



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.04.2024 Bulletin 2024/14

(21) Application number: **23275142.0**

(22) Date of filing: **27.09.2023**

(51) International Patent Classification (IPC):
E06B 3/58 (2006.01) **E06B 3/82** (2006.01)
E06B 5/16 (2006.01) **E06B 3/70** (2006.01)

(52) Cooperative Patent Classification (CPC):
E06B 3/825; E06B 3/5892; E06B 3/70;
E06B 5/162; E06B 2003/7023; E06B 2003/703;
E06B 2003/7032; E06B 2003/7036;
E06B 2003/704; E06B 2003/7042; E06B 2003/7061

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **27.09.2022 GB 202214070**

(71) Applicant: **Scotdor, a partnership under Scots Law**
Nerston Industrial Estate
East Kilbride, Glasgow G74 4QL (GB)

(72) Inventor: **Brown, David**
East Kilbride, Glasgow G74 4QL (GB)

(74) Representative: **Murgitroyd & Company**
165-169 Scotland Street
Glasgow G5 8PL (GB)

(54) **AN IMPROVED DOOR LEAF**

(57) A door leaf (110) is provided, the door leaf having two insulation layers (118), a fireboard (122) comprising a main portion sandwiched between the insulation layers and a tongue portion (124) protruding from between the insulation layers. The door leaf has at least one casing element with a groove (133), wherein the tongue portion

(124) of the fireboard (122) is fitted into the groove of the at least one casing element. The door leaf has a door aperture lined by at least one liner (134) upon which at least one glazing element (136) is located, wherein the at least one liner comprises the at least one casing element.

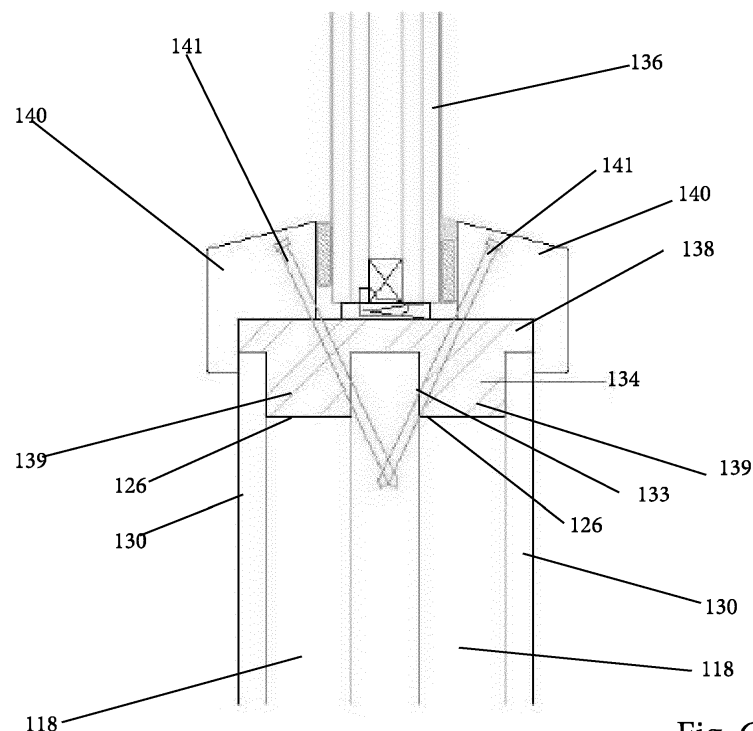


Fig. 6

Description

Field of Invention

[0001] This invention relates to doors and door leaves which are used in building structures, and in particular such doors and door leaves that are required to be fire resistant and thermally efficient.

Background of Invention

[0002] As depicted in Figure 1, a conventional door leaf 1 comprises a panel 2 which is held in position by an internal frame 3. The internal frame 3 is formed of frame elements known as stiles 4 and rails 5 that surround the panel 2. The stiles 4 are vertical frame elements whereas the rails 5 are horizontal frame elements.

[0003] A conventional door leaf 10 with a door aperture 11 is shown in Figure 2. The door aperture 11 is lined with liners 13 upon which a glazing element (not shown) is positioned. The liner 13 adds strength between the glazing element and the rest of the door leaf 10.

