Chapter 30 TRAILING EDGE FLAP JACKS

Type No. 1.00698.003
1.00698.004

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LIST OF ILLUSTRATIONS

Introduction

1. Each jack embodies an internal lock that locks it in the closed position, the lock being mechanically made and hydraulically released. An external indicator gives visible warning when the jack is in the closed and locked position. Each jack incorporates a restrictor, relief and relay valve. The jacks differ only in the handing of the end fitting and the pipe sub-assembly.

DESCRIPTION

General

2. The body of the unit is a cylinder with a boss formed to accommodate the banjo bolt retraction connection (*fig.* 1). Located on a seat formed in the banjo bolt is a spring loaded restrictor valve, retained by a sealed end cap with a spring seat formed at its inner end. Secured to the boss by a cap screw and surrounding the banjo bolt is the banjo union end of a pipe sub-assembly, which links the retraction connection to the relief valve, and relay valve piston. A rubber 'O' ring seals this end of the assembly while two single rings seal the post at the opposite end, the post is secured in the end fitting by a collar and split pin. The fork end-fitting which closes one end of the cylinder houses the static portion of the lock mechanism and spring-loaded relay, restrictor and relief valve; a boss on the end fitting forms the extension connection. The three valves together with sealed seats and a sealed piston are housed in the bore formed at right angles to the extension connection. The spring loaded valve rod which protrudes through the ball guide to preload the relief valve (at A in *fig.* 1), is located at its opposite end in a valve rod guide and enclosed by a sealed spring housing secured by four cap screws; shims are interposed between the spring and guide for the adjustment of the relief valve blow-off pressure. An interconnecting fluid duct connects the venting side of the relief valve to the retraction connection via the pipe assembly.

3. Housed in the fork-end fitting is a spring-loaded lock bolt that houses two concentric springs; the inner spring is supported at its outer end by a spacer. The lock bolt carries a visible indicator that protrudes through a slot in the end fitting. The indicator is secured to the lock bolt by a screw, and has a point that aligns with an arrow on the body when the lock is engaged. A gland carrier is fitted to the lock bolt and is interposed between an abutment ring, which is drilled for the passage of fluid, and a washer, which acts as a stop for the lock bolt in its travel away from its springs. The gland carrier is sealed on the lock bolt by a rubber sealing ring and a backing ring, and a single rubber ring seals it in the body. Between the abutment ring and the end of the cylinder, which protrudes into the fork-end fitting, is the flange of a lock sleeve that engages with a lock tongue when the jack is locked.

4. Working in the body is a hollow piston rod whose inner end carries the moving portion of the lock mechanism and terminates in a flange for locating a piston. The piston is interposed between a washer and lock tongue that is in turn retained by a slotted nut screwed on to the end of the piston rod. A triple seal, consisting of two backing rings and a rubber ring, seal the piston in the body, while two

