Chapter 20 REAR FREIGHT DOOR JACKS

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. These units are double-extension jacks which can be operated in two stages to give two extension positions when operating the lower rear freight door. They are similar in their construction but differ in their handling to suit installation requirements. ◀A basic type jack is described in the chapter with illustrations showing a PORT unit, variants being covered in the appendices.▶

2. Each unit consists principally of a two-stage jack, of which the first stage, (fig. 1) lowers the freight door for vehicle loading, while the second stage (fig. 2) lowers it further for ramp loading; the rate of extension of the second stage is controlled by a locking valve. An internal locking device is incorporated to lock the second stage in the closed position until the first stage is fully extended. This condition is signalled to the cockpit through a micro-switch. A second micro-switch signals when the second stage is closed and locked. The lock is mechanically made and hydraulically released.

3. If a failure should occur in the normal supply system, a shuttle valve operates to close off that system and admits fluid from the emergency system to close the first stage. Two swivel coupling units convey fluid to the locking valve, and the jack.

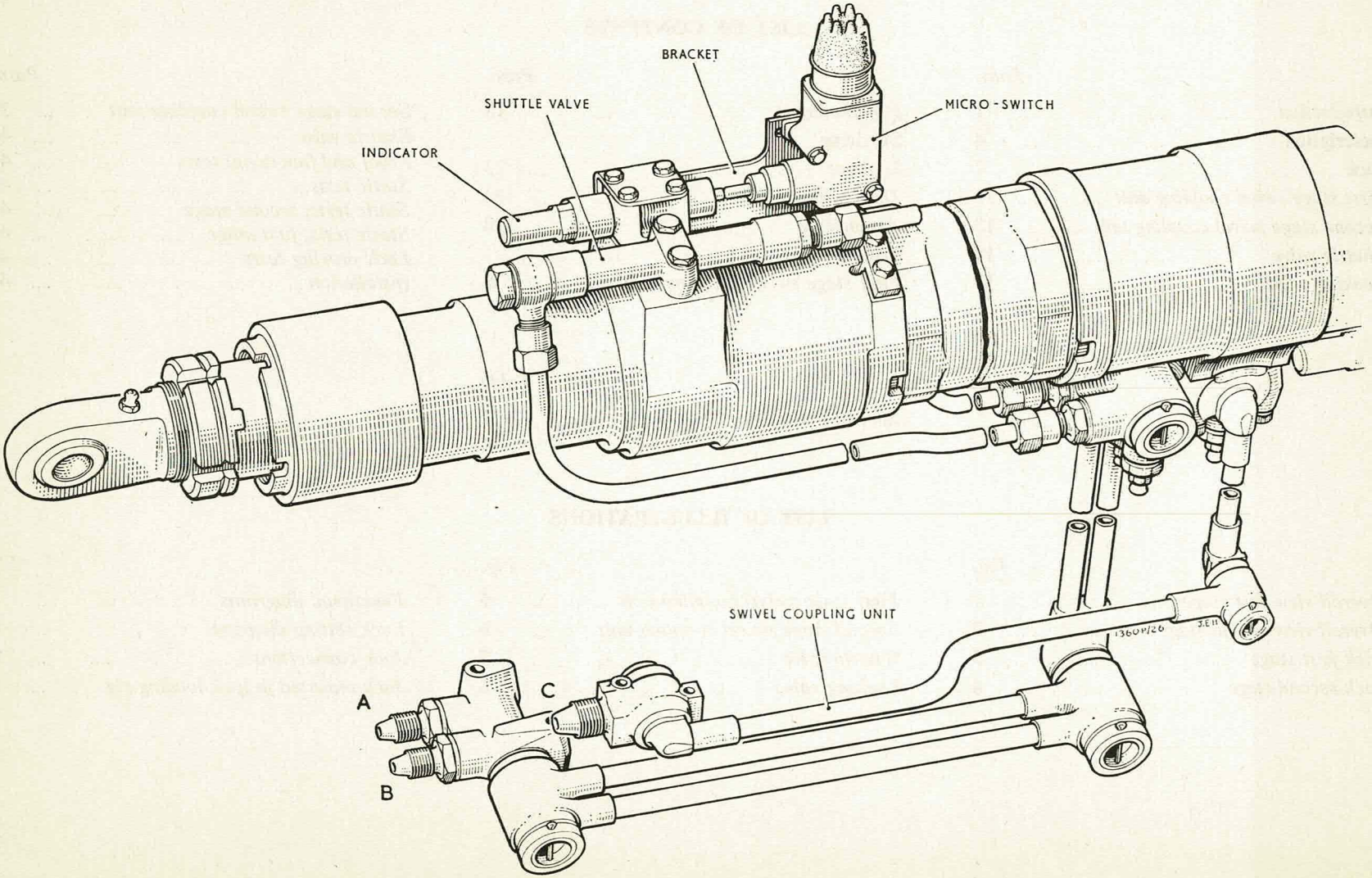


Fig. 1. Overall view first stage

DESCRIPTION

4. The shuttle valve is located parallel with an indicator that actuates a micro-switch which is carried on a bracket secured to the indicator; adjustment of the micro-switch is catered for by slots in the bracket. The indicator consists of a cover which is screwed into a body, inside of which is housed a spring-loaded plunger that protrudes through a plug screwed into the end of the body where it retains a double seal, composed of a backing ring and an O ring. A slot in the plunger caters for the movement of the upper end of a spindle, the other end of which protrudes into a boss formed on the jack body to make contact with the first stage piston when it is in the extended position. The spindle is spherically-shaped at mid-point where it pivots about a pin and thus operates the plunger. A gland carrier, fitted with two double seals, retains a washer which acts as a stop for the plunger.

5. Fluid is conveyed to the shuttle valve through two parallel pipes which are connected to one of the swivel couplings and are supported at mid-length by two clips, *cushioned* on rubber strips. Fluid from connection A of the swivel coupling passes to the normal connection of the shuttle valve, while that from connection B passes to the emergency connection. This swivel coupling also conveys fluid from connection C to the extension port of the first stage.

6. Adjacent to this swivel coupling is another indicator assembly similar to that previously described, which gives warning when the mechanical lock is released. Fluid supply to release the lock, extend and close the second stage is supplied through the locking valve and another swivel coupling.

Jack

7. The jack body comprises a cylinder, to each end of which is screwed an end fitting. Each fitting is secured to the cylinder by a

