# CHAPTER 9

# BRAKES

## SUBJECT INDEX

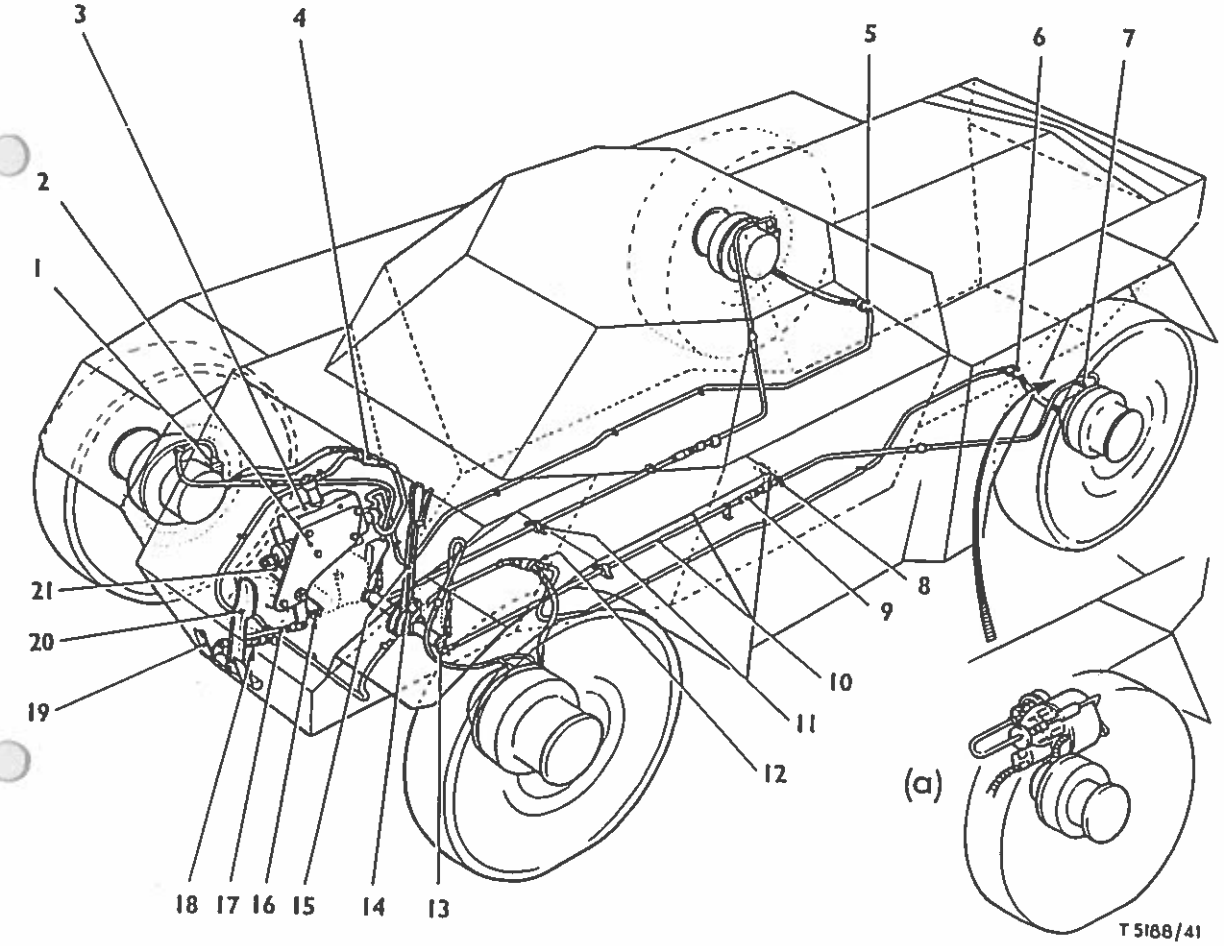


## LIST OF FIGURES

# BRAKES

## GENERAL

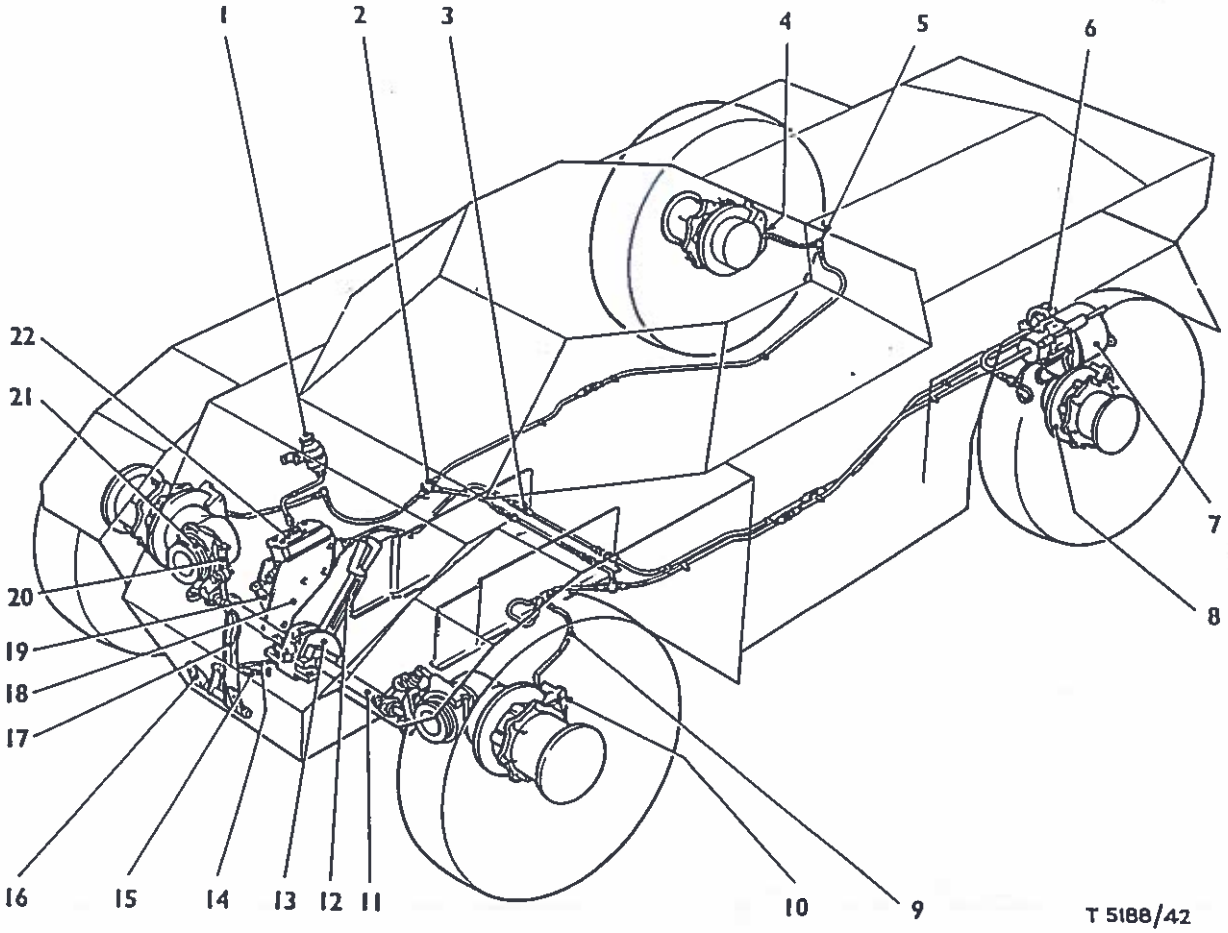
1. The main brake assemblies, operated hydraulically by a foot pedal, are fitted at each wheel station, the rear assemblies being similar in construction to those on the front wheel stations of each mark of vehicle. On Mk 1 and 2 vehicles the brakes are of the two-leading shoe type, whilst the Mk 4 and 5 vehicles are fitted with single disc type brakes. On Mk 2/6, 2/7, 4 and 5 vehicles a vacuum-servo unit, interposed between the master cylinder and the brake units, is provided to reduce the manual effort required when applying the brakes. The fluid pressure lines are of steel tubing clipped to the hull plates at suitable points. Flexible hoses, connected to the steel tubing by unions, carry the fluid to the brake operating components at each station.




