GENUINE

Lockheed

REGD. TRADE MARK

TANDEM POWER-VALVE BRAKING SYSTEM

SERVICE MANUAL

SERVICE DIVISION

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2nd EDITION

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SERVICE MANUAL

SECTION 1 DESCRIPTION AND OPERATION

Prior to a detailed description of the various units that comprise the system it is considered advantageous to understand the operation of the complete system.

An illustration showing the arrangement of the units is given on Fig. 1.

A rotary pump draws filtered oil from the supply tank and delivers it to the centre connection of the cut-out valve for the purpose of charging No. 1 accumulator to which it is attached. From the latter connection, a branch pipe extends to carry this same oil to charge the oil chamber of No. 2 accumulator. When No. 1 accumulator has become fully charged, the cut-out valve will operate to maintain it in the charged state and at the same time direct oil from the pump back to tank by way of the power valve to maintain a continuous flow circuit. During this operation, oil pressure will have ceased to flow to No. 2 accumulator, due to the transfer of oil to the supply tank, whilst a non-return valve situated in the oil head will re-seat to maintain this accumulator in the now charged condition.

The power valve, which is operated by the brake pedal, is the vital link between the accumulators and the brakes, as it is the function of this valve which actually controls the complete system. Further, the valve is also capable of controlling two entirely separate brake systems, for instance, should a failure occur in the line from No. 1 accumulator to the power valve or rear brakes, the front brakes are still capable of being operated to bring the vehicle safely to a stop, likewise, should some defect occur in the line from No. 2 accumulator to the power valve or front brakes, the rear brakes can still be operated. In addition to this safety factor, two pressure warning switches, incorporated in the system between the accumulators and the power valve, provide visible alarm to the driver indicating that a fault has occurred in the brake system.

When a brake application is made under normal conditions, the power-valve plungers move along their respective valve bores to uncover the INLET connections and so permit oil pressure from the accumulators to flow from the OUTLET connections for operation of the front and rear brakes.

The front brakes are operated in the most part by oil pressure supplied by the rotary pump which is driven by the gearbox, it will be seen, therefore, that as the speed of the vehicle decreases as a result of braking, so the running speed of the pump gets slower until such time as the output from the pump is eventually supplemented by oil pressure from No. 2 accumulator. From the foregoing it will be seen that as No. 2 accumulator is supplemented by the pump so its rate of discharge will be less than that of No. 1 accumulator, therefore, the fact that the cut-out valve is attached to the latter accumulator will always ensure that pressure in No. 2 accumulator does not fall to a dangerously low level.

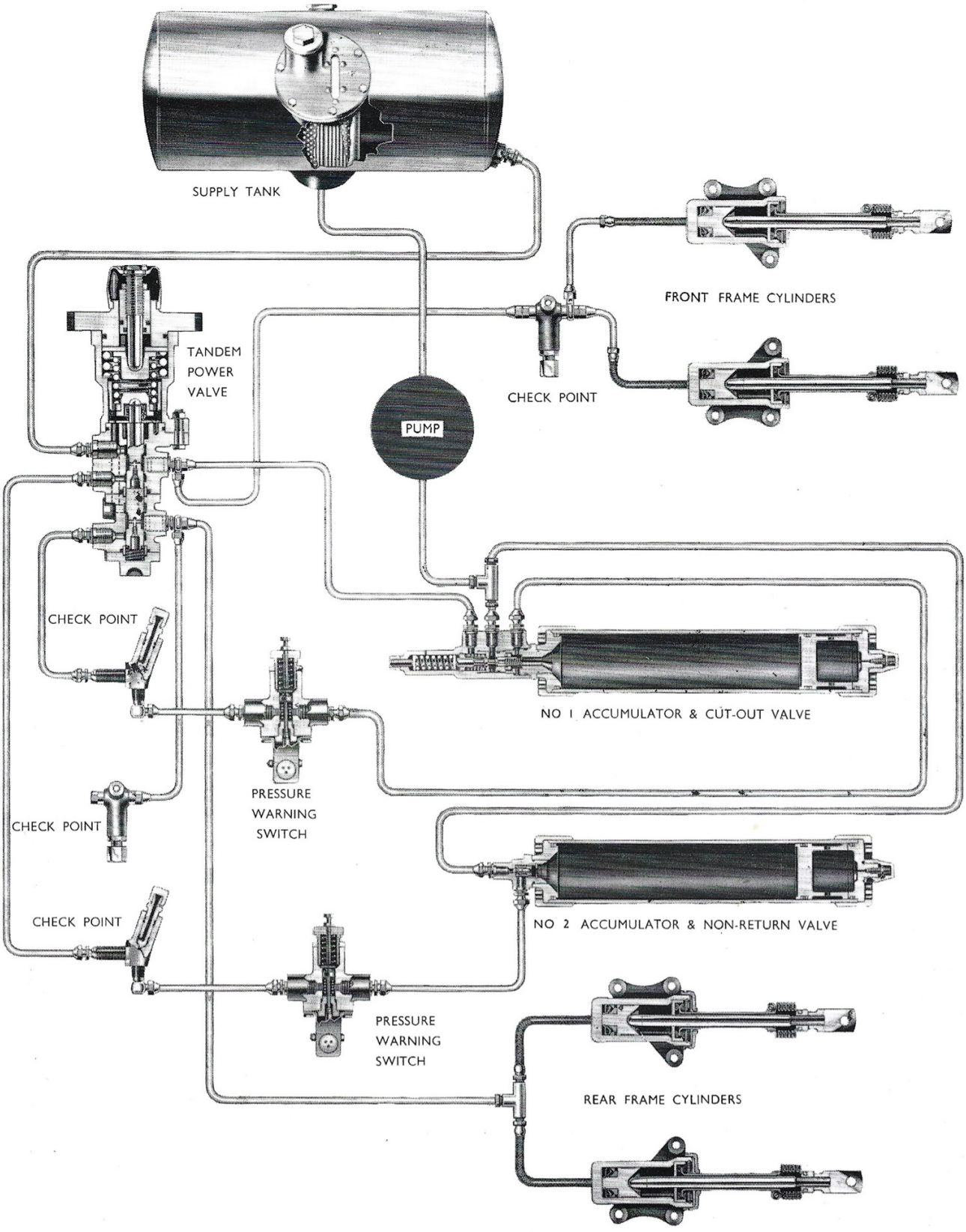

Fig. 1 Layout of System

SECTION 2

OVERHAUL INSTRUCTIONS

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CUT-OUT VALVE

Description (Refer to Fig. 3)

The purpose of this cut-out valve is to control the charging of the accumulators by the rotary pump and to allow the pump to circulate oil around an idling circuit when the accumulators become fully charged.

The valve comprises a body formed with three tapped pipe connections and is bored to accommodate the working parts, these items comprises a main sleeve which has a groove around its outer diameter for the purpose of retaining a rubber seal, and a bore within which a spring-loaded sliding valve operates. An additional groove in the bore of the sleeve also retains a rubber seal and loads a fabric ring against the full diameter of the sliding valve.

An adaptor, grooved to accommodate two separate rubber seals, is screwed into the bore to retain the main sleeve whilst in turn this sleeve retains a valve seat and a second sleeve which abuts a shoulder in the bore of the body. This latter sleeve has a valve stem passing through it which is flanged to provide the seat for a spring-loaded flutter plate whilst that portion of the valve stem just forward of the flutter plate is mushroom shaped, to provide a seat for the sliding valve. The large domed portion of the valve stem passes through the centre of a seal and seal retainer which is loaded by a spring situated between two spring retainers. An adjusting screw at the reduced end of the valve body is provided so that load on the large spring can be varied in order to give a range of cut-out pressures for the valve.

Principle of Operation (Refer to Figs. 3 & 4)

When the cut-out valve is installed on the vehicle the pipe connections are arranged as follows:—

Connection "A"—Return to supply tank via connections "E" and "C" of power valve (brakes off).
Connection "B"—Delivery from pump.
Connection "C"—To connection "A" of power valve.

Oil is drawn from the supply tank by the rotary pump, where it flows via a three-way connection to connection "B" of the valve in order to charge the oil side of No. 1 accumulator. A branch pipe from the three-way connection carries this same oil to charge the oil side of No. 2 accumulator.

The oil flow, having entered connection "B" of the valve is directed through the radial porting in the main sleeve to unseat the sliding valve and charge the oil chamber of No. 1 accumulator, where it is compressed until the "cut-out" pressure is reached. The pump delivery pressure will now commence to build up in the valve and in so doing will cause the valve stem to lift slightly against the springs. The flutter plate will now move away from the valve stem and produce an oil passage to connection "A" and the supply tank, which causes the pump delivery to fall; the accumulator pressure will now assert itself and drive the sliding valve hard against the mushroom head of the valve stem to complete the "cut-out" condition.

During this operation, oil pressure will have ceased to flow to No. 2 accumulator, due to the transfer of oil to tank, and a non-return valve fitted in the oil head will re-seat to maintain this accumulator in the now charged condition.

When the accumulators are called upon to supply pressure, the valve stem will gradually close on to its seat, the flutter plate will return to its original position and the charging cycle will re-commence as previously described.

