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SHEET METAL FASTENERS

GENERAL AND TECHNICAL INFORMATION

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CONTENTS

Chapter 1

METRICATION

Introduction

1 This chapter introduces conversion tables to enable imperial measurements and certain tool and material sizes (e.g. drills and wire gauge), used in the following chapters to describe and detail the installation of imperial manufactured sheet metal fasteners, to be converted to metric measurements.

2 Where exact conversion of imperial tool and material sizes cannot be obtained, care is to be exercised to ensure that when selecting the nearest conversion the minor difference is allowed to the correct side, up or down, to provide the best condition.

3 The following tables are provided:-

3.1 Table 1 Conversion table - s.w.g. to inches and millimeters.

3.2 Table 2 Twist drill sizes.

3.3 Table 3 Fraction of an inch to decimal of an inch and to millimeters.

TABLE 1 CONVERSION TABLE S.W.G. TO INCHES AND MILLIMETERS

Gauge	Inches	mm	Gauge	Inches	mm	Gauge	Inches	mm
7/0	0.5000	12.700	13	0.0920	2.337	32	0.0180	0.274
6/0	0.4640	11.786	14	0.0800	2.032	33	0.0100	0.254
5/0	0.4320	10.972	15	0.0720	1.829	34	0.0092	0.234
4/0	0.4000	10.160	16	0.0640	1.626	35	0.0084	0.213
3/0	0.3720	9.449	17	0.0560	1.422	36	0.0076	0.193
2/0	0.3480	8.839	18	0.0480	1.219	37	0.0068	0.173
0	0.3240	8.230	19	0.0400	1.016	38	0.0060	0.152
1	0.3000	7.620	20	0.0360	0.914	39	0.0052	0.132
2	0.2760	7.010	21	0.0320	0.813	40	0.0048	0.122
3	0.2520	6.401	22	0.0280	0.711	41	0.0044	0.112
4	0.2320	5.893	23	0.0240	0.610	42	0.0040	0.102
5	0.2120	5.385	24	0.0220	0.559	43	0.0036	0.091
6	0.1920	4.877	25	0.0200	0.508	44	0.0032	0.081
7	0.1760	4.470	26	0.0180	0.457	45	0.0028	0.071
8	0.1600	4.064	27	0.0164	0.417	46	0.0024	0.061
9	0.1440	3.658	28	0.0148	0.376	47	0.0020	0.051
10	0.1280	3.251	29	0.0136	0.345	48	0.0016	0.041
11	0.1160	2.946	30	0.0124	0.315	49	0.0012	0.030
12	0.1040	2.642	31	0.0116	0.295	50	0.0010	0.025

TABLE 2 TWIST DRILL SIZES

Old drill gauge and letter size		British Standard (international) series		
OLD SIZE	Decimal equivlnt.	NEW SIZE		Decimal equivlnt.
	in	mm	in	in
80	0.0135	0.35		0.0138
79	0.0145	0.38		0.0150
78	0.0160	0.40		0.0157
77	0.0180	0.45		0.0177
76	0.0200	0.50		0.0197
75	0.0210	0.52		0.0205
74	0.0225	0.58		0.0228
73	0.0240	0.60		0.0236
72	0.0250	0.65		0.0256
71	0.0260	0.65		0.0256
70	0.0280	0.70		0.0276
69	0.0292	0.75		0.0295
68	0.0310		1/32	0.0312
67	0.0320	0.82		0.0323
66	0.0330	0.85		0.0334
65	0.0350	0.90		0.0354
64	0.0360	0.92		0.0362
63	0.0370	0.95		0.0374
62	0.0380	0.98		0.0386
61	0.0390	1.00		0.0394
60	0.0400	1.00		0.0394
59	0.0410	1.05		0.0413
58	0.0420	1.05		0.0413
57	0.0430	1.10		0.0433
56	0.0465		3/64	0.0469
55	0.0520	1.30		0.0512
54	0.0550	1.40		0.0551
53	0.0595	1.50		0.0591
52	0.0635	1.60		0.0630
51	0.0670	1.70		0.0669
50	0.0700	1.80		0.0709
49	0.0730	1.85		0.0728
48	0.0760	1.95		0.0768
47	0.0785	2.00		0.0787
46	0.0810	2.05		0.0807
45	0.0820	2.10		0.0827
44	0.0860	2.20		0.0866
43	0.0890	2.25		0.0886
42	0.0935		3/32	0.0938
41	0.0960	2.45		0.0965

TABLE 2 TWIST DRILL SIZES (continued)

Old drill gauge and letter size		British Standard (international) series		
OLD SIZE	Decimal equivlnt.	NEW SIZE		Decimal equivlnt.
	in	mm	in	in
40	0.0980	2.50		0.0984
39	0.0995	2.55		0.1004
38	0.1015	2.60		0.1024
37	0.1040	2.65		0.1043
36	0.1065	2.70		0.1063
35	0.1100	2.80		0.1102
34	0.1110	2.80		0.1102
33	0.1130	2.85		0.1122
32	0.1160	2.95		0.1161
31	0.1200	3.00		0.1181
30	0.1285	3.30		0.1299
29	0.1360	3.50		0.1378
28	0.1405		9/64	0.1406
27	0.1440	3.70		0.1457
26	0.1470	3.70		0.1457
25	0.1495	3.80		0.1496
24	0.1520	3.90		0.1535
23	0.1540	3.93		0.1535
22	0.1570	4.00		0.1575
21	0.1590	4.00		0.1575
20	0.1610	4.10		0.1614
19	0.1660	4.20		0.1654
18	0.1695	4.30		0.1693
17	0.1730	4.40		0.1732
16	0.1770	4.50		0.1772
15	0.1800	4.60		0.1811
14	0.1820	4.60		0.1811
13	0.1850	4.70		0.1850
12	0.1890	4.80		0.1890
11	0.1910	4.90		0.1929
10	0.1935	4.80		0.1929
9	0.1960	5.00		0.1968
8	0.1990	5.10		0.2008
7	0.2010	5.10		0.2008
6	0.2040	5.20		0.2047
5	0.2055	5.20		0.2040
4	0.2090	5.30		0.2087
3	0.2130	5.40		0.2126
2	0.2210	5.60		0.2205
1	0.2280	5.80		0.2293

TABLE 2 TWIST DRILL SIZES (continued)

Old drill gauge and letter size		British Standard (international) series		
OLD SIZE	Decimal equivlnt.	NEW SIZE		Decimal equivlnt.
	in	mm	in	in
A	0.2340		15/64	0.2344
B	0.2380	6.00		0.2382
C	0.2420	6.10		0.2492
D	0.2460	6.20		0.2491
E	0.2500		1/4	0.2860
F	0.2570	6.50		0.2559
G	0.2610	6.50		0.2598
H	0.2660		17/64	0.2656
I	0.2720	6.90		0.2717
J	0.2770	7.00		0.2756
K	0.2810		9/32	0.2812
L	0.2900	7.40		0.2913
M	0.2950	7.50		0.2953
N	0.3020	7.70		0.3081
O	0.3160	8.00		0.3150
P	0.3230	8.20		0.3228
Q	0.3320	8.40		0.3307
R	0.3390	8.60		0.3386
S	0.3480	8.80		0.3465
T	0.3580	9.10		0.3583
U	0.3680	9.30		0.3661
V	0.3770		3/8	0.3750
W	0.3860	9.80		0.3858
X	0.3970	10.10		0.3976
Y	0.4040	10.30		0.4055
Z	0.4130	10.50		0.4134

TABLE 3 FRACTION OF AN INCH TO DECIMAL OF AN INCH AND TO MILLIMETRES

Inch		Millimetre	Inch		Millimetre
1/64	0.015 625	0.396 875	33/64	0.515 625	13.096 875
1/32	0.031 250	0.793 750	17/32	0.531 250	13.493 750
3/64	0.046 875	1.190 625	35/64	0.546 875	13.890 625
1/16	0.062 500	1.587 500	9/16	0.562 500	14.287 500
5/64	0.078 125	1.984 375	37/64	0.578 125	14.684 375
3/32	0.093 750	2.381 250	19/32	0.593 750	15.081 250
7/64	0.109 375	2.778 125	39/64	0.609 375	15.478 125
1/8	0.125 000	3.175 000	5/8	0.625 000	15.875 000
9/64	0.140 625	3.571 875	41/64	0.640 625	16.271 875
5/32	0.156 250	3.968 750	21/32	0.656 250	16.668 750
11/64	0.171 875	4.365 625	43/64	0.671 875	17.065 625
3/16	0.187 500	4.762 500	11/16	0.687 500	17.462 500
13/64	0.203 125	5.159 375	45/64	0.703 125	17.859 375
7/32	0.218 750	5.556 250	23/32	0.718 750	18.256 250
15/64	0.234 375	5.953 125	47/64	0.734 375	18.653 125
1/4	0.250 000	6.350 000	3/4	0.750 000	19.050 000
17/64	0.265 625	6.746 875	49/64	0.765 625	19.446 875
9/32	0.231 250	7.143 750	25/32	0.781 250	19.843 750
19/64	0.296 875	7.540 625	51/64	0.796 875	20.240 625
5/16	0.312 500	7.937 500	13/16	0.812 500	20.637 500
21/64	0.328 125	8.334 375	53/64	0.828 125	21.034 375
11/32	0.343 750	8.731 250	27/32	0.843 750	21.431 250
23/64	0.359 375	9.128 125	55/64	0.859 375	21.828 125
3/8	0.375 000	9.525 000	7/8	0.875 000	22.225 000
25/64	0.390 625	9.921 875	57/64	0.890 625	22.621 875
13/32	0.406 250	10.318 750	29/32	0.906 250	23.018 750
27/64	0.421 875	10.715 625	59/64	0.921 875	23.416 625
7/16	0.437 500	11.112 500	15/16	0.937 500	23.812 500
29/64	0.453 125	11.509 375	61/64	0.953 125	24.209 375
15/32	0.468 750	11.906 250	31/32	0.968 750	24.606 250
31/64	0.484 375	12.303 125	63/64	0.984 375	25.003 125
1/2	0.500 000	12.700 000	1	1.000 000	25.400 000

Note ...

All values in Table 3 are exact.

Chapter 2

DZUS FASTENERS

CONTENTS

Introduction

1 Dzus fasteners (Ref. No. 27FP/-) are used on aircraft for holding sheet-metal components firmly in position, while at the same time providing a means for their rapid removal and re-attachment. Various types of fastener are used for different applications, and this chapter describes those most generally found in the Service. Information is also given on the methods adopted for fitting the components of the various types of fastener.

2 All types of Dzus fasteners consist of a catch and spring, the main variations being in the type of head and the size. The catch is held in position in the outer member, e.g. a cowling, by a light-alloy, steel, or

stainless steel grommet, and the spring is riveted to the underside of the inner member. In the body of the catch is a helix slot which engages with the centre portion of the spring, drawing it up when the catch is given a quarter turn in a clockwise direction.

DESCRIPTION

Catch (fig.1)

3 The catch, which is made of nickel steel with a rustproof coating, has a sleeve-type body and a slotted head. A helix slot is machined in the body to form a bayonet fitting. The catch may be dome-headed, or, in instances where the fastener is required to be flush-fitting, the underside of the head is recessed or bevelled. The neck portion under the head is made in different lengths according to the application of the fastener and to the thickness of the plate in which the catch is fitted.

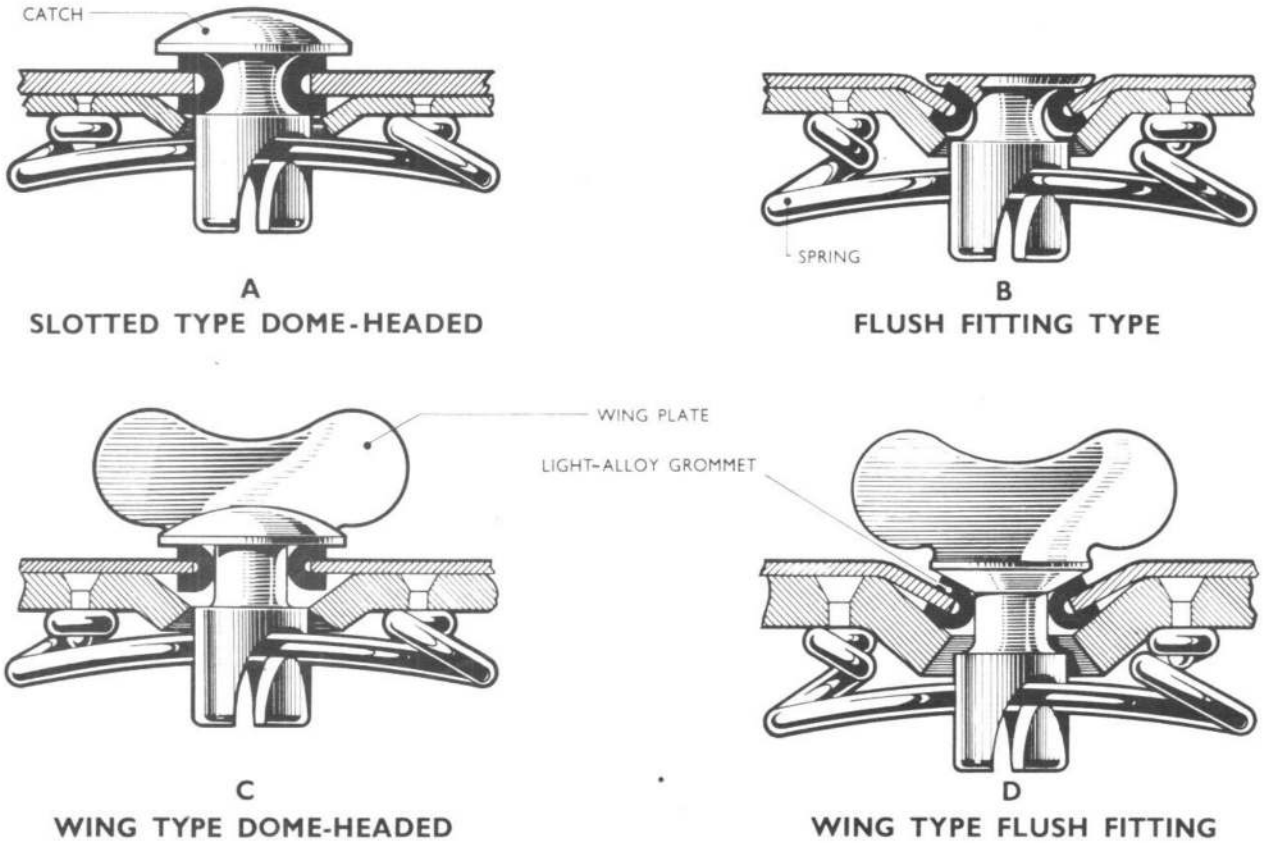


Fig.1 Types of Dzus fasteners

4 The hole in the outer sheet metal member is fitted with a grommet which prevents the catch from falling out when the fastener is unlocked. The head of the catch is usually slotted to provide for the engagement of a locking key. In addition to the slotted-head types of catch, similar catches are available fitted with a fixed wing plate. This facilitates the locking and unlocking operations in positions where drag does not prohibit its use.

Spring (fig.2)

5 The fastener spring is a short length of spring-steel wire, the ends of

which are coiled in opposite directions to form spirals. The spring is riveted to the inner member through the eyes of the spirals. The centre portion of the spring engages with the helix slot in the body of the catch. The pitch of the rivet centres of the springs and the height of the spring vary with the different types. A typical arrangement of small type springs at a joint in an engine cowling is shown. When the fastener is in its locked position, the spring is deflected by the helix slot, and the outer member is thereby held firmly in position under compression.

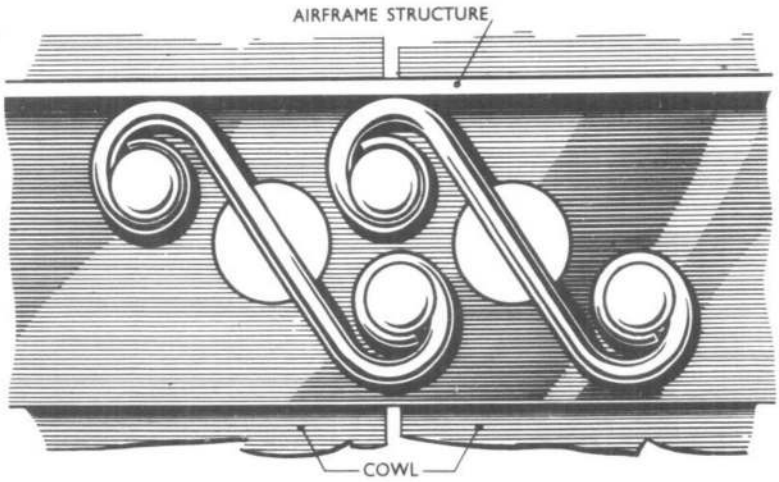


Fig.2 Typical installation of small-type springs

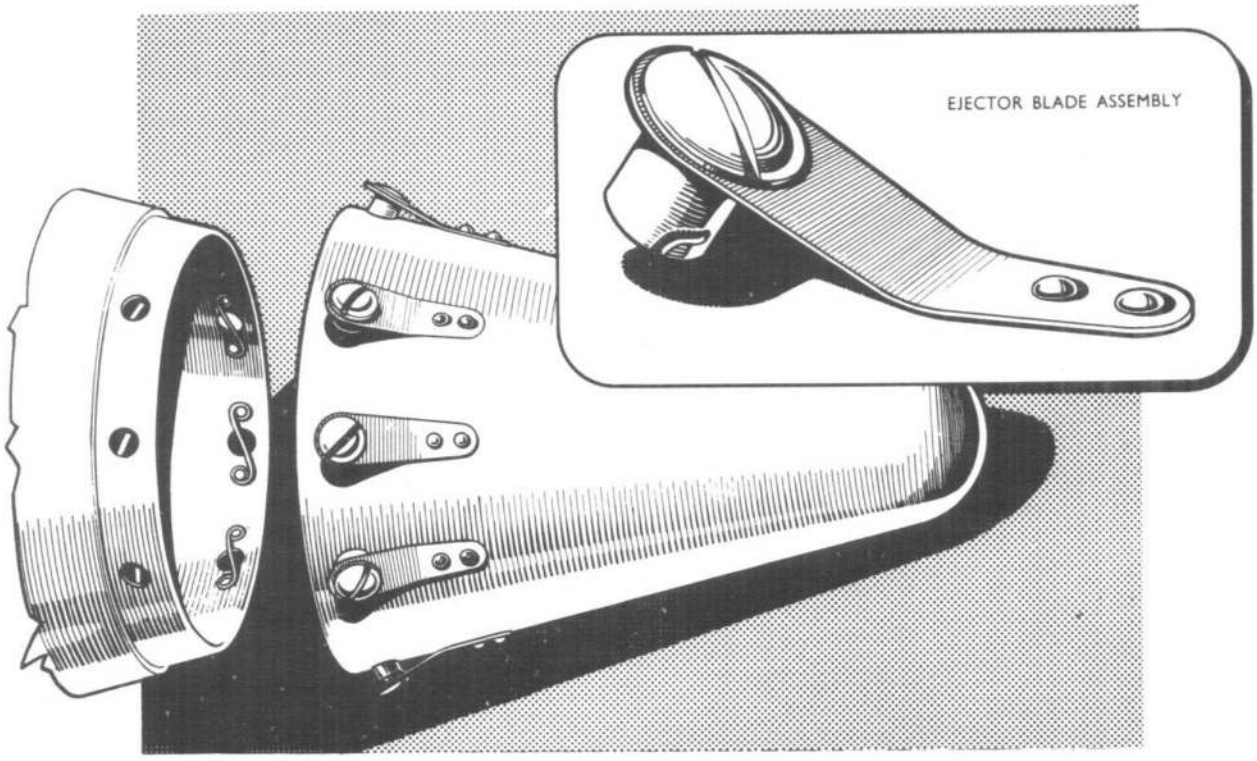


Fig.3 Ejector blade with Dzus fastener

Ejector blade (fig.3)

6 On certain installations, e.g., circular or particularly large fairings, an addition in the form of an ejector blade is made to the catch and spring

already described. This consists of a strip of rustproof spring steel or stainless steel, which is held in position on the outer member by light-alloy rivets. There are two types of ejector blade; one is bent to form a permanent set of 30 deg., and the other is curved. The angled blade is attached by two rivets, while the curved blade is attached by one rivet so that the blade can swivel. When the fastener is unlocked, the tension in the blade holds the catch free of the outer member.

INSTALLATION

Selecting the size of fastener (fig.4)

7 The following instructions for determining the correct length of fastener must be carefully observed. In instances where a defective fastener is to be replaced by a new one, the defective parts should be used as guide to the size and shape of the new parts required.

8 The length of the catch is measured from the lower edge of the locking slot to the upper surface of the head for flush-type fasteners, and to the underside of the head for round-headed fasteners.

9 The length of the catch for any particular application may be determined by the subtraction of the spring deflection (para.11) from the combined thicknesses of the plates and the packing (where fitted), the thickness of the grommet, and the height of the spring.

