(12) UK Patent Application (19) GB (11) 2 213 113 (13) A

(43) Date of A publication 09.08.1989

(21) Application No 8728284.4

(22) Date of filing 03.12.1987

(51) INT CL⁴
B64C 9/02

(52) UK CL (Edition J)
B7G GCM G308

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) B7G GCM
INT CL⁴ B64C

(71) Applicant
British Aerospace Public Limited Company

(Incorporated in the United Kingdom)

11 Strand, London, WC2N 5JT, United Kingdom

(72) Inventor
George Harry Williams

(74) Agent and/or Address for Service
T H Jones
British Aerospace PLC, Corporate Patents Department, Brooklands Road, Weybridge, Surrey, KT13 0SJ, United Kingdom

(54) Leading edge slat support on an aircraft wing

(57) A support arrangement for laterally supporting a leading edge slat upon an aircraft wing. Slat support beams 3 are positioned between spaced apart pairs of wing leading edge ribs 7 and are supported upon rollers (4) (Fig. 1). The slat is restrained against lateral displacement by side rollers 18 of roller assemblies 15 protruding inwardly from each of the wing ribs at one or more support beam positions. In the present arrangement, the side roller mounting brackets 21 are located upon the outer faces of the wing ribs 7 and the rollers protrude inwardly through apertures 17. The design provides readily accessible lubrication points.

Fig.3.

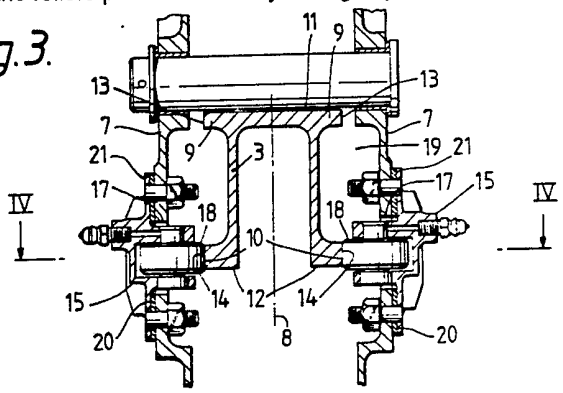
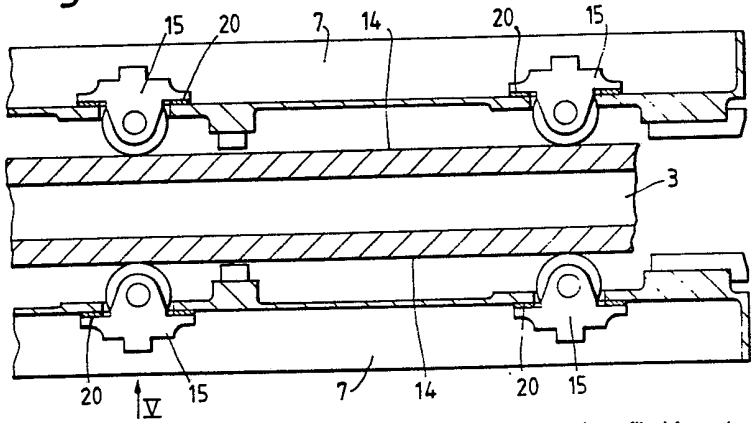