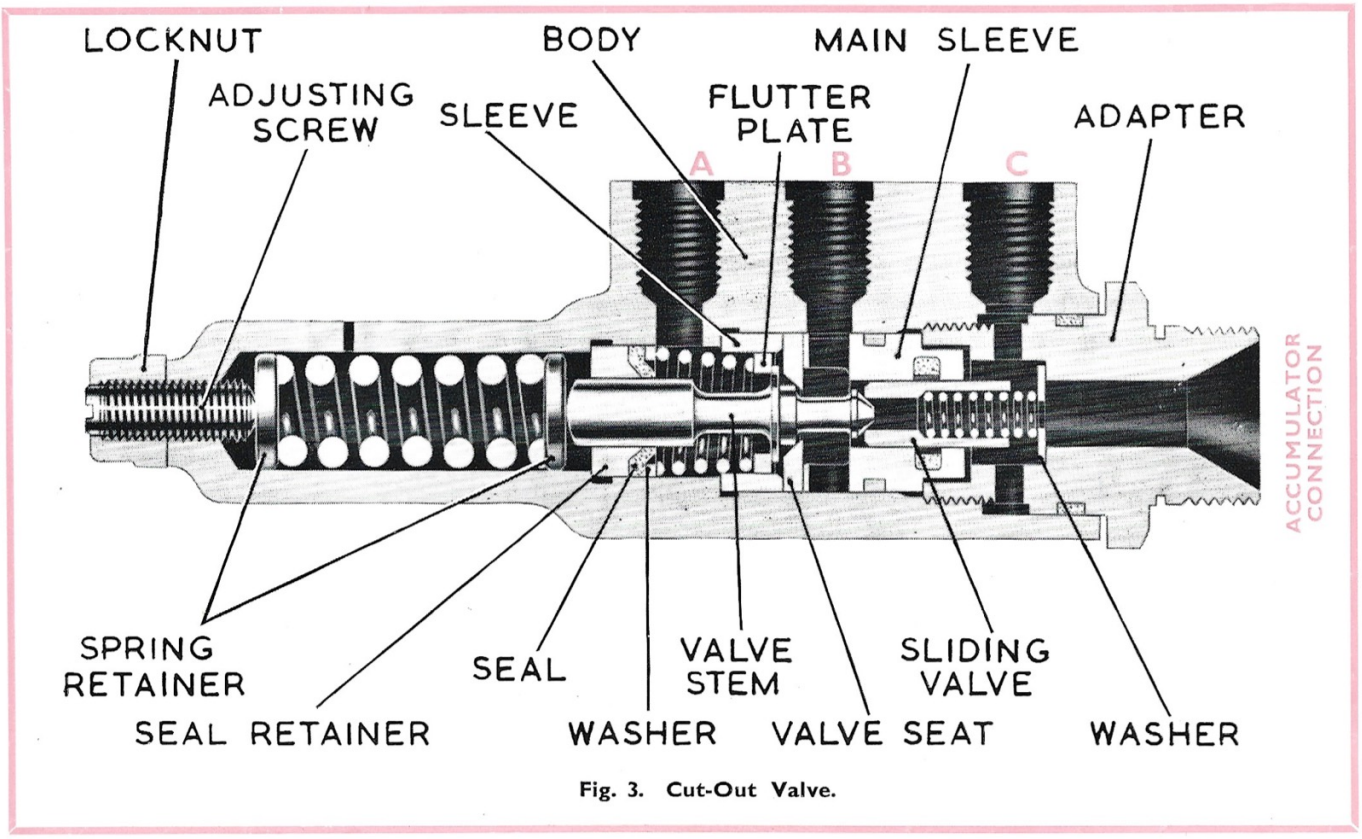
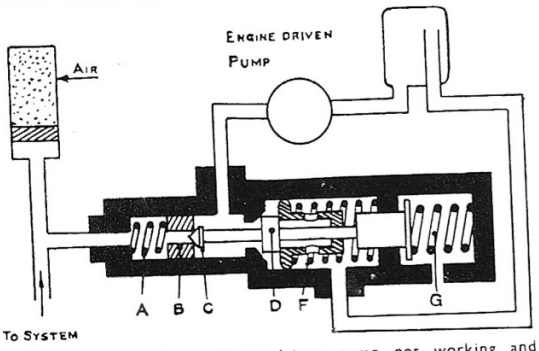
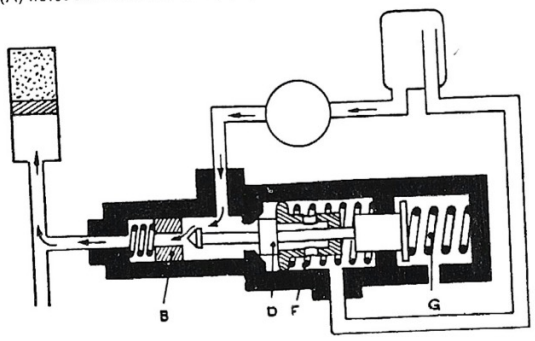


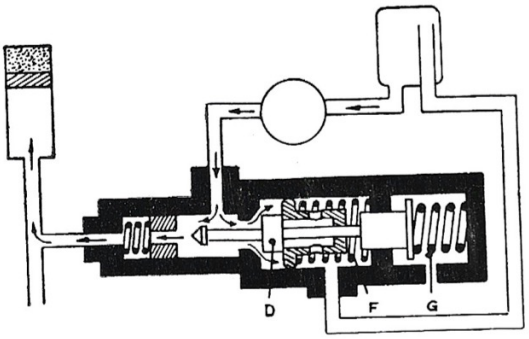
Fig. 3. Cut-Out Valve.



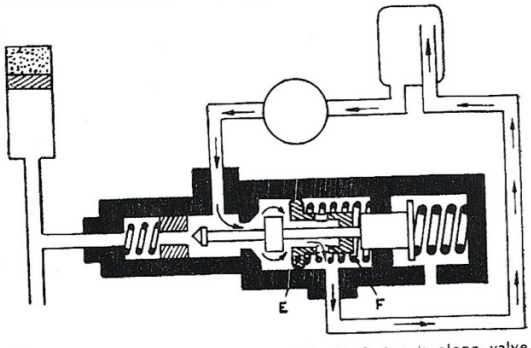
No. 1 STATIC position. Engine-driven pump not working and accumulator discharged. Spring (F, G) keep valve (D) seated and spring (A) holds slidable valve seat (B) against valve (C).



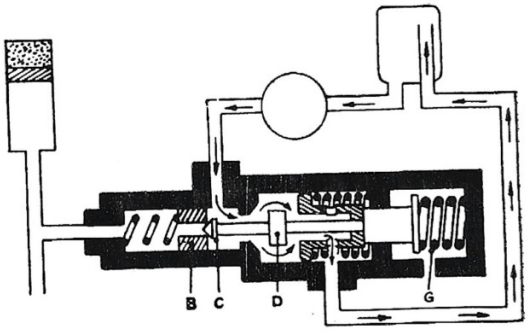
No. 2 When engine-driven pump starts working, fluid lifts valve seat (B) and flows into accumulator, compressing air and storing energy. Springs (F, G) keep valve (D) seated until . . . .



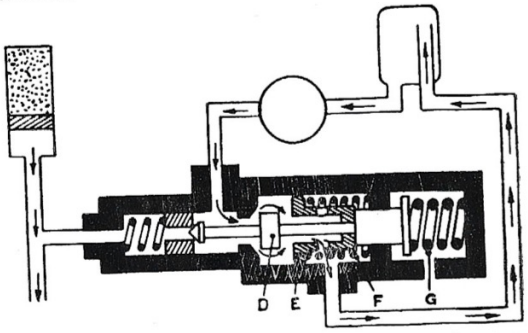
No. 3 Accumulator pressure reaches "cut-out" figure. Pressure acting on valve (D) then lifts it slightly against force of springs (F, G) so that . . . . .



No. 4 Pressure acts on flutter plate (E), displacing it along valve spindle against spring (F). Fluid then escapes to reservoir through holes in flutter plate and . . . . .



No. 5 Delivery pressure of pump falls. Accumulator pressure pushes seat (B) on to valve (C) and opens valve (D) fully against spring (G). Full delivery of pump flows through flutter plate to reservoir. This is the "cut-out" condition.



No. 6 As accumulator pressure falls during operations of system, spring (G) pushes valve (D) towards its seat. When "cut-in" pressure is reached, valve (D) engages seat, spring (F) returns flutter plate on to valve (D), and charging cycle commences as in diagram (2).

Fig. 4
Operational Diagram for Cut-out Valve

Dismantling (Refer to Fig. 3)

Proceed as follows:—

Note: When dismantling the cut-out valve it is assumed that it has been removed from the accumulator.

(1) For reference when re-assembling it is advisable to measure the distance from the end of the adjusting screw to the adjacent end face of the valve body. To do this, hold the adjusting screw against rotation and remove the locknut; after noting the dimension remove the adjusting screw.

(2) Unscrew the adaptor and remove the internal parts, this is best done with the aid of a brass or soft metal rod inserted through the hole from which the adjusting screw was removed.

(3) Ease the seals from their grooves in the various parts.

Cleaning

Clean all parts as described under the heading of "GENERAL CLEANING".

Assembling (Refer to Fig. 3)

Using new parts as found necessary and new seals throughout, assemble the unit as follows:—

(1) Position a spring retainer at the bottom of the bore, followed by the large spring and the second spring retainer.

(2) Pass the seal retainer, plain face leading, down the bore so that it rests on the shoulder provided, follow up with the seal, recessed face leading, and the washer.

(3) Pass the smaller of the two sleeves down the bore, followed by the larger of the two remaining springs. Now insert the flutter plate so that it rests on the spring and enter the valve stem into the bore ensuring that its large domed end passes through the seals to seat on the innermost spring retainer.

(4) Insert the valve seat, with the larger diameter of its tapered bore leading and push the part fully up to the sleeve.

(5) Ease the large fabric seal into its groove on the main sleeve and the appropriate rubber seal, followed by the fabric seal into the groove in the sleeve bore.

(6) Insert the sliding valve, smaller bore leading, into the reduced end of the main sleeve and enter the assembly, ported end leading, into the bore pushing it fully home against the valve seat.

(7) Ease the two remaining rubber seals into their appropriate grooves in the adaptor.

(8) Position the small spring in the bore of the sliding valve and the spring washer on its seat in the larger bore of the adaptor. Offer up the adaptor to the valve body and screw it fully home ensuring that the valve washer does not tilt and become wedged whilst doing so.

(9) Fit the adjusting screw in the end of the valve body; loosely fit the locknut. Adjust the screw until the dimension noted prior to dismantling is obtained and, whilst holding the screw against rotation securely tighten the locknut.

Testing

Using oil of the type used in the system test the cut-out valve as follows:—

Note: Throughout these tests, connection "C" is to be blanked off.

(1) With the valve connected into circuit with an accumulator and with the pump delivering 1 (one) gallon per minute, adjust the valve by means of the adjusting screw, to "cut-out" at between 1,200 and 1,250 lb. per sq. in. With the valve at this setting, "cut-in" should commence before the pressure in the accumulator has reduced to 900 lb. per sq. in; the range between "cut-out" and "cut-in" pressures on any valve must not be less than 275 lb. per sq. in.

