 Flange for P.T.O. input shaft
33 Special bolts for propeller shaft
34 Circlip retaining bolts to flange
35–37 Fixings for flange
38 Output shaft for P.T.O. 6-spline
39 Bearing for output shaft, rear
40 Circlip for bearing
41 Retainer for oil seal } For output
42 Oil seal } shaft
43 Joint washer for retainer
44 Screw fixing retainer
45 Gear wheel, 24 teeth
46 Bearing for output shaft, front
47 Shim, for front output shaft bearing
48 Circlip, bearing to housing
49 Housing for output shaft front bearing
50 Joint washer for bearing housing
51–52 Fixings for bearing housing
53–55 Fixings for front bearing
56 Cover plate for bearings
57 Joint washer for cover plate
58–59 Fixings for cover
60 Breather for casing
61 Filler plug
62 Drain plug for casing
63 Fibre washer for plug
64–67 Fixings for P.T.O. assembly
68 Guard for P.T.O. spline
69–70 Fixings for guard

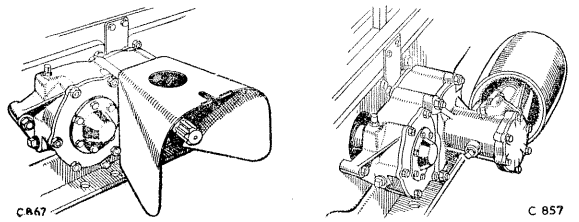


Fig. T-9—Rear power take-off and rear drive pulley

Secure the front end of the rear propeller shaft to the front shaft flange.

4. Fill the unit with oil, 1 pint (0,5 litre).

To overhaul — Operation T/8

1. **88 models** only. Disconnect the front end of the propeller shaft from the flanged drive shaft on the gearbox.
2. **109 models** only. Disconnect the rear propeller shaft from the front shaft.
3. Remove the unit complete with propeller shaft from the rear chassis cross-member.
4. **109 models** only. Remove the front propeller shaft complete with centre bearing assembly.
5. Disconnect the propeller shaft from the input flange. To overhaul the propeller shafts see Section D.
6. Remove the output shaft guard.
7. Drain off the oil from the take-off and secure it in a vice by means of the input flange.
8. Remove the input shaft rear bearing cover plate and joint washer.
9. Remove the breather.
10. Remove the split pin, castle nut and plain washer securing the input shaft rear bearing; remove the bearing inner race and shims, which should be preserved.
11. Remove the input shaft rear bearing housing complete with circlip and outer race and a joint washer. If necessary, remove the circlip and drift the race from the housing.
12. Withdraw the 20-tooth gear and front inner race from the input shaft.
13. Lift off the complete unit from the input shaft and set aside.
14. Remove the external circlip retaining the propeller shaft bolts in the input flange and remove the bolts. Remove the split pin, castle nut and plain washer securing the flange to the shaft and drift the flange from the shaft.
15. Secure the complete unit in a soft-jawed vice by means of the output shaft.
16. Remove the input shaft oil seal retainer complete with oil seal and joint washer. Drift the seal from the retainer.

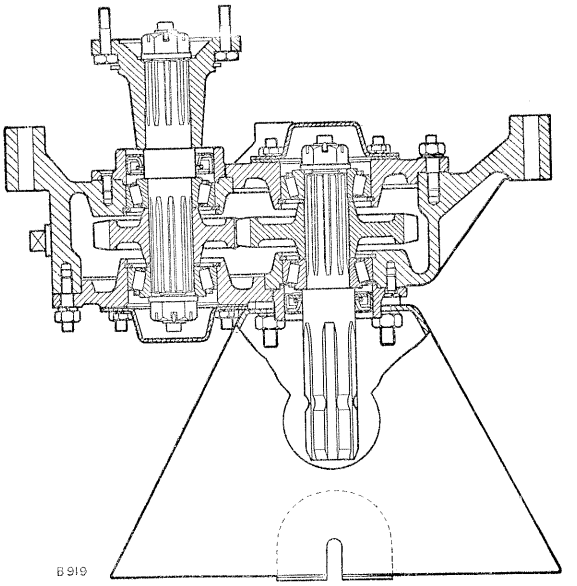


Fig. T-10—Cross-section of rear power take-off unit

17. Remove the output shaft front bearing cover plate and joint washer.
18. Remove the split pin, castle nut and plain washer securing the output shaft front bearing; remove the bearing inner race and shims, which should be preserved.
19. Remove the output shaft front bearing housing complete with circlip and outer race and a joint washer. If necessary, remove the circlip and drift the race from the housing.
20. Withdraw the 24-tooth gear and rear inner race from the output shaft.
21. Lift off the power take-off housing, leaving the output shaft in the vice.
22. Remove the output shaft oil seal retainer complete with oil seal and joint washer. Drift the seal from the retainer.
23. To remove the bearing outer races remaining in the housing, remove the two internal circlips, heat the housing in water and tap out the races.
24. Wash all the component parts thoroughly and lay them out for inspection. Renew all joint washers and split pins.
25. Check all the bearings for wear and damage and renew them as necessary.
26. Check the gears for damage marks and rectify or renew as necessary; the gears must only be replaced as a pair.
27. Examine the housings for signs of damage or cracks and renew them as necessary. A housing may also be scrap as a result of excessive wear in a bearing bore; such wear will be obvious during the course of assembly.

28. Assemble the unit by reversing the stripping procedure, paying particular attention to the following points:—
29. The two bearing outer races must be a *warm tap fit* in the take-off housing.
30. The other bearing outer races must be a *light drive fit* in the bearing housings.
31. The bearing inner races must all be an *easy tap* fit on the input and output shafts.
32. The backlash between the gears must be .008 in. to .012 in. (0,20 to 0,30 mm).
33. The recess in the splined bore in each gear must be fitted adjacent to the centre flange on each shaft. The input shaft gear must be fitted on the longer end of the shaft.

Power take-off gears

To transpose **Operation T/10**

1. Remove the rear pulley unit (if fitted).
2. Drain off the oil from the take-off unit.
3. Remove the take-off unit from the chassis frame.
4. Remove the input shaft cover plate.
5. Remove the split pin, castle nut and plain washer from the end of the input shaft.
6. Remove the input shaft bearing housing complete with bearing.
7. Remove and preserve the shims from the input shaft and withdraw the 20-tooth gear.
8. Withdraw the 24-tooth gear from the output shaft in a similar manner.
9. Transpose the gears and reassemble the unit by reversing the stripping procedure.
10. It is most important that the two sets of shims removed be replaced on their original shafts.
11. Refill the unit with oil, 1 pint (0,5 litre).

Rear drive pulley

To fit **Operation T/12**

1. Remove the output shaft guard from the rear power take-off casing.
2. Offer the pulley unit to the power take-off by entering the splined output shaft into the pulley sleeve and secure it by means of the nuts and spring washers.
3. Fill the unit with oil, $\frac{3}{4}$ pint (0,5 litre).
4. It is most important to ensure alignment of the driving belt in the centre of the pulley and also to obtain the correct tension of the belt; the belt tension is correct when the hand brake will hold the vehicle and the two sides of the belt cannot be compressed completely together by hand at a point midway between the vehicle and the driven machine.
34. Each oil seal must be pressed into its retainer until the plain face is approximately 5/16 in. (8 mm) below the outer face of the retainer.
35. When replacing the shafts, a piece of shim steel or stiff paper should be wrapped round the shaft splines, to prevent damage to the oil seals.
36. Adjust the bearings in the following manner:—
    (*a*) When both shafts are in position with the castle retaining nuts pulled up tightly, tap both ends of each shaft to settle the bearings.
    (*b*) Rotate each shaft in turn; it should turn quite freely, but no end-float must be present. Adjustment to achieve this condition is provided by the shims adjacent to the bearing inner race which are available .005 in., .010 in. and .020 in. (0,12 mm., 0,25 mm and 0,50 mm) thick. To reduce the end-float, shims must be removed; if the bearings have too much interference, suitable shims must be added to bring the setting correct.

To overhaul **Operation T/14**

1. Remove the pulley unit from the rear drive unit.
2. Drain off the oil from the pulley unit.
3. Remove the pulley from the bevel pinion shaft.
4. Remove the pinion shaft housing from the drive housing complete with shims, which should be preserved.
5. Tap the pinion shaft from the housing, complete with one inner race, distance tube and shims, which should be preserved; the second inner race can only be withdrawn after the oil seal is removed. Slide the shims, distance tube and inner race off the pinion shaft.
6. Warm the housing in hot water, drift out the oil seal, remove the second inner race and drift out the outer races.
7. Remove the bevel wheel bearing end plate from the drive housing, complete with the bearing outer race and shims, which should be preserved.

   If desired, the outer race can be removed from the end plate by heating the plate in hot water.
8. Remove the drive shaft and bevel wheel complete with the bearing inner races from the housing.
9. Remove the set bolt and spring washer securing the bevel wheel retaining plate, lift off the plate and cork washer and slide off the bevel wheel complete with an inner race and shims which should be preserved. Drift the inner race from the bevel wheel.
10. Drift the second inner race from the drive shaft and remove the retaining circlip.
11. Warm the drive housing in hot water and drift out the oil seal and outer race.
12. Wash all the component parts thoroughly and lay them out for inspection.

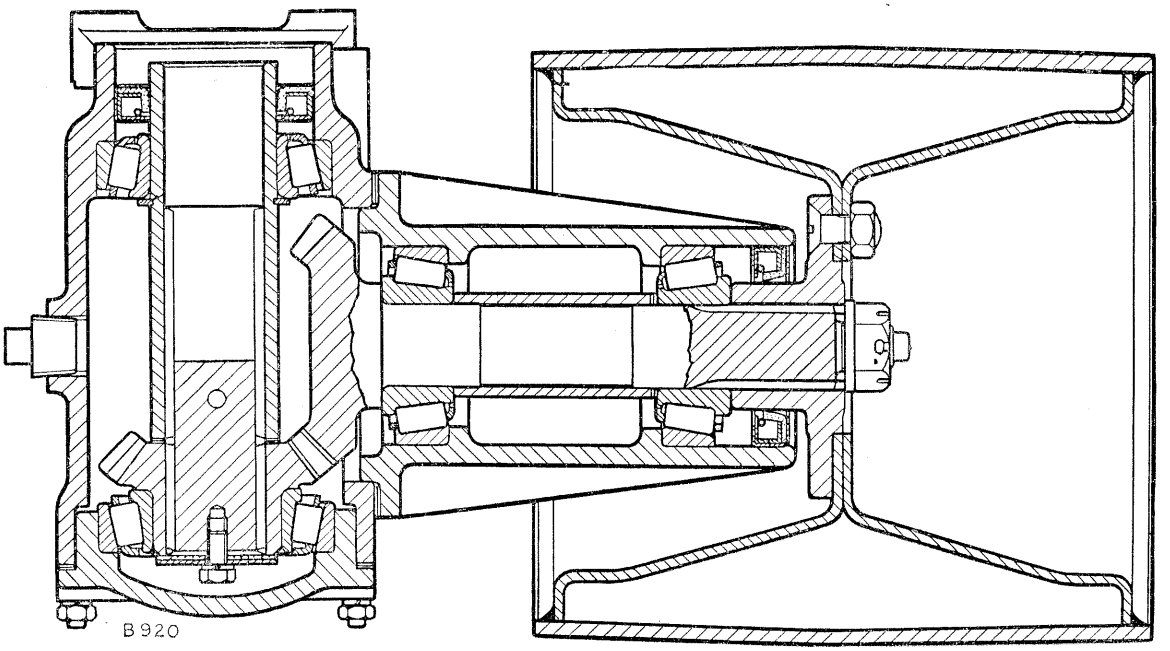


Fig T-11—Cross-section of rear pulley unit

13. Check all the bearings for wear and damage and renew them as necessary.

14. Check the gears for damage marks and rectify or renew them as necessary; the gears must only be renewed as a pair.

15. Examine the housings for signs of damage or cracks and renew them as necessary. A housing may also be scrap as a result of excessive wear in a bearing bore; such wear will be obvious during the course of assembly.

16. Assemble the unit by reversing the stripping procedure, paying particular attention to the following points:—

17. The two drive shaft bearing outer races must be a *warm tap fit* in the drive housing and end plate. The two inner races must be a *light drive fit* on the drive shaft and bevel wheel.

18. The pinion shaft bearing outer races must be a *warm tap fit* in the pinion housing. The inner races must be an *easy tap fit* on the pinion shaft.

19. The drive housing, end cover and pinion housing should be warmed to facilitate fitting the bearing outer races.

20. The small shims (available .005 in., .010 in. and .020 in. (0,12 mm, 0,25 mm and 0,50 mm) thick) behind the bevel wheel, provide adjustment for alignment of the bevel wheel and pinion teeth; the original shims should be correct if the original gears, etc., are replaced.

21. The drive housing oil seal must be fitted with its sealing lip inwards.

22. The drive shaft must be able to turn quite freely, no end-float must be present. Adjustment to achieve this condition is provided by the shims under the end cover, which are available .005 in., .010 in. and .020 in. (0,12 mm, 0,25 mm and 0,50 mm) thick. To reduce the end-float, shims must be removed.

23. The pinion housing oil seal must be fitted just below the housing end face with its sealing lip inwards.

24. Adjust the pinion shaft bearings as follows:—
    (*a*) With the pulley fitted and the pinion shaft retaining nut pulled up tightly, tap both ends of the shaft to settle the bearings.
    (*b*) Rotate the shaft; it should turn quite freely, but no end-float must be present. Adjustment to achieve this condition is provided by the shims on the shaft between the distance tube and outer bearing, which are available .005 in., .010 in. and .020 in. (0,12 mm, 0,25 mm and 0,50 mm) thick. To reduce the end-float, shims must be removed.

25. The shims between the pinion and drive housings, available .005 in., .010 in. and .020 in. (0,12 mm, 0,25 mm and 0,50 mm) thick, are provided for adjustment of the backlash between the bevel wheel and pinion. There must be definite backlash at all positions of a complete revolution, but this must not exceed .004 in. (0,10 mm) at any point. Excessive backlash can be corrected by removing suitable shims.

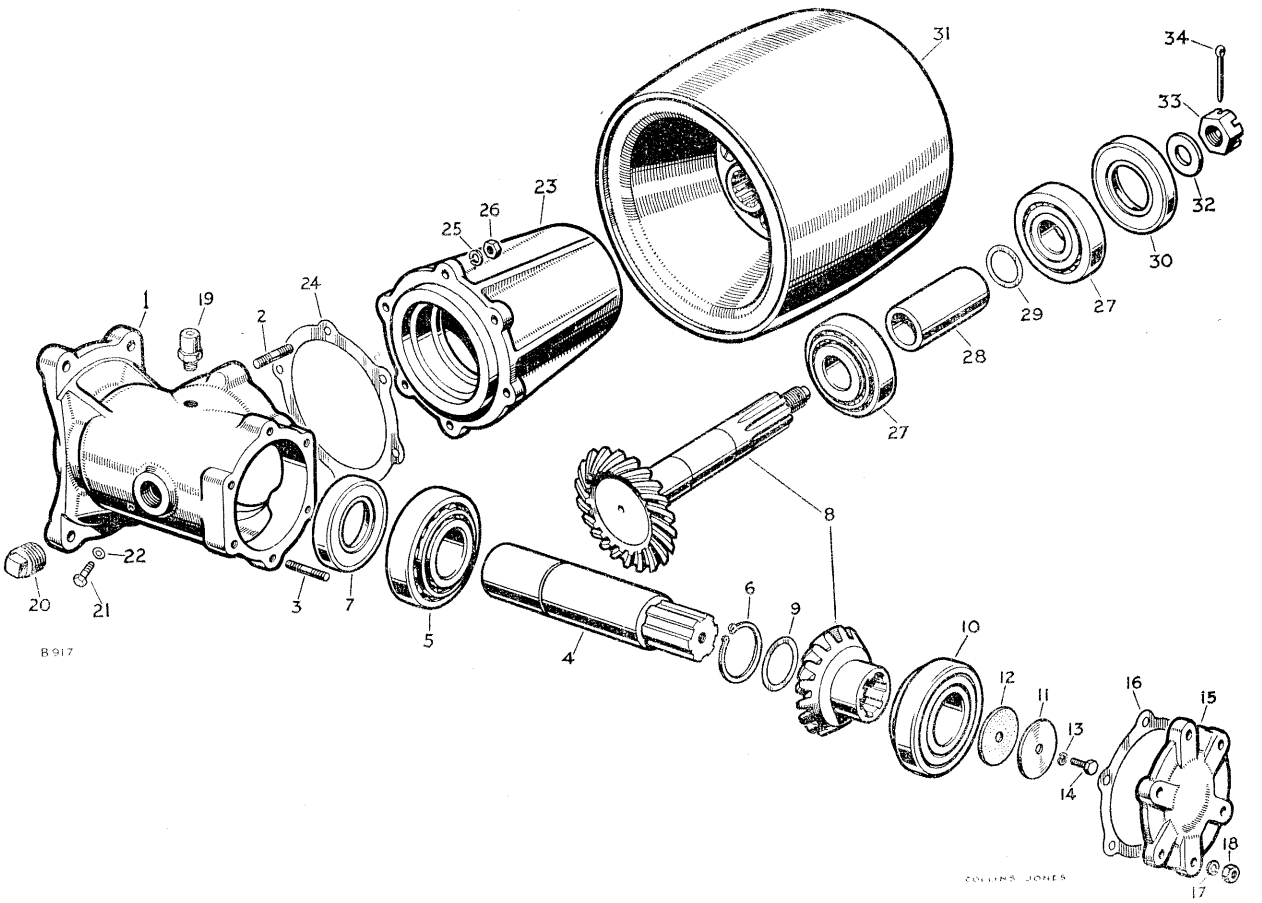


Fig. T-12—Layout of rear pulley unit

1 Housing assembly for P.T.O. pinion
2 Stud for pulley drive housing
3 Stud for end plate
4 Pinion driving sleeve, 6-spline
5 Bearing for sleeve
6 Circlip, bearing to sleeve
7 Oil seal for driving sleeve
8 Spiral bevel wheel and pinion
9 Shim
10 Bearing for bevel wheel
11 Retaining plate for bevel wheel
12 Cork washer for retaining plate
13–14 Fixings for plate
15 End plate for bevel wheel bearing
16 Shim for bevel wheel end plate
17–18 Fixings for bearing end plate
19 Breather for housing
20 Filler plug for housing
21 Plug for oil level
22 Washer for plug
23 Housing for pulley drive pinion
24 Shim for pulley drive pinion housing
25–26 Fixings for pulley drive
27 Bearings for pinion
28 Distance tube for bearings
29 Shim for bevel pinion bearings
30 Oil seal for bevel pinion bearings
31 Pulley
32–34 Fixings for pulley

Engine governor—2 litre Petrol

To fit **Operation T/16**

1. Disconnect the bonnet prop rod from the bonnet.
2. Remove the bonnet.
3. Fit the governor bracket support on top of the dynamo support bracket, using the bolt already securing the dynamo bracket. Turn the support to the rear and leave the bolt slack.
4. Fit the governor to the bracket (three bolts and spring washers).
5. Slacken the dynamo adjusting bolt to relieve the tension on the fan belt.
6. Remove the original fan pulley and distance piece from the hub of the water pump spindle, and fit the new double groove pulley and distance piece.
7. Remove the three set bolts securing the thermostat housing and in their places fit the three studs using the existing spring washers.

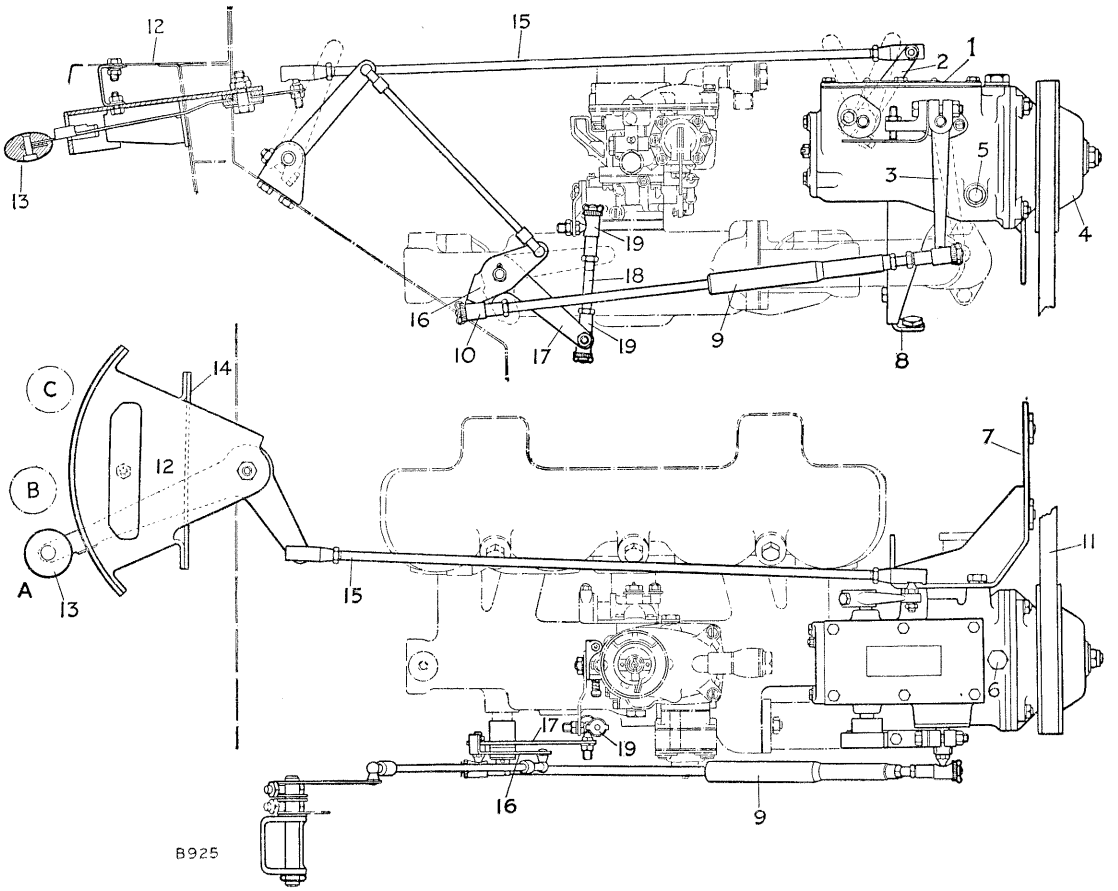


Fig. T-13—Installation of engine governor—2 litre Petrol
A—Inoperative position B—1,500 R.P.M. C—3,000 R.P.M.

1 Engine governor
2 Loading lever
3 Throttle control lever
4 Governor pulley
5 Oil level plug
6 Oil filler plug
7 Bracket for governor
8 Support for bracket
9 Collapsible control rod
10 Adjustable ball joint for rod
11 Drive belt
12 Control quadrant
13 Operating lever
14 Draught excluder
15 Governor operating rod
16 Relay lever
17 Carburetter bell crank
18 Rod, bell crank to carburetter
19 Adjustable ball joint for rod

8. Readjust the fan belt tension.

9. Place the governor driving belt over the fan pulley and round the governor pulley. Fit the mounting bracket and governor to the extension studs on the front of the thermostat housing, securing the bracket with the three special nuts and shakeproof washers, leaving the nuts slack.

10. Secure the mounting bracket to the support with one bolt, spring washer and nut, leaving the nut slack.

11. Carefully bend the distributor vacuum pipe to clear the governor and bracket.

12. Hold the governor out to tension the belt, (it should be possible to depress the belt $\frac{1}{2}$ in. (12,5 mm) by thumb pressure midway between the pulleys) and tighten the nuts and bolts holding the governor mounting bracket and support.

13. Check the oil level in the governor, by removing the filler plug at the top front and the level plug at the R.H. side. Replenish as necessary with engine oil through the filler hole until the level is to the bottom of the level plug hole. Replace both plugs.

14. Remove and discard the throttle return spring between the bell crank lever and the anchor on the petrol filter bracket.

15. Remove the cover plate on the dash panel immediately below the instrument panel.

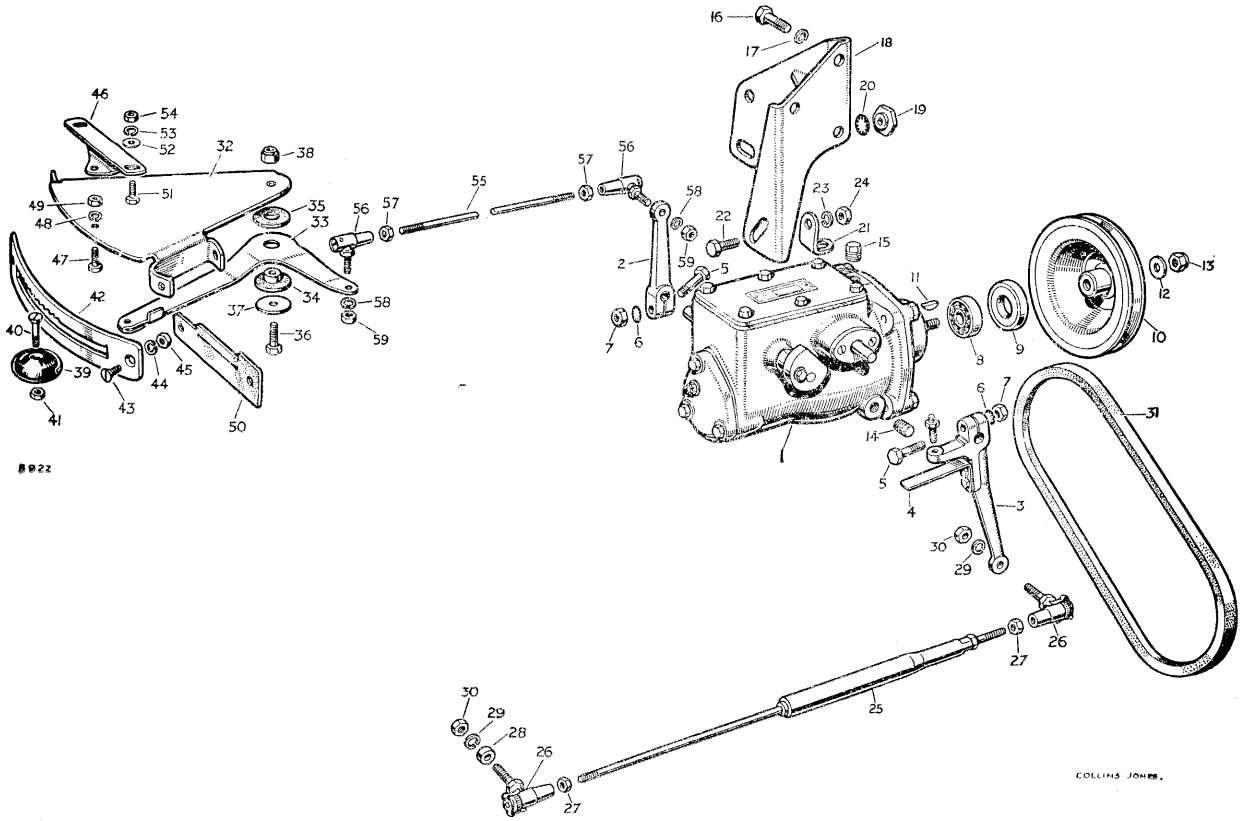


Fig. T-14—Layout of engine governor—2 litre Petrol

1 Engine governor complete
2 Lever, governor to quadrant
3 Lever, grommet to bell crank
4 Spring blade for bell crank
5–7 Fixings for levers
8 Bearing, large } For engine
Bearing, small } governor
9 Oil seal for pulley end
10 Pulley for governor
11 Woodruff key for pulley
12–13 Fixings for pulley
14 Level plug for governor
15 Filler plug for governor
16–17 Fixings for governor
18 Bracket for governor
19–20 Fixings for bracket
21 Support for bracket
22–24 Fixings for support
25 Control rod, governor to bell crank
26 Ball joint complete for rod
27 Locknut for ball joint
28 Distance piece, bell crank lever end
29–30 Fixings for rod
31 Belt for governor drive
32 Housing for governor control quadrant
33 Lever for control
34 Bush for lever
35 Washer for lever
36–38 Fixings for control lever to housing
39 Knob for lever
40–41 Fixings for knob
42 Quadrant plate
43–45 Fixings for quadrant plate
46 Support for governor control
47–49 Fixings for support
50 Rubber draught excluder
51–54 Fixings for control
55 Operating rod, quadrant to governor
56 Ball joint for rod
57 Locknut for ball joint on rod
58–59 Fixings for operating rod

16. Insert the governor control quadrant in the rectangular hole uncovered, and bolt it to the dash, using the fixings originally securing the cover plate and with the rubber draught excluder between the quadrant housing and the dash.

    Leave the nuts slack at this stage.

17. Remove the instrument panel complete, without disconnecting the instruments.

18. Secure the quadrant bracket to the underside of the instrument box. Tighten the nuts securing the quadrant to the dash and then the nuts fixing the bracket to the instrument box.

19. Replace the instrument panel.

20. Fit a ball joint to each end of the governor operating rod and attach the rod to the control quadrant lever, using a spring washer and nut. Loosen the governor throttle control (R.H.) lever on its shaft and place the quadrant lever in the inoperative (extreme R.H.) notch. Push the governor loading (L.H.) lever forward until a marked resistance is felt, indicating that the internal mechanism is against the stop in the rear end cover. With the loading lever in this position, adjust the length of rod and connect it to the loading lever, using a spring washer and nut. Tighten the ball joint locknuts.

21. Fit the collapsible control rod between the bell crank lever and the governor throttle control (R.H.) lever; secure it at the governor end, and at the bell crank end with two spring washers, nuts and one distance piece to be fitted between rod and bell crank.

    Before fitting, ensure that there is no free play in the collapsible control rod.

22. Check that the carburetter throttle is fully open when the accelerator pedal is fully depressed. If this is not so, the throttle lever on the dash cross-shaft should be adjusted as necessary.

    The Amal adjustable ball joints on the linkage should be adjusted as follows:—

    (*a*) Tighten the ratchet screw at the head of the joint until the ball is held solidly in its cup.

    (*b*) Unscrew the ratchet one or two clicks until the ball is free.

Setting the governor control linkage

23. Place the quadrant control lever in its highest speed position, i.e., in the extreme L.H. notch.

24. Hold the carburetter throttle fully open and tighten the governor throttle control (R.H.) lever on its shaft.

25. With the engine running, move the quadrant control lever to the first operating notch, i.e., the 1,500 R.P.M. position; with the lever in this position, check the anti-surge stop clearance. The stop clearance should be .020 in. to .025 in. (0,5 mm to 0,6 mm) measured between the spring leaf attached to the throttle control lever and the cam on the loading lever shaft. Adjust the clearance as necessary by means of the set screw and locknut in the bracket attached to the throttle control lever.

26. Return the quadrant lever to the inoperative position.

    With the linkage set in this way, the governor should control the speed of the engine between 1,500 R.P.M. with the quadrant lever in the first operating notch, and 3,000 R.P.M. in the extreme L.H. notch.

    Whenever any part of the governor linkage is disturbed for any reason, the complete linkage must be reset.

Checking the engine speed with the governor in position

27. It is possible to check the governed speed of the engine with the governor in operation, by measuring the rear power take-off speed with a revolution counter.

    The relationship between the engine speed and the rear power take-off speed is shown in the following tables:—

(*a*) Rear power take-off pulley:—

		Pulley Speed	
Governor position	Engine speed	5:6 Power take-off ratio	6:5 Power take-off ratio
1	1500	1070	1540
4	1950	1390	2000
8	2550	1820	2630
11	3000	2145	3100

(*b*) Rear power take-off drive shaft:—

		Drive shaft speed	
Governor position	Engine speed	5:6 Power take-off ratio	6:5 Power take-off ratio
1	1500	1250	1800
4	1950	1625	2350
8	2550	2125	3050
11	3000	2500	3600

Points to be checked if the governor surges

28. Ensure that there is negligible backlash in the linkage between the governor and carburetter. Such backlash must not exceed .010 in. (0,25 mm).

29. Ensure that there is no drag at any point in the linkage and that the throttle moves freely.

30. Ensure that all the carburetter jets are clean.

31. Check and correct as necessary, the tension in the fan and governor belts. If it is necessary to retension the governor belt, it may also be necessary to reset the linkage in the manner described.

32. Fit the new spring to the accelerator pump actuating rod.

33. If the governor still surges after attentions 28-32, it can be rectified by inserting 2 B.A. washers behind the spring on the accelerator pump actuating rod. Washers to the thickness of $\frac{1}{8}$ in. (3 mm) should be inserted initially and additions of one washer at a time then made until the surge is eliminated:—

    (*a*) Remove the nut securing the pump lever to the carburetter throttle spindle.

    (*b*) Slide the lever off the spindle and unscrew it from the pump actuating rod, counting the number of turns of the lever to unscrew.

    (*c*) Remove the split pin holding the spring abutment washer.

    (*d*) Thread the new washers up the pump rod, screw the lever on the pump actuating rod, giving the same number of turns as when removed, and reassemble on the carburetter.

    On no account must the split pin be removed from the end of the pump rod, as this is set to give the correct pump action.

    Only just enough washers to rectify the surge should be incorporated, as their addition pre-loads the governor linkage.

    In any case, no further washers should be inserted after the point when the spring is compressed to $\frac{1}{2}$ in. (12,5 mm) length with the throttle fully open.

34. Replace the bonnet and reconnect the bonnet prop rod to the bonnet.

To remove **Operation T/18**

1. Disconnect the operating rod at the governor end by removing the nut and spring washer.

2. Disconnect the control rod at the governor end by detaching the adjustable ball joint.

3. Remove the governor unit complete with mounting bracket and support.

Engine governor—2¼ litre Petrol

To fit **Operation T/20**

1. Disconnect the bonnet prop and remove the bonnet.

2. Drain the radiator, then disconnect the top and bottom hoses. If fitted, disconnect the oil cooler.

3. Disconnect the headlamps from the harness.

4. Remove the grille panel complete with radiator and cowl. See Section L.

5. Remove the forward engine lifting bracket and remove the two L.H. front cylinder head bolts and fit the two special bolts provided.

6. Fit the governor mounting bracket to the cylinder head bolts and to the front of the cylinder head, using the fixings provided.

7. Fit the engine governor to the bracket and leave the bolts slack.

8. Slacken the dynamo adjusting bolts to relieve the tension on the fan belt, remove the four fan fixing bolts, then remove fan and fan belt.

9. Remove the original fan pulley from the water pump and fit the new double pulley supplied.

10. Remove and discard the dynamo pulley and replace with the double pulley supplied.

11. Remove the crankshaft pulley and replace with the double pulley supplied. Secure with the starter dog, using a new lockwasher.

12. Assemble the jockey pulley, shaft, bearing and circlip, then fix to the adjusting plate with a nut and spring washer.

13. Fit the adjusting plate and the jockey pulley assembly to the support plate, using the nuts, bolts and washers provided.

14. Fit the above assembly to the front cover.

15. Fit the fan driving belt supplied to the inner groove on the fan pulley and inner groove on the crankshaft pulley and around the jockey pulley; adjust the tension by moving the jockey pulley.

16. Fit the governor driving belt over the governor pulley and inner groove of dynamo pulley; do not adjust at this stage.

17. Replace the original fan belt, if in good condition, on the outer grooves of the dynamo, fan and crankshaft pulleys; adjust the tension by moving the dynamo.

18. Adjust the governor driving belt tension by raising the governor on the support bracket, then fit the eight-bladed fan provided to the fan pulley, using four set bolts. Remove the bracket, supporting the carburetter bell crank spindle, from the wing fitting.

19. Replace the two front studs securing the exhaust manifold to the inlet manifold with the two larger studs provided. Fit the bell crank bracket provided to these studs. Screw the bell crank spindle into this bracket, using a shakeproof washer.

20. Attach the governor control rod assembly to the angle of the bell crank lever, using a ball joint, distance piece, nuts and spring washer.

21. Attach the other end of the governor control rod to the ball joint on the governor (throttle control) lever held by a nut and spring washer. Ensure, before fitting, that there is no free play in this collapsible control rod.

22. Remove the original carburetter lever and fit the new lever provided and connect up to the bell crank lever, using the original rod. Connect up the original control rod from the accelerator cross-shaft lever.

23. Remove the cover plate on the dash panel immediately below the instrument panel, remove the instrument panel and fit the new plate provided.

24. Insert the governor control quadrant into the rectangular hole uncovered and bolt it to the dash, using the fixings originally securing the cover plate and with the rubber draught excluder between the quadrant housing and the dash. Leave the nuts slack.

25. Withdraw the instrument panel as far as possible and secure the quadrant bracket to the underside of the instrument box, using the fixings provided.

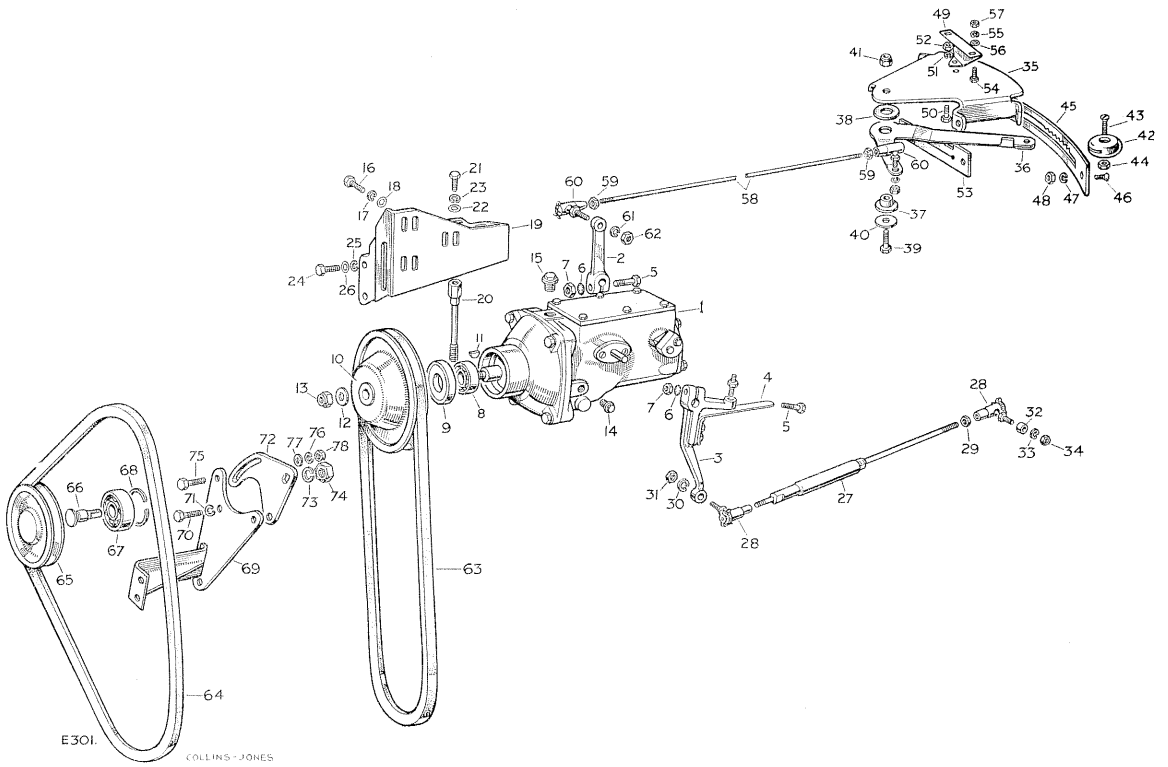


Fig. T-15—Layout of engine governor—2½ litre Petrol

1 Engine governor
2 Lever, governor to quadrant
3 Lever, governor to bell crank
4 Spring blade for bell crank
5–7 Fixings—lever to governor
8 Bearing for engine governor
9 Oil seal, pulley end
10 Pulley for governor
11 Woodruff key for pulley
12–13 Fixings for pulley
14 Level plug
15 Filler plug
16–18 Fixings—governor to bracket
19 Governor bracket
20 Special bolt for mounting bracket
21–23 Fixings—bracket to set bolt
24–26 Fixings—bracket to cylinder head
27 Control rod, governor to bell crank
28–29 Ball end and locknut for control rod
30–31 Fixings—control rod to governor
32–34 Fixings—rod to bell crank lever
35 Housing for governor control quadrant
36 Control lever
37 Bush for lever
38 Washer
39–41 Fixings—lever to housing
42 Knob for lever
43–44 Screw and nut, for knob
45 Quadrant plate
46–48 Fixings—quadrant plate to housing
49 Support for governor control
50–52 Fixings—support to housing
53 Rubber draught excluder
54–57 Fixings—governor control to dash
58 Operating rod
59–60 Locknut and ball joint for operating rod
61–62 Fixings—operating rod to control lever
63 Belt for engine governor
64 Fan belt
65 Jockey pulley
66–68 Shaft, bearing and circlip for jockey pulley
69 Support plate for jockey pulley
70–71 Fixings—support plate to front cover
72 Belt adjusting plate
73–74 Fixings—jockey pulley shaft to plate
75–78 Fixings—adjusting plate to support plate

26. Tighten the nuts securing the quadrant to the dash and then the nuts fixing the bracket to the instrument box. Replace the instrument panel.