Fig.4.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 213 113 A

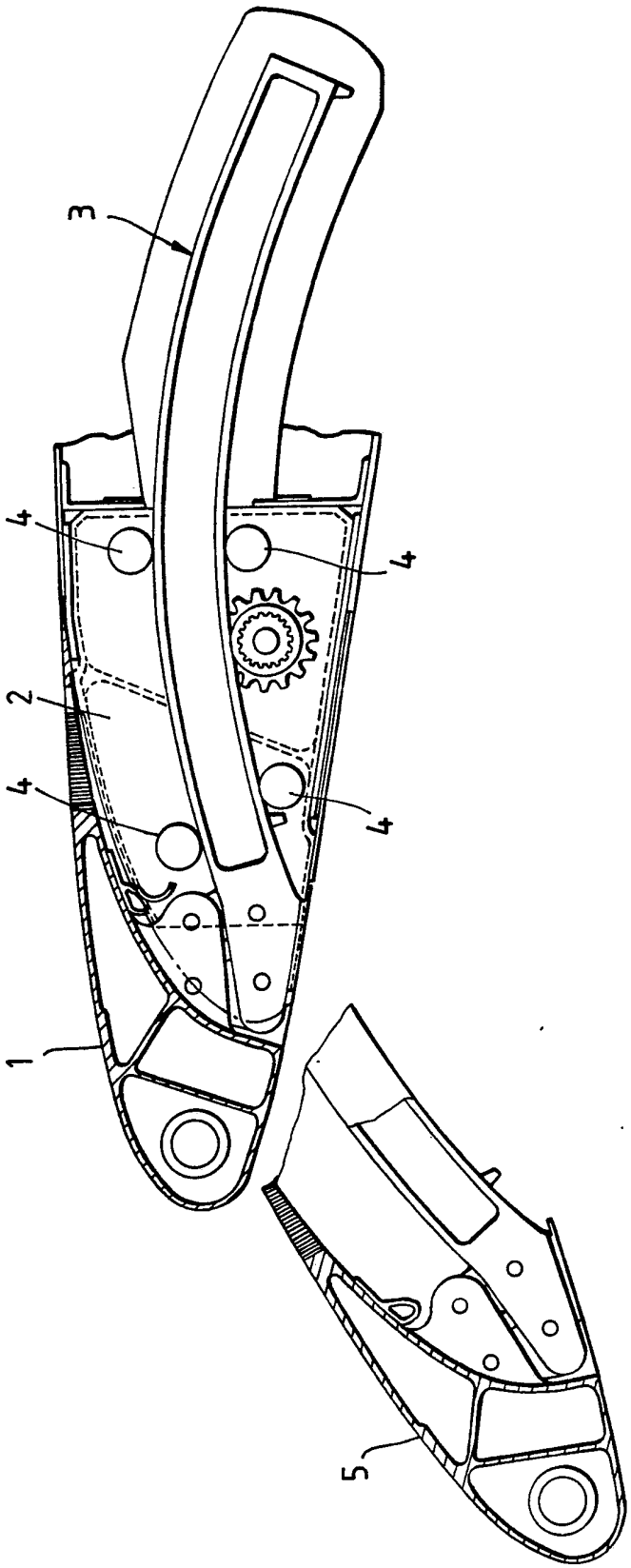


Fig.1.