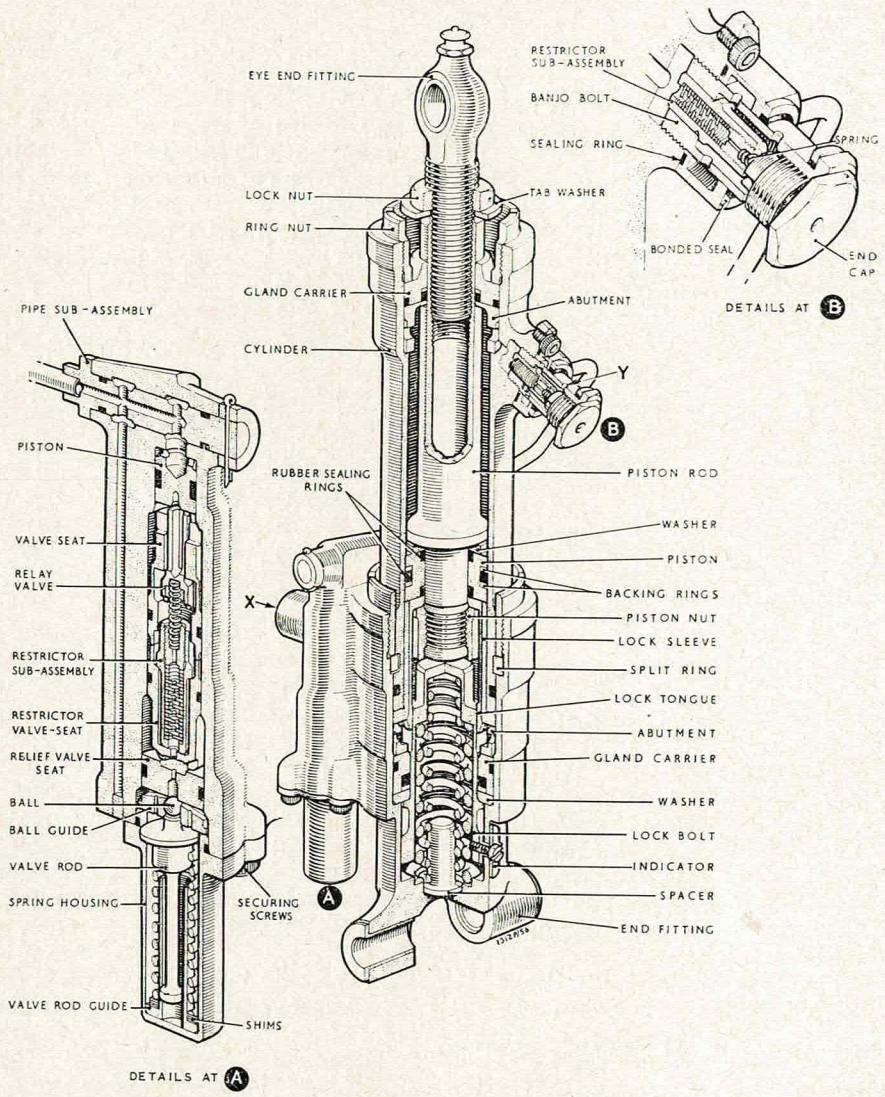

Fig. 1. Trailing edge flap jack

single rubber rings in its bore seal it on the piston.

5. The opposite end of the piston rod passes through another abutment ring and a gland carrier, which is retained in the body by a ring nut. A rubber ring and a backing ring in its bore seals the gland carrier on the piston rod and a single rubber ring seals it in the body.

6. An adjustable eye-end is screwed into the end of the piston rod where it is secured by a lock nut and a tab-washer. The eye-end carries a spherical bush and is fitted with a grease nipple.

Principle of operation (*fig.* 2)

Extension

7. With the jack in the closed position, fluid entering the unit at port X, moves the relay valve off its seat, flows through the restrictor valve to the jack port, and passes through the abutment ring and the prongs in the lock tongue to move the lock bolt against its springs; when the lock bolt is clear of the lock tongue its prongs disengage from the lock sleeve to unlock the jack. The fluid also acts on the piston moving the piston rod to the extended position, the prongs of the lock tongue being compressed as they pass through the lock sleeve. The displaced fluid venting through connection Y moves the spring loaded restrictor valve off its seat. When the fluid pressure is released, the lock bolt returns to its normal position under pressure of its spring. Any increase in pressure, above a pre-determined figure in the extension side of the jack, moves the relief valve off its seat against its spring, venting through the valve, fluid duct and pipe to the retraction connection X; the valve returns to its seat under the influence of its spring to re-seal, when the pressure in the jack returns to normal.

Retraction

8. With the jack extended, fluid entering the unit at port Y passes through the restrictor valve and the abutment ring to act on the face of the piston and retract the jack. Fluid also passes through the pipe assembly to the back of the relay valve piston, which moves to un-

seat the valve breaking the hydraulic lock, allowing the displaced fluid from the jack to flow past the restrictor valve and vent through the extension connection X. As the jack nears the end of its stroke, the prongs of the lock tongue enter the bore of the lock sleeve and are compressed and strike the face of the lock bolt. The lock bolt then moves with the piston rod, against the pressure of its springs, until the piston rod reaches the full extent of its travel. The prongs of the lock bolt, which have been compressed, then spring open to engage on the end face of the lock sleeve. Under the influence of its spring, the lock bolt returns to its normal position; in doing so it passes into the lock tongue to retain its prongs in the open position and thus lock the jack in the closed position.