27. Fit a ball joint and locknut to each end of the governor operating rod and attach the rod to the quadrant control lever, using the nuts and spring washers provided. Loosen the governor throttle control lever on its shaft and place the quadrant in the inoperative position. Push the governor loading lever forward until a marked resistance is felt, indicating that the internal mechanism is against the stop in the rear of the cover. With the loading lever in this position, adjust the length of the rod and connect it to the loading lever, using a spring washer and nut. Tighten the ball joint locknuts.

28. As further settings will require the engine running, replace the grille panel assembly and connect the radiator hoses. Connect the head lamp to the harness and refill the radiator.

29. Check the oil level in the governor and adjust as necessary, using the recommended oil. The L.H. front plug is the level guide.

30. Before proceeding with further settings of the control linkages, ensure that the carburetter throttle is fully open when the accelerator pedal is fully depressed. Adjust as necessary.

Fitting the tie-rod

31. Fit the bracket provided to the L.H. rear flange of the bell housing, using the nuts, bolts and washers provided.

32. Fit a locknut, nut, top washer, sleeve and rubber bush to the engine tie-rod; insert the rod through the bracket fitted to the bell housing, from the rear.

33. Complete the fixing to the bracket on the bell housing with a further rubber bush, top washer (dished side inwards), nut and locknut. The nuts should only be finger-tight at this stage.

34. Attach the rear bracket to the tie-rod in a similar manner and hook the bracket over the frame cross-member. With the vehicle on level ground and the handbrake off, position the rear bracket so that the tie-rod is parallel to the ground and in line with the longitudinal axis of the vehicle.

35. Using the hole in the bracket as a template, drill a $\frac{25}{64}$ in. hole (19 mm) through the cross-member and secure the bracket with a nut, bolt and spring washer.

36. Adjust the tie-rod so that there is no strain on it with the vehicle on flat ground and the handbrake off; tighten the locknut.

Setting the governor control linkages

37. Place the quandrant control lever in its highest speed position.

38. Hold the carburetter throttle fully open and tighten the governor throttle control lever on its shaft.

39. With the engine running, move the quandrant control lever to the first operating notch, i.e. the 1500 r.p.m. position; with the lever in this position check the anti-surge stop clearance. The clearance should be .008 in. to .010 in. (0,20 to 0,25 mm) measured between the spring leaf attached to the throttle control lever and the cam on the loading lever shaft. Adjust the clearance as necessary by means of the set screw and locknut in the bracket attached to the throttle control lever.

40. Return the quadrant lever to the inoperative position.

    With the linkage set in this way, the governor should control the speed of the engine between 1,500 r.p.m. with the quadrant lever in the first operating notch and 3,000 r.p.m. in the last.

Checking the engine speed with the governor in position

41. It is possible to check the governor speed of the engine with the governor in operation either by checking directly off the front of the engine crankshaft, with a suitable adaptor, or by measuring the rear power take-off speed with a revolution counter.

42. The relationship between engine speed and rear power take-off is shown in the following tables:

(*a*) Rear power take-off pulley:—

		Pulley speed	
Governor position	Engine speed	5: 6 power take-off ratio	6: 5 power take-off ratio
1	1500	1070	1540
4	1950	1390	2000
8	2550	1820	2630
11	3000	2145	3100

(*b*) Rear power take-off drive shaft—

		Drive shaft speed	
Governor position	Engine speed	5: 6 power take-off ratio	6: 5 power take-off ratio
1	1500	1250	1800
4	1950	1625	2350
8	2550	2125	3050
11	3000	2500	3600

Points to be checked if the governor surges

43. Ensure that there is negligible backlash in the linkage between the governor and carburetter. Such backlash must not exceed .010 ins. (0,25 mm).

44. Ensure that there is no drag at any point in the linkage and that the throttle moves freely. Ensure that all carburetter jets are clear. Check and correct as necessary the tension in the fan and governor belts; re-tension as necessary and re-set the linkage as necessary. Replace the bonnet prop and bonnet.

Front capstan winch—mechanical—all models

A hand throttle must be fitted and used in conjunction with the front capstan winch, on Petrol models.

New heavy duty front springs must be fitted to 2 litre Petrol models. See Section J for removal and refitting procedure.

To fit **Operation T/22**

1. Remove and discard the front apron panel. Remove the grille panel and radiator complete (Section L).

2. Remove the four set bolts and spring washers and withdraw the fan.

3. Mark off a point on the front face of chassis second cross-member $3\frac{9}{32}$ in. (83,3 mm) from the top face and mid-way between the side-members.

   Use a pilot drill first, then drill the front face only of the cross-member to $\frac{27}{64}$ in. (10,318 mm).

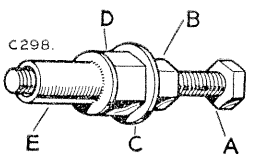


Fig. T-16—Rivnut ready for fitting

A—Set bolt
B—$\frac{5}{16}$ in. U.N.F. nut
C—Plain washer
D—Distance piece
E—Rivnut

4. Fit a nut and plain washer to a $\frac{5}{16}$ in. U.N.F. set bolt having a threaded length not less than $1\frac{1}{2}$ in. (38 mm). Drill or file the thread clear, of a $\frac{3}{8}$ in. U.N.F. nut, and slide it on to the set bolt, then screw on a Rivnut. Adjust so that $\frac{1}{8}$ in. (3 mm) of the set bolt extends beyond the Rivnut and then lock the assembly. Insert the Rivnut into the hole in second cross-member and then, keeping the set bolt and distance nut stationary, turn the $\frac{5}{16}$ in. U.N.F. nut clockwise $2\frac{1}{4}$ turns. Remove set bolt, nut, plain washer and distance nut.

5. Assemble the winch support plate temporarily to the cross-member, securing with a set bolt and spring washer.

   Using the support plate as a template, mark off and drill the other four holes as in item 3, and five $\frac{5}{16}$ in. (8 mm) clearance holes in the front bumper.

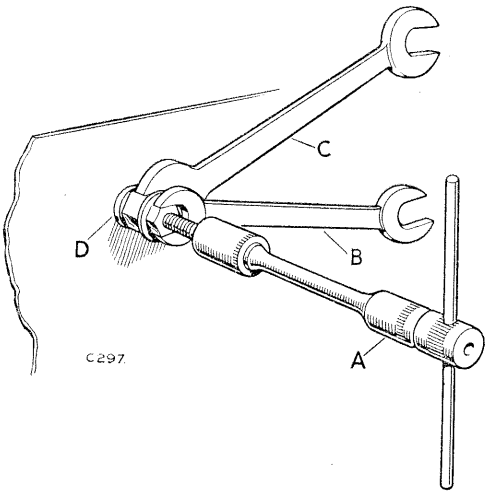


Fig. T-17—Rivnut fitting

A—$\frac{5}{16}$ in. U.N.F. spanner
B—$\frac{5}{16}$ in. U.N.F. spanner
C—$\frac{3}{8}$ in. U.N.F. spanner
D—Rivnut

6. Remove the winch support plate and front bumper. Fit the other four Rivnuts to second cross-member.

7. **2 litre Petrol models:** Relieve the fan belt tension.

8. Prise up the tabs on the starting dog lock washer and remove the dog and washer.

9. **2 litre Petrol models:** Using a suitable extractor, withdraw the vibration damper from the crankshaft. Withdraw the six screws from the damper and remove retaining plate, shims, rubber disc and remove the existing driving flange. Reassemble the damper, using the new driving flange; it will be necessary to true the damper between centres by adjusting the six fixing screws. (Section A.)

   $2\frac{1}{4}$ litre Petrol, Diesel models: Fit new driving plate, complete with special plug and shakeproof washer.

10. Secure the two shaft plate brackets to the engine front cover, replacing the original four bolts or studs with the four new bolts or studs.

11. **2 litre Petrol models:** Replace the vibration damper, securing it to the crankshaft by means of the winch driving plate, locking washer and special set bolt. Readjust the fan belt tension.

12. Secure the shaft housing to the shaft support plate by means of two spring washers and two nuts. Grease the driving shaft and insert it in the housing, sliding the driving flange on to its spline. Insert the control shaft in the housing and secure the selector fork to the control shaft and in the groove of the flange by means of a spring washer and nut. Push the steel ball into the hole, holding it in position by the spring and the plug. Fit the grease nipple in the shaft housing.

13. Bolt the housing and support plate to the brackets.
14. Slide two rubber dust covers on to the propeller shaft and fit a spring and plunger into each end of the shaft; insert one end of the shaft into the driving shaft held in the shaft housing; slide the dust cover over the joint.
15. Bolt the winch support plate to the front bumper.
16. Fit the winch to the support plate. Offer the winch, plate and bumper into position; engage the propeller shaft with the universal joint sleeve on the winch; secure the winch and plate to the cross-member. Secure the bumper to the chassis. Slide the second dust cover over the propeller shaft joint.
17. Slide the eyebolt on to the control rod and fit the locknut and clevis to the end of the rod.
18. Pass the rod through the hole in the cross-member and secure it to the support plate with a spring washer and nut on the eyebolt; fit the spring, plain washer, locknut and knob on the rod.
19. Fit the clevis to the control shaft in the shaft housing and adjust it so that the driving flange is engaged and disengaged fully, when the rod is moved in its slot to the "drive" and "free" positions, located by the selector ball.
20. Mount the rope guide brackets and guide bar on the support plate. Making sure that the bar turns freely, drill four holes through the brackets into the front face of the bumper; secure the brackets to the bumper.
21. Fill the unit with oil, to the mark on the dipstick, using an S.A.E. 90 oil.
22. Turn the unit (by means of the short starting handle supplied) until the hole in the side of the bollard exposes a grease nipple provided for lubrication of the bollard shaft and apply grease, using a suitable gun.
23. Grease all moving parts and apply grease, by means of a gun, to the nipples provided on the rope guide brackets and the drive shaft housing.
24. Replace the fan blade.
25. Replace the grille panel and radiator. Section L.

    It may be necessary to tighten the starting dog on the front of the winch shaft and secure it by means of the lock washer.

To overhaul **Operation T/24**

1. Remove the control knob and locknut, plain washer and spring from the control rod; remove the nut and spring washer securing the control rod eyebolt to the support plate and drop the control rod, slide back the dust cover from the front universal joint on the winch propeller shaft.
2. Remove the nuts, spring and plain washers securing the support plate to the chassis cross-member, and the bolts, plain washers and self-locking nuts securing the front bumper to the chassis; remove the bumper, support plate, rope guide and winch complete, at the same time disengaging the propeller shaft from the universal joint sleeve on the winch. The spring and plunger in the propeller shaft will be freed at this stage and care should be taken that these are not lost.
3. Remove the winch from the support plate.
4. Slide the rear dust cover along the propeller shaft and withdraw the propeller shaft from the sleeve of the driving shaft, care being taken that the second spring and plunger are not lost.
5. Extract the driving shaft from the shaft housing and remove the driving flange from engagement with the selector fork.
6. Disconnect the control rod clevis from the control shaft and remove the drive shaft support plate, housing and control shaft complete from the brackets.
7. Remove the selector fork from the control shaft; remove the plug, spring and ball from the drive shaft housing and withdraw the control shaft; remove the shaft housing from the plate.
8. Remove the radiator and grille panel assembly—Section L.
9. **2 litre Petrol models:** Remove the driving plate from the crankshaft vibration damper; remove the vibration damper (Section A).
10. Remove the two support plate brackets.
11. **2¼ litre Petrol, Diesel models:** Remove the driving plate from the fan driving pulley or vibration damper.
12. If necessary, remove the two rope guide brackets and rope guide from the front bumper and support plate.

    If necessary, remove the bushes from the brackets.
13. Remove the drain plug and filler plug and drain off the oil.
14. Drive out the Mills pin securing the universal joint sleeve to the rear of the worm shaft and remove the sleeve.
15. Unscrew the dog from the front of the worm shaft; slide off the lock washer.
16. Remove the oil seal retainer, oil seal and joint washer from the casing. If necessary, remove the oil seal from the retainer.
17. Turning the shaft to disengage the worm from the worm wheel, drive the worm shaft, ball bearing and distance piece from the casing. Drift the bearing and distance piece from the shaft.

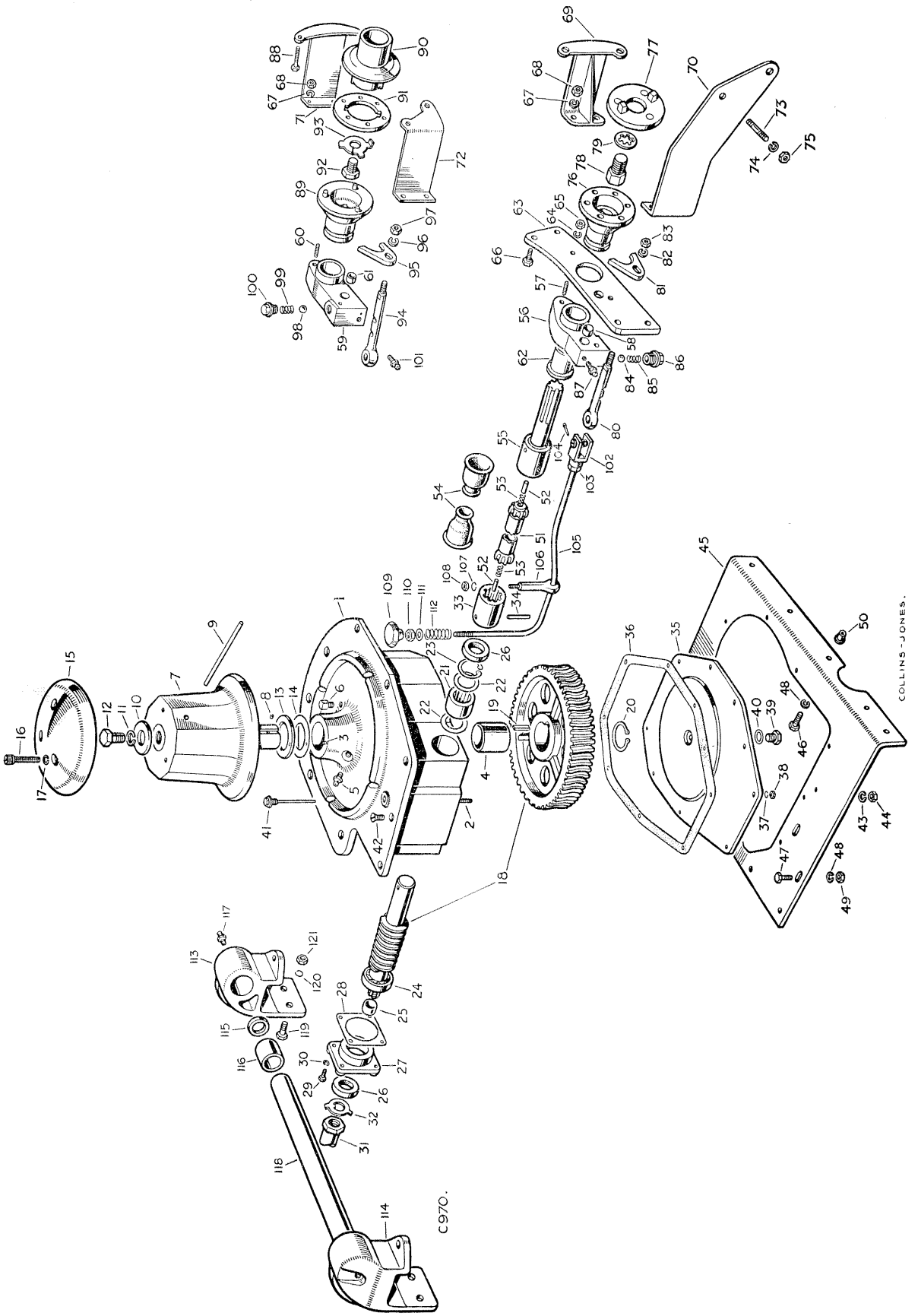


Fig. T-18—Layout of front capstan winch, mechanical

Key to Fig. T-18

1 Casing assembly for front winch
2 Stud for bottom cover
3 Dowel for thrust washer
4 Bush for bollard shaft
5 Grease point for shaft
6 Breather cup for housing
7 Bollard and shaft assembly
8 Dowel for shaft
9 Pin for bollard
10–12 Fixings for bollard
13 Thrust washer } For bollard
14 Shim } For bollard
15 Cap for bollard
16–17 Fixings for cap
18 Worm wheel and worm complete
19 Special key to worm wheel
20 Circlip fixing worm wheel
21 Roller bearing for worm
22 Washer for bearing
23 Circlip fixing bearing to casing
24 Ball bearing for worm shaft
25 Distance piece for worm shaft
26 Oil seal for worm shaft
27 Retainer for oil seal
28 Joint washer for oil seal retainer
29–30 Fixings for oil seal retainer
31 Starting dog
32 Lock washer for starting dog
33 Universal joint sleeve
34 Special pin fixing sleeve to worm
35 Bottom cover for winch casing
36 Joint washer for bottom cover
37–38 Fixings for bottom cover
39 Drain plug for front winch
40 Joint washer for drain plug
41 Filler plug and dipstick
42–44 Fixings for front winch
45 Support plate for front winch
46-49 Fixings for support plate
50 Rivnut
51 Propeller shaft for front winch
52 Plunger spring } For propeller shaft
53 Plunger } For propeller shaft
54 Dust cover } For propeller shaft
55 Driving shaft for front winch
56 Winch shaft housing assembly } 2¼ litre Petrol, Diesel models
57 Stud for support plate } 2¼ litre Petrol, Diesel models
58 Bush for control shaft } 2¼ litre Petrol, Diesel models
59 Winch shaft housing assembly } 2 litre Petrol models
60 Stud for support plate } 2 litre Petrol models
61 Bush for control shaft } 2 litre Petrol models
62 Bush for winch driving shaft
63 Support plate for winch shaft
64-65 Fixings for housing
66–68 Fixings for support
69 Bracket for winch shaft support plate R.H. } 2¼ litre Petrol, Diesel models
70 Bracket for winch shaft support plate L.H. } 2¼ litre Petrol, Diesel models
71 Bracket for winch shaft support plate R.H. } 2 litre Petrol models
72 Bracket for winch shaft support plate L.H. } 2 litre Petrol models
73–75 Fixings—bracket to front cover } 2¼ litre Petrol, Diesel models
76 Driving flange for front winch } 2¼ litre Petrol, Diesel models
77 Winch driving plate } 2¼ litre Petrol, Diesel models
78–79 Fixings for driving plate } 2¼ litre Petrol, Diesel models
80 Control shaft for driving flange } 2¼ litre Petrol, Diesel models
81 Selector fork for control shaft } 2¼ litre Petrol, Diesel models
82–83 Fixings for fork } 2¼ litre Petrol, Diesel models
84 Steel ball } For control shaft
85 Spring } For control shaft
86 Plug for spring } For control shaft
87 Grease point for control shaft } 2¼ litre Petrol, Diesel models
88 Set bolt fixing bracket to front cover } 2 litre Petrol models
89 Driving flange for front winch } 2 litre Petrol models
90 Driving flange for fan pulley } 2 litre Petrol models
91 Winch driving plate } 2 litre Petrol models
92–93 Fixings for driving flange and plate } 2 litre Petrol models
94 Control shaft for driving flange } 2 litre Petrol models
95 Selector fork for control shaft } 2 litre Petrol models
96–97 Fixings for fork } 2 litre Petrol models
98 Steel ball } For control shaft
99 Spring } For control shaft
100 Plug for spring } For control shaft
101 Grease point for control shaft } 2 litre Petrol models
102–104 Clevis, locknut and split pin
105 Control rod for winch
106 Eye bolt for winch control rod
107–108 Fixings for eye bolt
109 Knob for control rod
110 Locknut for knob
111 Plain washer for spring
112 Spring for control rod
113 Rope guide bracket assembly R.H.
114 Rope guide bracket assembly L.H.
115 Thrust washer
116 Bush for guide bar
117 Grease point for bush
118 Guide bar for winch rope
119–121 Fixings for rope guide

18. Remove the bottom cover and joint washer from the casing.

19. Withdraw the three Allen screws and spring washers and lift off the bollard cap.

20. Remove the set bolt, spring washer and plain washer from the end of the bollard shaft; drift out the safety pin securing the bollard to the shaft and remove the bollard.

21. Remove the thrust washers and shims, which should be preserved and withdraw the worm wheel and shaft from the casing.

22. Remove the circlip securing the worm wheel and press the shaft from the wheel; if necessary, remove the peg and key from the shaft.

23. If necessary, press the two bollard shaft bushes from the casing; remove the worm shaft oil seal from the casing; remove the roller retaining circlip, a distance washer, the roller bearing, and a further washer; remove the grease nipple, the breather cup and the thrust washer peg, leaving the bare casing.

24. Wash all the component parts thoroughly and lay them out for inspection.

25. Check all the bearings for wear and damage and renew them as necessary.

26. Check the gears for damage marks and rectify or renew them as necessary; the gears must only be renewed as a pair.

27. Examine the casing for signs of damage or cracks and renew as necessary. The casing may also be scrap as a result of excessive wear in a bearing bore; such wear will be obvious during the course of assembly.

28. The bollard and shaft are only supplied as an assembly.

29. Assemble the unit by reversing the stripping procedure, paying particular attention to the following points:—

30. The roller bearing must be a *push fit* in the casing and on the worm shaft. The ball bearing must be a *light press fit* in the casing and on the worm shaft.

    Renew the bearings, casing or shaft as necessary.

31. If necessary, renew the bollard shaft bushes, which must be a *press fit* in the casing and a *sliding fit* on the bollard shaft. They must be reamed to 1.312 in. (33,4 mm).

    The upper bearing must stand $\frac{1}{8}$ in. (3 mm) proud of the top face of the casing.

32. The bollard shaft must be well greased on assembly.

33. The worm shaft oil seals must be replaced with their knife edges inwards.

34. The worm shaft must be able to turn quite freely, but no end-float must be present.

35. The shims between the bollard thrust washer and the casing, available .005 in. thick, are provided for adjustment of the bollard shaft end-float, which must be set on assembly to .003 in. to .005 in. (0,07 to 0,12 mm).

36. If necessary, renew the bushes in the rope guide brackets.

    The old bushes may be removed by screwing a suitable size tap into the bearing and then extract; a thrust washer is fitted behind each bush.

    The new bushes must be a *light press fit* in the brackets. The guide bar must be able to rotate freely in the bushes, which must be reamed in position to 1.390 in. (35,3 mm).

37. If necessary, renew the drive shaft bush in the shaft housing. The bush must be a *press fit* in the housing. After fitting, ream the bush to .750 in. (19 mm) and drill the lubrication hole through the nipple side of the bush. The drive shaft must be a *sliding fit* in the bush.

38. If necessary, renew the two control shaft bushes in the housing, the bush on the studded side of the housing should stand 3/32 in. (2 mm) proud of the housing face.

39. Complete the assembly and installation. Fill the winch with oil. $3\frac{1}{2}$ pints (2,0 litres). Apply grease at the nipples on the rope guide, bollard shaft and drive shaft housing. Smear all moving parts liberally with grease.

Hydraulic front winch

To fit **Operation T/26**

1. Remove and discard the front valance and mounting clips.

2. Remove the radiator grille.

3. If the winch rear mounting bracket is not already attached to the winch, fit this mounting bracket loosely to the winch rear connecting tube with the U bolts supplied.

4. Remove the two large thimble protection covers from the R.H. and L.H. sides of the winch hydraulic motor inlet and outlet ports.

5. Fit to the L.H. side hydraulic motor port a right-angled elbow, with the elbow outlet facing forward. Secure with an 'O' ring, a set bolt and a spring washer.

6. Fit an adaptor to the right-angle elbow, using a bonded seal.

7. Fit to the R.H. side hydraulic motor port the high pressure hose connection, using an 'O' ring, a set bolt and a spring washer.

8. Ensure that the bumper is level and is not damaged. Replace or rectify if necessary.

9. Offer the winch assembly into position between No. 1 and No. 2 cross-members and insert a half-inch (13,0 mm) block of wood between the top of the worm shaft housing and grille tunnel—to ensure adequate grille clearance when refitted.
10. Ensure that the half-round cut-away in the winch rear mounting bracket is flush with the large hole in No. 2 cross-member and that the right-angle elbow fitted to the hydraulic motor maintains a clearance of $\frac{1}{8}$ to $\frac{1}{4}$ in. (3,0 to 6,0 mm) between chassis frame side member.
11. Using the winch mounting bracket as a template, mark off the accessible fixing holes in No. 2 cross-member.
12. Remove the winch and front bumper and drill the marked-off holes $\frac{25}{64}$ in. (10,0 mm) dia. in in No. 2 cross-member and fit the rivnuts, using a special rivnut tool. Reference to Operation T/22 will show an alternative method. Care must be taken not to overtighten when fitting rivnuts.
13. Remove the mounting bracket from the winch connecting tube and temporarily fit the mounting bracket to the rivnuts on No. 2 cross-member. Mark off the remaining fixings in the cross-member and complete the rivnut fitting.
14. Finally, fit the mounting bracket to the cross-member, using the ten $\frac{5}{16}$ U.N.F. x $1\frac{1}{4}$ in. (32 mm) long bolts and spring washers supplied.
15. Replace the front bumper, leaving the fixing bolts loose, and temporarily secure the winch in position with the U bolts to the mounting bracket.
16. Line up the front bumper and tighten the bumper fixing bolts. Mark off the winch forward fixing holes in the bumper.
17. Remove the winch and drill the fixing holes in the bumper $\frac{25}{64}$ in. (10,0 mm) dia. holes.
18. Replace the winch in position together with the roller rope snubber frame and secure the winch to the mounting bracket with the U bolts and to the front bumper, using the four $\frac{3}{8}$ U.N.F. x $1\frac{3}{4}$ in. (44 mm) long bolts, plain washers, spring washers and nuts supplied.
19. Position the guide frame on to the winch rear connecting tube with the two short U bolts supplied, and against the front face of the bumper.
20. With the rope snubber frame central to the cable drum, maintain a $\frac{3}{8}$ in. (10,0 mm) clearance between frame and cable drum flanges. Using the three holes in the snubber frame as a template, drill the $\frac{25}{64}$ in. (10,0 mm) dia. fixing holes in the front bumper. Secure in position with the bolts $\frac{3}{8}$ U.N.F. x 1 in. long (25,4 mm), plain washers, spring washers and nuts supplied. Tighten the U bolts.
21. Replace the radiator grille.

Installing the pump, control valve and P.T.O. selector units assembly

22. Remove the centre seat inspection panel and the centre seat strap retaining bollard.
23. Mark off and prepare the positions for fitting the hydraulic control valve and the selector lever operating the P.T.O. selector unit as illustrated at Fig. T-18A.

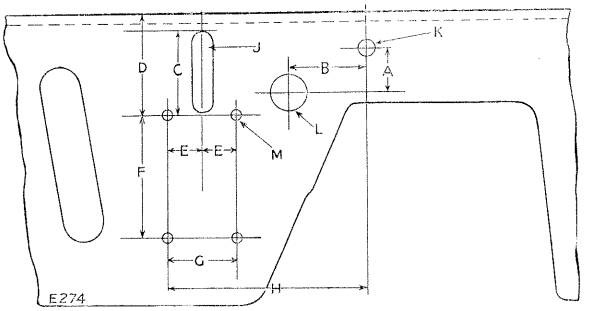


Fig. T-18A—Drilling heel board for selector unit
A—1.187 in. (30 mm)
B—1.968 in. (50 mm)
C—2.250 in. (57 mm)
D—2.750 in. (69 mm)
E—Equal
F—3.00 in. (76 mm)
G—1.500 in. (38 mm)
H—4.968 in. (126 mm)
J—Slot $\frac{1}{2}$ in. (12,5 mm) wide
K—Hole for seat strap retaining bolt
L—$\frac{3}{4}$ in. (19 mm) diameter hole
M—Four holes, $\frac{3}{8}$ in. (9,5 mm) diameter

24. Fit a grommet to the $\frac{3}{4}$ in. (19,0 mm) dia. hole and replace the seat strap bollard.
25. Before fitting the hydraulic control valve to the heel board, fit a brass union and washer and adaptors complete with bonded seals to the control valve. Temporarily cover unions and adaptors for protection against damage and dirt. See Fig. T-19 for fitting adaptors and the brass union.

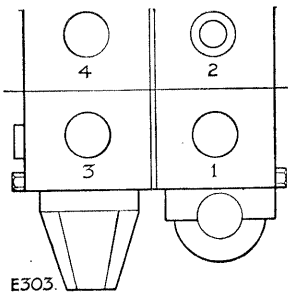


Fig. T-19—Rear view of control valve showing positions of adaptors and union
1—Steel adaptor and seal
2—Brass union and washer
3—Steel adaptor and seal
4—Steel adaptor and seal

26. Remove the control valve knob to facilitate fitting the control valve to the heel board. Secure control valve in position, using a mounting plate, to the outside of the heel board panel, using the four set bolts $\frac{5}{16}$ U.N.F. x $\frac{5}{8}$ in. (16 mm) long supplied. Replace the control knob and check for free movement of the control lever.
27. Remove the top cover plate and joint washer from the transfer box casing.
28. Remove the main shaft rear bearing housing assembly and joint washer from the rear of the transfer box casing.

29. Remove one bearing housing fixing stud from the L.H. side top corner on the transfer box casing and replace with the longer stud supplied.

30. Fit the assembled P.T.O. unit with the hydraulic pump to the transfer box casing, with the port marked Inlet to the R.H. side and the tapped holes in the pump flange uppermost. Secure in position to the studs on the transfer box casing, using the spring washers and nuts already removed.

31. Fit the P.T.O. selector unit and joint washer to the top face of the transfer box casing, ensuring that the selector fork engages the dog. Secure in position, using the spring washers and nuts already removed. The selector control rod to be fitted to the heel board after the installation of the control valve.

Installing the oil reservoir—88 models

32. Mark off and drill three holes $\frac{11}{32}$ in. (9,0 mm) dia. in the underside of the rear cross-member, as illustrated.

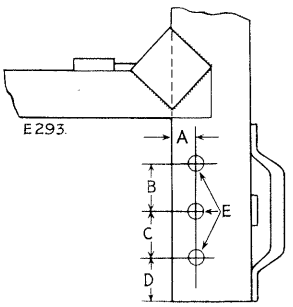


Fig. T-20—Drilling holes in rear cross-member for Reservoir—88 models

A—$1\frac{1}{4}$ in. (32,0 mm) C—$2\frac{5}{8}$ in. (67,0 mm)
B—$2\frac{5}{8}$ in. (67,0 mm) D—$2\frac{1}{2}$ in. (63,5 mm)
E—Three holes $\frac{11}{32}$ in. (9,0 mm) dia.

33. Cut a 6 in. (152 mm) dia. hole in the left-hand wheel arch box as illustrated. Mark off a 7 in. (178 mm) dia. circle parallel to the 6 in. (152 mm) dia. hole just cut.

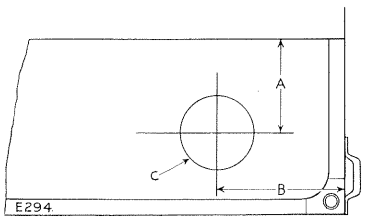


Fig. T-21—Position of hole in L.H. rear wheel arch box —88 models

A—7 in. (178 mm) B—9 in. (229 mm)
C—6 in. (152 mm) dia. hole.

34. Using the cover plate as a template, position the three holes in the plate centrally with the 7 in. (178 mm) diameter circle and drill $\frac{25}{64}$ in. (10,0 mm) dia. holes in the seat panel.

35. Position the three spire nuts supplied to the three holes in the seat panel and fit the protection strip supplied to the tank access hole, using a suitable adhesive. Secure the cover plate in position after the tank has been fitted, using the three Acme bolts and plain washers provided.

36. Jack up the vehicle and remove the L.H. road wheel and wing stay.

37. Attach the tank lower mounting bracket loosely to the holes in the rear cross-member, using the three bolts $\frac{1}{4}$ U.N.F. x $\frac{3}{8}$ in. (9,5 mm) long, plain washers, spring washers and nuts provided.

38. Attach the tank loosely to the mounting bracket, using the two bolts $\frac{1}{4}$ U.N.F. x $\frac{5}{8}$ in. (16 mm) long provided. Position the tank so that the pipe connections in the tank side face the gap between chassis frame and body floor, to provide for pipe fitting.

39. Using the fixing holes in the upper split flange as a template, drill a $\frac{17}{64}$ in. (7,0) dia. hole in the seat panel and secure in position, using two $\frac{1}{4}$ U.N.F. x $\frac{5}{8}$ in. (16 mm) long bolts provided. Tighten all the tank fixings.

40. Cut out a 4 in. (102,0 mm) dia. hole in the L.H. side rear wing, central and opposite to the oil reservoir filter plug, and fit the protection strip provided with a suitable adhesive. See Fig. T-22.

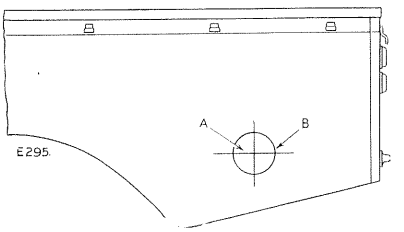


Fig. T-22—Position of hole in L.H. body side panel—88 models

A—One 4 in. (102,0 mm) dia. hole central to oil filter plug.
B—Protection strip at this edge.

41. Fit the rear wing stay provided to one of the bottom tank fixing bolts and the original wing stay fitted to the wing. Replace the road wheel.

Installing the oil reservoir—109 models

42. Mark off and drill $\frac{17}{64}$ in. (7,0 mm) dia. hole in the underside of the rear cross-member as illustrated.

43. Cut out the aperture 15 x 12 in. (381 x 305 mm) in the L.H. side wheel arch locker box base, as shown at Fig. T-24.

44. Attach the tank lower mounting bracket loosely to the holes in the rear cross-member, using the two bolts $\frac{1}{4}$ U.N.F. x $\frac{3}{4}$ in. (19 mm) long supplied.

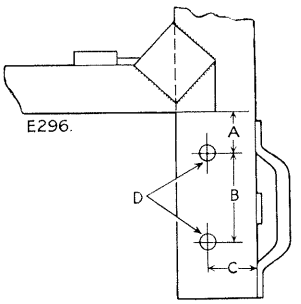


Fig. T-23—Position of holes on underside of rear cross-member, 109 models

A—4¾ in. (121 mm)
B—7½ in. (191 mm)
C—2½ in. (64 mm)
D—Two holes 17/64 in. (7,0 mm) dia.

45. Attach the tank loosely to the lower mounting bracket, using the bolts ¼ U.N.F. x ¾ in. (19 mm) long supplied. Position the tank so that the pipe connections in the tank side face the gap between chassis frame and body floor to allow for pipe fitting.

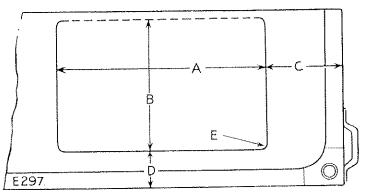


Fig. T-24—Position of cut-out in L.H. side wheel arch locker base—109 models

A—15 in. (381 mm)
B—12 in. (304 mm).
C—3½ in. (89 mm)
D—1½ in. (38 mm)
E—¼ in. (6,0 mm) radius

46. Using the tank top mounting bracket as a template, position tank and top mounting bracket squarely in the locker base aperture and mark off position for fixing top mounting bracket to wheel arch seat. Drill three 7/64 in. (7,0 mm) dia. holes, and secure mounting bracket in position, using the three bolts ¼ U.N.F. x ¾ in. (19 mm) long provided.

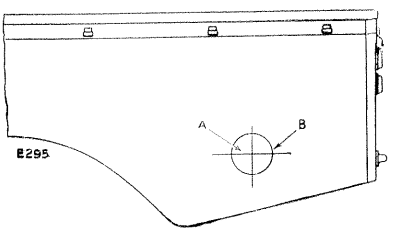


Fig. T-25—Position of hole in L.H. body side panel—109 models

A—One 4 in. (102 mm) diameter hole central to the oil filler plug
B—Dash protection strip around this edge.

47. Mark off and drill 7/64 in. (7,0 mm) dia. holes for the tank fixing positions to the top mounting bracket and secure tank to the mounting bracket, using the fixings provided. Tighten all tank fixings.

48. Cut out a 4 in. (102 mm) diameter hole in the L.H. side rear wing, central and opposite the oil reservoir filter plug, and secure the protection strip provided with a suitable adhesive.

Installation of hydraulic pipes and clip fitting —88 models (and 109 models forward of the hydraulic pump)

Use a suitable ramp to facilitate pipe and clip installation.