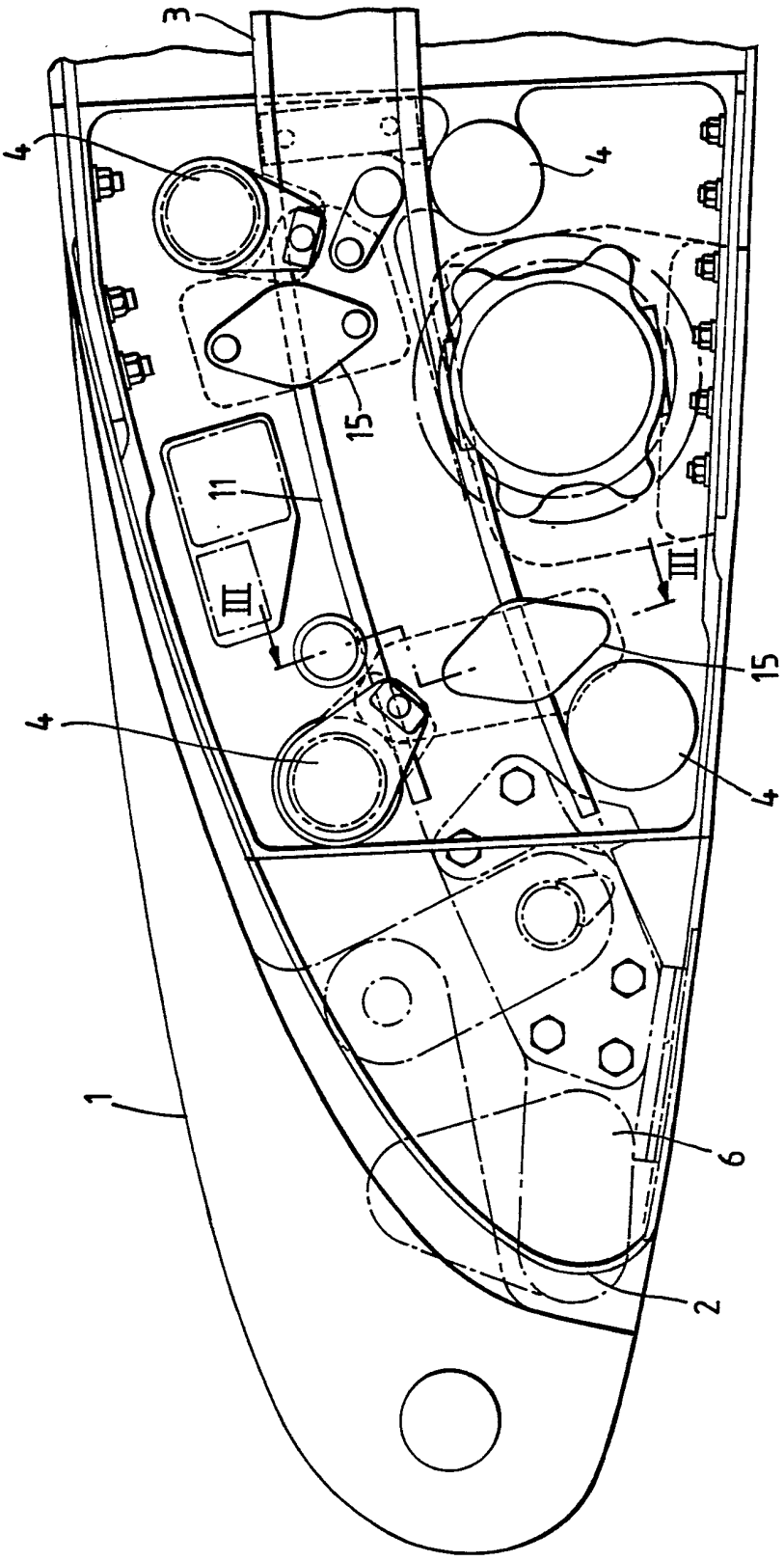


Fig.2.

Fig.3.

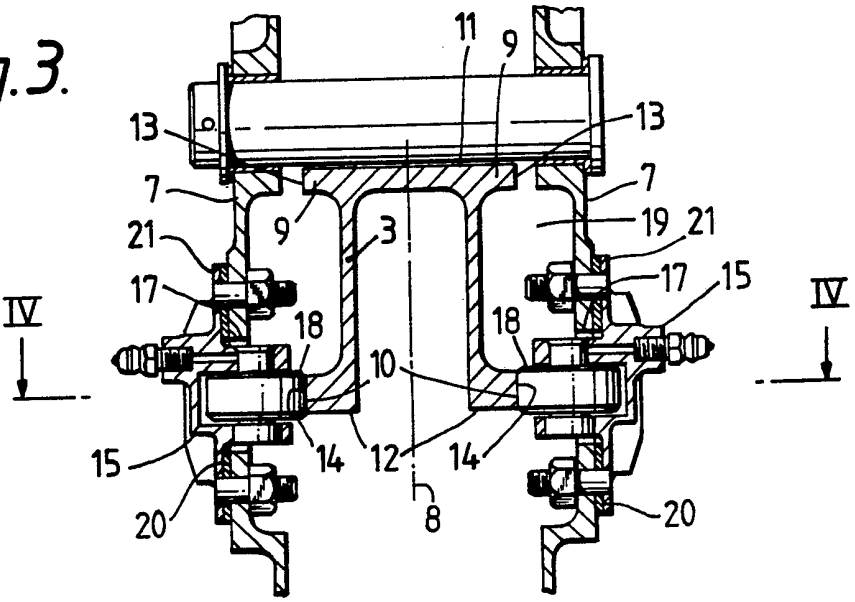


Fig.4.

