Chapter 1

STRAIGHT STICK CONTROL HANDLES, Dunlop types

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Introduction

1. The Dunlop type of straight stick control handle is a self-contained unit capable of being readily mounted on the control column and is designed to offer the minimum obstruction in the event of the pilot using the ejection apparatus. The handle normally fits on the control column with the slight curvature of the body set forward and 15 degrees to port.

2. There are several variants of the basic handle, but many are fitted with a similar brake lever mechanism whereby the aircraft's undercarriage wheel brakes are applied. The main difference between one variant and another is that different switches or switch arrangements are embodied in the handle to cater for the specific requirements of the aircraft in which the handle is to be installed.

3. Appendix 1 to this Chapter lists various handles which are in existence, and indicates details of each handle, including types of switches fitted. Details of a particular switch will be found in A.P. 4343C, Vol. 1, Book 1, Sect. 1 and information on the complete handle will be issued in the relevant Aircraft handbook, since each handle is designed for a specific aircraft installation. The " schedule of spare parts for Dunlop

Equipment " is A.P. 4515C, Vol. 3, Part 1, Section 2, each chapter being separately bound, and applicable to a specific aircraft.

4. Representative handles of the straight stick type are shown in fig. 1 and 2, 6, 7 and 8. Fig. 1 and 2 depict a typical handle fitted with a brake lever mechanism, while fig. 6 and 7 show typical variants not having the brake mechanism. Fig. 8 illustrates a typical helicopter handle having two removable butt plates for inspection purposes, some handles of this type may have a brake lever and parking attachment fitted.

5. The body of the handle is a light alloy die-casting, the middle portion of which is shaped and covered with hard stippled rubber to provide a convenient hand grip. The upper end of the handle is provided with recesses in which are accommodated the switches and, in some instances, firing mechanism. In addition, some handles are fitted with safety flaps or catches to prevent accidental operation of certain switches or mechanisms. The lower end of the handle has an internal cylindrical cavity into which fits a multi-point plug, to provide terminal points for the internal wiring of the handle. When issued from Store the internal cavity will also house a socket which mates with the plug. This socket is similar to that on the electrical cable of the control handle (*fig.* 2) and is provided with a wire loop to facilitate its removal from the handle. A spare socket should be obtained if required for test purposes (*para.* 20). On later type handles, the internal wiring is passed through a grommet and, housed in P.V.C. sleeving is routed along the control column, the plug and socket connection is then made at the adjacent aircraft structure.

Note . . .

The socket supplied with a replacement handle should be transferred to the unserviceable handle being returned, to afford protection to the plug during transit and storage.

6. Location of the handle on the control column is effected by means of a small peg on the inner edge of the brake mechanism guide plate (*fig.* 2) which engages in a hole in the wall of the upper end of the control column. When it is installed in the aircraft, the handle is secured to the control column by means of two Allen type screws, which pass through and clamp the handle to the control column. Handles not fitted with a brake lever mechanism are located on the control column by the two clamping screws