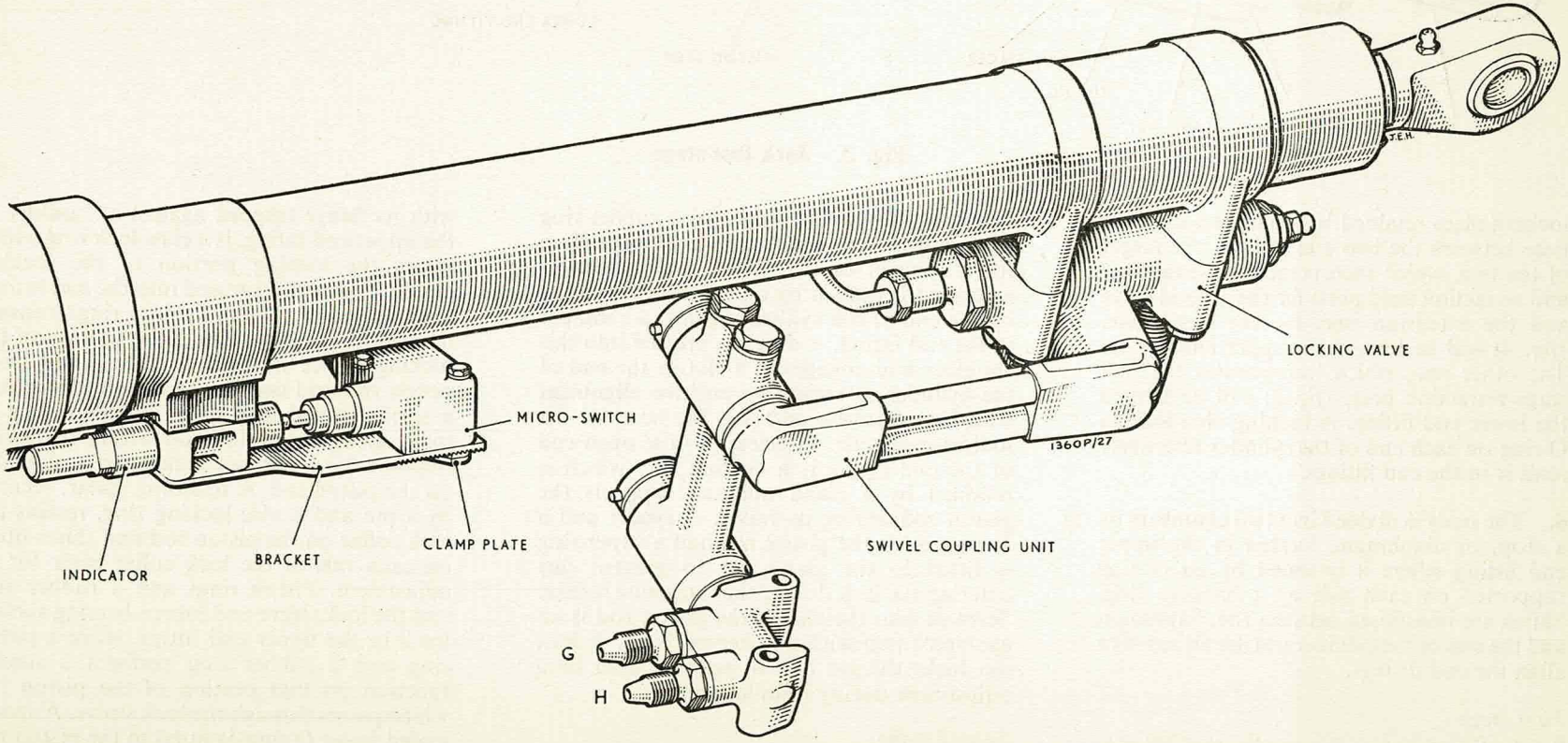


Fig. 2. Overall view second stage

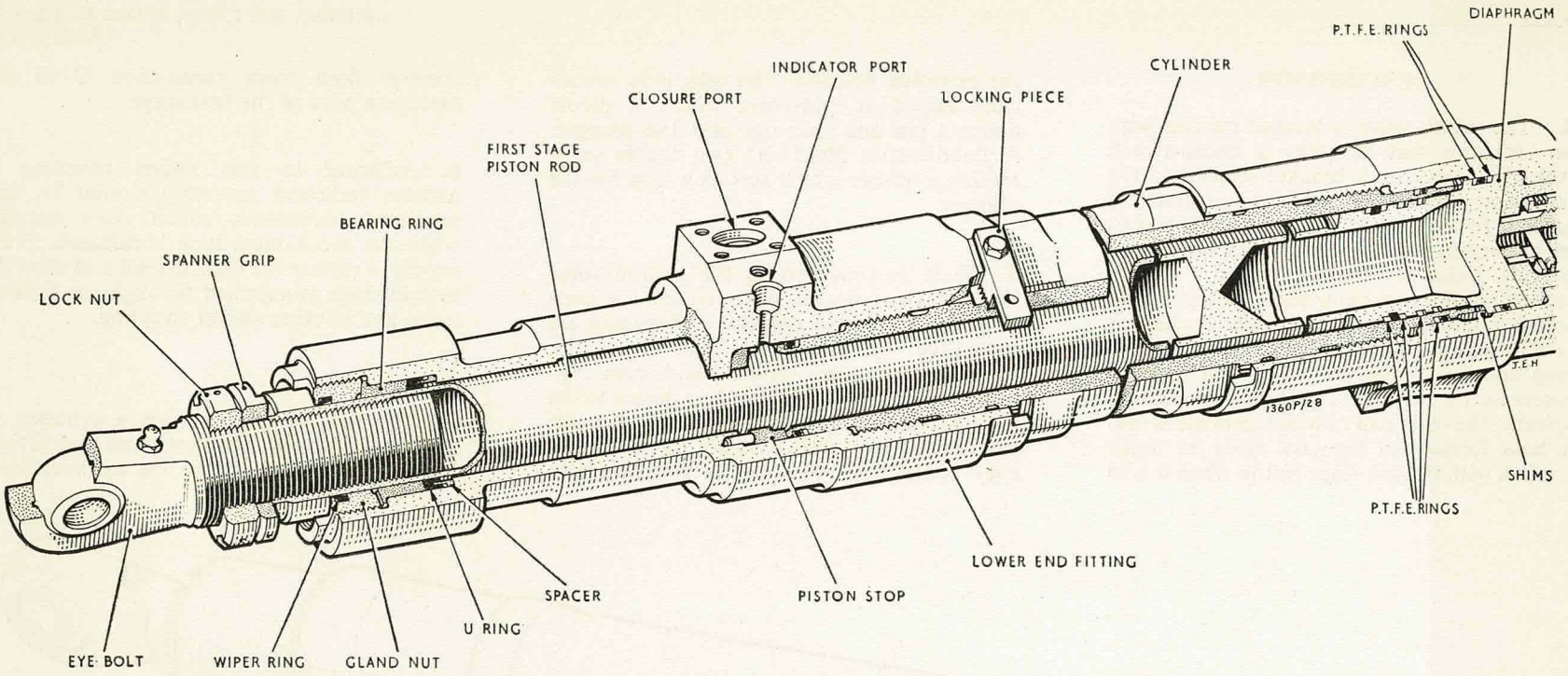


Fig. 3. Jack first stage

locking piece retained by a bolt. To differentiate between the two end fittings, the larger of the two, which incorporates the extension and retraction fluid ports for the second stage and the extension port for the first stage, *(fig.* 4) will be termed the upper end fitting. The other one, which incorporates the first stage retraction port, *(fig.* 3) will be termed the lower end fitting. A backing ring and an O ring on each end of the cylinder effectively seals it in the end fittings.

8. The body is divided into two chambers by a stop, or diaphragm, located in the upper end fitting where it is sealed by an O ring supported on each side by a backing ring. Shims are interposed between the diaphragm and the end of the cylinder and are adjusted to align the end fittings.

First stage

9. In the chamber formed by the cylinder and the lower end fitting is housed the first stage piston which is fitted with a rubber ring and piston rings that form a bearing surface for it. Travel of the piston rod during its extension is limited by a piston stop retained by the end of the cylinder against a shoulder in the end fitting. A dowel is pressed into this shoulder and engages in a slot in the end of the cylinder to ensure its positive alignment with the extension port and the bore for the indicator spindle. Inserted into the open end of the end fitting is a bearing ring which is retained by a gland nut and supports the piston rod during its travel. A spacer and a U ring, seals the piston rod and a wiper ring is fitted to the gland nut to prevent dirt entering the jack during the retraction stroke. Screwed into the end of the piston rod is an eye-bolt fitted with a spherical bush. A lock nut locks the eye bolt in position after final adjustment during installation.

Second stage

10. Abutting the other side of the diaphragm, with its flange trapped against a shoulder in the upper end fitting, is a claw lock ring which forms the moving portion of the locking device. A dowel is pressed into the end fitting, and engages in a slot in the lock ring to ensure its positive location. The static portion of the locking device is fitted to the second stage piston rod and consists of a lock collar, and a spring-loaded lock sleeve, which is free to move along the piston rod within the limits imposed by a distance collar and a shoulder on the piston rod. A retaining collar, secured by a pin and a wire locking ring, retains the lock collar on the piston rod and shims fitted on each side of the lock collar cater for its adjustment. Piston rings and a rubber ring seal the lock sleeve and form a bearing surface for it in the upper end fitting, while a piston ring and a rubber ring perform a similar function on that portion of the piston rod which passes through the lock sleeve. A spacer sealed by an O ring, is fitted to the piston rod to reduce the stroke of the second stage. The