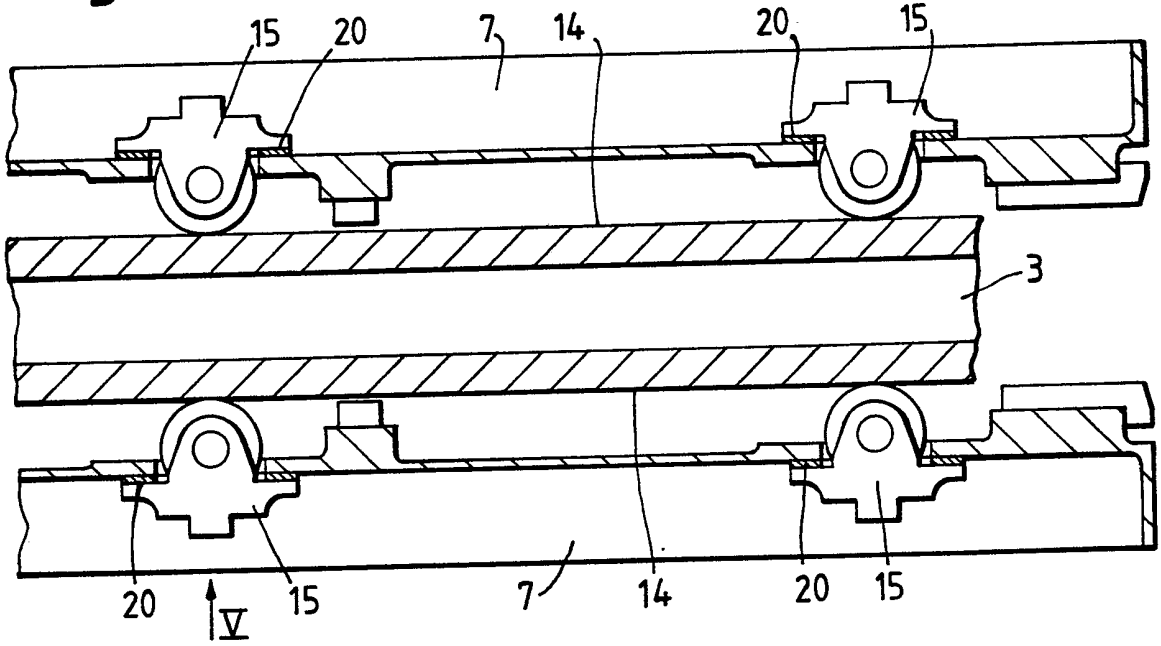


Fig.5.

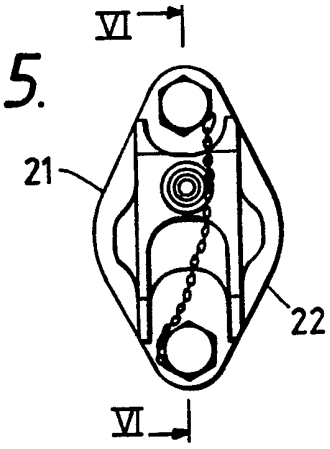
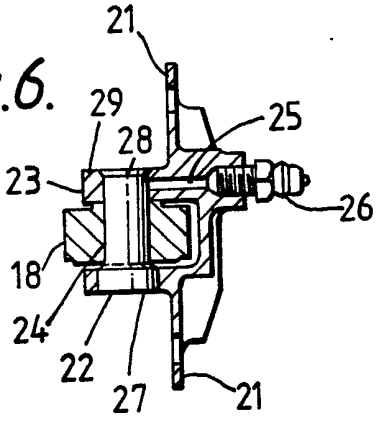


Fig.6.