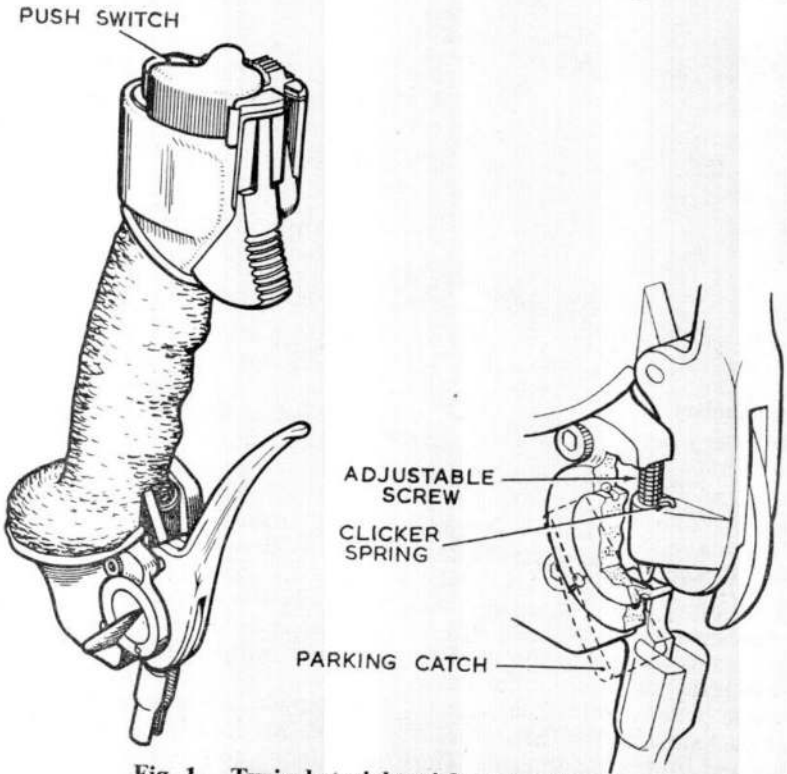

Fig. 1. Typical straight stick control handle

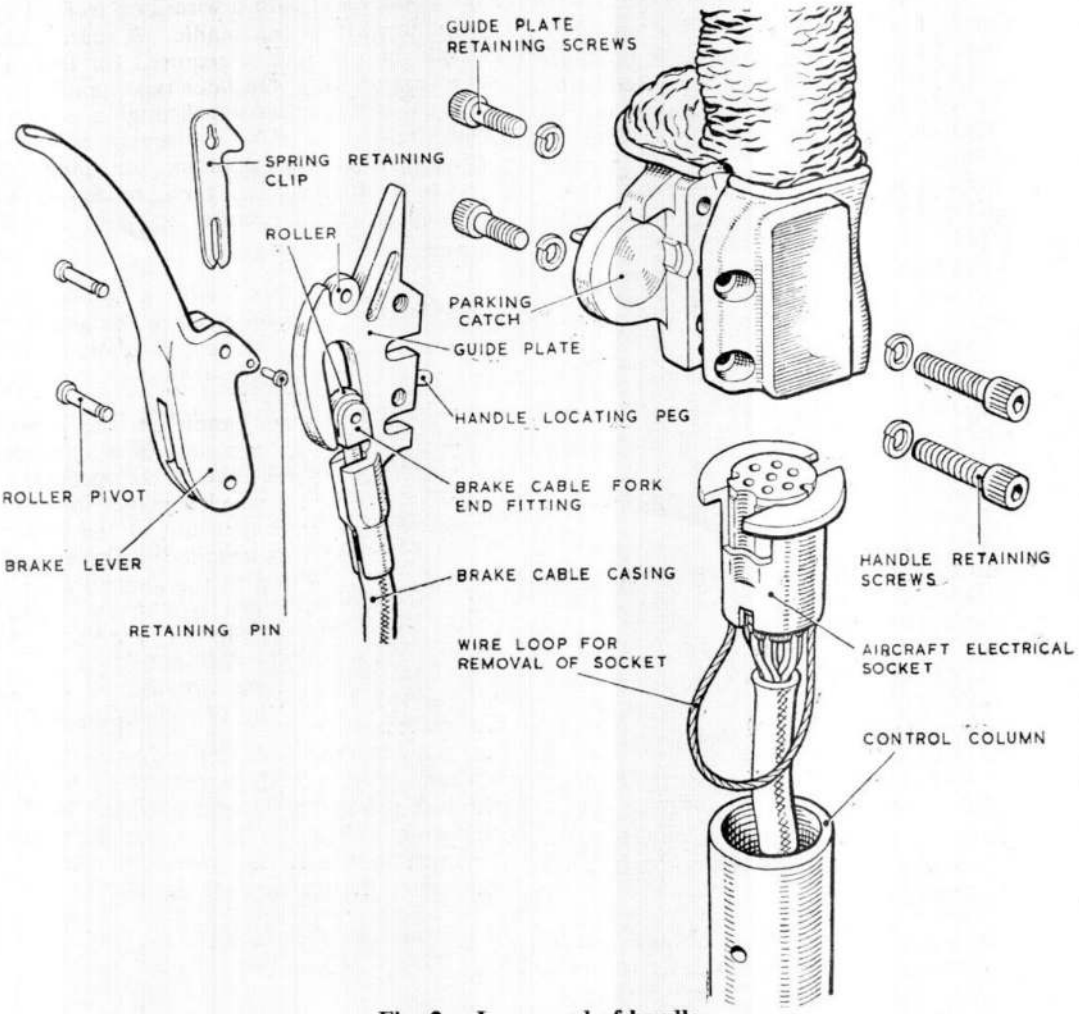

Fig. 2. Lower end of handle

which align with grooves in the side of the column tube.

Brake lever mechanism

7. The brake lever (*fig.* 2) is mechanical in operation and exerts a straight line cable pull for the operation of the aircraft brakes. A parking catch, at the side of the handle, allows the lever to be maintained in the " pressed " position and so to keep the brakes on when the aircraft is parked.

8. The mechanism (*fig.* 2) consists essentially of a non-magnetic steel guide plate, a light alloy brake lever and the rotary parking catch. The guide plate is secured in the slot in the front of the handle by two 2 B.A. Allen type screws entered from the side and locked by spring washers. The lower end of the guide plate terminates in an integral cable casing end fitting; above this formation is a machined roller slot which is in line with the bore of the cable casing end fitting. The upper end of the guide plate has a roller track which inclines towards the handle grip. The brake lever carries an upper and a lower roller which run on their respective tracks on the guide plate. The pivot pins for these rollers pass through the brake lever and are retained by a retaining clip (*fig.* 2) on the side of the lever. A retaining pin, near the upper roller pivot, engages in a machined slot in the upper end of the guide plate and ensures that the upper roller is kept in contact with its track. When the control handle is fitted to the control column, the lower roller of the brake mechanism is carried in the