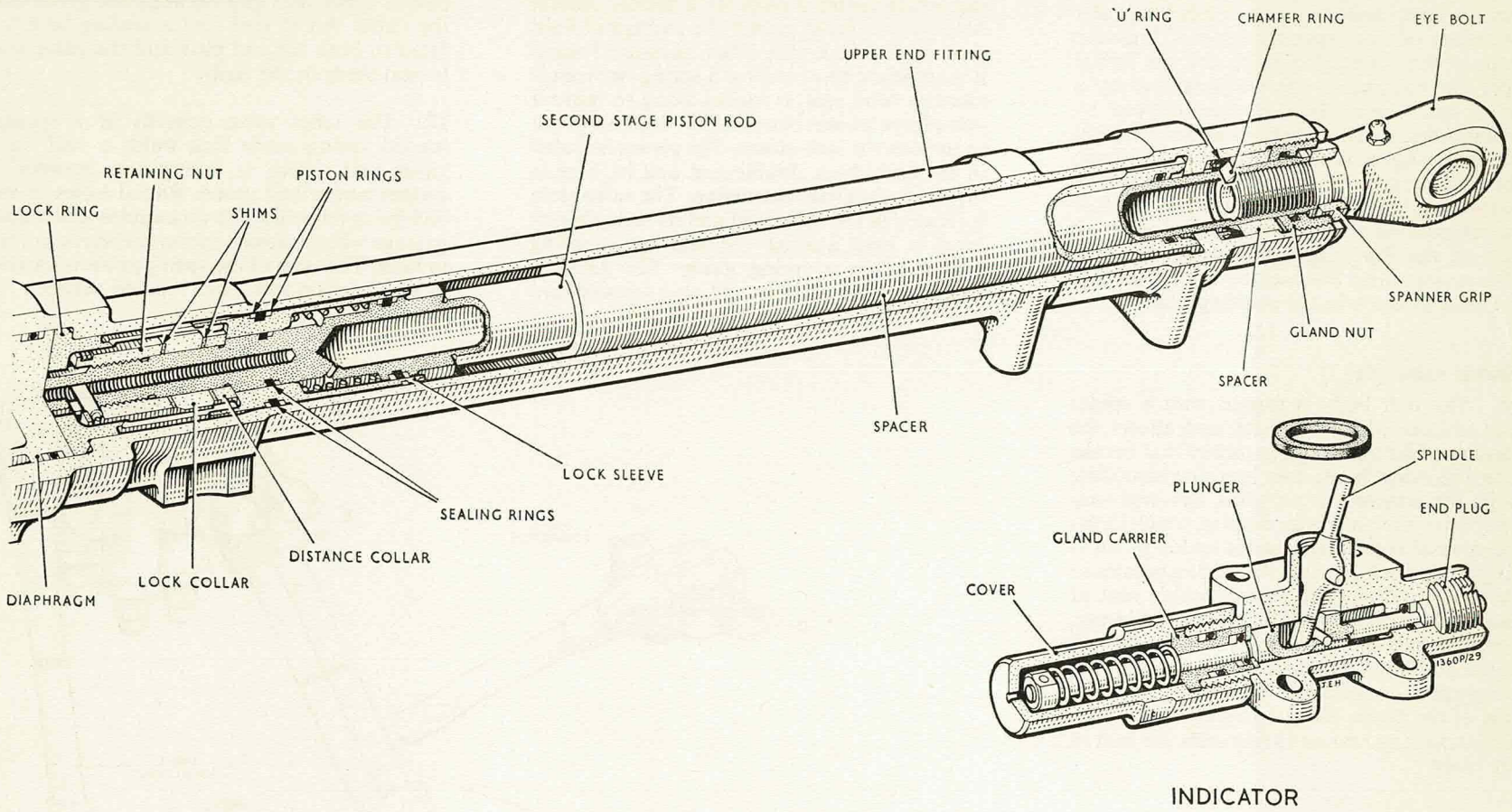


Fig. 4. Jack second stage

open end of the upper end fitting is closed in a similar manner to that of the lower end fitting, with a gland nut, bearing ring, and a U ring. An eye-bolt is screwed into the piston rod and is fitted with a spherical bush, a grease nipple, and a spanner grip.

First stage swivel coupling unit *(fig.* 5)

11. A connection body, fitted with two cone adapters and three bleed screws, all sealed by bonded seals, is shaped to form a spigot, and makes a junction for two sets of swivel pipe sub assemblies, one double and one single, both of which terminate in a swivel post at each end.

12. Fitted to the swivel post of the double swivel pipe is the banjo end of another swivel pipe assembly. The banjo at the other end receives the swivel post of a connection block. Two cone adapters are screwed into this connection block and are sealed by bonded seals. Fitted to the swivel post of the single swivel pipe is the banjo end of a second single swivel pipe assembly. The other end of this terminates in a swivel post that carries a swivel connection. Each swivel post is grooved and has radial holes that align with the pipes to give an individual flow through the unit from the connections. Backing rings and O rings on each side of the grooves seal them on their respective banjos and, in the case of the double pipes, maintain the two fluid streams separated. A collar, secured by a split pin, retains the parts fitted to the swivel posts.

Second stage swivel coupling unit *(fig. 6)*

13. A swivel coupling link connects a swivel post assembly and a connection block together by means of two separated oilways. Both the stem of the connection block and the swivel post are retained in the coupling link by a collar and a pin. Two grooves, pierced by radial holes, in the swivel post and connection block are aligned and permit fluid to flow from the adapters screwed into the connection block to the jack, via twin parallel pipes and another swivel post. O rings and backing rings each side of the fluid grooves maintain the two streams separated and seal the swivel post and connection block in the coupling link.

Shuttle valve *(fig. 7)*

14. The unit body is formed with a spigot that is inserted into the jack and allows the passage of fluid through an oilway that breaks into the body bore; two lugs accommodate bolts for attachment purposes. Screwed into one end of the body is an adapter, which forms the normal connection, and is sealed by an O ring and a backing ring. A shuttle operates in the body and is fitted with a rubber seat at each end which seals off the system not in use. Screwed into the other end of the body is a banjo bolt fitted with a banjo which forms the emergency connection. Bonded seals each side of the banjo affect oil-tight joints, while a backing ring and an O ring seals the bolt in the body.

Locking valve *(fig. 8)*

15. The locking valve body is formed with a spigot that locates in and conveys fluid to extend the jack, and also with lugs for attachment bolts. Sealing of the spigot is effected by an O ring and a sealing ring. Contained within the body is a locking valve and a thermal relief valve, located at right angles to each other, and connected together by internal passages. Further passages from the valves connect to a transverse bore above the locking valve that houses the swivel post of the second stage swivel coupling unit. Radial grooves along the length of the bore are fitted with sealing rings and O rings for sealing the swivel post.

16. Screwed into one end of the body, where it is sealed by an O ring, is a cone-ended end cap which forms a stop for a piston. Radial holes in the piston permit the passage of fluid to close the jack and, when pressure behind it is sufficient to overcome a spring between it and the valve seat, it moves along to move a valve from its seat in order that fluid may vent to tank as the jack closes. The piston is sealed in the body by a double seal and its bore is tapped to facilitate extraction. The valve stem is located in the valve seat and its cone-shaped head is held against the seat by a spring supported by a spring guide. The guide is located in a recess in an end plug screwed into the body, and a washer and shims located beneath the guide are adjusted together to ensure a specified gap between the guide and the valve. An O ring and a sealing ring are fitted to both the end plug and the valve seat to seal them in the body.

17. The relief valve consists of a spring-loaded spring guide that holds a ball on a valve seat which is interposed between a washer and a ball guide. Radial holes in the ball guide coincide with an annulus and a fluid passage which permits excess pressures to vent to tank. The stem of the spring guide is located in a travel stop and shims located between the