(2) After setting the valve, charge the accumulator to the "cut-out" pressure and then discharge to below "cut-in" pressure.

(3) Repeat test (2) and check that the range between "cut-out" and "cut-in" pressures is as indicated in test (1).

(4) Apply an oil pressure of 1,250 lb. per sq. in. at the accumulator connection with connections "A" and "B" open to atmosphere. The combined seepage from connections "A" and "B" must not be in excess of 10 c.c. per minute.

(5) Blank off the accumulator connection and apply an oil pressure of 1,100 lb. per sq. in. at connection "B"; seepage from connection "A" must not be in excess of 10 c.c. per minute.

(6) With connection "B" and the accumulator connection blanked off apply an oil pressure of 250 lb. per sq. in. at connection "A" when there is to be no external leakage.

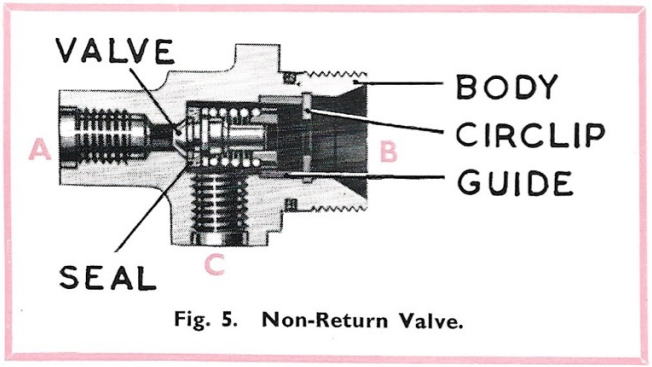


Fig. 5. Non-Return Valve.

NON-RETURN VALVE

Description (Refer to Fig. 5)

The non-return valve is fitted in the fluid head of No. 2 accumulator where its purpose is to prevent the escape of oil to the supply tank after the accumulator has become charged.

In view of the valve's simplicity it is not considered necessary to provide Dismantling and Assembling instructions.

Cleaning

Clean all parts as described under the heading of "GENERAL CLEANING."

Testing

Using oil of the type used in the system test the valve as follows:—

(1) Blank off connection "C" and with pump delivering 1 gallon per minute, apply a slowly increasing oil pressure at connection "A" which must not exceed 20 lb. per sq. in. to produce a free flow of oil from connection "B".

(2) With connection "C" blanked off apply an oil pressure of 2,000 lb. per sq. in. at connection "B" for a period of 15 seconds during which time seepage from connection "A" must not be in excess of 10 c.c. per minute.

PISTON TYPE ACCUMULATORS

Introduction

There are two accumulators installed in the system where their purpose is to store oil under pressure and to release it automatically when called upon to do so.

Both units are similar in construction but differ only by the fitting of an additional unit into the oil head of each accumulator; the oil head of one accumulator has a cut-out valve assembly attached to it and the other a non-return valve assembly.

Description (Refer to Fig. 6)

Each accumulator comprises a cylinder tube, the open ends of which are closed by cylinder heads retained by screwed end caps. A Schrader inflation valve is screwed into the air-head connection and to prevent it from damage or being inadvertently turned a protective cap is fitted.

A sliding separator piston in the bore of the cylinder tube divides the oil and air chambers of the accumulator and to further prevent the association of oil with air the piston is grooved to retain two fabric seals which are backed by a single seal of rubber. Both cylinder heads are grooved to carry one fabric and one rubber seal to prevent external leakage from the air and oil chambers.

Principle of Operation (Refer to Fig. 6)

The air chamber of the accumulator is initially inflated to a given air pressure, and oil is pumped in to the oil chamber from the cut-out valve, driving the separator piston further down the bore thus compressing the air until the pressure has reached the "cut-out" figure.

When the accumulator is called upon to supply oil pressure the compressed air thrusts the piston up the bore and oil is expelled through the connection in the oil head. Throughout the operation of the accumulators the oil pressure will be approximately equal to the value of air pressure, the slight difference being occasioned by friction of the seals on the separator piston.

Dismantling (Refer to Fig. 6)

Warning: Prior to dismantling the accumulator it is vitally important to ensure that no air pressure exists within the unit. Do not rely upon a zero reading on a pressure gauge as being a definite indication that all air pressure is exhausted. It is essential, therefore, that after releasing the air through the air charging valve, the valve itself be removed prior to dismantling the accumulator.

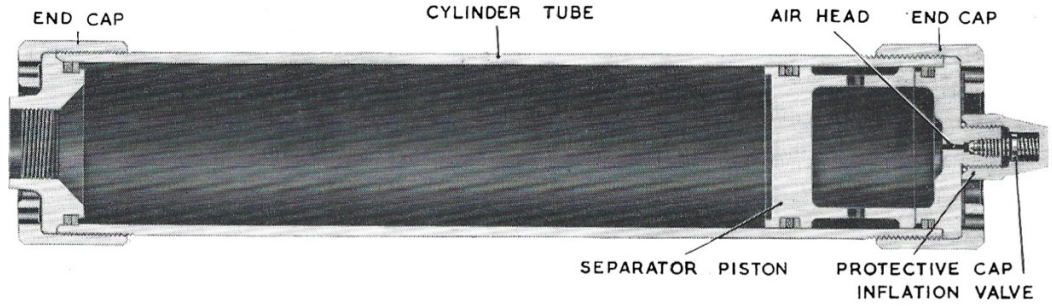


Fig. 6. Accumulator.

After observing the above vital precaution, dismantle the accumulator as follows:—

(1) Grip the cylinder tube in a vice between formed jaws, ensuring that excessive pressure is not applied, and if fitted, unscrew the valve assembly from the oil head connection.

Note: All reference to dismantling and assembling the cut-out valve or non-return valve will be found under their appropriate headings.

(2) Unscrew the end caps and withdraw the cylinder heads; use a brass or soft metal rod to push out the separator piston.

(3) Ease the fabric and rubber seals from their grooves in the appropriate parts.

Cleaning

Clean all parts as described under the heading of "GENERAL CLEANING."

Assembling (Refer to Fig. 6)

Using new parts as found necessary and new seals throughout, assemble the unit as follows:—

(1) Ease one rubber seal and two fabric seals into the groove on the separator piston, with the rubber seal between the two fabric ones. Ease a rubber seal and a fabric seal into the groove on each of the cylinder heads, with the rubber seals nearer to the flange on the heads.

(2) Hold the cylinder tube firmly in a vice between formed jaws, ensuring that excessive pressure is not applied. Insert the piston, crown leading, into one end of the cylinder and follow up with the air-head, easing the seals past the end of the bore. Fit an end cap to secure the air-head, screwing it firmly home.

(3) Screw the inflation valve into the air-head, fit the "O"-ring over the connection and screw the protective cap fully on to it. Fit the oil head into the opposite end of the cylinder tube and secure it with the remaining end cap.

(4) After the accumulator has been assembled, ease the appropriate seal into its groove on the connecting end of the valve previously removed and screw it firmly into the oil head.

Testing

Using oil of the type used in the system, test the accumulator as follows:—

Note: Remove the protective cap covering the inflation valve and the valve itself during tests (2) and (3). The oil temperature throughout the tests is to be maintained between 30 and 50 deg. C.

(1) With the oil connection open to atmosphere, apply an air pressure of 30 lb. per sq. in. at the air connection in order to displace the separator piston; the piston is to be in contact with the oil head. Check for this condition by inserting a brass rod through the oil connection and feeling for the piston crown. The accumulator is to be immersed in oil and a check made for air leakage around the inflation valve.

(2) With the air connection open to atmosphere, apply an air pressure of 30 lb. per sq. in. at the oil connection to displace the separator piston; the piston is to be in contact with the air head. Check for this condition by inserting a brass rod through the air connection and feeling for the inner face of the piston crown. The accumulator is to be immersed in oil and a check made for air leakage around the oil head.

(3) With the air connection open to atmosphere, apply an oil pressure of 2,000 lb. per sq. in. at the oil connection for a period of 15 seconds, during which time there must be no drop in pressure or external leakage.

(4) Further increase the oil pressure to 3,500 lb. per sq. in. for a period of 15 seconds in order to check the security of the end caps.

(5) Discharge the oil chamber and with the oil connection open to atmosphere, apply an air pressure of 500 lb. per sq. in. of the air connection. Immerse the accumulator in oil and check for air leakage.

(6) With the air chamber inflated to 500 lb. per sq. in. charge the oil chamber to an oil pressure of 2,500 lb. per sq. in. Immerse the accumulator in clear water for a period of 10 minutes, afterwards remove the unit and immerse in oil of the type used in the system, the accumulator should then be left to stand for a period of 12 hours when there is to be no drop in pressure and no external leakage.

(7) Release the oil pressure and check the air pressure which is to be 500 lb. per sq. in.; release the air pressure and re-fit the protective cap over the inflation valve.

Testing accumulator with valve attached to oil connection.

Note: Before carrying out the following tests it will be necessary to have previously tested the accumulator, the cut-out valve and the non-return valve according to their specific test schedule.

Cut-out valve fitted

With connections "A" and "B" blanked off, apply an air pressure of 25 lb. per sq. in. at connection "C". Immerse the assembly in oil and check for the escape of air.

Non-return valve fitted

Blank off the oil connection adjacent to the valve seat and apply an air pressure of 25 lb. per sq. in. at the other connection. Immerse the assembly in oil and check for the escape of air.

TANDEM POWER VALVE

Introduction

The tandem power valve is directly linked to the brake pedal mechanism where its purpose is to control two entirely separate brake lines, additionally, the valve is capable of controlling the pressure so that it will remain equal in each brake line.

Should a failure occur in the pipe line which serves one set of brakes, for example, a fractured brake pipe leading to the front brakes, the plunger valve controlling the effective rear brakes will still be operative so that the vehicle can be safely brought to a stop.