[0004] A conventional insulated and fire resistant door leaf 20 with a glazing element 21 (or window element) is shown in Figure. 3. The door leaf 20 includes a fireboard 23 sandwiched between two insulating panels 24. The insulating panels 24 are formed of combustible materials, whereas the fireboard 23 is formed of a non-combustible material. As shown a stile 25 and a liner 26 of the door leaf 20 are secured to the fireboard 23 and insulating panels 24 with adhesive. This means that, as shown in Fig. 4, in the event of a fire, the adhesive often fails and the fireboard 23 migrates out of position or collapses once the insulating panels 24 have burnt away, meaning the fireboard 23 ceases to provide helpful fire protection. This also means that the liner 26 is not very well supported and tends to fall from its position supporting the glazing element 21, meaning the glazing element 21 also falls.

[0005] It is an object of the present invention to mitigate or obviate one or more problems with prior door leaves.

Summary of Invention

[0006] According to a first aspect of the present invention, there is provided a door leaf comprising:

- two insulation layers;
- a fireboard comprising a main portion sandwiched between the insulation layers and a tongue portion protruding from between the insulation layers;
- at least one casing element with a groove, wherein the tongue portion of the fireboard is fitted into the groove of the at least one casing element; and
- wherein the door leaf comprises a door aperture lined by at least one liner upon which at least one glazing element is located, wherein the at least one liner comprises the at least one casing element.

[0007] The "casing element" is an element of the door leaf which at least partially encases the tongue portion of the fireboard. In the invention, the casing element may be, for example, a rail, stile or liner of the door leaf. Preferably, there are multiple casing elements which form a casing into which the fireboard is set. The tongue portion of the fireboard may be fitted into the at least one casing element such that an interference fit is formed between the at least one casing element and the tongue portion.

[0008] The insulation panels may be flush with each other, and the casing element may be in contact with the insulation panels.

[0009] The insulation panels may comprise a first non-wood based material. The first non-wood based material may comprise foam insulation.

[0010] The insulation layers may be pre-formed panels. Alternatively, the insulation layers may be formed by injecting the foam insulation into cavities formed between the fireboard and respective facing elements. The foam insulation may be injected into the cavities via one or more holes formed in the at least one casing element.

[0011] The fireboard may comprise a second non-wood based material.

[0012] The second non-wood based material may comprise a ceramic material, preferably a gypsum-based material.

[0013] The casing element may comprise wood.

[0014] The door leaf may further comprise opposing facing elements, wherein the two insulation layers and fireboard are located inside the facing elements and the casing element is at least partly located inside the facing elements.

[0015] The fireboard may be located in a casing formed of two rails and two stiles and one of the rails or stiles comprises the at least one casing element.

[0016] The at least one liner may comprise: an edging portion upon which the glazing element is located; and parallel extending projections that extend from the edging portion and define the groove between them, wherein the edging portion overhangs the opposing facing elements.

[0017] The casing element may be a first casing element. The groove may be a first groove, The tongue portion may be at least a first tongue portion.

[0018] The fireboard may be located in a casing formed of two stiles and two rails, wherein at least one of the stiles or rails may comprise a second casing element with a second groove, wherein the at least a first tongue portion may be fitted into the second groove of the second casing element.

[0019] The at least a first tongue portion may comprise first and second tongue portions, wherein the first tongue portion may be fitted into the first groove and the second tongue portion may be fitted into the second groove.

[0020] The door leaf may further comprise at least one metal sheet layer, the or each metal sheet layer located between a respective facing element and insulation layer.

[0021] According to a second aspect of the present

invention, there is provided a door comprising a door-frame and the door leaf according to the first aspect of the present invention hingeably or pivotably mounted in the doorframe.

[0022] According to a third aspect of the present invention, there is provided a building comprising a wall with a door according to the second aspect of the present invention.