1 *Brake expander unit*
2 *Master cylinder mounting plate*
3 *Master cylinder*
4 *Straight connector*
5 *Elbow connector*
6 *Elbow connector*
7 *Cable support bracket*
8 *Abutment bracket*
9 *Turnbuckle*
10 *Control rod*
11 *Guide bracket*
12 *Straight connector*
13 *Parking brake operating lever*
14 *Parking brake quadrant and bracket*
15 *Parking brake lever*
16 *Footbrake pedal adjustable stop*
17 *Footbrake control rod*
18 *Footbrake pedal return spring*
19 *Footbrake pedal bracket*
20 *Footbrake pedal*
21 *Master cylinder operating lever*

*(a) Vacuum servo unit fitted to late production Mk 1 and 2 and Mk 2/7 and 2/6 vehicles*

**Fig 1 Brakes arrangement (Mk 1 and 2 vehicles)**




1 *Hydraulic fluid tank*
2 *Three-way connector*
3 *Straight connector*
4 *Banjo connector*
5 *Elbow connector*
6 *Vacuum-servo unit air cleaner*
7 *Vacuum-servo unit*
8 *Brake disc*
9 *Brake hose, rubber*
10 *Caliper brake unit*
11 *Parking brake cross-shaft*
12 *Parking brake lever*
13 *Parking brake quadrant and cover*
14 *Footbrake pedal control rod*
15 *Brake pedal return spring*
16 *Pedal bracket*
17 *Pedal*
18 *Master cylinder mounting plate*
19 *Master cylinder operating lever*
20 *Parking brake release spring*
21 *Parking brake assembly*
22 *Master cylinder*

**Fig 2 Brakes arrangement (Mk 4 and 5 vehicles)**

2. The hand operated parking brake lever is connected by mechanical linkage to the brake shoes on all four wheel stations on Mk 1 and 2 vehicles and to the brake bands surrounding the brake drums on the front input bevel pinion shafts on the Mk 4 and 5 vehicles.

3. Brake arrangements pertaining to the various marks of vehicle are illustrated at Fig 1 and 2.

## MASTER CYLINDER

4. The master cylinder (Fig 3), located on the right of the driver, is screwed between two vertical mounting plates by four bolts and lockwashers, the bolts passing through distance pieces. The master cylinders fitted on all marks of vehicle are of similar basic design and construction, with the exception of the filler arrangements. Mk 1 and 2 vehicles have an extended filler tube (4) complete with a spring-loaded air inlet valve (3) and screwed filler plug (2) screwed into the cover plate (1).

The master cylinder fitted to Mk 4 and 5 vehicles is fed from an oil tank (25), with a filler cap (26) and dust excluder, mounted on the driver's compartment right hull side plate; a synthetic rubber hose (24) is clamped at one end to the bottom of the tank and at the other to a length of steel tubing (23) which is coupled to the adaptor (22) in the master cylinder cover plate (1), thus forming a passage for the flow of oil from the external tank to the master cylinder tank.

5. The master cylinder is of the integral tank type and has below the tank a body bored to receive a piston (13). A tapered return spring (9), fitted with a valve (8) at the large end and a spring retainer (21) on the smaller end, loads a main rubber cup (10) on to the piston head, a piston washer (11) preventing adhesion of one part to the other. The piston also carries a secondary rubber cup (14) and is deeply recessed to receive the push-rod (18) which is connected to the brake linkage. A piston stop (15) and retaining ring (16) retain the piston in the bore. A rubber boot (17) surrounds and is attached to the push rod by a small metal strap (19), the larger end of the boot being attached to the body of the master cylinder by a large boot strap (20). A bleed valve (12), adjacent to the outlet union, is provided on Mk 4 and 5 vehicle master cylinders.

## FOOTBRAKE PEDAL AND LINKAGE

6. The brake pedal and linkage to the master cylinder are the same on all marks of vehicle and for the convenience of description, reference is made to the annotations contained in Fig 1. The brake pedal (20) comprisesatubular member with the brake pedal welded to the left end and a lever welded to the right end. The lever end is drilled to accommodate a pin by which the front fork-end of the control rod (17) is connected to the lever. The pin also serves as an anchor for one end of the pedal return spring (18). Flat washers and split cotter pins are used to retain the pins in both fork-ends of the control rod.

7. The tubular portion of the pedal is fitted with two bronze self-lubricating bushes and is mounted on a shaft between two brackets (19) which are bolted to the hull. At the pedal end, a grooved headless pin secures the shaft to the bracket.

8. The pedal return spring (18) is hooked at the rear end to a hull floor mounted anchor plate. The control rod (17) is threaded for adjustment purposes and the rear fork-end is fitted to the lower end of the master cylinder operating lever (21). This lever is fitted with self-lubricating bushes and pivots on a shaft secured between the inner (2) and outer mounting plates by means of nuts and lockwashers. The upper end of the operating lever is attached to the fork-end of the master cylinder push-rod.

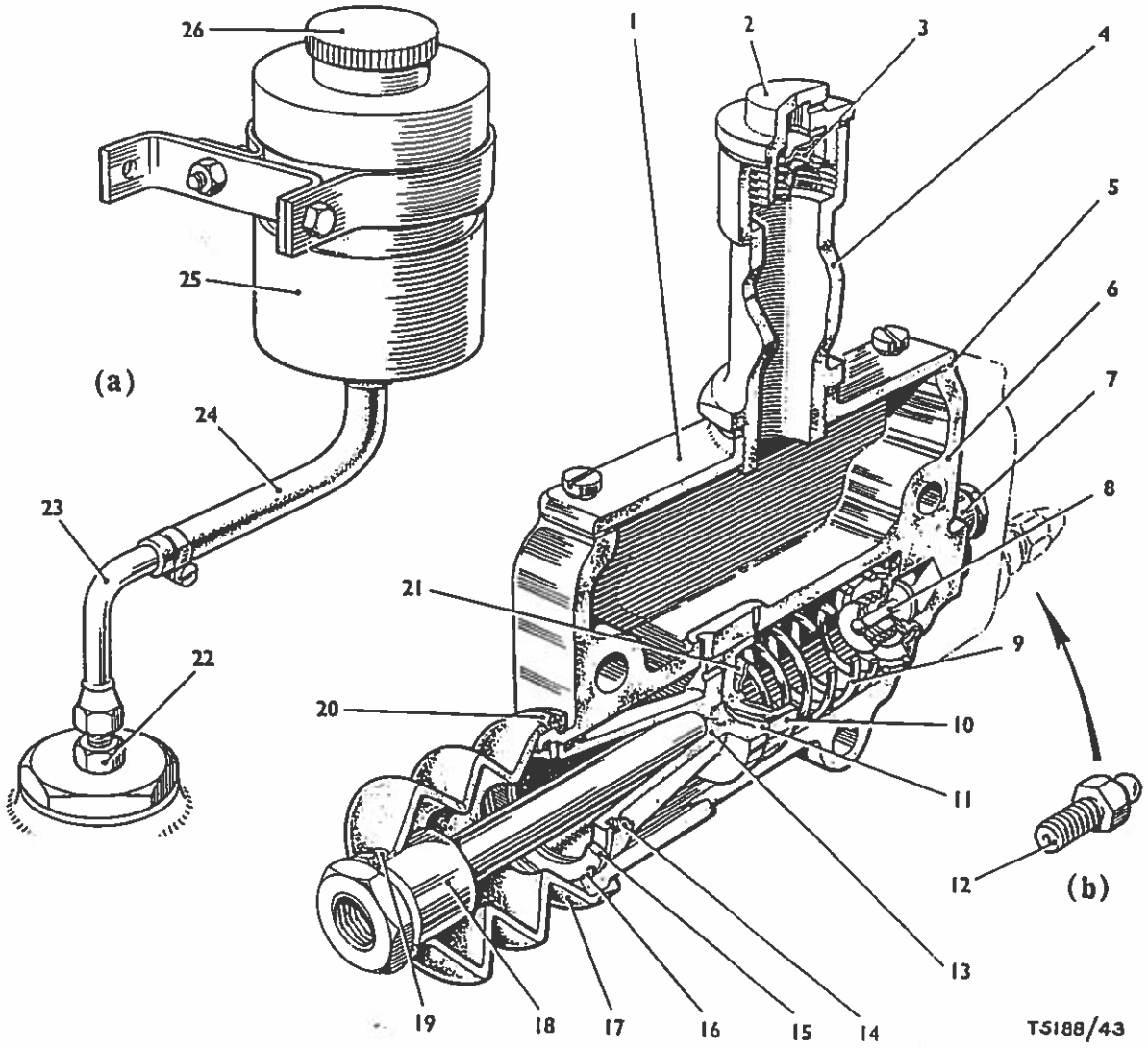
9. A hexagon headed stop (16) screwed into a fixed bracket on the hull, is contacted by the operating lever (21) when the brake pedal is released. The stop is adjusted to give 0.76 mm (0.030 inches) clearance between the push-rod and master cylinder piston. Prior to this adjustment being made, the fork-end connecting the master cylinder push-rod to the operating lever is adjusted so that a vertical line taken through the centre of the pivot pin of the lever is 5.08 mm (0.200 inches) forward of the control rod rear joint pin. After adjusting the stop and locking it by means of the locknut and lockwashers, the control rod is adjusted to give a maximum travel of 222.25 mm (8.75 inches) at the top of the pedal.