Description (Refer to Fig. 7)

The complete power valve actually comprises four main parts, a primary valve body and lapped plunger assembly, a secondary valve body and lapped plunger assembly and a spring box assembly within which a pushrod housing is fitted.

The primary valve body is formed with three tapped pipe connections and the secondary valve body with two, therefore, as the plunger valves are moved within their respective bores so differing pairs of connections are communicated by way of the radial ports in each plunger. In addition to the radial ports in each plunger, a longitudinal counter bore, within which a restrictor is fitted, adjoins each port; a further longitudinal port for the passage of fluid, commences beneath the blanking ball in the secondary valve body and terminates at the large oil connection in the primary valve body. An additional oilway extends from this large connection to coincide with a small restricting port in the stop plate, it is through this small hole that oil is permitted to pass for the purpose of lubricating the moving ports in the spring-box.

The open end of the secondary valve body is closed by a cover and to prevent oil leakage between the jointing faces of the cover and the respective valve bodies, rubber seals are provided which have a spigot fitted on their inner diameter.

The spring box, which is attached to the primary valve body by three bolts and nuts, houses a primary spring and a larger diameter secondary spring. The primary spring is positioned between a spring retainer and a spring guide which in turn loads an additional spring retainer on to the domed end of the primary plunger. The secondary or large spring is positioned between a buffer plate and a buffer pad which abuts a shoulder in the bore of the spring box whilst the complete spring box assembly is retained by the pushrod housing.

The pushrod housing is bored for the passage of a sliding adjustment sleeve which has the pushrod screwed into it and retained by a locknut. To protect the adjustment sleeve from dirt and moisture, a rubber boot encloses the otherwise exposed end of this sliding member.

Rubber seals and a combination of rubber and fabric seals are fitted at various points of the unit for the purpose of preventing oil leakage.

Principle of Operation (Refer to Fig. 7)

When the unit is installed on the vehicle the oil connections are arranged as follows:—

Connection "A"—Pressure from No. 1 accumulator.
Connection "B"—Pressure from No. 2 accumulator.
Connection "C"—Return to tank.
Connection "D"—To rear-wheel frame cylinders and check gauge fitting.
Connection "E"—To front-wheel frame cylinders and return line to tank from cut-out valve.

Prior to a brake application being made, the power valve will be in the condition as shown on Fig. 7, this is with the primary and secondary springs fully extended and the short land on each of the plunger valves blanking off connections "A" and "B" respectively. Once the accumulators have become fully charged, the cut-out valve will operate and direct oil from the rotary pump back to tank via connections "E" and "C" to maintain a continuous flow.

When a brake application is made the pushrod immediately re-acts to the brake pedal and as a result a load is imposed upon the primary spring, this load is then transmitted through the spring guide and spring retainer to move the plunger valves and so restrict the return of oil to the supply tank. In consequence an increase in pressure will be felt in the line from the pump to the front brakes and simultaneously this same pressure will act against the head of the secondary plunger by way of the restrictor chamber in the primary plunger. It will be seen therefore, that the secondary plunger is moved both by hydraulic effort and direct mechanical push from the primary plunger.

As a result of this movement, not only is the flow to tank restricted, but the lines from No. 1 and No. 2 accumulators will gradually be opened to the rear and front brakes by way of connections "B" and "E", also "A" and "D" respectively via the radial port in each plunger.

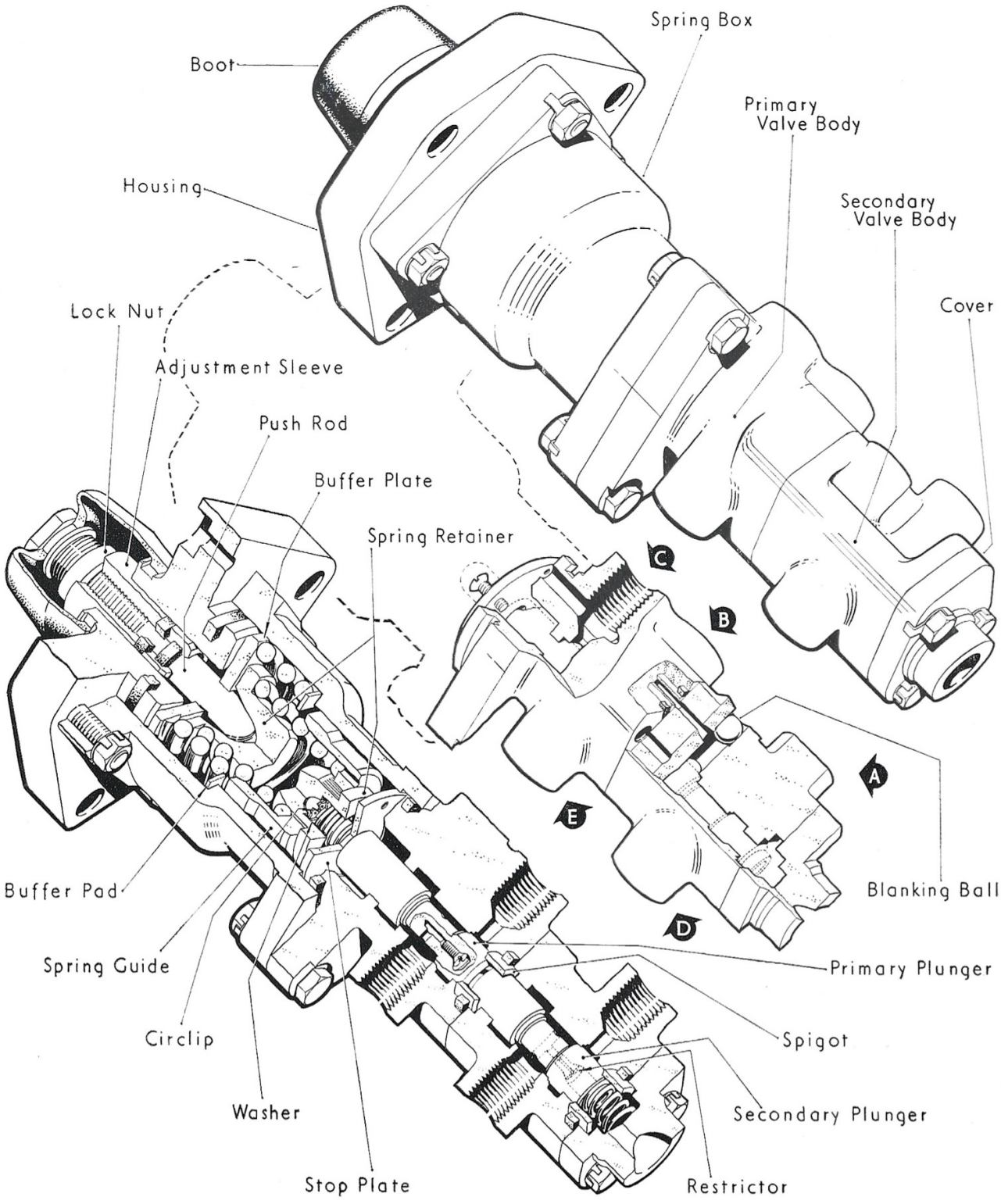


Fig. 7. Tandem Power Valve.

From the foregoing it will be evident that the front brakes are operated in the most part by pressure supplied direct by the rotary pump but, as the retardation of the vehicle gradually increases so the running speed of the pump gets slower until such time as the output from the pump has been supplemented by oil pressure from No. 1 accumulator.

Throughout a brake application, hydraulic pressure acting within the restrictor chamber of each plunger valve will actually induce them to re-act against the thrust of the pushrod and together with the resistance of the springs will provide the driver with a re-active "feel" at the brake pedal.

It has already been mentioned that the power valve is capable of controlling two entirely separate brake systems, for instance, in the event of there being a fractured pipe or faulty accumulator supply to the rear brakes, the vehicle can be brought to a stop by use of the front brakes only, likewise, should there be some defect in the delivery line to the front brakes, the brakes at the rear will still remain operative.

In an instance where a fracture has occurred in the line from No. 1 accumulator to the power valve and as a result the rotary pump has exhausted oil from the supply tank, the front brakes will be operated by oil pressure direct from No. 2 accumulator in the following manner:—

When the brake pedal is depressed, the pushrod immediately loads the primary spring against the spring guide to displace the plunger valves and so permit oil pressure from No. 2 accumulator to flow to the front brakes by way of connnections "B" and "E" via the radial port in the primary plunger. Simultaneously, oil pressure within the restrictor chamber of the primary plunger will have forced the secondary plunger along its bore towards the cover whilst pressure acting against the head of this same plunger will maintain the primary plunger re-acting to the thrust of the pushrod.

Additional effort at the brake pedal will bring the sliding adjustment sleeve into contact with the buffer plate so that the secondary spring will be called upon to provide a further degree of resistance and so increase the re-active "feel" at the brake pedal.

Dismantling (Refer to Fig. 7)

It is recommended that wherever possible a complete tandem power valve should be fitted if a fault develops in this unit. However, details for servicing the complete valve are given below but on no account is it to be undertaken unless adequate facilities are available.

Proceed as follows:—

Note: Mark the edge of the jointing faces of the primary valve body and spring box for reference when re-assembling.

(1) Remove the three nuts and bolts which retain the valve bodies to the spring box assembly and separate the two halves.

(2) Remove the three long bolts which retain the cover to the secondary valve body and the latter to the primary valve body; take out the small spring, the two spigots and rubber seals.

(3) Remove the circlip and washer from the domed end of the primary plunger and take off the spring.

(4) Remove the three countersunk screws which retain the stop plate to the primary valve body and separate the plate.

(5) Push out the plungers from their valve bodies but keep each assembly together.

Note: Each plunger and valve body represents a matched assembly, therefore, should one part become damaged the complete assembly will have to be renewed.

(6) Remove the four nuts and bolts which retain the pushrod housing to the spring box and separate both parts; withdraw the spring box components.

(7) Remove the rubber boot and withdraw the pushrod and adjustment sleeve from the housing.

(8) Measure the distance from the end of the pushrod to the face of the adjustment sleeve for reference when re-assembling.

(9) Slacken the locknut and unscrew the pushrod from the adjustment sleeve.