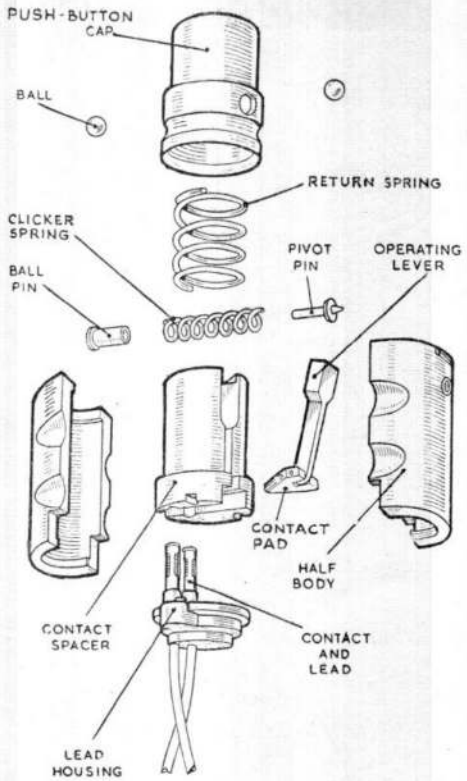

Fig. 3. Exploded view of push switch

gap of a swaged fork on the end of the brake cable, and the disposition of the roller tracks is such as to cause a straight pull to be exerted on the brake cable when the brake lever is squeezed.

9. A boss on the side of the brake lever carries an adjusting screw, which is locked by a clicker spring (*fig.*1). The upper sloted end of the screw contacts a lip on the body of the handle. Adjustment of this screw regulates lever movement (and therefore brake cable tension) to the fully " on " position. In this position, rotary movement of the parking catch through an angle of 70 degrees brings a small lip under the lower end of the adjusting screw and thus holds the brake lever at the " on " or " parked " position. The parking catch is retained in either of its extreme positions by a spring-loaded ball which locates in recesses at the extremities of travel.

10. The location and type of switches and the safety flaps or catches is different for each type of handle. In some handles the switches are retained by pegs or dowels and spring loaded plungers, and can be removed only by following a definite sequence of operations. In later types the switches can be separately removed. A type of push button switch used in early designs of handles is described in the following paragraphs. Later type switches will be described in A.P. 4343C, Vol. 1, Book 1, Sect. 1.

Note . . .

*Jamming of the gun trigger mechanism of safety flaps may occur due to the safety flaps being struck whilst the trigger is depressed, on control handles, Type AC.*10300, *AC.*11232, *AC.* 12346, *AC.*12356, *AC.*12580 *and AC.*12590.

Push switches

11. Many of the handles have common push-button switches mounted vertically or slightly inclined at the top or horizontally at the side of the handle. An exploded view of this type push switch showing the various components is shown in fig. 3, and a section of an assembled switch is shown in fig. 4.

12. The action of the switch is as follows. When the push-button cap is depressed the return spring is compressed and the two steel balls are forced towards the centre as they are carried down the body of the switch by the push-button and ride over the steps on the metal inserts inside the body halves. The clicker spring is further compressed between the ball pin and pivot pin until the level of the two balls is below the recess in the operating arm in which the pivot pin rests. At this point the pressure of the clicker spring

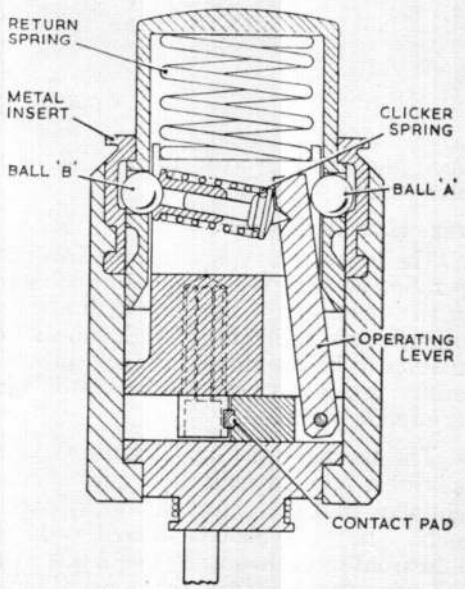

Fig. 4. Section of assembled push switch

will rock the operating arm on the ball A, causing the contact pad pivoted on the lower end of the operating arm to move, in the recess formed between contact spacer and lead housing, towards the two vertical fixed contacts into which the conducting leads are crimped. The metal contact shoe on the contact pad will contact the two contacts and so complete the circuit through the switch. On releasing the push-button, the return spring will return the mechanism to the off position shown in the illustration (*fig.* 4).

13. Each switch has two grooves in each side and when fitted correctly in the handle one of these grooves will line up with a tangential hole in the body of the handle. A retaining peg passes through this hole securing the switch in position.