Brief Description of the Drawings

[0023] Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a conventional door leaf comprising a panel which is held in position by an internal frame;

Figure 2 shows a conventional door leaf with a door aperture;

Figure 3 shows a sectional view of a conventional insulated fire door with a glazing element (or window element);

Figure 4 shows the insulated fire door of Figure 3 failing in a fire;

Figure 5 shows a sectional view of a door leaf of the present invention;

Figure 6 shows in detail a sectional view of a liner incorporated in the present invention; and

Figure 7 shows the performance of the door leaf of Figure 5 in use.

Detailed Description of the Drawings

[0024] With reference to Figure 5, there is shown a door leaf 110 according to the present invention. The door leaf 110 is mounted in a doorframe 112 by means of hinges or pivots 114. As shown the door leaf 110 comprises two opposing insulation panels 118, and a fireboard 120 positioned between the panels 118. In particular, a main portion 122 of the fireboard 120 is sandwiched between the panels 118 and a tongue portion 124 of the fireboard 120 protrudes from between the insulation panels 118. As shown the tongue portion 124 is a continuation of the main portion 122 of the fireboard, and the tongue portion 124 projects beyond peripheral edges 126 of the insulation panels 118. In the depicted example of Figures 5 and 6, there is a single tongue portion 124 which extends beyond outer peripheries of the insulation panels 118.

[0025] As shown, the insulation panels 118 may be located inside opposing facing elements 130. The insulation panels 118 preferably comprise a material which

comprises a foam, meaning the door leaf 110 provides effective insulation. The fireboard 120 comprises a material that provides effective fire protection. A ceramic material may therefore be used to form the fireboard 120.

A gypsum-based material may be used.

[0026] As shown, the door leaf 110 comprises at least one first casing element 132 and at least one second casing element 134. Each of these casing elements 132, 134 has a groove 131, 133 into which the tongue portion 124 of the fireboard 120 is fitted. In the depicted example, the door leaf 110 comprises a casing formed of two stiles and rails into which the fireboard 120 is set and the first casing element 132 is a stile of the door leaf (only one stile 132 of the casing is visible in Figure 5).

[0027] Also in the depicted example, the door leaf 110 comprises a door aperture 135. A portion of the door aperture 135 is shown in Figure 5, and the door aperture 135 is lined with at least one liner 134, which supports at least one glazing element 136. In the depicted example, the at least one liner 134 is the at least one second casing element 134. The tongue portion 124 of the fireboard 120 is fitted into the casing elements 132 and 134 such that the tongue portion 124 is securely held by each respective casing element 132, 134. An interference fit may be formed between each respective casing element 132, 134 and the tongue portion 124. As shown, each casing element may be at least partly located between the two opposing facing elements 130.

[0028] In Figure 6, the at least one second casing element or liner 134 shown in Fig. 5 is shown in greater detail. The liner 134 comprises an edging 138 which forms an edge of the door leaf 110 upon which the at least one glazing element 136 is located. In the depicted example the at least one glazing element 136 comprises a double glazing element. Parallel extending projections 139 depend from the edging 138 and are in contact with the edges 126 of the insulation panels 118. The projections 139 define the groove 133 formed in the liner 134 between them and the edging 138 overhangs and is in contact with the facing elements 130. The at least one glazing element 136 is secured in position by two clamping elements 140. Each clamping element 140 is located on the liner and on a respective side of the at least one glazing element 136. Each clamping element 140 is fixed in position by a fixture 141 which is driven into the door leaf 110 and clamping element at an angle to the door leaf 110. As shown each fixture 141 extends through its associated clamping element 140, the liner 134 and the fireboard 120. The fixture 141 may be a screw or a nail. The specific configuration of the liner 134 with the edging 138 and parallel projections 139 is advantageous as it provides improved fixture retention, meaning the glazing element is securely held in position on the liner 134.

Industrial Applicability

[0029] With reference to Figure 7, in a prolonged fire the facing 130 and insulation panel 118 on the fireside

of the door leaf eventually burn away, thereby exposing the fireboard 120. The fireboard 120 is non-combustible so prevents passage of the fire through the door. As the fireboard 120 is held in position within the grooves 131, 133 of the casing elements 132, 134 the fireboard does not migrate out of position, meaning the fire cannot pass through the door leaf in contrast to prior arrangements where the fireboard collapses due to failure of the adhesive.