## PARKING BRAKE

10. The parking brake is located centrally in front of the driver's seat and is connected by adjustable rod and cable linkage to all four brake assemblies on Mk 1 and 2 vehicles and by rigid mechanical components to the external contracting brake bands, which operate on brake drums attached to the front bevel box input pinion shafts on Mk 4 and 5 vehicles.

### Parking brake lever and linkage (Mk 1 and 2)

11. The steel parking brake lever (Fig 1(15)) is welded to a cross-shaft mounted at the extreme ends in brackets where it is free to pivot in self-lubricating bronze bushes. A third control bracket is situated midway along the shaft and to this bracket are bolted two quadrants (14) and their coverplates. The shaft is supported in the control bracket by four half-bushes, pegged by grooved headless pins, located two at each side and secured on the shaft by two bearing caps. Oil grooves are formed in the bushes for lubrication purposes and the caps are bolted down by socket head cap screws. All three brackets are bolted to the hull floor.




1 Cover plate
2 Filler plug
3 Air inlet valve
4 Filler tube
5 Gasket
6 Body
7 Union
8 Valve
9 Return spring
10 Main cup
11 Piston washer
12 Bleed valve
13 Piston
14 Secondary cup
15 Piston stop
16 Retaining ring
17 Rubber boot
18 Push rod
19 Small metal strap
20 Large metal strap
21 Spring retainer
22 Adaptor
23 Steel tubing
24 Rubber hose
25 Hydraulic fluid tank
26 Filler cap

(a) Fluid supply tank and fittings (Mk 4 and 5 vehicles)
(b) Bleed valve (Mk 4 and 5 vehicles)

**Fig 3 Master cylinder**

12. The parking brake release lever pivots on a grooved headless pin and is connected by a joint pin to two release rods, the bottom ends of which are screwed into pawls. Between each pawl and release rod guide is a light helical compression spring. Hand pressure on the release lever forces the pawls out of engagement with the quadrant serrations; when the pressure is released, the springs return the pawls into engagement and lock the parking brake in the selected position.

13. Two parking brake operating levers (13), set at 90 degrees to each other, are mounted at each end of the cross-shaft. The eye-ends of these levers are connected to the fork-ends of the front brake cables and rear brake rods. Each pair of levers operates the brakes on one side of the vehicle and apart from a minor difference in an abutment bracket fitted to the rear run, the linkage at each side is identical.

14. The control rods (10) connecting the cross-shaft to the rear turnbuckles (9) at each side are supported in guide brackets (11) and brackets housing rubber grommets. Each turnbuckle is connected at the other end to the rear brake cable. Adjustment of the front brake cables is effected by means of the fork-ends directly attached to the screwed ends of the cable and adjustment of the rear cables by means of the turnbuckles and fork-ends at the front of the control rods. The fork-ends which screw on to the threaded portions of the front cables and rear rods are secured after adjustment by means of locknuts. Flats are formed on the cable end portion so that an additional spanner may be used to prevent the cable from being twisted or kinked when tightening or loosening the locknuts.

15. The brake cables are enclosed in outer casings which are retained by fixed abutments at suitable positions and are held, where they pass through drillings in the hull side plates, in abutment sleeves (Fig 6(25)) protected on the outside by small rubber boots. At the termination end, the cable casings are held in the cylinder end cap (22) of the expander unit (see para 28).

16. Each brake cable is supported in a support bracket (Fig 1(7)) at its hub end. The bracket is positioned between two red bands (Fig 6(2)) painted on the cable casing. In the hull interior, the brake linkage is protected by the propeller shaft tunnels.

**Parking brake operation (Mk 1 and 2)**

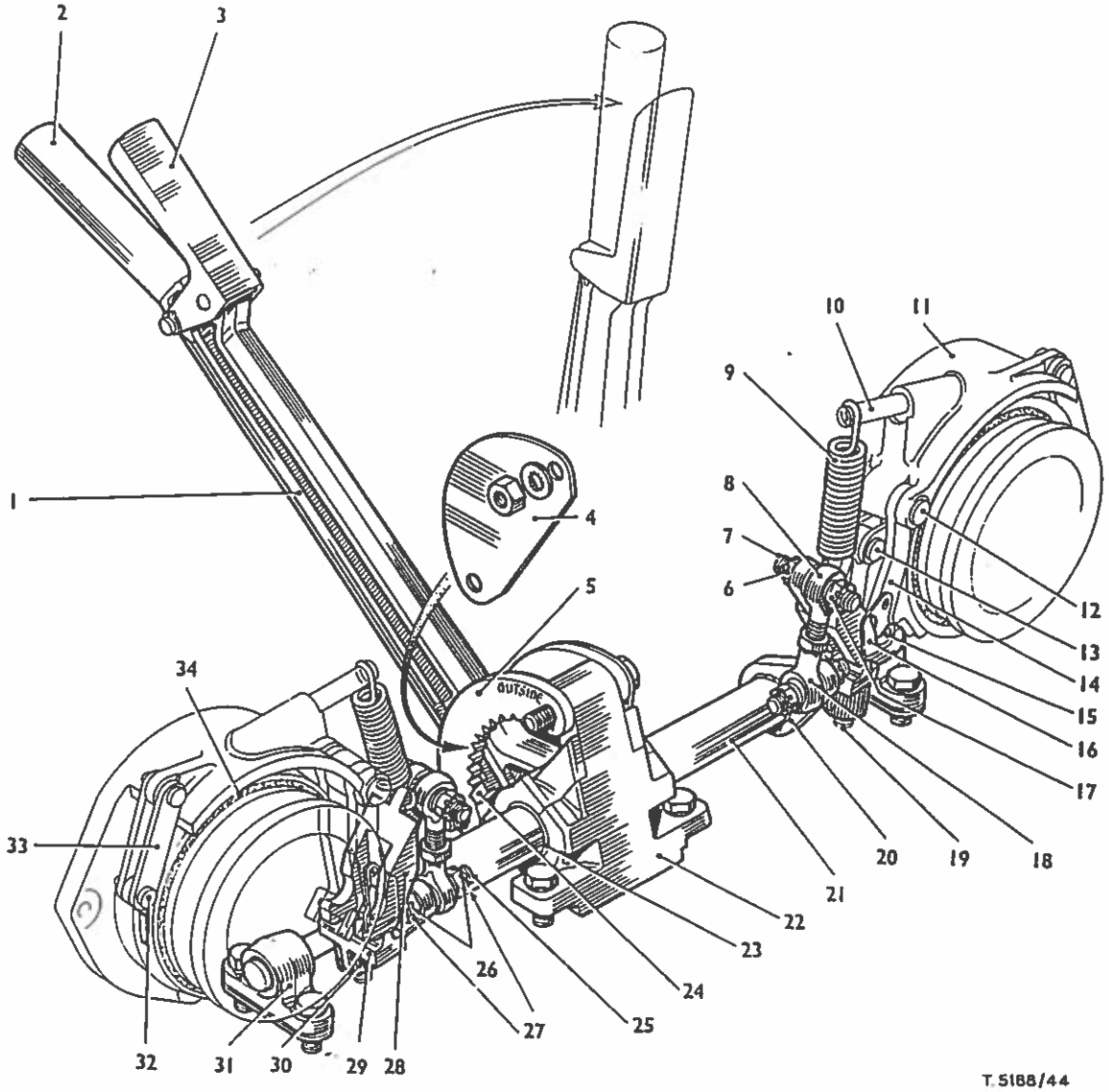
17. The operation of the parking brake is described in para 35.