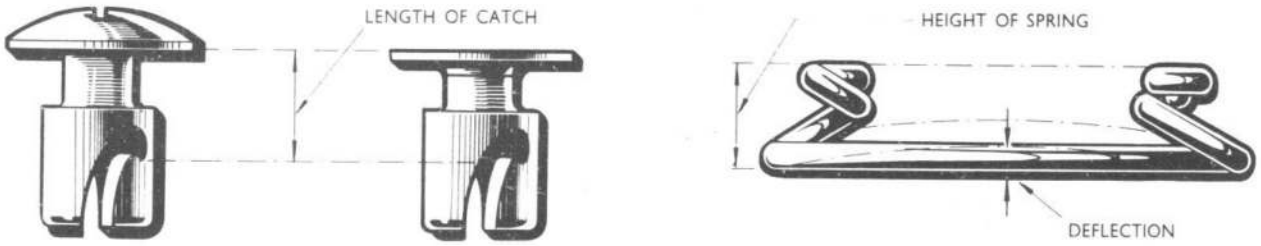


Fig.4 Primary dimensions of catch and spring

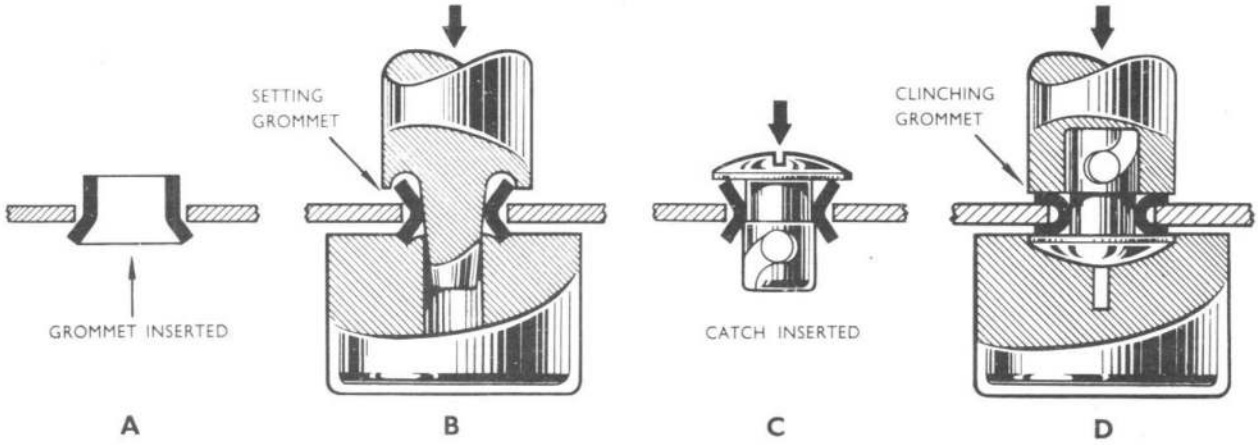


Fig.5 Fitting a dome-headed catch

Note ...

For the types of head which are bevelled or recessed on the underside the thickness of the grommet should be omitted.

10 If the calculated length of catch differs from the length of the nearest size available, the next larger size should be used, and shim washers to the required thickness should be inserted under the spring seats to bring the spring deflection to the recommended figure.

Spring deflection

11 The recommended deflections for the various sizes of spring are given in Table 1. The pitch of the rivet centres is included as an additional guide.

TABLE 1 SPRING DEFLECTIONS

Wire diameter of spring	Pitch of rivet centres	Recommended deflection
0.100 in	Over 1 in	0.062 in ± 0.010 in
0.090 in	Over 1 in	0.062 in ± 0.010 in
0.080 in	1 in	0.047 in ± 0.010 in
0.062 in	0.75 in	0.045 in ± 0.010 in
0.045 in	0.625 in	0.040 in

Equipment required

12 Special drifts and blocks are used for the installation of Dzus fasteners. Each tool is marked with the type and size of fastener for which it is to be used. These drifts and blocks are made of case-hardened steel and should be struck with a soft-faced mallet only. Under no circumstances should a steel hammer be used for this purpose, or the drifts and blocks will be damaged. Round-head light-alloy rivets of the same diameter as the eyes of the spring spirals will also be required, together with various drills the sizes of which are indicated in the following paragraphs.

To fit dome-headed fasteners and springs (fig.5)

13 Dome-headed fasteners and springs should be fitted as follows:-

13.1 Drill a hole in the outer member of the same outside diameter as the grommet, and then insert the grommet from the underside.

13.2 Partially 'set' the grommet, using the appropriate drift and block.

13.3 Insert the catch in the grommet and clinch the grommet, using the drift and block.

13.4 Drill a hole in the inner member, using a drill of the same diameter as the body of the catch. Take care to ensure that the hole will register correctly with the catch.

13.5 Countersink the inner member, using the drift and block shown in fig.6.

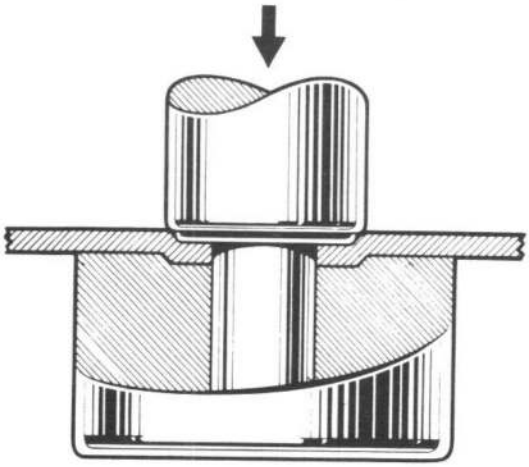


Fig.6 Forming countersink in inner member (dome-headed fastener)

13.6 Mark out and drill the rivet holes for the spring. If the pitch of the rivet centres is $\frac{3}{4}$ in or below, use a No. 41 (0.096 in) drill. If the pitch is 1 in or above, use a No. 30 (0.128 in) drill. The holes must be symmetrically placed with regard to the hole through which the fastener passes.

13.7 Next countersink the rivet holes on the upper side of the inner member. Where a No.41 drill is used, a 3/16 in diameter countersink should be employed, and where a No.30 drill is used, a $\frac{1}{4}$ in diameter countersink is required.

13.8 Rivet the spring in position, using two appropriately sized round-headed light-alloy rivets, long enough to enable the countersink to be filled completely when the rivet head is riveted over. File the rivet ends remote from the head flush with the surface.

To fit flush-type fasteners and springs (fig.7)

14 The set of installation tools provided for fitting flush-type fasteners consists of three drifts and two blocks. The various operations are shown in fig.7 and 8. Flush-type fasteners should where possible be installed with the slot in the head parallel to the direction of the slipstream, and the slot is cut at various angles for this purpose.

15 Flush-type fasteners and their springs should be fitted as follows:-

15.1 Drill a hole in the outer member and then countersink using the drift and block to accommodate the grommet. Table 2 gives the sizes of drill to be used for the varying sizes of catch.

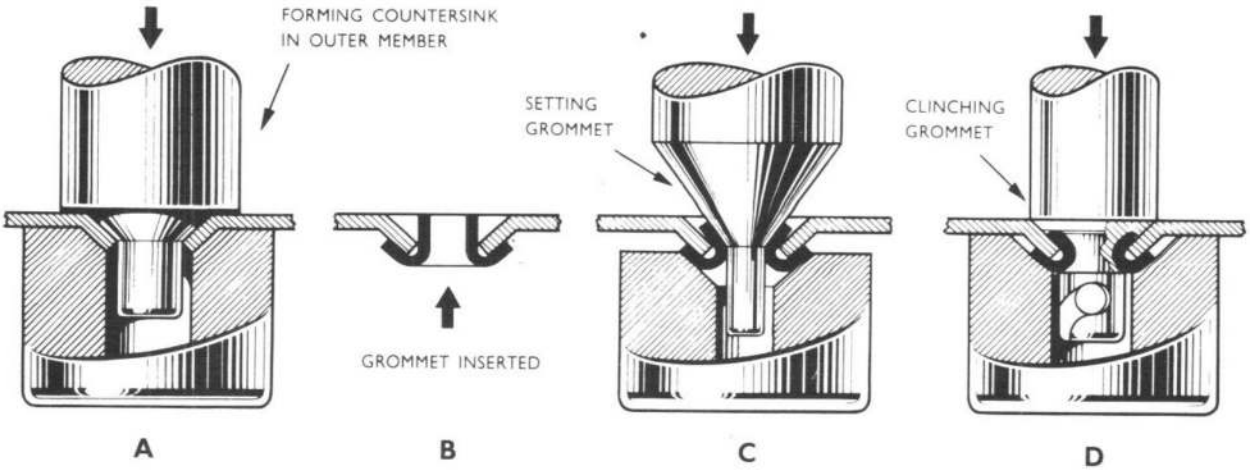


Fig.7 Fitting a flush-type catch

TABLE 2 DRILL SIZES FOR CATCHES

Diameter of catch	Diameter of drill
1/4 in	17/64 in
5/16 in	5/16 in
3/8 in	3/8 in
13/32 in	7/16 in
7/16 in	15/32 in

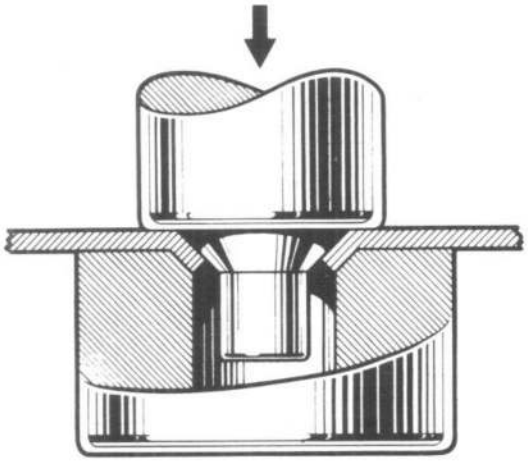


Fig.8 Forming countersink in inner member (flush fastener)

15.2 Insert the grommet into the countersunk hole from the underside of the outer member and partly set.

15.3 Insert the catch and clinch it by a few light blows with a mallet on a flat-nosed punch of the same diameter as the head of the catch, the outer member and the grommet being supported in a block.

15.4 The procedure for fitting the spring is similar to that described in para.13.4 to 13.8, except that the drift and block shown in fig.8 must be used for countersinking the inner member.

To fit wing-type fasteners and springs

16 The assembly of fasteners fitted with wing plates is identical with that described for the same type of fastener without the wing plate. The drifts and blocks are provided with a slot to take the wing plate.

To fit the catch to the ejector blade

17 The method used for fitting the catch to the ejector blade is identical with that used for fitting the catch to the outer member. Allowance must be made for the thickness of the ejector blade when the length of the fastener is being determined.

Marking of locked position

18 The locked position of each cowling or skin-panel fastener must be clearly marked by lines painted on the cowling or panel. A line $\frac{1}{8}$ in wide by $\frac{1}{2}$ in long must be painted on each side of the fastener in line with the screwdriver slot when the fastener is in the locked position. Black or white paint, whichever shows more clearly against the colour scheme of the aircraft, must be used for these markings.

WARNING ...

IT MUST NEVER BE ASSUMED THAT, BECAUSE THE MAJORITY OF THE INDICATING LINES ARE IN ONE DIRECTION (NORMALLY FORE-AND-AFT), THEY ARE THE SAME FOR ALL THE FASTENERS ON THE AIRCRAFT. IN SOME INSTANCES, PARTICULARLY ON WING GUN PANELS, THEY ARE AT RIGHT ANGLES TO THE NORMAL DIRECTION. EACH FASTENER MUST BE CAREFULLY EXAMINED TO ENSURE THAT THE INDICATING LINES DO, IN FACT, CORRESPOND TO THE POSITION OF THE SCREWDRIVER SLOT WHEN THE FASTENER IS IN THE LOCKED POSITION.

REMOVAL AND RENEWAL OF FASTENERS (fig. 9 and 10)

19 If the catch is defective in any way, it should be replaced by a new one. The method of removing a damaged catch is described in the following paragraphs, and may be used whenever the cowling is strong enough to prevent distortion (that is, the cowling should be not less than 16 s.w.g.)

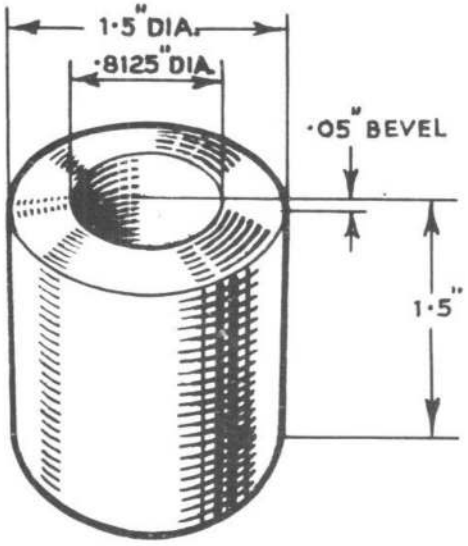


Fig.9 Block to remove catch

20 The method of removal involves the use of a case-hardened mild steel block. The diameter of the hole in the block should be double that of the body of the catch with which it is to be used; for example, for a 13/32 in diameter catch, the hole should be 0.8125 in (13/16 in) in diameter, as shown in fig.9. The top of the block should be bevelled slightly, to allow for any curvature in the cowling.

21 Each catch should be removed as follows:-

21.1 When the cowling has been removed from the aircraft, hold it, with the inner face uppermost, with the head of the catch over the hole in the steel block. The block must be either fixed in a vice or placed on a solid surface.

Note ...

Worn catches tend to develop sufficient slack for the head of the catch to project slightly below the cowling, and this simplifies the location of the catch in the block.

21.2 When the catch is in position, strike a sharp blow with a hammer on the base of the catch. This forces the catch out through the grommet.

21.3 To remove the grommet, cut away the inner edge of the grommet with a twist drill. The grommet will eventually fall away in two parts. When using the drill, take care not to damage or enlarge the hole in the cowling in any way. The size of the drill required for the various sizes of catch is shown in Table 2.

22 When the defective catch has been removed, a new catch should be fitted as described in para. 13 to 18.

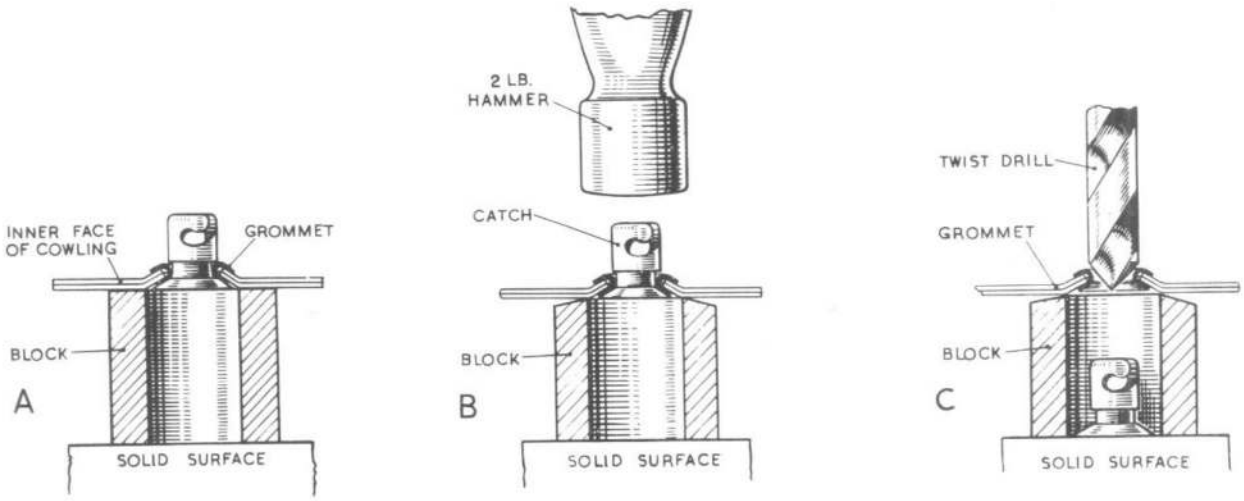


Fig.10 Removing catch and grommet

Spring

23 If a spring is distorted or damaged in any way, it should be replaced by a new one of the same type. To remove a broken spring, the rivets should be drilled out with a drill of the same diameter as the rivets, and the new spring should be riveted in position as described in para. 13.

Chapter 3

ODDIE FASTENERS

CONTENTS

Introduction

1 Oddie fasteners (Ref. No. 27H/-) are used to secure engine cowlings, fairing panels, and similar sheet metal components requiring repeated and rapid attachment on aircraft, airborne equipment, and ground equipment. The use of the fasteners on aircraft external cowlings or panels is restricted to small inspection doors of not more than 0.14 m^2 (1.5 ft^2) area and with curvatures of not more than 20 deg. included angle.

DESCRIPTION (fig.1)

2 Each fastener consists of a central stud, a rubber washer or coil spring, and a two-bladed spring clip. The spring clip is riveted to the underside of the structure at the point where the fastening is to be made.

3 Fasteners are available in standard, midget and atom sizes. The standard and midget studs may be either wing-, dome- or flush-headed, but the atom studs are made with dome heads only.

4 The atom fasteners are designed for very light duties, and its application is therefore limited to lightly-stressed and easily-handled parts.

5 The centre stud is made of mild steel with a rustproof coating and is undercut below the head to accommodate the rubber washer or coil spring, which retains the stud in its panel and absorbs vibration. The tapered end of the stud is recessed at each side to form grooves, which, in the locked position, engage with the spring blades. On earlier type studs the shoulders formed at the bottom of these grooves were 45 deg. to the axis of the stud, but on later types this angle has been increased to 90 deg. to give a more positive lock. The later type stud is fully interchangeable with the earlier

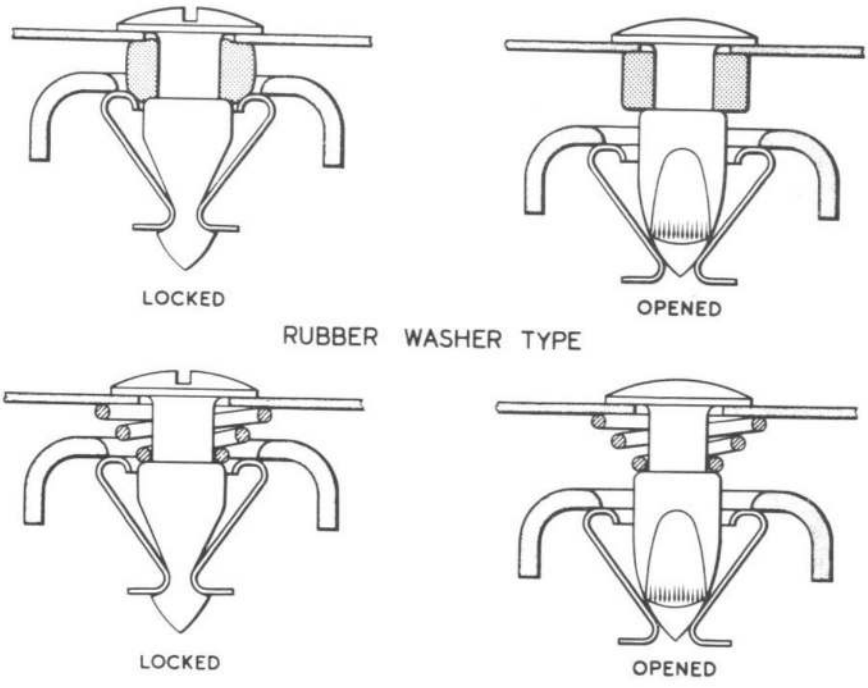


Fig.1 Assembly of Oddie fastener

type and should be used whenever replacement is necessary.

6 The studs may have the following types of heads:-

6.1 Dome head, generally used for panels from the engine cowling to the tail plane fairing.

6.2 Flush head, for use where a flush surface is required; e.g. the upper surface of a main plane,or gun access doors on the upper wing surface.

6.3 Wing type head,used for a large variety of applications but chiefly at internal stowage positions.

7 The rubber washer, which is spaced between the panel and the mounting, reduces vibration and chatter to a minimum; similarly, the coil spring is used for positions where excessive heat is encountered.

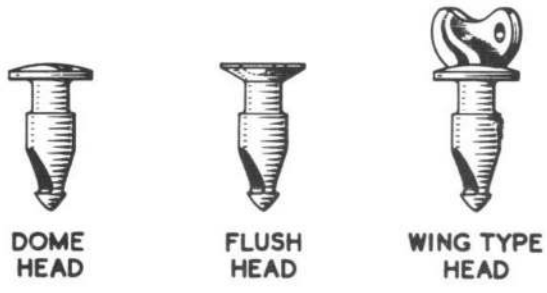


Fig.2 Types of head

8 The spring clips are made from rust-proofed spring steel, and are held in position on the mounting member by two light-alloy rivets. In the centre of the clip is a clearance hole through which the stud is inserted so that the spring blades engage in the grooves on the tapered end of the stud (fig.2)

9 The studs standardised for general use on aircraft and airborne equipment are listed in Table 1.

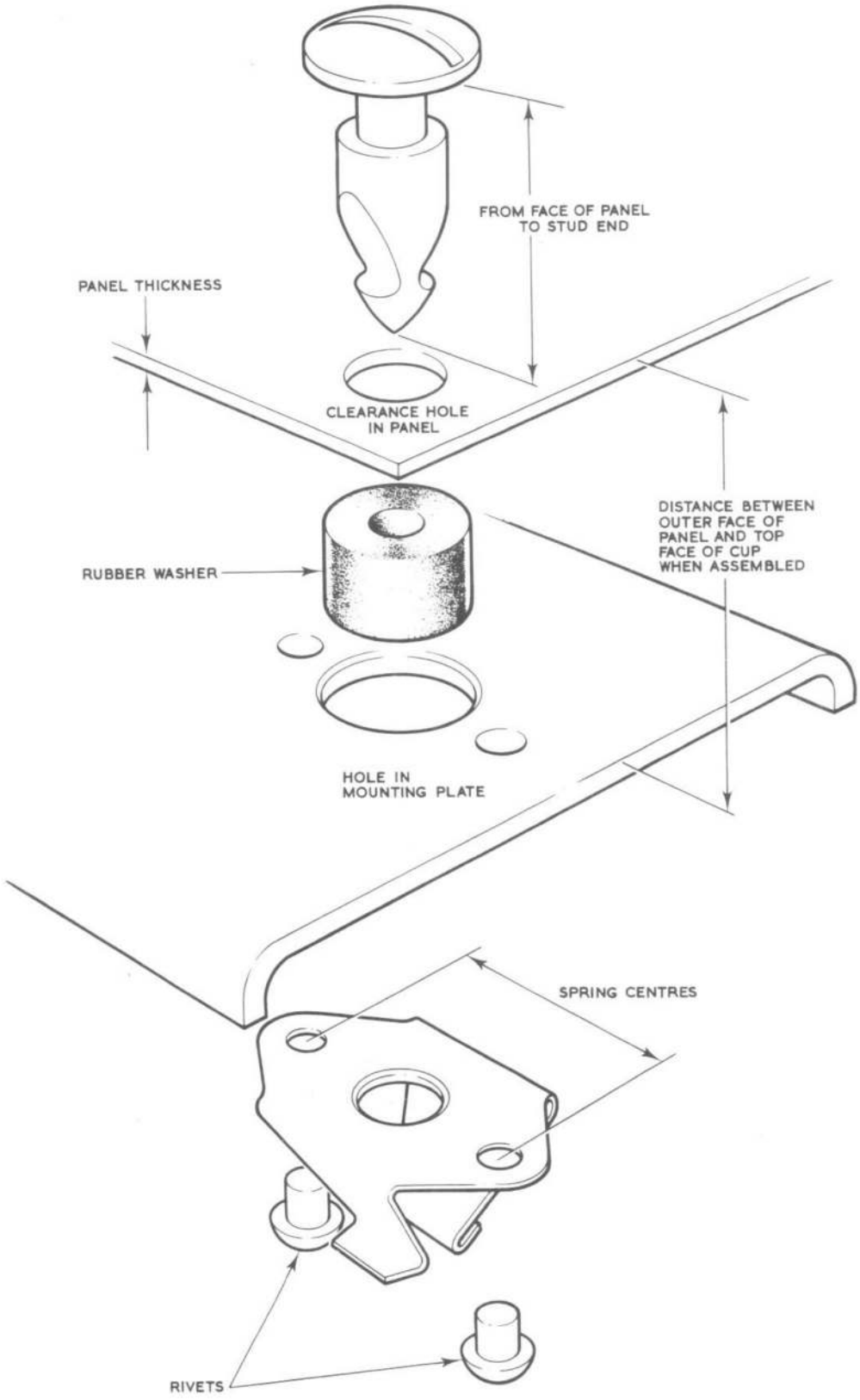


Fig.3 Exploded view of Oddie fastener

TABLE 1 TYPES OF STUDS

Ref. No.	Description	Design Drawing No.
27H/2578	Midget $\frac{1}{4}$ in dome head	213/2
27H/2581	Midget $\frac{1}{4}$ in flush head	217/2
27H/2587	Standard $\frac{3}{8}$ in dome head	204/5
37H/2591	Standard $\frac{3}{8}$ in flush head	211/2

INSTALLATION

10 To ensure the correct functioning and use of the fasteners, it is essential that all installation data and dimensions are strictly adhered to; correct alignment between the stud and the spring clip is most important.