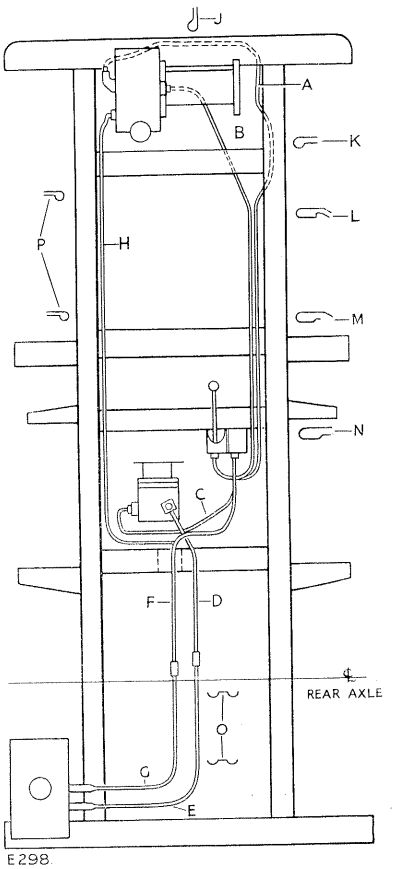


Fig. T-26—Layout of pipes and clips, 88 models

A—Pipe, upper on control valve
B—Pipe, lower on control valve
C—Pipe, lower on control valve
D—Pipe, suction
E—Pipe, suction
F—Pipe, upper on control valve
G—Pipe, return reservoir
H—Pipe, exhaust
J—Clip, front bumper (single)
K—Clip, R.H. chassis side member (single)
L—Clip, R.H. chassis side member (double)
M—Clip, R.H. chassis side member (double)
N—Clip, R.H. rear engine mounting (double)
O—Clip, suction and return pipes to body floor stiffeners
P—Clip, motor exhaust

49. Connect the flexible pipe loosely to the L.H. side pipe connection on the winch hydraulic motor and secure the pipe inside the front bumper, using the clip provided.

50. Feed the pipe beneath the battery carrier and over the R.H. side front engine mounting. Secure the pipe to the chassis frame side member, adjacent to the cross-member, with a clip provided.

51. Connect the flexible pipe loosely to the R.H. side pipe connection on the winch hydraulic motor and secure the pipe to the cross-member adjacent to the relay damper fixing.

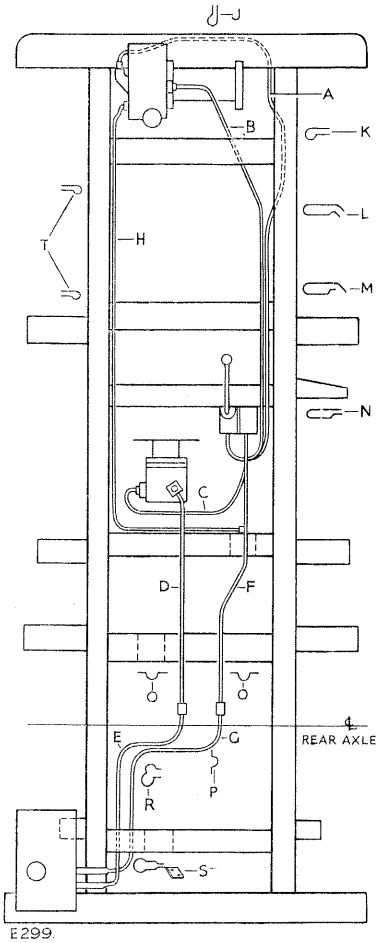


Fig. T-27—Layout of pipes and clips, 109 models

A—Pipe, upper, on control valve
B—Pipe, lower, on control valve
C—Pipe, lower, on control valve
D—Pipe, suction
E—Pipe, suction
F—Pipe, upper, on control valve
G—Pipe, return reservoir
H—Pipe, exhaust
J—Clip, front bumper (single)
K—Clip, R.H. chassis side member (single)
L—Clip, R.H. chassis side member (double)
M—Clip, R.H. chassis side member (double)
N—Clip, R.H. rear engine mounting (double)
O—Clip, chassis cross member
P—Clip, return pipe to body
R—Clip, suction and return pipes together
S—Clip, suction return pipe to rear cross-member
T—Clip, motor exhaust pipe to chassis frame

52. Secure both pipes from the hydraulic motor to the R.H. top shock absorber fixing bolt, using a double clip, fitted uppermost.

53. Secure both pipes from the hydraulic motor to the centre bolt on the steering mounting bracket, using a double clip provided.

54. Secure both pipes from the hydraulic motor to the R.H. rear engine mounting, using a double clip provided.

55. Fit the suction hose connections to each end of the suction pipe, using hose clips, then connect the pipe complete to the suction connection on the tank, using a hose clip.

56. Fit the return hose connections to each end of the return pipe, using hose clips, then connect the pipe complete to the return connections on the tank, using a hose clip.

57. Remove the protection cup from the hydraulic pump inlet port, marked 'Inlet' and fix the suction elbow to the pump, using an "O" ring. Secure the elbow to the pump, using the set bolts provided.

58. Fit the suction pipe connection to the suction elbow on the hydraulic pump, using a hose clip.

59. Fit the suction pipe between the hose connection on the hydraulic pump and the hose connection on the suction pipe from the tank. Use hose clips.

60. Remove the protection cup from the hydraulic pump outlet port marked 'Outlet' and fit the delivery connection to the pump, using an "O" ring. Secure the connection to the pump, using the fixings provided.

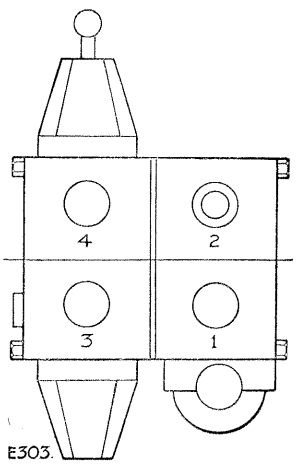


Fig. T-28—Rear view of control valve, showing sequence of pipe fitting

1—Flexible pipe from pump, to be fitted first
2—Return pipe to tank, to be fitted second
3—Flexible pipe from front winch, R.H. side connection, fitted third
4—Flexible pipe from front winch, L.H. side connection, fitted last

61. Connect the flexible pipe by the right-angle connection to the delivery connection on the hydraulic pump.

62. Fit the return pipe to the hose connection on the tank return pipe, using a hose clip.

63. Connect the four hydraulic pipes to the control valve on the heel board as shown at Fig. T-28.

64. Secure the rear suction and return pipes to the body floor stiffeners above the rear axle and silencer, using the double clips provided as templates.

65. Remove protection cap from the L.H. side winch hydraulic motor and fit the banjo connection to the exhaust port.

66. Fit the coupling to the short connecting pipe on the return pipe, using the olive provided.

67. Anneal the copper exhaust pipe if necessary to facilitate bending when fitting, and feed pipe from the left-hand side front of the vehicle over the rear engine mounting.

68. Bend the copper pipe in as large a radius as possible and connect the end of the pipe to the coupling fitted on the return pipe to the tank, using the olive provided.

69. Slide the retaining clip on to the exhaust pipe and secure the clips to the chassis side member at approximately 12 in. (305 mm) apart from No. 2 cross-member by drilling a $\frac{1}{8}$ in. (3 mm) dia. hole and using drive screws.

70. Connect the copper pipe to the banjo connection on the winch motor, using the olive provided.

71. Before fitting the P.T.O. control, attach the link rod to the lever, using a clevis pin and spring, and split pin. Remove the knob and locknut.

72. Pass the link rod attached to the lever through the heel board grommet and fit the lever to the selector shaft on the selector unit and stud fitted to transfer box casing. Secure with a clevis pin and spring and split pin. Replace the knob and locknut.

73. Check free movement of the control and lock the locknut on the stud fitted to the transfer box casing.

74. Fit the winch hydraulic motor protection shield to the front bumper, central to the motor position, using the protection shield fixing holes as a template. Drill the bumper $\frac{11}{32}$ in. (9 mm) diameter and secure the protection shield inside the bumper, using the fixings provided.

75. Fit the tank protection panel to the body wheel arch, seat panel and wing edge. Using the protion panel fixing holes as a template, drill a $\frac{3}{16}$ in. (5 mm) diameter hole and secure in position with the pop rivets provided. Fit centre seat panel after test.

Installation of hydraulic pipes and clip fixing—109 models—rear

76. On the L.H. underside of the chassis cross-member, adjacent to the tank connections, mark off and drill $\frac{1}{8}$ inch (3 mm) holes for fixing the clip as illustrated.

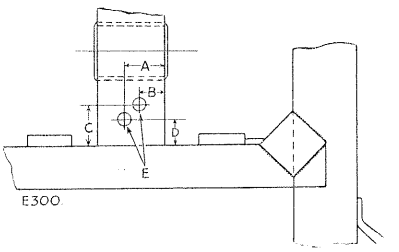


Fig. T-29—Position of clip on underside of chassis cross-member

A—$2\frac{1}{8}$ in. (54 mm) C—$\frac{3}{8}$ in. (79 mm)
B—$1\frac{3}{4}$ in. (45 mm) D—$2\frac{5}{8}$ in. (67 mm)
E—Two holes .120 in. (3 mm) on underside chassis cross-member

77. Fit the hose connections to each end of the suction pipe, using the hose clips provided, and connect the suction pipe by the hose connections to the suction connection on the tank, using the hose clip provided.

78. Fit the hose connections to each end of the return pipe, using the hose clip provided.

79. Carry out operations 57 and 58 as detailed for 88 models.

80. Fit the suction pipe between the hose connection on the hydraulic pump and the hose connection on the suction pipe from the tank, using the hose clips provided.

81. Carry out operations 60 and 61 as detailed for 88 models.

82. Fit the return pipe to the hose connections on the tank return pipe, using the hose clips provided.

83. Connect the four hydraulic pipes to the control valve on the heel board in the sequence illustrated at Fig. T-28.

84. Secure the suction and return pipes to the drilled holes in the chassis frame cross-member, using the clips, drive screws and bolts provided.

85. Secure the return pipe from the control valve to the centre stiffener on the body floor, using the clip and drive screws provided.

86. Secure the suction and return pipes together with a clip, using the fixings provided.

87. Secure the suction and return pipes to the chassis cross-member, with a clip securing the return pipe and a clip securing the suction pipe, using the drive screws as provided. Use the clips as templates.

88. Carry out operations 65 to 74 as detailed for 88 models.

89. Fit the tank protection panel to the body wheel arch and seat panel; using the protection panel as a template, drill five $\frac{7}{64}$ in. (7 mm) dia. holes in the body and secure in position, using the fixings provided. Fit the centre seat panel after test.

Test after installation

Important

The oil reservoir and front winch gearbox must be filled with the recommended oils before any tests are carried out.

Fill the oil reservoir at rear of vehicle by removing the filler cap, leaving the filler gauze in position, with $4\frac{1}{2}$ gallons (20,0 litres) of the correct grade of oil as follows:—

Fill winch gearbox by removing the filler plug and breather and level plug on the L.H. side gearbox casing cover plate, with 2 pints (1,0 litre) of the correct grade of oil as follows. Replace filler and level plugs.

Recommended lubricants

	COMPONENTS		
	Hydraulic winch supply tank	Hydraulic winch gearbox	Lubrication nipples
Capacities	$4\frac{1}{2}$ gallons (20,0 litres)	2 pints (1,0 litre)	—
S.A.E.	—	90 E.P.	—
B.P.	—	Energol E.P. S.A.E. 90	Energrease L.2
Duckham's	—	Duckham's Hypoid 90	Duckham's L.B. 10 Grease
Esso	Terresso 43 or Essolube HD 10/W	Esso Gear Oil G.P. 90	Esso Multi-purpose Grease H
Mobil	D.T.E. Light	Mobilube GX90	Mobilgrease M.P.
Shell	Tellus 27	Spirax 90 E.P.	Retinax A
Wakefield	Hyspin 70 or Castrolite	Castrol Hypoy	Castrolease L.M.

1. Apply grease to all grease nipples on the winch rope snubber rollers and inspect run of pipes to ensure pipes are not fouling moving parts, engine, gearbox, steering and spring shackles.

2. With the winch driving dog uncoupled, select neutral position on transfer gear change lever and apply hand brake.

3. Run the engine at tick-over speed, engage 3rd gear and pull out P.T.O. operating lever on the heel board.

   The hydraulic control valve lever should be in the central position. With controls in this position the hydraulic system is operating in the neutral circuit, tank to pump, pump to control valve, control valve to tank.

4. Run the assembly light for three minutes by moving the control valve lever upwards and run the assembly in the reverse direction for one minute by moving the control valve lever downwards. Check for oil leaks.

5. Fit the winch cable ($\frac{3}{8}$ in. dia. x 100 ft. (9,5 mm dia. x 35 m.) long) to the winch drum flange, through the hole provided, far enough to facilitate bending the end of the cable at right angles with pliers. Secure the end of the cable to the drum with the cleat provided.

6. Engage the winch driving dog, and with an assistant offering resistance to the cable by using protective gloves, wind the cable on to the top of the drum by operating the control valve lever upwards to pay-in cable.

7. Pay out the cable by operating the control valve lever downwards and anchor the cable hook to a suitable solid fixture. Secure the vehicle with ground anchors or sprags under wheels.

8. Run up to speed in 3rd gear for five minutes so that the drum is stalled. Check all pipes and points for leaks. The safety valve in the pressure line of the hydraulics will prevent damage to both winch and vehicle.

Instructions for using hydraulic winch

1. Vehicle should be positioned in line with the object to be recovered, or in the case of self-recovery the end of the cable should be anchored in line with the vehicle.

2. The transfer box lever should be placed in the neutral position.

3. Engage 3rd gear in the main gearbox and pull out the power take-off lever protruding through the heel board. The hydraulic pump will then be driving when the clutch is released.

   The engine should be run at approximately 2,000 r.p.m., which will result in the pump being driven around 1,500 r.p.m. In practice the engine can be controlled during self-recovery by the accelerator pedal, but for some applications the hand throttle can be used.

4. The hydraulic control lever protruding from the heel board, which should be in the central position, can now be moved downwards to "Pay-out" or upwards for "Pay-in" the cable and held in position.

The following points should be noted:

(*a*) The control knob on the left-hand side of the winch unit (viewed from the front) is for the engagement of the cable drum to the driving shaft. When disengaged for a rapid run-out of the cable, two inbuilt brake pads prevent over-run of the drum, which would otherwise cause the cable to spring into loose coils.

(*b*) When rewinding the slack cable after a winching operation it is necessary to apply some resistance to the cable to obtain a neat and even lay on the drum (*i.e.* an assistant holding the end of the cable against the pull of the drum).

(*c*) If the overload safety valve operates during a winching operation (indicating that the maximum pull has been exceeded), the control valve can be moved to the "Pay-out position" and then re-engaged to "Pull-in position".

(*d*) When recovery or self-recovery operations take place on a very steep slope, the maximum pull is sometimes exceeded due to the angle of the cable when the vehicle has reached the apex of the hill. If the safety valve operates it will sometimes be found that a restart is not possible. In these circumstances the vehicle should be lowered a certain amount in the "Pay-out position", and a further attempt made after the tension in the cable has been reduced.

(*e*) Ground anchors, sprags under the wheels, other vehicles, trees, etc., can be used for securing the vehicle when it is used for general winching or for securing the end of the cable when self-recovery is necessary. The safety valve in the pressure line of the hydraulics will prevent damage to both the winch and the vehicle.

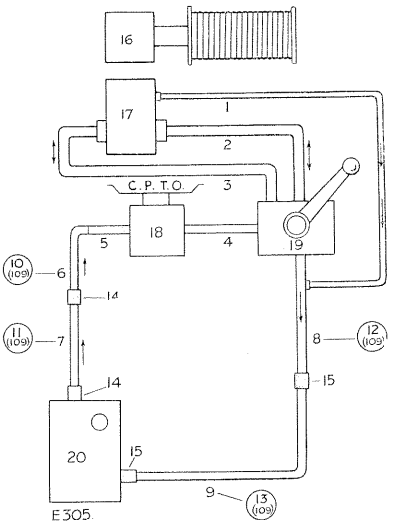


Fig. T-30—Diagrammatic layout of hydraulic winch equipment—88 and 109 models

1—Pipe, motor exhaust—88 and 109
2—Pipe, flexible, valve to motor—88 and 109
3—Pipe, flexible, valve to motor—88 and 109
4—Pipe, flexible, pump to valve—88 and 109
5—Pipe, pump suction—88 and 109
6—Pipe, suction pump end—88
7—Pipe, suction tank end—88
8—Pipe, return control end—88
9—Pipe, return tank—88
10—Pipe, suction pump end—109
11—Pipe, suction tank end—109
12—Pipe, return control end—109
13—Pipe, return tank—109
14—Hose connection—88 and 109
15—Hose connection—88 and 109
16—Front winch
17—Motor
18—Pump
19—Control valve
20—Oil reservoir

(*f*) The power take-off lever should be pushed in after winching operations are completed, to prevent the pump being driven unnecessarily when travelling along the road.

Hydraulic winch, to service

Winch, to remove — Operation T/28

1. Remove the cable by unwinding the drum and slackening the cable retaining cleat on the outside of the right-hand drum flange.
2. Disconnect the copper exhaust pipe and the two flexible pipes from the winch motor.
3. Disconnect the clip securing the copper pipe from the winch mounting flange.
4. Remove the bolts securing the roller guide frame to the front cross-member (bumper bar).
5. Remove the bolts securing the winch support brackets to the front bumper.
6. Remove the two outer U bolts securing the winch rear connecting tube to the mounting bracket.
7. Lift off winch complete. Remove the hydraulic motor if necessary.

Winch, to refit — Operation T/30

1. If removed, refit the hydraulic motor.
2. Refit the roller guide frame, complete with winch, loosely to the rear connecting tube.
3. Refit the bolts securing the winch support brackets to the front bumper.
4. Refit the bolts securing the roller guide frame to the front bumper.
5. Refit the clip for copper pipe to the winch mounting flange.
6. Reconnect the copper exhaust pipe and the two flexible pipes to the winch motor.
7. Refill the winch with the correct oil; then test and wind on cable. Check for leaks under normal load conditions.

Roller guide frame, to remove and refit — Operation T/32

1. Remove the front winch complete.
2. Remove the bolts securing the roller guide frame to the rear connecting tube.
3. To refit, reverse the removal procedure, but do not fully tighten the roller guide frame U bolts until the winch is secured.

   Note that there must always be a minimum of $\frac{3}{8}$ in. (9,5 mm) clearance between the cable drum flanges and the guide frame.

Hydraulic winch, to strip **Operation T/34**

1. Remove the winch drain plug and allow the oil to flow into a suitable receptacle. Do not use this oil again.

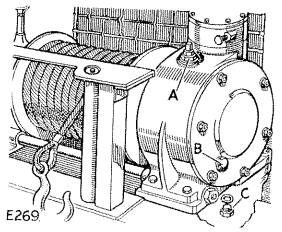


Fig. T-31—Hydraulic front winch gearbox
A—Filler plug B—Level plug C—Drain plug

2. Remove the nuts securing the left-hand side support bracket to the front and rear connecting tubes, and remove the bracket complete with the shaft bearing and dog clutch selector lever.

   If necessary, remove the bearing and selector lever.

3. Remove the two slotted screwed plugs from the right-hand side of the winch drum flange. Withdraw the springs and braking pads.

4. Withdraw the dog clutch and the two keys from the shaft. Remove the winch drum and thrust ring.

5. Remove the securing nut and washers and withdraw the hydraulic motor complete with gasket, from the gearbox casing.

6. Remove the securing nuts and lift off the end plate and gasket from the casing.

7. Support the worm wheel on a suitable tubular stand. If a stand is not to hand, a strong deep tin of suitable diameter will suffice. Using a copper-headed mallet drift out the main shaft from the worm wheel, support bearing and friction disc. Retain the brass shims, if fitted, and worm wheel key.

8. Slacken the brake band plunger, then remove the set bolts and washers securing the brake drum cover and brake band to the gearbox casing. Remove the joint washer.

9. Withdraw the brake drum from the worm shaft. Remove the locating key.

10. Remove the bearing retaining cap from the worm shaft housing, complete with joint washer and brass shims.

11. Gently tap the worm shaft, complete with bea ring races, out from the gearbox casing.

12. Remove the shaft bearing and oil seal from the gearbox casing. If necessary remove the outer shaft bearing from the cover plate.

13. If necessary, remove the front and rear connecting tubes from the gearbox casing.

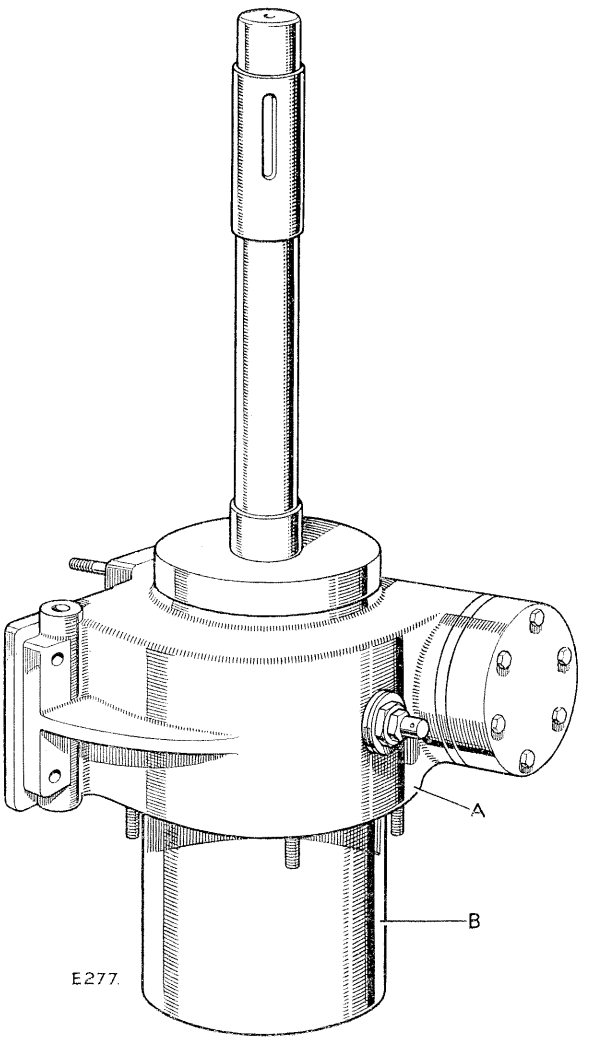


Fig. T-32—Winch on tubular stand
A—Winch B—Tubular stand

Hydraulic winch, to assemble
Operation T/36

1. Clean all parts thoroughly in paraffin. Carefully inspect the bearing races, and renew if showing signs of wear. Examine the worm shaft and worm wheel; renew as an assembly if badly worn or if damaged.

2. Slide the two distance pieces on to the worm shaft, one either side of the gear, with the chamfered recesses facing inward.

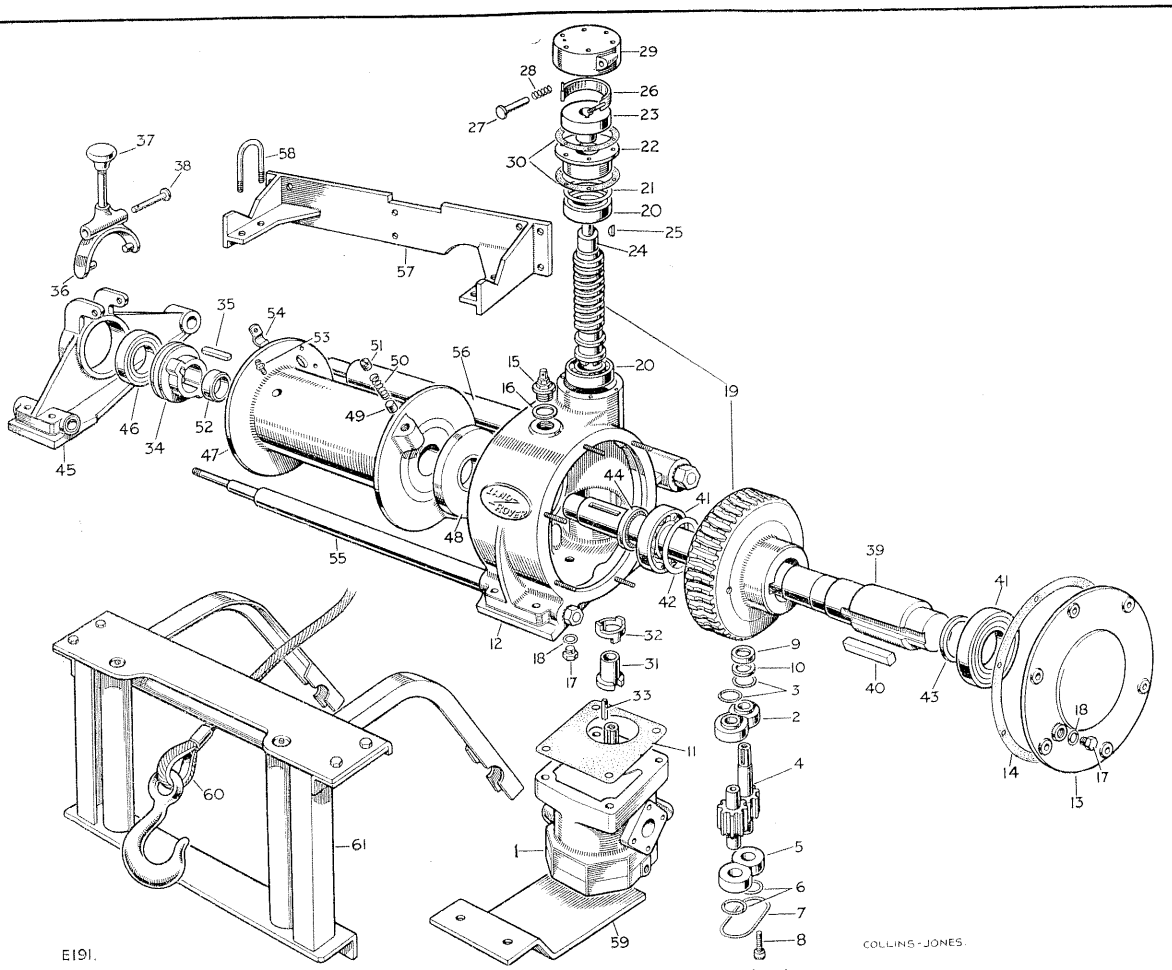


Fig. T-33—Layout of hydraulic winch

1 Hydraulic motor
2 Bushes, 'B' for gear shaft
3 'O' rings
4 Gears and shafts
5 Bush 'A' for gear shafts
6 Sealing ring for 'A' bushes
7 'O' ring for housing
8 Special screw fixing body cover and body
9 Shaft oil seal
10 Oil seal baffle
11 Joint washer
12 Gearbox casing
13 End plate for casing
14 Joint washer
15 Oil filler plug
16 Joint washer
17 Oil level and drain plug
18 Joint washer
19 Worm wheel, worm shaft and distance pieces
20 Bearing for worm shaft
21 Shims
22 Retaining cap
23 Brake drum
24 Distance piece } For brake drum
25 Key }
26 Brake band
27 Plunger
28 Spring
29 Brake drum cover
30 Joint washer
31 Coupling sleeve } Connecting motor unit to worm shaft
32 Coupling dog }
33 Key }
34 Dog clutch
35 Key
36 Selector lever
37 Knob
38 Retaining pin
39 Worm and drum shaft
40 Key fixing worm to shaft
41 Bearing for shaft worm end
42 Shims
43 Distance wing for shaft, worm end
44 Oil seal for shaft, worm end
45 Support bracket for worm and drum shaft
46 Bearing for worm and drum shaft
47 Cable drum
48 Friction disc
49 Pad } For friction disc
50 Spring }
51 Retaining plug }
52 Thrust spring
53 Grease point
54 Pleat
55 Connecting tube, front
56 Connecting tube, rear
57 Rear mounting bracket
58 U bolt
59 Protection shield
60 Winch cable
61 Guide frame for cable

3. Fit one of the worm shaft bearings on to the shaft, at the keyway end, and position the other shaft bearing into the winch casing at the hydraulic pump end, ensuring that it is squarely located. Note carefully that these are thrust bearings, and that they must be fitted the correct way round, or excessive worm shaft backlash will be present. See Fig. T-34, item D, upper and lower, for correct fitting.

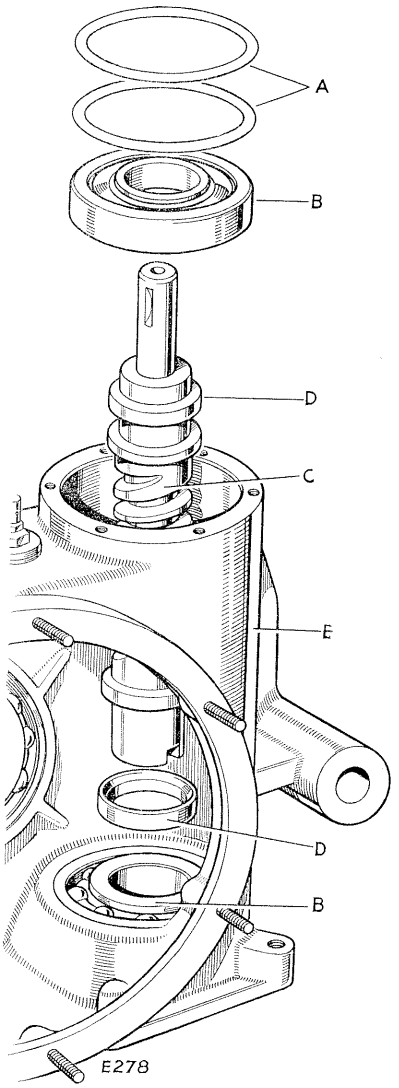


Fig. T-34—Worm shaft fitting

A—Shims
B—Bearing
C—Worm shaft
D—Collars
E—Casing

4. Enter the worm shaft complete with bearing into the lower bearing located in the gearbox casing. Holding the shaft absolutely central, gently tap the bearings and shaft fully home.

5. Temporarily fit the bearing retaining cap and brake drum cover and check the worm shaftend-float as illustrated. Obtain the correct end-float of .002 in. (0,05 mm) by fitting shims between the retaining cap and upper shaft bearing. Brass shims are available .002 in., .005 in. and .010 in. (0,05 mm, 0,12 mm and 0,25 mm) thick. When the correct end-float has been obtained, remove the brake drum cover and retaining cap.

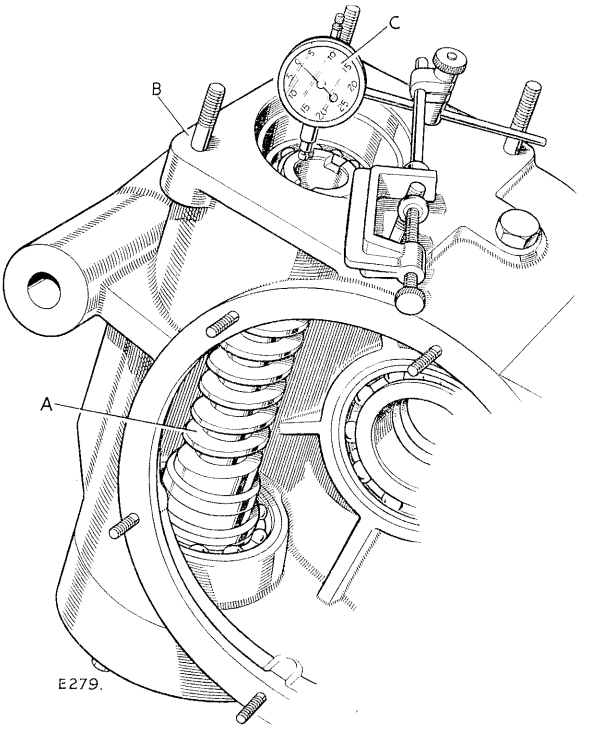


Fig. T-35—Checking worm shaft end-float

A—Wormshaft B—Casing C—Clock gauge

6. Slide the brake drum distance piece over the shaft, with the chamfered recess facing inwards. Fit the key.

7. Position the bearing retaining cap and a new joint washer on the winch gearbox casing. Fit the brake drum to the shaft and key.

8. Fit the brake band to the brake drum cover, allowing the peg to enter the locating hole, and the adjustment screw to enter the operating plunger hole. Fit the plunger and return spring but do not screw in at this stage.

9. Fit the brake drum cover, complete with brake band and a new joint washer. The brake band must also be located in the small hole in the bearing retaining cap and the whole assembly must be positioned so that the operating plunger faces forward. Secure with the set bolts and washers.

10. Fit the oil seal and drum shaft bearing to the winch gearbox casing.

11. Fit the worm wheel to the winch drum shaft and key and ensure a smooth sliding fit. Mark the key and remove the worm wheel and key from the shaft.

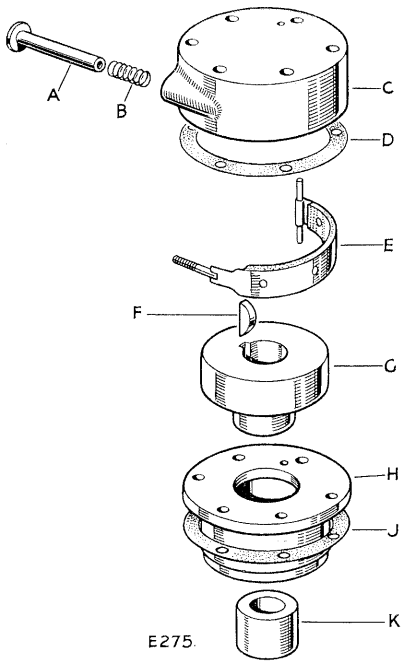


Fig. T-36—Brake drum assembly

A—Plunger
B—Spring
C—Drum cover
D—Joint washer
E—Brake band
F—Key
G—Brake drum
H—Retaining cap
J—Joint washer
K—Distance piece

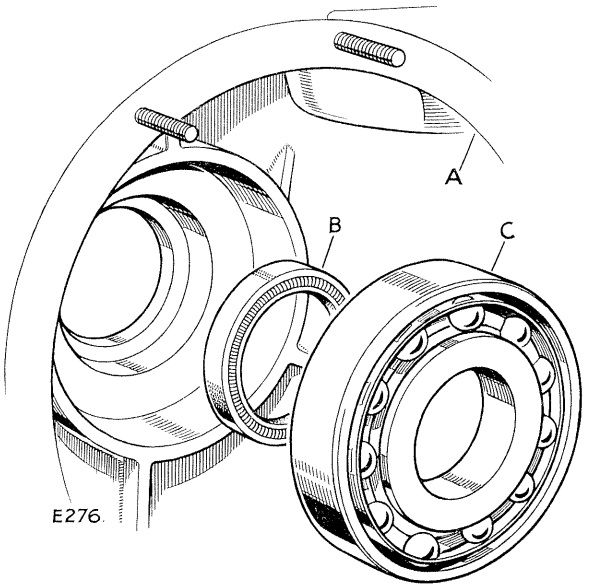


Fig. T-37—Drum shaft bearing and oil seal

A—Casing B—Oil seal C—Bearing

12. Place the worm wheel into the gearbox casing in mesh with the worm shaft.

13. Temporarily fit the drum drive shaft less key to the worm wheel and bearing in the gearbox casing.

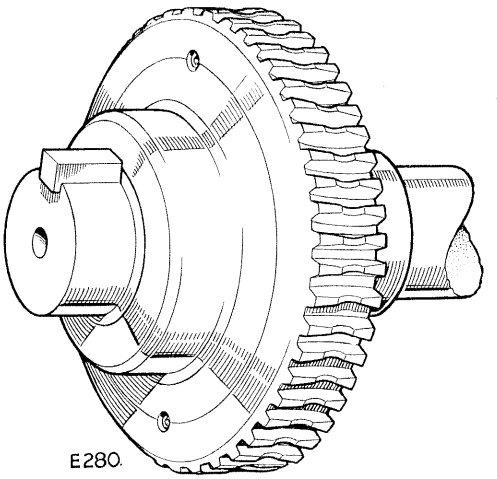


Fig. T-38—Worm wheel, key and drum shaft

14. Fit the distance ring to the shaft and measure the clearance between the ring and worm wheel. Remove the drum shaft, then fit shims to this value between the worm wheel and the shaft bearing located in the gearbox casing. Shims are available .002 in., .005 in. and .010 in. (0,05 mm, 0,12 mm and 0,25 mm) thick.

15. Refit the drum shaft to the worm wheel and casing and tap home the securing key. Ensure that the key is below the surface of the worm wheel.

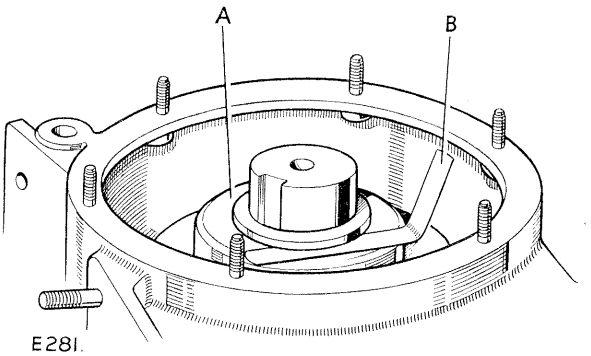


Fig. T-39—Checking worm wheel position

A—Worm wheel B—Feeler gauge

16. Fit the distance ring, with the chamfered side facing inward, and thrust bearing to the winch drum shaft.

17. Fit the end cover plate complete with gasket to the gearbox casing and drum shaft bearing, with the oil level plug adjacent to the front connecting tube.

18. Fit the friction disc to the winch drum shaft with the slight boss towards the gearbox casing. Ensure that the disc is driven right home on to the shaft shoulder.

19. Fit the cable drum to the shaft with the dog clutch slots facing outwards.

exercised to ensure that the seal counterbore housing is not scored.

20. Fit the thrust ring on to the drive shaft and tap fully home into the drum. The chamfer should face towards the drum. Fit the two keys to the drive shaft and ensure that the dog clutch slides freely on the shaft.

21. If removed, fit the clutch bearing into the end support bracket and fit the dog clutch operating lever.

22. Fit the end support bracket with the bearing facing the shaft to the front and rear connecting tube and winch drum shaft. Secure in position.

23. Fit the friction pads, springs and screwed plugs to the winch drum. Screw in until tight, then slacken back one complete turn.

24. Fit the key and coupling sleeve to the hydraulic pump and secure in position with plain washer, spring washer and set bolt.

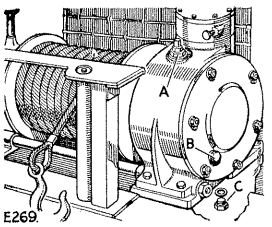


Fig. T-40—Hydraulic front winch gearbox

A—Filler plug B—Level plug C—Drain plug

25. Fit the coupling dog to the pump sleeve, then fit the hydraulic pump to the worm shaft, with the exhaust outlet pipe facing outward, using a new joint washer.

26. Refill the winch casing with the recommended oil up to the level plug and refit the oil filler plug. Capacity 2 pints (1,0 litre).

Hydraulic motor, to strip Operation T/38

1. Remove the special screws securing the end cover to the body.

2. Withdraw the end cover and the two small and one large sealing rings.

3. Press the drive shaft into the body so that a finger-hold on the first pair of bushes marked 'C' can be obtained.

4. Remove the bushes and slide off the drive shaft and gear; remove the driven gear, the second pair of bushes marked 'A' and the two small sealing rings.