SERVICING

TABLE 1

Special tools

Part No.	Description
MT.1025	Bench clamp for securing holding blocks.
MT.1026/19	Holding blocks for piston rod
MT.1026/2	Holding blocks for fork-end fitting and cylinder
MT.1322	Tube spanner for piston nut
RS.181/24	Hook spanner for fork-end fitting ring nut
RS.181/21	Hook spanner for cylinder ring nut

Examination

9. External leakage will indicate a faulty seal which must be renewed. Internal leakage indicated by sluggish operation of the unit may be due to a damaged piston seal or a scored cylinder bore. Renew the faulty part. A leaking valve may be due to grit between mating faces or a scored seat. If cleaning is ineffective renew the parts affected.

Dismantling

10. Before commencing to dismantle the jack it must be in the unlocked condition. To unlock the jack, carry out the following operations.

(1) Fill the unit with clean fluid at connection X until all air has been expelled. Connect a hand pump to connection X; apply a gradually increasing pressure to release the lock and extend the jack. The pressure used to release the lock must not be allowed to exceed 1,000 lb/in^2.

(2) Disconnect the hand pump and drain all oil from the unit.

(3) Remove all locking wire.

(4) Unscrew and remove the banjo bolt from the cylinder; unscrew the plug and withdraw the spring and restrictor from the bolt.

(5) Remove the cap screw securing the banjo union of the pipe assembly to the cylinder and the pin and collar securing the post in the end fitting. Withdraw the post from the end fitting and remove the pipe assembly from the unit.

(6) Secure the fork-end fitting in its holding blocks held in the bench clamp and remove the ring nut securing the fork-end fitting to the cylinder. Withdraw the fork-end fitting from the cylinder. The split ring is in two halves and will fall away from the cylinder, retain the halves together.

(7) With the cylinder secured in its holding blocks held in the bench clamp remove the ring nut retaining the gland carrier in the cylinder. Withdraw the piston rod from the cylinder, together with the gland carrier and abutment ring.

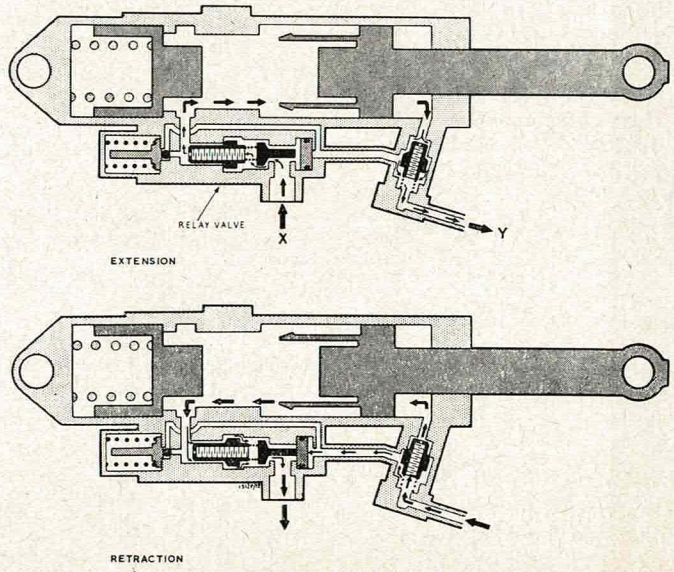

Fig. 2. Principle of operation

(8) Secure the piston rod in its holding blocks in the bench clamp; using the tube spanner unscrew the piston nut. Remove the lock tongue, piston, and washer.

(9) Slacken the lock nut on the eye-end fitting, release the tab-washer, and remove the eye-end fitting from the piston rod, followed by the gland carrier.

WARNING . . .

As the springs in the lock bolt are under compression, the lock bolt must be removed as follows.

(10) Place the fork-end fitting under a press, and depress the lock bolt until tension on the indicator screw has been relieved, i.e. when the indicator is out of alignment with the arrow.

(11) Remove the indicator screw, plate and collar.