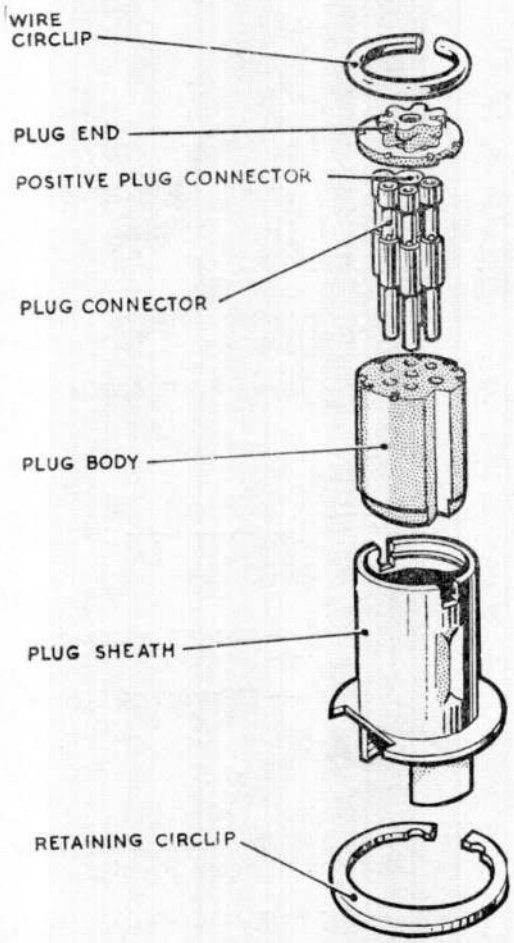

Fig. 5. Exploded view of plug

Electrical plug

14. The plug used to make the electrical connections to the handle is retained inside the handle by an internal circlip. The plug (*fig.* 5) consists of a Bakelite plug body locating the connectors or pins and a Bakelite plug end. The plug end is a spacer for the connecting leads from the various switches, the leads being crimped into their appropriate connectors. The plug body, together with the connectors and the plug end, are retained in a metal sheath by a circlip, a groove in the side of the plug body engaging with an internal projection of the plug sheath. The leads from the switches are coloured for identification purposes and correspond with coloured dots on the top of the plug body and the plug end adjacent to the holes through which the leads and connectors pass.

SERVICING

Note . . .

Care must be taken when servicing that the safety flap is not forced home when the trigger is depressed. It is also essential to ensure that the trigger, or safety flap when open, cannot foul any part of the aircraft structure or equipment.

General

15. It is possible to replace certain of the brake mechanism components and also some of the electrical switches. The switches themselves cannot be repaired and unserviceable switches will normally have to be returned to store. For complete servicing, the brake cable will have to be disconnected from the handle and the handle removed from the control column. For the replacement of electrical parts only, it is not always necessary to disconnect the brake cable; since the brake lever assembly and cable can be removed from the handle and supported to prevent kinking the cable, and the handle then removed from the control column for servicing.

Removal of brake cable.

16. (1) With an Allen key or Unbrako wrench ($\frac{5}{32}$ in. across hexagonal flats) remove the two screws retaining the guide plate and remove the latter, taking care to avoid kinking the brake cable.

(2) Slacken the brake adjusting screw (*para.* 9) to relieve the tension of the cable.