[0030] In the invention, the fireboard is held within the groove of the at least one casing element (which may, for example be a rail, stile or liner of the door leaf), meaning no adhesive is required to secure the fireboard in an upright position. This means that when the combustible insulation is burnt in a fire the fireboard is held in position, meaning the fireboard continues to provide fire protection for longer than prior arrangements. The present invention therefore provides a door with both good insulation and fire protection properties.

[0031] Advantageously, the present invention provides a rigid and strong door leaf structure that does not rely on adhesive.

[0032] Advantageously, in the specific liner and glazing arrangement of the present invention, there is increased screw retention due to the configuration of the specific liner employed. This means that in a fire the fixtures retain the clamping elements and glazing element in position, meaning the glazing element does not collapse and allow the fire to pass through the door.

[0033] The at least one casing element may be a stile, rail or liner of the door leaf. The door leaf may be located inside a casing comprising two stiles and two rails and the casing may comprise at least one casing element with a groove as described above into which a tongue portion of the fireboard is fitted. The casing may include a single casing element with a groove or multiple casing elements, which each have a groove. The tongue portion may extend beyond an entire outer periphery of the insulation panels or only a portion of the periphery. There may be a single tongue portion or multiple tongue portions extending from between the panels.

[0034] Modifications and improvements may be incorporated without departing from the scope of the invention, which is defined by the appended claims.

[0035] For example, a preferred embodiment of the present invention uses pre-formed panels of closed cell insulation material either side of the fireboard. The closed cell insulation panel used is a rigid 100% recycled and recyclable foam board with none or limited hazardous emissions during either combustion or the manufacturing process. As an alternative cavities may be formed between the fireboard and the door facings, with expandable foam injected into the cavities to form the insulation. During manufacture 5-10 mm diameter holes are drilling into the stiles and/or rails such that they may accommodate the nozzle of a foam-injecting apparatus. After the nozzle is inserted into the holes, the injection of the foam slowly fills the empty cavities between the fire rated core

material and the timber facings of the door leaf.

[0036] For added security a thin (e.g. 0.9-1 mm) steel sheet can be added to at least one side of the door leaf. The steel sheet may be added to the exterior of the facings, but for aesthetic reasons it may alternatively be located on the side of the door leaf, between the facing and the insulating material. As well as hindering attempts to cut through the door the steel sheet also acts as a fire shield, enhancing fire resistance.

Claims

1. A door leaf comprising:

two insulation layers;
a fireboard comprising a main portion sandwiched between the insulation layers and a tongue portion protruding from between the insulation layers;
at least one casing element with a groove, wherein the tongue portion of the fireboard is fitted into the groove of the at least one casing element;
and wherein the door leaf comprises a door aperture lined by at least one liner upon which at least one glazing element is located, wherein the at least one liner comprises the at least one casing element.

2. The door leaf of claim 1, wherein the insulation layers are flush with each other, and the casing element is in contact with the insulation layers.

3. The door leaf of either preceding claim, wherein the insulation layers comprise a first non-wood based material.

4. The door leaf of claim 2, wherein the first non-wood based material comprises foam insulation.

5. The door leaf of claim 4, wherein the insulation layers are pre-formed panels.

6. The door leaf of claim 4, wherein the insulation layers are formed by injecting the foam insulation into cavities formed between the fireboard and respective facing elements.

7. The door leaf of claim 6, wherein the foam insulation is injected into the cavities via one or more holes formed in the at least one casing element.

8. The door leaf of any preceding claim, wherein the fireboard comprises a second non-wood based material.

9. The door leaf of claim 8, wherein the second non-

wood based material comprises a ceramic material,
preferably a gypsum-based material.