(12) Release the pressure on the lock bolt until the springs are fully extended; remove it from the press, and extract the lock bolt.

(13) Remove the four cap screws and the spring housing from the end fitting together with the spring, valve rod, shim and guide; retain the shim with the guide and spring. Remove the ball valve and guide, and then by tapping the end fitting on to a flat bench top, ease out the valve seats, valves, spring and piston from the bore, together with abutment ring, gland carrier, washer, springs and spacer from the end fitting.

(14) Remove all sealing rings and backing rings.

Assembling

Note . . .

Refer to the General Notes, Book 1, Sect. 1, Chapter 1, for detailed information on fitting of all sealing and backing-rings.

Lubricate all sealing rings with Grease XG315 prior to assembling into the unit.

11. (1) Fit all sealing and backing rings; refer to *fig.* 1 for their disposition. Care must be taken not to overstretch the rubber rings.

(2) Insert the relay piston and valve seat, valve spring, restrictor valve and seat and the relief valve seat into the bore provided in the end fitting; place the ball guide and ball valve in position on the seat. Locate the spigot of the valve rod in the ball guide bore, with the spring, rod guide and shim fitted, then fit the spring housing securing it tight with the four cap screws.

(3) Insert the spacer into the fork-end, followed by the two concentric springs. Insert the lock bolt.

(4) Place the fork-end fitting under a press, and depress the lock bolt until the indicator screw hole in the lock bolt is visible through the indicator plate slot. Insert the bush of the indicator plate assembly into the lock bolt; secure the plate with the screw. Remove the end fitting from the press.

(5) Fit the washer to the lock bolt, chamfered face leading, followed by the gland carrier, inner sealing rings leading, and then the abutment ring. Care must be taken not to twist or damage the sealing rings.

(6) Secure the piston rod in its holding blocks held in the bench clamp. Fit the washer, chamfered face leading, followed by the piston, also chamfered face leading.

(7) Fit the lock tongue to the piston rod; secure it with the piston nut, using the tube spanner. Wire-lock the piston rod, ensure that the wire does not protrude beyond the end of the piston nut.

(8) Insert the lock sleeve into the cylinder.

(9) Secure the cylinder in its holding blocks in the bench clamp. Fit the ring nut to the cylinder.

(10) Insert the piston rod, lock tongue leading, into the pipe connection, end of the cylinder. Care must be taken to ensure that the lock tongue does not damage the bore of the cylinder, and that the piston seals are not damaged. Do not attempt to force the lock tongue into the lock sleeve.

(11) Fit the abutment ring to the piston rod, open face leading, and insert it into the cylinder, followed by the gland carrier, sealing rings leading; secure it with the ring nut. Wire-lock the ring nut to the cylinder after satisfactory tests have been carried out.

(12) Refit the nut and tab-washer on to the eye-end fitting; screw it into the piston rod, but do not tighten the lock nut until after the unit has been installed in the aircraft.

(13) If it has been removed refit the grease nipple to the eye-end fitting and fill the grease cavity with grease.

(14) Stand the end fitting on its fork end, and locate the two halves of the split ring into their groove in the cylinder. Insert the cylinder into the end fitting; ensure that the split ring is still level in its groove. Secure the end fitting in its holding blocks in bench clamp. Tighten the ring nut, the angular relationship of connection Y must be at right angles to the two bores of the fork $\pm \frac{1}{2}$ deg. (*fig.* 1).

(15) Insert the post of the pipe assembly through the bore in the end fitting, fit the collar, align the holes and lock it in position with a split pin.

(16) Secure the banjo union of the pipe assembly to the cylinder with the cap screw. Insert the restrictor valve and spring into the banjo bolt and secure it with the end cap, then screw the banjo bolt into the cylinder retraction port, through the banjo union of the pipe assembly.

TESTING

Test equipment

12. A static hydraulic test rig with two hand pumps, a power pump rig capable of delivering 2·8 in^3/sec. at 1,000 lb/in^2, banjo bolt test adapter 4.70095.001 banjo union adapters 4.70095.001-002 cylinder adapter 4.70095.004 and a 160 in^3 piston-less accumulator will be required to carry out the following tests.