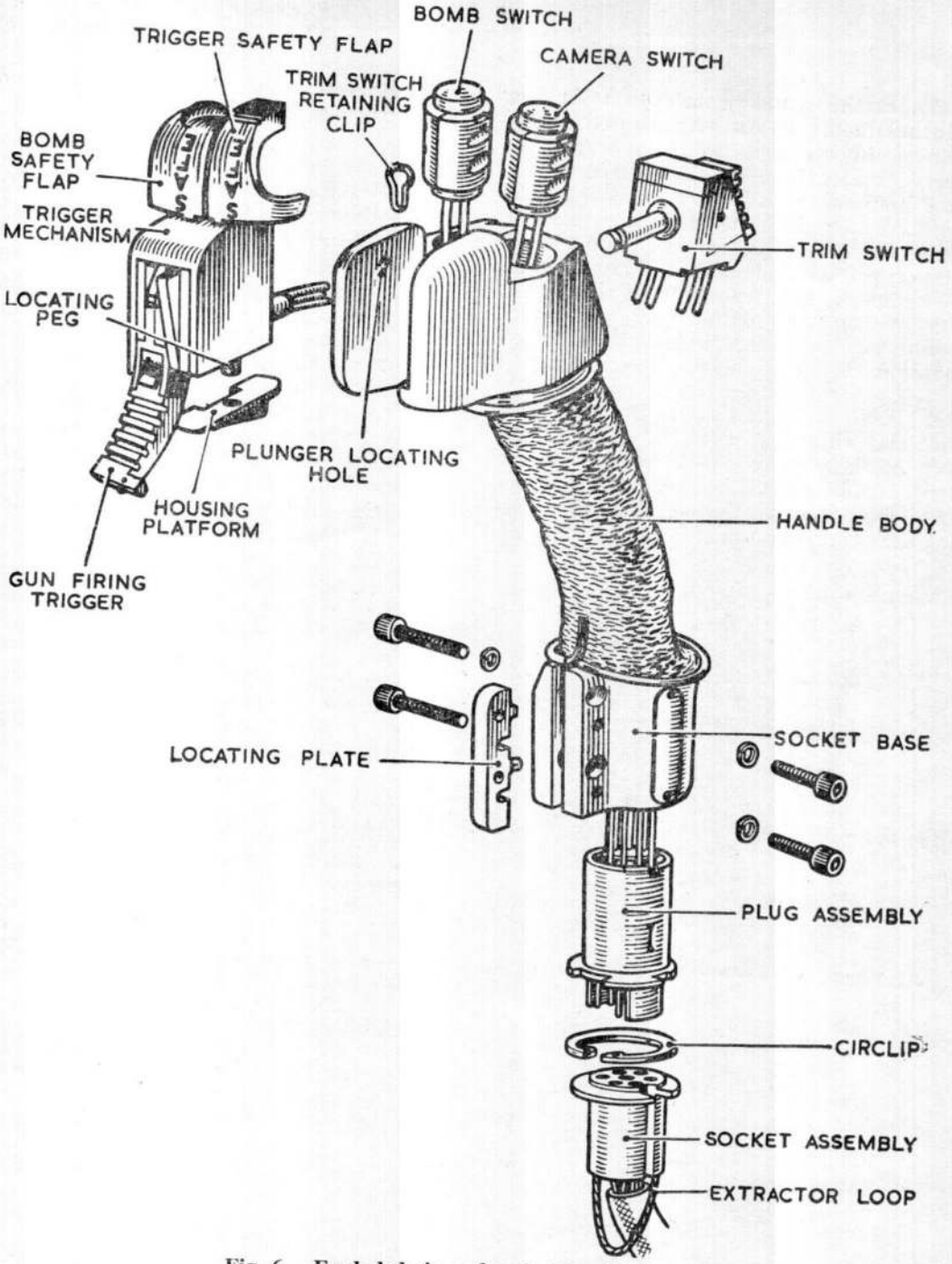

Fig. 6. Exploded view of typical handle

(3) Remove the flat spring retaining clip (*fig.* 2), remove the small retaining pin which engages in the slot of the guide plate, push out the lower roller pivot, lift off the brake lever and remove the cable end from the guide plate, taking care not to lose the upper roller pivot, upper roller or retaining pin during the operation.

(4) Re-assemble the lower roller, brake lever and lower roller pivot, and replace the retaining clip.

(5) Fit the brake mechanism to the handle and secure it with the two screws previously removed.

Note . . .
Do not replace the brake mechanism (sub-para. 5) at this stage if it is desired to remove the handle from the control column; the handle locating peg on the inner edge of the guide plate engages a hole in the control column and will prevent removal.

Removal of handle from control column

17. (1) With an Allen key or Unbrako wrench, loosen the handle retaining screws (*fig.* 2).

(2) With the brake lever mechanism removed (see note to *para.* 16), carefully withdraw the handle until it is free from the control column, taking care not to strain the electric cable passing from the control column to the interior of the handle.

(3) Grasp the wire loop, which may be seen in the recess at the base of the handle, and exert a steady pull. This will remove the socket on the end of the electric cable from the plug in the handle. The handle will now be free from the control column.

Removal of switches

18. (1) Remove the circlip from the inside of the lower part of the handle using the type S.I.S. pliers (Ref. No. 1B/4428.) If the circlip grip holes are not opposite the cut-away portion on the flange of the plug sheath, ease the circlip into that position to enable the circlip pliers to pass through the grip holes and obtain a firm hold.

(2) Pull down the electric plug assembly until it is exposed outside the handle. It will be necessary to twist the plug in order to straighten the leads so that the plug may be extracted to its fullest extent.

(3) Dismantle the handle until the defective switch is removed from its housing. Before a push switch can be removed, it is necessary to remove its retaining peg; then, by engaging a screwdriver under the lip at the top of the switch body, the switch can be levered from its recess in the handle.

Note . . .
Before a push switch is completely withdrawn, a piece of wire should be twisted round the switch in order to prevent the body halves from separating.

(4) Remove and dispose of the wire circlip from the top of the plug sheath and dismantle the plug assembly. Remove the twine around the top of the plug end which holds the outer leads in position.

(5) Identify the plug connections engaging the leads from the defective switch. On some handles a common positive plug connector secures all the leads from the various switches which are required to be connected to the positive supply. These common leads are red and must be removed from the connector without damaging them since only the red lead from the defective switch is replaced. The larger positive plug connector is also used wherever more than one lead has to be secured in the same connector even though it may not be connected to the positive supply. Where only one lead in a positive plug connector is to be replaced, carefully file away the metal of the connector in the vicinity of the crimping until the leads can be withdrawn.

(6) Cut away the other lead or leads of the defective switch from the connectors. The leads can be identified by the colour code wiring diagram for the particular handle.

(7) Manually withdraw the defective switch complete with leads.

Replacing new switches

19. (1) Enter the new switch complete with leads into its housing in the control handle. The leads may be pulled through the handle with a piece of stiff copper or brass locking wire attached to their ends. As the switches are pushed into their recesses, in the manner described for each particular handle, ensure that the leads are not pinched or damaged between the switch and its recess, if necessary by gently pulling the leads downwards. If a push switch

is being replaced, do not remove the piece of wire which holds the body halves together until the bottom of the switch has been pushed into its recess in the handle.

(2) Replace the retaining pegs and any other switches which have been removed.

(3) Remove the pull-through wire and cut off the leads one and a half inches from the base of the handle. Strip the insulations to leave half an inch of bare wire exposed on each lead.

Note . . .

Care is necessary during this operation in order to avoid damaging leads, with consequent circuit faults.

(4) Thread all the red leads through the appropriate hole in the plug end and twist the bare ends of the wires together. Push them into a new positive plug connector (which has a slightly larger hole than the other connectors) and pass the sighting hole in the side of the connector and securely crimp with crimping pliers (Ref. No. 27VA/3733) and re-crimp at 180 deg.