10. The door leaf of any preceding claim, wherein the casing element comprises wood. 5

11. The door leaf of any preceding claim, further comprising opposing facing elements, wherein the two insulation layers and fireboard are located inside the facing elements and the casing element is at least partly located inside the facing elements. 10

12. The door leaf of any preceding claim, wherein the fireboard is located in a casing formed of two rails and two stiles and one of the rails or stiles comprises the at least one casing element. 15

13. The door leaf of claim 11 wherein the at least one liner comprises: an edging portion upon which the glazing element is located; and parallel extending projections that extend from the edging portion and define the groove between them, wherein the edging portion overhangs the opposing facing elements. 20

14. The door leaf of any preceding claim, wherein the at least one glazing element is held in position by at least two clamping elements, each clamping element on a respective side of the glazing element and located on the liner, wherein each clamping element is fixed in position by a fixture that extends through the liner, and the fireboard; 25
and/or 30

wherein the casing element is a first casing element, wherein the groove is a first groove, wherein the tongue portion is at least a first tongue portion, wherein the fireboard is located in a casing formed of two stiles and two rails, wherein at least one of the stiles or rails comprises a second casing element with a second groove, wherein the at least one first tongue portion is fitted into the second groove of the second casing element. 35
40
45

15. The door leaf of any preceding claim, further comprising at least one metal sheet layer, the or each metal sheet layer located between a respective facing element and insulation layer. 50