   A drift must not be used when extracting bushes. Should they be tight, tap the body on a wooden block to dislodge them.

   To facilitate assembly, the parts should be laid out in the same order as they were withdrawn, in order to maintain mating shafts and bushes in the same relative position. Mark the bushes 'I' for idler and 'D' for drive respectively.

5. If necessary drift the shaft seal and baffle washer out from inside the case; care should be

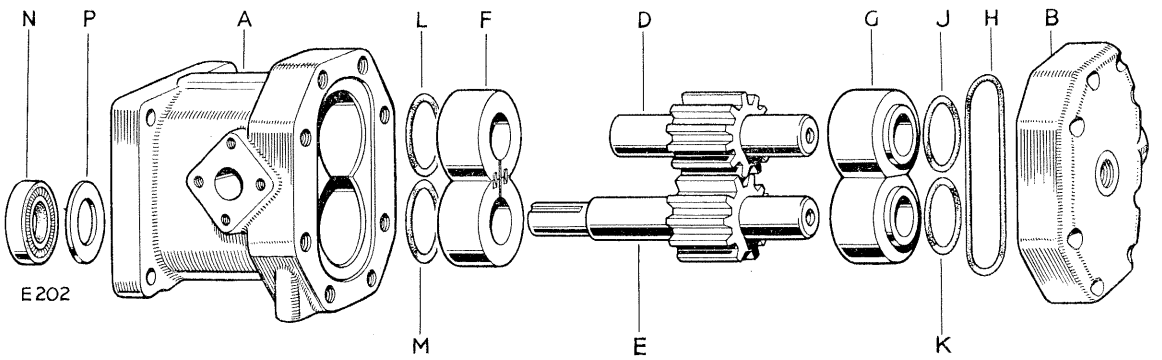


Fig. T-41—Hydraulic motor

A—Body
B—Cover plate
D—Drive shaft and gear } Matched
E—Driven gear } pair
F—Bushes 'A'
G—Bushes 'C'
H—'O' ring
J—Support ring
K—Support ring
L—'O' ring
M—'O' ring
N—Shaft seal
P—Baffle washer

Hydraulic motor, to assemble

Operation T/40

Before assembling the motor, carefully inspect the various components. New bushes should be fitted if the original ones show signs of wear or scoring. If a new body is necessary new bushes must be fitted to ensure maximum efficiency. New sealing rings must always be fitted, and gear shafts should be renewed if not in good condition. Measure the shafts with a micrometer, and if the diameter is less then 0.75 in. (19 mm) dia., it should be replaced.

1. Wash all parts thoroughly in a bath of petrol or thinners and blow out passage ways with an air line.

2. If removed fit a new shaft seal as follows: place the baffle washer and new seal, with the sealing lip facing inwards, in the body counterbore and press in flush with the spigot on the motor body.

3. Place new rubber sealing rings on the forward pair of bushes marked 'A', retaining them with a smear of Silicone MS4 grease, and slide the bushes into location in the body bore. The bushes must be kept square both to the bore and to each other during insertion, otherwise possible damage will occur. Lightly oiled bores will facilitate fitting.

4. Check that the rubber sealing rings have not slipped during assembly and that they are located between the bushes and the bottom of the bores. Ensure that the recess in the bush faces are not staggered.

5. Fit the drive shaft to the body, using assembly sleeve, Part No. 515743.

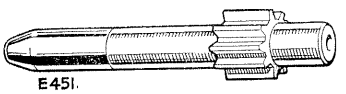


Fig. T-42—Assembly sleeve for drive shaft

6. Fit the driven gear to the pump body. If the original gears and shafts are being used, check that the driven gear takes up its 'bedded' position by mating the teeth contact marks with those on the drive gear.

7. Lubricate the rear pair of bushes, marked 'C', and insert into the housing.

8. Mount the new rubber sealing rings in position on the bushes, and place a new large rubber sealing ring in the housing.

9. Fit the end cover and secure with the eight special screws, tightening down evenly. Lock by centre punching the cover around the heads.

10. Pour a small quantity of oil in the ports, and turn the pump over by hand. If it has been correctly assembled it should rotate smoothly by hand from a radius of 4 in. (102 mm). Undue stiffness must be investigated and remedied.

11. A pump that has been assembled with new gears, bushes or body must be carefully run in. This should be effected for a period of at least thirty minutes, starting at 500 r.p.m., and zero pressures, gradually increasing speed and pressure to full working requirements. It should be ensured that there is no undue rise in temperature during this process, or extended running-in at reduced pressure may be necessary.

Hydraulic pump and P.T.O. assembly, to remove

Operation T/42

1. Remove the seat centre panel.

2. Remove the three clevis pins and withdraw the selector lever and linkage.

3. Remove the four bolts securing the selector unit to the gearbox housing.

4. Remove the hose connecting the suction pipe to the pump.

5. Disconnect the flexible pressure pipes between selector valve and pump.

6. Remove the twin pipe clips from the pump flange.

7. Remove the four nuts securing the pump to the rear of the transfer box, noting that the left-hand upper stud is longer and includes the clevis pin fixing for the selector lever.

8. Withdraw the pump and power take-off complete.

9. If necessary, remove the pump and composite coupling from the P.T.O. assembly.

Hydraulic pump and P.T.O., to refit

Operation T/44

1. If removed, refit the pump and composite coupling to the P.T.O. assembly, using a new joint washer.

2. Offer up the pump and power take-off assembly with the port marked 'Inlet' to the right-hand side. The two tapped holes on the top of the pump body should be uppermost. Secure the pump to the gearbox casing.

3. Fit the power take-off selector unit complete with a new gasket and ensure that it will enter the dog clutch.

4. Reconnect the flexible hoses to the pump in accordance with the diagram at Fig. T/43.

5. Refit the twin hose clips to the pump flange.

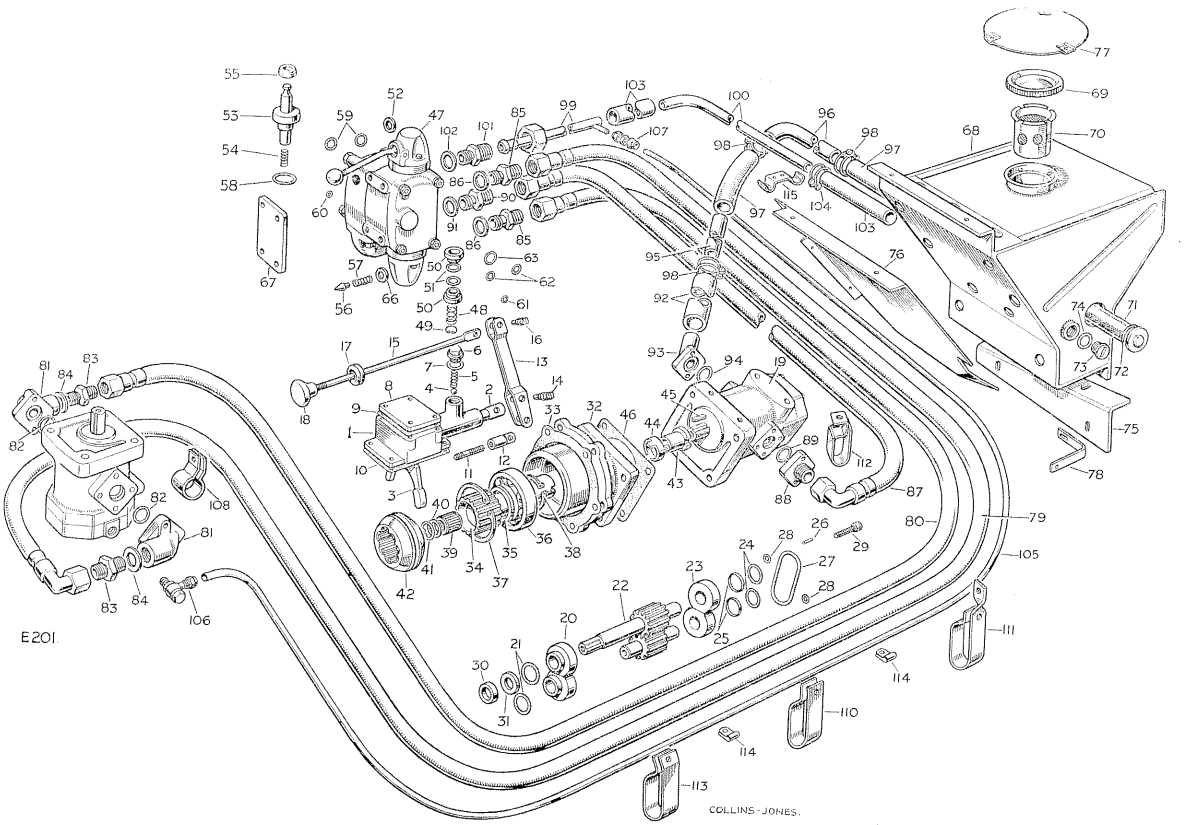


Fig. T-43—Controls, tank and pipes

1 Selector housing
2 Selector shaft
3 Selector fork
4 Ball
5 Spring
6 Plug for spring
7 Joint washer
(4–7: For selector control mechanism)
8 Cover plate for selector housing
9 Joint washer, top cover plate
10 Joint washer
11 Stud for selector pivot
12 Pivot for selector lever
13 Operating lever for shaft
14 Clevis complete—fixing lever and pivot to selector shaft
15 Rod for operating lever
16 Clevis complete—fixing rod to operating lever
17 Grommet for rod
18 Knob
19 Hydraulic pump for power take-off unit
20 Bush 'A' for gear shafts
21 'O' ring for 'A' bushes
22 Gears and shafts
23 Bush 'C' for gear shafts
24 Sealing ring for 'C' bushes
25 Support ring for 'C' bushes
26 Special dowel for body and bush
27 'O' ring for housing
28 'O' ring, body ports
29 Special screw fixing body cover to body
30 Oil seal for shaft
31 Throttle for oil seal
32 Adaptor for hydraulic pump
33 Joint washer
34 Drive shaft
35 Distance piece
36 Ball bearing
37 Circlip
38 Circlip
39 Roller bearing
(33–39: For power take-off unit)
40 Retaining ring
41 Circlip
(40–41: Fixing roller bearing to shaft)
42 Dog clutch
43 Coupling sleeve
44 Coupling dog
45 Key
(43–45: Connecting hydraulic pump to drive shaft)
46 Joint washer, hydraulic motor
47 Control valve assembly
48 Piston return spring
49 Retaining ring for piston
50 Gland washer for piston
51 'O' ring for piston
52 Washer for selector lever
53 Unloader piston
54 Spring for unloader piston
55 Valve seat for unloader piston
56 Relief valve
57 Spring, relief valve
58 'O' ring, relief valve housing to unloader housing
59 'O' ring body face
60 'O' ring body face
61 'O' ring body face
62 'O' ring left hand cover plate
63 'O' ring left hand cover plate
64 'O' ring left hand unloader
65 'O' ring left hand unloader
66 Special seal
67 Mounting plate—fixing control valve to heel board
68 Oil tank
69 Filler cap
70 Filter gauze
71 Oil filter
72 Joint washer, oil filter
73 Drain plug
74 Joint washer, drain plug
75 Brackets for oil tank
76 Protection panel
77 Cover plate
78 Rear wing stay
79 Flexible pipe, control valve to motor, 113 in. long
80 Flexible pipe, control valve to motor, 101½ in. long
81 Elbow for flexible pipe
82 'O' ring
83 Adaptor
84 Special seal
85 Adaptor
86 Special seal
(85–86: Fixing flexible pipe to control valve)
87 Flexible pipe, pump to control valve, 26 in. long
88 Connection for pipe, pump to control valve
89 'O' ring—connection to pump
90 Adaptor
91 Special seal
(90–91: For pipe. Pump to control valve, on control valve)
92 Flexible pipe, pump to tank, pump end
93 Elbow on pump for flexible pipe
94 'O' ring—fixing elbow to pump
95 Pipe, steel, front
96 Pipe, steel, rear
(95–96: Pump to tank)
97 Rubber connection, front to rear pipe and rear pipe to tank
98 Hose clip
99 Pipe, steel, front
100 Pipe, steel, rear
(99–100: Control valve to tank)
101 Adaptor on control valve for tank pipe
102 Joint washer for adaptor
103 Rubber connection, front to rear pipe and rear pipe to tank
104 Hose clip
105 Oil exhaust pipe for motor
106 Banjo complete
107 Union for exhaust pipe at rear
108 Clip
109 Clip
110 Clip
111 Clip
112 Clip
113 Clip
114 Clip
115 Clip
(108–115: Fixing oil pipes)

6. Refit the control levers and linkage, adjust by means of the lower clevis, to ensure that the dog clutch makes full engagement and that the control knob does not foul the heelboard.
7. Test and check for correct operation and leaks, under normal load conditions.
8. Replace the seat box cover panel.

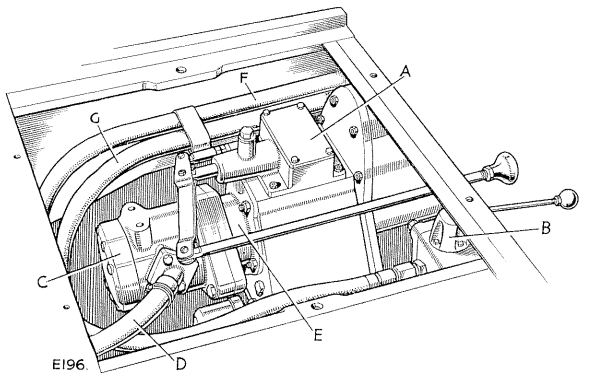


Fig. T-44—Pump in position

A—Power take-off
B—Control valve
C—Pump
D—Suction pipe to tank
E—Pump adaptor
F—Hose winch motor to control valve, L.H. side
G—Hose, winch motor to control valve, R.H. side

Hydraulic pump, to strip Operation T/46

1. Remove the set bolt and withdraw the coupling from the pump driving shaft.
2. Remove the key.
3. Remove the eight special screws securing the end cover to the body.
4. Withdraw the end cover and the two small and one large sealing rings.
5. Press the drive shaft into the body so that a finger, hold on the first pair of bushes marked 'C' can be obtained.
6. Remove the bushes and slide off the drive shaft and gear; remove the driven gear, the second pair of bushes marked 'A' and the two small sealing rings.

   A drift must not be used when extracting bushes. Should they be tight, tap the body on a wooden block to dislodge them.

   To facilitate assembly the parts should be laid out in the same order as they were withdrawn, in order to maintain mating shafts and bushes in the same relative position. Mark the bushes 'I' for idler and 'D' for drive respectively.

   If necessary drift the shaft seal and baffle washer out from inside the case; care should be exercised to ensure that the seal counterbore housing is not scored.

Hydraulic pump, to assemble Operation T/48

Before assembling the motor, carefully inspect the various components. New bushes should be fitted if the original ones show signs of wear or scoring. If a new body is necessary new bushes must be fitted to ensure maximum efficiency. New sealing rings must always be fitted, and gear shafts should be renewed if not in good condition. Measure the shafts with a micrometer, and if the diameter is less than 0.75 in. (19 mm) dia. it should be replaced.

1. Wash all parts thoroughly in a bath of petrol or thinners and blow out passage ways with an air line.
2. If removed fit a new shaft seal as follows: place the baffle washer and new seal, with the sealing lip facing inwards, in the body counterbore and press in flush with the spigot on the motor body.

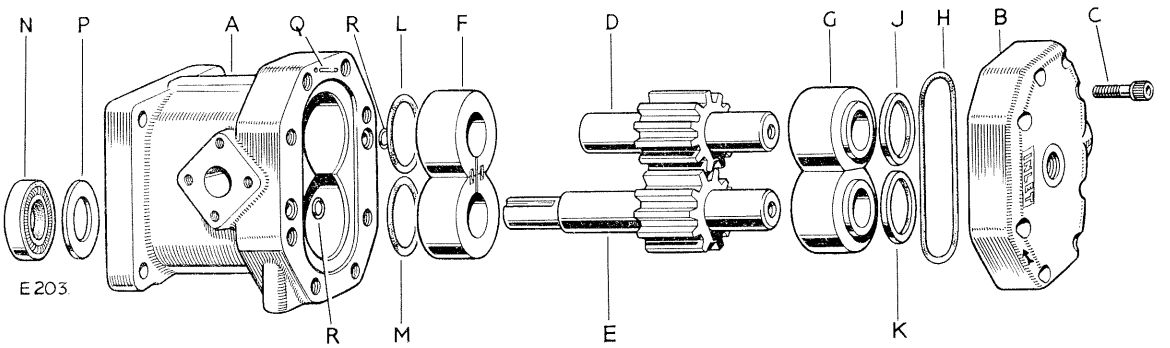


Fig. T-45—Hydraulic pump

A—Body
B—Cover plate
C—Special bolts
D—Drive shaft and gear } Matched
E—Driven gear } pair
F—Bushes 'A'
G—Bushes 'C'
H—'O' ring
J—Support ring
K—Support ring
L—'O' ring
M—'O' ring
N—Shaft seal
P—Baffle washer
Q—Dowel
R—'O' ring

3. Place new rubber sealing rings on the forward pair of bushes marked 'A', retaining them with a smear of Silicone MS4 and slide the bushes into location in the body bore. The bushes must be kept square both to the bore and to each other during insertion, otherwise possible damage will occur. Lightly oiled bores will facilitate fitting.

4. Check that the rubber sealing rings have not slipped during assembly and that they are located between the bushes and the bottom of the bores. Ensure that the recess in the bush faces are not staggered.

5. Fit the drive shaft to the body, using assembly sleeve, Part No. 515743; lubricate the sleeve before use.

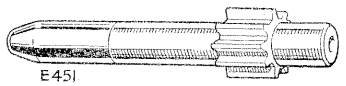


Fig. T-46—Assembly sleeve for drive shaft

6. Fit the driven gear to the pump body. If the original gears and shafts are being used, check that the driven gear takes up its "bedded" position by mating the tooth contact marks with those on the drive gear.

7. Lubricate the rear pair of bushes, marked 'C', and insert into the housing.

8. Mount the new rubber sealing rings in position on the bushes, and place a new large rubber sealing ring in the housing.

9. Fit the end cover and secure with the eight special screws, tightening down evenly. Lock by centre punching the cover around the heads.

10. Pour a small quantity of oil in the ports, and turn the pump over by hand. If it has been correctly assembled it should rotate smoothly by hand from a radius of 4 in. (102 mm). Undue stiffness must be investigated and remedied.

11. Refit the coupling and key, and secure with a set bolt and plain and spring washers.

12. A pump that has been assembled with new gears, bushes or body must be carefully run in. This should be effected for a period of at least thirty minutes, starting at 500 r.p.m. and zero pressures, gradually increasing speed and pressure to full working requirements. It should be ensured that there is no undue rise in temperature during this process, or extended running-in at reduced pressure may be necessary.

Power take-off, to strip **Operation T/50**

1. Remove the pump and composite coupling. Withdraw the dog clutch.

2. Remove the large circlip securing the shaft and bearing to the P.T.O. housing.

3. Remove the circlip and withdraw the ball race and distance piece.

4. Remove the retaining ring and circlip and withdraw the needle roller race from the splined shaft.

Power take-off, to assemble **Operation T/52**

1. Fit the needle roller race into the splined drive shaft and secure with the retaining ring and circlip.

2. Fit the driving shaft ball race and distance piece on to the shaft and secure with a circlip.

3. Fit the shaft, complete with bearings, into the P.T.O. housing and secure with the large circlip.

4. Refit the pump and composite coupling, using a new joint washer.

5. Fit the dog clutch to the splined shaft, with the internal recess facing the vehicle gearbox.

Control valve, to remove **Operation T/54**

1. Remove seat centre panel.

2. Remove the power take-off control rod, to gain access to the hoses and pipes.

3. Disconnect the three flexible hoses and the steel tank-return pipe.

4. Remove the knob and locknut, from control valve rod.

5. Remove the four set bolts and mounting plate.

6. Withdraw the control valve complete.

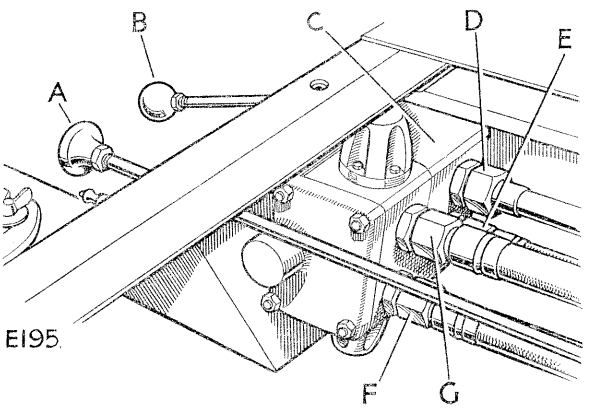


Fig. T-47—Control valve in position

A—Power take-off lever
B—Control valve lever
C—Control valve
D—Steel pipe, valve to tank
E—Hose, pump to control valve
F—Hose, valve to winch motor
G—Hose, control valve to winch motor

Control valve, to refit — Operation T/56

1. Offer up the control valve and secure in position with the mounting plate and four set bolts.
2. Check that the operating lever moves freely.
3. Refit the three flexible hoses and the steel tank-return pipe in accordance with the diagram given at Fig. T/47.
4. Refit the locknut and knob to control valve rod.
5. Fit the power take-off control rod.
6. Test and check for fluid leaks under normal load conditions.

Control valve, to strip — Operation T/58

1. Remove the four tie-bolts and separate the side plate and unloader valve.

Control valve, items 2-4

2. Remove the hand lever and end cap, also cap at other end of body.
3. Extract the locating peg and tap out the lever pin. Draw the hand lever shank down through the wiper washer and then extract the wiper washer. Remove the other end cap.
4. Remove the piston, followed by the gland washers and rubber sealing rings.

Unloader valve, items 5-8

5. Remove the end cap from the unloader valve body and the seal from the end cap spigot.
6. Extract the spring and unloader piston from the body.

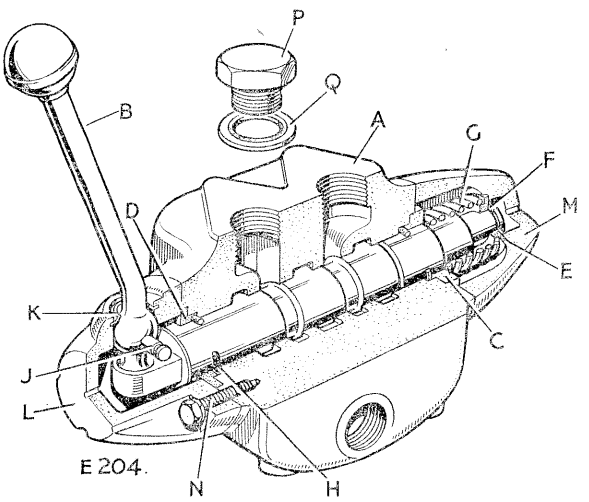


Fig. T-48—Control valve

A—Body
B—Hand lever
C—Gland washer
D—Gland washer
E—Retaining washer
F—Retaining ring
G—Return spring
H—'O' ring (piston)
J—Lever pin
K—Wiper washer
L—Hand lever end cap
M—End cap
N—Securing bolt
P—Blanking plug
Q—Bonded seal

7. Unscrew and remove the cap nut and locknut from the adjusting screw and, using a screwdriver, remove the adjusting screw.
8. The spring and valve can now be extracted.

Control valve, to assemble — Operation T/60

Examine all bores, spools and pistons for scoring, cracks, indentation, high spots, corrosion, etc., and renew as necessary.

Examine all valves and seatings for pitting, scoring, etc. Ensure that a thin, bright, unbroken line is apparent on both the valve and the seating.

Examine all seals for deterioration, cuts or signs of deformation.

Renew as necessary.

1. Fit the return spring and retaining washer to the piston and secure with a new circlip.
2. Insert the piston into the valve body, ensuring that the eye end protrudes from the 'control' side of the body.

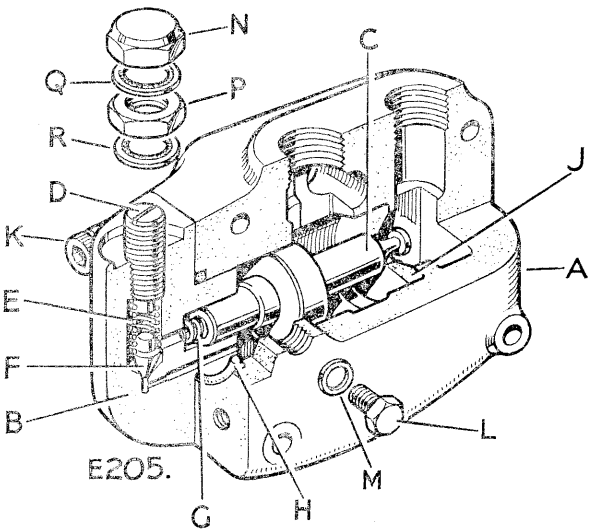


Fig. T-49—Relief and unloader valve

A—Body
B—End cap
C—Unloader piston
D—Adjusting screw
E—Valve spring
F—Relief valve
G—Piston spring
H—'O' ring
J—Valve seat
K—Retaining screws
L—Blanking plug
M—Bonded seal
N—Cap nut
P—Locknut
Q—Locknut
R—Bonded seal

3. Carefully insert the two rubber sealing rings into their housings between the piston and the body.
4. Place the gland washers in position, at each end of the piston.
5. Fit the end cap, which should be packed with Silicone MS4 grease.

6. Slide the hand lever through the hole in the other end cap and carefully fit the wiper washer in the housing. Pack the cap with Silicone MS4 grease.

7. Align the hand lever with the end cap bores and enter the lever pin, locating it by means of the locating peg.

8. Place the hand lever ball in the eye of the piston and then locate and secure the end cap.

Unloader valve, items 9-13

9. Insert the piston into the bore in the unloader body and follow this with the spring.

10. Smear the rubber sealing ring with Silicone MS4 grease and position it on the end cap spigot.

11. Offer up the end cap to the unloader body and secure it in position.

12. Insert the relief valve and valve spring into the end cap bore and then temporarily assemble the adjusting screw, bonded seal, locknut, bonded seal, cap nut, in that order.

13. After smearing the face seal (rubber 'O' rings) with Silicone MS4 grease, locate them in their respective recesses in the valve body and in the side plate. Align the side plate, control valve and unloader/relief valve, then insert the four tie-bolts and secure the assembly.

Setting relief valve pressure Operation T/62

1. Connect the valve in circuit, then remove the pressure port plug from the unloader valve and substitute a suitable pressure gauge.

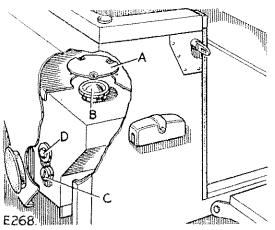


Fig. T-50—Supply tank

A—Cover plate
B—Filler cap
C—Drain plug
D—Oil filter

2. Remove the cap nut, locknut and bonded seals, from the unloader valve.

3. Set the hand lever to the normal operating position and, using a screwdriver, turn the adjusting screw until the gauge indicates a pressure of 1000 lb/sq.in. (70 kg/sq.cm).

4. Fit the locknut, cap nut and bonded seals—lock in position.

5. Remove the pressure guage and refit the plug.

Tank, to remove Operation T/64

1. Drain the oil from the tank into a suitable receptacle.

2. 88 models—Drill out the pop rivets and remove the protection plate.

3. 109 models—Remove the nuts and bolts and remove the protection plate.

4. Slacken the clips securing the suction and return pipes to the under-side of the vehicle body, then slacken the two hose clips at the tank, and manoeuvre the two pipes away.

5. Remove the cover plate from the wheel-arch seat base.

6. Remove the four bolts securing the tank to the seat base.

7. Remove the two nuts and bolts securing the tank to the bracket on the rear cross-member.

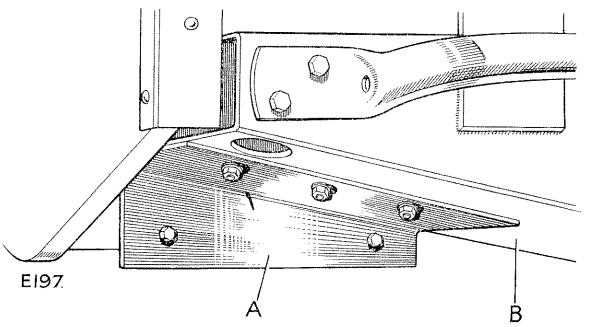


Fig. T-51—Tank fitting

A—Mounting bracket B—Rear cross-member

Tank, to refit Operation T/66

1. Offer up the tank and loosely secure to the mounting brackets and seat box panel.

2. Ensure that the tank is positioned so that the outlet pipes face the gap between the body floor and chassis side member.

3. Tighten the tank fixings.

4. Connect the hoses to the tank pipes and tighten all the securing clips.

5. Refill the tank with the filler neck gauze in position, with $4\frac{1}{2}$ gallons (20 litres) of the recommended oil.

6. Test and check for leaks under normal load conditions.

7. Replace the top cover and the protection panel (rivets on 88 models—nuts and bolts on 109 models).

Hand throttle—2 litre Petrol

To fit **Operation T/68**

1. Remove the air cleaner and connecting tube.
2. Disconnect the control rod between the accelerator relay lever and the carburetter relay lever, the rod between the carburetter lever and the bell crank lever, and the return spring from the bell crank lever.
3. Remove the bell crank lever and the relay lever from the bell crank spindle, unscrew the spindle from the inlet manifold, and replace with the new spindle.
4. Secure the abutment bracket to the tapped hole in the top rear face of the inlet manifold, using a set bolt, spring washer and plain washer.
5. Remove the ball pin from the original bell crank lever and fit it in the same position on the new bell crank lever.
6. Fit the hand throttle lever, the new bell crank lever, and the new relay lever to the spindle, using the original plain washer and split pin.
7. Replace the control rod between the carburetter lever and the bell crank lever, and connect the return spring to the bell crank lever.
8. Drill a $\frac{19}{32}$ in. (15 mm) dia. hole in the control panel $1\frac{3}{16}$ in. (30 mm) from the right-hand edge of the panel and $1\frac{3}{8}$ in. (9 mm) from the bottom.
9. Place the hand throttle control in the hole drilled in the panel and secure with the fixings provided.
10. Secure the control outer casing to the abutment bracket with a clip, screw, spring washer and nut.
11. Connect the control inner cable to the hand throttle lever, using the fixings provided. Position the abutment bracket so that the control cable lies in smooth curves.
12. Connect the control rod between the accelerator relay lever and the carburetter relay lever. Adjust the control rods until there is $\frac{1}{16}$ in. (1,58 mm) clearance between the hand throttle lever and the bell crank lever, and between the bell crank lever and the relay lever.
13. Test the operation of the control and replace the air cleaner.

Engine hand speed control—$2\frac{1}{4}$ litre Petrol

To assemble quadrant control. **Operation T/70**

1. Fit lever for hand speed control to lever housing with large washer above lever and the bush beneath. Secure with bolt, plain washer from beneath and self-locking nut above.
2. Attach quadrant plate to front of housing with ratchet teeth to top, secure with countersunk screw, plain washers, spring washers and nuts.
3. Fit knob to lever with 2 B.A. screws and nuts.

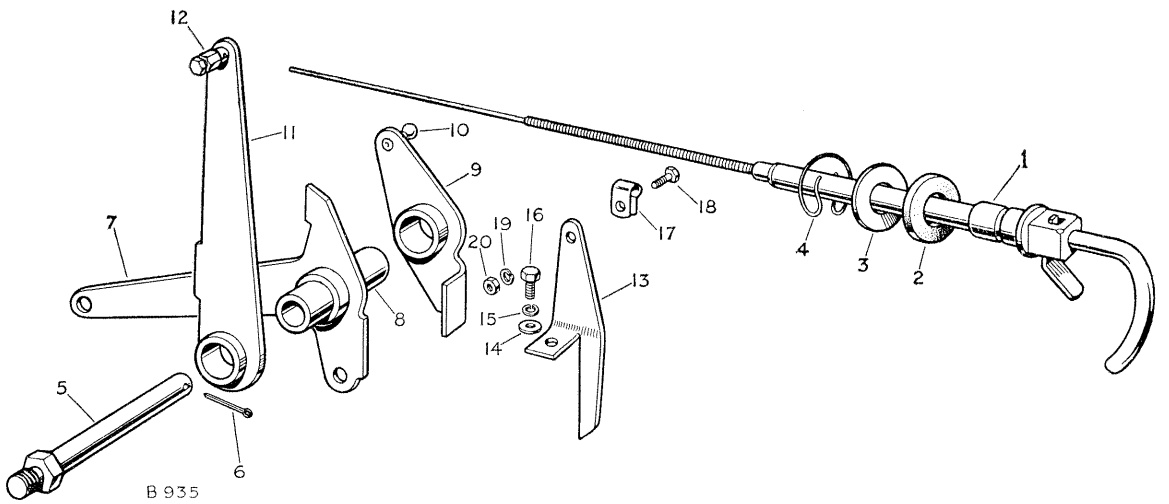


Fig. T-52—Layout of hand throttle—2 litre Petrol

1–4	Hand throttle control	
5–6	Spindle for bell crank	
7–8	Bell crank lever	
9–10	Relay lever	
11–12	Hand throttle lever	
13	Abutment bracket for hand throttle	
14	Plain washer	Fixing abutment bracket
15	Spring washer	
16	Set bolt	
17	Cable clip	Fixing hand throttle cable to abutment bracket
18	Screw	
19	Spring washer	
20	Nut	

To fit quadrant assembly to vehicle.

4. Insert rubber grommet in cover panel.
5. Remove original cover panel from dash, (mounted beneath instrument panel), and replace with new panel, grommet to right-hand side, also position quadrant assembly and affix both with 2 bolts, spring washers and nuts.
6. Screw 2 B.A. locknut and ball socket on to control rod. Push control rod through grommet on dash and secure ball joint socket to ball end on hand speed control lever.
7. Disconnect battery feed lead.
8. Remove the 6 2 B.A. screws holding the instrument panel and pull panel forward.
9. Fit the two upper bolts, plain washers, spring washers and nuts securing the control housing to the dash panel.
10. Replace instrument panel, and reconnect battery lead.
11. Remove bracket supporting accelerator relay cross-shaft, and relay lever to engine.
12. Slide lever for quadrant control rod along cross-shaft until it aligns with control rod.
13. Replace relay lever to engine and cross-shaft supporting bracket.
14. Fit relay lever securing pinch bolt and nut.
15. Push joint pin through eye in relay lever, fit plain washer and split pin to joint pin.
16. The control rod should now be fitted through the hole in the joint pin and the adjusting and locking nut fitted to the control rod.
17. With the quadrant lever in the fully off position, lock the relay lever to the cross-shaft, and adjust the length of the control rod, until there is a small clearance between the adjusting nut and the joint pin.
18. Check the operation of the hand throttle. It is important to ensure that the throttle is allowed to return to the fully closed position when the quadrant lever is in the off position.

Oil cooler—all models

To fit **Operation T/72**

1. Disconnect the bonnet prop rod from the bonnet by removing the split pin, plain and spring washers, then remove the bonnet.

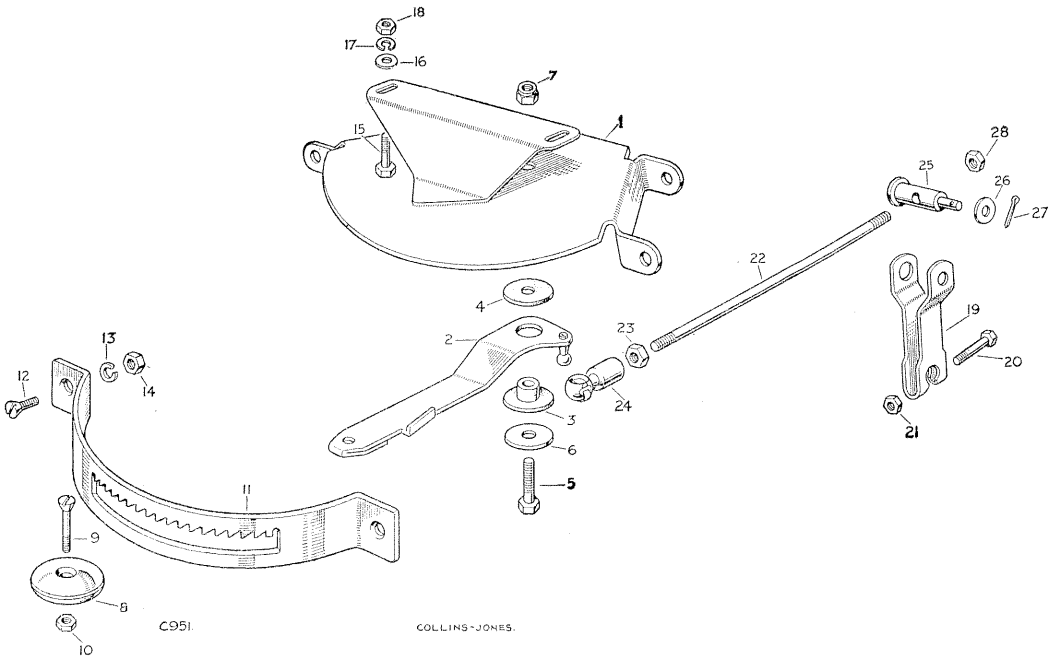


Fig. T-53—Layout of engine hand speed control—2¼ Litre Petrol

1 Control quadrant housing
2 Lever and ball end for control
3 Bush for lever
4 Washer for lever
5–7 Fixings—control lever to housing
8 Knob for lever
9–10 Fixings—knob to lever
11 Quadrant plate
12–14 Fixings—quadrant plate to housing
15–18 Fixings—control to dash
19 Operating lever, for hand engine speed control
20–21 Fixings—operating lever to accelerator cross-shaft
22 Control rod, for engine speed control
23–24 Nut and ball socket, for control rod
25–27 Joint pin and fixings, for engine speed control rod
28 Nut, fixing control rod to joint pin

2. Drain the oil from the sump into a suitable receptacle.
3. Remove the dipstick, then remove the sump.
4. **2¼ litre Petrol and Diesel models:** Remove the oil relief plug from the pump, then fit new plug complete with joint washer; fit the new crankcase sump complete with drain plug and replace the dipstick.
5. **2 litre Petrol models**
   (*a*) Slacken the locknut securing the oil pressure relief valve, then screw out the valve, complete with spring, plunger and ball. Discard the screw and spring. Remove the locating screw and withdraw pump, leaving the pump driving shaft in position in the distributor shaft housing.
   (*b*) Dismantle the pump and fit the new gears (Section A). Fit the new pump cover with the new bolts and split pins. Fit a new split split pin fixing the oil strainer.
   (*c*) Fit the reassembled pump to the engine, using the original locating screw. Replace the oil pressure relief valve, using the new adjusting screw and spring.
   (*d*) Fit the new crankcase sump complete with drain plug and replace the dipstick.
6. Secure the flexible oil pipe to the sump by means of the banjo centre and two joint washers. Do not fully tighten.
7. Remove the air cleaner body, oil reservoir and flexible pipe.
8. Remove the battery or batteries and carrier top/s.
9. Drain the coolant from the radiator.
10. Remove the front apron, radiator, and grille panel complete with headlamps. (Section L.)