(5) Place the other new leads through their appropriately coloured holes in the plug end and crimp as in (4) above into ordinary connectors, ensuring that the wires extend beyond the sighting holes. Test all crimped connections by tugging on the wires after crimping.

(6) With all the crimped connectors pushed back hard on to the face of the plug end, securely bind the outer leads around the recess at the back of the plug end with Thread Linen No. 18 (Ref. No. 32B/644). Paint the binding with shellac varnish (Ref. No. 33A/512 or 513) and allow it to dry. There should not be any bare wire exposed above the top of the plug end.

(7) Position the connectors in the plug body, checking the colour of the leads with the coloured spots beside the holes on the plug body. Place the sheath over the plug body and the plug end and secure the assembly in position with a new inner circlip.

(8) Gradually feed the leads into the handle by twisting and pushing the assembled plug. When the plug is finally housed, retain it in position with the circlip, using the circlip pliers. The gap in the circlip should be positioned over the gap in the flange at the base of the plug. This facilitates subsequent removal of the circlip.

Testing

20. Wire up a spare socket (para. 5) with a short length of cable of a similar type to that used in the control column. It is essential that the coloured leads of the cable are connected to the contacts of the socket in exactly the same order as that on the control column socket. Remove sufficient sheathing from the free end of the cable to facilitate test connections and insert the socket to mate with the plug in the handle.

Electrical

21. Using the circuit or wiring diagram for the appropriate handle as a guide, test the various circuits of the handle for continuity whilst operating the switches. Check that all the switches have a snappy action and that they make unfaltering contact when operated slowly. With all the switches open, check that the insulation resistance of the circuit to earth is not less than 50 megohms when measured with a 250 volt insulation resistance tester. When these tests are completed, remove the test plug and put it away safely for future use. Safety flaps and catches must be retained in either of their extreme positions by their respective springs.

Mechanical

22. Check that the components of the brake mechanism are in good condition and that, when assembled into the handle, operation is smooth and that the parking catch operates correctly. If the handle is not immediately fitted to a control column, the lower end must be suitably sealed off to prevent the ingress of foreign matter.

Fitting handle to control column

23. In order that the handle may be fitted to the control column, it is essential that the brake lever mechanism be detached from the handle because of the locating peg on the guide plate of the mechanism (see note to *para.* 16).

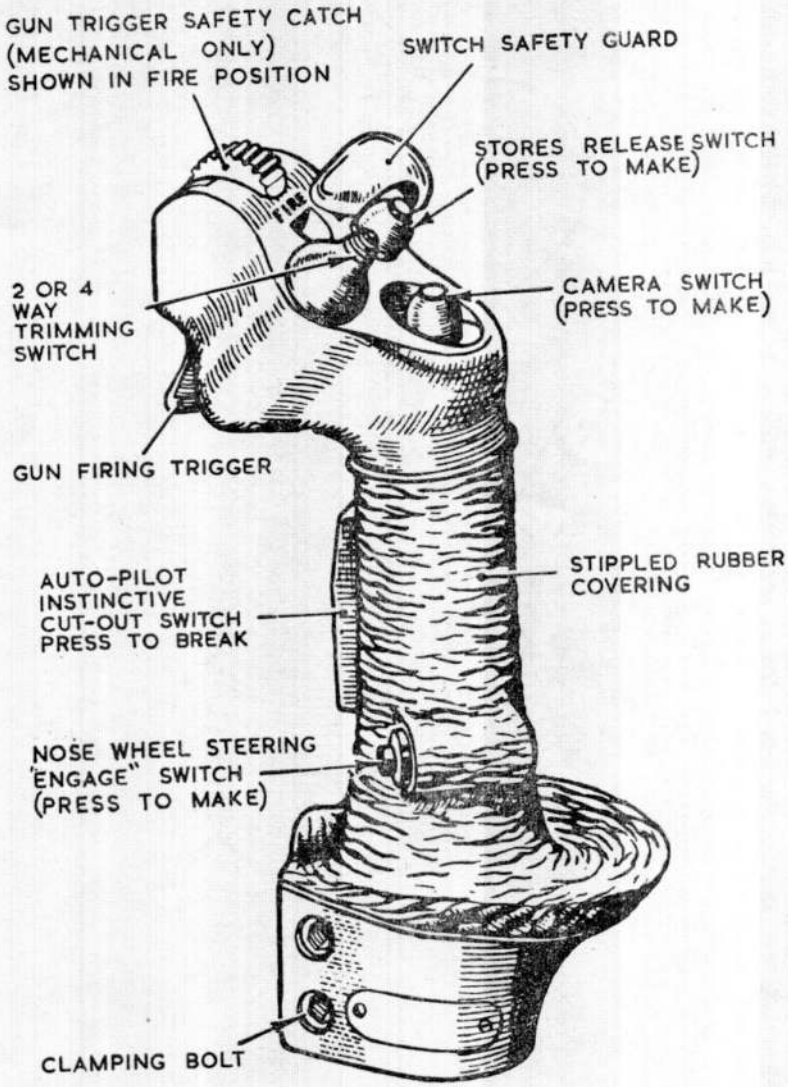

Fig. 7. Typical handle without brake mechanism

24. Assuming that the brake lever mechanism has been detached, proceed as follows:—

(1) Enter the aircraft electrical socket into the base of the handle and press it right home to ensure mating with the plug in the handle.