55

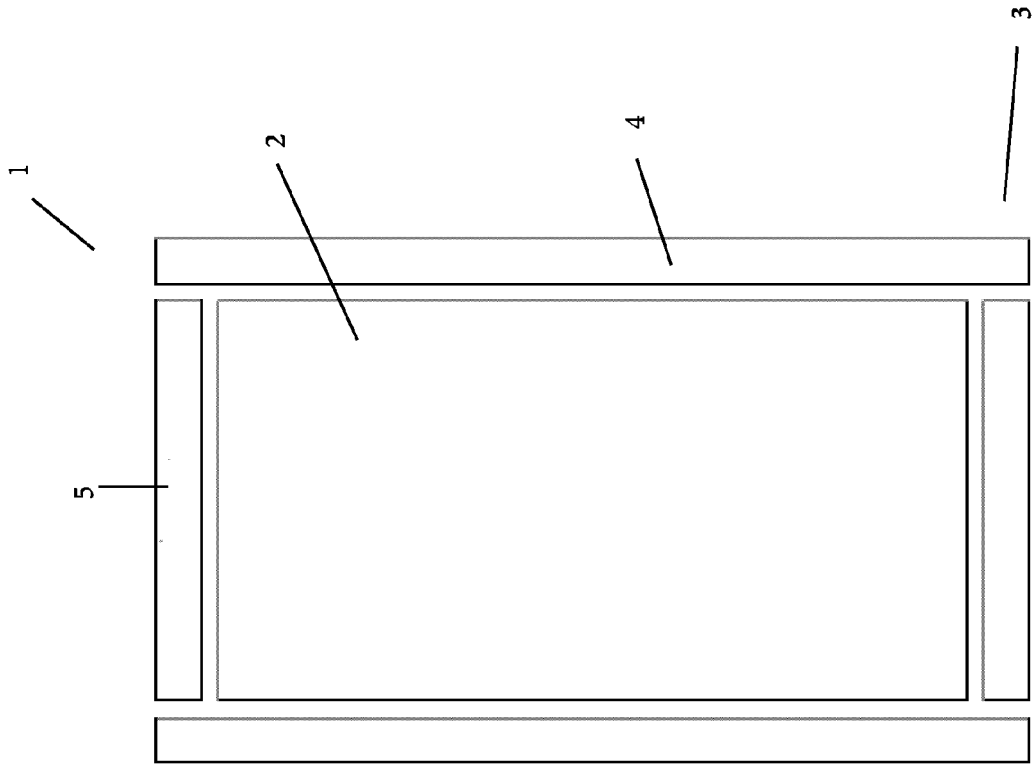


Fig. 1

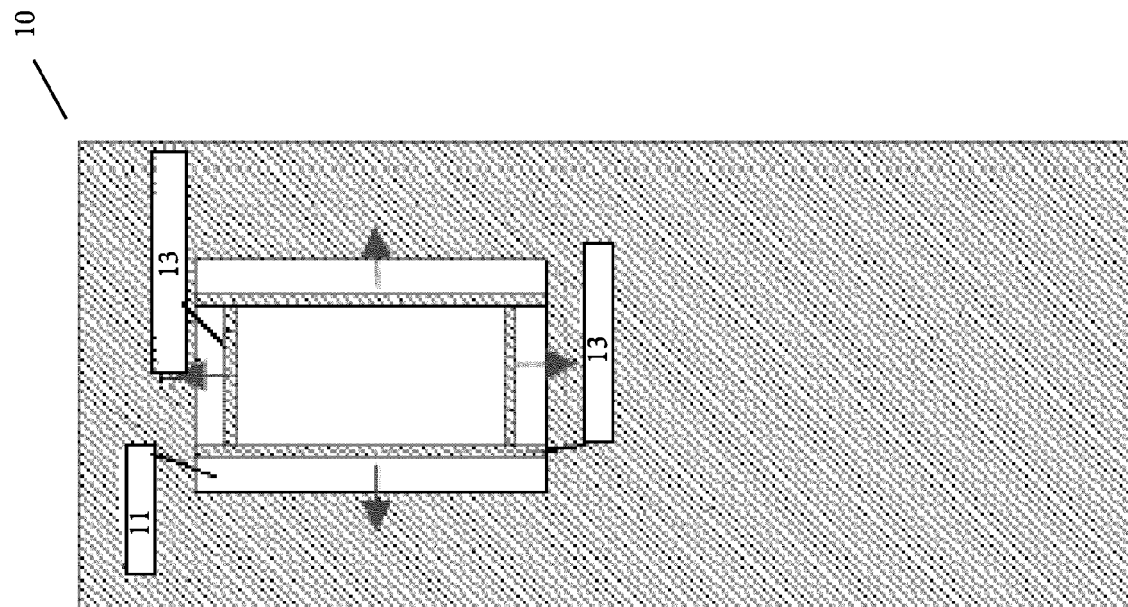