11 The essential dimensions for the installation of various types of these fasteners are given in Table 2. The maximum dimensions given for the various assemblies between the top face of the clip and the top or outer face of the panel, must not be exceeded and is always to be kept on the minus side of these dimensions to obtain secure engagement of the studs in the spring clips.

12 It should always be possible to engage the fasteners by finger-pressure only, and there must be an audible click as the stud engages, indicating that it is locked. If the click is not heard, then the installation is incorrect and the condition should be rectified.

13 A screwdriver blade or similar tool may be used to unlock the fastener by turning the head through 90 deg. When unlocked it is advisable to turn the head 90 deg. back again to its original position ready for assembly.

Marking of locked position

14 The locked position of each cowling or skin-panel fastener must be clearly marked by lines painted on the cowling or panel. A line $\frac{1}{8}$ in wide by $\frac{1}{2}$ in long must be painted on each side of the fastener in line with the screwdriver slot when the fastener is in the locked position. Black or white paint, whichever shows more clearly against the colour scheme of the aircraft, must be used for these markings.

WARNING ...

IT MUST NEVER BE ASSUMED THAT, BECAUSE THE MAJORITY OF THE INDICATING LINES ARE IN ONE DIRECTION (NORMALLY FORE-AND-AFT), THEY ARE THE SAME FOR ALL THE FASTENERS ON THE AIRCRAFT. IN SOME INSTANCES, PARTICULARLY ON WING GUN PANELS, THEY ARE AT RIGHT ANGLES TO THE NORMAL DIRECTION. EACH FASTENER MUST BE CAREFULLY EXAMINED TO ENSURE THAT THE INDICATING LINES DO, IN FACT, CORRESPOND TO THE POSITION OF THE SCREWDRIVER SLOT WHEN THE FASTENER IS IN THE LOCKED POSITION.

REMOVAL OF FASTENERS

15 To release the stud from its mounting, the rubber washer at the inner side of the panel should be removed; the stud can then be easily slipped out. To remove the spring clips, the rivets in the structure should be drilled out and new rivets and spring clips fitted, the same rivet holes being used.

TABLE 2 INSTALLATION DATA

Description (fig.3)	Atom	Midget		Standard	
	Dome head	Dome head	Flush Head	Dome Head	Flush head
Panel thickness (in)	0.065	0.065	0.065 dimpled 0.10 max	0.10	0.10 dimpled 0.15 max
Clearance hole in panel (in)	3/16 dia	1/4 dia	1/4 dia	3/8 dia	3/8 dia
Hole in mounting plate (in)	5/16 dia	15/32 dia	15/32 dia	5/8 dia	5/8 dia
Distance between outer face of panel and top face of spring clip when assembled (in)	0.15 max	0.17 max	0.21 max	0.26 max	0.31 max
Dia. of light alloy rivets for spring clip (in)	1/16	3/32	5/32	1/8	1/8
Recommended pitch of fasteners per inch run (in)	1 to 2	2 to 4	2 to 4	6 to 10	6 to 10
Distance from top face of panel to end of stud (in)	0.475	0.70	0.77	0.95	1.04
Distance of rivet hole centres on clips (in)	0.50	0.69	0.69	1.000 min 1.062 max	1.000 min 1.062 max

Chapter 4

AMAL FASTENERS

CONTENTS

LEADING PARTICULARS

Amal fastener Type 249/1 (short)	
Thickness of materials to be fastened	3/16 in max.
Material	Steel with rustproof finish
Length of body	27/32 in
Body diameter	1/2 in
Weight	0.83 oz approx
Amal fastener Type 249/2 (long)	
Thickness of materials to be fastened	3/8 in max.
Material	Steel with rustproof finish
Length of body	1 3/32 in
Body diameter	1/2 in
Weight	0.89 oz approx
Back anchor plates (all types)	
Thickness	0.048 in
Rivet holes (if applicable)	3/32 in dia
Weight	0.31 oz approx

Note ...

The cotters and click washers are interchangeable between the long and short types but the springs and locking screws are not interchangeable.

Introduction (fig.1)

1 The Amal fasteners, Type 249, are used for the attachment of inspection panels or cowlings to the airframe and fuselage. The fasteners are

flush-fitting and are supplied in two sizes, a short body Type 249/1, and long body Type 249/2.

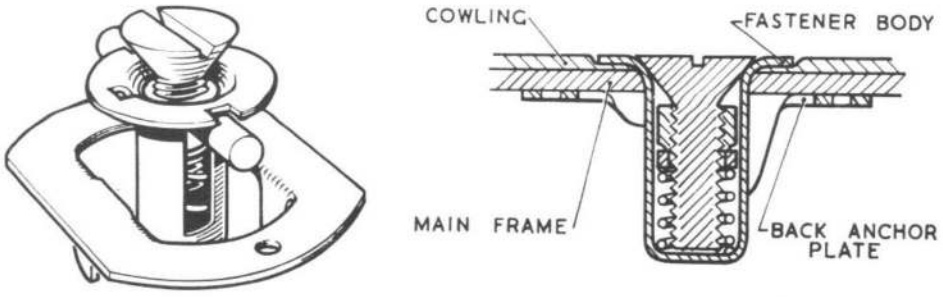


Fig.1 Amal fastener, Type 249

2 The fastener is usually supplied assembled, and has to be dismantled before it can be fitted on the cowling. No rivets are required for its attachment. The back anchor plate with which the fastener engages may be either riveted or welded to the frame. The fastener is so constructed that it allows a misalignment between the body and the back anchor plate of 1/8 in in any direction.

DESCRIPTION

3 The construction of both types of fastener is identical except for the length of some of the components. The description in the following paragraphs therefore applies equally to the long and the short types.

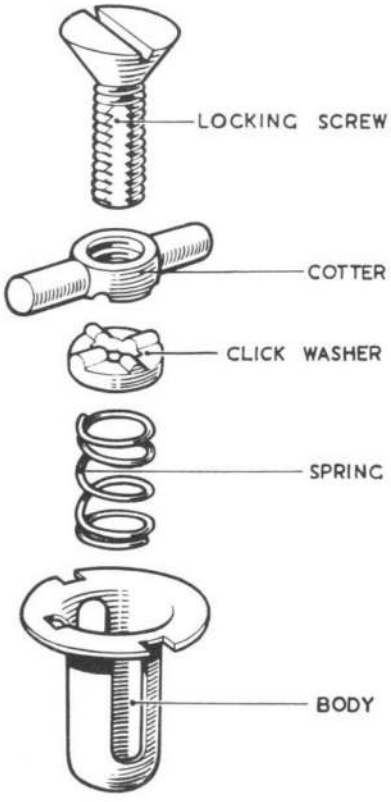


Fig.2 Exploded view of fastener

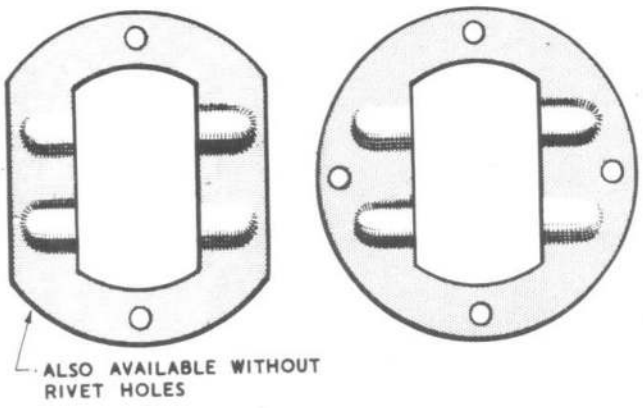
Fastener (Fig.2)

4 An exploded view of the fastener is shown. The spring is placed inside the body with the click washer on top. The cotter is fitted with its arms extending through the slots in the body and its serrated face engaging the washer. The cotter is pressed upwards by the spring and is free to move downwards, only when the spring is compressed by downward pressure on the locking screw.

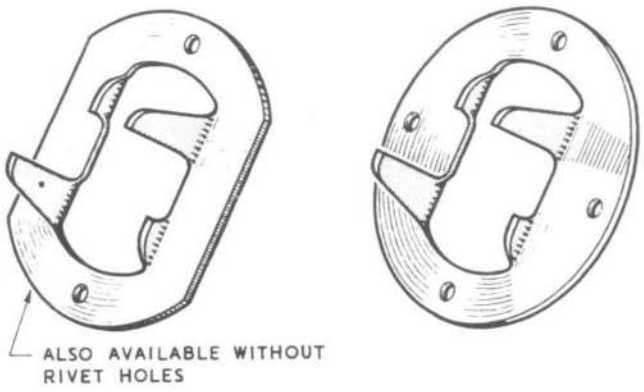
5 The locking screw is assembled through the cotter and the click washer. The screw has a two-start thread to give quick operation. Flats are machined on the screw to fit those on the washer which is thus locked to the screw and rotated by it. The serrated faces of the cotter and the washer provide a locking action when they are engaged.

Back anchor plates (Fig.3)

6 The fasteners can be used with any of the various back anchor plates. The plates may be either riveted to the main fairing or welded to a member of the airframe. Four projections or lugs are formed on the plate, one diagonal pair being slightly lower than the other so that the cotter may pass more easily over them when the fastener is being locked or unlocked.



OLD TYPE



NEW TYPE

Fig.3 Types of back anchor plate

Action of fastener

7 When the fastener and its back anchor plate are engaged the cotter is pressed against the underside of the back anchor plate. The projections on the plate prevent the cotter from moving more than about 1/8 in. The head of the locking screw is flush with the flange on the body of the fastener.

8 To release the fastener, the locking screw is screwed outwards for about two half-turns. This raises the screw head, so that it can be pressed downwards against the spring, carrying the cotter with it. The cotter is now free of the projections on the back plate, and the fastener is freed by a quarter turn counter-clockwise. The fastener is not rigidly attached to the cowling, but it cannot fall out because the cotter extends beyond the hole in which the fastener is mounted.

INSTALLATION

Fastener

9 The fastener is usually supplied assembled and it must be dismantled before it is fitted to the cowling. The cowling panel should be pierced with a 1/2 in diameter chamfered clearance hole to take the fastener body. If the fastener is to be flush-fitting, the hole should be counterbored to suit the flange on the body.

10 Prior to being fitted, the fastener should be dismantled as follows:-

10.1 Remove the locking screw.

10.2 Insert a thin bar between the click washer and the cotter, and compress the spring.

10.3 Turn the cotter through 90 deg. and withdraw it through the slots in the body.

11 When the fastener has been dismantled, it should be assembled as follows through the hole prepared in the cowling:-

11.1 Insert the body of the fastener through the hole in the cowling.

11.2 Place the spring and the click washer inside the body with the serrations on the washer facing towards the flanged portion of the body.

11.3 Place a small screwdriver across the washer and press is down so that the spring is compressed.

11.4 Insert the cotter and turn it through 90 deg., taking care that the serrated face engages with that of the washer.

11.5 Screw the locking screw through the cotter. The fastener is now ready for use.

Back anchor plate

12 The back anchor plate may be either riveted to the main fairing or welded to a member of the frame. The rivet holes, if any, are 3/32 in diameter. The hole in the main fairing or frame member should be of the same size and shape as that on the back plate. The plate should if possible be so fitted that the cotter is in the line of flight position when the fastener is locked.

Marking of locked position

13 The locked position of each cowling or skin-panel fastener must be clearly marked by lines painted on the cowling or panel. A line 1/8 in wide by 1/2 in long must be painted at each side of the fastener in line with the slots (or embossed projections) on the flanged portion of the body when the fastener is in the locked position. Black or white paint, whichever shows more clearly against the colour scheme of the aircraft, must be used for these markings.

14 There are two slots (or two embossed projections) on the outer edge of the flanged portion of the fastener body (fig.2). These are in line with the cotter and always indicate its position (fig.1). With the fastener in the locked position, i.e. with the cotter between the projections or lugs on the anchor plate, the indicating marks are to be painted in line with the

two slots (or embossed projections) in the flanged portion of the fastener body.

15 It is emphasised that the fastener is correctly locked only when the slots (or embossed projections) in the flanged portion of the body coincide with the lines painted on the cowling, and when the locking screw has been tightened. The screw must be tight irrespective of the position of the screwdriver slot in relation to the painted lines.

WARNING ...

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INSTRUCTIONS FOR USE

16 To lock the fastener in position, a screwdriver should be inserted in the slot of the locking screw, pressed firmly down, and turned a quarter turn clockwise. This brings the cotter into place between the projections on the anchor plate. The fastener should then be screwed up. Extreme force is not necessary, and the use of a square-ended screwdriver about 4-5 in long should be sufficient.

17 To release the fastener, the locking screw should be screwed out for about two half-turns, pressed firmly inwards, and turned a quarter turn counter-clockwise. This disengages the cotter from the projections on the anchor plate and allows the cowling to spring free.

18 An additional screwdriver slot is provided in the body to enable a screwdriver to be engaged with the locking screw and the body at the same time. This is to overcome any extra friction caused by extreme misalignment or by a badly fitting cowling. For normal operation, the screwdriver should be inserted only in the slot in the locking screw.

FAULTY OR DAMAGED FASTENERS

19 If a fastener becomes damaged or broken, it should be dismantled and removed as described in para.10. A new fastener of the appropriate type should then be fitted in its place.

Chapter 5

FAIREY FASTENERS

CONTENTS

Introduction

1 Fairey fasteners are used on aircraft for the attachment of cowlings and other sheet-metal components. The fasteners are flush-fitting and are riveted to the detachable cowling. There are four types of fastener. Types 1 and 2 are similar in working principle, but the Type 1 is longer and is suitable for direct engagement in an elongated hole in the main member, whereas the Type 2 engages in a catch plate riveted to the member. Types 3 and 4 are similar to one another, the main difference being in the latch and catch fittings, which makes the Type 4 suitable for small doors and panels without hinges.

2 The height of the Type 1 fastener can be adjusted between 0.74 in and 0.95 in to suit the particular application. The maximum height of the Type 2 fastener is $\frac{1}{2}$ in and this can be adjusted by three or four steps of 0.019 in each. The Type 3 fastener has a plain latch which abuts a catch fitting; the latch on the Type 4 fastener is shaped to engage a lip on the catch fitting.

FASTENERS TYPES 1 AND 2

DESCRIPTION

Fastener Type 1 (Fig. 1, 2 and 3)

3 The fastener, Type 1 is riveted on the cowling and engages with an elliptical hole in the frame member to which the cowling is attached. Fig.2 shows the fastener riveted on the back of the cowling with the rivets in tension, and fig.3 shows the fastener mounted on the front of the cowling. With the latter method of mounting, the cowling is dished to take the fastener housing and a cover plate is fitted over the head of the fastener.

4 The fastener, which is made of steel with a rust-proof finish, has a flanged housing which is riveted to the removable cowling. The body of the housing is spherical and provides the seating for the head of the fastener bolt. The purpose of the spherical seating is to allow for any misalignment between the cowling and the inner member. A cotter, which engages in the hole in the main frame, is screwed on to the threaded end of the bolt.

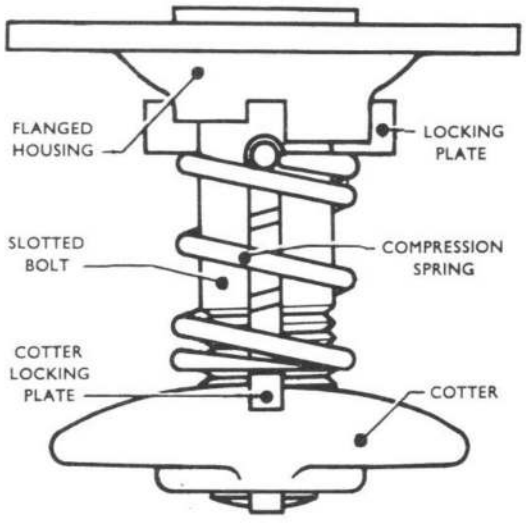


Fig.1 Fairey fastener Type 1

5 The ends of the bolt are slotted axially the slots being at an angle of 90 deg. to one another. Locking plates are fitted in the slots and are held apart by a compression spring. One plate engages with locking slots on the housing and the other with adjustment slots on the cotter. The length of the fastener can be adjusted in steps of 0.019 in within a range of about $\frac{1}{4}$ in.

In other words, if the spring is depressed so that the locking plate is disengaged from the cotter, the cotter can be screwed along the bolt and re-locked in its new position.

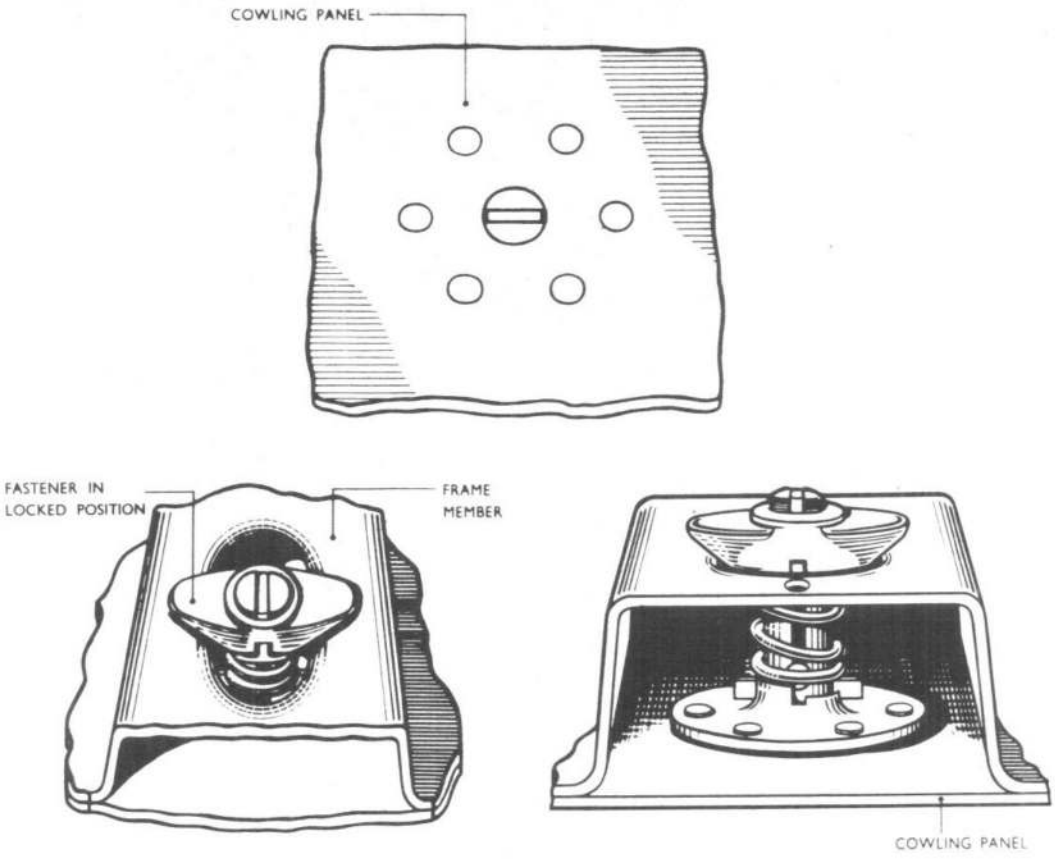


Fig. 2 Fastener, Type 1 mounted on the back of the cowling

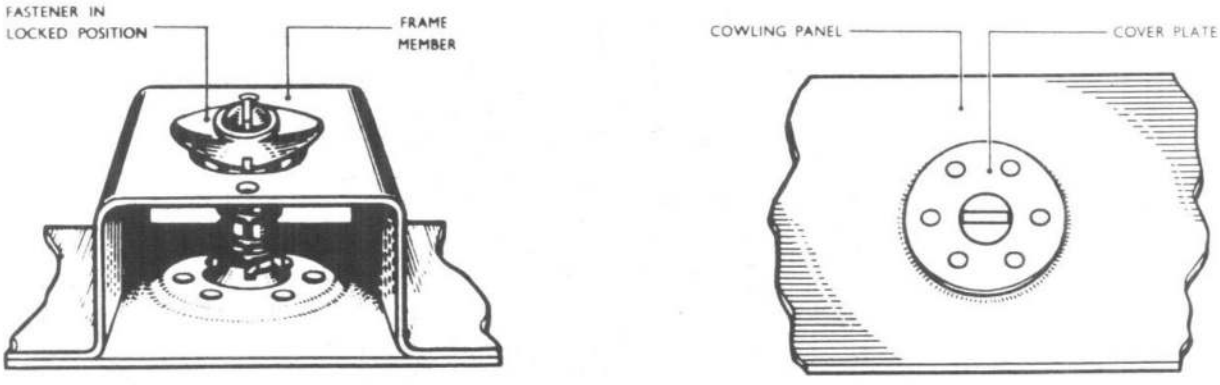


Fig. 3 Fastener, Type 2 mounted on the front of the cowling

6. The cotter itself is elongated in shape and engages with an elliptical hole in the main frame. To lock the fastener in position, the cotter is passed through the hole and turned through 90 deg. so that the major axis of

the cotter lies on the minor axis of the elliptical hole (fig. 2). The contact faces of the cotter are tapered and act as wedges to clamp the cowling in position. The locking plate engages with the slots in the housing and so locks the bolt rigidly. When the fastener is locked, the top of the locking plate is level with the top of the bolt, but when the fastener is in the unlocked position, the top of the plate is depressed below the level of the bolt.