**Parking brake lever and linkage (Mk 4 and 5)**

18. The steel parking brake lever (Fig 4(2)), release lever (3), release rods (1), pawls (24), rod springs, rod guides and quadrants (5) are the same as those fitted to the Mk 1 and 2 vehicles as are the methods of security and operation.

19. Welded to the cross-shaft (21), on either side of the brake lever, are two drilled cams (20) each being fitted with a shouldered stud (25) which is secured to the cam by a hexagon slotted nut (27) and split pin (26). The other end of the stud carries the female part of an adjustable ball joint assembly (18) which is located on the stud by a hexagon slotted nut (27) and split pin (26). A brake actuating link (28), which rides on the raised pegs of a table (29), is connected to each drilled male portion of the ball joint assembly by a shouldered stud (7). Hexagon slotted nuts (17) and split pins (6) secure the actuating link and upper portion of the ball joint in position on the stud. A helical extension spring (9) is fitted between the actuating link (28) and steady post (10) on the brake back plate (11). An eye bolt (19), fitted to each external band assembly (34) by a grooved headed pin (13) and retaining ring, passes through the slot in the actuating link and a hole in the table, and is retained in position by a knurled brake adjusting nut (30) situated at the base of the table.

20. Drilled link plates (33) and distance pieces fitted to the brake plate and brake band assembly projections by headed pins (32) and retaining rings, connect these two assemblies on one side. On the opposite side, an anchor link assembly (14) is fitted to slots in a drilled right angled extension of the upper part of the brake plate towards the propeller shaft and is located by and free to pivot about a headed pin (12), which is retained in position by a retaining ring. The lower portion of the anchor link




1 *Release rod*
2 *Brake lever*
3 *Release lever*
4 *Quadrant cover*
5 *Quadrant*
6 *Split cotter pin*
7 *Shouldered stud*
8 *Ball joint, male end*
9 *Extension spring*
10 *Steady post*
11 *Back plate assembly*
12 *Headed pin*
13 *Grooved headed pin*
14 *Anchor link*
15 *Screw*
16 *Guide plate*
17 *Slotted nut*
18 *Ball joint, female end*
19 *Eye bolt*
20 *Cam*
21 *Cross-shaft*
22 *Bracket*
23 *Bearing half sleeve*
24 *Pawl*
25 *Shouldered stud*
26 *Split cotter pins*
27 *Slotted nuts*
28 *Brake actuating link*
29 *Table*
30 *Brake adjusting nut*
31 *Cross-shaft bracket*
32 *Headed pin*
33 *Link plate*
34 *Brake band*

**Fig 4 Parking brake lever and linkage (Mk 4 and 5 vehicles)**

assembly is located in position by shaped angular projections fitting into mating shapes on the exterior of the brake band assembly, the heel of the anchor link assembly being seated in recesses cut in the actuating link (28). Guide plates (16), secured to the anchor link assembly by screws (15) and lock-washers, position the anchor link assembly in the recess of the actuating link. A band clip is secured to the bottom of each brake band assembly by a lockwasher and screw.

**Brake drums and brake bands (Mk 4 and 5)**

21. These assemblies are an integral part of the front bevel box assemblies and the location and means of security of each of these parking brake assemblies is described in Chapter 6, para 94 and 95.

**Parking brake operation (Mk 4 and 5)**

22. In operation, when the parking brake is applied, movement of the brake lever (2) causes the cams (20) and ball joint connectors (18) to be pivoted downwards, against spring (9) pressure, towards the hull floor. This motion causes the actuating link (28) to pivot about the raised pegs on the table (29) thereby bringing the brake lining into contact with the brake drum at the actuating link hook end position. When the parking brake is further applied, the actuating link pivots about the hook end and the eyebolt (19) is pulled downwards taking with it the upper portion of the brake band. This movement continues until the brake lining is completely wrapped around the brake drum.

23. When the lever is returned to the released position, the upward movement of the cams causes the actuating link to pivot in the reverse direction, thereby allowing the spring (9) to return the brake bands to the released condition.

**BRAKE ASSEMBLY (Mk 1 and 2)**

24. The brake drums are located on flanges on the hubs and are each held by two countersunk screws and the wheel nuts. A stiffening flange is cast on the outside diameter of the drum. The brake backplates are each held by four setscrews and shakeproof washers, and are mounted on the hub carriers at the rear positions and to the hub swivels at the front.

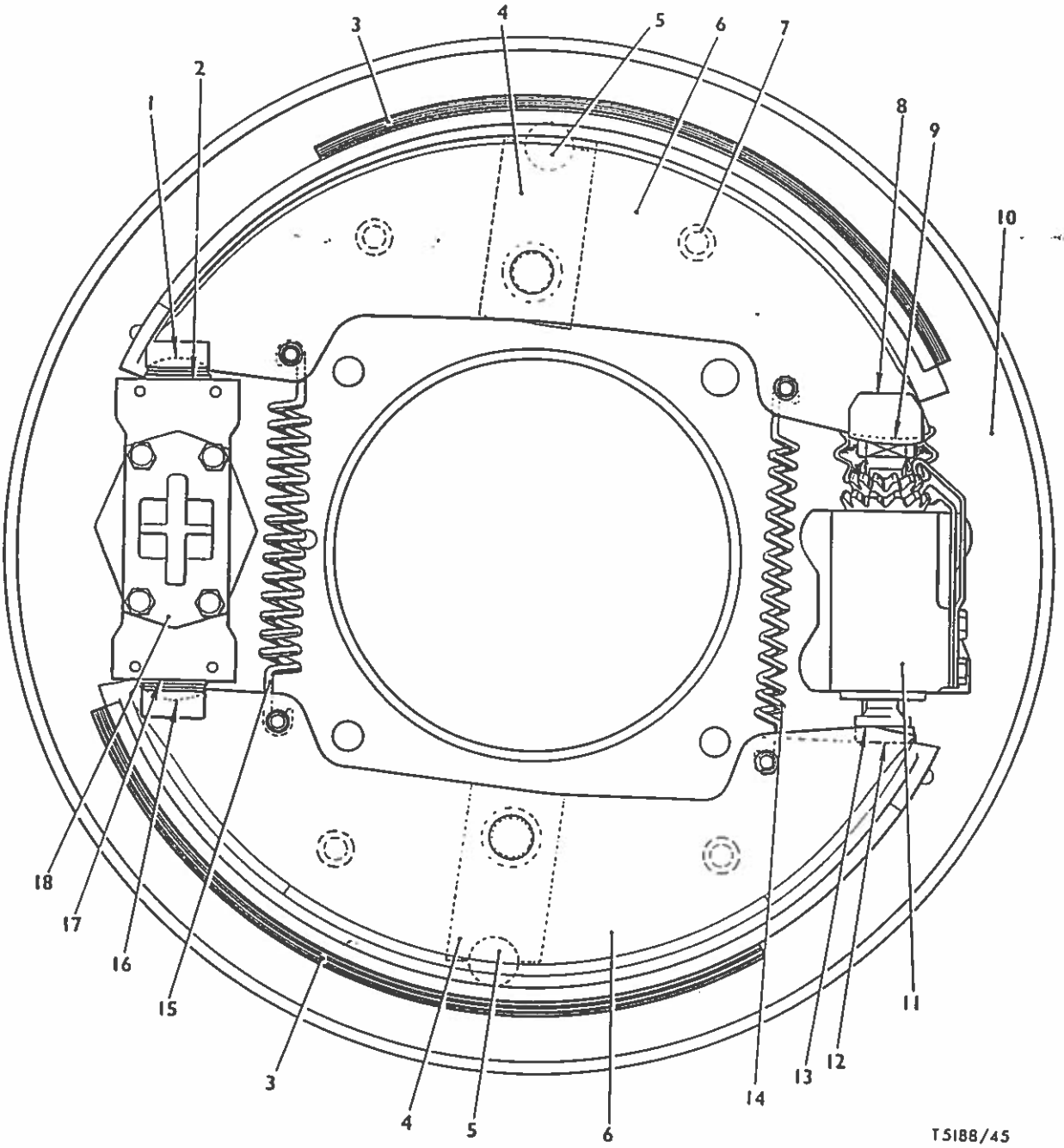
25. The two brake shoes (Fig 5(3)) of each assembly are not anchored directly to the backplate (10), but are each frictionally held in a carrier (6) by two helical brake shoe retaining springs (7). These springs pass through holes in the brake shoe web and are compressed between the sides of the carrier. Each shoe pivots on a rocker pin (5) which is located in a depression in a link (4), this link being interposed between the sides of the carrier. Abutments for the carriers are provided at points (1), (9), (13) and (16). The carrier and shoe assemblies are retained on the backplate by two pull-off springs (14 and 15), the spring (15) nearer the tappet assembly having the larger diameter. Additional support for the shoes is provided by two steady pins retained by locknuts.