Fig. 2

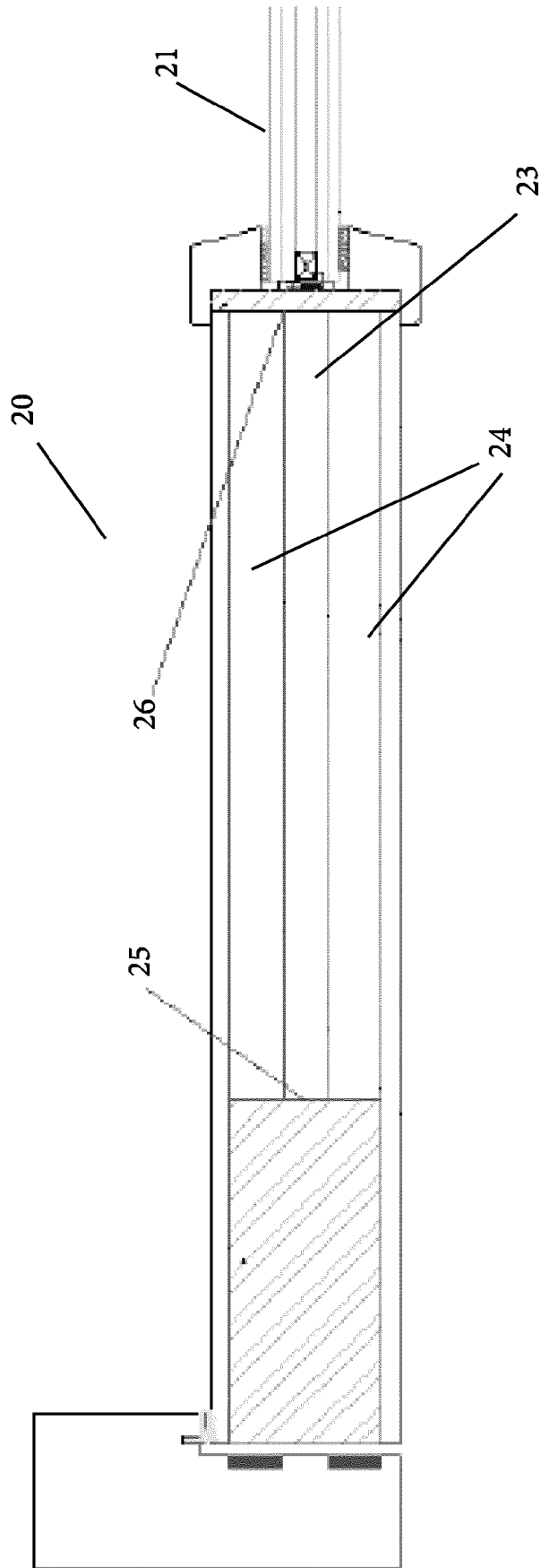


Fig. 3