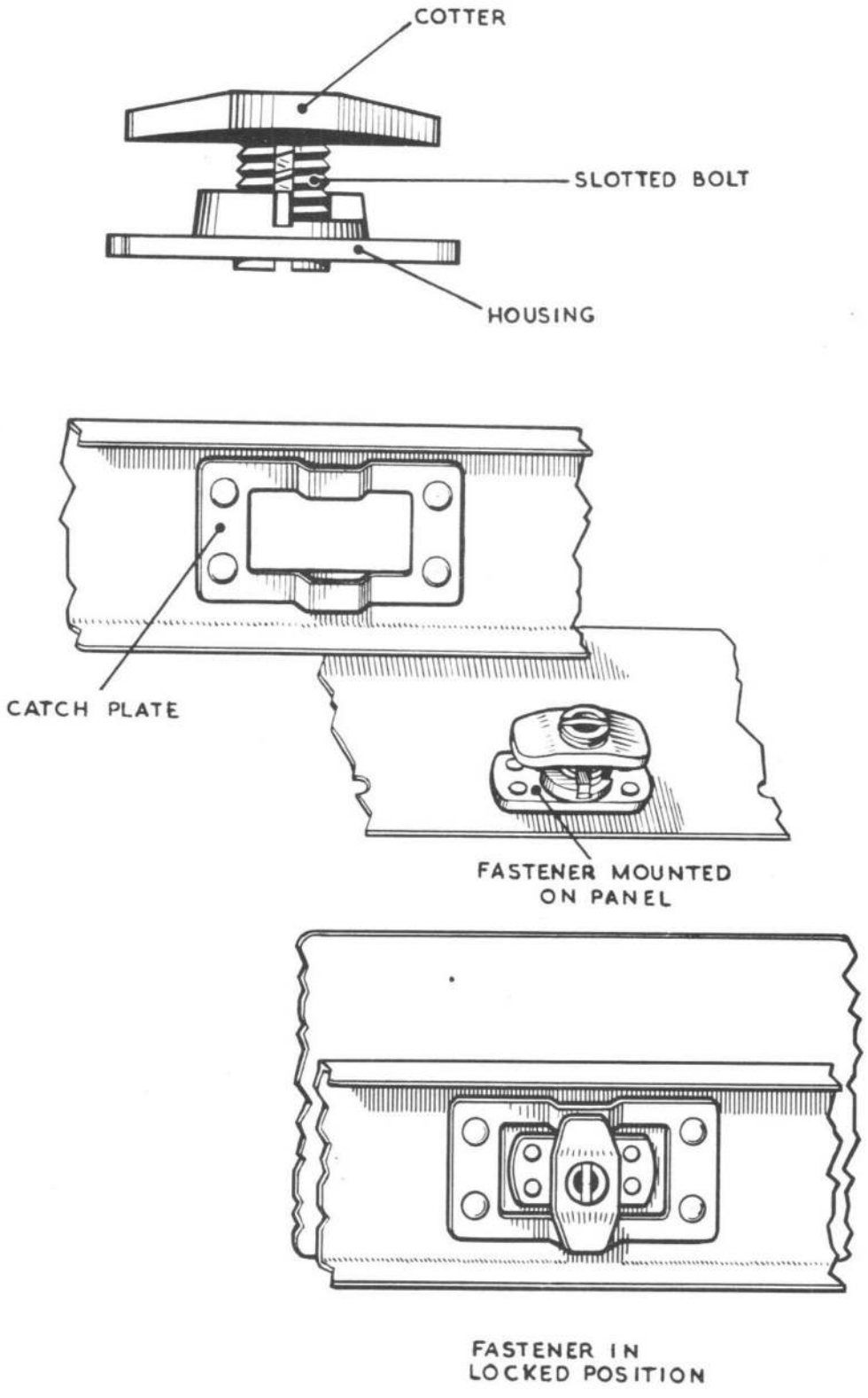


Fig. 4 Fastener, Type 2

Fastener, Type 2 (Fig. 4)

7 The fastener, Type 2 is smaller than the Type 1, but is constructed on exactly the same principle except that instead of engaging with an elliptical hole it engages with a catch plate riveted on the inside of the main frame.

INSTALLATION AND ADJUSTMENT

Fastener, Type 1 (Fig. 5, 6 and 7)

8 The fastener, Type 1, may be fitted on either the back or the front of the cowling panel. Fig. 5 shows the method of mounting a fastener on the back of a panel, and fig. 6 shows an alternative method by which the fastener is mounted on the front of the panel in a recessed hole. This method should be used where the rivets must not be in tension, and it should be noted that a cover plate is fitted over the head of the fastener.

Note ...

The fastener should, where possible, be so mounted that the screwdriver slot on the bolt is parallel to the line of flight when the fastener is locked.

9 All information required for making the elliptical hole is shown in fig.7.

10 To adjust the length of the fastener, the cotter locking plate should be pressed down with a small screwdriver until it is free of the locking slots, and the cotter should then be screwed inwards or outwards as necessary. One half turn gives a movement of 0.019 in and the range of adjustment is about $\frac{1}{4}$ in.

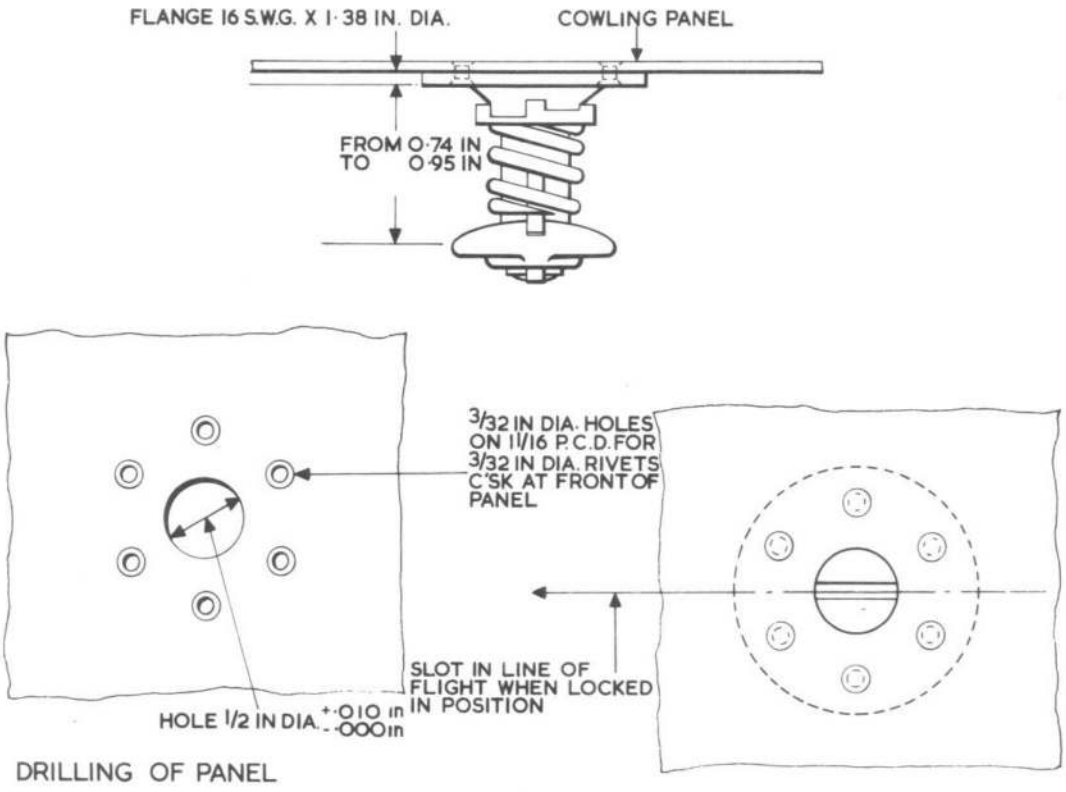


Fig. 5 Mounting a fastener, Type 1, on the back of the cowling

Fastener, Type 2

11 The fastener, Type 2, is riveted at each corner of its housing to the back of the panel. Rivets $\frac{1}{8}$ in diameter should be used. A rectangular hole is cut in the main frame member and the catch plate riveted to the back of it as shown in fig. 4.

12 The method of adjusting the Type 2 fastener is the same as for the Type 1. The maximum height is $\frac{1}{2}$ in and it can be reduced by three or four steps of 0.019 in each.

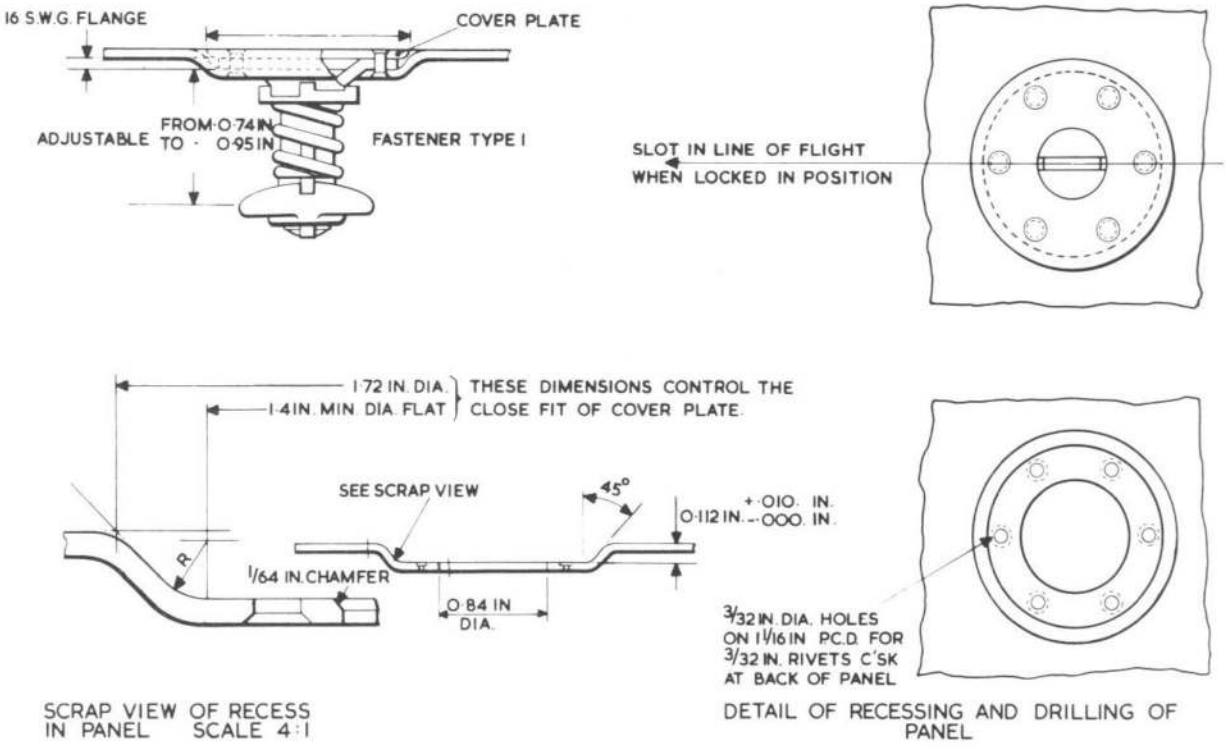


Fig. 6 Mounting a fastener, Type 1, on the front of the cowling

Marking of locked position

13 The locked position of each cowling or skin-panel fastener must be clearly marked by lines painted on the cowling or panel. A line $\frac{1}{8}$ in wide by $\frac{1}{2}$ in long must be painted on each side of the fastener in line with the screwdriver slot when the fastener is in the locked position. Black or white paint, whichever shows more clearly against the colour scheme of the aircraft, must be used for these markings.

WARNING ...

IT MUST NEVER BE ASSUMED THAT, BECAUSE THE MAJORITY OF THE INDICATING LINES ARE IN ONE DIRECTION (NORMALLY FORE-AND AFT), THEY ARE THE SAME FOR ALL THE FASTENERS ON THE AIRCRAFT. IN SOME INSTANCES, PARTICULARLY ON WING GUN PANELS, THE ARE AT RIGHT-ANGLES TO THE NORMAL DIRECTION. EACH FASTENER MUST BE CAREFULLY EXAMINED TO ENSURE THAT THE INDICATING LINES DO, IN FACT, CORRESPOND TO THE POSITION OF THE SCREWDRIVER SLOT WHEN THE FASTENER IS IN THE LOCKED POSITION.

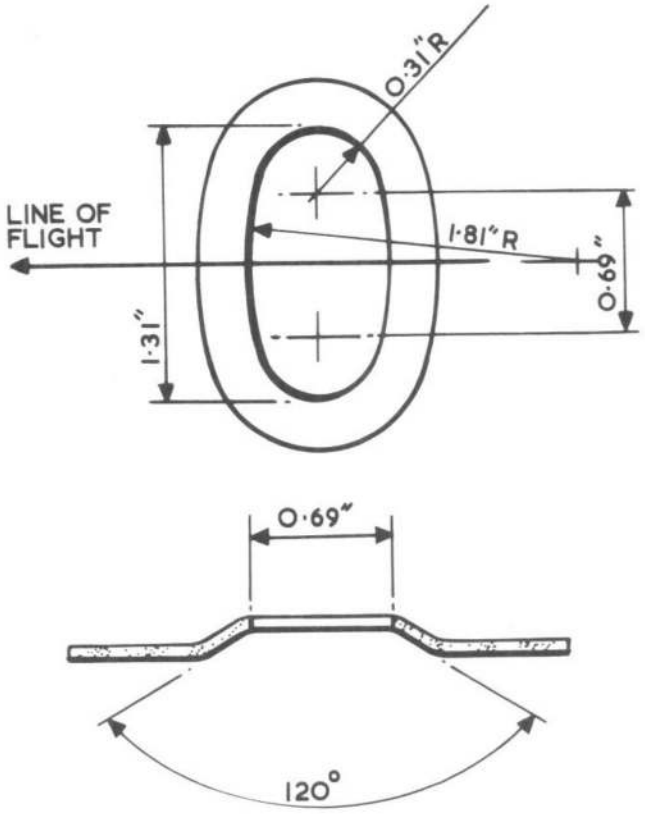


Fig. 7 Preparing the elliptical hole

OPERATION

Locking

14 To lock the fasteners in position, the cowling should be held against the main frame member so that the cotters pass through their engagement holes. Each fastener should then be locked as follows:-

14.1 Insert a screwdriver in the slot on the head of the bolt.

14.2 Press the screwdriver down to force the locking plate out of the slots on the housing.

14.3 Turn the bolt (and so the cotter) through 90 deg. in a clockwise direction so that the screwdriver slot is in line with the indicating marks.

14.4 When the screwdriver is withdrawn, the locking plate engages with the slots in the housing and the bolt is locked in position. The top of the locking plate should be flush with the head of the bolt.

Unlocking

15 To unlock the fastener, a screwdriver should be inserted in the bolt head and pressed firmly downwards to disengage the locking plate. The bolt should then be turned through 90 deg. counter-clockwise to release the fastener.

Damaged or faulty fasteners

16 Any damaged or faulty fasteners should be replaced by new ones. The rivets holding the defective fasteners should be carefully drilled out with

an $\frac{1}{8}$ in or a 3/32 in drill as appropriate and new fasteners should be fitted as described in para. 8 to 13.

FASTENERS, TYPES 3 AND 4

DESCRIPTION

Fastener, Type 3 (fig. 8)

17 The Type 3 fastener is suitable for small hinged doors and panels, and is not to be used for engine or similar main panels. It has a thumb tab which lies flush with the panel when the fastener is in the closed position, and is perpendicular to the panel when the fastener is open. The fastener is available with a range of thumb tabs of thicknesses to suit the material to which the fastener is fitted.

18 A channel-section housing is riveted to the panel and the thumb tab pivots about a tubular pivot pin between the sides of the channel. A hinge pin forms the pivot for a latch which is actuated by the crosspiece of a tee-bolt. The tee-bolt is screwed into a tapped hole in a toggle pin which is secured between the flanges on the inner part of the thumb tab.

19 A toggle spring is mounted on the toggle pin, one end bearing on the arm of the tee-bolt and the other end on the hinge pin. One end of the latch is shaped to receive the crosspiece of the tee-bolt, and the other end is shaped to abut the inner face of the adjacent airframe structure, which may be fitted with a catch fitting.

20 The tee-bolt can be screwed in and out of the toggle pin with a pair of long-nose pliers, thus enabling the latch gap to be varied between 0.02 in and 0.15 in. This enables the fastener to be adjusted to suit catch fittings of different thicknesses.

Fastener, Type 4 (fig. 8)

21 The Type 4 fastener is similar to the Type 3, the only difference being that the latch is shaped to fit over a lip on the catch fitting. This makes the fastener suitable for small doors and panels that are not hinged.

INSTALLATION AND ADJUSTMENT

Fastener, Type 3 (fig. 9)

22 The fastener is fitted to the inner face of the door or panel, which must be drilled and cut away as shown. A catch fitting for the latch to bear against is only fitted if the metal is not of sufficient strength to take the load imposed by the fastener. The fastener is designed for a maximum load of 113 kg (250 lb).

23 After installation the fastener should be adjusted to ensure that the latch abuts the catch fitting, as follows:-

23.1 Press the thumb tab inwards to unlock the fastener.

23.2 Open the panel or door sufficiently to gain full access to the fastener.

23.3 Grip the cross piece of the tee-bolt with a pair of long-nosed pliers.

23.4 Lever the cross piece of the tee-bolt from its recess in the latch and swing the latch clear of the cross-piece.

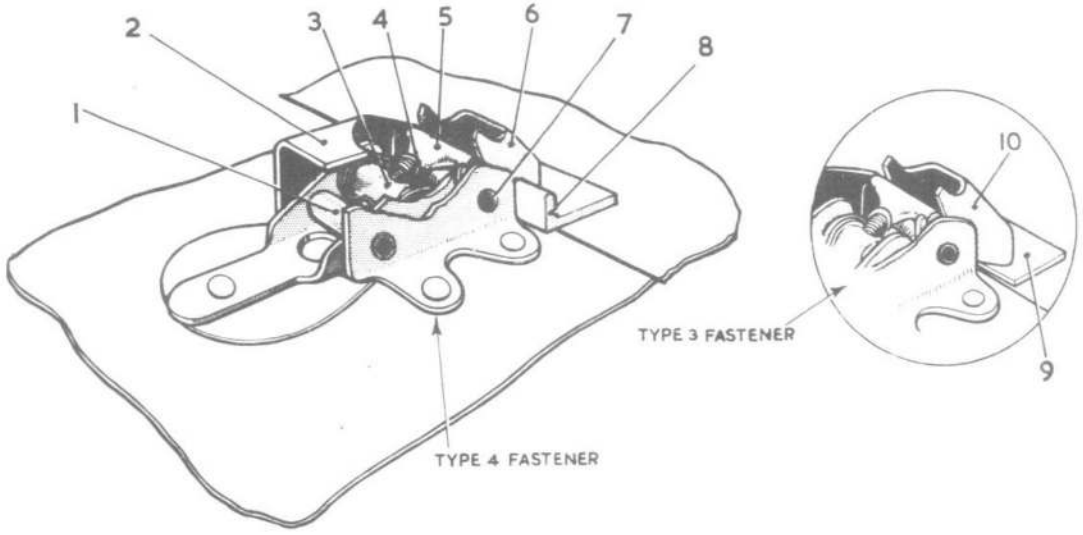


Fig. 8 Fasteners, Types 3 and 4

23.5 Turn the tee-bolt clockwise to increase the gap and counter-clockwise to decrease it.

23.6 Release the tee-bolt with the cross piece in the recess in the latch.

23.7 Close the door or panel, and lock it by pressing the narrow end of the thumb panel until the tab is flush with the surface of the door.

23.8 Check the fit of the door or panel and, if necessary, re-adjust the fastener.

Fastener, Type 4 (fig. 10)

24 The different catch fitting necessitates a slight difference in the mounting of the fastener, as shown in fig. 10. The method of adjusting the fastener is the same as for the Type 3 (para. 21). Adjustment should be made to suit the height of the catch fitting, i.e. for maximum height (0.28 in) the gap should be 0.11 in and for minimum height (0.22 in) the gap should be 0.03 in.

Note ...

On certain installations the latch gap may differ, and reference should always be made to the aircraft air publication to verify the correct clearance.

SERVICING

25 The fasteners Types 3 and 4 should be regularly examined for signs of wear, both to the fastener and to the catch fitting. If either part is excessively worn it should be renewed. The tee-bolt should be adjusted, if necessary, to compensate for wear on the catch fittings. All moving parts should be periodically lubricated with Grease, low temperature, XG-287, NATO Code No. G-354.