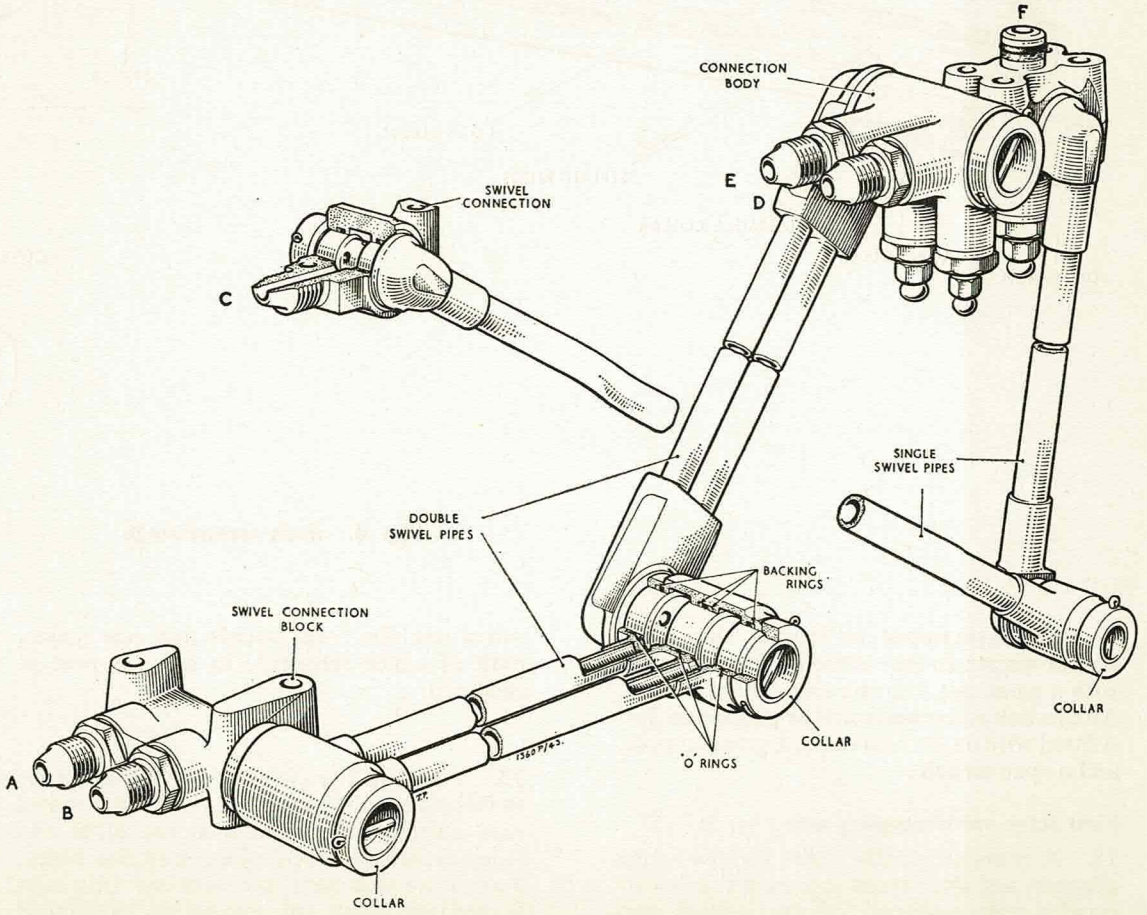


Fig. 5. First stage swivel coupling unit

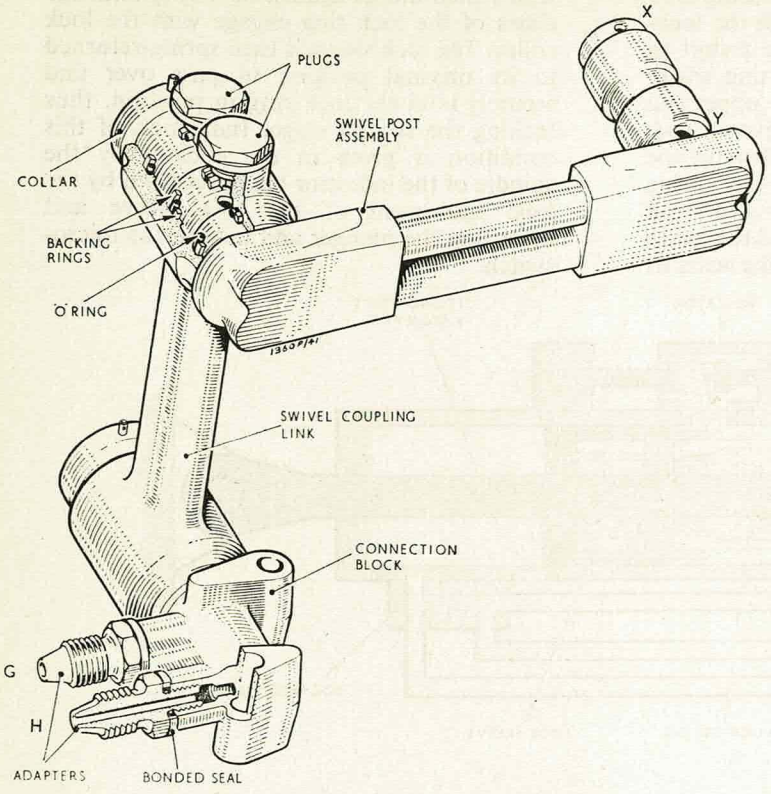


Fig. 6. Second stage swivel coupling unit

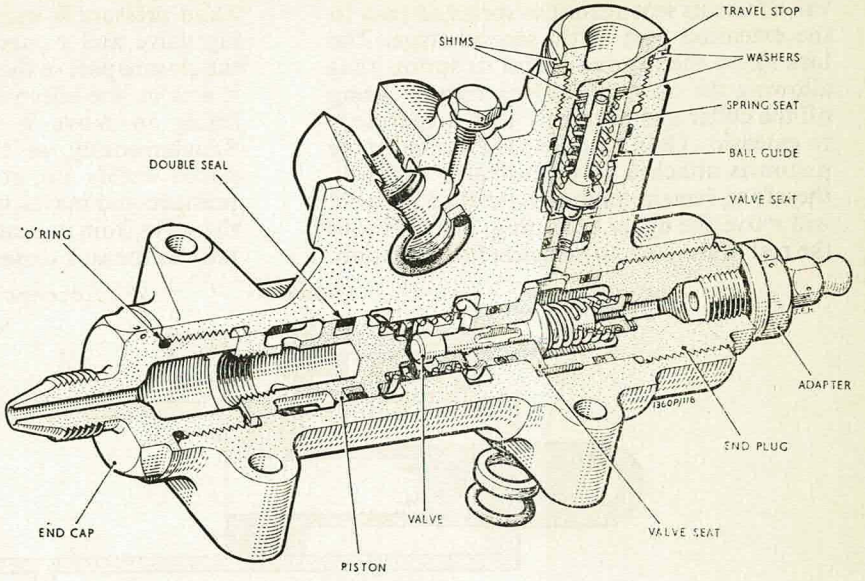


Fig. 8. Locking valve

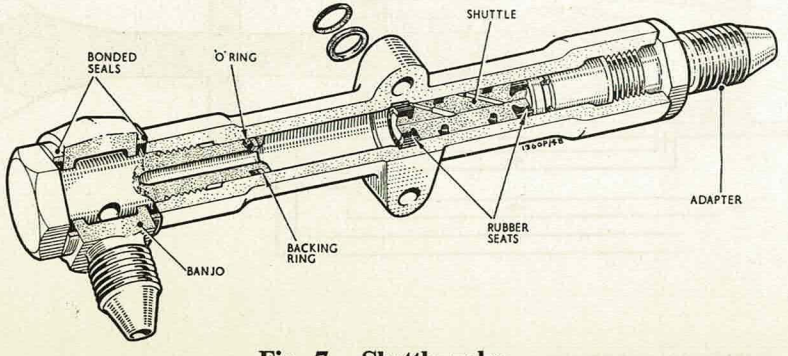


Fig. 7. Shuttle valve

stop and the spring are adjusted to govern the spring loading and consequently the relief pressure. A plug, sealed in the body by an O ring, closes the bore and is fitted with a washer and a shim, adjustment of which permits the ball guide to float.

Functioning (fig. 9)

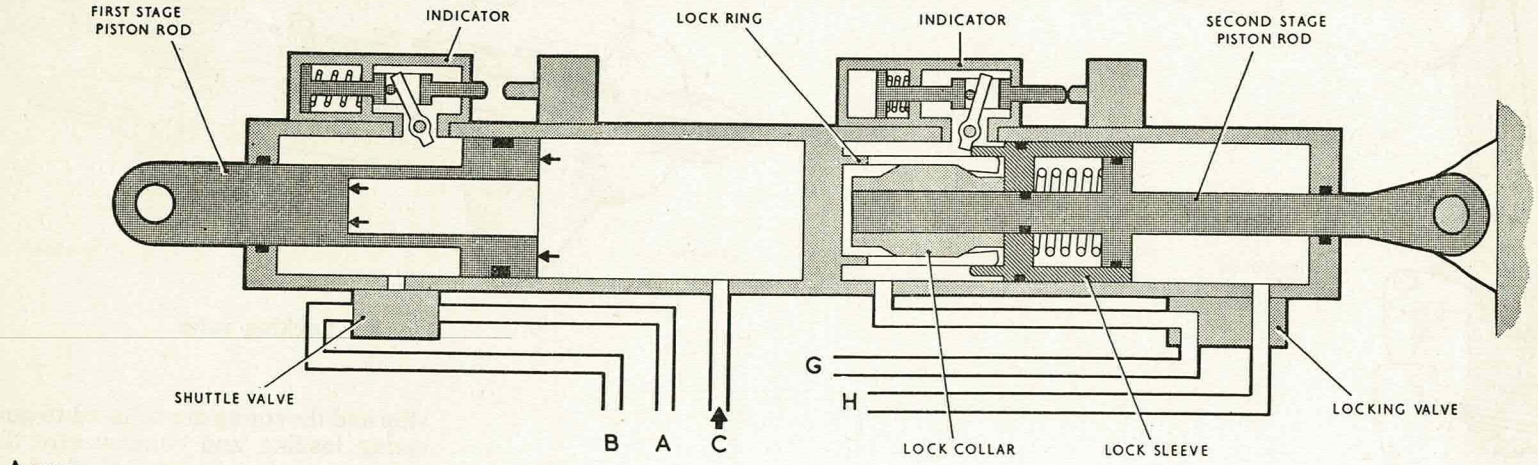
Extension

18. To open the lower rear freight door for vehicle loading, the first stage of the jack is extended by admitting fluid pressure through connection C where it acts on the full area side of the piston rod, which then moves outwards. As the piston rod reaches the final movement of its stroke, the piston contacts the indicator spindle, which then causes the plunger to actuate the micro-switch which then signals that the first stage is fully extended. During the operation the second stage will remain closed and locked.

