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(72) Inventors:
• **Jackson, George Ian**
Chellaston, Derby DE73 1UD (GB)
• **Rodwell, Brian Nicholas**
Loughborough, Leicestershire LE11 3PN (GB)

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(74) Representative: **Gunn, Michael Alan**
Rolls-Royce plc
P.O. Box 31
Derby DE24 8BJ (GB)

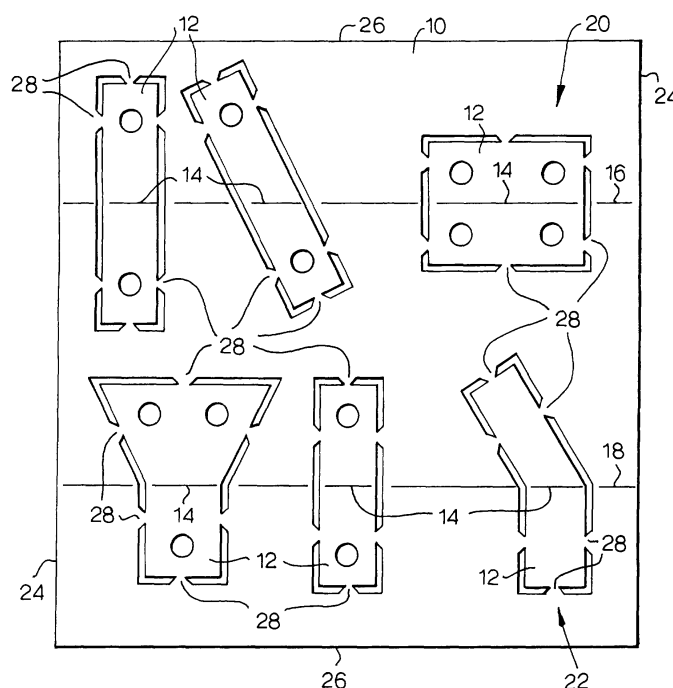
(71) Applicant: **ROLLS-ROYCE PLC**
London, SW1E 6AT (GB)

(54) A method of manufacturing ductile sheet material components

(57) A method of manufacturing ductile sheet material brackets (12) comprises cutting out the shape of a plurality of brackets (12) in a single piece of ductile sheet material (10) except for frangible retaining means (28) retaining the brackets (12) on the piece of ductile sheet material (10). The components (12) are arranged within the piece of ductile sheet material (10) such that the bend lines (14) of the brackets (12) are arranged in at

least one common bend line (16,18). The piece of ductile sheet material (10) is bent about the at least one common bend line (16,18) to bend a plurality of brackets (12) in a single operation. The frangible retaining means (28) are subsequently broken to allow removal of the brackets (12) from the piece of ductile sheet material (10). This reduces manufacturing costs and increases usage of the ductile sheet material (10).

Fig.1.



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Description

[0001] The present invention relates to a method of manufacturing ductile sheet material components and in particular to a method of manufacturing ductile sheet metal brackets.

[0002] It is known to manufacture a ductile sheet metal bracket by firstly cutting out the shape of the bracket from a piece of ductile sheet metal and then bending the bracket to the required angle. The brackets are commonly cut out of the ductile sheet material by guillotine cutting, hand cutting, turret punching, water jet cutting or laser cutting.

[0003] A problem with this method is that it is relatively expensive to produce the ductile metal brackets and it is relatively wasteful of sheet metal. This is because each bracket is produced individually.

[0004] Accordingly the present invention seeks to provide a novel method of manufacturing ductile sheet material components which reduces, preferably overcomes, the above mentioned problems.

[0005] Accordingly the present invention provides a method of manufacturing ductile sheet material components comprising cutting out the shape of a plurality of components in a single piece of ductile sheet material except for frangible retaining means retaining the components on the ductile sheet material, arranging the components within the ductile sheet material such that the bend lines of the components are arranged in at least one common bend line and bending the ductile sheet material about the at least one common bend line to bend a plurality of components in a single operation.

[0006] Preferably the method comprises arranging a plurality of components within the ductile sheet material such that the bend lines of the components are arranged in a first common bend line, arranging a plurality of components within the ductile sheet material such that the bend lines of the components are arranged in a second common bend line, bending the ductile sheet material about the first common bend line and bending the ductile sheet material about the second common bend line to bend a plurality of components in a single operation.

[0007] Preferably the first and second common bend lines are parallel.

[0008] Preferably the at least one bend line is perpendicular to an edge of the ductile sheet material.

[0009] Preferably the method comprises subsequently breaking the frangible retaining means to remove the components from the ductile sheet material.