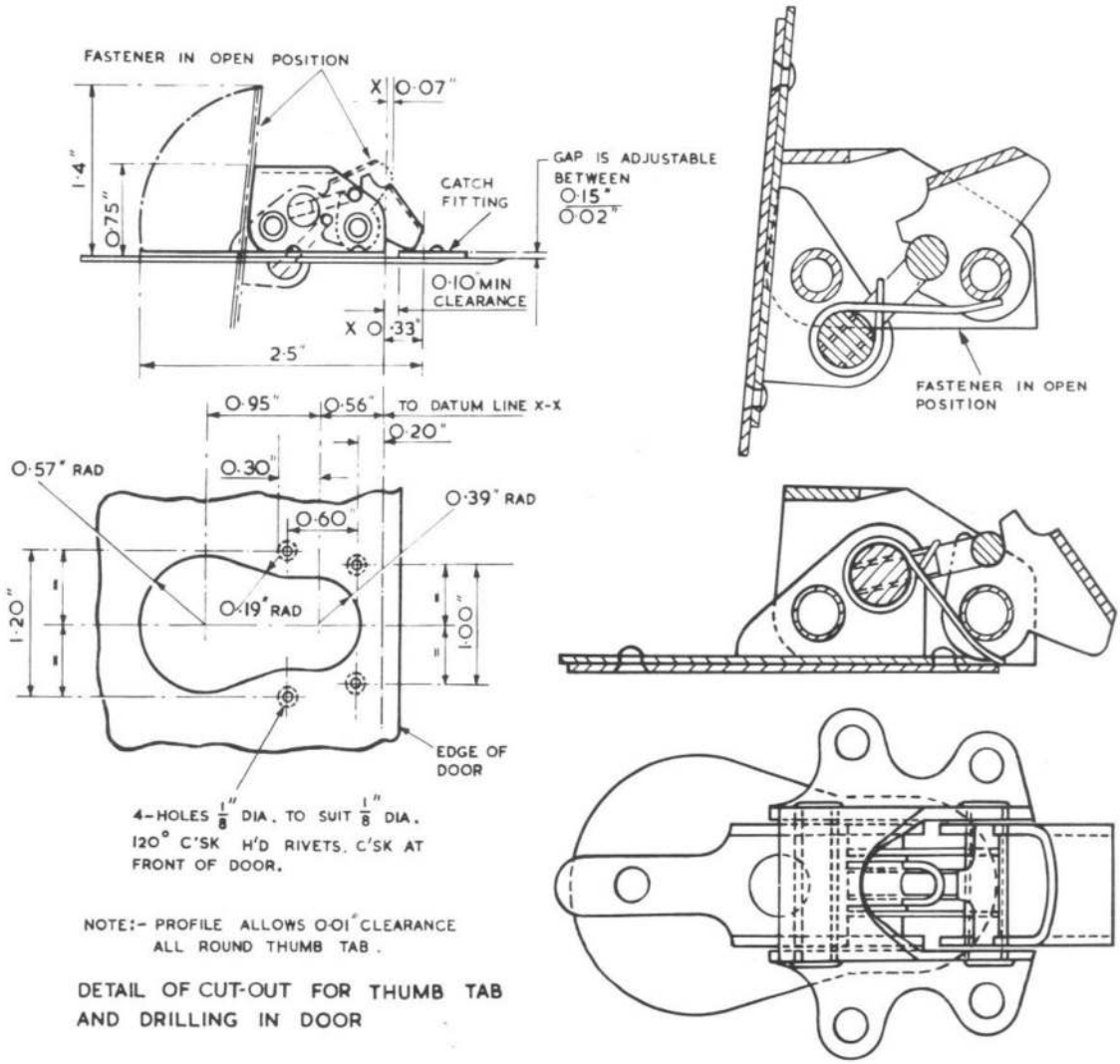


Fig.9 Fastener, Type 3

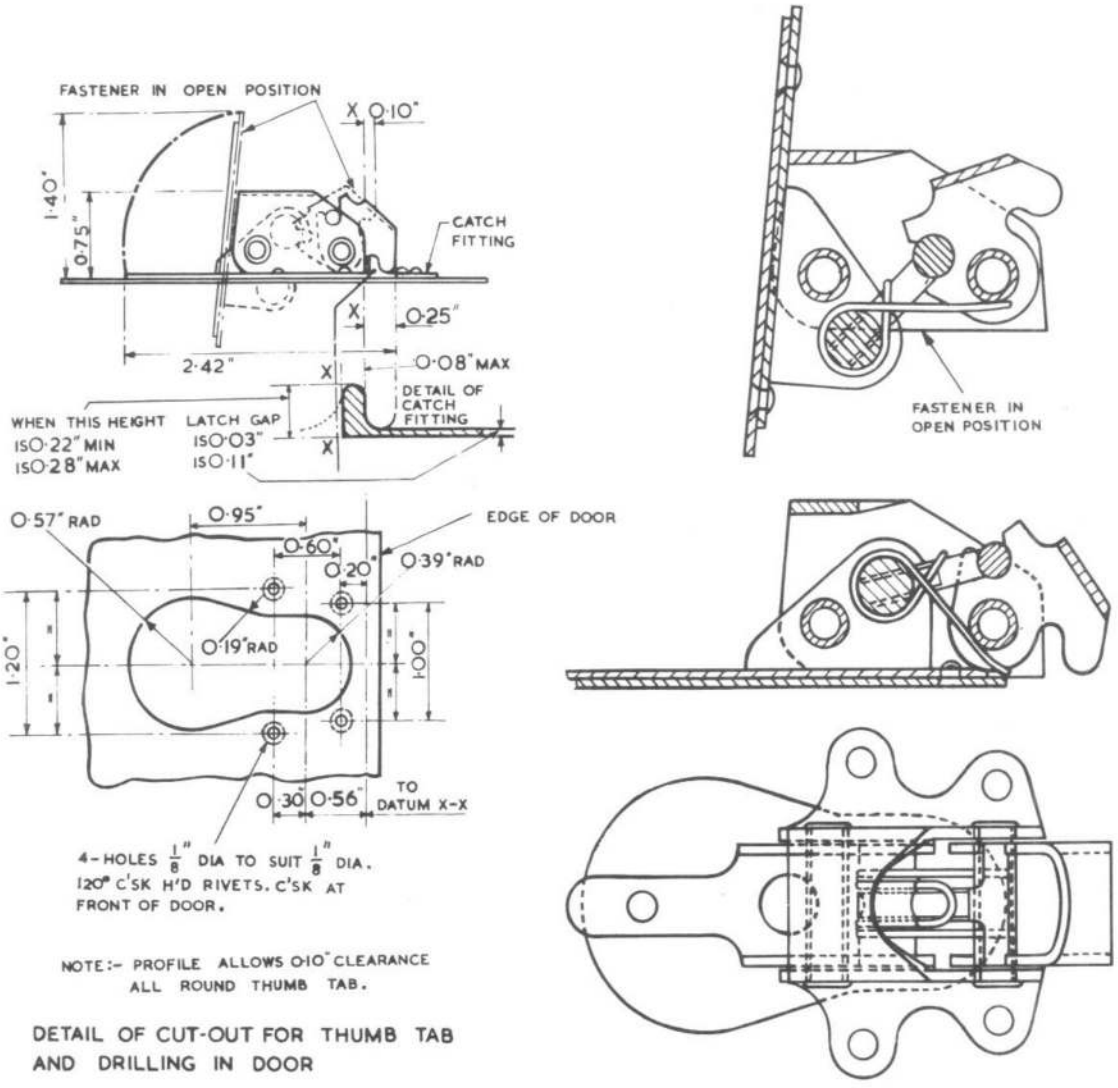


Fig.10 Fastener, Type 4

Chapter 6

HAWKER TOGGLE-TYPE PANEL FASTENERS

CONTENTS

Introduction

1 The Hawker toggle-type panel fastener is used to secure the larger sizes of detachable panels and cowlings, particularly where considerable pressure is likely to be exerted, either from the outside of the aircraft, or, as in the case of engine cowlings, from the inside.

DESCRIPTION

General

2 The toggle-type fastener consists of two major parts, a double-threaded adjusting link and fairing piece, and a toggle lever to which is attached a spring-loaded catch plate. The fastener is contained in a lower and an upper toggle housing, and is mounted in the lower housing so that it can be swivelled and locked into the upper housing. In general, the upper toggle housing is fitted into the detachable panel and the lower toggle housing is fitted to the component to which the panel is to be fastened, but the positions may be reversed.

Adjusting link and fairing piece (fig.1)

3 The adjusting link consists of two eye-ends connected together by a right-hand and left-hand thread adjuster bolt, the centre of which is hexagon shaped for spanner operation. At one end a fulcrum pin attaches the link to the toggle lever and at the other end a hinge-pin attaches it to the lower toggle housing. The fairing piece consists of a light-alloy plate riveted to a channel section which fits over the adjusting link and is retained in position by the fulcrum and hinge pins. Slotted holes are provided at one end of the channel section to allow movement of the hinge pin during adjustment. When adjusted the eye-ends are secured with locking wire.

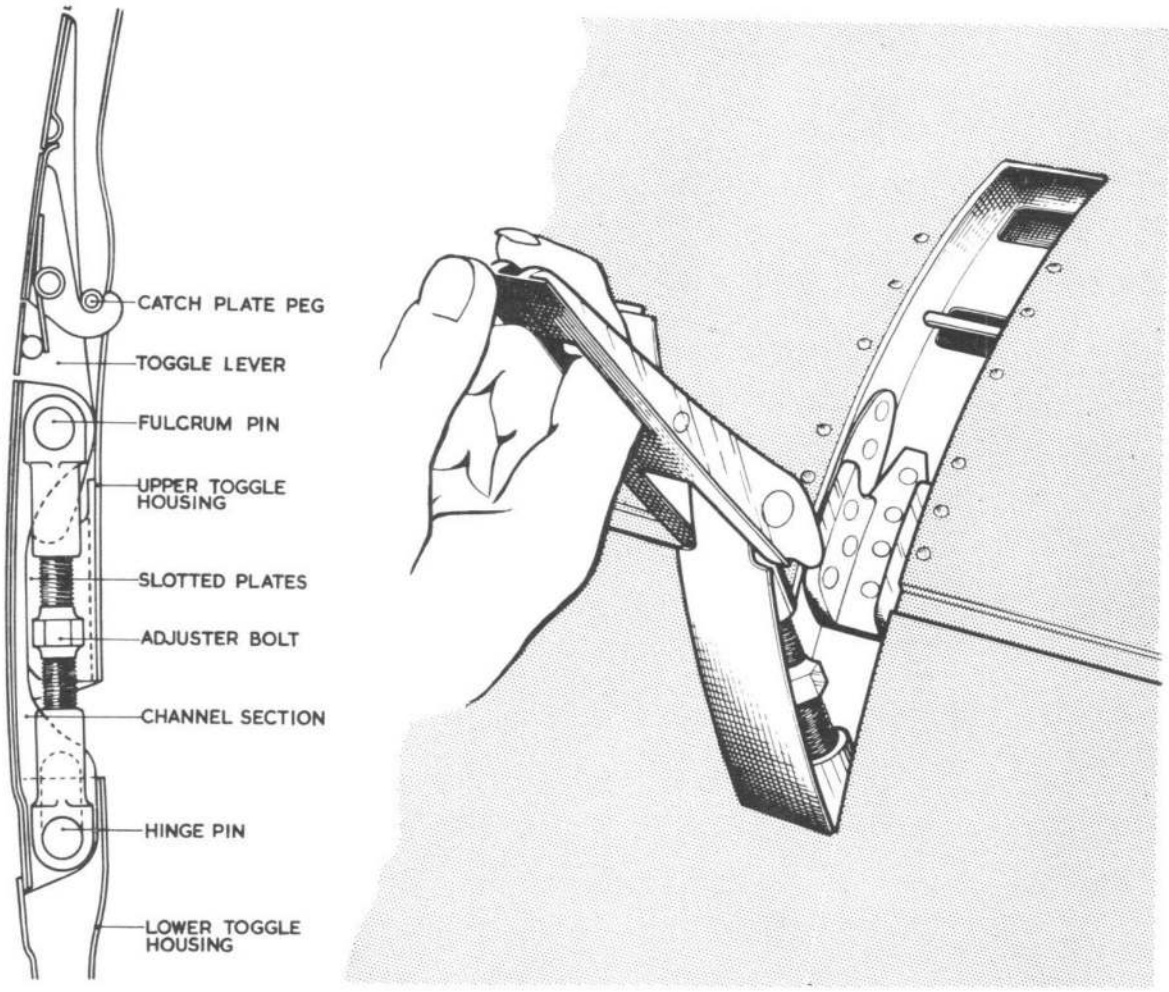


Fig.1 Hawker toggle-type panel fastener

Toggle lever and spring-loaded catch plate (fig.1)

4 The toggle lever is a steel channel section with its flanges tapered at one end, and shaped at the other end to form two lugs which fit into correspondingly shaped slotted plates riveted to the upper toggle housing. The lever is attached to the upper end of the adjusting link and fairing piece by the fulcrum pin. A rectangular slot is cut in the face of the toggle lever to accommodate the spring-loaded catch plate. This plate pivots at its lower end about a pin mounted across the toggle lever, and is spring-loaded so that it remains flush with the face of the toggle lever. Two hooks formed on the catch plate engage a peg fitted across the upper housing, when the fastener is in the locked position.

ACTION OF THE FASTENER (fig.2)

5 To close and lock the panel fastener, the lugs at the end of the toggle lever must be placed in the correspondingly slotted plates in the upper toggle housing, and the toggle lever pressed home, so that the fairing piece and toggle lever lie flush with the surface of the panel. The hooks on the catch plate will then engage the peg, full engagement being indicated by the return of the catch plate flush with the toggle lever. To open the fastener, depress the catch plate, with the finger, until the hooks disengage from the peg, and then pull out the toggle lever until it disengages from the upper housing.

ADJUSTMENT OF THE FASTENER

6 When new panels are fitted or existing ones adjusted, the toggle fasteners may be found to be either too tight or too slack, necessitating adjustment. It is essential that all fasteners on a panel are adjusted to give the same degree of tension, otherwise distortion of the panel is likely to result. When the tension of the fasteners on a panel is adjusted, the panel must first be held firmly in position by the outer fasteners, before the remainder of the fasteners are adjusted. The procedure for adjusting the fasteners is as follows:-

6.1 Remove the locking wire from the eye-ends on the adjuster bolt.

6.2 Rotate the adjuster bolt to increase or decrease the distance between the centres of the eye-ends, as required.

6.3 Check that the adjuster bolt is in'safety'at the inspection holes in both eye-ends.

6.4 Check that the full extent of the slots in the channel section attached to the fairing piece has not been taken up.

6.5 Replace the locking wire.

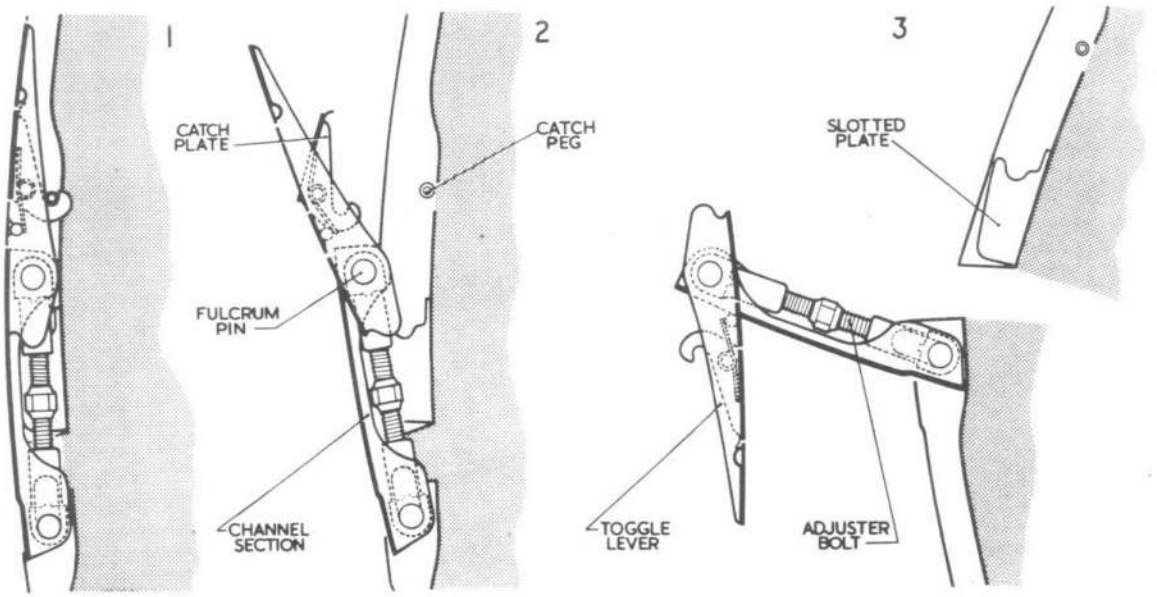


Fig.2 Action of the fastener

7 A regular check must be made to ensure that the lugs of the toggle lever of each fastener bear fully on the slotted plates in the upper toggle housing when the fastener is in the fully closed position. If it is found that the distance between the lugs on the toggle plate is insufficient to allow full bearing in the slotted plates, the distance should be increased by opening out the lugs between the fulcrum pin and the tips.

Chapter 7

K.A.C. TOGGLE-TYPE PANEL FASTENERS

CONTENTS

Introduction

1 The fasteners described in this chapter are all flush fitting fasteners used for securing aircraft panels and cowlings, and to facilitate their rapid removal and re-attachment. The three types are similar in design, the latter two being improved versions of the standard type, but not interchangeable with it. The Cam lever type and the Arctic type are interchangeable.

STANDARD TYPE FASTENER

DESCRIPTION

Housing (fig. 1)

2 The housing comprises a light-alloy rectangular casting in which a spring-loaded catch lever is fitted. At the open end of the housing, on the inner

faces, are riveted two fulcrum plates whose contours conform to those of the tips of the fulcrum lever.

3 The catch lever pivots about a hinge pin and a small coil spring, inserted between the lever and the back of the housing, returns it to the locked position with its finger plate flush with the surface of the housing. A distance piece, mounted across the housing in front of the catch lever, regulates its position and prevents it from being forced out of the housing.

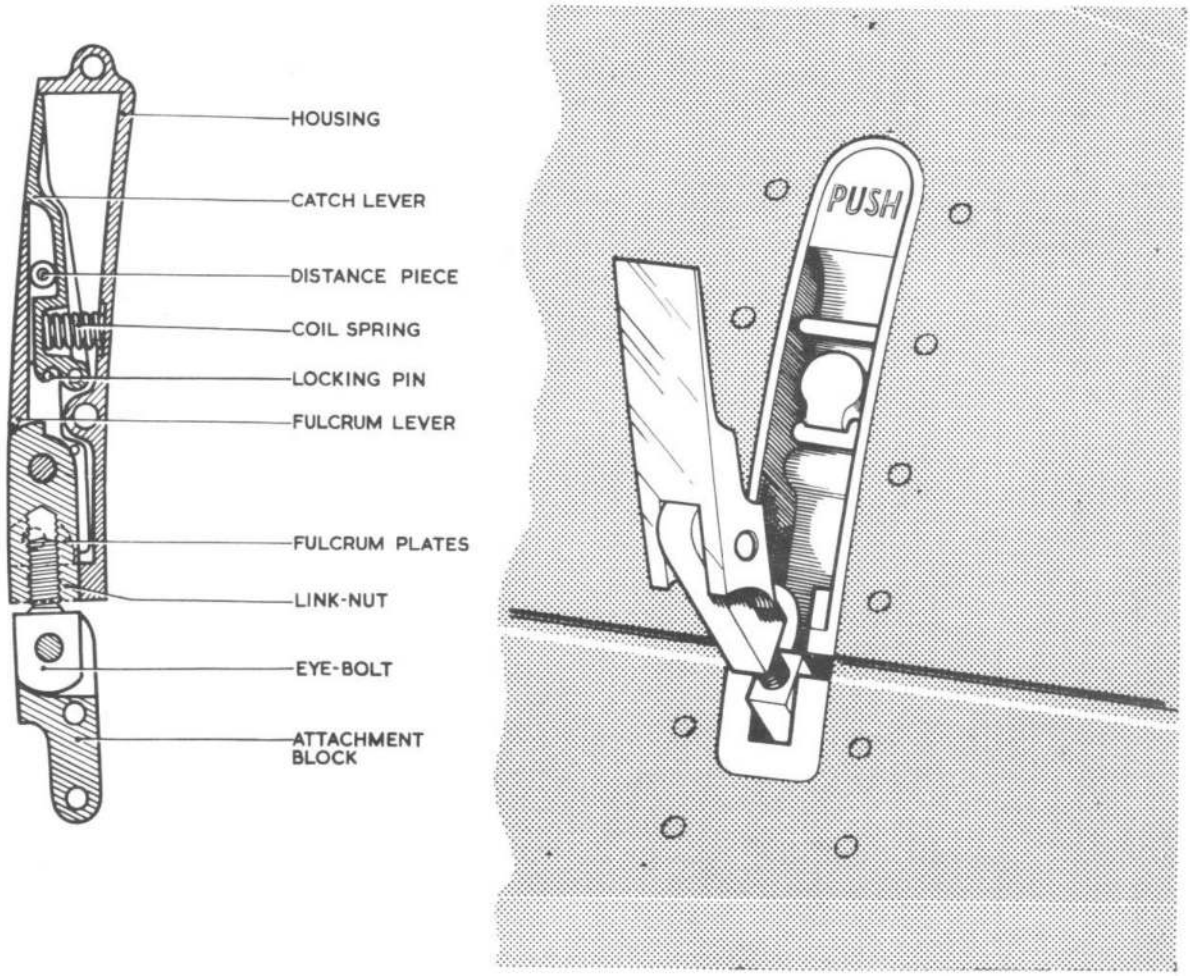


Fig.1 Standard type fastener

Fulcrum lever assembly

4 The fulcrum lever assembly, which is mounted in the opposite panel or cowling to that in which the housing is fitted, comprises an attachment block, and eye-bolt and link-nut, and fulcrum lever. The attachment block is a light-alloy and is secured in position by two bolts. Attached to the block by a hinge pin is the mild steel eye-bolt which is screwed into the link-nut, the link-nut in turn being attached to the fulcrum lever by a hinge pin.

5 The light-alloy fulcrum lever is of channel section at its inner end, and the tips of the flanges are radiused to fit over the fulcrum plates fitted in the housing. A locking pin fitted across the flanges of the fulcrum lever engages a lip formed on the catch lever when the fastener is in the closed position. The face of the fulcrum lever is so shaped that when the fastener is closed it will lie flush with the surface of the cowling or panel.