(10) Ease the remainder of the seals from their grooves in the various parts.

Cleaning

Clean all parts as described under the heading of "GENERAL CLEANING."

Assembling (Refer to Fig. 7)

Using new parts as found necessary and new seals throughout, assemble the power valve as follows:—

Note: Each plunger and valve body, represents a matched assembly, therefore, should one part become damaged the complete assembly will have to be renewed.

Prior to assembling the respective valve assemblies to the spring box, each must be subjected to a separate test.

(1) Ease a rubber seal into its groove at the mouth of the oilway in the primary valve body followed by the smaller of the three spigots.

(2) Position the stop plate at the appropriate end of the valve body and secure with the three countersunk screws.

(3) Offer up the primary plunger, domed end leading, to the bore of the body, pushing it fully home. Pass the spring over the domed end of the plunger, fit the washer and secure the whole with the circlip.

Note: Before proceeding further with assembly subject to the primary valve assembly to the following tests, using oil of the type used in the system. The oil temperature is to be maintained between 30 and 40 deg. C. throughout the tests.

(i) Attach a pressure gauge at connection "E" and blank off the small port in the stop plate also the end of the plunger bore.

(ii) Apply an oil pressure of 1,250 lb. per sq. in. at connection "B"; seepage from connection "C" must not be in excess of 10 c.c. per minute.

(iii) Maintain the oil pressure of 1,250 lb. per sq. in. at connection "B" and slowly move the plunger inwards to a dimension of not more than 0.070 in. and not less than 0.060 in.; observe the increase in pressure on the gauge attached to connection "E" during this movement. When the pressure has risen to 600 lb. per sq. in., check the seepage at connection "C" which must not be in excess of 20 c.c. per minute.

(iv) Move the plunger further inwards in order to increase the pressure on the gauge to 1,250 lb. per sq. in. and check the seepage at connection "C" which must not be in excess of 20 c.c. per minute.

(v) Remove the blanking plate from the end of the plunger bore and the pressure gauge from connection "E".

(4) Offer up the secondary plunger to the bore of its valve body so that the restrictor chamber of the plunger is furthest from the port housing the blanking ball.

(5) Ease a seal followed by a spigot into the groove at the end of the respective valve bodies.

(6) Place a spring in the recess of the cover, join the two valve bodies together, position the cover over the end of the secondary valve body and secure with the three long bolts and tabwashers.

Note: Before proceeding further with assembly, subject the secondary valve assembly to the following tests, using oil of the type used in the system. The oil temperature is to be maintained at between 30 and 40 deg. C. throughout the tests.

(i) Attach a pressure gauge at connection "D" and blank off connections "B" and "E".

(ii) Apply an oil pressure of 1,250 lb. per sq. in. at connection "A"; seepage from connection "C" must not be in excess of 10 c.c. per minute.

(iii) Maintain the oil pressure of 1,250 lb. per sq. in. at connection "A" and slowly move the plungers inwards to a dimension of not more than 0.100 in. and not less than 0.080 in.; observe the increase in pressure on the gauge attached to connection "D" during this movement. When the pressure has risen to 600 lb. per sq. in., check the seepage at "C" which must not be in excess of 20 c.c. per minute.

(iv) Move the plunger further inwards in order to increase the pressure on the gauge to 1,250 lb. per sq. in. and check the seepage at connection "C" which must not be in excess of 20 c.c. per minute.

(v) Release the load on the plungers and cut-off the fluid pressure. Depress the plungers 0.12 in. and immediately release the load when the plungers must return fully under influence of their springs only.

(vi) On the satisfactory completion of testing, remove the pressure gauge and blanking plugs.

(7) Ease a rubber seal into the groove in the primary valve body. Offer up the valve assemblies to the spring box ensuring that the markings previously made are aligned and secure with the three bolts, nuts and tabwashers.

(8) Insert the spring guide and spring retainer assembly into the spring box so that the recess of the spring retainer rests on the domed end of the primary plunger.

(9) Position the buffer pad on the shoulder in the spring box and follow this with the two springs. Place the remaining spring retainer on the end of the primary spring and follow up with the buffer plate.

(10) Ease a rubber seal into the groove on the outer diameter of the pushrod housing and insert the part, sealed end leading, into the spring box and secure with the four bolts, nuts and tabwashers.

(11) Ease a rubber seal into the groove on the inner diameter of the adjustment sleeve and follow this by fitting a rubber seal and a fabric ring into the groove on the outer diameter.

(12) Thread the locknut fully on to the pushrod then screw the part into the adjustment sleeve until the dimension previously noted is obtained; do not tighten the locknut.

(13) Do not fit the rubber boot until after the power valve has been completely tested.

Testing the Complete Power Valve

Before attempting these tests, each plunger valve assembly must have been subjected to its specific tests as detailed during the course of assembly.

Using oil of the type used in the system, test the power valve as follows:—

Note: Throughout these tests there is to be no external leakage.

(1) With connections "C", "D" and "E" blanked off, apply an air pressure of 25 lb. per sq. in. at connections "A" and "B". Immerse the unit in oil of the type used in the system and watch for signs of air bubbles.

(2) Move the pushrod inwards to operate the plungers and repeat test (1).

(3) With accumulator pressure of 1,250 lb. per sq. in. at connections "A" and "B" set the adjustment sleeve so that, with a load of not more that 280 lb. applied at the pushrod, the output pressure at connections "D" and "E" is 600–650 lb. per sq. in. Check three times, then secure the adjustment by tightening locknut.

(4) Ensure that the pushrod is in the fully "OUT" position and with the pump delivering 3 gallons per minute at connection "E" check that the back pressure does not exceed 25 lb. per sq. in.

(5) On the satisfactory completion of testing fit the rubber boot so that it is secured in the groove around the pushrod housing and that of the pushrod.

PRESSURE WARNING SWITCH

Introduction

Two of these pressure warning switches are installed on the vehicle, one in each accumulator circuit, where their purpose is to provide the driver with a visual means of indicating whether the braking system is in full working order.

Description (Refer to Fig. 8)

Each pressure warning switch comprises a body formed with three threaded pipe connections, one of which is fitted with a threaded boss for the purpose of attaching the unit to the vehicle. The main bore in the body houses a spring-loaded piston, the stem of which passes through a pair of spring-loaded rubber cups and a spring guide to abut the insulated contact of a micro switch.

Principle of Operation (Refer to Fig. 8)

When oil pressure is applied to the unit, the piston is forced upwards against the load of its spring, this action breaking the contact between the stem of the piston and the insulated plunger of the micro-switch. In this condition the warning light in the driver's cab will be extinguished and the signalling indicator will be raised thus conveying to the driver that oil from the hydraulic accumulator is being provided at the correct pressure. However, should the warning light be illuminated and the signalling indicator be in the "down" position this will immediately convey to the driver that the accumulator pressure has fallen to below the safe limit, possibly as a result of air leakage from the air chamber of the accumulator or failure of the rotary pump, in which case the vehicle must be halted and the fault rectified.

As both pressure warning switches are connected in series, so failure of either circuit will set the signalling indicator at "danger" and the warning light will be illuminated.

Because of this arrangement, an electrical failure will indicate "danger" and there is no possibility of an electrical fault masking a defect in the brake system.

Dismantling (Refer to Fig. 8)

Proceed as follows:—

(1) Remove the cover and measure the distance between the head of the setting screw and the locknut for reference when assembling; slacken the locknut and remove the adjusting screw.

(2) Unscrew the two remaining bolts which hold the switch cover to the body and remove the cover.

Note: There will be no need to separate the micro-switch from its cover unless it is to be renewed.

(3) Unscrew the stop and withdraw the piston, piston guide and rubber cup.

(4) Slacken the large locknut and unscrew the adjusting screw; remove the spring and the spring seat.

(5) Remove the attachment boss from its connection in the body.

Cleaning

Clean all parts as described under the heading of "GENERAL CLEANING."

Caution: Do not allow the cleaning agent in contact with the micro-switch.

Assembling (Refer to Fig. 8)

Using new parts as found necessary and new seals throughout, assemble the unit as follows:—

(1) If the micro-switch was previously removed and is still serviceable, re-fit this unit or a new one into the switch cover and secure with the two bolts and self-locking nuts; assemble a new rubber grommet in the switch casing.

(2) Thread the locknut on to the spring-housing and position the spring inside it. Locate the spring seat on its shoulder in the bore and screw the adjusting screw into the body but do not tighten the locknut at this stage.

(3) Pass a rubber cup, plain face leading, over the stem of the piston and push right up to the head, follow this with the spring and the remaining rubber cup, recessed face leading.

(4) Insert the piston assembly, head leading, into the bore and follow up with the piston guide. Place a gasket in position on the guide and secure the complete assembly with the stop, screwing it fully home.

(5) Thread the locknut fully on to the setting screw and screw the part into the adjusting screw until the dimension, previously noted is obtained but do not secure with the locknut at this stage.

(6) Place the large rectangular gasket in position on the body, offer up the switch assembly and secure with the four bolts and spring washers.

Note: The two long fixing bolts are to be fitted on the same side of the body as the electrical connections.

(7) Fit a gasket on the attachment boss and screw the part fully home into the appropriate connection.

(3) Do not fit the cover until after the unit has been tested.

Testing

Using oil of the type used in the system and with the unit connected into a 24 volt (D.C.) electrical circuit of the type illustrated on Fig. 9, test the pressure warning switch as follows:—

(1) With two oil connections blanked off and the remaining one connected to hydraulic pressure (not applied) it will be observed that the warning light is illuminated.

(2) Slowly raise the hydraulic pressure to 750 lb. per sq. in. and when this is obtained set the adjusting screw until switch contact is just made with the warning light illuminated.

(3) Reduce the hydraulic pressure to zero then gradually increase the pressure to 1,250 lb. per sq. in., reduce this pressure to zero and observe that the warning light illuminates at between 700 and 750 lb. per sq. in; there must be no external leakage.

Note: Should the warning light fail to illuminate at between these pressures, re-adjust as detailed in test (2).