26. An expander unit and a tappet unit (18) are mounted on each backplate, the tappet unit being within the drum and the expander unit being adjacent to the tappet unit on the outside. Diametrically opposite to these units at the front of each backplate is mounted an adjuster unit (11).

27. Red spots are normally painted on the shoe carriers adjacent to the tappet housing and also on the tappet housing. This prevents incorrect assembly of the carrier and thus of the brake shoes.

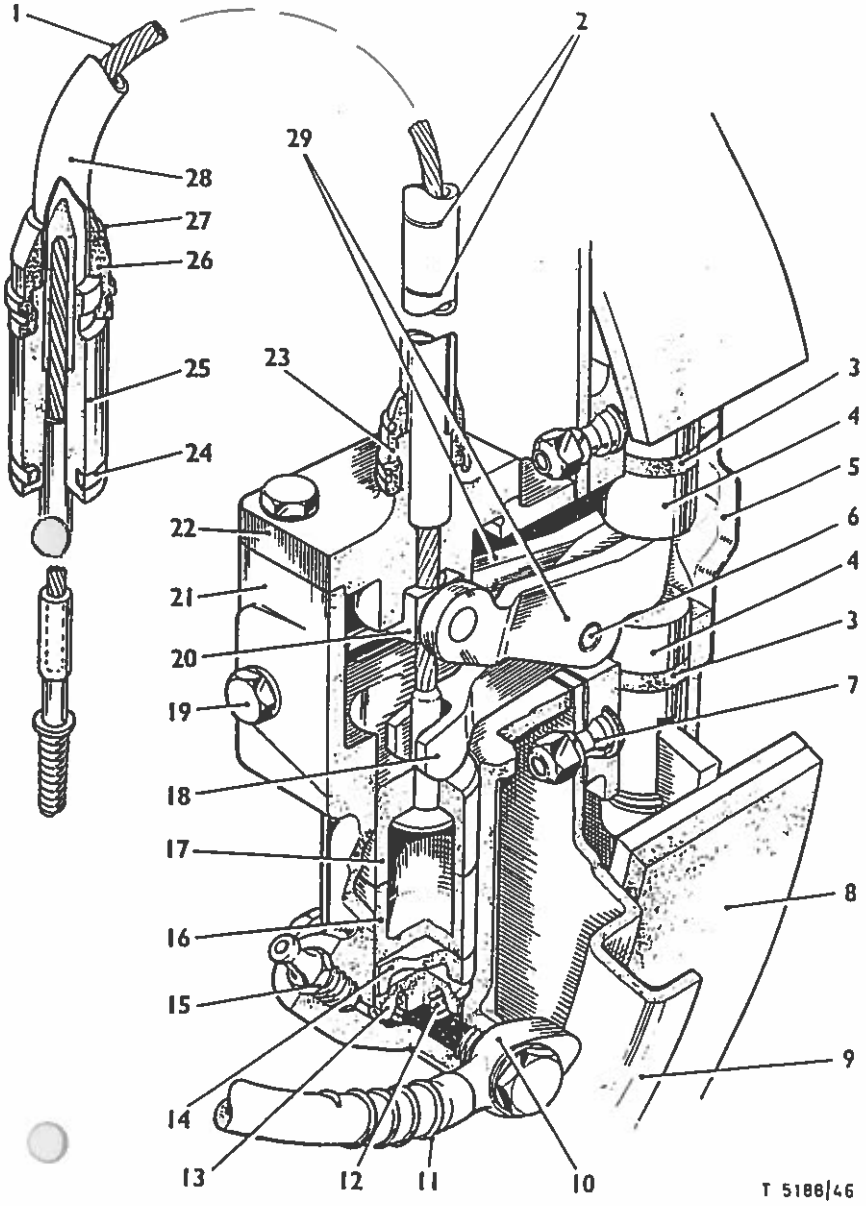
**Expander unit**

28. The expander unit comprises an aluminium alloy body (Fig 6(21)) which is held by four bolts which pass through the backplate and screw into holes in the tappet body. Two dowels are fitted in the expander body to locate it on the backplate and a gasket is fitted to seal it on the backplate. A piston (17) and piston head (16) are fitted in a vertical bore in the expander body. This bore is connected to the fluid line and has a bleeder hole fitted with a bleed screw (15). A rubber cup (14) expanded by a filler (13) and spring (12) bears against the piston head. The piston is part of the cable assembly and has a clearance hole to permit free passage of the shank of the swaged-on cable end-portion. A trunnion (20) having a square centre section and cylindrical ends, and drilled to take the cable, is fitted to a slot in the cylinder end cap (22). Pivoted on each end of the trunnion and retained by a circlip is an outer lever (29). A fork-ended inner lever (18) lies between the two prongs of the outer lever and is secured by a hinge pin (6).




1 *Carrier abutment - forward direction*
2 *Shoe abutment - forward direction*
3 *Brake shoe*
4 *Link*
5 *Rocker pin*
6 *Brake shoe carrier*
7 *Brake shoe retaining spring*
8 *Shoe abutment - reverse direction*
9 *Carrier abutment - reverse direction*
10 *Back plate*
11 *Adjuster unit*
12 *Shoe abutment - forward direction*
13 *Carrier abutment - forward direction*
14 *Small pull-off spring*
15 *Large pull-off spring*
16 *Carrier abutment - reverse direction*
17 *Shoe abutment - reverse direction*
18 *Tappet unit*