OPERATION (fig.2)

6 The panel or cowling should be placed in position and, if necessary, held there by another person, it being a two-handed job to lock each fastener. The fastener is locked as follows:-

6.1 Engage the tips of the fulcrum lever with the fulcrum plate and swing the lever into the position.

6.2 Depress the catch lever to the extent of its movement and press the fulcrum lever until it is flush with the panel.

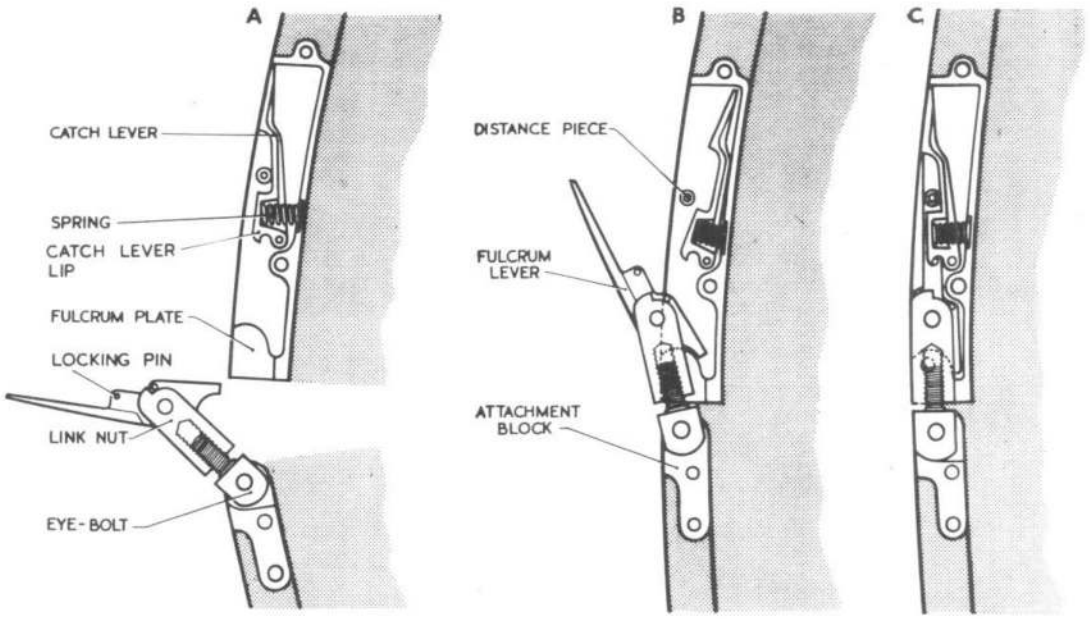


Fig.2 Action of the standard type fastener

6.3 Release the catch lever, the return spring of which will return it to the closed position, thus engaging the locking pin in the tips of the lever and locking the fastener.

WARNING ...

DO NOT PRESS THE FULCRUM LEVER INTO POSITION WITHOUT FIRST DEPRESSING THE CATCH LEVER. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN THE LOCKING PIN AND/OR THE LIPS OF THE CATCH LEVER BEING WORN OR DAMAGED TO SUCH AN EXTENT THAT THEY WILL NOT LOCK. THIS COULD RESULT IN A PANEL BECOMING DETACHED IN MID-AIR.

7 The fastener is unlocked as follows:-

7.1 Press the catch lever to the extent of its movement.

7.2 Swing the fulcrum lever outwards until it is perpendicular to the panel.

7.3 Release the catch lever.

7.4 Support the panel and disengage the fulcrum lever from the fulcrum plate.

ADJUSTMENT AND SERVICING

8 After installation of new fasteners ensure that they give correct tension to the cowlings or panels, as overtightening may result is distortion and consequent damage. To adjust the fastener, decrease or increase the distance between the two pins by screwing the eye-bolt either in or out of the link-nut. Ensure that after adjustment has been made enough of the eye-bolt thread remains in the link-nut for strength and safety.

9 The fasteners must be examined at regular intervals for damage and excessive wear, and all moving parts lubricated with anti-freeze oil. Particular care must be taken to ensure that:-

9.1 The catch lever is free in the housing, and that it returns to the flush position under the influence of its return spring.

9.2 The lip of the catch lever is not damaged or excessively worn, and that it provides full engagement for the pin of the fulcrum lever.

Note ...

The fastener is to be classed as unserviceable if the amount of movement of the catch lever necessary to release the locking pin is less than $\frac{1}{2}$ in approximately.

9.3 The fulcrum pin is straight and not excessively worn.

9.4 Any wear on the fulcrum face or tips is not sufficient to allow the locking pin to become disengaged from the catch lever lip.

10 If a fastener becomes unserviceable it must be removed and a new fastener fitted. Instructions for fitting new fasteners are included in the relevant aircraft publication.

HEAVY DUTY ARCTIC TYPE FASTENER

DESCRIPTION

Housing (fig.3)

11 The housing is an assembly consisting of two side plates, two guide plates, and a catch plate with its return spring and spring anchor plate, the assembly being pinned and riveted together. The catch plate pivots on a hinge pin, and a lip on the plate engages a tongue on the fulcrum lever. A projection on the plate extends to a position on the inner side of the fulcrum lever. Four rivets secure the spring anchor plate in position between the side plates.

12 The guide plates are positioned against the inner faces of the side plates and are secured by pins. Two pins are positioned to form stops for the fulcrum lever when it is being closed. Projections on the inner faces of the side plates are radiused to form fulcrum plates, the contours of which are shaped to suit the flanges of the fulcrum lever.

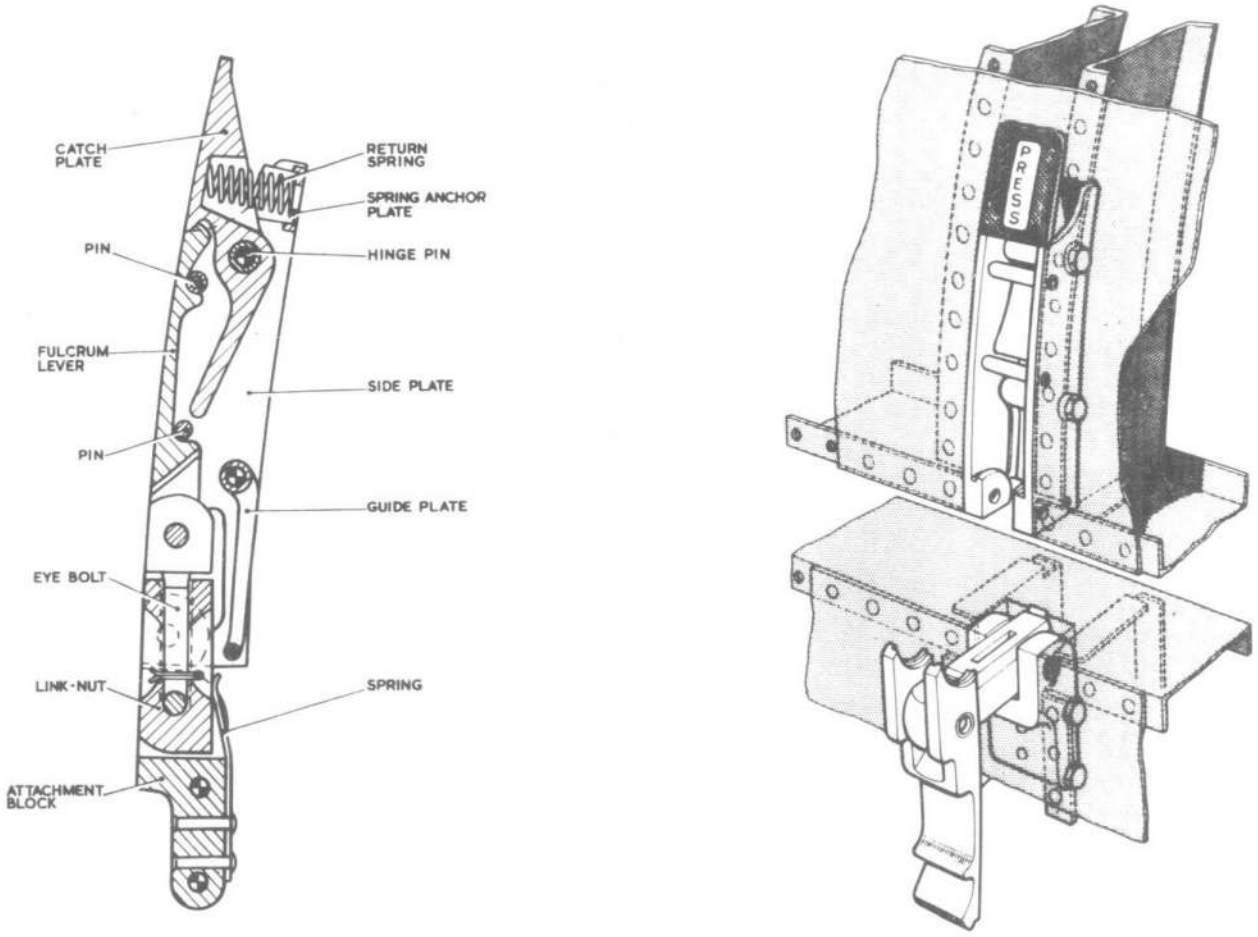


Fig.3 Heavy duty Arctic type fastener

Fulcrum lever assembly (fig.3)

13 The fulcrum lever assembly consists of two sub-assemblies, the attachment block and link-nut, and the eye-bolt and fulcrum lever. The attachment block is secured to the opposite part of the panel or cowling to which the housing is fitted. A flat spring riveted to the inner face of the attachment block maintains the link nut perpendicular to the panel or cowling when the fastener is open, the link nut being pivoted on a hinge pin fitted across the forked end of the attachment block.

14 The eye-bolt is screwed into the link-nut and two vertical slots in the nut enable a split pin to be inserted through a hole in the stem of the eye-bolt. The position of the eye-bolt in the link-nut determines the gap between the panels when the fastener is closed, the positioning of the split pin and slot being such that an adequate number of threads of the eye-bolt are always in engagement.

15 The fulcrum lever is secured to the eye-bolt by a hinge pin, the pin passing through the flanges of the fulcrum lever and the head of the eye-bolt. The ends of the flanges of the fulcrum lever are radiused and grooved to fit the fulcrum plates, and the inner edges of the flanges are chamfered.

OPERATION (fig.4)

16 The fastener is closed and locked by placing the tips of the fulcrum lever over the fulcrum plates and swinging the lever inwards into the housing, the guide plates ensuring that the fulcrum lever locates correctly. The tongue of the fulcrum lever presses the catch plate inwards until the lever is flush with the panel, the catch plate then returning to the closed position under the pressure of the return spring; the lip on the plate engages the tongue of the fulcrum lever and locks the fastener. The toggle action of the fastener will bring the two edges of the two panels together.

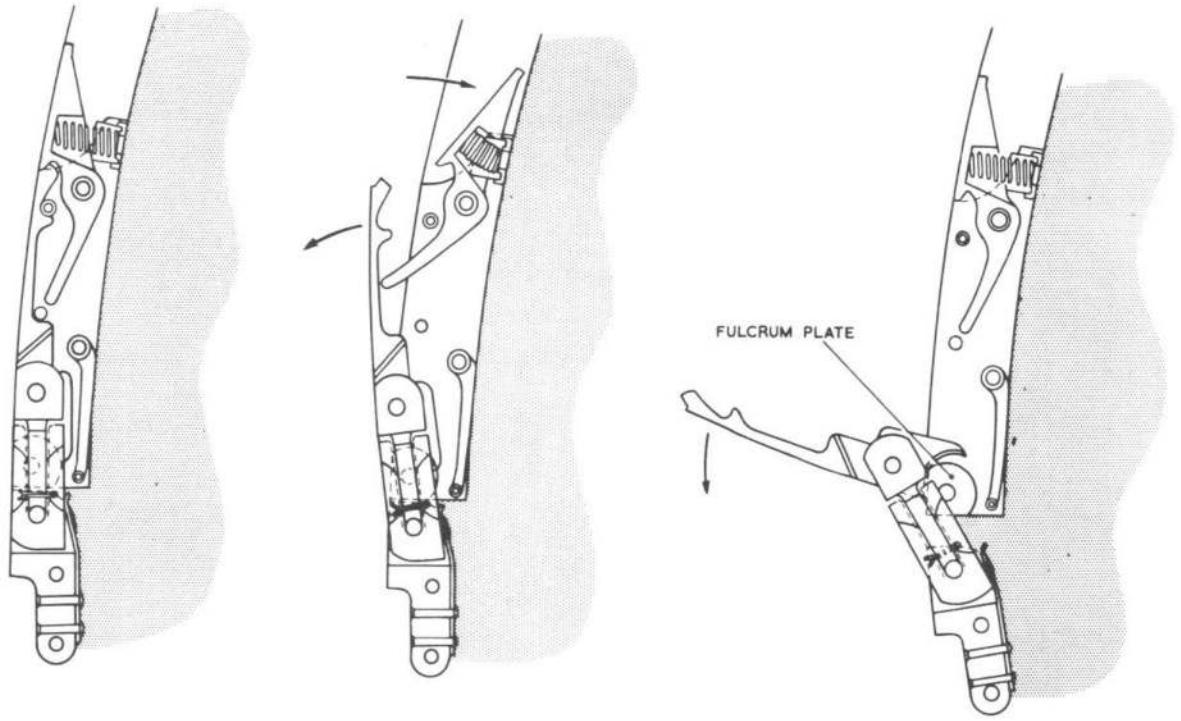


Fig.4 Action of the Arctic type fastener

17 The fastener is opened by pressing the catch lever plate inwards until the end of the plate clears the tongue of the fulcrum lever; further movement of the catch plate then causes the projection on the plate to force the fulcrum lever outwards. The fulcrum lever is then pulled outwards, the radiused ends of the flanges sliding on the fulcrum plates, thus forcing the eye-bolt and link-nut outwards until the fulcrum lever is clear of the fulcrum plates.

ADJUSTMENT AND SERVICING

18 When new fasteners are installed they must be adjusted to give a minimum clearance of 0.05 in between the edges of the panels. Adjustment is made, with the fastener in the open position, as follows:-

18.1 Remove the split pin fitted through the stem of the eye-bolt.

18.2 Turn the fulcrum lever clockwise to decrease the distance between the panels and counter-clockwise to increase the distance.

18.3 Align the split pin hole with the slot in the link-nut and fit a new split pin.

19 The fasteners must be examined at regular intervals for damage and excessive wear, and all moving parts lubricated with anti-freeze oil. If a

fastener becomes unserviceable it must be removed and a new fastener fitted. Instructions for fitting new fasteners are included in the relevant aircraft publication. Care must be taken to ensure that:-

19.1 The lip of the catch plate provides full engagement for the tongue of the fulcrum lever when the fastener is closed.

19.2 The catch plate is free in its housing and returns to the flush position under the pressure of the return spring.

HEAVY DUTY CAM TYPE FASTENER

DESCRIPTION

Housing (fig.5)

20 The housing is an assembly comprising two side plates, a cam plate, an ejector spring, and a catch lever with its return spring and spring anchor plate. The catch lever return spring maintains the face of the lever in the flush position, the lever pivoting on a hinge pin. A lip formed on the catch lever engages a tongue on a cam lever and retains the lever in the closed position.

21 The cam plate is secured at the back of the housing by pins, and is shaped at each end to form abutments for projections on the cam lever and link. Two fulcrum plates whose contours conform to those of the tips of the link, are formed on the inner faces of the housing. The ejector spring is anchored to one of the dowel pins that secure the side plates, the end of the spring exerting an outward force on the inside of the cam lever.

Lever assembly (fig.5)

22 The lever assembly is fitted to the panel or cowling opposite to that in which the housing is fitted and consists of two sub-assemblies, the attachment block with its link-nut, and the eye-bolt, link, and cam lever. The attachment block is the part that is secured to the panel, and has a hinge pin about which the link-nut pivots.

23 A flat spring riveted to the attachment block keeps the link-nut in a position perpendicular to the panel when the fastener is open. The link-nut has vertical slots in its inner and outer faces, the depth of the slots being such that they enable a split pin to be passed through a hole in the stem of the eye-bolt.

24 The eye-bolt is screwed into the link-nut, the position of the bolt determining the gap between the panels when the fastener is closed. The split pin hole in the eye-bolt stem and the slot in the link-nut are positioned to ensure that, with a split pin fitted, a sufficient number of threads for safety remain in engagement.

25 A hinge pin at one end of the eye-bolt provides a pivot for the link, and a hinge pin at the end of the link provides the pivot for the cam lever. Projections on the inner faces of the link and cam lever form cams which bear on the cam plate when the fastener is being unlocked. The flanges of the link are radiused on their lower edges to fit the fulcrum plates formed on the inner faces of the housing.

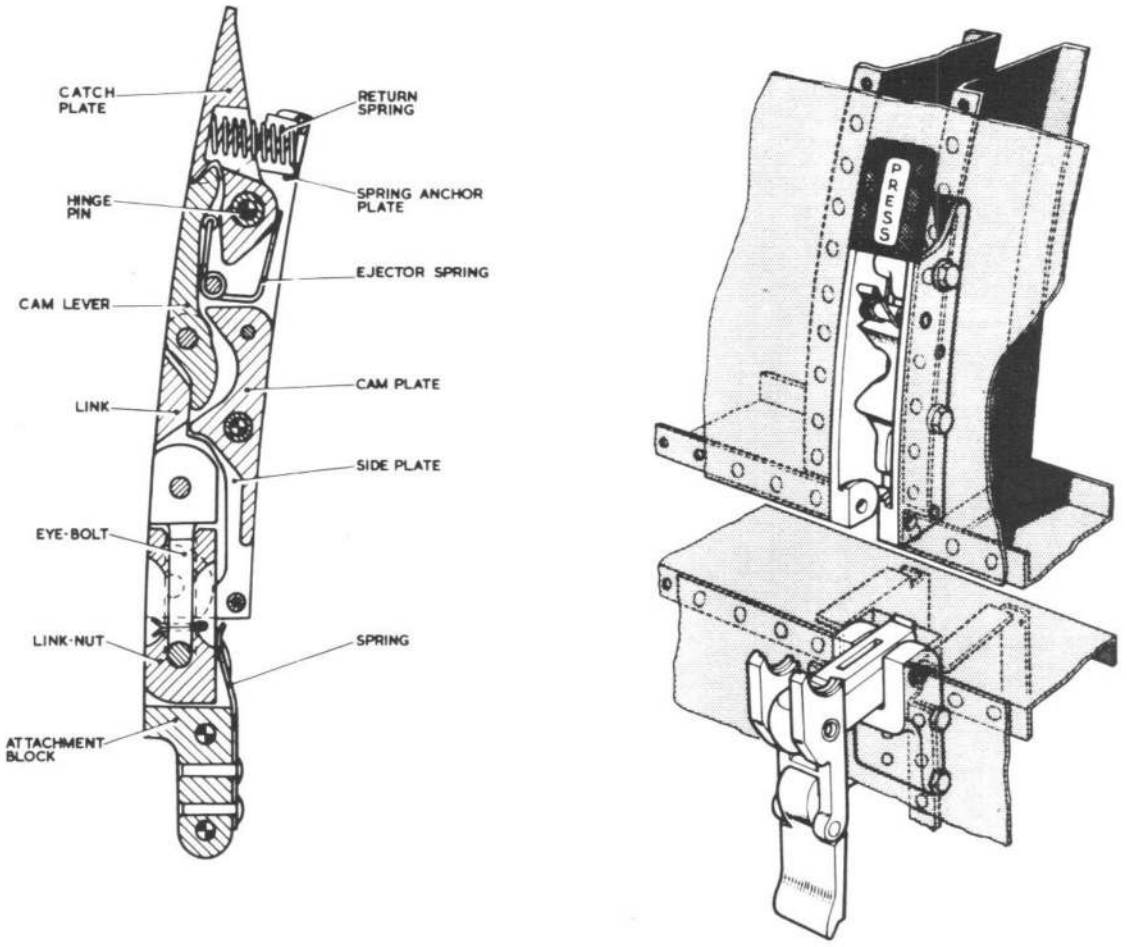


Fig.5 Heavy duty Cam type fastener

OPERATION (fig.6)

26 The fastener is closed and locked by placing the tips of the flanges of the link over the fulcrum plates and swinging the link and cam lever inwards into the housing, the end of the cam plate ensuring that the link flanges locate correctly. The tongue of the cam lever will depress the catch plate until the cam lever is flush, the catch plate then returning to the flush position under the pressure of the return spring. In the flush position, the lip of the catch plate engages the tongue of the cam lever, thus locking the fastener. The toggle action of the fastener will bring the two edges of the panels or cowlings together.

27 The fastener is opened by pressing the catch plate until the cam lever is forced outwards by the pressure of the ejector spring. The cam lever is then pulled outwards, the pressure of the cam bearing on the cam plate giving the leverage necessary to initially open the fastener. Further movement of the cam lever pivots the link about the fulcrum plates, the movement being continued until the link flanges are clear of the fulcrum plates.

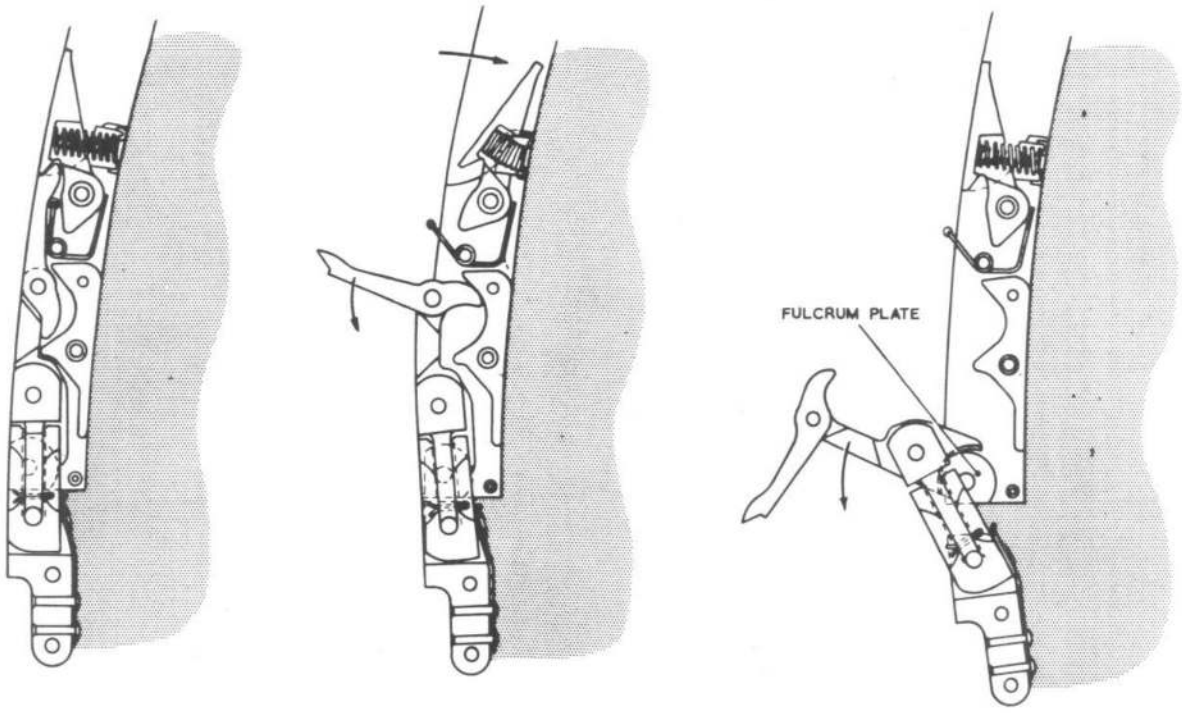


Fig.6 Action of the Cam type fastener

ADJUSTMENT AND SERVICING

28 When new fasteners are installed, they must be adjusted to give a minimum clearance of 0.05 in between the edges of the panels or cowling. Adjustment is made, with the fastener in the open position, as follows:-

28.1 Remove the split pin fitted through the stem of the eye-bolt.

28.2 Turn the link and cam lever clockwise to decrease the distance between the panels, and counter-clockwise to increase it.