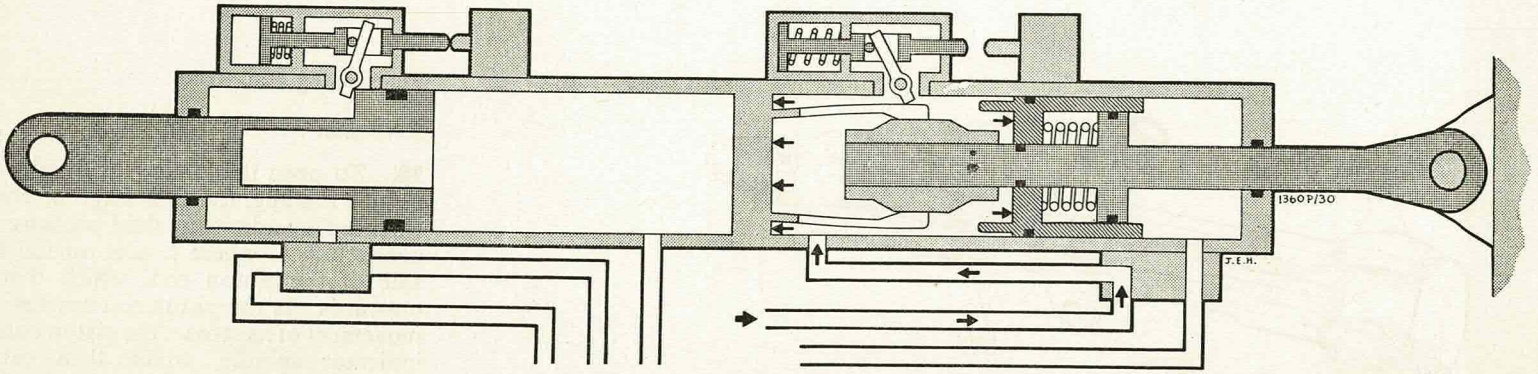
19. To extend the freight door further for ramp loading, fluid pressure is directed through the locking valve where it moves the valve from its seat against its spring to pass to the extension port of the second stage. The lock sleeve then moves against its spring, thus allowing the claws of the lock ring to spring off the collar and release the lock preparatory to extension (B in fig. 9). As the second stage piston is attached to the airframe and will, therefore, remain stationary, the fluid pressure will move the upper end fitting, together with the rest of the jack, to complete full extension.

Closure

20. Closure of the freight door is again in two stages, with the second stage closing first. Fluid pressure is admitted through the locking valve and passes through the piston to the closure port of the upper end fitting, where it acts on the effective area of the upper end fitting to move it along the piston rod. Simultaneously, as the pressure behind the piston builds up, it overcomes the spring pressure and moves the piston along to move the valve from its seat to allow fluid to vent to tank as the jack closes. As the stroke nears its completion, the lock ring expands and passes over the lock collar to contact the lock sleeve, which then moves against its spring until the claws of the lock ring engage with the lock collar. The lock sleeve is then spring-returned to its original position to pass over and securely hold the lock ring in position, thus locking the second stage. Indication of this condition is given in the cockpit by the spindle of the indicator being actuated by the final movement of the lock sleeve and operating the plunger and in turn the micro-switch.



A FIRST STAGE EXTENDING



B SECOND STAGE UNLOCKING AND EXTENDING

Fig. 9. Functional diagrams

21. With the second stage locked, fluid is admitted through connection A to pass through the shuttle valve, where it acts on the annular side of the first stage piston rod to move it along the cylinder, thereby closing the jack and the freight door.

22. Should the emergency system be selected fluid pressure will be admitted through connection B and pass to the emergency port of the shuttle valve. This will cause the shuttle to move over to blank off the normal inlet and admit fluid from the emergency system to close the jack.

SERVICING

Leakage

23. External leakage will indicate a faulty seal which must be renewed. Sluggish action of either stage during service or testing indicates a faulty sealing ring, that must be renewed, on the affected piston, or in the case of the extension stroke of both stages, on the diaphragm.

Dismantling

24. (1) Remove the two clips securing the pipes to the body. Then disconnect them from both the shuttle valve and the swivel coupling.

(2) Detach the shuttle valve by removing the two bolts.

(3) Unscrew the four bolts securing the indicator, lift off the bracket complete with the micro-switch. Remove the indicator from the body and the micro-switch from the bracket.

(4) Unscrew the bolts securing the swivel coupling to the body.

(5) Remove the short pipe by disconnecting it from the locking valve and unscrewing the two bolts securing it to the body.

TABLE 1

Special tools

Part No.	*Description*
ST.1215 and ST.1215 Mk.6	Vice clamp for holding assembly
RS.181/13	C spanner to fit and remove retaining nut – second stage jack piston rod
RS.181/36	C spanner to fit and remove cylinder
RS.181/20	C spanner to fit and remove gland nut – first stage jack
RS.181/28	C spanner to fit and remove gland nut – second stage jack
RS.181/25	C spanner to fit and remove eyebolt – first stage jack
4.60001.080	Blank for testing lock valve
4.60001.081	Assembly tool for assembling 'U' ring into upper end fitting
4.60001.082	Assembly tool for assembling 'U' ring into lower end fitting
4.60001.088	Adapter for testing locking valve
4.60001.257	Extractor to remove piston from lock valve body
4.60001.266	Setting plug for obtaining lock gap.
4.60001.254	Test block for first stage swivel coupling unit
4.60001.255	Test block for second stage swivel coupling unit
ST.2616	Test adapter for shuttle valve

(6) Remove the locking valve, complete with the swivel coupling, from the body. Extract the pin and remove the collar that secures the swivel coupling to the valve; withdraw the valve.

(7) Remove the other indicator and detach the micro-switch from the bracket. Then dismantle both indicators as follows:—

(a) Tap out the pin retaining the spindle in the boss; withdraw the spindle.

(b) Unscrew the cover from the body.

(c) Withdraw the plunger, together with the gland carrier and the spring, from the body.

(d) Tap out the pin securing the spring retaining nut to the plunger. Unscrew the nut and remove the spring; gland housing and washer. Remove the sealing rings from the gland housing.

(e) Do not remove the plug in the end of the body unless the sealing rings have to be renewed.

Jack

25. (1) Unscrew the eye bolt from the first stage piston rod. Remove the grease nipple, then the spherical bush by rotating it through 90 deg. edgeways and pushing it out.

(2) Unscrew the gland nut and extract the bearing ring, U ring, and the spacer.

(3) Remove the locking piece securing the lower end fitting to the cylinder, and unscrew the end fitting. Tap the piston stop out of the end fitting.

(4) Withdraw the piston rod from the cylinder.

(5) Before attempting to dismantle the second stage the lock must be released as follows:—

(a) Connect a hand pump to the upper end fitting extension port.

(b) Apply a gradually increasing pressure until the lock is released.

(c) Disconnect the hand pump.

(6) Remove the eye bolt, grease nipple, and spherical bush as detailed in (1).

(7) Unscrew the gland nut, extract the bearing ring, U ring, and spacer.

(8) Remove the locking piece securing the upper end fitting to the cylinder, and unscrew the end fitting. Extract the shims from the end fitting and identify them with the jack.

(9) Tap the end fitting on the bench to remove the diaphragm.

(10) Using a suitable drift against the exposed end of the piston rod, push out the complete piston rod assembly.

(11) Remove the wire lock ring that secures the pin in the retaining nut. Tap out the pin and unscrew the retaining nut.

(12) Before removing the shims and lock collar, make a note of the number of shims fitted each side of the collar and identify them with their position.

(13) Withdraw the lock sleeve, together with its spring, from the piston rod.

(14) Remove all sealing and piston rings.

First stage swivel coupling unit

26. (1) Remove the split pin and collar securing the two single swivel pipes together; remove the pipe from the swivel post.

(2) Remove the swivel connection from the other end of the pipe in a similar manner.

(3) Remove the collar from the other single swivel pipe and withdraw it from the connection body.

(4) Disconnect the double pipe assemblies in a similar manner.

(5) Remove the cone adapters and bonded seals from the connection body and the connection block, together with the bleeder screws.

(6) Remove all sealing rings.

Second stage swivel coupling unit

27. (1) Unscrew the two adapters and remove the bonded seals.

(2) Extract the pins and remove the collar retaining the connection block, and the swivel post; withdraw the coupling link.

(3) Unscrew the plugs from the coupling link and remove all sealing rings.

Shuttle valve

28. (1) Remove the adapter.

(2) Unscrew the banjo bolt, and remove the bonded seals and the banjo.

(3) Using a suitable drift, push the shuttle out of the body.

(4) Remove all sealing rings.

Locking valve

29. (1) Unscrew the adapter and remove the bleeder and the bonded seal.

(2) Remove the locking valve end plug, extract the spring guide and shims which should be identified with the unit.

(3) Extract the spring and the valve.

(4) Remove the end cap and extract the piston and spring.

(5) Insert a suitable drift in the piston end of the body and push out the valve seat.

(6) Remove the thermal relief valve end plug and remove the washer and shims, identify the shims with the unit.

(7) Lift out the travel stop, shims, spring and ball guide; identify the shims with the unit.

(8) Remove the ball guide and tap out the valve seat.

(9) Using a suitable rod, having 8 BA threaded end, withdraw the washer.

(10) Remove all sealing rings.