**Fig 5 Left front brake assembly (Mk 1 and 2 vehicles)**



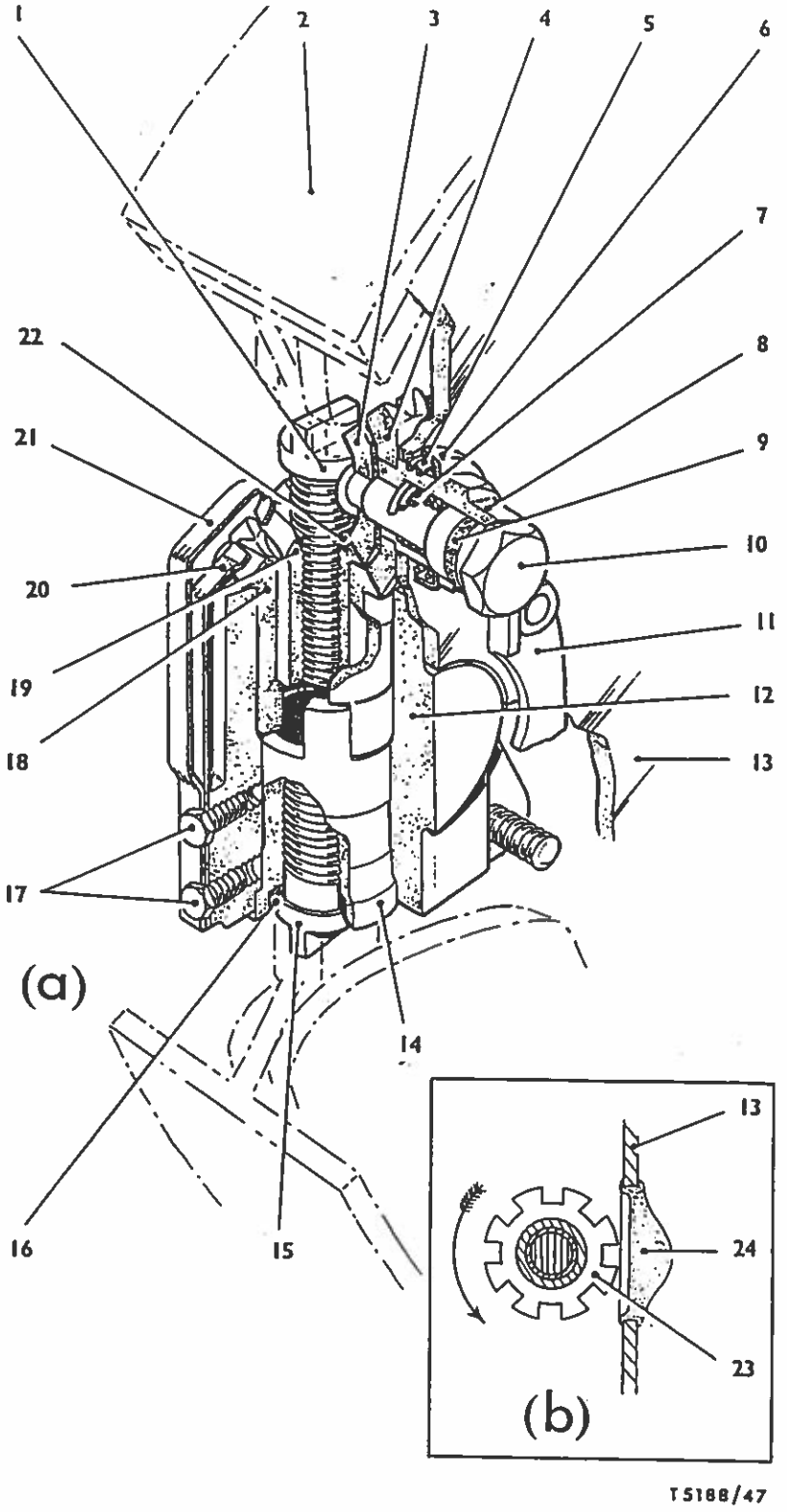

1 Cable
2 Red bands
3 Tappet seal
4 Tappet
5 Cover plate
6 Hinge pin
7 Stud
8 Brake shoe
9 Back plate
10 Union
11 Flexible hose
12 Spring
13 Filler cup
14 Piston cup
15 Bleed screw
16 Hydraulic piston
17 Parking brake piston
18 Inner lever
19 Expander securing bolt
20 Trunnion
21 Expander body
22 Cylinder end cap
23 Rubber boot
24 Sleeve sealing ring
25 Abutment sleeve
26 Rubber boot
27 Strap
28 Cable outer casing
29 Outer levers

**Fig 6 Brake expander and tappet unit (Mk 1 and 2 vehicles)**

29. The cable outer casing is fitted to the cylinder end cap at one end and to an abutment sleeve (25) which is secured to the hull at the other. The outer casing is rubber covered and a rubber boot (23) is fitted to the casing and end cap at one end and a similar boot (26) is fitted to the casing and sleeve at the opposite end. Both boots are secured by spring clips.

**Tappet unit**

30. The tappet unit is used, in conjunction with the expander, to operate the brakes. It is held on the backplate by nuts and spring washers on studs (7) cast into the aluminium alloy tappet body, the joint being sealed by a gasket. Two tappets (4) fitted with rubber seals (3) are located in bores in the body. Abutment keys, which lie in slots in the tappets, are each secured to the body by two grooved headless pins. The opening in the tappet body is closed by a steel coverplate (5) secured by four self-tapping screws and sealed by a gasket. One end of the body is drilled with two inclined holes which are towards the top of the brake assembly when the unit is fitted on the backplate.




1 *Right hand thread adjuster screw*
2 *Brake shoe*
3 *Inner bevel wheel*
4 *Outer bevel wheel*
5 *Outer spring*
6 *Adjuster bolt housing*
7 *Inner spring*
8 *Square headed adjuster*
9 *Fibre washer*
10. *Hexagon headed adjuster*
11 *Washer*
12 *Adjuster housing*
13 *Back plate*
14 *Adjuster sleeve*
15 *Left hand thread adjuster screw*
16 *Fibre washer*
17 *Clicker spring screws*
18 *Adjuster cap*
19 *Adjuster nut*
20 *Inner clicker spring*
21 *Outer clicker spring*
22 *Fibre washer*
23 *Adjuster nut*
24 *Dust cover*

*(a) Later production vehicles adjuster unit*
*(b) Early production vehicles adjuster arrangement*

**Fig 7 Adjuster unit (Mk 1 and 2 vehicles)**

**Adjuster unit**

31. The adjuster housing (Fig 7(12)) has studs incorporated in the casting by which it is secured on the backplate by nuts locked in pairs by lockplates. The housing is bored to receive an adjuster cap (18) at one end and an adjuster sleeve (14) at the other, the inner end of the sleeve being specially formed to engage with similar slots in the cap. The adjuster cap is counterbored and is fitted with a

bevelled adjuster nut (19). This adjuster nut is provided with an internal right hand thread and the adjuster sleeve with a left hand thread to accommodate two adjuster screws (1) and (15). A two-part clicker spring (20) and (21) is retained on the side of the housing by two screws (17) and engages with the adjuster nut and the adjuster cap respectively to lock the adjustment of the shoes in any required position.

32. The adjuster cap (18) and nut (19) are engaged by a similar pair of bevel wheels (3) and (4) mounted coaxially in the backplate and individually controllable by a hexagon-headed adjuster (10) for the smaller (nut) wheel and a square headed adjuster (8) for the larger (cap) wheel. The hexagon-head adjusts the leading shoe; the square head adjusts the trailing shoe.

**Operation**

33. Depressing the brake pedal causes the push-rod (Fig 3(18)) in the master cylinder to move the piston (13) along the cylinder and the fluid is forced into the pipe lines, past the valve (8) against the reaction of its spring, to the brake expanders. The fluid pressure forces the hydraulic piston head (Fig 6(16)) along the bore, carrying the handbrake piston (17) before it and deflecting the lever (18) which is pivoted to the two outer levers (29) by the pin (6). These levers are pivoted to a cap (22) and therefore a 'scissors' action prevails, the heels of the levers forcing the tappets outwards and applying a load to the carriers (Fig 5(6)) at points (1) and (9). The carriers move outwards, reacting against points (13) and (16) on the adjuster screws until the brake shoes contact the brake drum. As the links (4) are allowed a certain amount of angular latitude, the shoes will move in the same sense of rotation as the drum until finding abutments at (2) and (12) with the vehicle moving in the forward direction and at (8) and (17) with the vehicle in reverse. The movement of the shoes is very small and no evidence of it can be felt or heard during operation. As the shoes always find abutments at their trailing ends, two leading shoe characteristics are obtained in both directions.

34. When the pedal is released, the brake shoe pull-off springs (14 and 15) cause the fluid to return to the master cylinder (Fig 3), the valve (8) moving away from its seating on the body against the pressure of the piston return spring (9). The small port ensures that the system is maintained full of fluid at all times and allows full compensation for expansion and contraction of the fluid due to temperature changes. It also allows any fluid drawn through the small holes in the piston head to return to the reservoir. The valve prevents the return of fluid to the master cylinder during bleeding thus ensuring that a charge of fresh fluid is delivered at each stroke of the pedal.