(4) Slowly increase the pressure until the warning light is extinguished, this should occur at approximately 850 lb. per sq. in. Maintain this pressure and turn the setting screw until it contacts the spring seat then rotate the screw half-a-turn in the reverse direction and secure with the locknut.

(5) Repeat test (3).

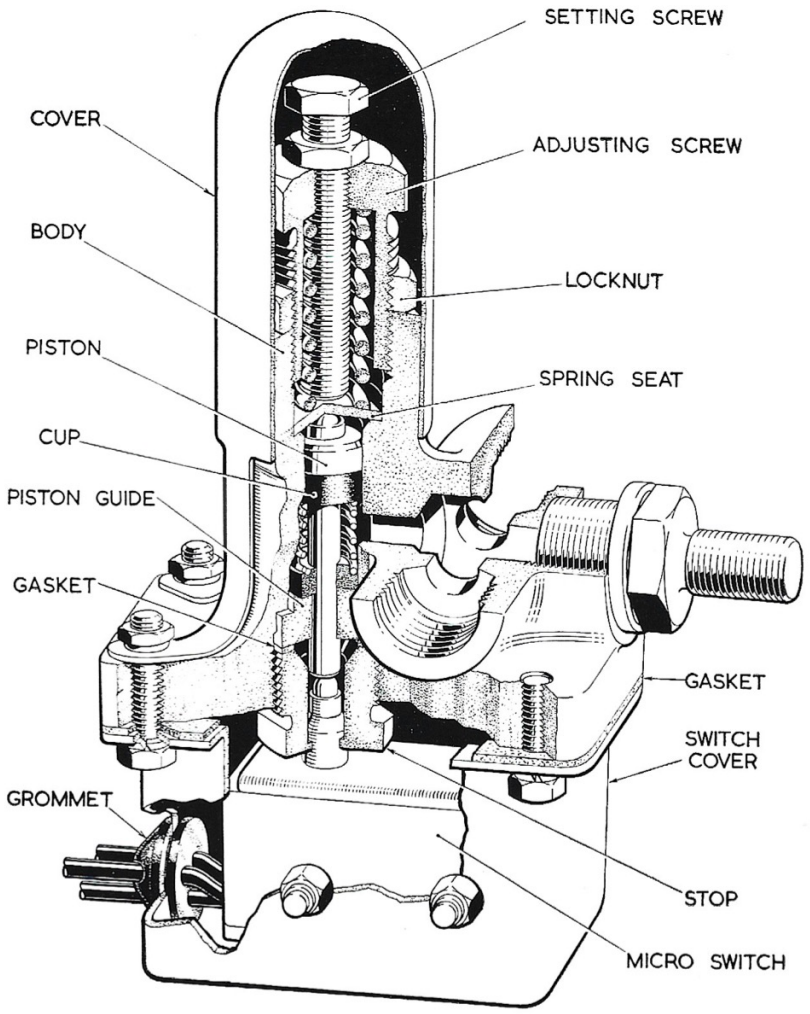


Fig. 8. Pressure Warning Switch

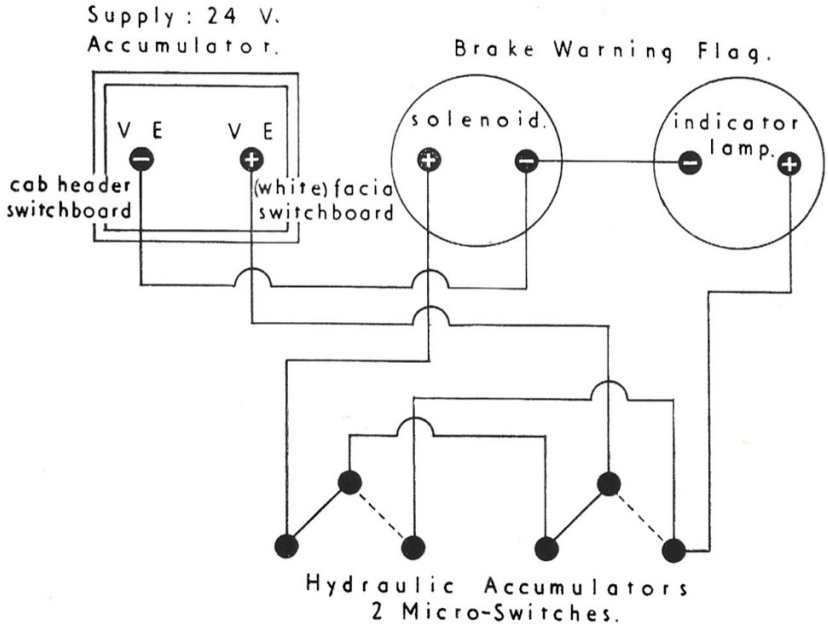


Fig. 9. Typical Wiring Diagram

CHECK GAUGE FITTINGS

Description (Refer to Figs. 10 & 11)

The purpose of these units is to provide points at which to attach a pressure gauge so that line pressure from the accumulators to the power valve and from the power valve to the frame cylinders can be checked for correct pressure.

Each check gauge fitting comprises a body formed with two pipe connections and bored to receive a valve. The valve is formed with a conical end and is drilled for the passage of fluid; a protective cap is fitted over the outer end of the valve to prevent the entry of foreign particles.

To check the oil line pressure at any time simply remove the dust cap and attach a pressure gauge capable of registering 2,000 lb. per sq. in. on the end of the valve. The valve is then unscrewed through one full turn when the line pressure will be indicated on the gauge.

After noting the pressure, screw the valve on to its seat, remove the gauge and re-fit the dust cap.

Dismantling (Refer to Figs. 10 & 11)

Proceed as follows:—

Hold the valve against rotation and unscrew the dust cap then remove the valve; ease the seal from its groove on the valve.

Cleaning

Clean all parts as described under the heading of "GENERAL CLEANING."

ASSEMBLING (Refer to Figs. 10 & 11)

Proceed as follows:—

Ease a new seal into its groove on the valve and screw it fully home into the body; re-fit the dust cap.

Testing

Using oil of the type used in the system, test the check gauge assembly as follows:—

(1) Remove the dust cap and in its place attach a pressure gauge capable of registering 2,000 lb. per sq. in.

(2) Blank off one pipe connection and at the other apply an oil pressure of 1,200 lb. per sq. in. Slacken the valve half-a-turn when the full pressure should register on the gauge.

(3) Further increase the pressure to 2,000 lb. per sq. in. and maintain for a period of 10 seconds, during which time there is to be no leakage around the valve.

(4) Re-tighten the valve and again apply a pressure of 2,000 lb. per sq. in.; during this test there is to be no leakage from the oil passage in the valve.

(5) After satisfactory testing, remove the pressure gauge and re-fit the dust cap.

FRAME CYLINDERS

Description (Refer to Fig. 12)

Each frame cylinder consists of a body within which a pushrod operates by means of a piston. The piston is fitted with a rubber cup which is held in position by a spring-loaded spreader, the spring in turn is secured by a retainer and the whole by means of a circlip.

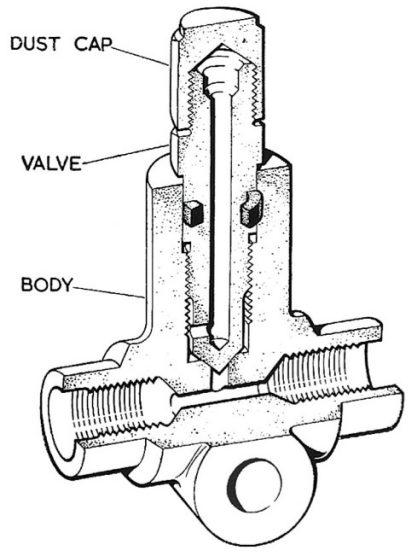


Fig. 10. Check Gauge Fitting.

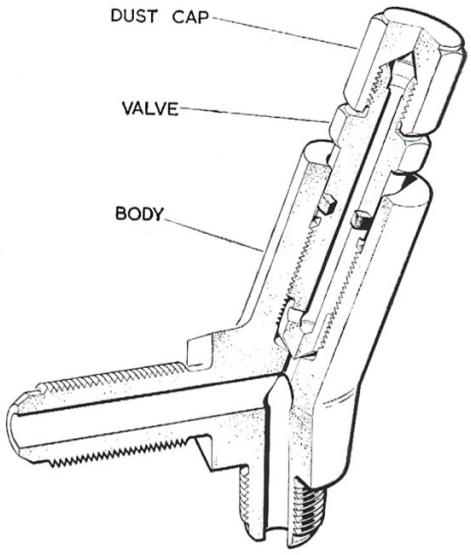


Fig. 11. Check Gauge Fitting.

The pushrod is fitted with a forkend which is adjustable for length; a locknut retains the adjustment. The whole assembly is protected against the entry of dirt and moisture by a rubber boot clipped between the locknut and an extension tube, the opposite end of this tube is held between two dust seals whilst the whole is secured in a housing by a washer and circlip.

A bleed screw is fitted to enable the unit to be purged of air during the bleeding operation.

The front and rear cylinders are identical except that the latter are fitted with a rubber boot at the end of the body.