Assembling

30. All sealing rings are to be lightly coated with grease XG-315 (34B/910059) before being assembled in the unit. If new piston rings are being fitted they must be gapped 0·009 to 0·012 in. on assembly and the sharp edges removed on the flat faces only, maximum radius $\frac{1}{64}$ in. All backing rings must be assembled with their rough face adjacent to the sealing ring.

Jack

31. (1) Fit the distance collar to the second stage piston rod, followed by the shims then the lock collar and the other shims.

Ensure that the shims are in their correct positions each side of the lock collar, see *para.* 25 (12).

Note . . .

If new parts are being fitted to the second stage piston rod the shims should be initially disposed equally on each side of the lock collar. Then carry out the following operations:—

(a) Screw the retaining nut on to the piston rod, followed by the lock ring, engage the claws of the lock ring with the lock collar.

(b) Secure the piston rod in a vice, and by holding the diaphragm firmly against the face of the lock ring, estimate the gap between the claws of the lock ring and the lock collar by movement of the lock ring, this should be 0·004 to 0·007 in. as shown in fig. 10. The shims should be adjusted if necessary to obtain the gap. A final check will be required at a later stage during assembly.

(2) Dismantle the locking device, making a note of the disposition of the shims as they are removed.

(3) Fit a rubber ring and a piston ring on the small diameter of the piston rod and a rubber ring, supported on each side by a piston ring, to its large diameter.

(4) Fit a single piston ring and a rubber ring, supported on each side by a piston ring, to the lock sleeve.

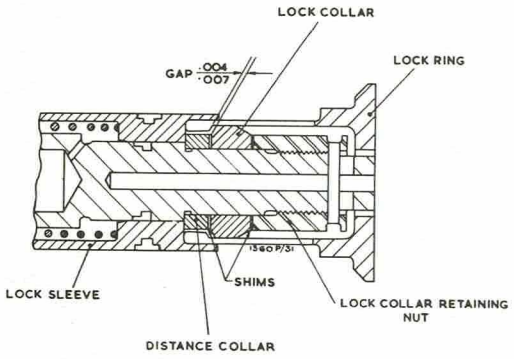


Fig. 10 Lock setting diagram

(5) Position the spring on the piston rod and slide on the lock sleeve. Assemble the locking device as detailed in (1), ensuring that the shims are in their correct position. Screw the retaining nut on to the piston rod until it abuts the shims, then screw it back to the nearest locking position. Extra shims Part No. 1.00448.614 may be fitted between the lock collar and the retaining nut to eliminate any slack.

(6) Insert the pin and retain it with the wire locking ring. Engage the lock ring with the lock collar.

(7) Fit an O-ring into the groove in the end of the spacer, and slide it on to the piston rod with the O-ring trailing.

(8) Insert the complete piston assembly into the upper end fitting until the lock ring abuts the shoulder.

(9) Insert the spacer into the small end of the end fitting, followed by the U-ring and chamfer ring, chamfered face leading.

(10) Locate the flange of the bearing ring on the shoulder in the end fitting.

(11) Fit the wiper ring on to the gland nut with the smaller diameter outwardly disposed. Screw in the ring nut.

(12) Screw the grease nipple into the eyebolt. Slide the spherical bush edgeways into the eyebolt and rotate it through 90 deg., then using the spanner grip, screw the eyebolt tightly into the piston rod.

(13) Insert the diaphragm, minus the rubber and backing rings, into the other end of the upper end fitting with its flat face leading, then screw in the setting plug. Using a dial indicator against the eyebolt, check that there is a movement of 0·004 to 0·007 in., i.e. gap between the lock ring and lock collar. If necessary, the shims must be re-adjusted to obtain this gap.

(14) After obtaining the correct gap, fit a rubber ring supported by two backing rings to the diaphragm. Insert the diaphragm.

(15) Fit a backing ring and an O-ring to the lower end of the cylinder only.

(16) Insert the piston stop into the lower end fitting, locating its slot on the dowel. Screw the end fitting on to the cylinder.

(17) Position shim Part No. 1.00448.650 on the diaphragm and screw in the cylinder until it abuts the shim. The fluid ports of the end fittings should be at 180 deg. to each other. If they are not, measure the gap between the end face of the upper end fitting and the adjacent shoulder on the cylinder, dimension A, then screw back the cylinder sufficiently to obtain correct angular position of the fluid ports, take the same measurement again, dimension B. B—A=dimension C, which is to be made up by addition of shims Part No. 1.00498.627 and 1.00448.628 interposed between the diaphragm and shim Part No. 1.00448.650.

(18) Before finally fitting the upper end fitting and the cylinder together, fit a backing ring and an O-ring to the end fitting. Also two single P.T.F.E. rings and a rubber ring supported by two more P.T.F.E. rings to the first stage piston rod.

(19) Insert the piston rod into the cylinder and screw the cylinder into the upper end fitting, and secure each end fitting with a locking piece. Each locking piece must engage with the serrations on the cylinder. Retain the locking pieces with bolts, taking care not to damage the locking pieces by screwing the bolts in too tight.

(20) Insert the spacer into the other end of the lower end fitting, followed by the U-ring and bearing ring.

(21) With a wiper ring fitted in the gland nut screw the nut into the end fitting.

(22) Locate the spherical bush edgeways in the eyebolt then rotate it

through 90 degrees. Fit the grease nipple, lock nut, and spanner grip to the eyebolt and screw it into the piston rod, but do not tighten it at this stage; final locking is carried out during installation.

Indicator

32. (1) Insert the plunger into the body until it protrudes beyond the body.

(2) Fit O-rings and backing rings to the gland carrier with the rough face of the backing rings adjacent to the O-rings. If new backing rings are being fitted they should be split at an angle to assist assembly.

(3) Slide the washer and the gland carrier along the plunger until the washer abuts the shoulder in the body.

(4) Insert the spindle into the boss, slotted end leading. Align the pin holes and insert the pin, peen over both ends to retain it.

(5) Align the pin holes in the body and the plunger, insert the pin and retain it by peening over both ends.

(6) Position the spring on the plunger and retain it with the nut, the unchamfered face of which must form a seat for the spring. Retain the nut with the pin and lightly peen over each end to lock it.

(7) Screw on the cover.

First stage swivel coupling unit

33. (1) Fit an O-ring, followed by a backing ring, into the seal grooves in the swivel connection and the banjo end of the single swivel pipe.

(2) Locate the swivel post of the single swivel pipe into the swivel connection and retain it with the collar and split pin.

(3) Connect the two single swivel pipes together and retain them with a collar and split pin.

(4) Fit an O-ring, supported by a backing ring into the centre seal groove in each banjo end of the double swivel pipe, and an O-ring, followed by a backing ring, into each of the other seal grooves.

(5) Screw the two adapters, each fitted with a bonded seal, into the connection block. Insert the stem of the block into either banjo of the double swivel pipe and secure it with the collar and split pin.

(6) Insert the swivel post of the other double swivel pipe into the other banjo end and again secure with a collar and a split pin.

Second stage swivel coupling unit

34. (1) Fit an O-ring, supported on each side by a backing ring, into the coupling link.

(2) Fit a bonded seal to each of the adapters and screw them into the connection block.

(3) Insert the connection block into the bore at the plain end of the coupling link, i.e. the end without the two plugs. Insert the swivel post into the other bore.

(4) Pass a collar over the protruding ends of the connection block and swivel post. Insert the pins and wire-lock their two ends together with the wire passing around the collars.

Shuttle valve

35. (1) Fit a backing ring and an O-ring into each seal groove in the shuttle into the body.

(2) Fit a backing ring and an O-ring to the adapter and screw it into the body.

(3) Fit a backing ring and an O-ring to the banjo bolt. Position the banjo, interposed between two bonded seals, on the bolt and secure it into the body. The angular position of the banjo connection is dependent upon the handing of the jack to which it is fitted.

Locking valve

36. (1) Fit an O-ring and a sealing ring to the valve seat, then insert the seat into the bore until it abuts the shoulder.

(2) Insert the valve into the valve seat, followed by the spring.

(3) Fit an O-ring and a sealing ring to the end plug, locate the shims and washer followed by the spring guide into the end plug and screw it into the body.

(4) Using a depth gauge in the open end of the bore, check the travel of the valve, this should be within 0·010 to 0·012 in. If necessary adjust the shims to obtain this dimension.

(5) Insert the spring into the open end of the body and ensure it seats squarely on the valve guide.

(6) Fit the double seal to the piston and insert the piston into the body.

(7) Screw the end cap, fitted with an O-ring, into the body.

(8) If the unit is being stored as a spare, the relief valve parts are to be stored in a suitable container and attached to the unit. If, however, the unit is being attached to the jack it is to be tested *in situ* on the jack and the relief valve parts assembled as detailed below after removing the blank, para. ◀45 (2). ▶

(a) Insert the washer, chamfered face leading, into the thermal relief valve bore.

(b) Fit a backing ring and an O-ring to the valve seat, and insert the seat into the body.