28.3 Ensure that the split pin hole is in alignment with the slot in the link-nut and fit a new split pin.

29 The fasteners must be examined at regular intervals for damage and excessive wear, and all moving parts lubricated with anti-freeze oil. Care must be taken to ensure that:-

29.1 The lip of the catch plate provides full engagement for the tongue of the cam lever.

29.2 The catch plate is free in its housing and that it returns to the flush position under the pressure of the spring.

30 If a fastener becomes unserviceable it must be removed and a new fastener fitted. Instructions for fitting new fasteners are included in the relevant aircraft publication.

Chapter 8

CAMLOC FASTENERS

CONTENTS

Introduction (fig.1)

1 Camloc fasteners are used on aircraft for securing sheet-metal components, e.g. access doors and inspection panels, securely in position.

2 The various types of fastener are basically similar, each consisting of a stud assembly and a receptacle. The stud assembly is fitted to the outer, or removable, sheet-metal component and the receptacle is firmly secured, either by rivets or nuts, to the inner component.

3 The stud assembly of each type of fastener is supplied with a variety of head styles, slotted, Philips, cross-recess, wing, or push-button. In addition, the head may be 'plus-flush', i.e. when fitted the head of the stud is above the surface of the component, or it may be 'flush', i.e. the head fits into a recess in the component.

4 The type of fastener used depends on:-

4.1 The work it has to do; i.e. the load it has to carry.

4.2 The 'grip thickness' of the material to which it has to be fitted; the material 'grip thickness' includes the thickness of the material to which the stud assembly is attached, the thickness of the material to which the receptacle is attached, plus gaskets (if used) and an allowance for paint or other protective finishes.

5 The types of fasteners most generally used in service are:-

5.1 Series 5F.

5.2 Series 15F.

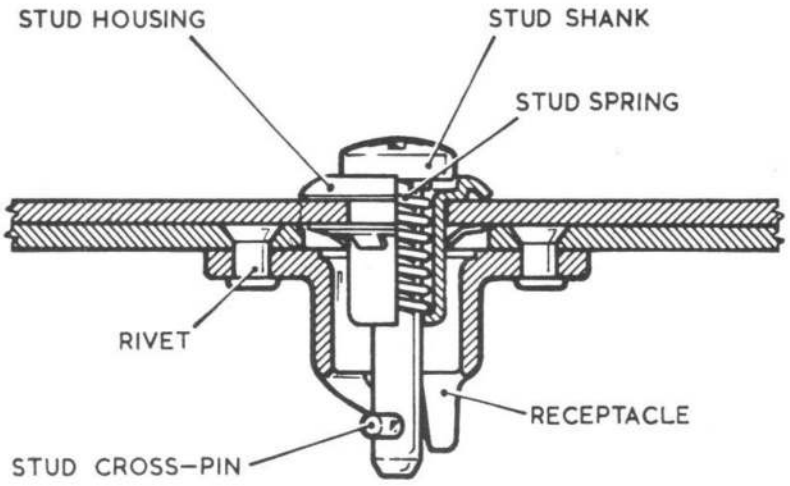


Fig.1 Typical Camloc fastener assembly

5.3 Series 2600.

5.4 Series 2700.

5.5 Series 4002.

DESCRIPTION

6 Basically the stud assembly of each type of fastener consists of a stud through the shank of which a cross-pin is fitted. When inserted into a receptacle and quarter-turned, the cross-pin of the stud rides up a cam formed on the face of the receptacle and draws the two components together. A spring, either incorporated in the receptacle or fitted to the stud, pulls the cross-pin into a groove at the end of the cam path and securely locks the two components together. The size of the stud assembly is indicated by a number stamped on the outer end of the stud.

Series 5F fastener (fig.2)

7 The Series 5F fasteners may be used for securing components where the 'grip thickness' is between 0.020 and 0.394 in.

8 The stud assembly of the Series 5F fastener consists of a stud, seating washer and a split retaining washer for securing the stud in a component.

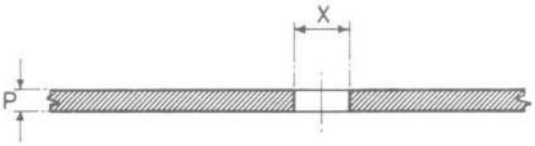
9 The receptacle, manufactured from sheet metal, acts as the spring of the fastener assembly; it is riveted to a component. The cam path is formed on the centre portion of the receptacle.

10 Typical information necessary for preparing the sheets to which a Type 5F fastener is to be fitted, and the instructions for installing the stud assembly, are given in fig.2.

STUD

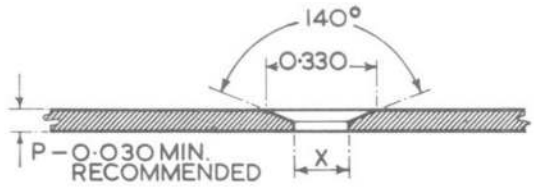
RETAINING WASHER

RECEPTACLE



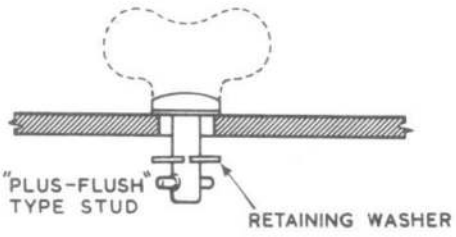
P	X DIA.
0·000–0·054	0·215–0·225
0·055–0·090 *	0·229–0·239

SHEET PREPARATION FOR "PLUS-FLUSH" AND WING TYPE STUD ASSEMBLIES.

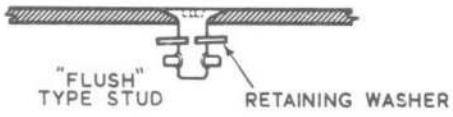


P	X DIA.
0·000–0·054	0·205–0·215
0·055 & GREATER	0·229–0·239

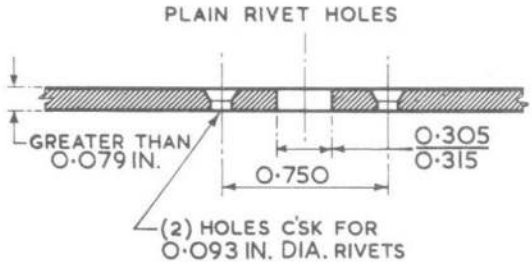
SHEET PREPARATION FOR "FLUSH" TYPE STUDS.

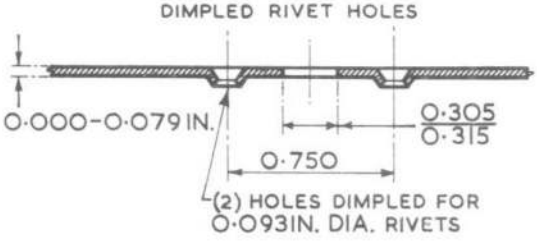


INSTALL STUD AND ATTACH RETAINING WASHER



INSTALL STUD AND ATTACH RETAINING WASHER





SHEET PREPATIONS FOR RECEPTACLES

Fig. 2 Typical Series 5F fastener

Series 15F fastener (fig.3)

11 The Series 15F fastener is a push-button type and may be used where the 'grip thickness' is between 0.030 and 0.569 in.

12 The stud assembly comprises a spring-loaded push-button type stud and a retaining washer.

13 The cylindrical receptacle, open at one end, has the stud locking face formed internally and is secured to a component by a nut.

14 Typical sheet preparation and fitting instructions for a Type 15F fastener are given in fig.3.

Series 2600 and 2700 fasteners (fig.4 and fig.5)

15 The Series 2600 and 2700 fasteners are generally similar, they differ only in the head formation of their studs. The studs of the Series 2600 fastener are of the 'plus-flush' type and the Series 2700 are 'flush'. These fasteners may be used where the 'grip thickness' of the components is between 0.020 and 1.889 in.

16 The stud assembly of both series of fastener comprises a stud with cross-pin, a spring, spring housing and retaining washer.

17 The receptacles for the Series 2600 and 2700 fasteners are identical. The receptacle has a cylindrical boss formed on it with the cam path on the outer end of the boss; the receptacle is riveted to its component.

18 Typical preparation and fastener fitting instructions for the Series 2600 and 2700 fasteners are given in fig. 4 and 5 respectively. When fitting the stud assemblies use pliers to compress the spring housing then insert the stud; release the spring housing after the cross-pin of the stud is clear of the inner surface of the component.

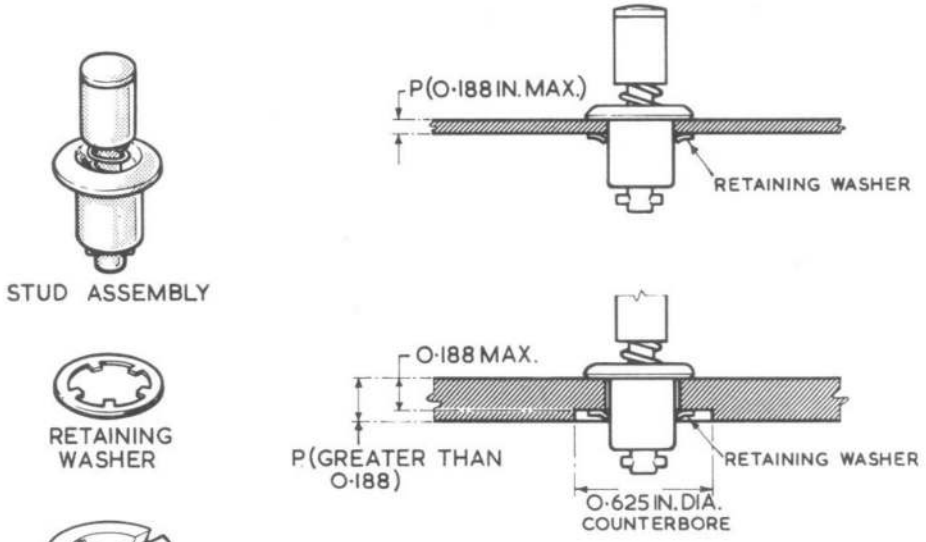
Series 4002 fastener (fig.6)

19 The Series 4002 fasteners may be used where the 'grip thickness' is between 0.021 in and 1.550 in. They are normally used where the components to be secured, e.g. access door panels, require high shear and tensile strength.

20 The stud assembly comprises a stud with cross-pin, a spring and spring housing (assembled on the shank of the stud), a grommet and a snap ring for securing the grommet in position.

21 When installing a Series 4002 fastener stud assembly into a component the grommet is fitted first and is secured in position by its snap ring; the ring should be fitted over the end of the grommet and then, using a metal tube of suitable diameter, it should be pushed towards the component until it seats behind the shoulder of the grommet; the grommet may be a firm or loose fit in the panel.

22 After the grommet has been installed the stud assembly should be fitted. To do this, using pliers (fig.4), compress the spring housing and insert the stud; release the spring housing when the cross-pin of the stud is clear of the inner face of the grommet. The stud assembly is retained in position by its cross-pin.



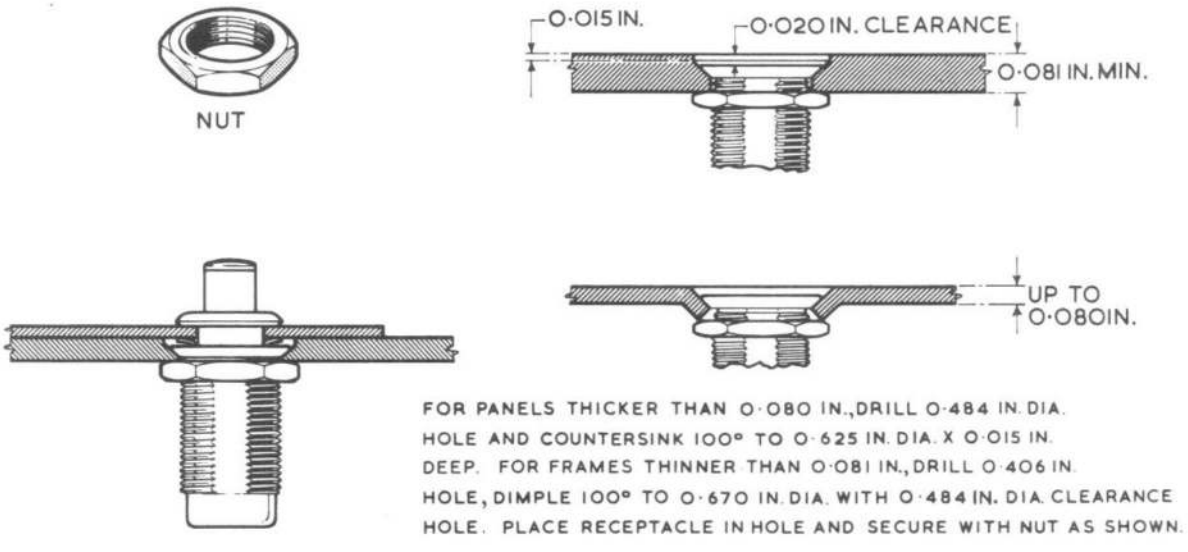
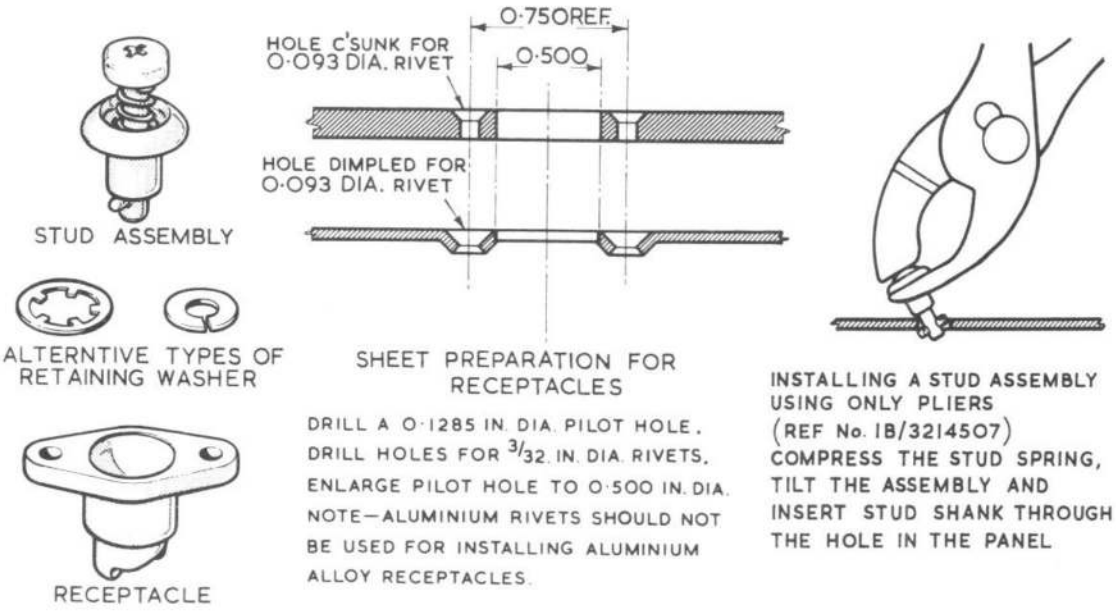


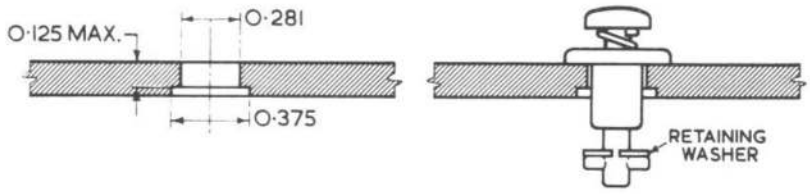
Fig. 3 Typical Series 15F fastener



SHEET PREPARATION FOR STUD ASSEMBLIES

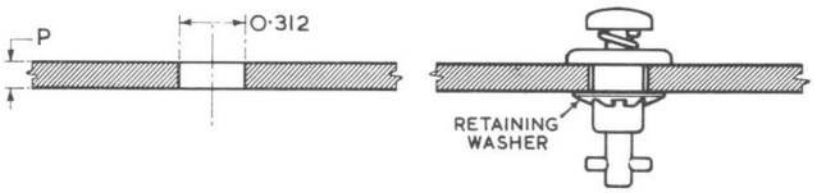
FOR MAXIMUM 0·125 IN. THICKNESS

"P" PANEL THICKNESS	"X" DIA.
0·030 TO 0·065	0·257
0·066 TO 0·125	0·281



FOR THICKNESS 0·126 IN. AND GREATER

DRILL STUD CLEARANCE HOLE 0·281 IN. DIA. THEN COUNTERBORE 0·375 IN. DIA. TO REMAINING THICKNESS OF 0·125 IN. INSTALL STUD ASSEMBLY AND FIT A RETAINING WASHER.



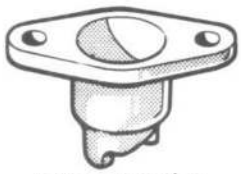
FOR THICKNESS 0·200 IN. TO 0·187 IN. MAXIMUM.

DRILL A 0·312 IN. DIA. STUD CLEARANCE HOLE, INSERT STUD ASSEMBLY AND PRESS THE RETAINING WASHER OVER THE STUD SPRING HOUSING.

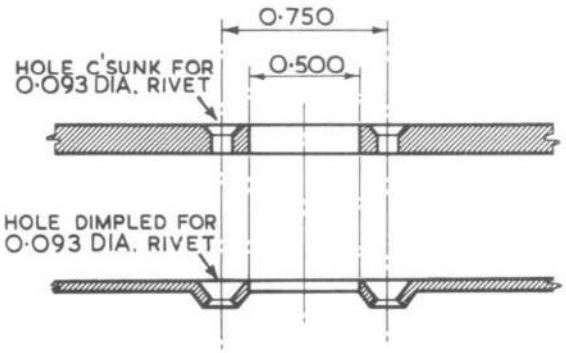
Fig. 4 Typical Series 2600 fastener

STUD ASSEMBLY

ALTERNATIVE TYPES OF RETAINING WASHER



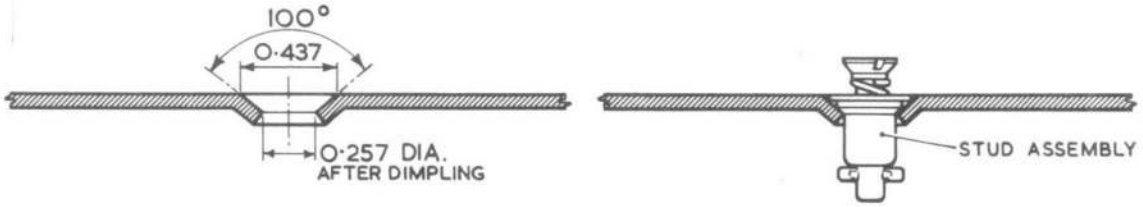
RECEPTACLE



SHEET PREPARATION FOR RECEPTACLES.

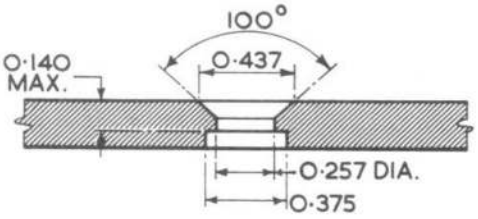
DRILL A 0·1285 IN. DIA. PILOT HOLE. DRILL HOLES FOR $^{3}/_{32}$ IN. DIA. RIVETS. ENLARGE PILOT HOLE TO 0·500 IN. DIA. NOTE—ALUMINIUM RIVETS SHOULD NOT BE USED FOR INSTALLING ALUMINIUM ALLOY RECEPTACLES.

SHEET PREPARATION FOR STUD ASSEMBLIES

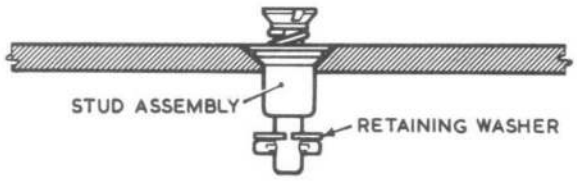


FOR PANEL THICKNESS 0·072 IN. MAXIMUM

DRILL A 0·213 IN. DIA. HOLE, AND, USING A DIMPLING TOOL, DIMPLE THE HOLE; REAM HOLE TO 0·257 IN. DIA. IF NECESSARY. USING PLIERS (FIG. 4), INSERT STUD ASSEMBLY.



FOR PANEL THICKNESS 0·073 IN. AND GREATER



DRILL A 0·257 IN. DIA. HOLE AND COUNTERSINK FACE OF PANEL AS SHOWN. FOR PANELS OF GREATER THAN 0·140 IN. THICKNESS, BACK COUNTERBORE 0·375 IN. DIA. TO REMAINING THICKNESS OF 0·140 IN., USING PLIERS (FIG. 4), INSTALL THE STUD ASSEMBLY AND FIT A RETAINING WASHER.