Proof test

13. (1) Connect the supply lines of the test rigs to connections X and Y *fig.* 1. With

the jack extended apply a pressure of 3,000 lb/in² at connection X, then apply a pressure of 1,000 lb/in² at Y. Raise pressure at X to 4,050 lb/in² and hold without external leakage for two minutes. Release the pressure and disconnect the supply line from connection X.

(2) With the jack closed and locked, apply a pressure of 4,050 lb/in² at connection Y and maintain without external leakage for two minutes. Release the pressure.

Fitting test adapters

14. To carry out further tests the jack is to be partially stripped and the test adapters fitted.

(1) Remove the piston rod assembly complete and replace the gland carrier with the cylinder test adapter.

(2) Remove the banjo bolt (one-way restrictor assembly) and pipe sub-assembly from connection Y.

(3) Fit the banjo bolt test adapter and a bonded seal to connection Y.

Note . . .

Care must be taken on assembly of test adapter to avoid damage to sealing face of connection Y.

(4) Swing the pipe sub-assembly clear of connection Y, assemble the banjo bolt bonded seals and the banjo union adapters to the pipe assembly.

(5) Throughout the following tests references to the connections on the banjo union test adapters 4.70095.003 and 4.70095.002 will be A and B respectively and unless otherwise stated connection B is to be blanked throughout the tests.

Functional and leakage tests

15. (1) Connect the unit as shown in *fig.* 3 with the connecting pipes as short as possible.

(2) With cocks 1 and 2 closed and cock 3 open apply a pressure of 3,000 lb/in² at X (this pressure must also be indicated at Y). Reduce the pressure at X to 2,500 lb/in², there must be no appreciable loss of pressure at Y. Retain the pressure at X for two minutes, any leakage across the non-return valve and/or the static seals will be indicated by a tendency for the pressure at X and Y to equalise. Reduce the pressure at X to zero and hold the pressure at Y for two minutes without leakage. Finally vent the pressure at Y. Repeat this test to complete five operations.

(3) Connect a low pressure gauge in the supply line to connection X. With cock 1 closed and cocks 2 and 3 open apply a gradually increasing pressure at X, the maximum pressure required to open the relay valve must not exceed 8 lb/in². Repeat this operation five times. Release the pressure and isolate the low pressure gauge.

(4) With cocks 2 and 3 closed and cock 1 open apply a pressure of 3,000 lb/in² at connection Y, then apply a gradually increasing pressure at A until the relay valve is moved off its seat allowing the pressure at Y to be vented through connection X to tank. The pressure applied at A to operate the valve must not exceed 850 lb/in². Open cock 3, close cock 1 and apply a pressure of 3,000 lb/in² at X to reset the relay valve. Finally vent all pressure from X and Y by opening cocks 1 and 2. Repeat this test to complete five operations.

(5) Close cocks 1 and 2 and open cock 3, apply an increasing pressure at Y until the relief valve cracks (indicated by fluid venting through cock 3). The valve must operate at a pressure of 3,500 lb/in² to 3,700 lb/in². Cease pumping; the valve must reseal before the pressure falls to below 3,100 lb/in². Release the pressure and disconnect the unit from the rig.

Flow test (Restrictors)

16. (1) Connect the power pump rig supply

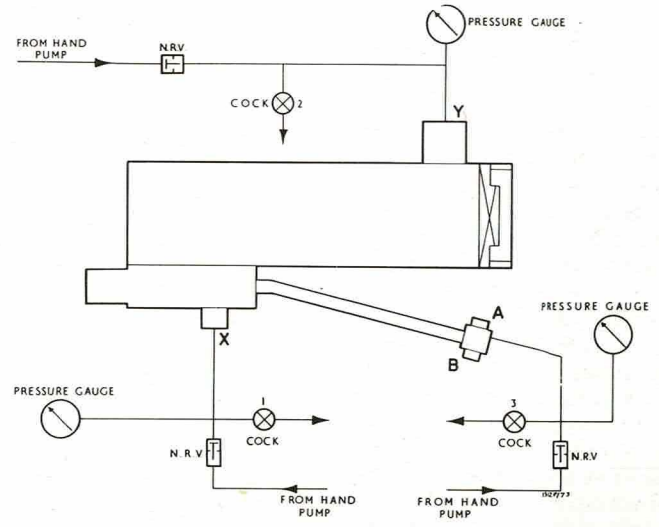

Fig. 3. Test diagram (Functional and leakage tests)

line to connection X. With connection Y open operate the power rig to flow the unit from X to Y with A open. At a pressure drop of 1,000 lb/in^2 the flow must be from 2·15 to 2·65 in^3/sec. Release the pressure and stop the pump.