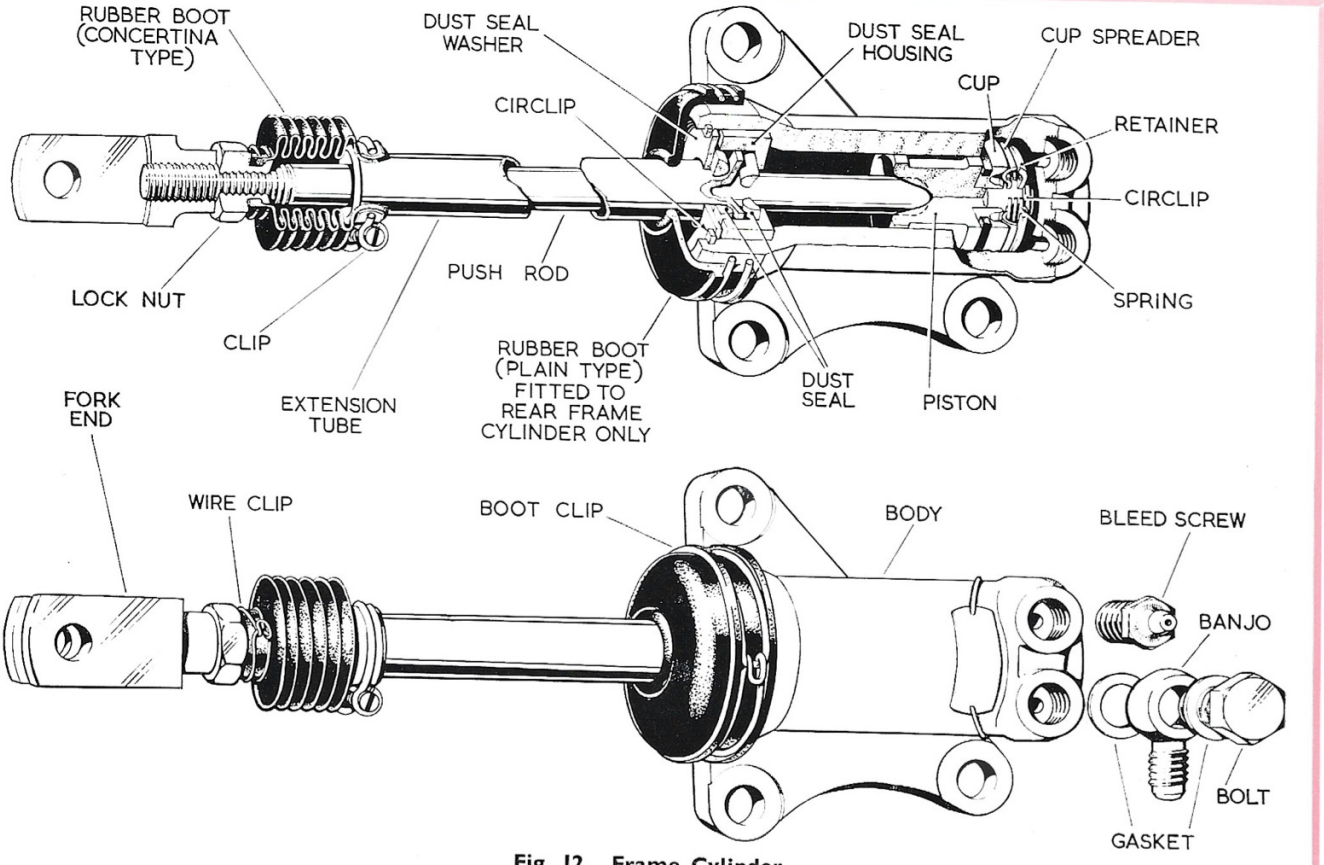


Fig. 12. Frame Cylinder.

Dismantling (Refer to Fig. 12)

Proceed as follows:—

(1) Disconnect the oil pressure pipe, remove the clevis pin connecting the forkend to the operating lever and detach the cylinder from its mounting.

(2) Remove the clips securing the rubber boot and detach that end of the boot which surrounds the locknut. Slacken the locknut and unscrew the forkend from the pushrod; remove the locknut.

(3) Withdraw the pushrod and remove the rubber boot from the extension tube.

(4) Remove the circlip securing the dust seal washer and remove the dust seals, extension tube and dust seal housing.

(5) Apply a low air pressure at one of the connections in the cylinder body to expel the piston; separate the various parts of the piston.

Cleaning

Clean all parts as described under the heading of "GENERAL CLEANING."

Assembling (Refer to Fig. 12)

Using new parts as found necessary, and new seals throughout, assemble the unit as follows:—

(1) Stretch the rubber cup, with the bonded seal leading, over the reduced end of the piston followed by the cup spreader, the spring retainer and circlip.

(2) Pass the piston assembly, reduced end leading down the bore of the cylinder.

(3) Position the dust seal housing in the mouth of the cylinder and place a dust seal on its seat, follow this with the extension tube, flange leading, and position the remaining dust seal securing the complete assembly with the dust seal washer and circlip.

(4) If a rear frame cylinder is being dealt with, pass the plain rubber boot over the extension tube, stretch the large end of the boot on to the body and secure it with the boot clip.

(5) Fit the concertina-type rubber boot with its plain end over the extension tube and secure it with a clip.

(6) Thread the locknut on to the pushrod and pass the latter through the extension tube and into the cylinder.

(7) Thread the forkend on to the pushrod then by turning the forkend adjust the distance between the mounting centre of the forkend and the end face of the cylinder until a dimension of 7.79 in. is obtained; tighten the locknut to maintain the adjustment and fit the other end of the boot in the recess of the locknut and secure with the wire clip.

(8) Screw the bleed plug into the appropriate tapped connection in the body.

Testing

Using oil of the type used in the system, test the frame cylinder as follows:—

(1) Remove the rubber boot and pushrod.

(2) Connect an air supply to the appropriate connection and with the unit submerged in oil, apply an air pressure of between 30 and 50 lb. per sq. in. for a period of 5 seconds when the piston must travel a full stroke without air leakage.

Bleeding the Frame Cylinder

Bleeding is not a routine operation and should only be necessary when some part of the system has been serviced resulting in the oil being drained off. First fill the supply tank and then slacken the bleed screw on one of the frame cylinders and depress the brake pedal gently. The resultant back pressure created in the pump delivery line will cause oil to issue from the slackened bleed screw which is to be tightened as soon as it is certain that all air has been exhausted. Repeat this operation at the bleed screws of the other frame cylinders.

SECTION 3

ROUTINE MAINTENANCE

SECTION 3 ROUTINE MAINTENANCE

ROUTINE MAINTENANCE

Periodically check the oil level in the supply tank.

Once per month check that the air pressure in each hydraulic accumulator is at the correct figure of 500 lb. per sq. in. If the pressure is less than this, re-inflate as described below.

Change the "Micronic" filter element in the supply tank at intervals of not more than 50,000 miles.

Adjust the brakes at regular intervals; uneven or fierce braking could indicate that adjustment is required.

FILLING THE SUPPLY TANK

Before filling or topping up the supply tank, ensure that the hydraulic accumulators are fully charged with oil by running the pump; this condition will be indicated by the warning light extinguishing.

Remove the filler cap from the tank and fill to the 'F' mark on the sight glass. As the accumulators become discharged it will be noticed that the oil level will rise above the 'F' mark, but the level will still be visible in the sight glass.

Re-fit the filler cap together with its gasket.

INFLATING THE ACCUMULATORS

It is essential that the accumulator be re-charged with air periodically, since, a gradual loss of air pressure takes place; it is recommended that re-charging be carried out once each month. To carry out this procedure, two items of equipment are necessary—firstly, a cylinder of compressed nitrogen or compressed air and secondly, one or other of the two types of inflation valve illustrated on Figs. 13 and 14.

Of the two gases which may be used, compressed nitrogen is considered more suitable; on no account should the accumulator be charged with any other type of gas. Charging with air is carried out with the accumulators in position on the vehicle, and the following instructions give the correct procedure to be adopted for both types of inflation equipment:—

Use of M.H.H. Inflation Equipment (Refer to Fig. 13)

(i) With the pump stationary, and the handbrake released, discharge the accumulators of oil by making repeated brake applications. An indication that all oil has been exhausted from the accumulators will be given when the warning light illuminates and the pedal begins to feel "light".

(ii) Screw the nut on the inflation equipment firmly into the union on the compressed nitrogen or air cylinder and attach the tube nut on the end of the hose to the air charging valve on the accumulator.

(iii) Slacken the pressure regulator until it is felt to be free and then open the stop valve on the nitrogen or air cylinder. The cylinder pressure will then be recorded on the gauge "B".

(iv) Slowly screw the pressure regulator inwards (clockwise) until the gauge "A" records 500 lb. per sq. in. Then close the stop valve on the nitrogen or air cylinder, slacken the pressure regulator until it is again free and detach the hose from the accumulator. Replace the blanking cap over the accumulator air charging valve and check the valve for security.

Use of Turner Inflation Equipment (Ref. to Fig. 14)

(i) With the pump stationary, and the handbrake released, discharge the accumulators of oil by making repeated brake applications. An indication that all oil has been exhausted from the accumulators will be given when the warning light illuminates and the pedal begins to feel "light".

(ii) Screw the adaptor firmly into the nut, remove the blanking cap, attach one end of the hose to the inflation equipment and the end to the union of the compressed nitrogen or air cylinder, tighten the release valve and unscrew the pressure gauge to its fullest extent.

(iii) Screw the adaptor on to the accumulator air charging valve and slowly thread the pressure gauge into the body of the valve until it registers the air pressure within the accumulator.

(iv) Very carefully open the stop valve on the nitrogen or air cylinder and close it as soon as the pressure gauge records 500 lb. per sq. in. Unscrew the gauge as far as it will go, slacken the release valve and detach the equipment from the accumulator and the charging cylinder. Replace the blanking cap over the accumulator air charging valve and check the valve for security.

The Turner inflation equipment may also be used to check the accumulator air pressure. To use it in this manner, detach the hose and fit the blanking cap. Attach the adaptor, slacken the pressure gauge, tighten the release valve and attach the equipment to the accumulator. Then slowly turn the gauge clockwise until the air pressure is recorded, slacken the gauge again and remove the equipment from the accumulator.

The normal method of checking the air pressure in the accumulator is to attach a pressure gauge at the air charging valve, alternatively, the air pressure can be ascertained at the same time as a pressure gauge is attached to the check point for oil pressure line readings.

To determine the accumulator air pressure in such a case, make repeated brake applications with the rotary pump stationary, during which time the pressure gauge needle will be seen to fall a small amount every time the brake pedal is depressed. Eventually, the needle will suddenly fall to zero, and the pressure indicated immediately prior to this sudden fall is the accumulator air pressure.

It should be appreciated that whatever the initial air pressure of the accumulator may be, the system will still operate within its normal pressure range of between 800 to 1,250 lb. per sq. in. However, a low initial air pressure seriously reduces the effective volume of the accumulator, thereby reducing the number of discharges which it can make before falling to the "cut-in" pressure and as a result increasing the frequency of cut-out valve operation thus imposing a greater load upon the pump.