(c) Insert the ball guide into the bore. Drop the ball into the guide, ensuring that it seats squarely on the valve seat.

(d) Fit the spring seat into the ball guide, followed by the spring. Locate the washer Part No. 1.00503.611, the shims and the other washer on the spring.

(e) Locate the travel stop on the stem of the spring guide.

(f) Fit the washer to the end plug and screw the end plug in until it bottoms. Measure the gap between the end plug and the washer. Re-assemble with the washer and shims adjusted to give a gap of 0·001 to 0·011 in.

Attachment of component assemblies

37. (1) All component assemblies, other than the locking valve, must be fully tested before their attachment to the jack; see para. 38, 39 and 40. Fit a rubber ring to the shuttle valve, and position it with the banjo connection nearest the eye bolt and secure it with the two bolts.

(2) Locate the spindle of the indicator in the port adjacent to the shuttle valve, with its spring cover adjacent to the banjo connection.

Note . . .

Ensure that the indicators are fitted to their correct ports, otherwise damage will be caused during operation. The indicator with the longest spindle is fitted adjacent to the shuttle valve.

(3) Secure the micro-switch (first stage) to the bracket as follows:—

(a) Mate the serrations of the screw plate with those of the bracket, place the micro-switch against the screw plate and pass the bolts through the switch, plate, and bracket in that order.

(b) Position the clamp plate, and secure it with the bolts finger-tight to allow for adjustment.

(4) Mount the bracket on the indicator and secure it with four bolts. The micro-switch is to be adjusted so that in the jack extended position the plunger is depressed by the striker 0·02–0·045 in. beyond the point of switch operation.

(5) Insert the connection of the short pipe, fitted with a rubber ring, in the extension port in the upper end fitting and secure it with two bolts.

(6) Position the second micro-switch (second stage) on the plain face of the bracket, place the plain face of the screw plate on the serrated face of the bracket followed by the clamp plate. Pass the bolts through the micro-switch and tighten them finger tight. Then secure the bracket and indicator with four bolts, see note at sub-para. (2). The micro-switch is to be adjusted so that in the jack closed and locked position the plunger is depressed by the striker 0·02–0·045 in. beyond the point of switch operation.

(7) Secure the locking valve to the upper end fitting with the four bolts. Connect the short pipe to the locking valve.

(8) Secure the small swivel coupling to the locking valve with the collar and pin. With the locking valve uppermost, the collar must be on the left-hand side when viewed from the adjacent eyebolt for the port unit, and on the right-hand side for the starboard unit.

(9) Insert the other swivel coupling into the extension port and secure it with four bolts.

(10) Apply a thin film of adhesive, DTD.900/4483, to the inner surface of the neophrene strips, also the cylinder at 25 and 26 in. from the centre of the eyebolt in the first stage piston rod. After 10 minutes press the strips on to the cylinder and trim their ends to butt.

(11) Connect the pipes to the shuttle valve and the swivel couplings.

Note . . .

The longest pipe must always be attached to that connection which is nearest to the retaining collars.

(12) Position the two clips on the rubber strips and secure them with the two bolts.

TESTING

First stage swivel coupling unit

38. A static test rig and the test block 4.60001.254 will be required to test the swivel pipes separately. The flow path for the double swivel pipe is from A to D and from B to E, as shown in fig. 5.

(1) Apply a pressure at A, there must be a free flow from D.

(2) Blank off D and apply pressure at A up to 4650 lb/in^2 in easy stages.

(3) With D still blanked, apply a pressure of 100 lb/in^2 at the other end. Move each swivel joint through 180 deg. and back ten times, then through 360 deg. ten times (five clockwise and five anti-clockwise).

(4) Repeat test (3) at 1200 lb/in^2 during which the torque must not exceed 35 lb. in.

(5) Repeat (1), (2), (3) and (4) with the pressure applied at B. Then carry out the operations again for the single swivel pipe.

(6) Remove test block from the double swivel pipes.

(7) With the adapters and the three bleeder screws fitted with bonded seals and screwed into the connection body, insert the swivel posts and secure them with a collar and split pin. For the port unit the single swivel pipe should be inserted from the right-hand side into the upper bore of the connection body when viewed on the spigot connection C, with the adapters uppermost, and the double swivel pipe should be inserted from the left-hand side. For starboard units the swivel posts are inserted from the other side.

(8) Repeat (1), (2), (3) and (4) again with the pressure applied at A, B and C in turn. The flow path will now be from A to D, B to E, C to F for port units, and for starboard units A to E, B to D and C to F.

Second stage swivel coupling unit

39. A static test rig and test block 4.60001.255 fitted to the swivel post will be required to test this unit. The flow path is from G to X and from H to Y, as shown in fig. 6.

(1) Apply a pressure at G, there must be a free flow from X.

(2) Blank off X and apply a pressure at 1800 lb/in^2 at G, reaching maximum pressure in early stages.

(3) With X still blanked, apply a pressure of 100 lb/in^2 at G. Move each swivel through 180 deg. and back ten times, then through 360 deg. ten times (five clockwise and five anti-clockwise).

(4) Repeat operation (3), but with a pressure of 1200 lb/in^2. The maximum torque required to move the swivels must not exceed 35 lb. in.

(5) Repeat operations (1), (2) and (4) with the pressures applied at H and Y blanked.

Shuttle valve

40. The following test equipment will be required:—

(1) A hydraulic test rig having both hand and power pumps. Test adapter ST.2616 which should be connected to the outlet connection C by two bolts. The unit should be connected to the rig with the normal and emergency connections A and B respectively to opposite service connections of the rig selector, while C should have a suitable screw down cock connected to enable a pressure drop of 100 lb/in^2 to be maintained at the valve.

Proof and functional tests

41. During these tests there must be no external leakage.

(1) Run the power pump and then adjust the rig by-pass valve to control the pressure at 100 lb/in^2 with the selector in neutral.

(2) Select pressure to A; fluid should flow from A to C. Reverse the selector, fluid should now flow from B to C.

(3) Carry out three complete operations of (2) and check that the shuttle moves freely. Stop the power pump.

(4) Remove the pipe from C, then blank off this connection. Disconnect the pipe from A. Apply a pressure at B, to move the shuttle, when a spurt of oil from A during the initial movement of the shuttle is permissible. Raise the pressure to 300 lb/in^2 and then to 6600 lb/in^2.

(5) With C still blanked, and B open to atmosphere, apply a pressure of 100 lb/in^2 at A. The shuttle should move across, as evident by a spurt of oil from B and the subsequent build up of pressure. Raise the pressure up to 300 lb/in^2 and then to 6600 lb/in^2. Release the pressure.

(6) Repeat (5), but with the pressure applied to B.

(7) Carry out three complete operations of (5) and (6) alternately.

(8) Connect a pressure gauge to B, a three-way selector to A, and a slave jack to C. With the pipe between the selector and A full of oil at zero pressure, and the rig selector in neutral, run the power pump and adjust the by-pass valve to control the pressure to 200 lb/in^2.

(9) Select pressure to B. The jack must extend and a stable pressure must register on the gauge. Vent fluid from A, there must be no leakage from A except for a possible initial spurt of fluid. Release the pressure.

(10) Carry out five complete operations of (9).

Jack

42. The following equipment is required for testing the jack, complete with component units:—

(1) A static hydraulic test rig and a power rig pump capable of delivering 3·45 gal/min. All pipes between the rig and the unit under test are to be $\frac{3}{8}$ in. outside diameter metal, or $\frac{3}{8}$ in. nominal diameter flexible hose. Reducing adapters must be fitted adjacent to the jack.

(2) A blank 4.60001.080 and an adapter 1.00035.128 which are used in place of the bleeder in the locking valve. Also adapter ◀4.60001.088▶ which is fitted to the closure port of the second stage.

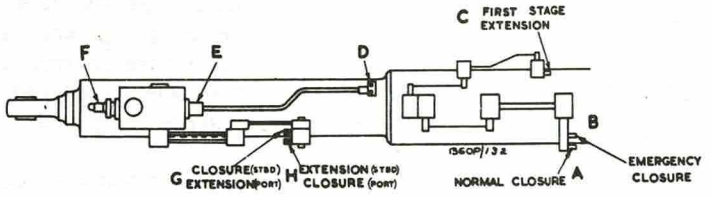


Fig. 11 Jack connections

(3) A lock loading rig Type Number 03260TA01 as described in A.P.1803D, Vol. 1, Book 1, Sect. 1, together with cylinder end fitting Part No. 4.60001.083, eyebolt Part No. 4.60001.084, and clamp plate Part No. ◀4.60001.691.▶

Inhibiting thermal relief valve

43. The thermal relief valve of the locking valve is to be rendered inoperative by inserting blank 4.60001.080, fitted with an O-ring into the empty bore. Fit another O-ring into the groove in the bore and insert the ball guide; retain it with the end plug.