[0010] Preferably the ductile sheet material comprises a metal or an alloy.

[0011] Preferably the ductile sheet material comprises stainless steel, nickel, nickel alloy, aluminium, aluminium alloy, titanium or titanium alloy.

[0012] Preferably the plurality of ductile sheet material components are cut from the ductile sheet material by laser cutting or water jet cutting.

[0013] The components may be bent to any suitable

angle for example 150°, 135°, 120°, 90°, 60°, 45°, and 30°.

[0014] Preferably the components are brackets.

[0015] The present invention also provides a ductile sheet material comprising a plurality of components and frangible retaining means retaining the components on the ductile sheet material, the ductile sheet material being bent about at least one common bend line, the components being arranged within the ductile sheet material such that the bend lines of the components are arranged in at least one common bend line.

[0016] Preferably the ductile sheet material comprises a plurality of components being arranged within the ductile sheet material such that the bend lines of the components are arranged in a first common bend line, a plurality of components being arranged within the ductile sheet material such that the bend lines of the components are arranged in a second common bend line and the ductile sheet material being bent about the first common bend line and being bent about the second common bend line.

[0017] Preferably the first and second common bend lines are parallel.

[0018] Preferably the at least one bend line is perpendicular to an edge of the ductile sheet material.

[0019] Preferably the ductile sheet material comprises a metal or an alloy.

[0020] Preferably the ductile sheet material comprises stainless steel, nickel, nickel alloy, aluminium, aluminium alloy, titanium or titanium alloy.

[0021] The components may be bent to any suitable angle for example 150°, 135°, 120°, 90°, 60°, 45° and 30°.

[0022] Preferably the components are brackets.

[0023] The present invention will be more fully described by way of example with reference to the accompanying drawings in which:-

Figure 1 shows a plan view of a piece of ductile sheet material with a plurality of components arranged therein according to the present invention. Figure 2 shows a plan view of the piece of ductile sheet material after bending.

Figure 3 shows a view in the direction of arrow A in figure 2.

[0024] A piece of ductile sheet material 10, as shown in figure 1, of predetermined dimensions, for example A3 sheet material size, is formed by cutting to size. A plurality of ductile sheet material components 12 are arranged to be cut from the piece of ductile sheet material 10. The ductile sheet material components 12 have a common thickness and have a common bend angle. The ductile sheet material components 12 may have identical shapes or may have different shapes.

[0025] The ductile sheet material components 12 are arranged in the piece of ductile sheet material 10 such that the bend lines 14 of the ductile sheet material com-

ponents 12 are arranged in one or more common bend lines 16, 18. In this example a first set 20 of ductile sheet material components 12 are arranged with their bend lines 14 co-linear with the common bend line 16 and a second set 22 of ductile sheet material components 12 are arranged with their bend lines 14 co-linear with the common bend line 18. The first and second common bend lines 16 and 18 are arranged substantially parallel, the first and second common bend lines 16 and 18 are arranged substantially perpendicular to the edges 24 and the first and second common bend lines 16 and 18 are arranged substantially parallel to the ends 26.

[0026] The ductile sheet material components 12 are cut from the piece of ductile sheet material 10 except for a plurality of frangible retaining means 28 which retain each of the ductile sheet material components 12 on the piece of ductile sheet material 10. The ductile sheet material components 12 are cut from the piece of ductile sheet material 10 by any suitable means for example laser cutting or water jet cutting.

[0027] The piece of ductile sheet material 10 is then bent around the common bend lines 16 and 18, as shown in figures 2 and 3, such that the ductile sheet material components 12 in the first set 20 are bent through the same angle around the common bend line 16 and the ductile sheet material components 12 in the second set 22 are bent through the same angle around the common bend line 18.

[0028] The angle through which the ductile sheet material components 12 in the first set 20 are bent may be the same or different to the angle through which the ductile sheet material components 12 in the second set 22 are bent. The angle through which the ductile sheet material components 12 are bent is any suitable angle and is preferably in the range 30° to 150°, for example 150°, 135°, 120°, 90°, 60°, 45° or 30°.

[0029] The frangible retaining means 28 are broken to allow the bent ductile sheet material components 12 to be removed from the piece of ductile sheet material 10. The bent ductile sheet material components 12 may be removed immediately after the piece of ductile sheet material 10 has been bent or preferably the bent ductile sheet material components 12 are retained on the piece of ductile sheet material 10 until the bent ductile sheet material components 12 are required.