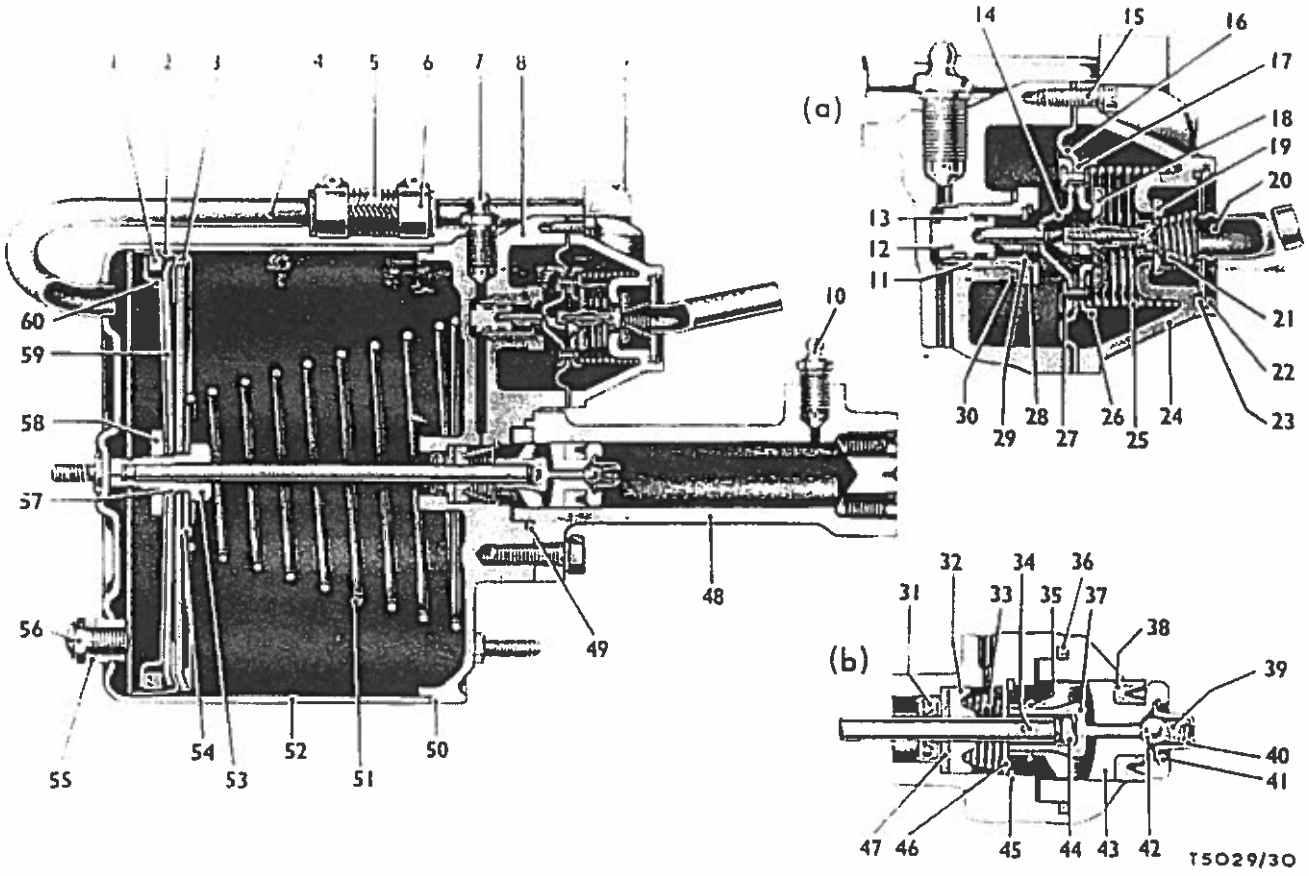
35. The parking brake lever operates each of the four brakes in the same way by means of the cable (Fig 6(1)) which moves the parking brake piston (17) along the bore, whilst the hydraulic piston (16) remains stationary.

**VACUUM SERVO UNIT**

36. A vacuum servo unit (Fig 8) is fitted to later production Mk 1 and 2 and Mk 2/6, 2/7, 4 and 5 vehicles and is mounted on a bracket at the left rear of the engine compartment. The unit comprises a vacuum cylinder and piston, a hydraulic slave cylinder and piston and, an end cover incorporating a valve chamber. The unit is interposed between the master cylinder and brake operating assemblies.

37. The vacuum cylinder (Fig 8(52)) is a steel pressing closed at one end and held to the end cover by four clamp bolts and nuts, the joint being sealed by a toroidal sealing ring (50). The piston assembly consists of a washer (54), two piston plates (3 and 59), a synthetic rubber packing ring (2), a felt ring (1) expanded by a spring steel ring and a steel felt retainer (60). The piston assembly is clamped against the piston rod head (53) by a nut (58) and a toroidal sealing ring (57) is fitted between the piston plates and the piston rod head to make an airtight seal. A conical helical compression spring (51) forces the piston towards the closed end of the cylinder.

38. The cast iron slave cylinder (48) is attached to the end cover by three bolts and lockwashers, the joint being sealed by a non-metallic washer (36). Two tapped outlet holes and a bleed screw (10) are provided at the end of the cylinder. A steel push-rod is pressed into the piston rod, and is secured by dimples in the piston rod pressed into an annular groove at the end of the push-rod. A piston (43), fitted with a cup (38), is held on the end of the push rod by a pin (34) retained by a




1 Felt ring
2 Packing ring
3 Piston plate
4 Connecting pipe
5 Hose
6 Hose clip
7 Bleed screw
8 End cover
9 Elbow
10 Bleed screw
11 Air valve piston body
12 Valve head
13 Seal
14 Diaphragm plate
15 Screw
16 Diaphragm
17 Washer
18 Vacuum inlet valve
19 Air inlet valve
20 Air inlet pipe
21 Spring
22 Retaining spring
23 Seal
24 Valve cover
25 Compression spring
26 Spring retainer
27 Rivet
28 Retaining ring
29 Stop washer
30 Washer
(a) Section through diaphragm and inlet valve

31 Oil seal
32 Cup
33 Compression spring
34 Pin
35 Retaining ring
36 Washer
37 Fork piece
38 Piston cup
39 Compression spring
40 Cup
41 Retaining ring
42 Ball valve
43 Slave piston
44 Fabric seal
45 Retaining ring
46 Abutment washer
47 Sealing plate
48 Slave cylinder
49 Washer
50 Sealing ring
51 Compression spring
52 Vacuum cylinder
53 Piston rod head
54 Washer
55 Washer
56 Drain plug
57 Sealing ring
58 Piston nut
59 Piston plate
60 Felt retainer
(b) Section through slave cylinder

Fig 8 Vacuum servo unit

circlip (35). A cup (40), retained in the piston head by a retaining ring (41), holds a spring (39) which loads a ball (42) on to a seating formed in the piston head and a fork piece (37) is free to slide in a diametral slot in the piston. An oil seal (31) is fitted to the bore of the end cover to prevent contamination of the fluid by any oil present on the push-rod and fluid leakage is prevented by a compression cup (32) loaded by a compression spring (33) which bears against an abutment washer (46) retained by a retaining ring (45).

39. The end cover (8) is of die cast aluminium alloy. A bleed screw (7) is fitted to a tapped hole at the end of a drilling from the central bore of the cover. A valve chamber is formed in the cover and an air valve piston body (11) is screwed into the central bore of this chamber, a copper washer (30) sealing the joint. A valve head (12), fitted with a seal (13), works in the bore of the body, its movement being limited by the wall of the end cover at one end and a stop washer (29), retained by a retaining ring (28) at the other. The valve chamber is closed by a valve cover (24) secured to the end cover by screws (15) and lockwashers which also hold a rubberized fabric diaphragm (16), the centre of which is riveted between two plates. A valve seat is formed on one plate and to the other is peened a push-rod which engages a depression in the end face of the valve head (12). The diaphragm is loaded towards the valve head by a helical compression spring (25) abutting the valve cover.