2213113

SUPPORT ARRANGEMENT FOR EXTENDIBLE HIGH LIFT DEVICES

This invention relates to high lift devices for aircraft wings and more particularly to slats supported upon the main wing structure by support beams or carrier tracks and which are extendible from a stowed cruise configuration to an extended high lift configuration.

It is well known to support a series of spanwise slat portions to a wing leading edge structure by means of generally arcuate slat support beams, the beams supporting the slat at their forward extremities and themselves being supported upon the wing fixed leading edge structure with which they are in sliding engagement to accommodate the desired range of operational deployment. The wing fixed leading edge structure generally incorporates at the location of each support beam a pair of spaced apart ribs to each of which is rotatably located a series of roller bearings for slidably engaging the installed support beam, reacting induced flight loads and accommodating miscellaneous differential movement between the slat and the wing structure, such as might arise from manufacturing tolerances, thermal expansion, etc.

The support beams are generally supported in the vertical plane by rollers rotatably mounted upon the support ribs and engaging at selected chordwise locations the supper and lower surfaces of the beams and by which means induced vertical or rear vertical flight loads are reacted. Similarly, however, the support beams must be capable of reacting induced side loads and this is generally achieved by side rollers mounted upon the support ribs at selected chordwise locations. Each slat portion, of which there are generally a number extending

spanwise along the wing, will incorporate two or more support beams and at least one, the master support beam, may be held in datum position by side rollers in mutual contact with both side faces of the beam. The side rollers associated with the remaining beams, however, may be slightly spaced apart from the beams to accommodate the said manufacturing tolerances and thermal expansions so that the end loads will principally be reacted by the side rollers associated with the master control beam.

The rib pairs lie to each side of the slat support beam and the side rollers are rotatably mounted on the ribs such that they protrude inwardly to lie in rolling contact with or closely adjacent the side faces of the installed support track. Preferably, however, the rib pairs are spaced apart just sufficiently to provide working clearance for the support track and this limits space in terms of access for manufacturing adjustments and jigging and for subsequent maintenance. It is the object of the present invention to provide a solution to this shortcoming.

According to the present invention there is provided a support arrangement for laterally supporting a slat upon an aircraft wing, said arrangement including a slat, at least two laterally spaced support beams to which said slat is connected at or about their forward extremities, said support beams slidably engaging said wing for moving said slat either forwardly or rearwardly with respect to said wing, said wing having a leading edge structure, including pairs of wing ribs associated with each of said support beams and spaced apart one to each side of said support beams and one or more side

roller means protruding inwardly from said wing ribs in a generally horizontal plane, said side rollers associated with at least one of said support beams lying in lateral supporting engagement with said support beams, characterised in that each of said side rollers is rotatably mounted upon a roller mounting bracket assembly located upon the outer faces of said wing ribs and said side rollers protrudes inwardly through apertures in said wing ribs.

One embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 illustrates a typical wing leading edge slat installation with the slat shown in stowed and deployed configuration.

Figure 2 illustrates, to a larger scale, the installation of the slat within the wing fixed leading edge structure.

Figure 3 is a section through the wing leading edge structure at a typical slat support beam installation looking along a line III-III in Figure 2.

Figure 4 is a longitudinal section through the typical slat support beam installation looking along a line IV-IV in Figure 3.

Figure 5 is a front elevation on a typical side side roller assembly in direction of Arrow I in Figure 4.

Figure 6 is a vertical section through the side roller assembly along a line VI-VI in Figure 5.

Referring to the drawings Figure 1 illustrates a typical wing leading edge slat installation in which a slat 1 is supported upon a wing fixed leading edge portion 2 by means of an arcuate support beam 3 such that support beam is mounted in rolling engagement with the wing

leading edge by means of spaced apart roller bearings 4. By this arrangement the slat may be deployed from it stowed 'cruise' configuration where it conforms to the wing aerodynamic profile to a fully extended 'high lift' configuration 5.