(2) Lightly smear the top end of the control column with Duralac or similar jointing compound and mount the handle on the control column so that the trigger lever is forward and approximately 15 degrees to port. When doing this, look in the slot of the handle which accommodates the brake lever mechanism to see that the locating hole in the control column is in a position to be engaged by the locating peg of the lever mechanism. If any difficulty is experienced in fitting the handle to the control column, make sure that the handle retaining screws are loose and that the base of the handle is not distorted; do not force the handle on to the control column.

(3) Fit the brake lever mechanism, with brake cable attached, to the handle,

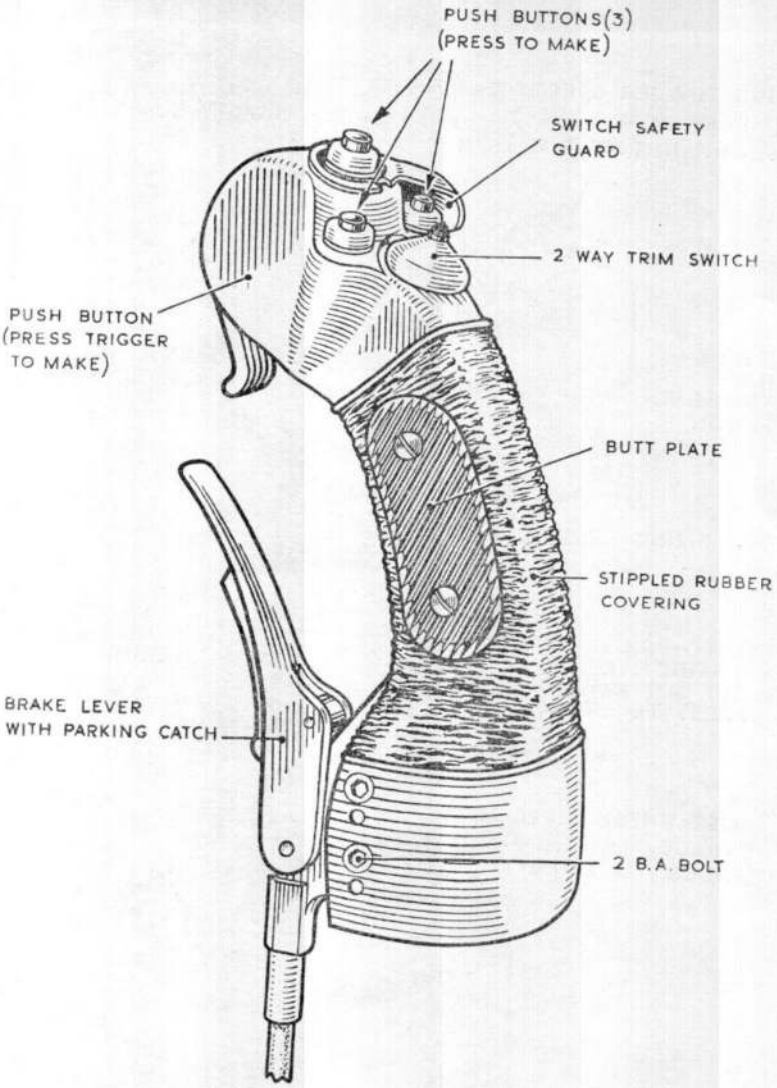

Fig. 8. Typical helicopter handle

making sure that the locating peg on the guide plate engages in the locating hole in the control column, and tighten up the two mechanism retaining screws (*fig.* 2). Instructions for fitting the brake cable are contained in the next paragraph.

(4) Adjust the brake cable tension, by means of the adjuster screw on the starboard side of the brake lever, to give maximum brake pressure and see that the parking catch functions correctly.

(5) Tighten up the handle securing screws.

Fitting brake cable to handle

25. The brake cable must be fitted and the cable tension adjusted before finally securing the handle to the control column. This may be done as follows:—

(1) Remove the spring retaining clip on the brake lever and push out the bottom pivot and roller, extract the small retaining pin which engages in the slot of the guide plate and lift off the brake lever.

(2) Pass the cable end through the slot in the lower end of the guide plate and enter the end of the cable casing into the guide plate end fitting recess.

(3) Position the roller in the fork of the cable end to locate in the guide plate as shown in fig. 2 and replace the brake lever on the guide plate. Then insert the lower roller pivot and replace the flat retaining clip and retaining pin.

(4) Insert and secure the brake lever mechanism in the handle and adjust the brake cable tension as described in para. 24, sub-para. (4).

Testing after installation

26. When the handle has been installed on the aircraft control column, test the various electrical circuits controlled by the handle switches in accordance with instructions in the relevant aircraft handbook.