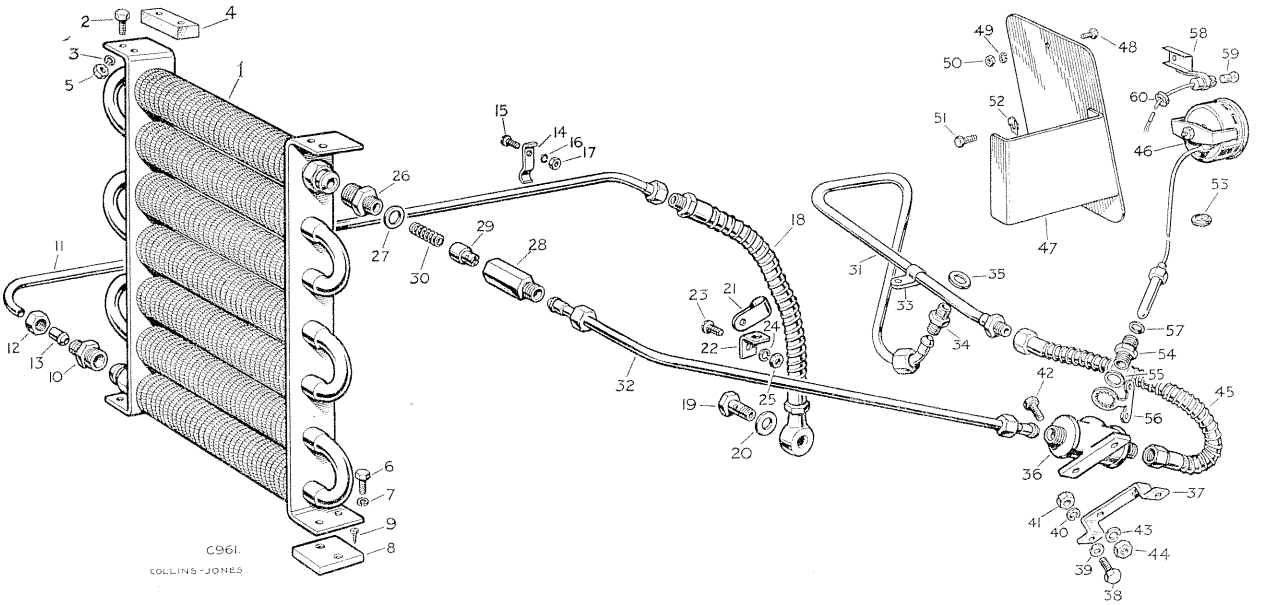


Fig. T-54—Layout of oil cooler—2 litre Petrol

1 Oil cooler
2–5 Fixings—oil cooler to radiator
6–7 Fixings—oil cooler to frame
8 Tapping plate for oil cooler
9 Drive screw fixing plate to frame
10 Oil return pipe union
11 Oil return pipe
12–13 Union fixings—for return pipe
14 Oil return pipe clip
15–17 Fixings—for clip
18 Flexible oil pipe, return to sump
19–20 Fixings—flexible pipe to sump
21 Flexible pipe clip
22 Clip bracket
23–25 Fixings—for clip
26 Oil union } For oil relief
27 Joint washer for union } valve
28 Body } For oil relief
29 Plunger } valve
30 Spring for plunger } valve
31 Oil pipe, union to flexible pipe
32 Oil pipe to relief valve
33 Clip for pipe—union to flexible pipe
34 Union for oil pipe } On oil filter
35 Joint washer for union } adaptor
36 Thermometer pocket complete
37–41 Not required
42–44 Fixings—pocket to wing valance
45 Flexible pipe—pump to pocket
46 Oil temperature gauge
47 Mounting bracket for gauge
48–52 Fixings—mounting bracket to dash
53 Grommet for pipe in dash

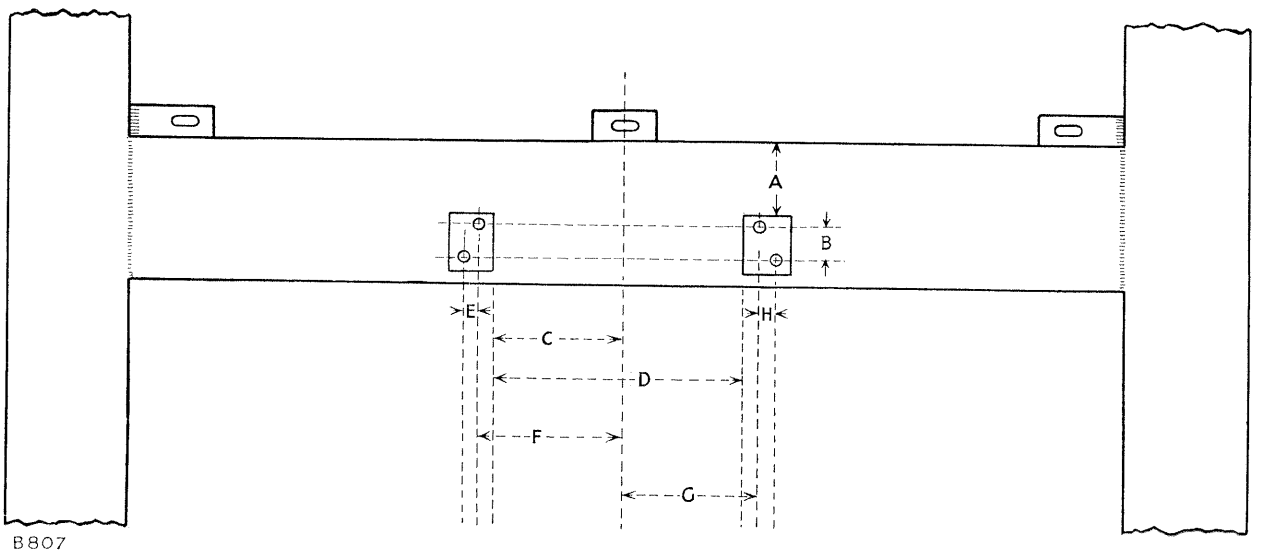


Fig. T-55—Location and drilling of tapping plates

A—1 15/16 in. (49 mm)
B—1¼ in. (31,5 mm)
C—4⅞ in. (124 mm)
D—8¼ in. (209,5 mm)
E—½ in. (12,5 mm)
F—5⅞ in. (149 mm)
G—4⅜ in. (111 mm)
H—½ in. (12,5 mm)

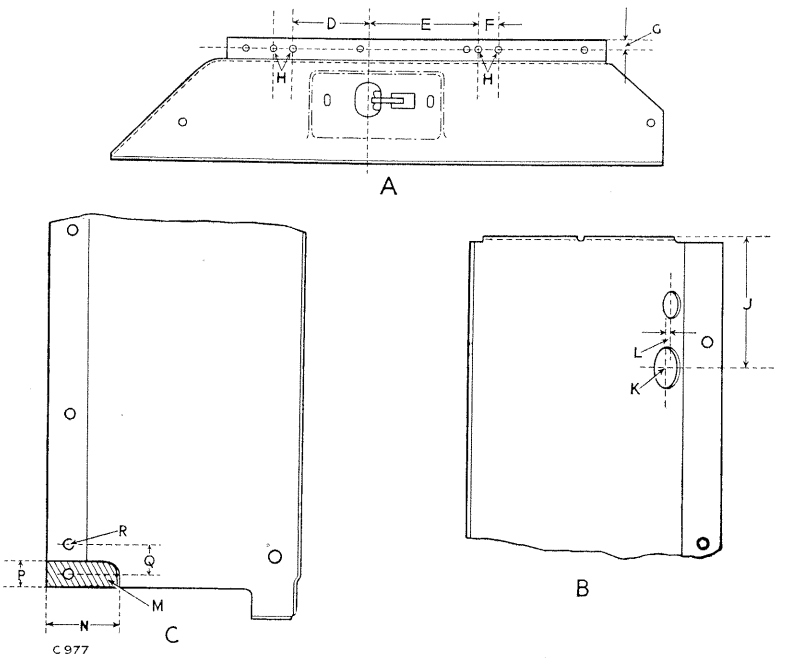


Fig. T-56—Details of additional drillings in grille panels

A—Top panel
B—L.H. side panel
C—R.H. side panel
D—3 15/16 in. (100 mm)
E—5 7/16 in. (138 mm)
F—15/16 in. (24 mm)
G—9/16 in. (14 mm)
H—Four new holes 9/32 in. (7 mm) dia.
J—3¼ in. (82,5 mm)
K—One new hole 1⅛ in. (29 mm) dia.
L—⅛ in. (3 mm)
M—Shaded area represents section to be cut away
N—1¾ in. (44 mm)
P—⅝ in. (16 mm)
Q—½ in. (12,5 mm)
R—One new hole 9/32 in. (7 mm) dia.

11. Ease the tension on the fan belt. Remove and discard the fan and (2 litre Petrol) distance piece, and (2¼ litre Petrol and Diesel models) fan belt, pulley and set bolts, but retain the spring washers.

12. Drive screw the two tapping plates to the chassis front cross-member, as illustrated in Fig. T-19.

13. Drill and tap the four holes in the tapping plates to ¼" U.N.F.

14. Remove and discard the inner left-hand nut and bolt, securing the grille panel assembly to the top of the radiator, then detach earth clip from the bolt in the top panel, and re-tighten the bolt.

15. Mark out and drill the L.H. side panel as shown in Fig. T-57.

16. Remove the lower securing nut and bolt, then mark out and cut away the section of the R.H. side panel indicated in Fig. T-57. Drill a hole above the cut-out, through the panel and radiator bracket, and refit securing nut and bolt.

17. **2 litre Petrol:** Remove and discard the fan cowl and replace with the new one.

18. **2 litre Petrol:** Remove and discard the radiator cap, and replace with the new one.

19. **2¼ litre Petrol and Diesel models:**

    (*a*) Remove the starter dog and withdraw the fan driving pulley or (Diesel) damper assembly. Replace with the new double pulley assembly and secure to the crankshaft with the starter dog and a new lock washer.

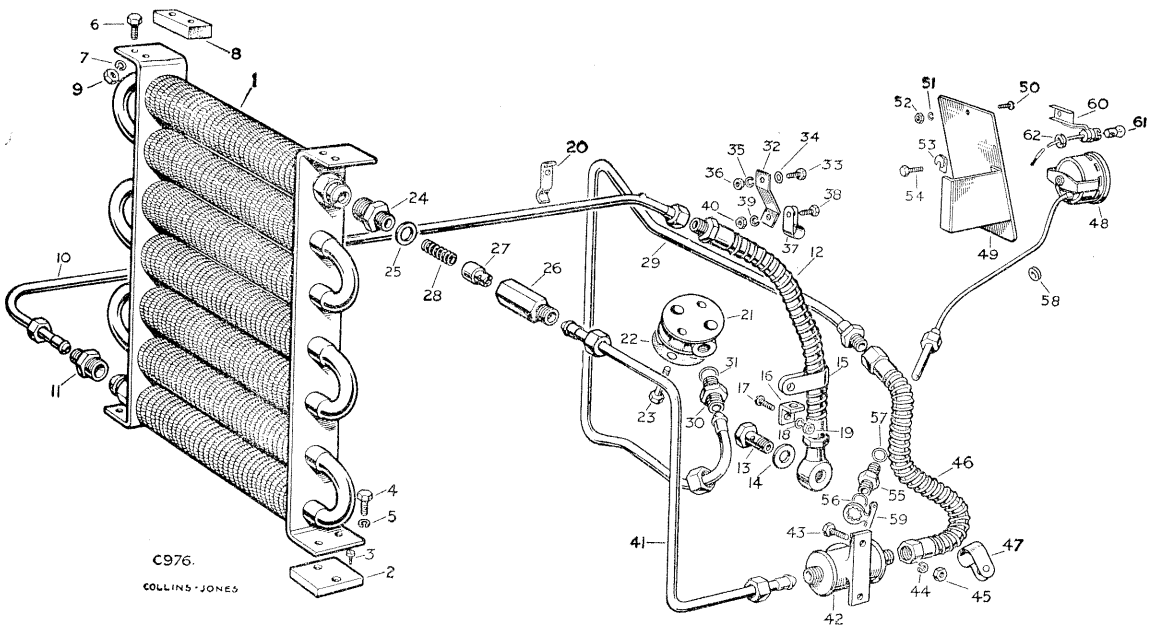


Fig. T-57—Layout of oil cooler—2¼ litre Petrol, Diesel models

1 Oil cooler
2 Tapping plate
3 Drive screw—plate to frame
4–5 Fixings—cooler to chassis frame
6–9 Fixings—cooler to radiator and grille panel
10 Oil return pipe
11 Union for return pipe
12 Flexible oil pipe, return to sump
13–14 Fixings—flexible pipe to sump
15 Clip, for flexible oil pipe
16 Bracket for clip
17–19 Fixings—return pipe clip to bracket
20 Clip for oil return pipe
21 Adaptor for engine oil filter
22 Joint washer for adaptor
23 Bolt, fixing adaptor
24–25 Oil union and joint washer
26 Body
27 Plunger
28 Spring for plunger
29 Oil pipe, union to flexible pipe
30 Union for oil pipe
31 Joint washer for union
32 Bracket for clip
33–36 Fixings—bracket to front engine lifting bracket
37 Clip for union to flexible oil pipe
38–40 Fixings—clip to bracket
41 Oil pipe to relief valve
42 Thermometer pocket complete
43–45 Fixings—thermometer pocket to valance
46 Flexible oil pipe, pump to pocket
47 Clip fixing flexible pipe to L.H. battery support

(*b*) Remove the dynamo, and withdraw the pulley; fit the new double pulley and refit the dynamo.

20. Fit the oil cooler to the tapping plates, using the four set bolts and washers provided, then fit the oil relief valve to the top union in the oil cooler.

21. Replace the radiator and grille panel assembly, securing with the original nuts and bolts. Do not fully tighten.

22. **2 litre Petrol:** Fit the new fan to the pulley and refit the belt.

    2¼ litre Petrol and Diesel models: Fit the new fan to the new double pulley, ensuring that the holes are in correct alignment, and fit two new belts.

23. Mark out and drill the radiator grille panel top, as shown in Fig. T-57.

24. Secure the oil cooler to the radiator and grille panel assembly, using the four holes drilled in the top panel and secure with the nuts, bolts, washers and distance pieces supplied.

25. Drill a further $\frac{9}{32}$ in. (7 mm) dia. hole in a suitable position in the grille top panel, and using the sherardised nut and bolt supplied, fit the earth clip.

26. Tighten all nuts and bolts.

27. Fit the union to the oil cooler lower R.H. side and fit the right-angled end of the oil return pipe to the union and secure the other end of the flexible pipe already fitted to the sump. Figs. T-59 and T-60. Secure the non-flexible pipe to the battery carrier (R.H. on Diesel), using a clip, screw, nut and spring washer.

28. Tighten the banjo bolt securing the flexible pipe to sump and secure the pipe to a convenient sump securing stud, using a bracket, clip, screw, nut and spring washer—Figs. T-55 and T-58.

29. Fit the oil pipe relief valve to the thermometer pocket, but do not fully tighten the union; connect the pipe to the foremost end of the thermometer bulb pocket—see Figs. T-55 and T-58. Secure the flexible oil pipe to the pocket.

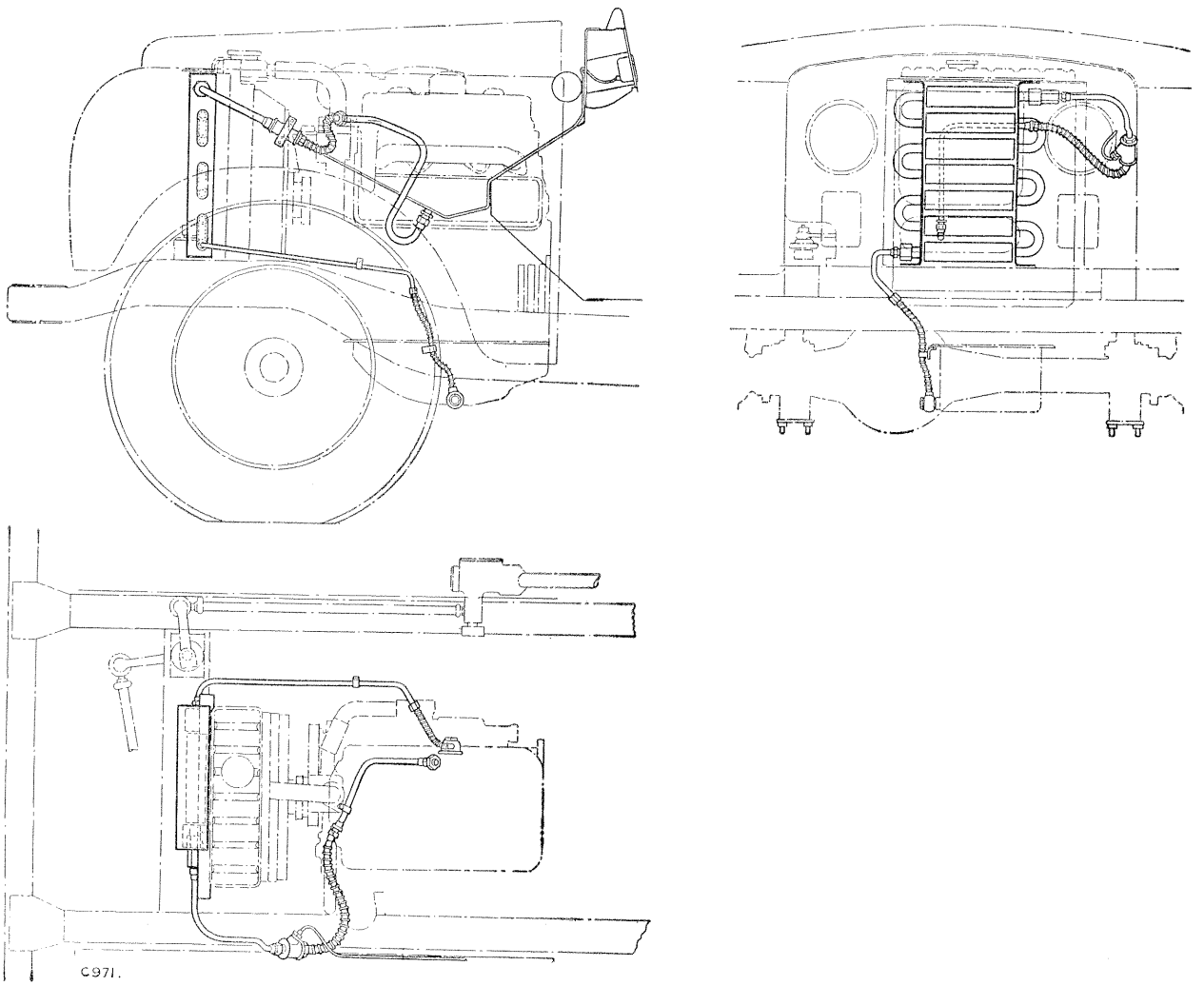


Fig. T-58—Installation of oil cooler—2 litre Petrol

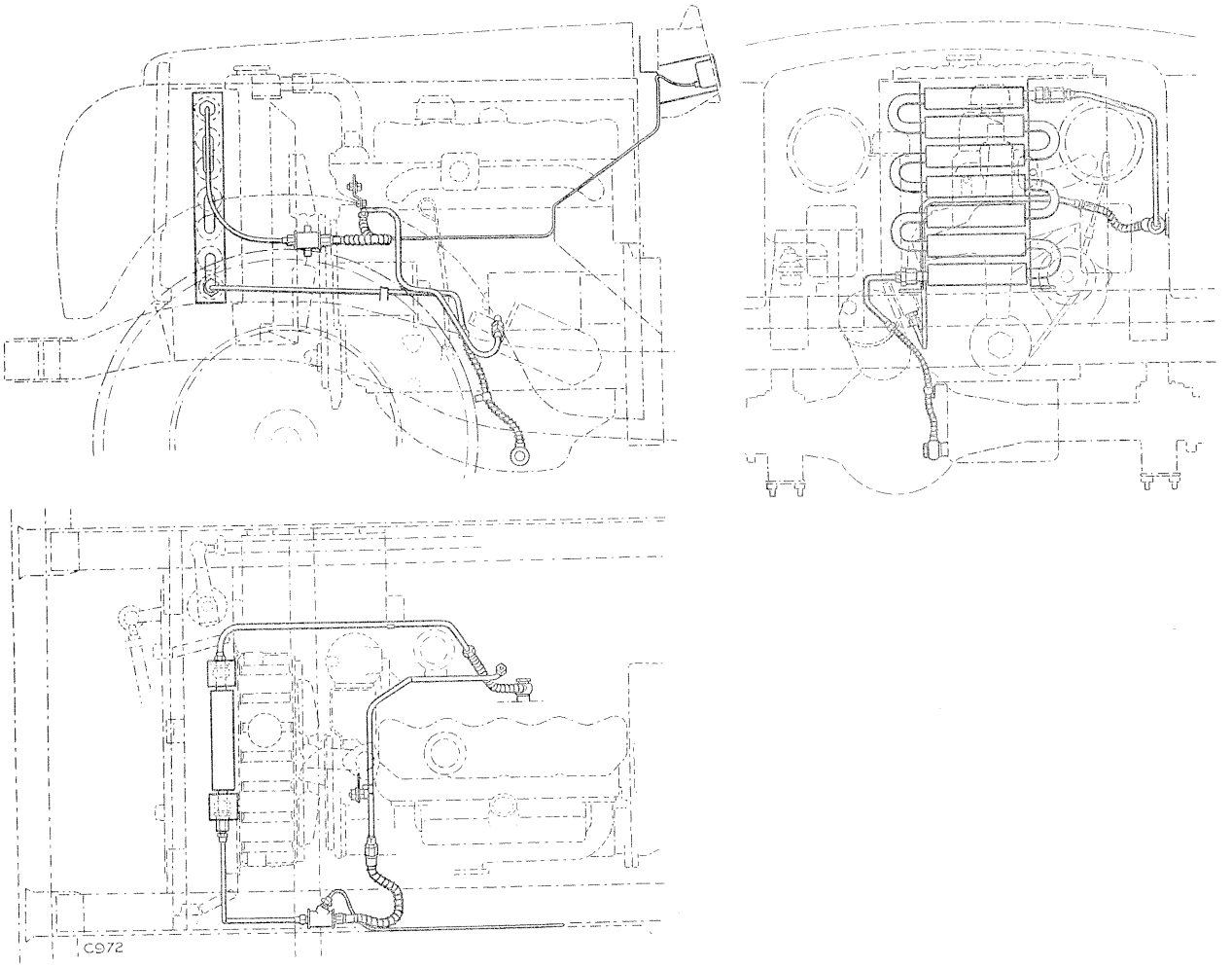


Fig. T-59—Installation of oil cooler—2¼ litre Petrol, Diesel models

30. Fit the oil pipe, flexible pipe to oil filter adaptor and 2 litre Petrol models: secure it with a clip to the thermostat housing stud, or 2¼ litre Petrol and Diesel models: fit a bracket to the engine lifting bracket, then secure the pipe to the bracket with a clip—See Figs. T-55 and T-58.

31. Using the thermometer pocket as a guide, drill two holes $\frac{13}{64}$ in. (5 mm.) dia. in the L.H. wing valance, or—Diesel models: L.H. battery valance, and secure the pocket, using two bolts, nuts and spring washers.

32. **2 litre Petrol models:** Remove plug from oil filter adaptor and fit a union and joint washer. Fit the pipe, connecting flexible pipe to adaptor, to the union, and connect the other end to the flexible pipe.

33. **2¼ litre Petrol and Diesel models:** Remove the engine oil filter and fit the adaptor and joint washer between it and cylinder block, and secure with the new bolts and original spring washers; fit the union and joint washer. Fit the pipe, connecting flexible pipe to adaptor, to the union and connect the other end to the flexible pipe.

34. Mark a centre at the rear of the left-hand glove box, positioned horizontally in line with, and 2 in. (50 mm) to the right of the top hole blanked off by a nut and bolt; cut a 1 in. (25 mm) dia. hole at this centre, then remove the blanking-off bolt.

35. Fit the oil temperature gauge to the bracket, using the existing attachments and fitting the bulb and holder to the inner fixing stud on the gauge.

36. Drill a $\frac{7}{32}$ in. (5,5 mm) dia. hole in the glove box stiffener, and a $\frac{1}{4}$ in. (6,3 mm) dia. hole in the bottom glove box stiffener, using the gauge mounting bracket as a guide, and secure bracket to stiffeners, using the fixings provided.

37. Pass a rubber grommet over the thermometer bulb and tubing and fit to the hole in the glove box.

38. Lead the capillary tubing conveniently over the toe box to the thermometer pocket, then fit the bulb and joint washer to the pocket.

39. Connect the lead from the bulb holder to the junction with the petrol gauge light. Check and tighten all nuts, bolts and unions, etc.

40. Replace the battery and terminals.
41. Replace the air cleaner assembly.
42. Refill the cooling system, and then the engine oil sump to the "H" mark on the dipstick.
43. **2 litre Petrol.**
    (*a*) Remove the oil pressure warning light switch at the L.H. rear of the cylinder block and in its place fit a slave oil pressure gauge.
    (*b*) Start the engine and when normal running temperature has been reached, adjust the oil pressure by means of the oil pressure relief valve on the cylinder block, to 75-80 lb/sq.in. (5,3-5,6 kg/cm²) at 2,500 r.p.m.
    (*c*) Remove the slave gauge and replace the warning light switch.
44. Run the engine and check for oil and coolant leaks, then refit bonnet.

Engine tie-rod (Diesel models only)

45. Fit the bell housing bracket to the left-hand rear flange of the bell housing with the nuts, bolts and washers provided.
46. To the engine tie-rod, fit a locknut, nut, cup washer, sleeve and a rubber bush and insert the rod through the bell-housing bracket, from the rear.
47. Complete the fixing to the bell-housing bracket with a further rubber bush, cup washer (dished side inwards), nut and locknut. The nuts should only be finger tight.
48. Attach the rear bracket to the tie-rod in a similar manner, and hook the bracket over the frame cross-member.
49. With the vehicle on level ground and the handbrake off, position the rear bracket so that the tie-rod is parallel to the ground, and in line with the longitudinal axis of the vehicle.
50. Using the hole in the bracket as a template, drill a $\frac{33}{64}$ in. (10 mm) dia. hole through the cross-member and secure the bracket to it with the fixings provided.
51. Adjust the tie-rod so that with the vehicle on level ground, and the handbrake off, there is no strain. Tighten the locknuts.

Water temperature and oil pressure gauge—all models

To fit **Operation T/74**

1. Disconnect the bonnet prop rod from the bonnet by removing the split pin, plain and spring washers, then remove the bonnet.

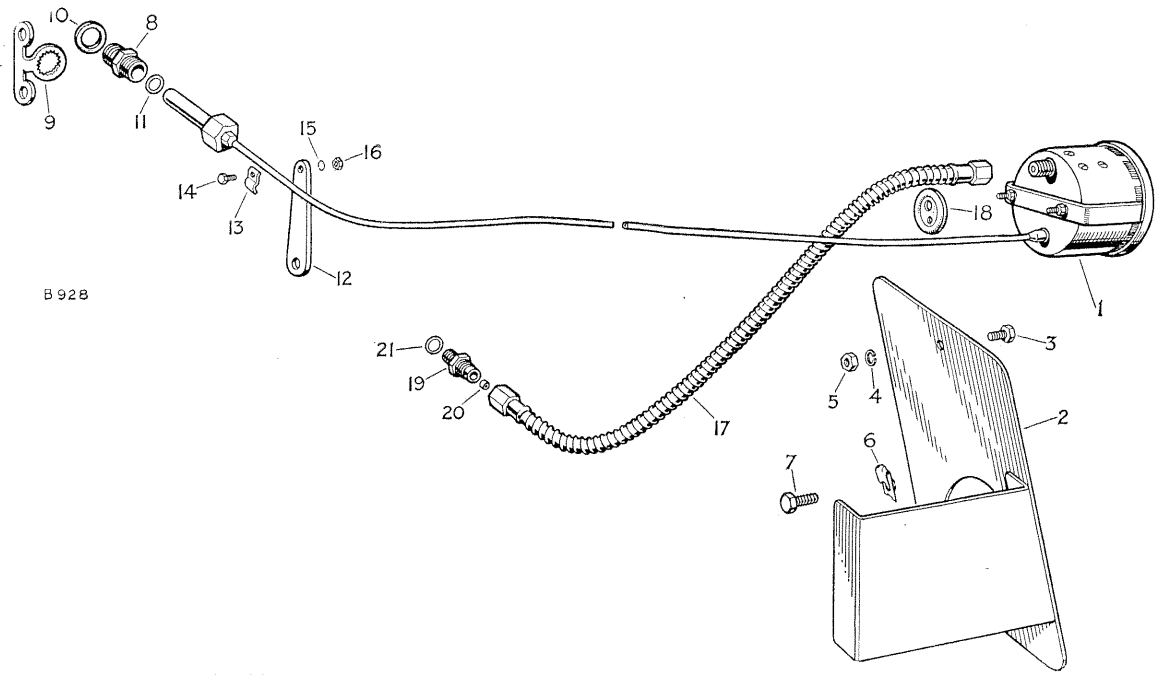


Fig. T-60—Water temperature and oil pressure gauge—2 litre Petrol

1 Water temperature and oil pressure gauge
2 Mounting bracket for gauge
3–7 Fixings—mounting bracket to dash
8 Union for thermometer bulb
9 Locker for union
10 Washer for union
11 Washer for thermometer bulb
12 Thermometer pipe support bracket
13 Thermometer pipe clip
14–16 Fixings for clips
17 Oil pipe for gauge
18 Grommet for pipe, in dash
19 Union for oil pipe
20 Meter valve
21 Washer for union

2. Drain the coolant from the radiator into a suitable receptacle.

3. Mark and cut out a 1 in. (25 mm) hole in the L.H. glove box, approximately 3 in. (75 mm) from the base and 2 in. (50 mm) from R.H. side of glove box.

4. Fit the combined water temperature and oil pressure gauge to the gauge-mounting bracket using the existing attachments, and fitting the bulb and holder to the inner fixing stud on the gauge. Attach the bulb holder lead to the panel light switch.

5. Fit the oil pipe to the union on the gauge.

6. Pass the oil pipe and bulb pipe of the gauge through the 1 in. (25 mm) dia. hole cut in the panel, and fit the bracket to the panel, using the lower ventilator control mounting hole and fixings to secure the top of the gauge bracket.

7. Secure the bracket stiffener to the glove box, using a bolt, washer and nut, after removing the rubber plug from the rear of the glove box.

8. Drill a $\frac{7}{32}$ in. (5,5 mm) dia. hole in the glove box stiffener, using the existing hole in the gauge-mounting bracket as a guide, and secure bracket to stiffener with a nut, screw and spring washer.

9. Pass a rubber grommet over the thermometer bulb and tubing and fit to the hole in the glove box.

10. **2 litre Petrol**

(*a*) If fitted, remove the governor (Operation T/18) and remove the thermostat housing. Strip the old housing, discard and fit parts to new housing.

(*b*) Fit the plug and washer to the larger tapped hole in the new thermostat housing and fit the union and washer to the other hole. Fit the locker over the union, and tighten the

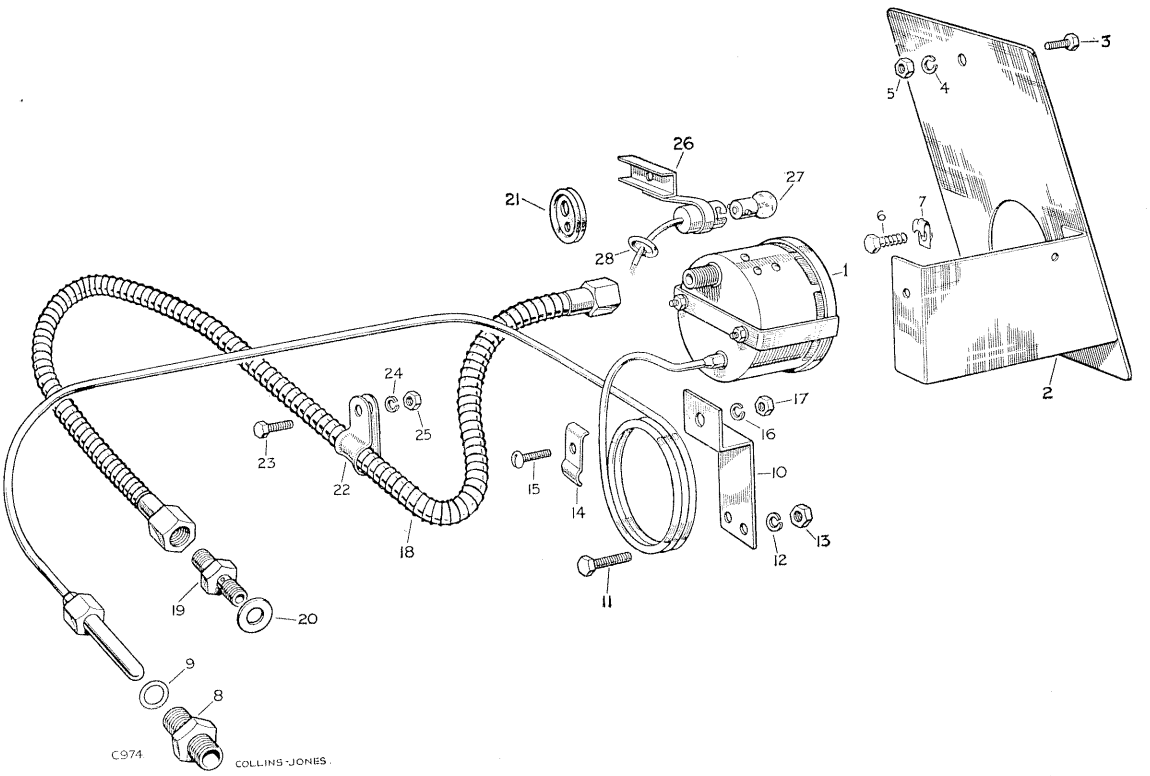


Fig. T-61—Water temperature and oil pressure gauge—2¼ litre Petrol and Diesel models

1 Water temperature and oil pressure gauge
2 Mounting bracket for gauge
3–7 Fixings—mounting bracket to dash
8 Union for thermometer bulb
9 Joint washer for gauge bulb
10 Support bracket for pipe clip
11–13 Fixings—bracket to dash
14 Clip for thermometer pipe
15–17 Fixings—pipe clip to support bracket
18 Oil pipe for gauge
19 Union for oil pipe
20 Joint washer for union
21 Grommet for oil pipe in dash
22 Clip for pipe
23–25 Fixings—clip to dash
26 Panel light adaptor
27 Bulb
28 Grommet for lead

union until the holes in the locker are in line with the holes in the right-hand side of the housing.

(*c*) Fit the new thermostat housing complete to the engine and secure with the existing bolts and spring washers, ensuring that the rubber seal is in position between the water pump and the housing.

(*d*) Refit the governor (if fitted).

(*e*) Form the thermometer pipe to pass to the left of the coil, down over the toe box and along the wing valance to the thermostat housing. Coil the excess thermometer pipe neatly, adjacent to the bulb and to the L.H. wing valance, tape both coils at the top, then fit the bulb to the union, using the joint washer provided.

(*f*) Fit the bracket under a convenient bolt on the engine front cover, fit a clip over the pipe and secure it to the bracket.

(*g*) Secure the pipe to the L.H. wing valance and toe box, using the two existing holes in the wing valance, opposite the two front manifold flanges, and to three other suitable points, using the remaining clips, screws, spring washers and nuts.

11. **2¼ litre Petrol**

(*a*) Remove the plug from the R.H. front of the cylinder head, discard, then replace with a union and joint washer.

(*b*) Drill two $\frac{7}{32}$ in. (5,5 mm) holes in dash for mounting thermometer pipe clip bracket. The holes to be 6 in. and $7\frac{7}{8}$ in. (152 and 200 mm) from R.H. side of L.H. toe box, and in a position to be approximately level with the top of the cylinder head.

(*c*) Secure the bracket to the engine side of the dash, using two nuts, screws and spring washers. Coil the thermometer pipe neatly into approximately a 3 in. (76,2 mm) coil, tape at the top; and clip to the bracket.

(*d*) Lead the thermometer pipe along the R.H. side of vehicle, clip it at three points to the carburetter feed pipe, using the existing rubber cleats, and fit the bulb to the union using the joint washer provided.

12. **Diesel models**

(*a*) Remove the plug from the L.H. rear of the cylinder head, discard, then replace with a union and joint washer.

(*b*) See item 11 (*b* and *c*).

(*c*) Lead the thermometer pipe along the L.H. side of the vehicle and fit the bulb to the union, using the joint washer provided.

13. **2 litre Petrol**

(*a*) Disconnect the feed wire from the oil pressure switch at the L.H. rear of the cylinder block and carefully cover the wire with insulating tape. Remove and discard the switch, then replace with a union and joint washer.

(*b*) Clip the flexible oil pipe to the dash panel at a convenient point and connect the oil pipe to the union.

14. **2¼ litre Petrol and Diesel models**

(*a*) Remove the banjo bolt fixing the valve gear feed pipe at the R.H. rear of the cylinder block, discard and replace with a union and joint washer.

(*b*) Clip the flexible oil pipe to an existing hole in the dash panel, located approximately $7\frac{1}{2}$ in. (190 mm) down and 4 in. (101 mm) to left of the thermometer pipe clip bracket previously secured to the dash.

(*c*) Lead the oil pipe along the dash panel and clip again to the panel about $2\frac{1}{2}$ in. (63 mm) to the right of the vehicle centre line. Secure the pipe to the R.H. toe box side panel, using the remaining clip and fixings, and connect the oil pipe to the union.

15. Refill the cooling system.

16. Start the engine and check for leaks (both coolant and oil).

17. Refit the bonnet.

Heater unit and demister tubes

Unit fitment **Operation T/76**

2 litre Petrol

1. Disconnect the bonnet prop rod from the bonnet.
2. Remove the bonnet.
3. Drain off the coolant.
4. Disconnect the bottom water hose at the inlet pipe to the pump end. Remove the inlet pipe from the pump and discard the pipe.
5. Fit the new inlet pipe to the pump with the joint washer and secure it using the existing bolts, spring washers and clip.
6. Fit the reducing union and joint washer to the pipe.
7. Disconnect the top water hose from the thermostat housing and disconnect the water hose to the inlet elbow.
8. Remove the thermostat housing from the cylinder head. Completely strip and discard the housing.
9. Fit the parts removed from the old housing to the new thermostat housing.
10. Fit the plug and joint washer to the smaller tapped hole in the housing and to the large tapped hole fit the water supply valve and joint washer.
11. Fit the thermostat housing complete to the cylinder head, ensuring that the rubber seal is in place on the top of the water pump, and secure using the existing set bolts and spring washers.