Referring to Figure 2-4 inclusive, the slat 1 is mounted via a knuckle assembly 6 to the arcuate support beam 3 which lies between two chordwise leading edge ribs 7 equally disposed about the support beam datum 8. The support beam 3 is of inverted U-shape configuration including upper and lower lateral extensions 9 and 10 respectively. The beam upper profile 11 and lower profiles 12 form rolling surfaces for supportingly engaging roller bearings 4. The side margins 13 and 14 of the lateral extensions 9 and 10 provide rolling surfaces for engaging side roller assemblies 15 spaced apart in a chordwise direction as illustrated diagrammatically in Figure 4.

As illustrated in Figure 4, the leading edge ribs include apertures 17 in their vertical webs for mounting the side roller assemblies 15 which are mounted upon the outer rib surfaces such that the side rollers 18 protrude into the interspace 19 the side roller assemblies being laterally adjustable as required by shim plates 20 seated under the attachment flanges 21 when the rollers are required to be in correct rolling contact with support track 3.

A typical side roller assembly is illustrated in more detail in Figures 5 and 6 and comprises a machined roller mounting bracket 22 incorporating a fork end 23 lying at right angles to the vertical attachment flanges 21. A side roller 18 is rotatably secured within the fork end by means of a shouldered pin 24. A lubricating oilway 25

extends through the mounting bracket 22 and into which is located a grease nipple 26 by which means lubricant is transmitted to the roller 18. The retention of the shouldered pin 24 is a significant feature of the assembly, since the use of a conventional bolt and nut would necessitate an aperture of increased size. This may be impracticable or undesirable at certain locations within the wing structure because of the lack of available depth. To overcome this, the pin 24 is configured such that its head lies flush with the lower surface 27 and is locked in position by spinning the shank end 28 such that it also lies flush with the upper surface 29. The principal benefits arising from the invention comprise:-

a) Installation and adjustment of the side roller assemblies with the support beam and consequently the slat in situ,

b) the ability to replace worn or damaged side roller assemblies without dismantling of the slat,

c) maintenance and lubrication of the installation outside the confines of the wing rib pairs,

d) minimised apertures in the wing rib webs,

e) structural benefits arising from the reduced separation of the wing rib pairs.

Whilst the invention is particularly described in the context of a master control track in which the side rollers are installed in mutual rolling contact with the support beam, it may equally be applicable to those alternative installations where the rollers 18 are deliberately spaced apart from the support beam to accommodate differential lateral movements between the beam and the adjacent fixed wing structure.

CLAIMS

1 A support arrangement for laterally supporting a slat upon an aircraft wing, said arrangement including a slat, at least two laterally spaced support beams to which said slat is connected at or about their forward extremities, said support beams slidably engaging said wing for moving said slat either forwardly or rearwardly with respect to said wing, said wing having a leading edge structure, including pairs of wing ribs associated with each of said support beams and spaced apart one to each side of said support beams and one or more side roller means protruding inwardly from said wing ribs in a generally horizontal plane, said side rollers associated with at least one of said support beams lying in lateral supporting engagement with said support beam, characterised in that each of said side rollers is rotatably mounted upon a roller mounting bracket assembly located upon the outer faces of said wing ribs and said side rollers protrudes inwardly through aperture in said wing ribs.

Amendments to the claims
have been filed as follows

1 A support arrangement for laterally supporting a slat upon an aircraft wing, said arrangement including a slat, at least two laterally spaced support beams to which said slat is connected at or about their forward extremities, said support beams slidably engaging said wing for moving said slat either forwardly or rearwardly with respect to said wing, said wing having a leading edge structure, including pairs of wing ribs associated with each of said support beams and spaced apart one to each side of said support beams and one or more side roller means protruding inwardly from said wing ribs in a generally horizontal plane, said side rollers associated with at least one of said support beams lying in lateral supporting engagement with said support beam, characterised in that each of said side rollers is rotatably mounted upon a roller mounting bracket assembly located upon the outer faces of said wing ribs and said side rollers protrudes inwardly through aperture in said wing ribs.

2 A support arrangement substantially as herein described with reference to the accompanying drawings.

Published 1989 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office. Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent, Con. 1/87