Two disc valves with bonded synthetic rubber faces are flexibly jointed by a short length of steel wire. The larger valve seats on the diaphragm centre plate, while the smaller seats on an annular face machined on the valve cover (24). The valve assembly is loaded towards the diaphragm by a helical compression spring (21) which abuts the plate of the air inlet pipe (20), this pipe being held in position in the valve cover by a retaining ring (22) and sealed by a sealing ring (23). The valve chamber is connected to the closed end of the vacuum cylinder by an air pipe (4) made in two parts and joined by a length of rubber hose (5) secured by hose clips (6). An elbow (9) is screwed into the valve cover, the joint being sealed with a sealing compound and the elbow end has one part of the connecting pipe brazed to it. The other part of the pipe is brazed to the vacuum cylinder.

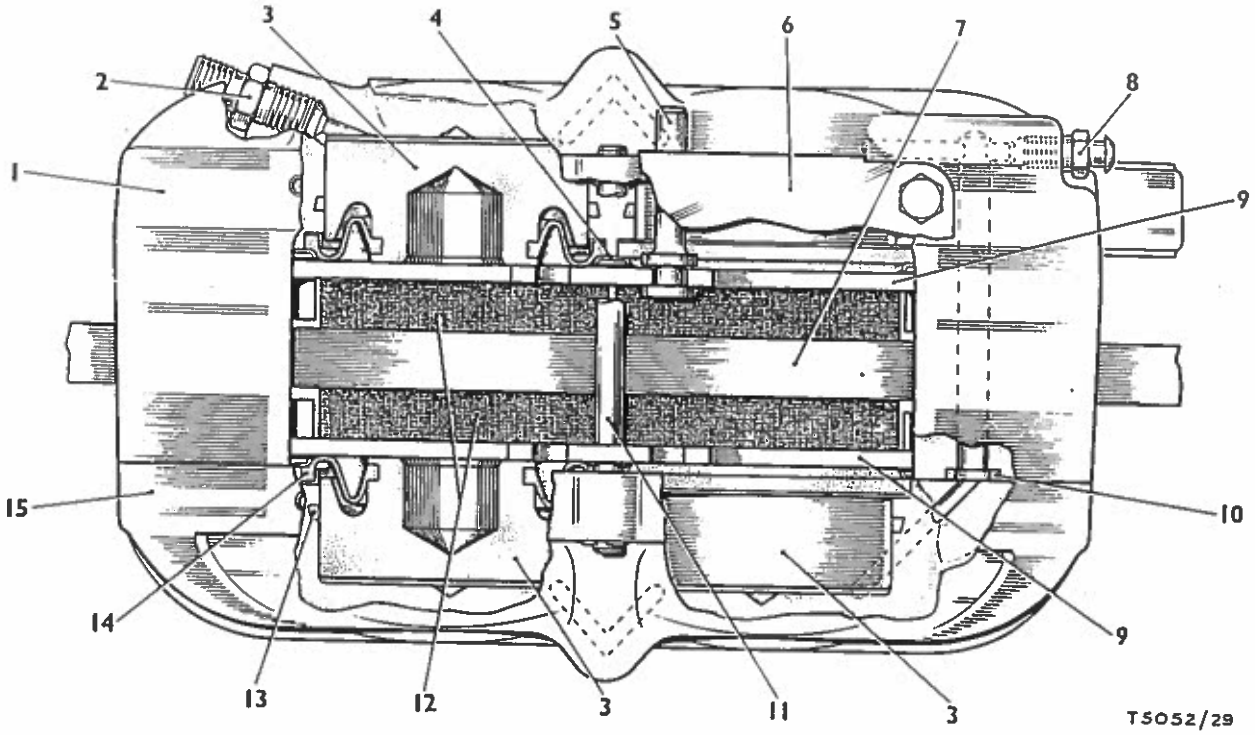
**Operation**

41. When the unit is at rest, the valve head (12) and the diaphragm (16) are in the normal position; the vacuum inlet valve (18) is open and the air inlet valve (19) is closed, the valves being maintained in position by the compression spring (21). A port connects the vacuum cylinder (52) to the engine inlet manifold and whatever degree of depression exists on the inner side of the piston is transmitted to the outer side by a port, the open vacuum inlet valve (18) and the connecting pipe (4).

42. On the brake pedal being depressed, fluid from the master cylinder enters the unit through a port and enters the slave cylinder by way of the open base valve in the slave cylinder piston. Additionally, fluid pressure is transmitted through the port to the face of the valve head (12), causing movement of the valve head which deflects the diaphragm (16) until it bears against the vacuum inlet valve (18) and the seal thus formed isolates the suction source from the outer side of the vacuum cylinder piston. Further movement of the valve head opens the air inlet (19), permitting air to enter through the pipe (20) and to reduce the degree of vacuum. The vacuum piston is thus caused to move forward, pushing the slave piston assembly before it and thereby increasing the fluid pressure within the slave cylinder to apply the brakes more firmly. The reduction in the degree of vacuum in the outer chamber results in the creation of a pressure difference across the diaphragm in opposition to the force applied by the master cylinder pressure to the valve head (12), allowing the air inlet valve (19) to re-seat and thus prevent further entry of air. Greater effort on the brake pedal results in an increased thrust on the valve head which can, therefore, sustain a greater pressure difference across the diaphragm, so allowing a greater amount of effort to be performed by the vacuum piston.

43. When the brake pedal is released, pressure is removed from the valve head (12), allowing the spring (25) to push the diaphragm (16) back to its original position, thereby reconnecting the outer chamber to the inlet manifold. The helical compression spring (51) is then able to return the vacuum and slave pistons to the 'off' position.

44. The ball valve (42) is operated by the fork piece (37), which in the 'off' position is held forward by the abutment washer (46). When the slave piston is faced forward, when the brake pedal is depressed, the fork lags behind the piston and the compression spring (39) forces the ball on to its seating in the piston head.




1 *Inner casing*
2 *Adaptor*
3 *Piston*
4 *Retainer*
5 *Indicator rod*
6 *Cover plate*
7 *Brake disc*
8 *Bleed screw*
9 *Pressure plate*
10 *Seal*
11 *Retaining pin*
12 *Lining*
13 *Seal*
14 *Boot*
15 *Outer casing*

**Fig 9 Caliper brake unit**

45. Should the servo unit fail for any reason the brakes can still be applied, but with more pressure required on the brake pedal, the pressure created in the master cylinder will have a free path through the slave piston.

## BRAKE ASSEMBLY (Mk 4 and 5)

46. The main brake assemblies fitted to Mk 4 and 5 vehicles comprise a disc (Fig 9(7)) bolted to the inner side of each wheel hub and a hydraulically operated caliper brake unit at each wheel station.

### Caliper brake unit

47. The caliper brake unit which operates on the brake disc is bolted to the rear of each wheel carrier. Each unit comprises two steel casings (1 and 15) secured together by four socket head cap screws, four hydraulically operated pistons (3), two steel brake pressure plates (9) with bonded friction linings (12) and a cover plate (6) which also houses an indicator rod (5) to indicate the amount of lining wear. A seal (10) is fitted in a counterbore in the inner casing and serves to seal the transverse port.

48. Each casing has two bores, each accommodating a piston (3) and a piston seal (13) which is fitted in an annular groove in the bore. A boot (14) fits in an annular groove on the piston and is retained on the casing by a retainer (4) secured by four countersunk screws.

49. Each pair of pistons acts upon a brake pressure plate (9) located on a retaining pin (11). The cover plate (6) is bolted to the top of the caliper unit and the indicator rod (5) rests in a slot in the upper portion of a pressure plate.

50. A flexible hydraulic pipe with an adaptor (2) is screwed to the casing and connects, through ports, to the chambers at the outer ends of each piston. A bleed screw (8) is also incorporated in the casing.

51. In operation, fluid under pressure is fed through the flexible pipe and ports to the piston chambers, thus forcing the pistons and pressure plates inwards, against the disc (7).