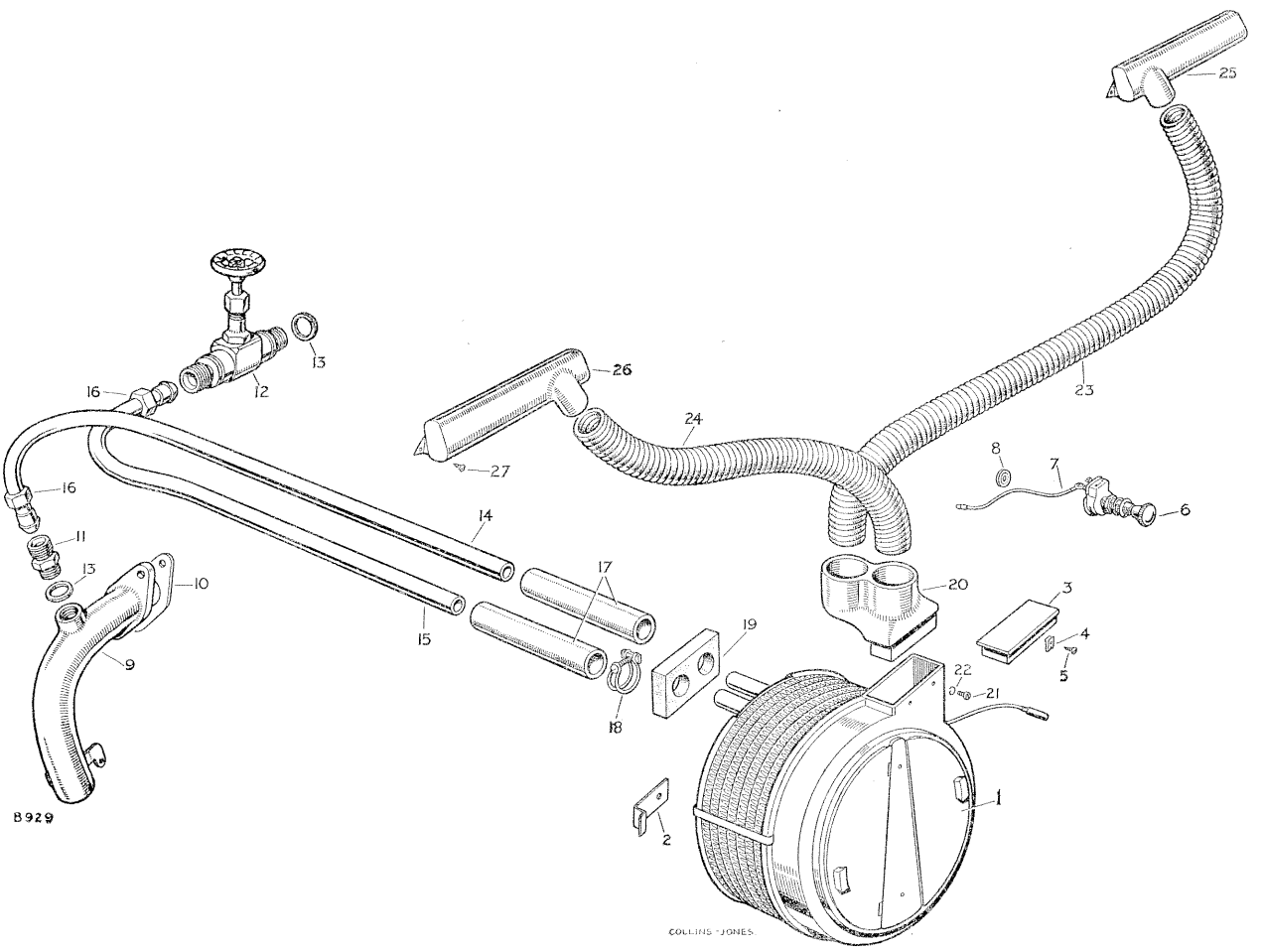


Fig. T-62—Layout of heater unit—2 litre Petrol

1 Heater
2 Bracket for heater
3 Blanking cap
4 Spire nut } Fixing blanking cap
5 Acme bolt } Fixing blanking cap
} Not required with demisters
6 Switch for heater
7 Feed wire for heater
8 Grommet for heater leads
9 Inlet pipe for water pump
10 Joint washer for pipe
11 Reducing union for pipe
12 Valve for water supply
13 Joint washer for valve and union
14 Water outlet pipe
15 Water inlet pipe
16 Union nut for heater pipe to valve and union
17 Hose for water pipes
18 Clip for hose
19 Rubber seal for pipes
20 Junction box for demister tubes
21–22 Fixings: junction box to heater
23 Tube for demister, R.H.
24 Tube for demister, L.H.
25 Nozzle for demister, R.H.
26 Nozzle for demister, L.H.
27 Drive screw fixing nozzle

12. Remove the rubber plugs, one from the front face of the control panel and the other from the L.H. side of the control panel box.
13. Fit to the heater switch the feed wire and also a suitable length of wire to connect the heater switch to the terminal with the single green wire in the fuse box.
14. Remove the knob from the switch and fit the switch to the face of the control panel using the existing hole. Refit the knob.
15. Remove the two large, and three small rubber plugs from the dash centre panel.
16. Fit the rubber seal to the heater over the water pipes.
17. Fit the rubber hoses to the water pipes and secure.
18. Remove the nuts, spring washers and plain washers from the three studs on the heater and fit to the studs the three brackets. Fit the heater to the dash and secure using the existing nuts, spring washers and plain washers.

    Before fully tightening the nuts ensure that the mounting brackets are lying radially outwards from the studs.
19. Connect the feed wire to the snap connectors on the heater lead.
20. Fit the two union nuts, one to the water inlet pipe and one to the water outlet pipe.
21. Fit the remaining two clips, one to each hose on the heater and fit the inlet and outlet pipes to the hoses. Secure the pipes to the water supply valve and the reducing union. Secure the pipes to the hoses using the two clips.
22. Fit the two spire nuts to the blanking cap and fit the blanking cap to the heater, securing by means of the two acme screws.

    This operation is eliminated if demisters are to be fitted.
23. Refill the cooling system.
24. Open the water supply valve and check the functioning of the heater.

2¼ Litre Petrol, Diesel models

1. Disconnect the bonnet prop and remove the bonnet complete.
2. Drain off the coolant.
3. Unscrew the plug from L.H. side of water outlet pipe and fit the union for hose with a copper sealing washer interposed.
4. Remove the plug from rear L.H. corner of cylinder head top and fit the flow control valve and copper joint washer.
5. Remove the rubber plug from R.H. side of control box panel face and another from L.H. side of control box.
6. Part the lead connected to the heater at the snap connector and connect the eyeletted end to one terminal of the rheostat switch. Connect the eyeletted end of the lead with bared opposite end, to the switch second terminal. Remove the control knob from switch and fit to hole in R.H. side of control panel, then lock in position. Replace knob.
7. Fit a rubber grommet to the hole in L.H. side of control box and pass both leads from the rheostat switch through the grommet.
8. Remove the two large and three small rubber plugs from the L.H. side of the scuttle centre panel.
9. Fit the sponge rubber seal over the heater pipes, then remove the nuts, plain and spring washers from the securing studs—leave the earth lead terminal on the lower stud.
10. Position a steady bracket to each mounting stud and offer the unit to the scuttle. Fit the nuts, spring and plain washers, but before tightening ensure that the steady brackets are extending radially outward.
11. Reconnect the heater to switch lead, at the snap connector, and connect the lead from switch with bared end to the terminal with the single green wire or—Diesel, unused terminal on fuse box. Switch the ignition or electrical services "on" and operate the rheostat switch to check that the heater motor works—switch off.
12. Fit the "Z" shaped hose to the control valve and heater inner pipe, then secure. The "L" shaped hoses should now be fitted to the water outlet pipe, then the hose and pipe assembly connected to the heater and water pump adaptor.
13. Fit the support clip for water outlet pipe and secure it loosely to the manifold securing stud. Adjust the hoses and pipe as necessary and secure.
14. Refill the coolant system, open the water valve and check the functioning of heater.

To fit demisters **Operation T/78**

1. Remove the blanking cap (if fitted) from the heater and fit the junction box for demister tubes.
2. Remove the rubber plugs from the top of both glove boxes.
3. **Petrol models:** Disconnect the battery.
   Diesel models: Disconnect the positive lead of R.H. battery.
4. Remove the securing screws and withdraw the instrument panel complete with controls and wiring.
5. Pass the R.H. demister tube through the hole in R.H. glove box top, through the hole in R.H. side of instrument box, over the wiring, on through the hole in instrument box, L.H. side, and fit the tube to one pipe of the demister junction box.

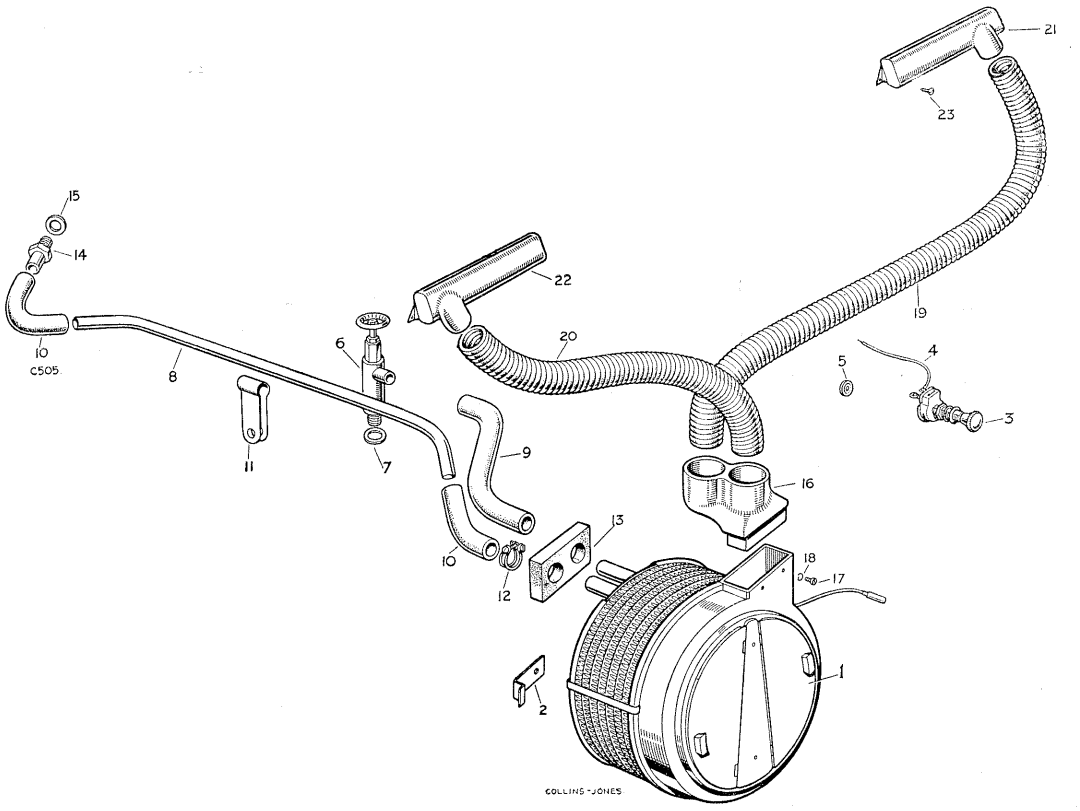


Fig. T-63—Layout of heater unit—2¼ litre Petrol and Diesel models

1 Heater
2 Bracket for heater
3 Switch for heater
4 Feed wire for heater
5 Grommet for heater leads
6 Valve for water supply
7 Joint washer for valve and union
8 Water outlet pipe
9 Water inlet pipe
10 Hose for water outlet pipe
11 Clip for hose pipe
12 Clip for hose
13 Rubber seal for pipes
14 Union outlet pipe to pump
15 Washer
16 Junction box for demister tubes
17–18 Fixings: junction box to heater
19 Tube for demister, R.H.
20 Tube for demister, L.H.
21 Nozzle for demister, R.H.
22 Nozzle for demister, L.H.
23 Drive screw fixing nozzle

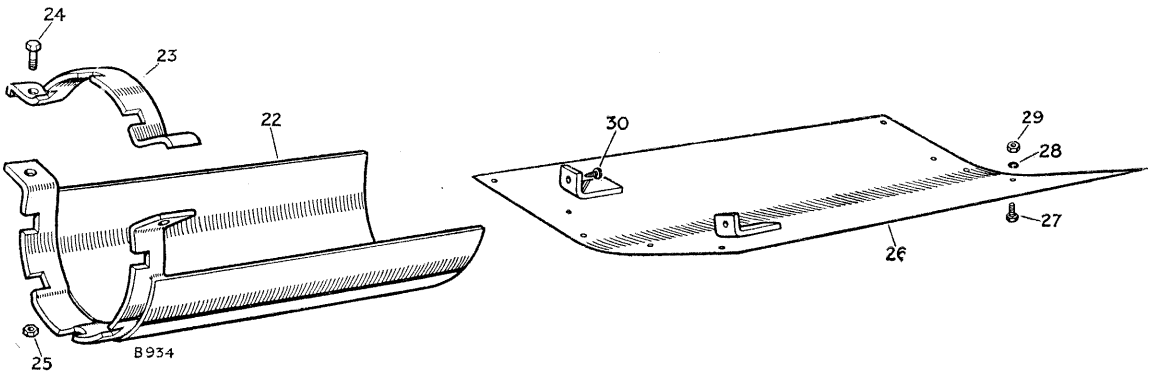


Fig. T-64—
Layout of propeller shaft joint cover plates

22	Cover plate for joint at differential housings	27	Bolt	Fixing shield
23	Top strap for cover plate	28	Spring washer	
24–25	Fixings for cover plates	29	Nut	
26	Shield for joint at transfer box	30	Drive screws	

6. Insert the L.H. demister tube into the hole in L.H. glove box top, pass it through the L.H. side of instrument panel and through the hole in L.H. bottom of instrument box. Fit the tube to the other pipe on the demister junction box.
7. Fit the demister nozzles to their respective tubes and using the holes in the nozzles as pilots, drill $\frac{7}{64}$ in. (2,5 mm) dia. holes in windscreen frame, then secure the nozzle with drive screws.
8. Refit the instrument panel and battery lead, then test heater and demister for correct functioning.
9. Refit the bonnet and prop rod.

Propeller shaft joint cover plates

To fit **Operation T/80**

1. Protect the rear shaft rear joint by placing a cover plate under the rear axle differential housing, with the slots in the retaining strap located in the stiffening webs of the housing; retain it with a strap over the housing and secure by means of two bolts and nuts.
2. Protect the front shafts front joint in a similar manner.

   Protect the front shaft rear joint by means of a plate which should be secured under the transfer box, between No. 3 and No. 4 chassis cross-members (front bumper is No. 1 member) as follows:—
3. Position the plate centrally beneath the front shaft rear joint, with the two right angle brackets abutting the rear of No. 3 cross-member.
4. Bend the plate to the contour of the cross-members and drill three $\frac{9}{64}$ in. (3,5 mm) dia. holes in the front member, and three in the rear member using the plate as a template, the holes should be the three outermost at each end of the plate.
5. Secure the plate in position with six drive screws; disregard the two right angle brackets which are not used when fitting the plate with the gearbox and transfer box unit in position.

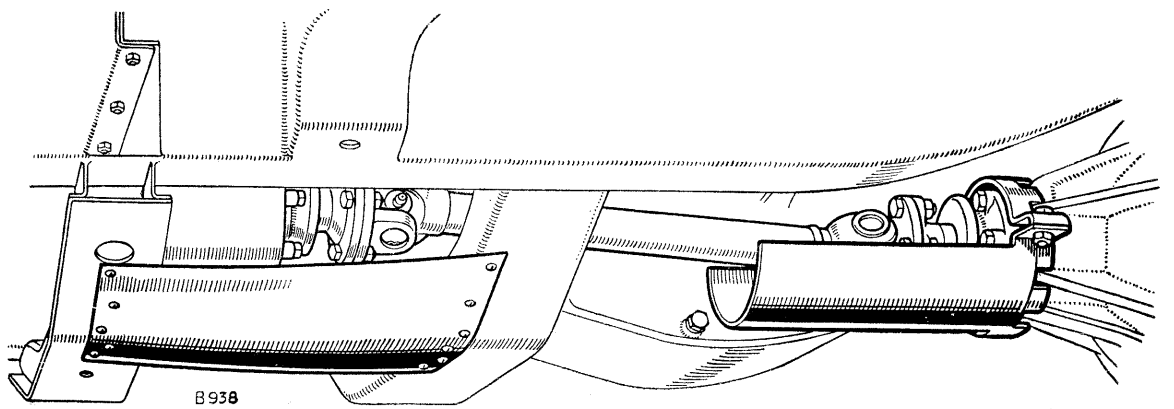


Fig. T-65—
Propeller shaft joint cover plates in position

6. The rear shaft front bearing is effectively screened by the transmission brake unit.

Flashing indicators, early type—All models

To fit **Operation T/82**

1. Remove the five screws and lower the instrument panel, drill one hole .189 in. (4,5 mm) dia. (No. 12 drill) in accordance with the dimensions in Fig. T-67 for mounting the flasher unit.

2. Drill one hole $\frac{3}{4}$ in. (18 mm) dia. in the dash, as shown in Fig. T-67.

3. Make the connections from the end of the flasher harness to the flasher switch and warning light, as indicated in the wiring diagram. The green lead connected to the X terminal on the flasher unit should be plugged into the spare hole in the petrol gauge snap connector.

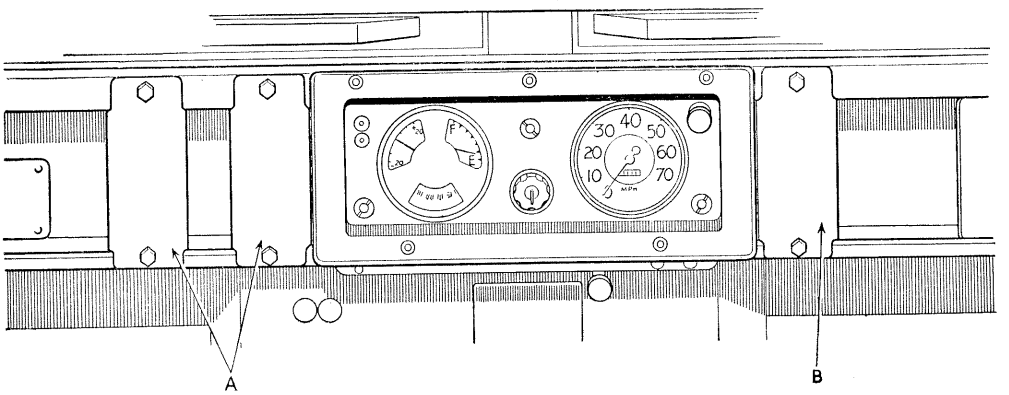
4. Mount the flasher unit to the dash, behind the instrument panel, using a drive screw and refit the instrument panel.

5. Fit the switch and warning light to the mounting bracket.

6. Secure the bracket to the upper glove box stiffener channel, by using the lower ventilator control fixings. Using the existing hole in the bracket as a guide, drill a $\frac{9}{32}$ in. (7 mm) dia. hole in the lower stiffener channel and secure bracket with a screw, washers and nut.

   The flasher switch and warning light mounting bracket is fitted to the R.H. side of the instrument panel on R.H.D. models and on the L.H. side on L.H.D. models.

   L.H.D. models fitted with oil pressure and/or water temperature gauge have the mounting bracket fitted between the steering column and



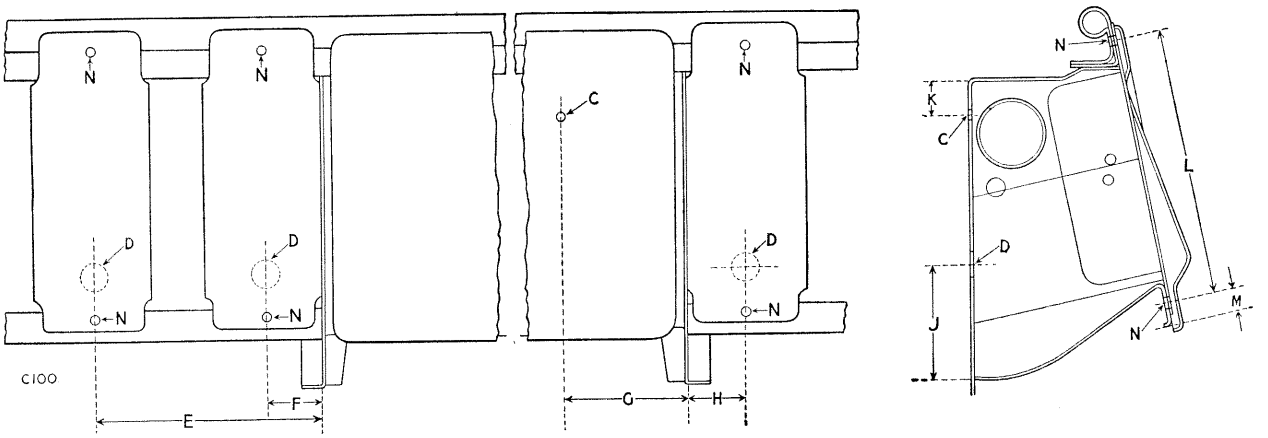


Fig. T-66—Position of flasher mounting bracket, early models

A—Alternative position of bracket on L.H.D. models.
B—Position of bracket on R.H.D. models
C—Hole in dash for flasher unit mounting .189 in. dia. (5 mm)
D—Hole in dash for flasher harness $\frac{3}{4}$ in. dia. (19 mm)
E—5 $\frac{5}{16}$ in. (135 mm)
F—1 $\frac{5}{16}$ in. (33 mm)
G—3 in. (76 mm)
H—1 $\frac{5}{16}$ in. (33 mm)
J—2$\frac{1}{2}$ in. (63 mm)
K—$\frac{3}{4}$ in. (19 mm)
L—6$\frac{1}{4}$ in. (158 mm)
M—$\frac{7}{16}$ in. (11 mm)
N—Hole in glove box stiffener $\frac{9}{32}$ in. dia. (7 mm)

the gauge panel, which means that the ventilator control fixing cannot be used and a further $\frac{9}{32}$ in. (7 mm) hole must be drilled as shown in Fig. T-67.

7. Fit a rubber grommet to the $\frac{3}{4}$ in. (19 mm) dia. hole in the dash and feed the harness through. Clip the harness to the dash panel.

8. Feed the flasher harness for the rear lamps through the side member, the harness emerging at the rear of the member with the rear light harness.

   It will be found that the best method of feeding the lead through the chassis member is to disconnect the wires of the frame harness at the rear of the vehicle, then attach a length of soft iron wire to the leads and withdraw leads and wire back through the side member. Attach the flasher harness to the iron wire and pull wire and harness back through the chassis.

9. Cut out two holes $1\frac{7}{16}$ in. (36 mm) dia. in the rear body panel to take rear flasher lamps. The cappings are pre-drilled to the correct size.

10. Connect the harness to the lamps and fit the lamp to the body. Connect the earth terminal to the rear cross-member.

11. Drill the wings as shown in Fig. T-31.

12. Move the side lamps to the inner hole.

13. Pass the harness through the wing valances and connect to flasher lamps.

14. Fit the lamps to the wings in the position vacated by the side lamps.

15. Check flasher system for correct operation.

Flashing indicators, late type—All models

To fit **Operation T/84**

1. Remove the five screws and lower the instrument panel, drill one hole .189 in. (4,5 mm) dia. (No. 12 drill) in accordance with the dimensions in Fig. T/67 ('C') for mounting the flasher unit.

2. With the steering wheel spokes vertical, offer the flasher switch to the steering column boss near the top of the steering column dust shield. Secure the flasher switch to the column. Do not fully tighten.

3. Adjust the flasher switch until it lies midway between the steering wheel spokes and tighten the fixings with the rubber operating ring slightly pre-loaded. Check the operation of the switch.

4. Run the harness down the column and into the instrument panel box through the hole in the side of the panel box. Use a rubber grommet. Secure the leads to the column, using the cleat provided. Secure the harness in the instrument panel box to the horn lead clip.

5. Secure the lead—black with red, to the terminal P on the flasher unit and the flasher switch lead —green with brown to terminal L and secure the flasher unit to the dash. The short green lead supplied should be connected to terminal B on the flasher unit, the other lead to be plugged into the spare hole in the petrol gauge snap connector. The black with white lead from the flasher switch should be drive-screwed into the dash.

6. Remove the two rear lamp cover plates from inside the vehicle.

7. Cut out two holes $1\frac{7}{16}$ in. (36 mm) dia. in the rear body panel to take the rear flasher lamps. The cappings are pre-drilled to the correct size.

8. Drill the front wings as shown in Fig. T/69.

9. Move the side lamps to the inner holes.

10. Disconnect the rear light connections from the main feed harness where it emerges from the chassis side member grommeted hole.

11. Remove the grommet from the chassis side member and secure a length of strong string to the main harness. Withdraw the harness through the side member to the front of the vehicle.

12. Attach the new flasher harness to the main harness and pull the pair through the side member to the rear. Replace the grommets.

13. Reconnect the rear lights to the main harness and make the connections between rear flasher lamps and flasher harness and secure the flasher lamps to the rear body panels.

    Replace the two-way earth clip on the frame with the four-way provided and make the lamp earth connections.

14. Connect the short twin cable flasher harness to the flasher switch harness in the instrument panel box, using snap connectors and ensuring that the colours are correctly matched.

15. Run the short harness through the grommeted hole carrying the vehicle main harness in the dash, and connect to the rear flasher harness and to the front flasher lamp harness, using snap connectors and ensuring that the colours are correctly matched. See the wiring diagram. Replace the two-way earth snap connectors on the side lamp harness with the four-way provided, and earth the flashers and side lamps.

16. Connect the front harness to the front flasher lamps. Green with red to the L.H. front flasher and green with white to the R.H. front flasher.

17. Secure the lead between harness and L.H. rear flasher lamp to the number plate harness, using the clip provided.

18. Check flasher system for correct operation. Ensure that the self-cancelling switch returns correctly. Adjust as necessary.

19. Replace rear lamp cover plates.

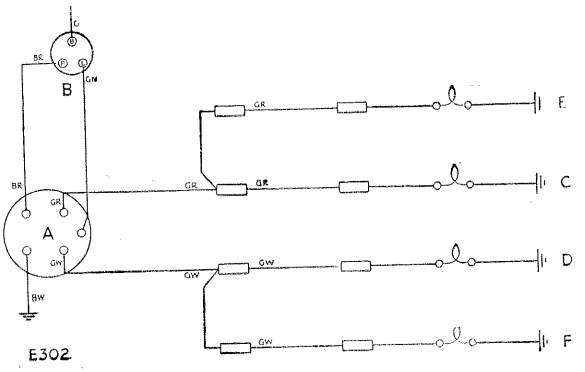


Fig. T-67—Flasher wiring diagram—late type

A—Switch and pilote light
B—Flasher unit
C—L.H. front flasher
D—R.H. front flasher
E—L.H. rear flasher
F—R.H. rear flasher

Colour code:
B—Black G—Green N—Brown R—Red W—White

Flashing indicator, late type, to service

Operation T/86

To replace warning bulb

1. Remove the nuts and bolts securing the indicator switch to the column.
2. Remove the two cover retaining bolts from the switch and unscrew the long chromed bolt until the cover can be removed.
3. Withdraw the long bolt, which also acts as a pivot for the operating lever, and gently remove the operating lever.
4. Replace the bulb and complete the operation by reversing the dismantling and removal procedure.

To remove flasher switch

1. Remove the fixings and withdraw the instrument panel as far as possible.
2. Remove the flasher unit and disconnect the leads—black with red, and green with brown.
3. Disconnect the remaining flasher leads—green with brown and green with white at the snap connectors, and the lead—black with white drive-screwed to the bulkhead.
4. Remove the nuts and bolts securing the indicator switch to the column, and withdraw complete with harness.
5. To refit, reverse the removal procedure with reference to the appropriate wiring diagram.

Trailer plug and socket

To fit

Operation T/88

Appropriate cable colours in parenthesis. See wiring diagram.

1. Using the dummy socket bracket as a template, mark off two mounting holes on rear cross-member, $1\frac{5}{8}$ in. (41 mm) from inner face of step mounting bracket to centre of socket aperture and 1 in. (25 mm) down from the bottom of the cross-member.
2. Drill two holes, $\frac{13}{64}$ in. (5 mm) and secure bracket to cross-member, using self-tapping screws.
3. Mark a point, $1\frac{3}{4}$ in. (44 mm) from the centre of the rear plug socket, towards the outer edge of cross-member, $1\frac{1}{4}$ in. (32 mm) from bottom edge, and drill a $\frac{15}{32}$ in. (12 mm) hole.
4. Fit a rubber grommet to the hole, then fit dummy socket to bracket, and thread flasher plug lead through grommet.
5. Fit the trailer socket and leads to rear cross-member.

Fitting vehicle flasher plug (items 6-12 inclusive)

6. Remove R.H. rear wheel and disconnect flasher and rear light wires from snap connectors under wheelarch.
7. Fit double snap connectors to main tail lamp lead from harness (red) and reconnect rear lamp wire.
8. Connect the stop and tail light wires from the lamps (green and purple) to the flasher plug wire (yellow) with a snap connector.
9. Connect the R.H. flasher wire (white and green) to the flasher plug wire (buff) with a snap connector.
10. Connect the L.H. flasher wire (red and green) to the flasher plug wire (purple) with a snap connector.
11. Connect the flasher plug earth wire (blue) to the existing earth wire on the rear cross-member, using an earth bridge lead.

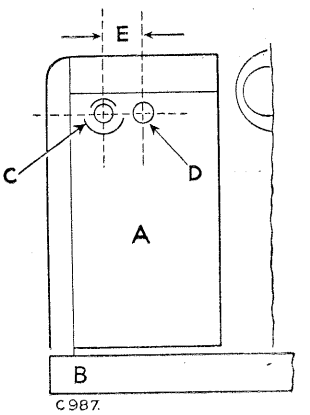


Fig. T-68—
Additional drillings in front wings

A—Wing
B—Bumper
C—Existing side light position
D—One new hole, $1\frac{7}{16}$ in. (36 mm) dia.
E—$3\frac{1}{4}$ in. (82 mm)

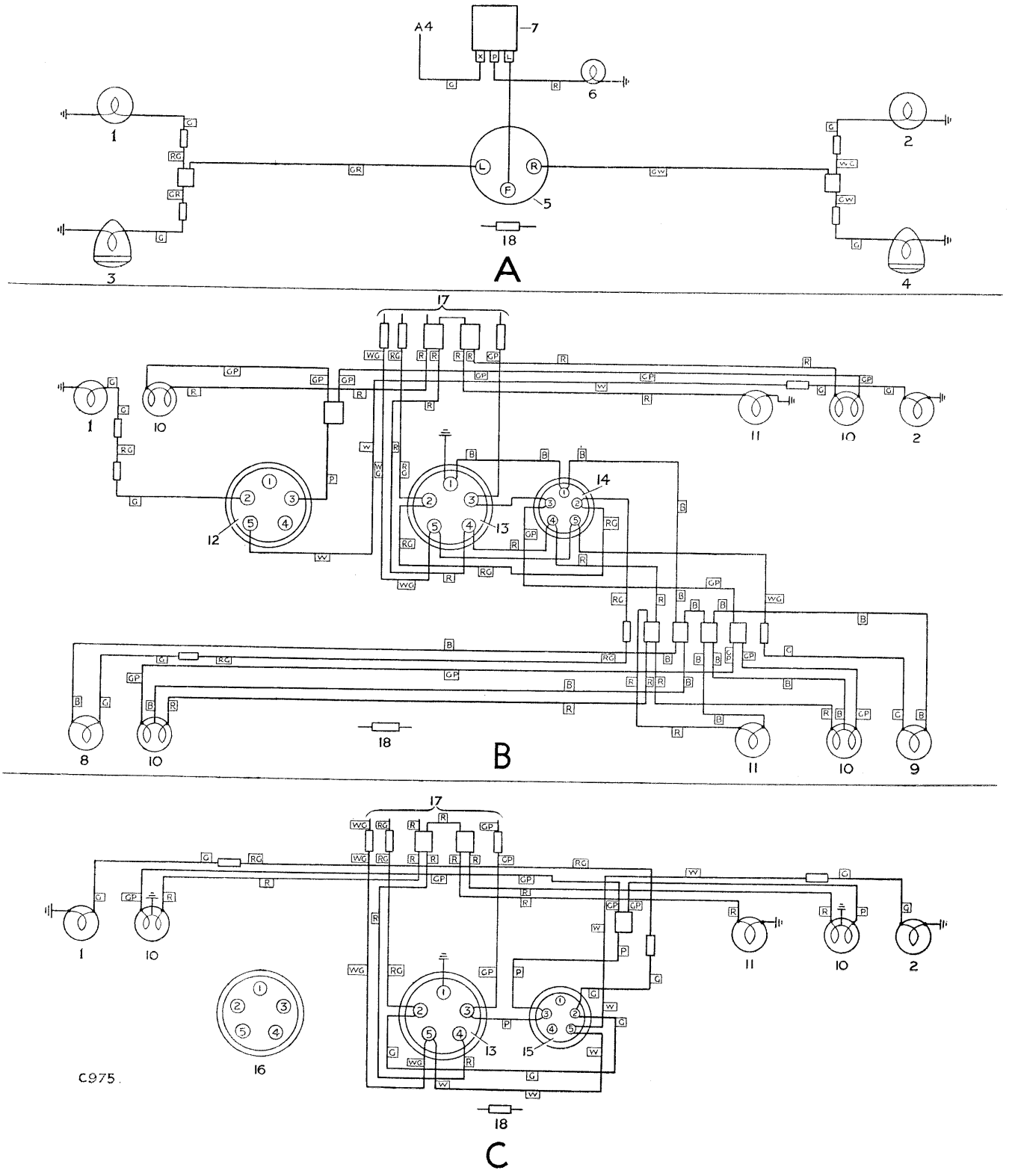


Fig. T-69—Flasher (early type) and trailer plug wiring diagrams

Key to Fig. T-69

A—Wiring diagram for flashers only.

B—Wiring diagram, using trailer and flashers. On this diagram, flashers are disconnected and trailer plug is in use, giving flashers on trailer.

C—Wiring diagram, using flashers and trailer socket. On this diagram, the rear flashers are shown connected via the trailer socket, and vehicle flasher plug; the plug must be in this position when the trailer is not in use.

1 Rear flasher lamp L.H.
2 Rear flasher lamp R.H.
3 Front flasher lamp L.H.
4 Front flasher lamp R.H.
5 Self-cancelling switch
6 Warning light
7 Flasher unit
8 Trailer flasher lamp L.H.
9 Trailer flasher lamp R.H.
10 Stop and tail lamp
11 Number plate illumination lamp
12 Vehicle flasher plug in dummy trailer socket
13 Trailer socket
14 Trailer plug
15 Vehicle flasher plug
16 Dummy trailer socket
17 Wiring as diagram "A" from this point
18 Snap connectors shown thus:

KEY TO CABLE COLOURS

B—Black	N—Brown	R—Red	W—White
G—Green	P—Purple	U—Blue	Y—Yellow

RN—Red with Brown and so on

12. The flasher plug wire (white) is for the rear lamps. Leave disconnected as the lamps are coupled direct from the main harness.

Trailer socket wiring (items 13-19 inclusive)

13. Connect trailer socket wire (red) to main loom wire (red) with a two-way snap connector.
14. Connect L.H. and R.H. tail lamp wires (red) to connectors (13).
15. Using tail lamp bridge lead, connect snap connectors (14) together.
16. Connect the trailer socket wire (green and purple) to the main loom wire (green and purple) with a snap connector.
17. Connect the R.H. flasher trailer socket wire (white and green) to main loom wire (white and green) with a snap connector.
18. Connect the L.H. flasher trailer socket wire (red and green) to the main loom wire (red and green) with a snap connector.
19. The trailer socket wire (black) goes to earth on rear cross-member with the main loom earth connection, using the earth bridge lead.

Fitting trailer plug and lead (items 20 and 21)

20. Pass the trailer plug wires through the retaining clip along the draw bar.
21. Connect the rear lamps, stop lamp and flashers to the terminals. See wiring diagram.

To use trailer plugs

22. Trailer not in use: remove trailer plug and fit flasher plug into trailer socket at rear cross-member.
23. Trailer in use: fit trailer plug from draw bar to trailer socket on rear cross-member and fit flasher plug into dummy socket.

12 volt A.C. generator—2¼ litre Petrol models

To fit **Operation T/90**

1. Remove the bonnet and disconnect the battery lead.
2. Remove the flexible connection between the air cleaner and carburetter and remove the cleaner complete.
3. Remove and discard the dynamo and the fan belt.
4. Slacken the four set bolts securing the fan and pulley to the water pump and, removing the securing bolt, remove the dynamo adjusting link.
5. Remove the lifting bracket from the front of the cylinder head and discard.
6. Remove the dynamo anchor bracket from the cylinder block and discard.
7. With the engine cold, remove one at a time the two most forward cylinder head bolts adjacent to the thermometer switch on the left-hand side of the engine and replace with the special set bolts (½ in. U.N.F. x 4 9/16 in long). Pull the bolts down to 65 lb/ft. (9 Kg/m).
8. Fit the generator mounting bracket to the top holes in the special bolts, but do not tighten fully at this stage.
9. Fit the packing piece to the cylinder head, together with the generator front mounting bracket and secure in position with a set bolt and spring washers.