[0030] For example the piece of ductile sheet material 10 may have all the ductile sheet material components 12 of a particular ductile sheet material and a particular sheet material thickness for a particular gas turbine engine type. Thus the fitter for the gas turbine engine is provided with a kit of ductile sheet material components 12 retained in the piece of ductile sheet material 10 and simply removes each ductile sheet material component 12 from the piece of ductile sheet material 10 as it is required in the build sequence for the gas turbine engine. The retention of the ductile sheet material components 12 on the piece of ductile sheet material 10 enables the ductile sheet material components to be stored

in flat stacks.

[0031] The ductile sheet material preferably comprises a metal or an alloy, for example steel, stainless steel, nickel, nickel alloy, nickel superalloy, aluminium, aluminium alloy, titanium or titanium alloy. However, components may be produced from other ductile sheet material.

[0032] The ductile sheet material components are preferably brackets, however other ductile sheet material components may be produced.

[0033] Although the invention has been described with reference to two common bend lines it may be possible to provide only a single common bend line or three, four or more common bend lines depending upon the size of the ductile sheet material components and the size of the piece of ductile sheet material. Although the invention has been described with reference to parallel common bend lines it may be possible to arrange the common bend lines at other angles. Although the invention has been described with reference to arranging the common bend lines perpendicular to an edge of the piece of ductile sheet material and parallel to an end of the ductile sheet material it may be possible to arrange the common bend lines at other angles relative to the edges or ends of the piece of ductile sheet material.

[0034] The advantages of the present invention are that the cost of manufacturing the ductile sheet material components is reduced and the amount of ductile sheet material is reduced. Additionally the logistics of ordering the components is reduced because a request for single piece of ductile sheet material, with all the components, on an order form places an order for all the components on the piece of ductile sheet material.

[0035] Although the invention has been described with reference to components, the invention is equally applicable to manufacturing of articles and thus the term components includes the term articles.

Claims

1. A method of manufacturing ductile sheet material components (12) comprising cutting out the shape of a plurality of components (12) in a single piece of ductile sheet material (10) **characterised by** providing frangible retaining means (28) retaining the components (12) on the ductile sheet material (10), arranging the components (12) within the ductile sheet material (10) such that the bend lines (14) of the components (12) are arranged in at least one common bend line (16,18) and bending the ductile sheet material (10) about the at least one common bend line (16,18) to bend a plurality of components (12) in a single operation.
2. A method as claimed in claim 1 wherein the method comprises arranging a plurality of components (12) within the ductile sheet material (10) such that the

bend lines (14) of the components (12) are arranged in a first common bend line (16), arranging a plurality of components (12) within the ductile sheet material (10) such that the bend lines (14) of the components (12) are arranged in a second common bend line (18), bending the ductile sheet material (10) about the first common bend line (16) and bending the ductile sheet material (10) about the second common bend line (18) to bend a plurality of components (12) in a single operation.

3. A method as claimed in claim 2 wherein the first and second common bend lines (16,18) are parallel.

4. A method as claimed in any of claims 1 to 3 wherein the at least one bend line (16,18) is perpendicular to an edge (24) of the ductile sheet material (10).

5. A method as claimed in any of claims 1 to 4 wherein the method comprises subsequently breaking the frangible retaining means (28) to remove the components (12) from the ductile sheet material (10).

6. A method as claimed in any of claims 1 to 5 wherein the ductile sheet material (10) comprises a metal or an alloy.

7. A method as claimed in claim 6 wherein the ductile sheet material (10) comprises stainless steel, nickel, nickel alloy, aluminium, aluminium alloy, titanium or titanium alloy.

8. A method as claimed in any of claims 1 to 7 wherein the plurality of ductile sheet material components (12) are cut from the ductile sheet material (10) by laser cutting or water jet cutting.

9. A method as claimed in any of claims 1 to 8 wherein the components (12) are bent at angle in the range 30° to 150°.

10. A method as claimed in any of claims 1 to 9 wherein the components (12) are brackets.

11. A ductile sheet material (10) **characterised in that** it comprises a plurality of components (12) and frangible retaining means (28) retaining the components (12) on the ductile sheet material (10), the ductile sheet material (10) being bent about at least one common bend line (16,18), the components (12) being arranged within the ductile sheet material (10) such that the bend lines (14) of the components (12) are arranged in at least one common bend line (16,18).

12. A ductile sheet material as claimed in claim 11 wherein the ductile sheet material (10) comprises a plurality of components (12) being arranged within

the ductile sheet material (10) such that the bend lines (14) of the components (12) are arranged in a first common bend line (16), a plurality of components (12) being arranged within the ductile sheet material (10) such that the bend lines (14) of the components (12) are arranged in a second common bend line (18) and the ductile sheet material (10) being bent about the first common bend line (16) and being bent about the second common bend line (18).