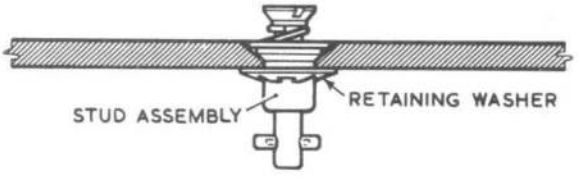
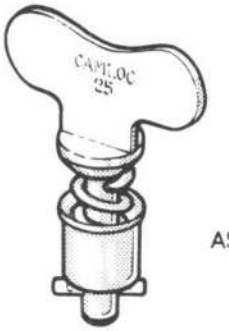
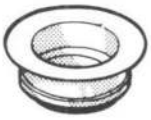


Fig. 5 Typical Series 2700 fastener



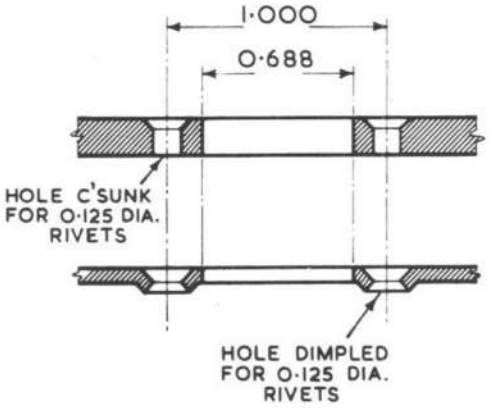
STUD ASSEMBLY



GROMMET

SNAP RING

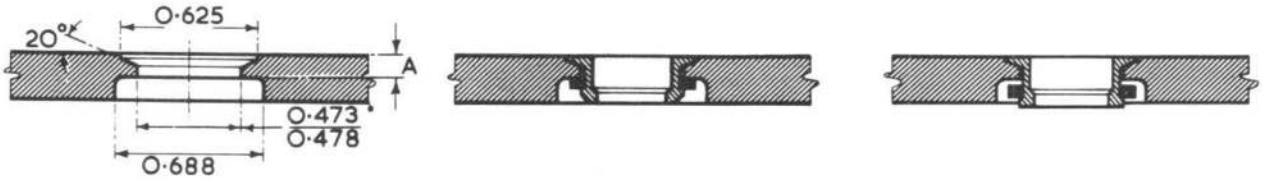
RECEPTACLE



SHEET PREPARATION FOR RECEPTACLES

DRILL A 0·1285 IN. DIA. PILOT HOLE. DRILL 1/8 IN. DIA. RIVET HOLES. ENLARGE PILOT HOLE TO 0·688 IN. DIA.

SHEET PREPARATION FOR GROMMETS



PANEL THICKNESS OF 0·065 IN. AND GREATER

DRILL A 0·1285 IN. DIA. PILOT HOLE. ENLARGE PILOT HOLE TO FINAL DIAMETER. COUNTERSINK FACE OF PANEL AND COUNTERBORE BACK OF PANEL TO REMAINING THICKNESS OF "A" DIMENSION. INSERT THE GROMMET AND ATTACH THE SNAP RING; SNAP RING MUST BE FULLY SEATED BEHIND SHOULDER OF GROMMET.

Fig. 6 Typical Series 4002 fastener

23 The receptacle for the Series 4002 fastener is similar to those used with the Series 2600 and 2700 fasteners, and it is riveted to its component.

24 Typical preparation and fastener installation instructions are given in fig.6.

SERVICING

25 The fasteners should be examined for wear or damage, both the stud assembly and the receptacle. If either part is excessively worn or damaged it should be renewed.

Chapter 9

KING CUSTODIAN FASTENERS

Description (fig.1)

1 The standard King Custodian stud fastener is used on aircraft to fasten sheet metal panels which need to be constantly removed and replaced rapidly. The upper body is attached to the panel and the lower body to the airframe.

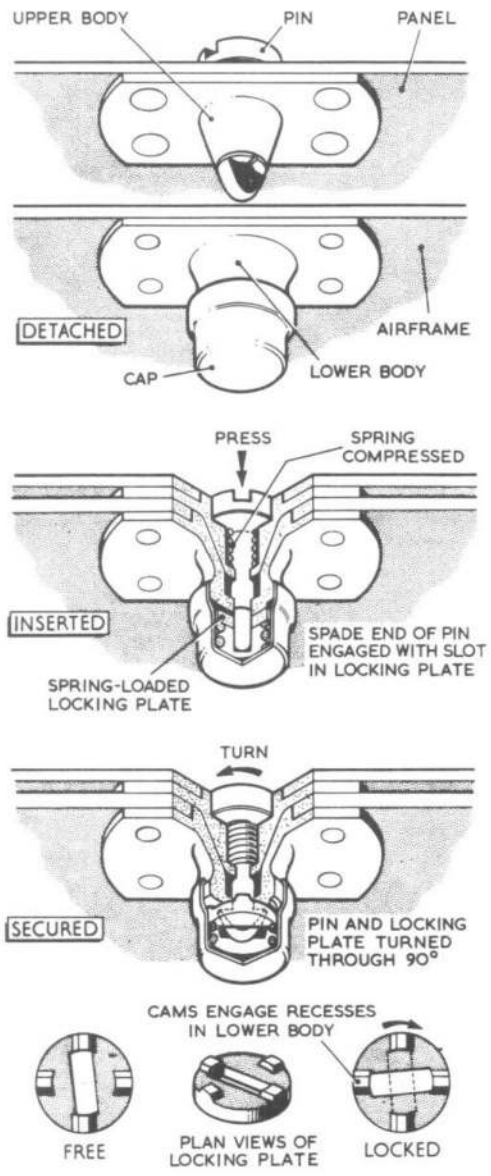


Fig.1 King Custodian fasteners

2 To lock the fastener the pin, which has 90 deg. of movement, should be pushed in against the spring with a screwdriver and turned fully clockwise against the stops. The pin is held firmly in this position by the spring loaded locking plate and the slot in the top of the pin should line up with the safety markings painted on the panel. To unlock the fastener turn the pin 90 deg. counter-clockwise against the stops; during the last few degrees of movement the pin should snap outwards. In the unlocked position the slot should be perpendicular to the line of the safety markings.

3 The dimensions of the three sizes of King Custodian fasteners are given in Table 1. The part numbers will be found stamped underneath the flanges of the upper and lower bodies.

Servicing

4 The fastener should be changed, as described in the relevant aircraft publication, if any of the following defects are found:-

4.1 The slot in the top of the pin is damaged or enlarged.

4.2 The pin is loose when in the locked position and has far more than 90 deg. of movement. This condition is caused by the spade at the base of the pin, and/or both the stops, being worn.

Note ...

If the fastener is locked and the slot in the pin is not lined up with the safety markings, the cause should be investigated.

4.3 Ths pin does not, or is slow to, snap out when in the unlocked position.

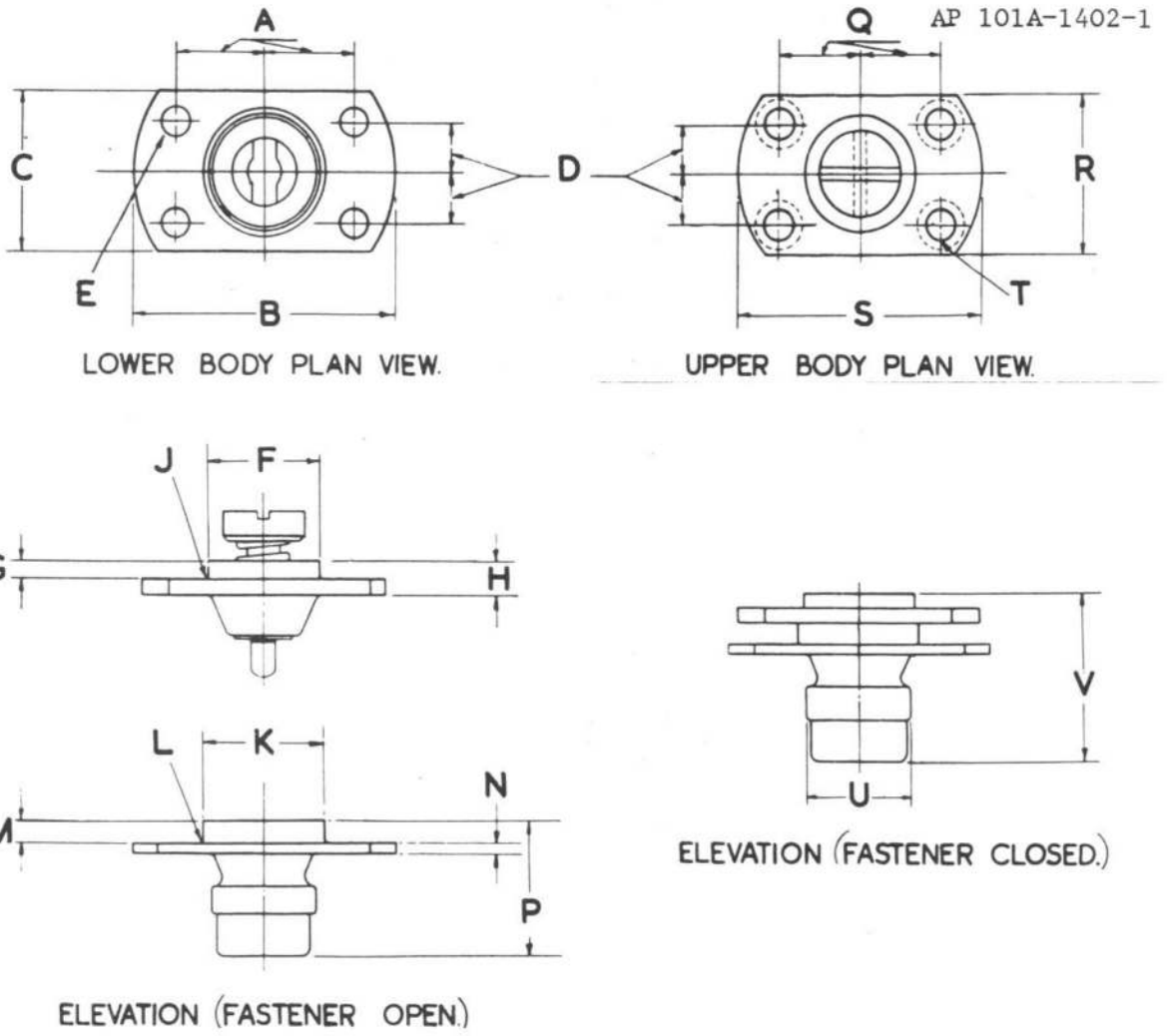


Fig.2 Fastener dimensions

TABLE 1 DIMENSIONS OF KING CUSTODIAN FASTENERS

(Refer to fig.2. All dimensions in inches)

Dimension Code	Size 1 Upper body Pt.No. C17366 / Lower body Pt.No. C7809	Size 2 Upper body Pt.No. C5331 / Lower body Pt.No. C7810	Size 3 Upper body Pt.No. C5332 / Lower body Pt.No. C7811
A	0.452 / 0.449	0.477 / 0.474	0.552 / 0.549
B	1.375 dia	1.5 dia	1.62 dia
C	0.75	0.83	0.94
D	0.212 / 0.209	0.227 / 0.224	0.302 / 0.299
E	0.130 / 0.128 dia	0.163 / 0.161 dia	0.163 / 0.161 dia
F	0.500 / 0.495 dia	0.560 / 0.555 dia	0.687 / 0.682 dia
G	0.048 / 0.042	0.083 / 0.077	0.104 / 0.098

TABLE 1 DIMENSIONS OF KING CUSTODIAN FASTENERS (continued)

Dimension Code	Size 1 Upper body Pt.No. C17366 Lower body Pt.No. C7809	Size 2 Upper body Pt.No. C5331 Lower body Pt.No. C7810	Size 3 Upper body Pt.No. C5332 Lower body Pt.No. C7811
H	$\frac{0.106}{0.101}$	$\frac{0.160}{0.155}$	$\frac{0.190}{0.185}$
J	0.02 rad	0.02 rad	0.02 rad
K	$\frac{0.625}{0.620}$ dia	$\frac{0.687}{0.682}$ dia	$\frac{0.750}{0.745}$ dia
L	0.01 rad	0.01 rad	0.01 rad
M	$\frac{0.071}{0.065}$	$\frac{0.111}{0.106}$	$\frac{0.136}{0.130}$
N	$\frac{0.06}{0.05}$	$\frac{0.07}{0.06}$	$\frac{0.07}{0.06}$
P	0.73 max	0.83 max	0.88 max
Q	$\frac{0.452}{0.449}$	$\frac{0.477}{0.474}$	$\frac{0.502}{0.499}$
R	0.75	0.83	0.94
S	1.375 dia	1.5 dia.	1.5 dia
T	$\frac{0.130}{0.128}$ dia	$\frac{0.163}{0.161}$ dia	$\frac{0.163}{0.161}$ dia
	csk 90 deg. on underside	csk 90 deg. on underside	csk 90 deg. on underside
	0.49 dia max	0.60 dia max	0.66 dia max
V	0.84 max	0.99 max	0.107 max

Chapter 10

HUCKBOLTS

CONTENTS

Introduction

1 Huckbolt fasteners are designed for use in high strength structural joints where access is available from both sides of the structure. A huckbolt is not a bolt in the accepted sense as it is not threaded; it is really a form of shear pin which is secured by the cold swaging of a metal collar into annular locking grooves on the stud.

DESCRIPTION

2 Two types of Huckbolt fasteners are used, a 'pin' type using a long serrated pin for use where a 'puller' tool can be used, and a 'stump' type having a short serrated pin for use with a swaging set where operating space is limited. Both types are basically the same except for the length of the pin and each use the same metal collar. The pin is manufactured of cadmium plated steel or anodised aluminium alloy with a variety of head styles including pan, countersunk and crown head.

3 There are circular grooves along the shank of the pin which vary in appearance and purpose (fig.1). Towards the tail of the pin, 'pulling' grooves provide a secure grip for the Huckbolt swaging gun. Nearer the head of the pin is a breaker groove followed by further shallow grooves which form a key on which the collar is eventually swaged to produce a 'head' on the Huckbolt.

4 Collars are produced in anodised aluminium alloy or cadmium-plated mild steel. The recessed end of the collar is applied to the face of the work. All collars are supplied lubricated to assist the swaging process.

5 A particular feature of the Huckbolt is that it can, when required, be applied to work with an interference fit; this makes it unnecessary for holes to be reamed subsequent to drilling, and ensures fuel and water-tight joints.

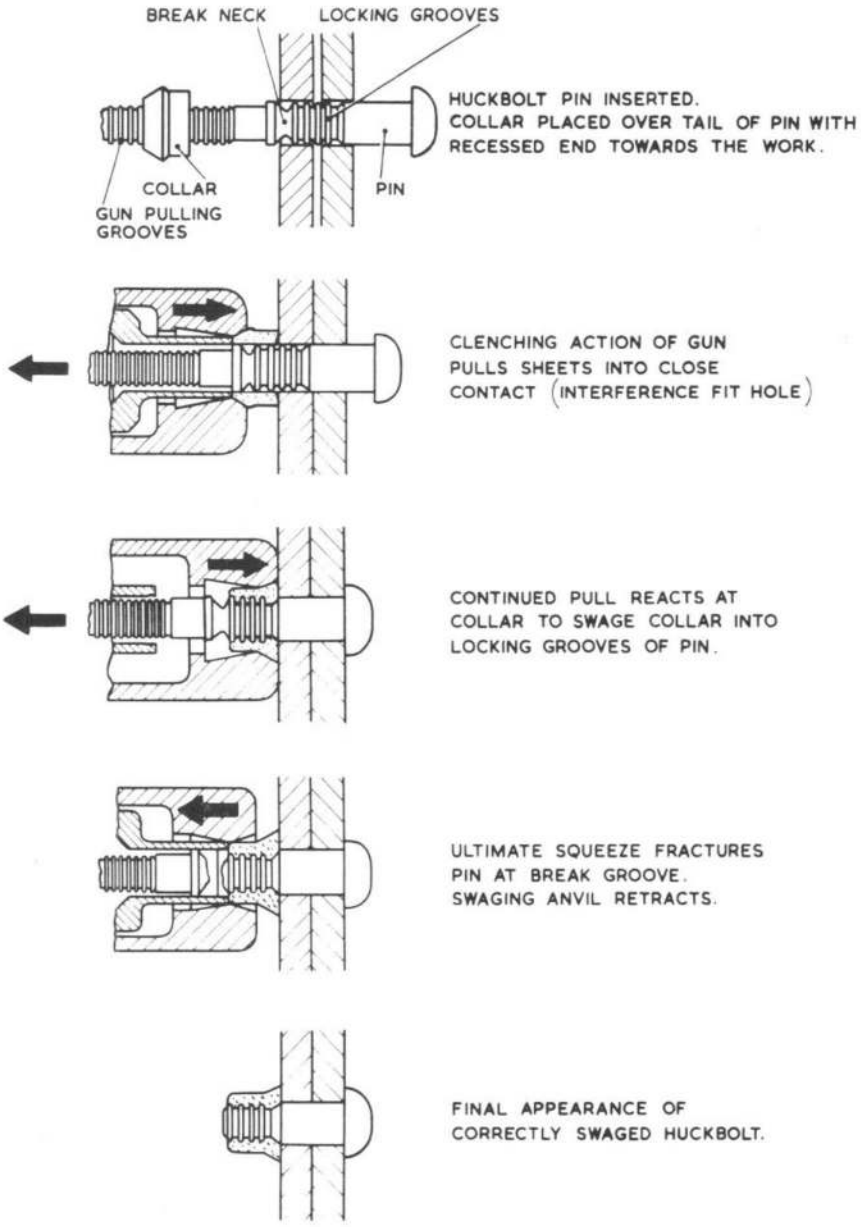


Fig.1 Huckbolt setting - pin type

HUCKBOLT SETTING

Pin type

6 These Huckbolts are set by pneumatically or manually-operated 'pull' guns. As shown in fig.1, the pin is inserted as far as possible and the collar applied. If the pin is an interference fit it may be necessary to tap the pin into the hole until the shank is gripped by the gun jaws. As the gun is operated the pin is drawn towards the gun and reaction is applied to the collar by a swaging anvil in the nose of the gun. The strong clenching action of the operation makes sheet grippers unnecessary other than for local registration. After the swaging anvil forces the collar into the pin locking grooves it begins to retract as pressure on the collar is transferred to a second head within the gun, which eventually fractures the pin at the break neck, flush with the outer face of the collar.

Stump type

7 The stump type of Huckbolt is set with a swaging set. As shown in fig. 2 the stump (short pin) is inserted into an interference hole and driven in with a hammer or air hammer. The collar is placed over the stump and a bucking bar placed against the head of the stump. The swaging set is placed over the collar and is driven using an air hammer, swaging the collar into the fastener locking grooves. When the swaging set meets the material being fastened, the stump and collar are fully locked in a permanent, integral unit.

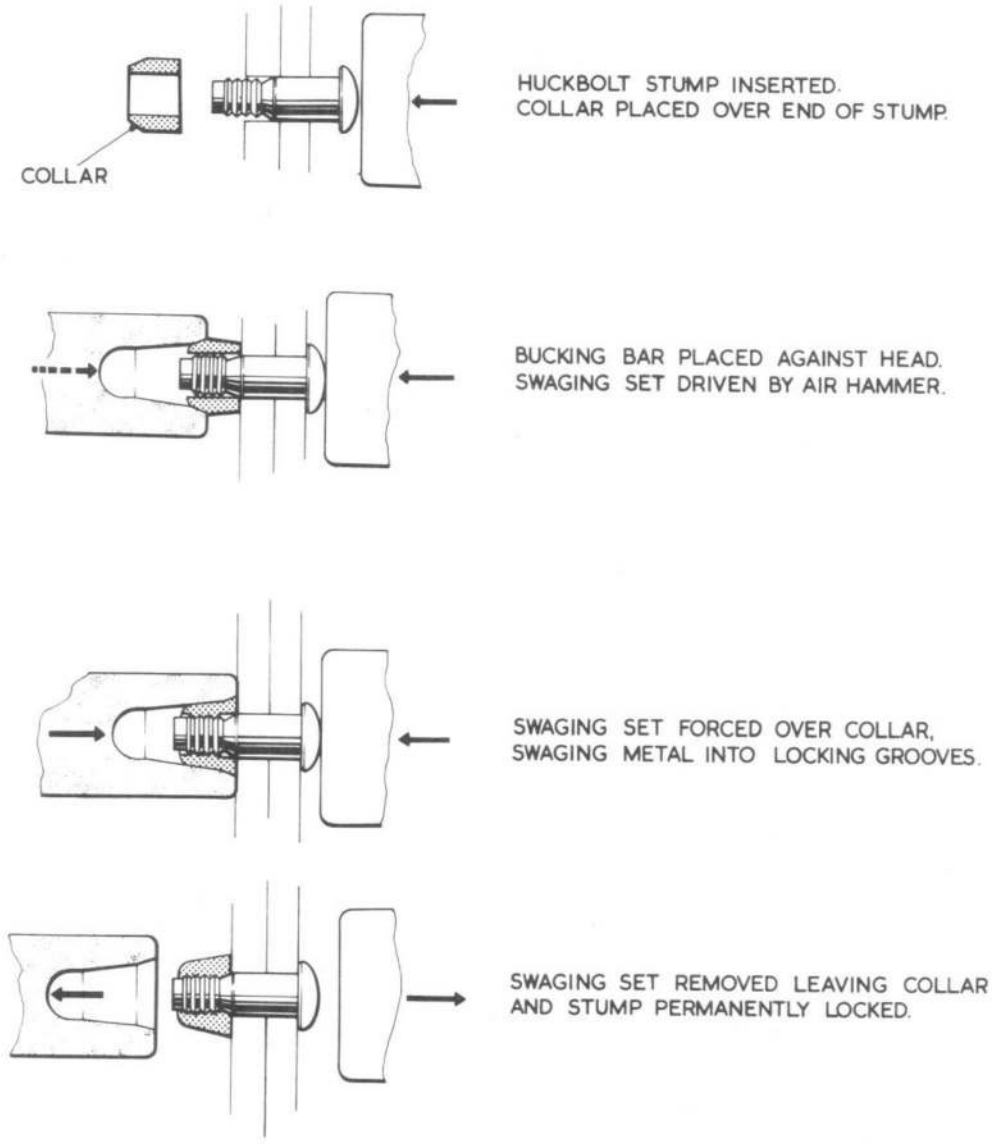


Fig.2 Huckbolt setting - stump type

HUCKBOLT REMOVAL

8 The simplest form of removal is to split the collar axially with a narrow-bladed chisel and drive out the pin with a parallel punch.

REPLACEMENT BOLTS

9 Close tolerance steel bolts to BS.A108 or A111 may be used in place of Huckbolts, but reference must always be made to the appropriate airframe Vol. 6 to ensure that the alternative use of bolts is agreed.

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