Idler wheel body on pulley assembly

10. Press the small bearing on to the idler spindle and fit the complete assembly into the idler wheel body.

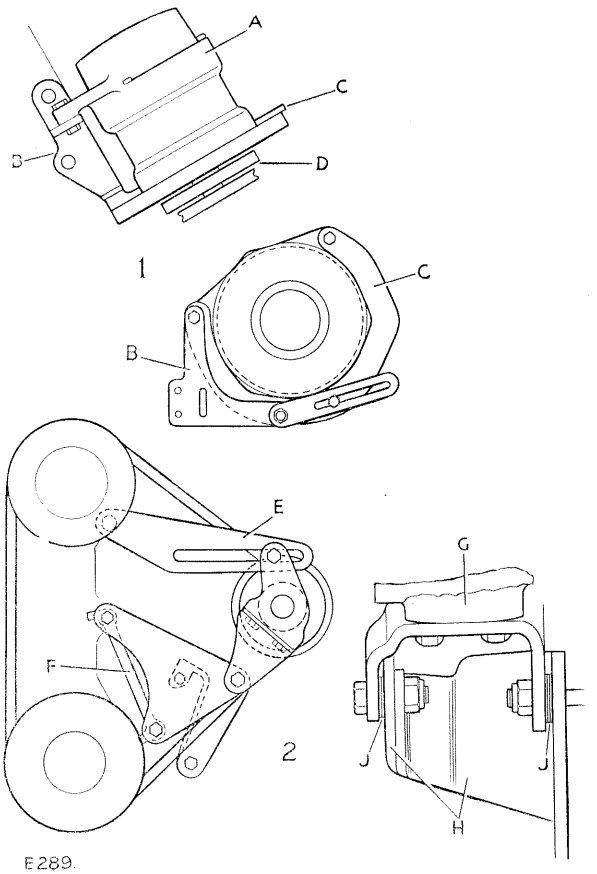


Fig. T-70—Diagrammatic layout of components

1—Alternator mountings
- A—Alternator
- B—Mounting brackets
- C—Yoke
- D—Fan

2—Idler body mounting and adjusting link
- E—Adjusting link
- F—Locking plate
- G—Idler body bracke
- H—Anchor brackets, front and rear

11. Half fill the idler body with front hub grease and fit the larger bearing with the bearing seal outwards on to the spindle and into the idler body. Care must be exercised to avoid damage to the bearing seal.
12. Secure the bearings and spindle with a circlip.
13. *Important:* Before fitting the double grooved pulley. Fit the adjusting link to the idler wheel body at the adjusting slot and see that the link is set away from the idler body.
14. Press the double grooved pulley on to the spindle with the larger diameter pulley towards the idler body and retain in position with a circlip.
15. Fit the plug and joint washer to the idler body.
16. Fit the short set bolt and joint washer to the lubrication hole in the idler body.
17. Assemble loosely to the idler body, the mounting bracket, with the joggle towards the pulley.
18. To the fixing hole in the joggle side of the idler body bracket, locate the pivot bolt complete with the two shim washers. First assemble the front anchor bracket on to the bolt with the bracket set away from the pulley, then assemble the rear anchor bracket on to the bolt. Secure the three brackets together with self-locking nuts.
19. Remove the crankshaft starting dog and withdraw the fan pulley sufficiently to remove the front cover securing bolt and the securing bolt immediately above.
20. Fit a long bolt ($3\frac{3}{4}$ in. (95 mm) into the original dynamo bracket top fixing hole in the engine cylinder block.
21. Fit the assembled idler pulley and fixing bracket to the front cover and secure the rear anchor bracket in position with two set bolts and spring washers to the original dynamo anchor bracket fixing holes in the cylinder block.
22. Secure the front anchor bracket to the front cover with set bolts, and secure with a locking plate.
23. Insert three shims between the idler body mounting bracket and rear anchor bracket; locate bracket and shims in position with the bolt fitted at item 20. Secure to the engine block with a self-locking nut.
24. Fit the adjusting link attached to the idler body, to the front cover behind the top fan pulley, using the set bolt and spring washer removed from the dynamo fixings.
25. Re-tighten the four set bolts securing the fan and fan pulley.
26. Re-tighten the lower fan pulley with the starting dog nut. Use a new lock washer.
27. Fit the fan to the generator with the fan blades inclined inwards, together with the drive pulley. Secure in position, using a spacing washer if necessary.
28. To the generator attach the yoke behind the generator body flange, using a special set bolt ($\frac{5}{16}$ in. A.N.F.—18 T.P.I.) and plain and spring washers.
29. Mount the generator complete with yoke to the mounting bracket previously fitted to the engine. Secure with bolts and spring washers and nuts.
30. Fit the adjusting link (removed with the dynamo fittings) to the front mounting bracket on the engine and to the centre hole in the yoke by the adjusting slot in the link.
31. Position the alternator driving belt between generator pulley and the large diameter pulley on the idler wheel.
32. Ensure that the driving belt between the generator pulley and idler wheel pulley is in line by adjusting the idler body on its mounting bracket. Tighten the set bolts, securing body to bracket.
33. Adjust the driving belt tension to allow the belt to move $\frac{1}{4}$ in. to $\frac{3}{8}$ in. (6 to 9 mm) when pressed by thumb between the pulleys. Secure the adjusting link.
34. Position the fan belt between top and lower pulleys on the engine and the small diameter pulley on the idler wheel.
35. Ensure that the fan belt is in line with the pulleys and finally tighten the top mounting bracket.
36. Adjust the fan belt tension to allow the belt to move $\frac{1}{4}$ in. to $\frac{3}{8}$ in. (6 to 9 mm) when pressed by thumb between the pulleys. Secure the adjusting link and check all fixing bolts.

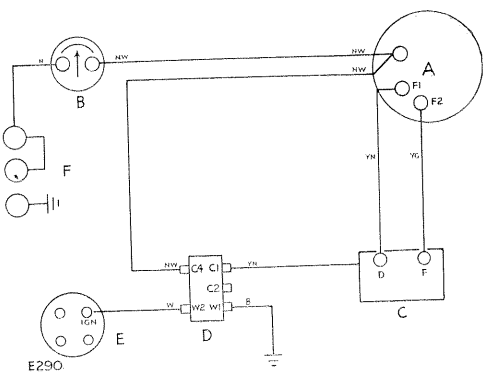


Fig. T-71—Alternator charging circuit

A—Alternator
B—Ammeter
C—Regulator box
D—Relay
E—Ignition and lighting switch
F—Terminals

Installation of new dash harness

1. Disconnect the leads from the horn and remove the clip securing all the wires to the bulkhead.
2. Disconnect the wires from the control box.
3. Remove the wires from the fuse box and junction box.

4. Disconnect the wires from the three-way snap connector, connecting dash harness to chassis harness.
5. Disconnect wiring from starter switch, oil switch, thermometer switch and choke warning light switch.
6. Disconnect the coil feed wires and remove control box earth connection.
7. Remove the control box.
8. Remove the instrument panel, and disconnect the speedometer cable.
9. Disconnect the dash harness wires from the instrument and at the snap connectors.
10. Remove the clip securing the harness to the bulkhead and withdraw the harness complete, withdrawing instrument panel wires and the grommet.
11. Enlarge the grommet hole in the bulkhead, situated behind the instrument panel, to 1 in. (25,4 mm) dia., to take the extra thickness of harness cable.
12. Fit the new regulator to the existing holes in the mounting bracket already secured to the scuttle. Note that if an auxiliary fuse box is fitted to the mounting bracket, remove and refit adjacent to the mounting bracket.
13. Fit the relay to the centre of the bulkhead, beneath the bonnet water rail.

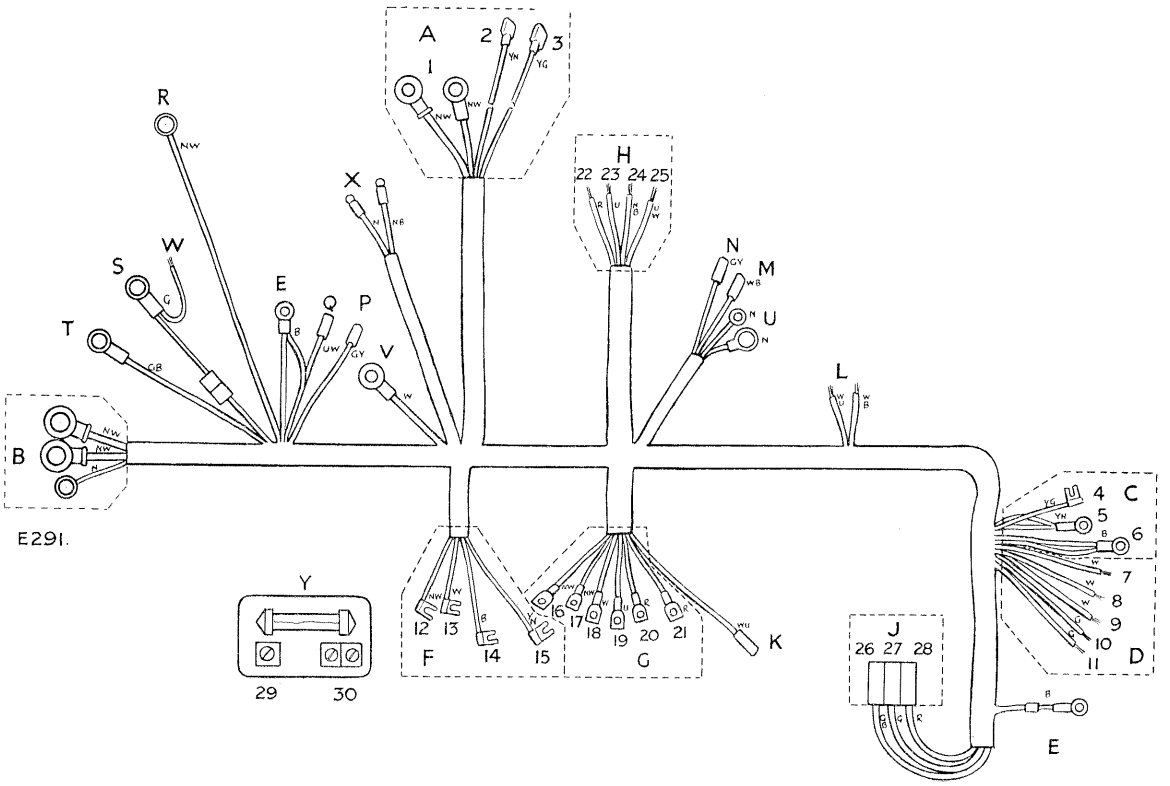


Fig. T-72—Dash harness connections

A—Alternator
- 1 Feed
- 2 To 'red' on alternator
- 3 To 'black' on alternator

B—Ammeter

C—Regulator
- 4 'F'
- 5 'D'
- 6 Earth

D—Fuse box
- 7 'A3'
- 8 'A3'
- 9 'A3'
- 10 'A4'
- 11 'A5'

E—Earth

F—Relay
- 12 'C4'
- 13 'W2'
- 14 'W1'
- 15 'C1'

G—Ignition and lighting switch
- 16 'A' feed
- 17 'A'
- 18 'Ignition'
- 19 'H'
- 20 'S'
- 21 'S'

H—Junction box
- 22 Tail
- 23 Head
- 24 Horn
- 25 Main beam warning light

J—Frame junction
- 26 Tail
- 27 Stop light switch
- 28 Petrol tank unit

K—Choke warning light

L—Choke warning light switch

M—Thermo-switch

N—Oil pressure switch

P—Oil warning light

Q—Main beam warning light

R—Inspection socket

S—Petrol gauge 'B'

T—Petrol gauge 'T'

U—Starter switch

V—Ignition coil

W—Windscreen wiper

X—Horn

Y—Fuse box details
- 29 White wire
- 30 Green wire

14. Fit the new harness connections for the instruments and ammeter to the enlarged hole in the bulkhead and into the instrument panel box. Feed the ammeter wires through the demister tube hole on the left-hand side of the tunnel aperture. If demister tubes are fitted enlarge the hole and grommet as necessary.
15. Connect the lead to the generator in accordance with the wiring diagram.
16. Fix a suitable clip and rubber grommet to one of the securing screws on the generator cover plate and secure the cable to the clip.
17. Secure the cable from the generator along the left-hand side wing valance folded edge with the clips and screws supplied.
18. Connect the horn wires to the horn and secure the leads to the scuttle.
19. Connect wires to the relay mounted on the scuttle, in accordance with the wiring diagram and fit the rubber cover.
20. Connect the wires to the regulator box in accordance with the wiring diagram.
21. Connect the three earth terminals on the harness to the lower fixing bolt securing the regulator to mounting bracket.
22. Connect the leads to the ignition fuse box and the junction box in accordance with the wiring diagram.
23. Connect the leads to the starter switch, oil warning light switch, ignition and lighting switch, choke warning light switch and ignition coil, in accordance with the wiring diagram.
24. Connect the harness wires to the three-way connector on the chassis frame harness in accordance with the wiring diagram and secure to the scuttle with a clip.
25. Secure the harness to the bulkhead as necessary.
26. Remove the ammeter from the multiple instrument and fit the blanking plate supplied in its place.
27. Remove charging warning light complete with leads and fit the plug supplied in its place.
28. Connect the wires of the new harness to the instruments and snap connectors in accordance with the wiring diagram.
29. Reconnect speedometer cable and refit the instrument panel.
30. Paint the ammeter mounting bracket the colour of the vehicle and fit the new ammeter.
31. Connect the leads to the ammeter in accordance with the wiring diagram.
32. Fit the mounting bracket and ammeter to the dash below the windscreen ventilator control and secure the top of the mounting bracket to the ventilator control fixing bolt.
33. Secure the rear of the mounting bracket to the glove box panel, using the fixings provided.
34. Use the mounting bracket as a template and drill a $\frac{3}{16}$ in. (4,7 mm) dia. hole in the grabrail and secure with the fixings provided.
35. Connect the battery leads and refit the oil bath air cleaner and the flexible pipe between cleaner and carburetter.
36. Test as follows:—

    Check operation of generator fittings;

    Check head, side and tail lights.

Servicing the alternator and ancillary equipment

General maintenance (points to check when the vehicle receives a major overhaul).

Lubrication

Pre-packed bearings, requiring no attention between major overhauls.

Brush gear

Excessive wear is unlikely as the brushes run on the smooth unbroken surface of the slip rings.

If for any reason excessive wear has taken place, the brushes should be replaced if worn to less than 0.400 in. (10 mm).

Brush spring tension (new brush) should be $7\frac{1}{2}$ oz. (213 grammes).

In service it is permissible for this value to fall to 4 oz. (113 grammes) (fully worn brush).

When changing brushes, the slip rings should be cleaned with a piece of smooth glass-paper. *Under no circumstances should emery cloth or other similar abrasives be used.*

Control box

Periodically check that the control box open circuit setting is within the specified limits. See under 'Testing the control box' on the following page.

Rectifiers

Inspect the alternator diode rectifiers and if necessary carefully wipe off any dirt or oil, which may have accumulated.

Fault diagnosis and service testing

Fault finding should always be carried out in a systematic manner. It is only necessary to carry out tests on the alternator rectified output (D.C.) side, as any faults in the A.C. section will be obvious by their effect on the D.C. output.

Equipment required

1. A good quality moving coil D.C. ammeter, capable of accurate readings up to at least 75 amps.
2. A good quality moving coil D.C. voltmeter, scale 0-20 volts.

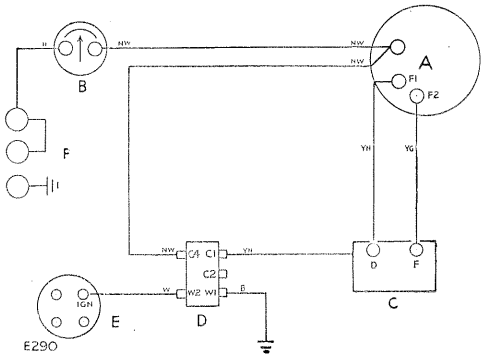


Fig. T-73—Alternator charging circuit

A—Alternator
B—Ammeter
C—Regulator box
D—Relay
E—Ignition and light switch
F—Terminals

Testing the alternator current output

1. Check the driving belt tension. The correct tension is when the driving belt can be depressed by the thumb $\frac{1}{4}$ to $\frac{3}{8}$ in. (6-9 mm), between pulleys.
2. Disconnect the battery earth lead.
3. Disconnect both cables from alternator output terminal 'G'.
4. Connect a D.C. ammeter between the alternator main terminal 'G' and the two cables previously disconnected from this terminal.
5. Disconnect the brown-with-green cable from the control box terminal marked 'F' and temporarily connect it to earth (vehicle chassis).
6. Reconnect battery earth lead—switch on the ignition, start the engine and slowly open the throttle until alternator speed is approximately 2,500 r.p.m. At this point the reading at the ammeter should be in excess of 45 amps., with the alternator at ambient temperature.

Conclusions

1. If satisfactory, a reading in excess of 45 amps. should be obtained at 2,500 alternator r.p.m., with the alternator at ambient temperature.
2. A low reading at 2,500 r.p.m. will indicate either a faulty alternator, bad earths or poor circuit wiring connections. If after checking the latter a low reading is still given, a replacement alternator is required.
3. A zero reading can be the result of a faulty alternator, faulty field isolating relay, or its associated circuit. If the relay fails to close it will prevent the rotor field circuit from being completed across contacts 'C1' and 'C4'.

   The alternator will not generate if the contacts fail to close when the ignition is switched on.

Testing the relay

1. With the D.C. ammeter connected as for the alternator test, connect a bridging lead between terminals 'C1' and 'C4' and again check alternator output.

Conclusions

1. If with the ignition switched on the alternator now charges with the bridging lead across 'C1' and 'C4', it indicates a faulty relay and the usual checks for continuity of relay windings, faulty wiring and earth connections, should be carried out.

   If fault still not eliminated, replace the relay unit.

Testing the control box

If after testing the alternator and relay the alternator proves to be capable of supplying its full output, and provided the control box earth is satisfactory, and previous checks on the wiring have been carried out, the fault lies in the control unit itself and a replacement unit should be fitted. Apart from re-setting, if necessary, the open-circuit voltage, no other adjustment should be attempted.

Checking and adjusting the open-circuit voltage

1. Disconnect battery earth lead.
2. Disconnect the battery (brown with white) cable from the alternator terminal 'G' leaving the smaller (brown with white) cable, which connects to the relay contact 'C1' in position. Care being taken not to short-circuit the battery lead to earth.
3. Connect a D.C. voltmeter between the main 'G' terminal of the alternator and earth.
4. Reconnect battery earth lead.
5. Switch on the ignition and start the engine.
6. Raise the engine speed momentarily to half-throttle or more to achieve self-excitation, then slowly reduce the alternator speed to approximately 3,000 r.p.m. At this point the open-circuit voltage at 20°C (68°F) should be 14.9-15.3 v. Temperature correction factor is 0.1 volt. **Add** this to standard setting for every 10°C (18°F) below 20°C. Conversely **subtract** for every 10°C above 20°C.
7. If necessary adjust the setting by removing the regulator cover and altering the setting screw as required. **Clockwise** to **increase** the voltage, or **anti-clockwise** to **decrease** the voltage, whilst maintaining an alternator speed of approximately 3,000 r.p.m. Make the adjustments as quickly as possible.
8. Increase the alternator speed to 4,500 r.p.m. when the open-circuit voltage must not exceed 15.8 v.
9. Switch off engine and remove battery earth lead, replace cover and reconnect the main (brown with white) cable to the alternator terminal 'G'.
10. Reconnect battery earth lead.

Conclusions:

1. If the regulator setting is unstable, particularly at the maximum speed of 4,500 r.p.m., the unit should be replaced.

Fault diagnosis procedure

Charging faults

'Flat' battery or low state of charge

1. Check battery condition.
2. Check driving belt tension.
3. Test alternator, relay and control box as necessary.

   Check to make certain that the field isolating relay opens when the ignition is switched off, otherwise the battery will be continually discharging through rotor field.

Battery overcharged

1. Test control box.
2. Check battery condition.

Alternator not charging or charging intermittently

1. Check driving belt tension.
2. Test alternator, relay and control box, as necessary.

Service notes

1. Due to the stresses imposed on the driving belt by the alternator it is absolutely essential to check periodically that there is no slackness in the driving belt and that the pulleys are in good condition.
2. Bad earths or loose wiring connections, particularly those associated with the regulator, will cause low alternator output.
3. Failure of the isolating relay contacts to open when the ignition is switched off will result in partial or complete discharge of the battery, depending on the length of time the fault exists.
4. The control box is polarised to suit a specific earth polarity. Earthing the wrong battery terminal will damage the regulator and the rectifiers in the alternator.

Rear seats—all models

To fit **Operation T/92**

1. Ensure that the support angles on the seat frame assembly are set and fitted in their correct positions, as below. For 88 models use the upper pair of holes and 109 models use the lower pair of holes. Leave the bolts loose until the seat frame assembly is in position.

88 models

2. Place each rear seat frame in position on the wheelarch box, ensuring that the support angles engage with the existing slots on the underside of the body cappings.
3. Drill two $\frac{1}{4}$ in. (6 mm) dia. holes in the wheelarch box, using the frames as a guide, and secure each seat frame to the wheelarch box by means of bolts, plain and spring washer and nuts. Tighten the support angle bolts.
4. Secure backrest panels to the seat back frames with bolts, spring washers and nuts.
5. Place each seat cushion in position and attach to the seat frame with the tapes provided.

109 models

It is possible to fit either one or two seat assemblies to each wheelarch box. The following items are for fitting two assemblies to each wheelarch box. Note also that when four seats are fitted it is necessary to remove the spare wheel, and blank the wheel well with a cover plate. A cover plate and a special dished bonnet to take the spare wheel are available.

6. Remove the spare wheel from the well and remove all the clamping attachments from the body capping.
7. Fit the two rubber buffers to the back of each seat frame, in the existing holes in the frame, just above the support angle, using two screws, packing washers, plain washers and nuts.
8. Repeat items 2-5 inclusive, noting that four packing washers must be fitted between the seat frame and the wheelarch box before securing with the two bolts, spring and plain washers and nuts.

Locking door handles—all models

To fit **Operation T/94**

1. Remove both door handles complete with locks and mounting plates.

R.H. door lock (locking)

2. Withdraw the key from the door lock and remove the locking plate, loosely secured by a pin; remove the lock securing nut.
3. Fit the lock to the new door handle with the key slot serrations facing downwards (unlocked) and the plain washer between the lock and bracket.
4. Replace the lock securing nut, but do not fully tighten.
5. Refit the locking plate so that the hooked part is uppermost.
6. Fit the pin to the locking plate, check the operation of the lock, and peen over the end of the pin.
7. Screw the slotted nut back to the locking plate.
8. Remove the exterior handle support bracket from the original door lock, transfer the rubber washer from the old handle to the new, and discard the old handle.

9. With the catch in the unlocked position, fit the handle to the door lock, securing with the support bracket and original fittings. The screw heads must be to the door interior.
10. Fit the handle and lock complete to the R.H. door, using the original fixings, then tighten the slotted nut securing the catch lock, using a special 'C' spanner, Part No. 248877.
11. Open out the centre inner hole at the rear of the mounting plate to $\frac{3}{16}$ in. (4,5 mm).
12. Secure the pillar in the drilled hole, using a plain washer, spring washer and nut.
13. Check the operation of the lock.

L.H. door lock (with catch)

14. Remove the top front screw, securing the lock to the mounting plate.
15. Secure the catch to the vacant hole, using a screw, plain washer and nut.
16. Ensure that the catch moves freely, and prevents the door handle from being lifted when in the lowered position.

Window locks

17. With the side screws shut, position the brackets of the catch assembly on the bottom rail, so that the screws are just clear of the rear of the sliding windows.
18. Drill two $\frac{13}{64}$ in. (5 mm) holes through each bracket into the bottom rail and secure each bracket with the two pop rivets provided.

Extra windscreen wipers—all models

To fit Operation T/96

1. Remove the blanking piece and washer from the passenger's side windscreen after withdrawing the two screws, spring washers and nuts.
2. Fit the new windscreen wiper motor to the windscreen, with the escutcheon and seal on the outside, using the fixings provided.
3. Remove the rubber plug and fit the plug socket in the hole in the glove box top.
4. Withdraw the five screws and lower the instrument panel.
5. Connect the feed lead to the two-way connector in the green lead to the fuel gauge terminal 'B'.
6. Replace the rubber plug in the instrument box side with a grommet ; pass the feed lead through the grommet and, with a cap placed on the lead, connect it to the plug socket.
7. Clip the feed lead to the rear of the glove box, using a clip.
8. Cut the feed lead with plug at a point 4 in. from the terminal end and bare the wire at the ends.
9. Connect the section of the lead with the plug between the wiper motor and the plug socket and the other portion with the terminal to a drive screw on the windscreen rail to act as an earth.
10. Fit the wiper arm to the motor, and the blade to the arm.
11. Adjust the blade position and test the wiper operation.
12. Replace the instrument panel.

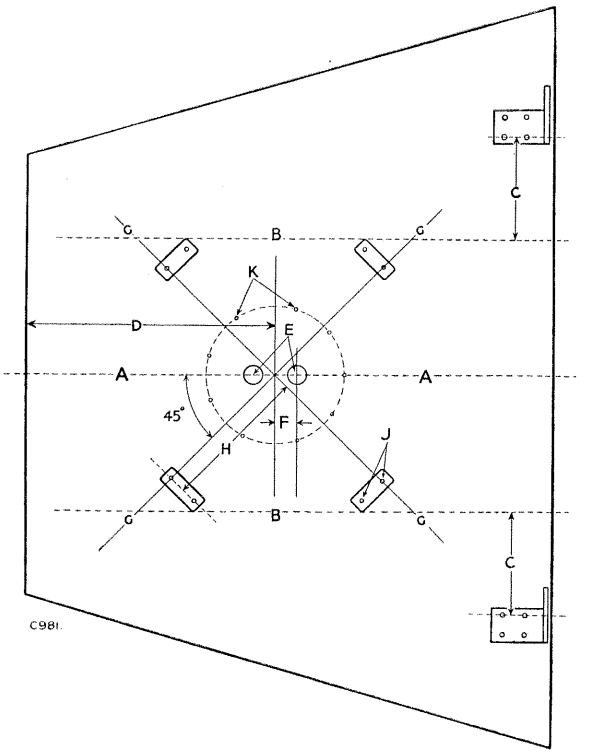


Fig. T-74—Bonnet panel carrier dimensions

A—Centre line
B—Guide lines
C—7½ in. (190 mm)
D—18⅛ in. (460 mm)
E—2 new holes, 1½ in. (38 mm) dia.
F—1 11/16 in. (42 mm)
G—Diagonals
H—11⅛ in. (282 mm)
J—Eight new holes $\frac{7}{32}$ in. (5,5 mm) dia.
K—Nine new holes—No. 6 drill .204 in. (5 mm) dia.

Spare wheel carrier on bonnet—all models

The following items are for fitting a spare wheel carrier to the existing bonnet on 88 models. A special dished bonnet, which must be fitted to 109 models, is available, which only requires the support plate fitting.

The clamps are reversible to accommodate 6 in. or 7 in. tyres.

To fit **Operation T/98**

1. Mark a centre line, with a pencil, along the bonnet from front to rear.
2. **88 models:** Mark a guide line on each side of this line, $7\frac{1}{2}$ in. (190 mm) from each inner hinge fixing. See Fig. T-33.
3. Mark and centre pop the centre line at $18\frac{1}{8}$ in. (460 mm) from the front edge of the bonnet, and using this as a centre, mark off a point either side at $1\frac{11}{16}$ in. (42 mm) and cut two $1\frac{1}{2}$ in. (38 mm) dia. holes.
4. **88 models:** Mark out from the centre pop, four diagonal lines, 45° to the centre line, as shown in Fig. T-33, then mark each line at $11\frac{1}{8}$ in. (282 mm) and drill a $\frac{7}{32}$ in. (5,5 mm) dia. hole.
5. Fit two bolts and clamps to the support plate, then secure a split pin to each bolt.
6. Locate the spare wheel support, complete with clamp to bonnet, ensuring that the two bolts are over the centres of the two $1\frac{1}{2}$ in. (38 mm) dia. holes.
7. Using the support plate as a template, drill nine .204 in. (5 mm) dia. holes (No. 6 drill) and rivet assembly to bonnet.
8. **88 models:**
   (*a*) Position the four rubber support blocks on the diagonal lines, and secure with a screw, large plain washer, small plain washer, spring washer and nut to the hole previously drilled. Do not fully tighten.
   (*b*) With the outer lower edge against the guide line, and using the hole in the block as a guide, drill four more $\frac{7}{32}$ in. (5,5 mm) holes. Secure to bonnet, and tighten.

Towing attachments—all models

To fit **Operation T/100**

1. All towing attachments can easily be fitted, using the nuts, bolts, spring and plain washers provided.

Full length hood—all models

The soft hood completely encloses the vehicle and can be opened at the rear to facilitate loading. It is available with plain sides or, for Export territories only, with side windows.

To fit **Operation T/102**

1. Fit the two hood sticks in the sockets at the corners of the rear body and secure with clamp arms, bolts, washers and nuts.
2. Secure the tie tube between the sticks by means of self-locking nuts.
3. Fit the intermediate hood stick between the tie tube, securing it with locknuts.

   On 109 models the intermediate hood stick is full length and should be secured to the body side cappings, using four bolts and two nut plates.
4. Secure the top drain channels to the front hood stick, using bolts, plain washers and self-locking nuts. Fit the adjustment plate between the top drain channel and the windscreen top rail.
5. If not already fitted, secure the door rear drain channels to the front hood stick with bolts, plain washers and self-locking nuts.
6. Secure the two rope hooks (one L.H., one R.H. —the hook towards the door jamb) to the body sides, $\frac{1}{4}$ in. (6 mm) from the door jamb, with the top of the rope hook touching the capping, using the 2 B.A. nuts, screws and washers provided.
7. Secure the two staples to the tailboard cotter brackets by removing the second pair of rivets down on each bracket. Fix the staples to the brackets with the $\frac{3}{4}$ in. (19 mm) long 2 B.A. screws, nuts and washers provided.
8. Place the hood over the sticks and secure it to the windscreen top rail.
9. Secure the front support straps to the staples on the windscreen top rail.
10. Secure the rear hood straps to the staples on the body and the side curtain straps to the front hood stick.
11. Pass the side ropes round the hooks at the front corner of the body, secure under the side hooks, and together with the rear ropes, to the hooks at the rear of the body.
12. Push the rear curtain side flaps through the side pockets and secure.

Three-quarter length hood—all models

The soft hood encloses the vehicle rear body, behind the cab, and can be opened at the rear to facilitate loading. It is available with plain sides or, for Export territories only, with side windows.

To fit **Operation T/104**

1. Position the drain channels against the cab rear panel so that with the lower edge resting on the rear body front capping, each drain channel protrudes approximately $\frac{1}{8}$ in. (3 mm) out from the body side capping. The drain channels are shaped to go round the hood stick.
2. Using the drain channels as templates, drill six holes $\frac{17}{64}$ in. (7 mm) dia. and secure the channels to the cab rear panel, using the fixings provided.
3. Position the hood mounting frame centrally against the cab rear panel and resting on the drain channels.

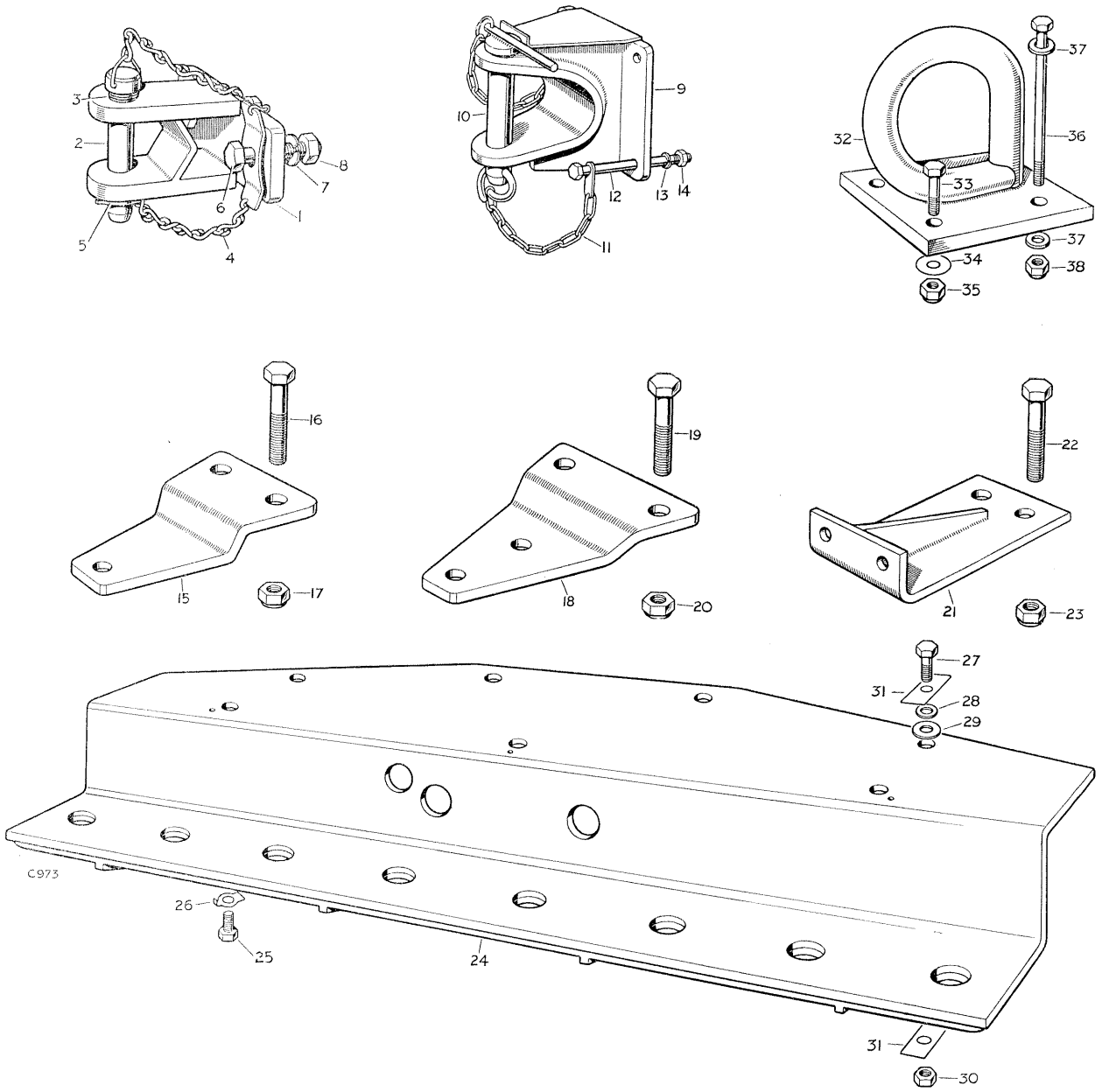


Fig. T-75—Towing attachments

1	Towing jaw assembly	Standard equipment
2	Pintle pin for jaw	
3	Spring for pin	
4	Retaining chain for pin	
5	Spring clip for chain	
6–8	Fixings—jaw to chassis frame	
9	Towing jaw	
10	Towing jaw pin	
11	Chain for towing jaw pin	
12–14	Fixings—jaw to chassis	
15	Rear tow plate	
16–17	Fixings—tow plate to rear draw bar	
18	Rear tow plate	For use with combine harvester only
19–20	Fixings—tow plate to rear draw bar	
21	Anchor plate for towing jaw	Only required when power take-off is fitted
22–23	Fixings—tow plate to rear draw plate	
24	Rear tow plate	
25–31	Fixings—towing plate to rear cross-member	
32	Lifting and towing ring	
33–35	Fixings—towing ring to front bumper	
36–38	Fixings—towing ring and bumper to frame	

4. Using the mounting frame as a template, drill twelve holes $\frac{11}{64}$ in. (7 mm) dia. and secure the frame to the cab rear panel, using the fixings provided.
5. Fit the rear hood sticks in the sockets at the rear corner of the body and secure with clamp arms, bolts, washers and nuts.
6. Fit the front hood sticks in the sockets in the front corners of the body and secure with bolt plates, spring washers and nuts.
7. Secure the tie tubes between the sticks, using self-locking nuts.
8. Fit the intermediate hood stick between the tie tubes, securing it with self-locking nuts and, 109 models, securing the hood stick flanges to the pre-drilled holes in the body side cappings, using the fixings provided.
9. Mark a centre 9 in. (229 mm) from the door jamb and 2 in. (50 mm) down from the top of the rear body capping, and using the front rope hooks as templates, drill four holes and fix the rope hooks to the body sides, using the 2 B.A. nuts, screws and washers provided.

   Two rope hooks, one L.H., one R.H.—the hook should be towards the door jamb.
10. Secure the two staples to the tailboard cotter brackets by removing the second pair of rivets down on each bracket. Fix the staples to the bracket with the $\frac{3}{4}$ in. (19 mm) long 2 B.A. screws, nuts and washers provided.
11. Place the hood over the sticks and secure to the mounting frame. The hood retaining strips should be inserted in the top and side channels of the mounting frame. Peg the upper retaining strip into the side strip.
12. Fit the lower ends of the two side retaining strips to the staples on the mounting frame and secure with the short straps.
13. Fasten the two straps over the intermediate hood stick, secure the ropes to the rope brackets on the body sides and, together with the rear ropes, to the hooks at the rear of the body.
14. Secure the rear curtain straps to the two staples fitted to the rear of the body.
15. Push the rear curtain side flaps through the side pockets and secure.

Ventilator flyscreens

To fit **Operation T/106**

1. The flyscreens may be fitted, an inner and an outer to each ventilator orifice, by using the screens as templates and drilling twenty $\frac{7}{64}$ in. (2 mm) dia. holes and then fixing in position over each orifice using the drive screws provided.

FIRE FIGHTING EQUIPMENT

The pump, mounted at the rear of vehicle, is a two-stage, self-priming, high-pressure impeller type. A single shaft, supported on a plain bearing at the rearmost end and a ball bearing at the driving end, carries three impellers. The first impeller, furthest from the driving end of pump, withdraws air from the suction pipe, causing the necessary depression and thus inducing a flow of water to the pump. The two main impellers maintain and pressurise the water flow.

An engine speed governor and oil cooler are used in conjunction with the pump; drive is taken from the rear of the gearbox transfer casing by propeller shaft.

To prime the pump (Fig. T-77)

Operation T/108

1. Select the "Priming" position with lever (1) and remove wing cap (2); pour water into the filler neck until it flows from the exhaust pipe (3), then replace the wing cap.

To engage the pump drive (Fig. T-77)

Operation T/110

1. Start the engine with the transfer gear lever in neutral position; depress the clutch, select top gear with main gear lever and move the "power take-off" selector (early models, beneath centre seat box; late models, knob on heelboard) forward, then release the clutch pedal. Control engine r.p.m. by means of the governor control lever (8).

To pump from first-aid tank (Fig. T-77)

Operation T/112

1. Fit a blanking cap (4) to suction port and ensure that main delivery valves (5) are closed.
2. Open first-aid suction control valve (6) and pressure control valve (7) and select "Working" position with lever (1).
3. Start the engine and engage the drive.
4. Increase engine r.p.m. to suit output requirements.
5. To decrease the flow from delivery hoses reduce the engine r.p.m.

To fill first-aid tank from a hydrant (Fig. T-77)

Operation T/114

1. Connect the suction hose to the hydrant.
2. Open first-aid suction control valve (6) and ensure that delivery valves are closed.

3. Open hydrant valve.
4. When first-aid tank is full, shut off the hydrant. The pump is not under power during this operation.

To pump from a static water supply (Fig. T-77) **Operation T/116**

1. Prime pump.
2. Connect the suction and main delivery hoses; ensure that a strainer is fitted to the suction hose to prevent impurities entering the pump.
3. Close the delivery valves.
4. With lever (1) at "Priming" start the engine and engage the drive.
5. Move the governor control quadrant to the fully open position. The vacuum gauge (9) should indicate an increasing depression, and when water flows from exhaust pipe (3), the delivery valves must be slowly opened. When the pressure gauge (10) indicates rising pressure, move the lever (1) into "Working" position.
6. To decrease the flow from delivery hoses, reduce the engine r.p.m.

To pump from a hydrant or gravity feed supply (Fig. T-77) **Operation T/118**

1. Connect the suction and delivery hoses and open the delivery valves.
2. Select "Working" position with lever (1).
3. Open the valve of tank or hydrant.
4. Start the engine and engage the pump drive.
5. Increase the engine r.p.m. to suit delivery requirements.
6. To decrease flow from delivery hoses, reduce the engine r.p.m.