13. A ductile sheet material as claimed in claim 12 wherein the first and second common bend lines (16,18) are parallel.

14. A ductile sheet material as claimed in claim 11, claim 12 or claim 13 wherein the at least one bend line (16,18) is perpendicular to an edge (24) of the ductile sheet material (10).

15. A ductile sheet material as claimed in any of claims 11 to 14 wherein the ductile sheet material (10) comprises a metal or an alloy.

16. A ductile sheet material as claimed in claim 15 wherein the ductile sheet material (10) comprises stainless steel, nickel, nickel alloy, aluminium, aluminium alloy, titanium or titanium alloy.

17. A ductile sheet material as claimed in any of claims 11 to 16 wherein the components (12) are bent (14) at angle in the range 30° to 150°.

18. A ductile sheet material as claimed in any of claims 11 to 17 wherein the component are brackets.

Fig.1.

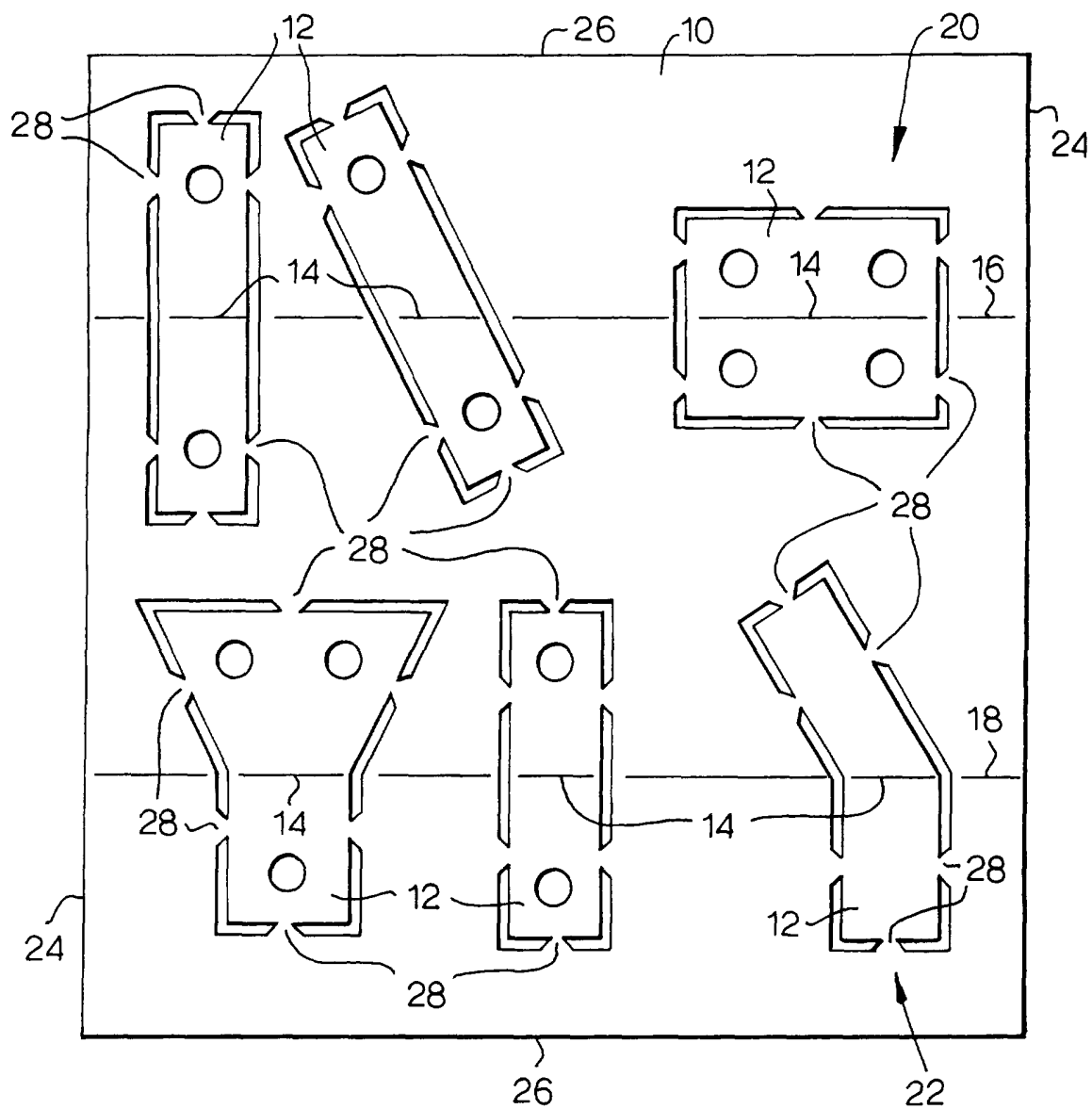


Fig.2.