(2) Connect the power pump supply line to connection A and remove the blank from connection B. Flow the restrictor from A to B. At a pressure drop of 1,000 lb/in^2 the flow must be from 2·55 to 3·05 in^3/sec. Release the pressure, stop the pump and disconnect the pump supply line from the unit.

Removal of test adapters

17. Remove the test adapters and completely re-assemble the unit as shown in *fig.* 1.

Functional tests (complete unit)

18. Connect the unit to a test circuit as shown in *fig.* 4; the connecting pipes must be as short as possible. The accumulator must not be less in capacity than 160 in^3, mounted in a vertical position with a small quantity of oil in the bottom (approximately 10 in^3), and initially inflated with air to 95 lb/in^2.

Note . . .

During the following tests the accumulator pressure must not be allowed to exceed 100 *lb/in^2. Any rise in pressure above this figure can be relieved by opening cocks* 1 *and* 2 *together.*

(1) With cocks 1 and 2 closed, and cock 3 open, operate the hand pump to extend the jack; increase the pressure to 3,000 lb/in^2 when fully extended. Open cock 1 close cock 3 and operate the hand pump to close the jack. When the jack is 1in. to 1½ in. from the fully closed position stop pumping, close cock 1, open cock 2. Continue pumping until the jack is closed and locked; then increase the pressure to 3, 000 lb/in^2. The lock indicator bolt must show that the unit is locked within three seconds from reaching the fully closed position. Carry out five complete tests.

(2) With the jack still connected as for test (1), close cock 2 and keep it closed throughout the following tests. Apply pressure at connections X and Y alternately to extend and close the jack three times each way against no load. The pressure must not exceed the following values:—

(a) At X during free travel (extending) 100 lb/in^2

(b) At X unlocking (extending) 260 lb/in^2

(c) At Y during free travel (closing) 60 lb/in^2

(d) At Y locking (closing) 280 lb/in^2

Note . . .

When applying pressure at Y raise pressure slowly until valve opens and jack commences to close. Continue pumping keeping the jack moving slowly.

When operating the hand pump at X, cock 1 is to be closed and cock 3 open, when operating the hand pump at connection Y cock 3 is to be closed and cock 1 is to be open. The movement must be smooth and regular. At the end of each complete stroke adjust the pressure to 100 lb/in^2 maintain it for one minute; there must be no leakage. Increase the pressure to 3,000 lb/in^2 and maintain it for a further minute; there must be no leakage. After satisfactory tests have been carried out, wire-lock the ring nuts and the screws.

Lock tests

19. Set the jack up in a suitable press.

(1) With the jack closed and locked, apply a tensile load of 2,000 lb then apply pressure at connection X to unlock. The pressure required must not exceed 450 lb/in^2. Repeat this test to complete five operations then release the pressure and the applied load.

(2) With the jack closed and locked apply a tensile load of 5,030 lb. and hold for one minute. Release the applied load.

(3) Repeat test 19 (1).

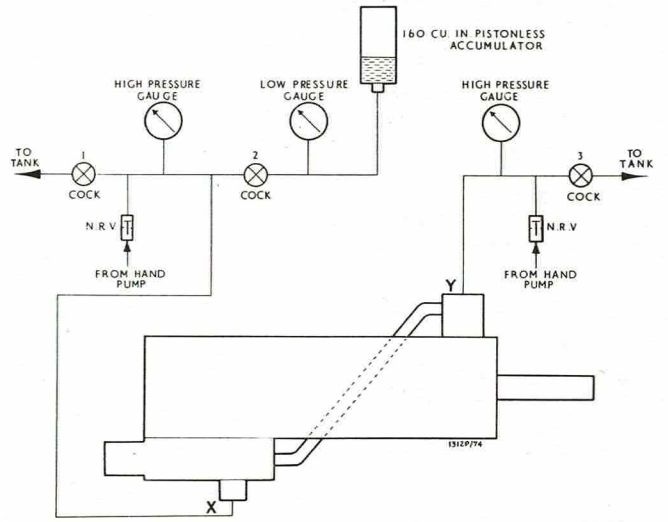

Fig. 4. Test diagram
(Functional tests—complete unit)