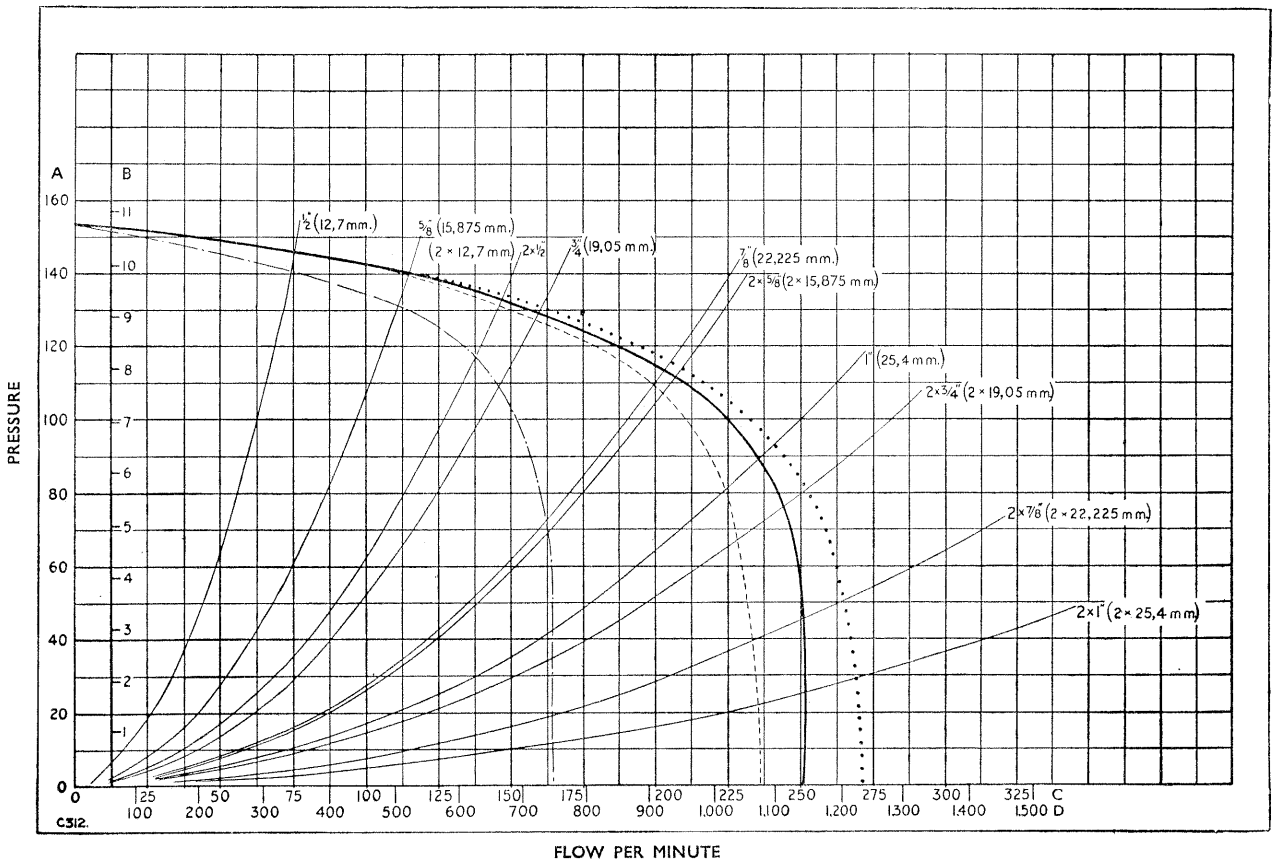


Fig. T-76—Flow and pressure chart

(Pump speed 2,850 r.p.m., Water temp. 42°F., Air temp. 46°F.)

A—Pounds per square inch

B—Kilogrammes per square centimetre

C—Gallons per minute

D—Litres per minute

——·——·—— 15 ft. (4,6 metres) lift, 3 in. (76 mm) suction

- - - - - - 10 ft. (3 metres) lift, 3 in. (76 mm) suction

——— 6 ft. (1,8 metres) lift, 3 in. (76 mm) suction

..... Zero lift, 3 in. (76 mm) suction

——— Nozzle sizes

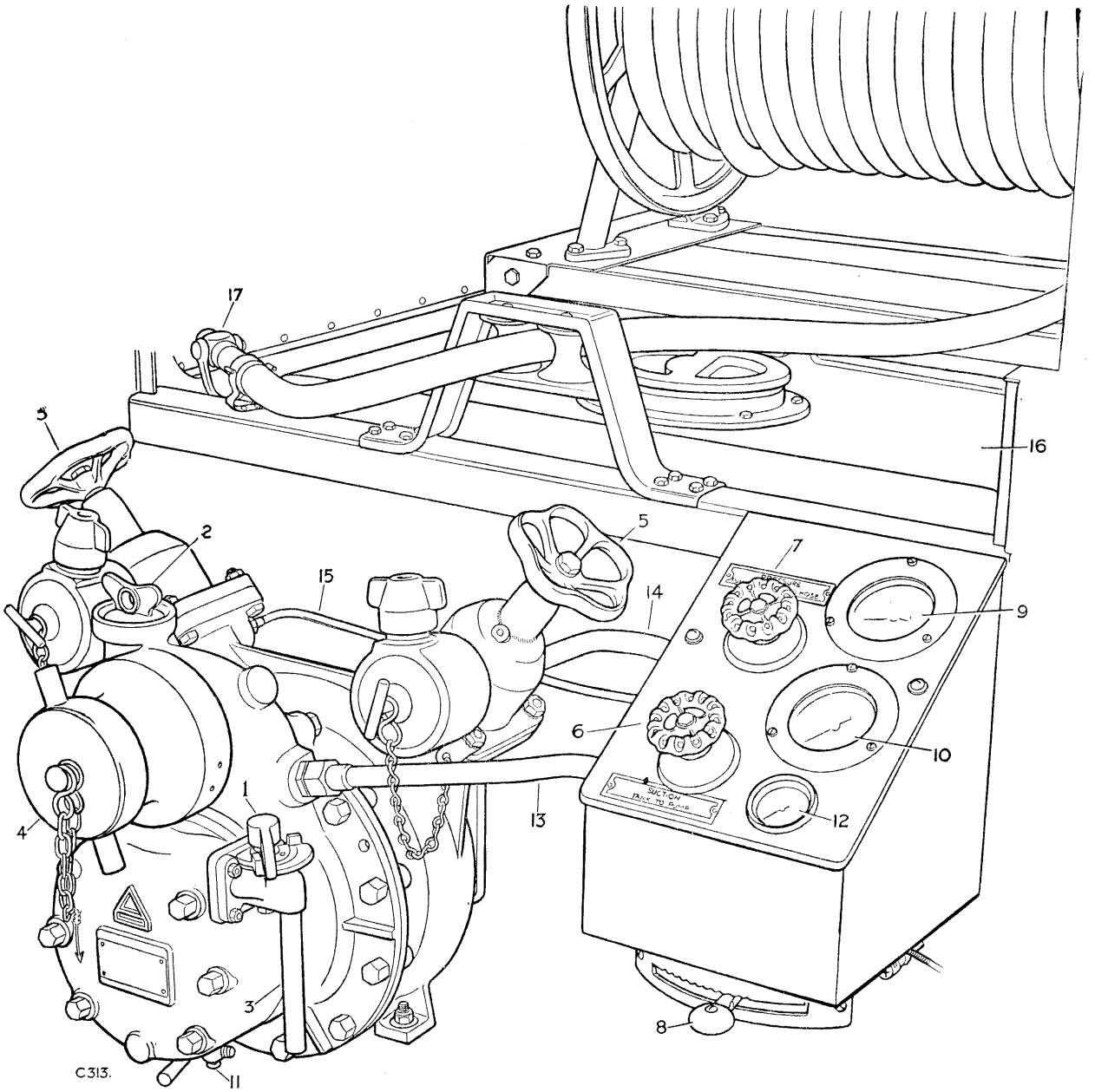


Fig. T-77—Pump and controls

1 Priming lever
2 Filler cap
3 Exhaust pipe
4 Blanking cap
5 Main delivery valves
6 First-aid suction control valve
7 First-aid pressure control valve
8 Governor control lever
9 Vacuum and pressure gauge
10 Pressure gauge
11 Drain cock
12 Oil temperature gauge
13 First-aid suction pipe
14 First-aid delivery pipe
15 Pressure gauge pipe
16 First-aid tank
17 First-aid hose nozzle

When the pump is working for a prolonged period it is desirable from time to time to close the delivery valve, reduce the engine r.p.m. and select the "Priming" position with lever (1), so changing the water in the priming pump and avoiding overheating.

To temporarily stop output (Fig. T-77) **Operation T/120**

1. Move governor control lever to extreme right-hand side to allow engine to idle, and close delivery valves.

   Periodically select "Priming" position with lever (1) in order to allow the water in pump to be changed and thereby avoid overheating.

To stop pumping **Operation T/122**

1. Close the valve of supply tank or hydrant, reduce engine speed and close delivery valves.
2. Disengage the drive to pump and disconnect the delivery and suction hoses.

Precautions to be taken when pumping (Fig. T-77) **Operation T/124**

A strainer in a wicker basket should be used on the end of the suction hose when the supply is being taken from open water. Care should be taken to ensure that as the water level falls the suction hose is kept far enough below the surface to ensure no air is drawn in. Suction hose joints must be screwed up tightly to avoid reduced delivery, and if necessary the hose must be secured to prevent kinking.

Rate of flow and pressure of the pump must be regulated by varying engine speed and **not** by partially closing the valves.

Should the suction hose be leaking and air is drawn in, the lever (1) should be left in the "Priming" position so that any air is passed through the exhaust pipe together with water from the priming pump. In this case a hose may be connected to the exhaust pipe to carry excess water away.

Frost precautions **Operation T/126**

1. Under cold weather conditions, where freezing may occur, the drain cocks must be opened when pumping is concluded. Complete drainage will be ensured if the pump is kept running for a few minutes after the suction hose is disconnected and whilst the cocks are open.
2. To ensure that the pump will be ready for instant use, prime with "anti-freeze mixture" instead of water alone.

Periodic checks **Operation T/128**

After every operation	.... Remove and clean filter in priming funnel.
After every operation and every seven days inoperative	.... Ensure that the priming pump casing is full. See Frost Precautions.
After pumping water containing impurities (lake, canal, sea water, etc.)	.... Thoroughly scavenge the pump with clean fresh water.
Every ten hours running and every fourteen days inoperative	Top up the filler pipes, protruding from the pump mounting ring, with engine oil. At the same time check the effectiveness of the mechanical seal by removing the oil drain plug from underneath the driving flange end of the pump. An undue proportion of water flowing out with the oil indicates a damaged seal, which should be replaced.
Every 1,000 hours running	.... (*a*) Remove the pump, driving flange and end cover. Syringe the ball bearing with petrol and re-pack one-third full with good quality non-acid grease. (*b*) Apply a suitable oil to the pump driving propeller shaft nipples, one on each universal joint and one on the sliding sleeve.
At convenient intervals (dry suction test)	.... Ensure that the priming casing is full of water; close all valves and blank off the suction port. With lever (1) at "Priming" run the engine for **not** more than two minutes with the control quadrant lever fully open and note the depression registered by the vacuum gauge. The gauge should soon show 24-28½ inches of mercury if the system is air tight. Move the exhaust lever to "Working" position and stop the engine. The vacuum gauge should record a drop of not more than three inches of mercury per minute if the pump is air tight.

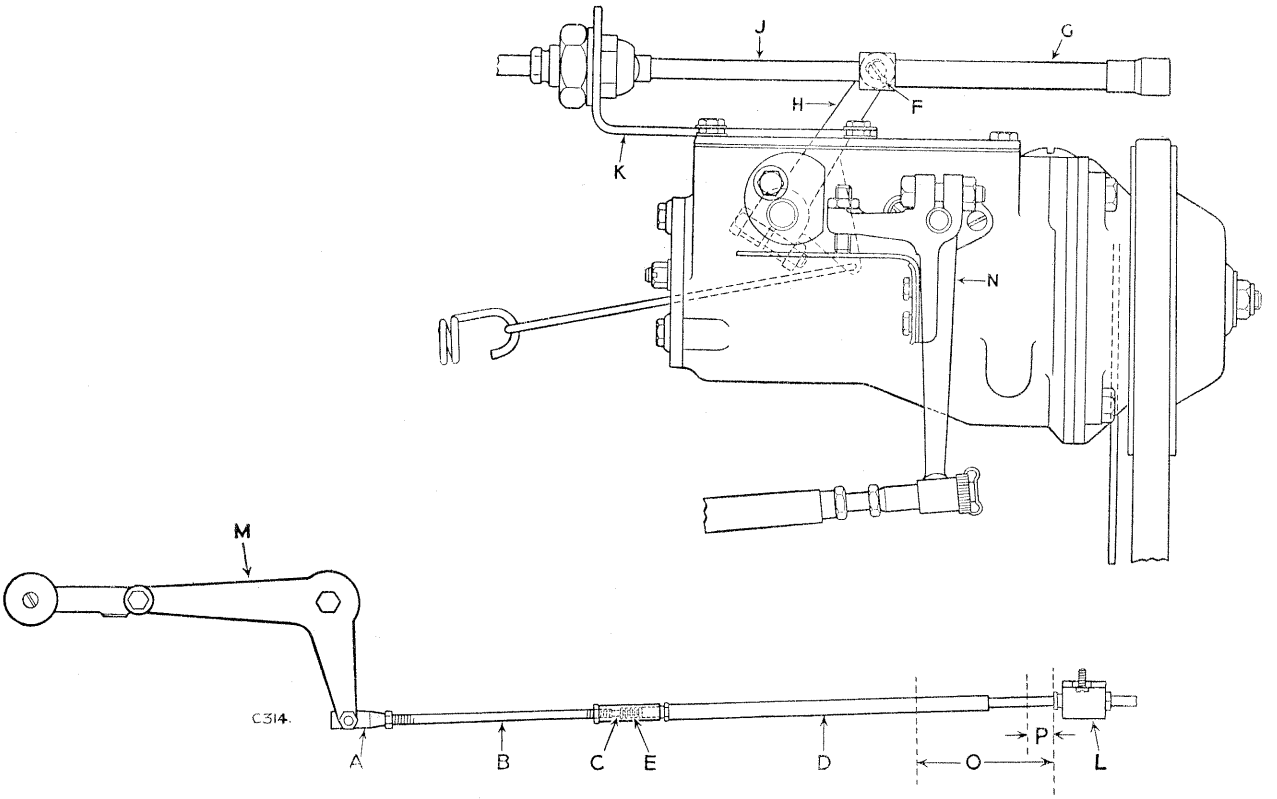


Fig. T-78—Arrangement of governor control (2 litre)

A—Ball joint
B—Adjusting rod
C—Body
D—Tube and plug assembly
E—Locking spring
F—Split pin
G—Inner cable and slider assembly
H—Governor arm
J—Swivel assembly
K—Support bracket for swivel assembly
L—Swivel coupling
M—Control quadrant lever
N—Governor arm (R.H.)
O—Control fully open
2 litre, $3\frac{1}{16}$ in. (78 mm)
$2\frac{1}{4}$ litre, $2\frac{1}{2}$ in. (63,5 mm)
P—Control inoperative
2 litre, $\frac{1}{2}$ in. (12,5 mm)
$2\frac{1}{4}$ litre, $\frac{3}{4}$ in. (19 mm)

Governor control cable—inner, to remove
(see Fig. T-78) **Operation T/130**

1. Disconnect the ball joint at control quadrant and remove it from the rod.
2. Unscrew the adjusting rod and body from tube and plug assembly.
3. Remove the locking spring from inner cable.
4. Withdraw the tube and plug assembly.
5. Take out the split pin securing the inner cable and slider assembly to the governor arm (L.H.) and withdraw the assembly from the swivel.
6. Grease the new cable assembly and feed it into the swivel assembly attached to support bracket on governor. Turn the cable occasionally to overcome any slight resistance which may be felt.
7. When fully inserted, the trunnion of the inner cable assembly should be attached to the governor arm again with a plain washer and split pin.
8. Press the governor arm fully forward. Pass the tube and plug assembly over the inner cable extending from the outer tube, until it is $\frac{1}{2}$ in. (12,5 mm), 2 litre; $\frac{3}{4}$ in. (19 mm), $2\frac{1}{4}$ litre, from the shoulder of swivel coupling on chassis side member.
9. Screw the locking spring over the inner cable until it is $\frac{1}{16}$ in. (1,5 mm) from the end of tube and plug assembly, and cut the surplus inner cable off with a small hack-saw.
   Ensure that the governor arm is extended fully forward before finally cutting the cable.
10. Screw the body tightly on to tube and plug assembly, position control quadrant in the fully closed position, screw the adjusting rod with ball joints and locknuts into body and adjust to fit quadrant. Open and close the quadrant lever fully and check for correct adjustment.

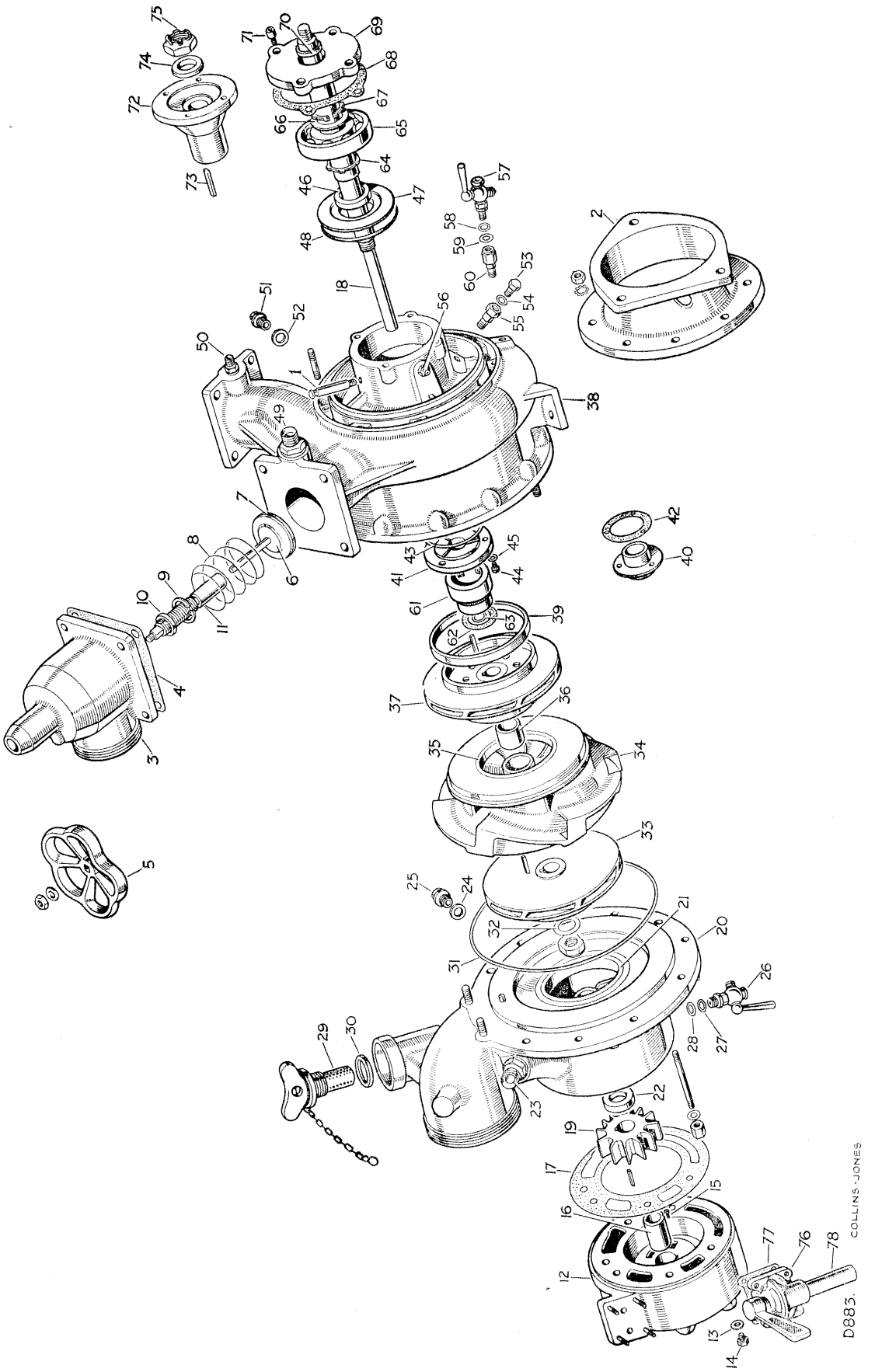


Fig. T-79—Exploded view of pump

Key to Fig. T-79

Plate Ref.	Description	Part No.
1	Oil filler tube	271751
2	Mounting ring	271752
3	Delivery valve	271754
4	Joint washer for valve	271755
5	Control wheel	271756
6	Spindle and seal assembly	271757
7	Rubber seal	271758
8	Spring	271759
9	Circlip	271760
10	Seal	271761
11	Spindle body	271762
12	Priming casing	267623
13	Washer } For priming	271770
14	Plug } casing	271771
15	Grub screw, securing bush	271763
16	Bush for shaft	271764
17	Gasket for priming casing	271765
18	Shaft with washers and keys	267615
19	Priming impeller	267620
20	Suction casing	271766
21	Wearing ring	271767
22	Seal (in suction casing) for shaft	271768
23	Suction pipe union, first aid	240041
24	Washer } For suction	271771
25	Plug } casing	271770
26	Drain cock	271772
27	Fibre washer	271773
28	Copper washer	213961
29	Cap and filter assembly	271775
30	Washer for cap	271776
31	Rubber 'O' ring	271777
32	Locking washer	275385
33	Suction impeller	267618
34	Diffuser ring	271778
35	Wearing ring	267621
36	Distance piece	271779
37	Suction and pressure impeller	267619
38	Main casing	271780*
	Main casing	514574†
39	Wearing ring	267622
40	Stationary sealing ring	271781*
41	Stationary sealing ring	514575†
42	Joint washer	514560*
43	Sealing ring	514561†
44	Screw } For sealing	271782
45	Washer } ring	271783
46	Seal	271784
47	Cover for rear seal	514563†
48	Sealing ring	514561†
49	Union for delivery pipe, first aid	240041
50	Union for pressure gauge pipe	3075
51	Plug	271771
52	Washer for plug	271770
53	Plug, oil drain	271771†
54	Joint washer	271770†
55	Extension tube	514564†
56	Grease nipple	271789
57	Drain cock	271772
58	Fibre washer } For drain	271773
59	Copper washer } cock	218961
60	Extension for drain cock	514562†
61	Mechanical seal	504062
62	Fibre washer	271790
63	Rubber 'O' ring	271791
64	Circlip	271793
65	Ball bearing	267616
66	Distance piece	271794
67	Circlip	271793
68	Joint washer	271796
69	Bearing cover	271797
70	Seal	271798
71	Screw for cover	271799
72	Driving flange	271800
73	Key for flange	271801
74	Washer } For	271802
75	Nut } flange	271803
76	Priming cock	271804
77	Joint washer for cock	271805
78	Exhaust pipe	271806

*—Up to pump A745059

†—From pump A745060 onwards

First-aid hose reel, to remove **Operation T/132**

1. Unscrew the nozzle from end of hose and withdraw the hose from fairleads.
2. Remove the union securing the delivery pipe to reel centre shaft.
3. Unscrew the breather pipe from first-aid tank.
4. Remove the bolts securing the supporting feet and lift the hose and reel assembly clear.

First-aid hose reel, to fit **Operation T/134**

1. Reverse removal procedure.

Reel support and first-aid tank, to remove **Operation T/136**

1. Remove the first-aid hose reel.
2. Disconnect the pressure pipe "reel to control cock" at the cock, and withdraw.
3. Disconnect the suction pipe "tank to control cock" at the tank and cock, then withdraw.
4. Unscrew the two bolts from the first-aid tank steady straps and move the tank centrally in the rear body.
5. Remove the bolts securing the reel support to the wheel arch box sides, then lift the support clear and remove the tank.

Reel support and first-aid tank, to refit **Operation T/138**

1. Reverse removal procedure.

Vacuum or pressure gauge, to remove **Operation T/140**

1. Disconnect the pipe from rear of gauge.
2. Remove the screws securing bezel to the instrument panel and withdraw the gauge.

   In some cases it may be necessary to raise the instrument panel slightly, to gain access to the rear of instruments with a spanner. To raise the panel remove the control wheels and rubber grommets, withdraw the screws securing panel and instruction plates.

Oil temperature gauge, to remove **Operation T/142**

1. Disconnect the ball joint at the control quadrant and remove the bolts securing quadrant to support bracket; lower quadrant.
2. Unscrew the knurled nut securing the oil temperature gauge to instrument panel.
3. Disconnect the capillary tubing from the oil pipe union on L.H. front wing valance and release the supporting clips from chassis side and cross-member.
4. Withdraw the gauge and capillary tubing, ensuring that the tubing is not bent unnecessarily nor twisted.

Oil temperature gauge, to refit **Operation T/144**

1. Reverse removal procedure, again taking great care to bend the tubing only where necessary; do not twist it.

Pump, to remove **Operation T/146**

1. Drain the pump and then remove the rearmost water drain plug or tap.
2. Disconnect from pump the first-aid delivery and suction pipes and also the pressure gauge pipe.
3. Remove the bolts securing the driving propeller shaft to the power take-off driving flange at rear of gearbox.
4. Ensure that the pump is suitably supported (with a sling, etc.), then remove the three bolts securing pump to rear cross-member and the two bolts to support plate.
5. Withdraw the pump and propeller shaft complete and lower. Unscrew the foremost drain tap as soon as possible to avoid damage, then disconnect the propeller shaft.

Pump, to dismantle (see Fig. T-79) **Operation T/148**

1. Unscrew the lubricating pipes (1) and oil drain plug and extension (53, 55). Drain off oil. Remove the nuts and washers securing mounting ring (2) and withdraw the ring.
2. Remove the delivery valve securing bolts and withdraw the valve assemblies (3). Take out the spindle and seal assembly (6) and (7) and spring (8). A peg spanner will be required to unscrew the lower plate of the spindle and seal assembly if a new disc type rubber seal (7) is required.
3. The discharge valves may be dismantled completely by unscrewing the nuts securing control wheel (5), withdrawing the wheels, pressing the spindle body (11) downwards and extracting the body. Circlip (9) and spindle seal (10) may now be removed from the discharge valve casting.
4. Unscrew the cap nuts and gently tap the priming pump cover (12) off with a hide-faced hammer. Carefully remove the gasket (17). If necessary remove the grub screw (15) and extract the bush (16).
5. Slide the priming pump impeller (19) from the shaft (18) and take out the impeller key.
6. Remove the cap nuts and withdraw the suction casing (20) with sealing 'O' ring. If necessary withdraw the shaft seal (22).

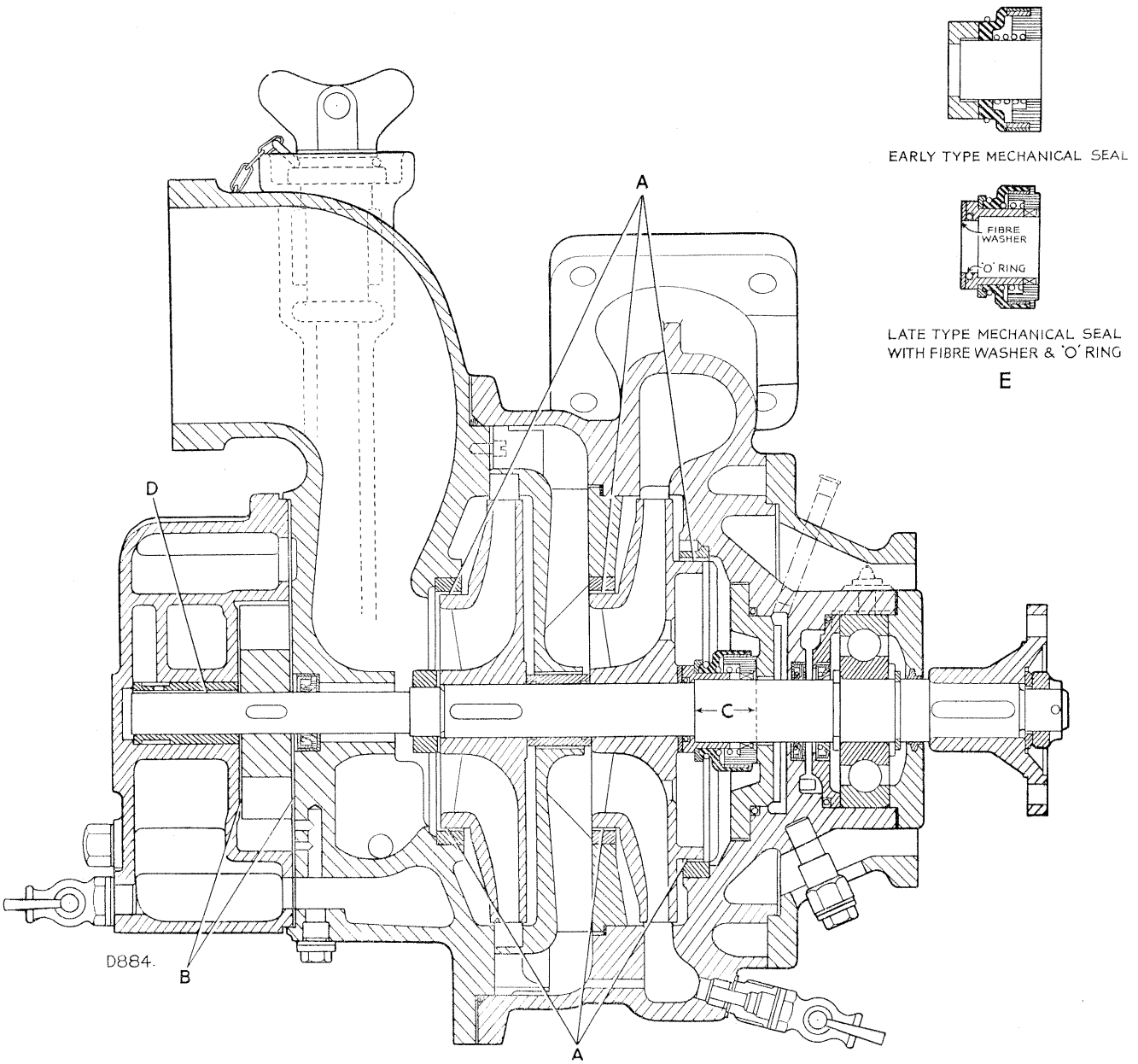


Fig. T-80—Sectioned view of pump, Serial No. A745060 onwards

A—Wearing ring clearance 0,25 mm (.010 in.) B—Impeller total end-float 0,2 mm (.008 in.)
C—28 mm ± 0,3 (1.102 in. ± .012)

7. Tap the locking washer (32) down and unscrew the impeller nut. Withdraw the suction impeller (33) and remove the key from the shaft.

   A metal strip, bent hook shape, will facilitate the removal of impeller.

8. Using the hooks if necessary, draw the diffuser (34) from housing and shaft. Remove distance piece (36), pressure impeller (37) and pressure impeller key.

9. Remove the split pin, washer and nut (**L.H. thread**) securing the driving flange (72), then withdraw the flange and key.

   The shaft should be positioned vertically between two pieces of wood and clamped in a vice when unscrewing the flange nut. *Do not* grip the shaft between metal jaw protectors or allow it to be held in the horizontal position. The weight of the main casing (38) plus the torque exerted by the operator on the flange nut, whilst the shaft is held horizontally, might cause distortion.

10. Using an "Allen" key, unscrew the socket-headed bolts (71) securing bearing cover (69).

11. Tap the shaft on the impeller side of main casing (38) with a hide-faced hammer to remove it

complete with bearing cover and ball bearing (65). The fibre washer (62), 'O' ring (63) and mechanical seal (61) may be withdrawn as the shaft is taken from the casing.

12. Remove the bearing cover, securing circlips, spacer and ball bearing from the shaft.
13. The seal (70) in bearing cover, seals (46) and stationary sealing ring (40 or 41), joint washer or sealing ring (42 or 43) and seal cover (47), if fitted, may now be removed if necessary, from the main casing.
14. Remove the priming cock and exhaust pipe assembly (76) from the priming pump cover.

Checking pump component parts for wear (Fig. T-80) **Operation T/150**

1. Check the bush in priming pump cover for excessive wear, see data section. If necessary remove the bush as instructed in Item 4 of the dismantling procedure, and fit a new one. Wear at this point must not be allowed to become excessive, since a corresponding amount of wear will take place in other components mounted on the shaft.
2. Note the end-float of priming pump impeller. Any increase on 0,2 mm (.008 in.) will result in reduced suction capacity. To check the end-float, place the impeller in position in priming casing with an already compressed gasket in place. Lay a straight-edge over the gasket and impeller and check the clearance with a feeler gauge.
3. Examine shaft seal in suction casing and renew if necessary.
4. Check the internal diameter of wearing rings, and the external diameter of shoulders on suction and pressure impellers. An *axial* clearance of 0,25 mm (.010 in.) is normal. A clearance in excess of 0,5 mm (.020 in.) will necessitate the regrinding of impeller shoulders and the fitment of suitably oversize wearing rings.
5. The fibre washer and 'O' ring seal (see Fig. T-79) must be replaced if any sign of deterioration exists.
6. If the mechanical seal has worn unduly and is to be renewed, the stationary sealing ring must also be replaced.

   Ensure that the dimension from friction face of the stationary seal and the shoulder of shaft when in position is 28 mm $\pm$ 0,3 (1.102 in $\pm$ .012).

   On pumps prior to Serial No. A745060 if the early type mechanical seal having a large distance piece and no fibre washer or 'O' ring is fitted, it may be replaced by the latest type complete with fibre washer and 'O' ring. When fitting the latest type mechanical seal the original seal distance piece as well as the seal should be discarded (see 'E', Fig. T-80).
7. When a new stationary sealing ring is fitted it must be secured in the main casing by the three fixing screws and then accurately turned and lapped in position.
8. Check the seals in pressure casing and bearing cover and replace if necessary. If a felt ring type of seal is fitted in the bearing cover, the new or old one must be soaked in engine oil before replacement.
9. The ball bearing should be renewed if its serviceability is in any way doubtful.
10. Thoroughly clean the exhaust cock and check for correct functioning.

Pump, to assemble **Operation T/152**

1. Reverse the dismantling procedure and note that the mechanical seal should be tapped on to the shaft (after ensuring that the seal splines are correlated), using a piece of tubing and a hide-faced hammer.

   When the mechanical seal is against the shaft shoulder, the end of the shaft key-way for pressure impeller will be 4 mm (.196 in.) from the face of the mechanical seal.
2. Use grease throughout assembly and top up with oil, using the filler tube at driving end, when assembly is complete.
3. After fitting pump to the vehicle, a dry suction check should be made as instructed on Page T-72.

DEFECT LOCATION, FIRE FIGHTING EQUIPMENT
(Symptom, Cause and Remedy)

A—PUMP NOT DELIVERING. HIGH VACUUM READING WITH LITTLE OR NO AIR ESCAPING FROM EXHAUST PIPE.

1. Strainer or suction pipe completely blocked—*Remove and clear.*

B—PUMP NOT DELIVERING. VACUUM READING LOWER THAN CORRESPONDING STATIC SUCTION LIFT. AIR CONTINUALLY ESCAPING FROM EXHAUST PIPE.

1. Badly leaking hose—*Rectify.*
2. Leaking delivery valve—*Rectify.*
3. Leaking mechanical seal—*Rectify.*

C—PRESSURE INDICATED BY GAUGE BUT LITTLE OR NO DELIVERY FROM HOSE.

1. Obstruction in suction hose—*Clear.*
2. Foreign matter in pump or at intake due to damaged strainer—*Dismantle, clean and rectify.*
3. Pressure gauge unserviceable—*Renew.*
4. Higher suction lift due to water level at supply failing—*Set pump at lower level if possible.*

D—VACUUM FALLS AFTER PROLONGED RUNNING WITH CLOSED VALVES.

1. Water in priming pump overheated—*Drain off hot water by opening drain cock in priming casing. Refill and re-prime pump.*

E—NO VACUUM INDICATED. AIR CONTINUALLY ESCAPING FROM EXHAUST PIPE.

1. Delivery valve open—*Close.*
2. Drain cock in main casing open—*Close and prime.*

F—NO VACUUM INDICATED. NO AIR ESCAPING FROM EXHAUST PIPE.

1. Priming pump contains too little or no water—*Refill and re-prime pump.*
2. Filler strainer choked—*Clean.*
3. "Priming" lever in "Working" position—*Re-set to "Priming" position.*

G—WATER EMERGES FROM OIL FILLER TUBE OR AT DRIVING FLANGE.

1. Worn mechanical seal or scored stationary seal—*Dismantle* pump and replace.

DATA

Fire fighting equipment

General

Capacity of first-aid water tank	40 gal. (182 litres) approx.
Length of first aid hose	120 ft. (40 metres)
Maximum permissible nozzle size when both delivery ports are in use	One $\frac{7}{8}$ in. (22 mm) and a 1 in. (25 mm)
Delivery port	$2\frac{1}{2}$ in. B.S.P. thread
Suction port	$4\frac{1}{2}$ in. B.S.P. thread
Delivery port adaptor	Suitable for standard British instantaneous $2\frac{1}{2}$ in. hose coupling
Suction port adaptor	Screwed to B.S.S. 336/1954 for 3 in. (76 mm) hose
Maximum self-priming suction lift	26 ft. (8 metres)

Pump

Type	Two-stage impeller, self-priming, high-pressure
Drive	Propeller shaft from gearbox at engine speed
Maximum R.P.M. (governed)	3,000
Threads	Metric
Priming pump impeller end-float	0,2 mm (.008 in.)
Face of stationary seal to shoulder on shaft	28 mm ± 0,3 (1.102 in ± .012)
Radial clearance between wearing rings and impeller shoulders	0,25 mm (.010 in.)

Alternator

Type	2 A.C.
Rotation	Clock or anti-clockwise
Output	52-57 amps (hot)

Centre power take-off

Drive shaft end-float	.003 to .005 in. (0,07 to 0,12 mm)

Rear power take-off

Backlash between gears	.008 to .012 in. (0,20 to 0,30 mm)
Input and output shaft end-float	Zero

Rear drive pulley

Drive shaft end-float	Zero
Pinion shaft end-float	Zero
Backlash: bevel wheel to pinion	.004 in. (0,10 mm)

Front capstan winch, mechanical

Bollard shaft bushes	
Bush bore	1.311 in. + .002 (33,31 mm + 0,050)
Bollard shaft end-float	.003 to .005 in. (0,07 to 0,12 mm)
Reamed bore	1.390in. +.004 (35 mm +0,10)
Drive shaft housing bush	
Reamed bore	.750 in. +.002 (19 mm + 0,05)

Front winch, hydraulic

Operation	Hydraulic oil
Relief valve setting	1000 lb/sq.in. (70 kg/cm²)