Appendix 1

STRAIGHT STICK CONTROL HANDLES, DUNLOP TYPES

Control Handle Makers Handle No. Ref. No.	Push Switch		Trim Switch		Cut-out switch	Hoist switch or Nose wheel Steering	Push Switch Centre Top	Socket or Pigtail	Remarks
	Port	Stbd	Two way	Four way					
AC 1400 27J/250	ACM 17763	ACM 17764						Socket	
AC 10300 27J/252	ACM 17763	ACM 17764						Socket	
AC 10522 27J/251	ACM 17923	ACM 17922						Socket	
AC 10800 27J/291	ACM 17763	ACM 17764						Socket	
AC 19022 27J/312	ACM 17763	ACM17764	AC12678						
AC 10926 27J/324					ACM 17050	ACM 16400		Socket	
AC 11230 27J/400	ACM 17763							Socket	
AC 11232 27J/339	ACM 17928	ACM 17764						Socket	
AC 11624	ACM 16912	ACM 16912	AC12352		ACM 17300	ACM 16912		Socket	
AC 11626		ACM 17936		ACM 17080				Pigtail	
AC 12332	ACM 17180	ACM 17182						Pigtail	
AC 12334 27J/371	ACM 17854	ACM 17854		ACO 9738	ACM 17300	ACM 17854		Socket	
AC 12580 27J/368	ACM 17763	ACM 17764	AC 13502					Socket	
AC 12590 27J/386	ACM 17763	ACM 17764	AC 12678					Socket	

Control Handle Makers Handle No. Ref. No.	Push Switch		Trim Switch		Cut-out switch	Hoist switch or Nose wheel Steering Switch	Push Switch Centre Top	Socket or Pigtail	Remarks
	Port	Stbd	Two way	Four way					
AC 12592 27J/408	ACM 17854	ACM 17854		ACO 9738	ACM 18320	ACM 17854		Socket	
AC 13032		ACM 17858	AC 13504				ACM 17858	Socket	
AC 13038		ACM 17854		AC 13500			ACM 17854	Socket	
AC 13066	ACM 19436		AC 14838				ACM 19436	Pigtail	Trigger Push sw. ACM 19436
AC 13068	AC 13486 AC 13488						ACM 18864	Pigtail	Trigger Push sw. ACM 18864
AC 14206			AC 14838		ACM 19082		ACM 19036	Pigtail	Trigger Push sw. ACM 19036
AC 14224	AC 17854	AC 17854	AC 14710		ACM 18850			Socket	Press to speak sw. ACM 17854 Press to mute sw. ACM 17854
AC 14238	ACM 19436	ACM 19436	AC 14834	AC 14712	ACM 19298			Pigtail	Press to speak sw. ACM 19436 Press to mute sw. ACM 19436
AC 14208	ACM 19436		AC 14838				ACM 19436	Pigtail	Trigger Push sw. ACM 19436
AC 14216 27J/465		ACM 19436			ACM 19082			Pigtail	
AC 14242 27J/506		ACM 19809	AC 13906					Pigtail	
AC 14244 27J/501				AC17404				Pigtail	Trigger Push sw. ACM 19436
AC 14248 27J/455	ACM 19436			AC 14716				Pigtail	
AC 14250 27J/463		ACM 17854		AC 14708			ACM 17854	Socket	Trigger Push sw. ACM 17854
AC 14252 27J/494		ACM 19436		AC 14712			ACM 19436	Pigtail	Trigger Push sw. ACM 19436
AC 14256 27J/459	ACM 19436	ACM 19436			ACM 19082	ACM 19436		Pigtail	
AC 14260							ACM 19436	Pigtail	

Control Handle Makers Handle No. Ref. No.	Push Switch Port	Push Switch Stbd	Trim Switch Two way	Trim Switch Four way	Cut-out switch	Hoist switch or Nose wheel Steering Switch	Push Switch Centre Top	Socket or Pigtail	Remarks
AC 14284 27J/462	ACM 19436		AC 14706					Pigtail	Trigger Push sw. ACM 19436
AC 14292 27J/504	ACM 19436	ACM 19436	AC 14864		ACM 19082			Pigtail	
AC 14294 27J/505	ACM 19085	ACM 19085	AC 14864		ACM 19082			Pigtail	
AC 14296	ACM 19436			AC 14716	ACM 19082			Pigtail	
AC 14360			AC 13486 AC 13488		ACM 19082		ACM 18864	Pigtail	Trigger Push sw. ACM 18864
AC 14362				AC 60264/8	ACM 19680		ACM 20098	Pigtail	
AC 14728 27J/461	ACM 17763	ACM 17764	AC 12678					Socket	
AC 14736	ACM 19436	ACM 19436						Pigtail	Trigger Push Sw. ACM 19436
AC 60050 27J/525	ACM 17854		AC 14710/2			AC 14710/2		Socket	Press to speak sw. ACM 17854 Trigger Push sw. ACM 18677
AC 60056 27J/526	ACM 17854							Socket	Trigger Push Sw. AC 17854
AC 60058									
AC 60042	ACM 19298	ACM 19436	AC 14834	AC 14712	ACM 19298			Pigtail	Press to speak sw. ACM 19436 Press to mute sw. ACM 19436
AC 60044 27J/527								Pigtail	
AC 60048 27J/530	ACM 19298					AC 14834		Pigtail	
AC 60046 27J/529	ACM 19298					AC 14834		Pigtail	
AC 60054 27J/528								Pigtail