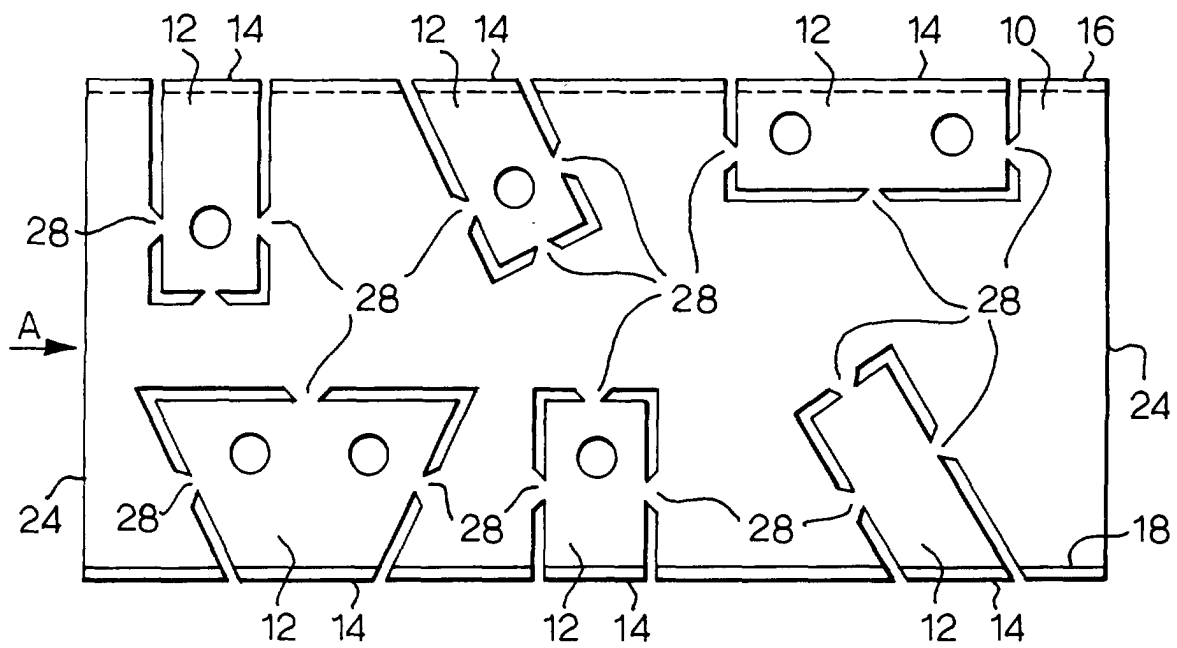
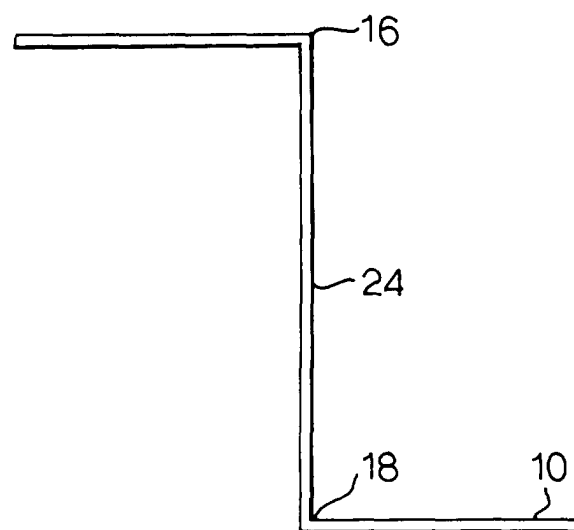


Fig.3.





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EUROPEAN SEARCH REPORT

Application Number
EP 01 30 8646

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 196 37 811 A (KLOECKNER MOELLER GMBH) 9 April 1998 (1998-04-09) * column 1, line 58 - column 1, line 64; figures 1-5 *	1-18	B21D28/06 B21D28/10 B21D35/00
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A	EP 0 325 121 A (LANZ IND TECHNIK AG) 26 July 1989 (1989-07-26) * figure 8 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B21D
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 12 February 2002	Examiner Vinci, V
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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