SECTION 3 ROUTINE MAINTENANCE

ROUTINE MAINTENANCE

Periodically check the oil level in the supply tank.

Once per month check that the air pressure in each hydraulic accumulator is at the correct figure of 500 lb. per sq. in. If the pressure is less than this, re-inflate as described below.

Change the "Micronic" filter element in the supply tank at intervals of not more than 50,000 miles.

Adjust the brakes at regular intervals; uneven or fierce braking could indicate that adjustment is required.

FILLING THE SUPPLY TANK

Before filling or topping up the supply tank, ensure that the hydraulic accumulators are fully charged with oil by running the pump; this condition will be indicated by the warning light extinguishing.

Remove the filler cap from the tank and fill to the 'F' mark on the sight glass. As the accumulators become discharged it will be noticed that the oil level will rise above the 'F' mark, but the level will still be visible in the sight glass.

Re-fit the filler cap together with its gasket.

INFLATING THE ACCUMULATORS

It is essential that the accumulator be re-charged with air periodically, since, a gradual loss of air pressure takes place; it is recommended that re-charging be carried out once each month. To carry out this procedure, two items of equipment are necessary—firstly, a cylinder of compressed nitrogen or compressed air and secondly, one or other of the two types of inflation valve illustrated on Figs. 13 and 14.

Of the two gases which may be used, compressed nitrogen is considered more suitable; on no account should the accumulator be charged with any other type of gas. Charging with air is carried out with the accumulators in position on the vehicle, and the following instructions give the correct procedure to be adopted for both types of inflation equipment:—

Use of M.H.H. Inflation Equipment (Refer to Fig. 13)

(i) With the pump stationary, and the handbrake released, discharge the accumulators of oil by making repeated brake applications. An indication that all oil has been exhausted from the accumulators will be given when the warning light illuminates and the pedal begins to feel "light".

(ii) Screw the nut on the inflation equipment firmly into the union on the compressed nitrogen or air cylinder and attach the tube nut on the end of the hose to the air charging valve on the accumulator.

(iii) Slacken the pressure regulator until it is felt to be free and then open the stop valve on the nitrogen or air cylinder. The cylinder pressure will then be recorded on the gauge "B".

(iv) Slowly screw the pressure regulator inwards (clockwise) until the gauge "A" records 500 lb. per sq. in. Then close the stop valve on the nitrogen or air cylinder, slacken the pressure regulator until it is again free and detach the hose from the accumulator. Replace the blanking cap over the accumulator air charging valve and check the valve for security.

Use of Turner Inflation Equipment (Ref. to Fig. 14)

(i) With the pump stationary, and the handbrake released, discharge the accumulators of oil by making repeated brake applications. An indication that all oil has been exhausted from the accumulators will be given when the warning light illuminates and the pedal begins to feel "light".

(ii) Screw the adaptor firmly into the nut, remove the blanking cap, attach one end of the hose to the inflation equipment and the end to the union of the compressed nitrogen or air cylinder, tighten the release valve and unscrew the pressure gauge to its fullest extent.

(iii) Screw the adaptor on to the accumulator air charging valve and slowly thread the pressure gauge into the body of the valve until it registers the air pressure within the accumulator.

(iv) Very carefully open the stop valve on the nitrogen or air cylinder and close it as soon as the pressure gauge records 500 lb. per sq. in. Unscrew the gauge as far as it will go, slacken the release valve and detach the equipment from the accumulator and the charging cylinder. Replace the blanking cap over the accumulator air charging valve and check the valve for security.

The Turner inflation equipment may also be used to check the accumulator air pressure. To use it in this manner, detach the hose and fit the blanking cap. Attach the adaptor, slacken the pressure gauge, tighten the release valve and attach the equipment to the accumulator. Then slowly turn the gauge clockwise until the air pressure is recorded, slacken the gauge again and remove the equipment from the accumulator.

The normal method of checking the air pressure in the accumulator is to attach a pressure gauge at the air charging valve, alternatively, the air pressure can be ascertained at the same time as a pressure gauge is attached to the check point for oil pressure line readings.

To determine the accumulator air pressure in such a case, make repeated brake applications with the rotary pump stationary, during which time the pressure gauge needle will be seen to fall a small amount every time the brake pedal is depressed. Eventually, the needle will suddenly fall to zero, and the pressure indicated immediately prior to this sudden fall is the accumulator air pressure.

It should be appreciated that whatever the initial air pressure of the accumulator may be, the system will still operate within its normal pressure range of between 800 to 1,250 lb. per sq. in. However, a low initial air pressure seriously reduces the effective volume of the accumulator, thereby reducing the number of discharges which it can make before falling to the "cut-in" pressure and as a result increasing the frequency of cut-out valve operation thus imposing a greater load upon the pump.

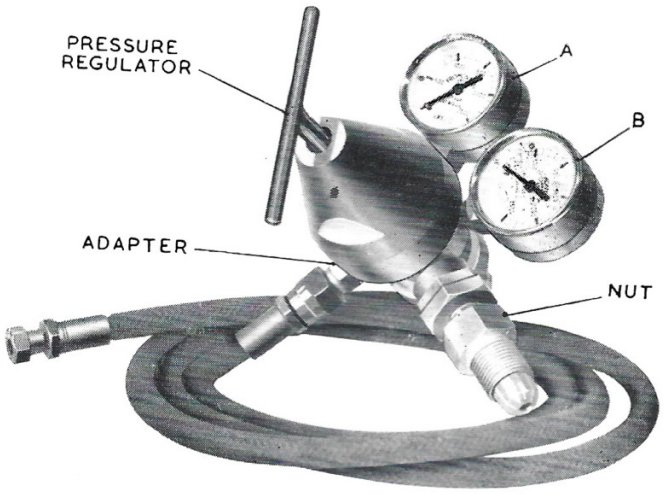


Fig. 13. M.H.H. Inflation Equipment.

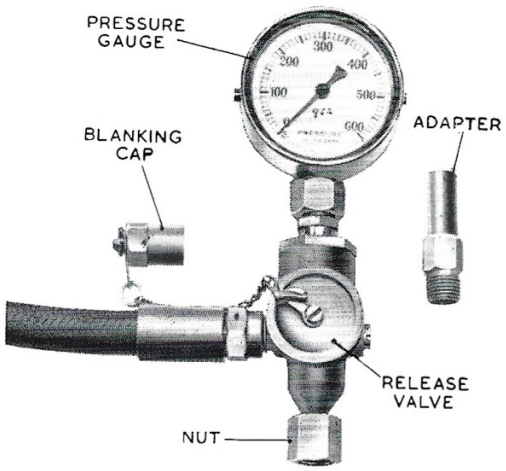


Fig. 14. Turner Inflation Equipment.

CHANGING THE FILTER ELEMENT

At intervals of 50,000 miles it will be necessary to change the filter element in order to maintain an efficient filter, otherwise should the element be left in position too long it will eventually clog so causing inefficient filtration.

To change an element proceed as follows:—

(1) Remove the filler cap and its sealing gasket.

(2) Remove the six bolts retaining the cover and take off the latter with its sealing gasket.

(3) Unscrew the retaining spindle, the element can then be withdrawn; separate the various attendant parts.

(4) Position a new filter element on the base retainer pass the spring followed by a washer, rubber seal and the second retainer over the retaining spindle and screw it fully home into the outlet adaptor.

(5) Place a new gasket on the lip of the filter container aligning the holes in each part, position the cover, align the bolt holes and secure with the six bolts and spring washers.

(6) Fit the gasket on the filler cap and screw it fully home into the filling orifice.

BRAKE SHOE ADJUSTMENT

For brake shoe adjustment, refer to vehicle handbook. Uneven or fierce braking could indicate that adjustment is necessary.

SECTION 4

FAULT FINDING

SECTION 4 FAULT FINDING

1. **Continual loss of pressure when pump is stationary (warning flag drops down and warning light illuminates)**
   (*a*) Accumulator air pressure exhausted due to excessive leakage, caused either by an insufficiently tightened end cap which secures the air head, a faulty or damaged seal(s) on the air head or a loose or damaged air charging valve.
   (*b*) Oil leakage past:—
      (i) Sliding valve in cut-out valve.
      (ii) Scored or worn plunger(s) in the primary and/or secondary valve body.
      (iii) Faulty or damaged non-return valve in No. 2 accumulator.
   (*c*) Oil leakage at any of the connections between the accumulators and the tandem power valve.

2. **Continual loss of pressure when brakes are applied.**
   (*a*) Faulty seals or scored bore in a frame cylinder body.
   (*b*) Oil leakage at any of the connections between the tandem power valve and frame cylinders.

3. **Chattering cut-out valve.**
   (*a*) Considerable or complete loss of air pressure in accumulators.
   (*b*) Considerable leak past sliding-valve seat in cut-out valve.

4. **Noisy Rotary Pump**
   (*a*) Low oil level in supply tank.
   (*b*) Choked filter element in supply tank.
   (*c*) Air leak in rotary pump suction hose.

5. **Rotary pump charges system too slowly.**
   (*a*) Air leak in rotary pump suction hose.
   (*b*) Air in rotary pump.
   (*c*) Faulty valve stem or seat in cut-out valve.

6. **Warning light fails to extinguish.**
   (*a*) Air leak in rotary pump suction hose.
   (*b*) Empty supply tank and/or choked filter element.
   (*c*) Defective rotary pump.
   (*d*) Defective pressure warning switch.

7. **Accumulator loses air pressure.**
   (*a*) Leakage past air charging valve.
   (*b*) Leakage past seal(s) on air cylinder head (to check this, brush soapy water around the air head and air charging valve and watch for signs of air bubbles).
   (*c*) Leakage of air past seals on separator piston. (To check this, charge the accumulator with air to a pressure of 500 lb. per sq. in. and allow to stand for a period of two hours then re-check the pressure).

8. **Excessive pedal travel.**
   Broken or weak primary spring in spring box of tandem power valve.

9. **Uneven or fierce braking.**
   Brakes may need adjusting.

Registered Trade Mark

L1426/1M/0861

Printed by Edward Fox & Son, Ltd., Stratford-on-Avon