Static tests

44. During this, and all subsequent tests, there must be no external leakage. Refer to fig. 11 for the jack connections.

(1) With the jack full of oil and bled free of all air, apply a pressure at F to fully close it. Raise the pressure slowly to 200 lb/in², then gradually to 6500 lb/in². There must be no leakage from connections G and H.

For port units

(2) (a) With a pressure of 6500 lb/in² applied at F, apply a second pressure not exceeding 550 lb/in² at G; the pressure from F must exhaust through H and the jack commence to extend.

For starboard units

(b) With a pressure of 6500 lb/in² still applied at F, apply a second pressure, not exceeding 550 lb/in², at H. The pressure from F must exhaust through G and the jack commence to extend.

(3) Carry out five complete operations of (2).

Thermal relief valve adjustment

45. (1) Remove the end plug and ball guide from the thermal relief valve, refit the end plug.

(2) Remove the blank by applying an oil pressure at either G or H. Unscrew the end plug and lift out the blank.

(3) The valve should now be assembled as detailed in para. 36 (8).

(4) Connect a hand pump and a pressure gauge to F and apply a pressure; the valve must relieve pressure at 6400 to 6500 lb/in² and re-seat at 6100 lb/in². The laminated shim under the travel stop must be adjusted to obtain these values; the laminations are 0·002 in. thick, and after final adjustment the shim must be thoroughly cleaned off.

(5) Disconnect the pipe from D and E and fit adapter 4.60001.088 at D.

(6) Fully close the second stage and remove the adapter from F. Refit the bleeder screw.

(7) Apply a pressure carefully at D and C simultaneously until the relief valve cracks. The pressure at both connections should be 4250 lb/in² approximately.

(8) Release all pressures and reconnect the pipe to D and E.

Static tests, second stage

46. In the event of leakage occurring at either connection G or H during these tests the seal on either the main piston or locking valve may be faulty. To ascertain this, disconnect the pipe from connection E and fit a blank, then close the jack and apply a pressure of 4250 lb/in² alternately at G and H.

(1) With the jack fully closed, apply a pressure slowly up to 300 lb/in² to extend the second stage, then gradually raise the pressure to 1800 lb/in². Particular attention must be paid to leakage over the pressure range 0 to 100 lb/in². Ensure that all seals are satisfactory.

(2) Close the jack applying the pressure at the closure connection and carry out the procedure as in operation (1).

(3) Apply a pressure, alternating between 0 and 1000 lb/in² simultaneously at both the extension and closure connections 200 times.

(4) Repeat (1) and (2).

No load friction tests

(5) With no load applied, apply a pressure of 150 lb/in² to extend the jack, which must fully extend within 4 seconds.

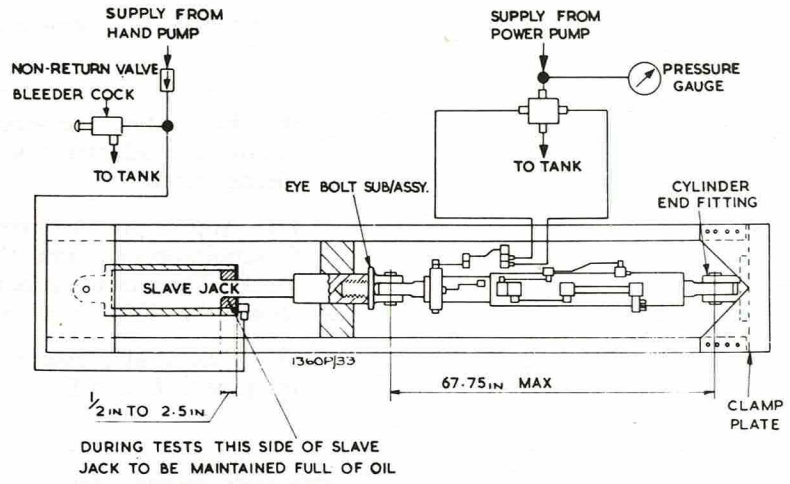


Fig. 12 Jack mounted in lock loading rig

(6) With no load applied, apply a pressure of 300 lb/in² to close the jack, which must close within 5 seconds.

Lock friction tests

(7) Apply a pressure, against no load, to engage and disengage the lock. The pressure required must not exceed 260 and 160 lb/in² respectively.

Static tests, first stage

47. (1) With the jack closed, apply a pressure slowly up to 300 lb/in² to extend the first stage, gradually increase the pressure to 4650 lb/in². Particular attention must be paid for leakage over the pressure range 0 to 100 lb/in². Ensure that all seals are satisfactory.

(2) Close the jack by applying the pressure at the closure connection and carry out the procedure as in operation (1).

(3) Apply a pressure, alternating between 0 and 3100 lb/in² simultaneously at both extension and closure connections 200 times.

(4) Repeat (1) and (2).

No load friction tests

(5) With no load applied, apply a pressure of 190 lb/in² to extend the jack, which must fully extend within 16 seconds.

(6) Apply a pressure of 475 lb/in², again with no load, to close the jack, which must close within 20 seconds.

Lock proving tests

48. Mount the unit in the lock test rig 03260TA01, *fig.* 12 obtaining the dimensions quoted by adjusting the attachment bolts. The dimension of 67·75 in. between centres when fully compressed, must not be exceeded. Set the test rig by-pass valve so that the pressure is 660 to 700 lb/in².

(1) Apply an end load on the jack by applying a pressure of 550 to 660 lb/in² to the slave jack. Then apply a pressure to extend and lock the second stage, close the power supply valve, then reverse the control valve. The lock must not disengage until the power supply valve is re-opened.

(2) Carry out six complete operations of (1).

(3) Apply and maintain a pressure of 800 lb/in² at the first stage closure port.

(4) With the jack fully closed, apply a pressure to extend the second stage $2\frac{1}{2}$ to 3 in.; close the bleeder cock.

(5) Apply a pressure to close the second stage and raise the pressure to 500 to 550 lb/in², opening the bleeder cock so that the jack closes slowly. When the lock engages it will be noted that the travel is momentarily arrested. To keep the jack moving, open the bleeder cock further until the lock is engaged.

(6) Carry out three complete operations of (3), (4) and (5), during which, the lock must satisfactorily engage.

(7) Release all pressures via the bleeder screws and leave the jack closed.

Installation

49. When the jack is installed in the aircraft the eye-bolt is to be adjusted to suit the aircraft pick-up points. In the closed position the dimension between the pin centres must be within 67·50 in. ±0·25 in. Finally tighten the lock nut against the spanner grip and wire-lock the eye-bolt, the lock nut and the spanner grip together.

Appendix 1 REAR FREIGHT DOOR JACKS

Type No. 1.00448.003 (Port)
1.00448.004 (Starboard)

Includes—

Swivel coupling units	**1.00519.001 (Port)** **1.00519.002 (Starboard)**
Swivel coupling unit	**1.00517.001**
Locking valve	**1.00510.001**
Shuttle valve	**1.00585.001 (Port)** **1.00585.002 (Starboard)**

Introduction

1. These units are identical to that described in the chapter.

Appendix 2 REAR FREIGHT DOOR JACKS

Type No. 1.00448.001 (Port)
1.00448.002 (Starboard)

Includes—

Swivel coupling unit	**1.00519.001 (Port)** **1.00519.002 (Starboard)**
Swivel coupling unit	**1.00517.001**
Locking valve	**1.00510.001**
Shuttle valve	**1.00585.001 (Port)** **1.00585.002 (Starboard)**

Introduction

1. These units are identical to that described in the chapter except for the travel limiting spacer and sealing ring which is not fitted.

Testing

2. The test instructions for this unit are identical to those in the chapter except for the static tests, second stage (para. 46) which for this unit are given in para. 3 of this appendix.

Static tests, second stage

3. Should leakage occur at either G or H during these tests, the seal on either the main piston or the locking valve may be faulty. To ascertain this, blank off E, close the jack and apply a pressure of 4,250 lb/in² alternately at G and H.

(1) With the jack fully closed, apply a pressure slowly up to 300 lb/in² to extend the second stage, then gradually raise the pressure to 1,500 lb/in². Particular attention must be paid to leakage over the pressure range 0 to 100 lb/in². Ensure that all seals are satisfactory.

(2) Close the jack applying the pressure at the closure connection and carry out the procedure as in operation (1).

(3) Apply a pressure, alternating between 0 and 1,000 lb/in² simultaneously at both the extension and closure connections 200 times.

(4) Repeat (1) and (2).

No load friction tests

(5) With no load applied, apply a pressure of 150 lb/in² to extend the jack, which must fully extend within 11 seconds.

(6) With no load applied, apply a pressure of 300 lb/in² to close the jack, which must close within 13 seconds.

Lock friction test

(7) Apply a pressure, against no load, to engage and dis-engage the lock. The pressure required must not exceed 260 and 160 lb/in² respectively.

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