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Chapter 31 UP-LOCK JACK

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Introduction

1. This jack is spring-loaded to the closed position and hydraulically operated to the extended position against the spring pressure. A shuttle valve is attached to the jack to provide for operation by an emergency system in the event of failure of the normal hydraulic system. A basic type is described in the chapter and the variants are given in the appendices, together with the type number of the applicable shuttle valve.

2. The shuttle valve and its operation are described in A.P.1803U, Vol. 1, Book 4, Sect. 9.

Description

3. The cylindrical body is formed with lugs for attachment purposes and the shuttle valve is spigoted into one end and secured by bolts screwed into wire inserts. The body houses a piston and also receives an end cap, screwed in to retain a spring and a piston rod. The spring loads the domed head of the piston rod against a conical recess in the head of the piston and movement of the rod is limited by the skirt of the end cap and the piston head, which abuts against a shoulder of the body. Shims are fitted between a flange of the end cap and the body, for adjustment of the piston rod travel. The outer end of the piston rod is slotted to locate a spanner grip and receives a screwed eye-bolt which is fitted with a lock-nut.

SERVICING

Leakage

4. External leakage will indicate a faulty sealing ring which must be renewed. Internal leakage past the piston sealing ring will be shown by sluggish action of the jack in service or loss of pressure during test. Renew the sealing ring. Failure of the jack to return to the closed position will be due to a weak or damaged spring which must be renewed.

Dismantling

5. (1) Unscrew the bolts and remove the shuttle valve.

(2) Slacken the lock-nut, unscrew the eye-bolt and remove the spanner grip from the piston rod.

(3) Unscrew the end cap and withdraw the spring, the piston rod and the piston from the body. Remove the shims from the end cap. Remove the sealing ring and the split ring from the piston.

Assembling

6. All sealing rings are to be lightly coated with Grease XG-315 (34B/9100519) before being assembled in the unit.

(1) Fit the sealing ring and the split ring to the piston. If a new split ring is fitted, it must be gapped 0·003 to 0·005 in. on assembly and the sharp edges at the gap on the flat faces only, removed by a radius of 0·005 to 0·015 in.

(2) Insert the piston into the body, sealing ring leading, until the head abuts the shoulder in the body.

(3) Insert the piston rod into the body, locating the domed head against the recess in the piston head. Locate the spring over the piston rod.

(4) Fit the shims to the end cap, pass the cap over the piston rod and screw it into the body to retain the spring and the piston rod. Adjust the number of shims to ensure that the stroke of the piston rod is within the limits of 0·187 to 0·193 in.

(5) Screw the lock-nut on the eye-bolt and locate the spanner grip to the slots in the end of the piston rod. Screw the eye-bolt into the piston rod. The eye-

TABLE 1

Special tool

Ref. No.	Part No.	Description
27Q/	ST.2075/9	C' key spanner for end cap

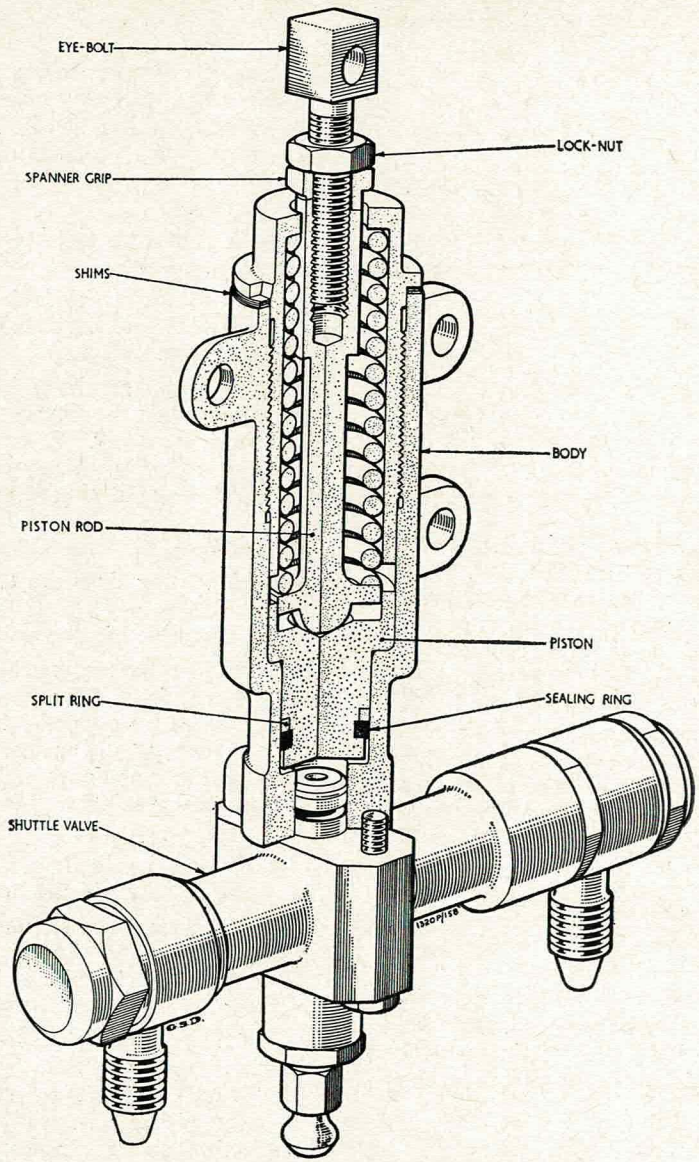

Fig. 1. Up-lock jack

bolt will be finally adjusted and locked after the unit is installed.

(6) Ensure that the sealing ring and backing ring are fitted to the shuttle valve spigot, with the rough face of the backing ring adjacent to the sealing ring. Fit the fully tested shuttle valve to the jack by inserting the spigot into the bore of the body and securing with the bolts.

(7) After final assembly and test, wire-lock the end cap to the body and the shuttle valve securing bolts together.

Testing

7. A static hydraulic test rig and a power pump rig fitted with a pump capable of delivering 3·45 gal/min, are required. Pipes between the test rigs and the jack are to be $\frac{3}{8}$ in. outside diameter for metal pipes or $\frac{3}{8}$ in. nominal for flexible hose. Before testing, the jack is to be hydraulically operated at least six times to expel all air.

(1) Connect the supply line of the static hydraulic test rig to one of the shuttle valve connections and slowly apply a pressure of 300 lb/in^2. Gradually increase the pressure to 6000 lb/in^2. Leakage is not permissible. Release the pressure and disconnect the supply line.

(2) Connect the supply line of the power rig to one of the shuttle valve connections and operate the rig. The pressures required to commence and complete the extending movement must not exceed 335 lb/in^2 and 370 lb/in^2 respectively. Release the pressure; the jack must return smoothly and immediately to the closed position.

(3) Check that the stroke of the piston rod is within the limits given in *para.* 6 (4).

Installation

8. When the jack is installed, the eye-bolt is to be adjusted to suit the pick-up points. The dimension between the centres of the attachment holes adjacent to the end cap and the centre of the eye-bolt hole is to be within the limits of 1·81 in. and 1·95 in. with the jack in the fully closed position. After adjustment, lock the eye-bolt with the nut and wire-lock the eye-bolt, the lock-nut and the spanner grip together.

Appendix 1

UP-LOCK JACK

Type No. 1.00594.003

incorporating—

Shuttle valve Type No. 1.00595.002

UP-LOCK JACK

Type No. 1.00610.003

incorporating—

Shuttle valve Type No. 1.00612.002

1. These units are identical to the type described in the chapter and differ from each other only in respect of the type of shuttle valve fitted.