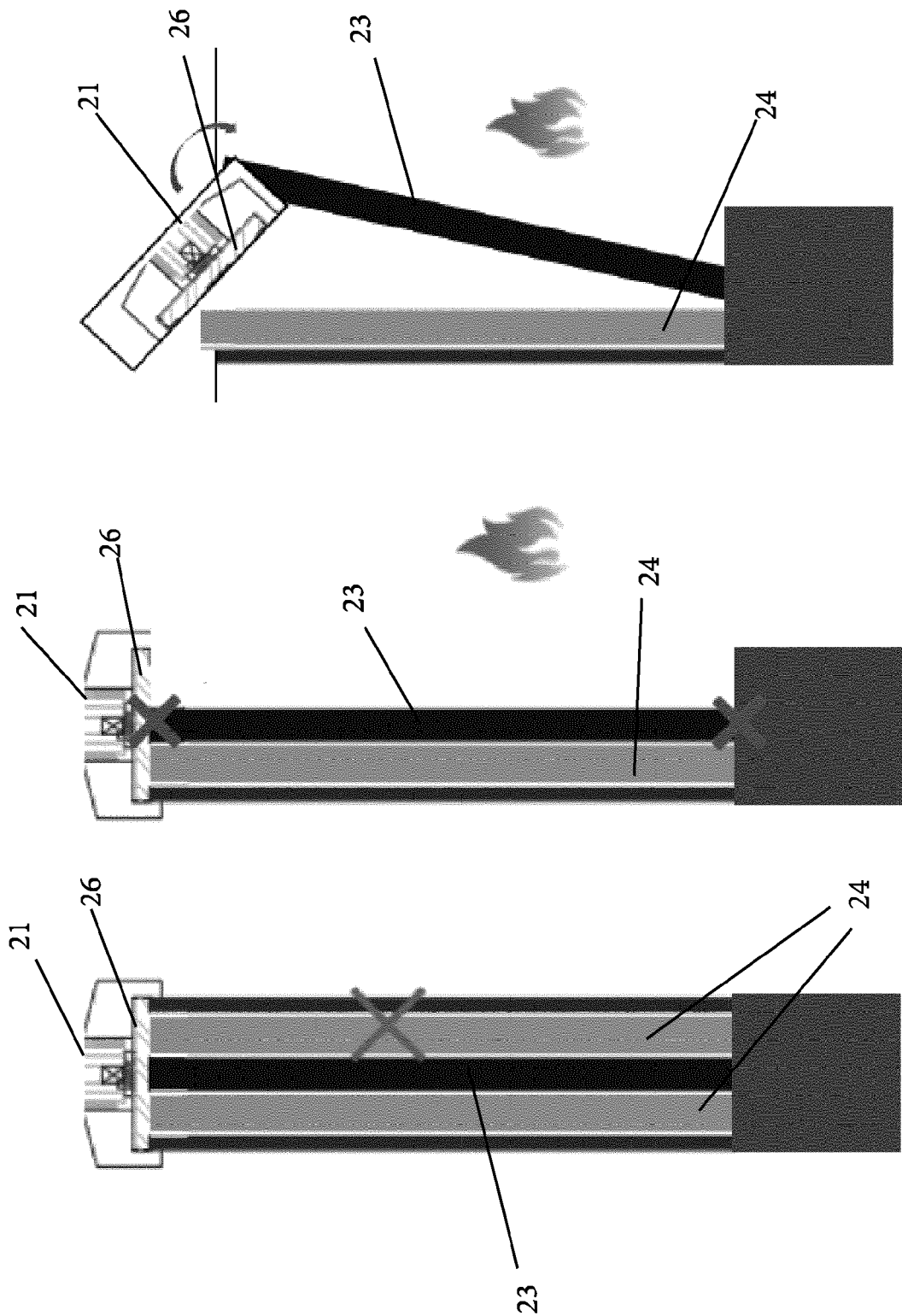


Fig. 4

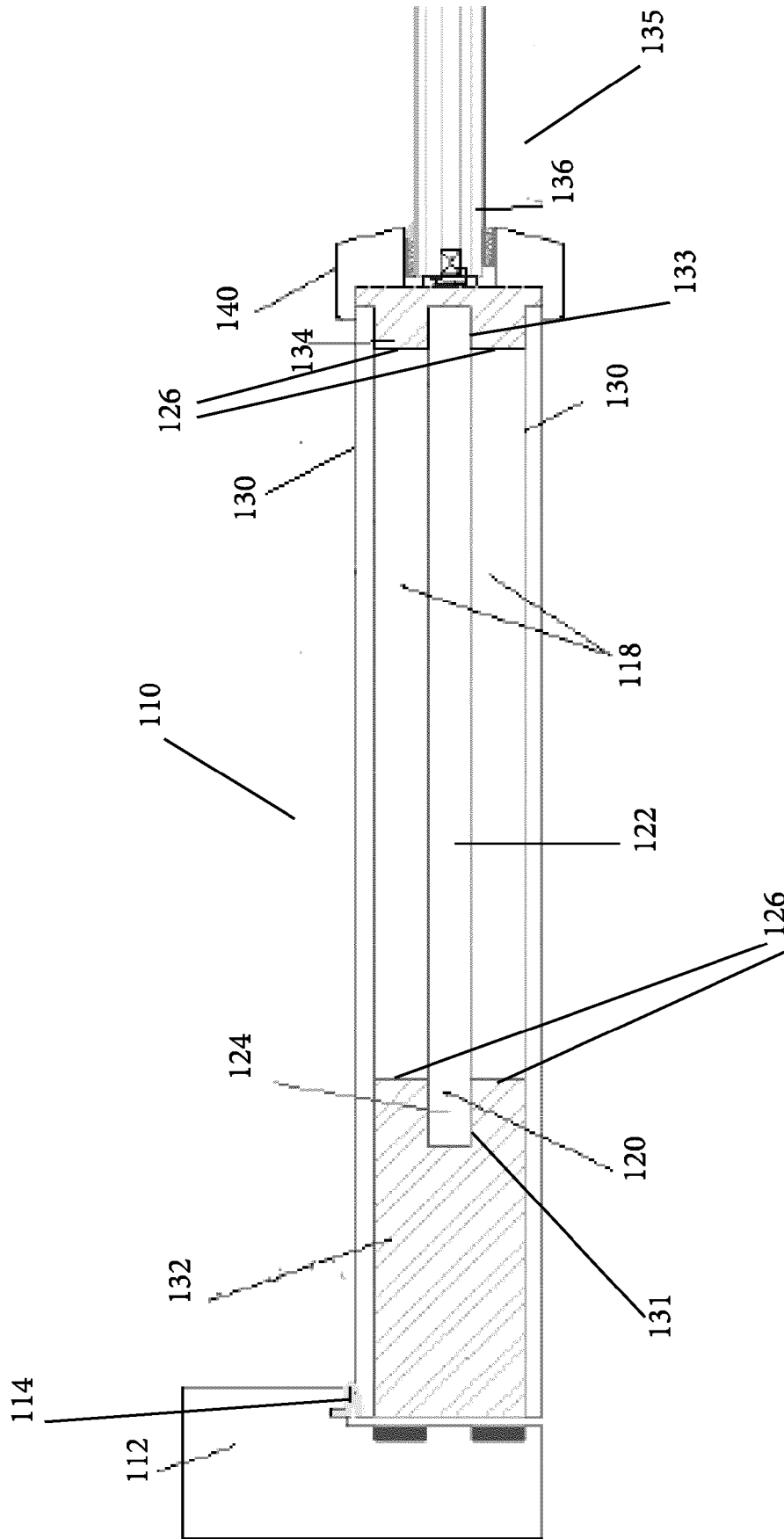


Fig. 5

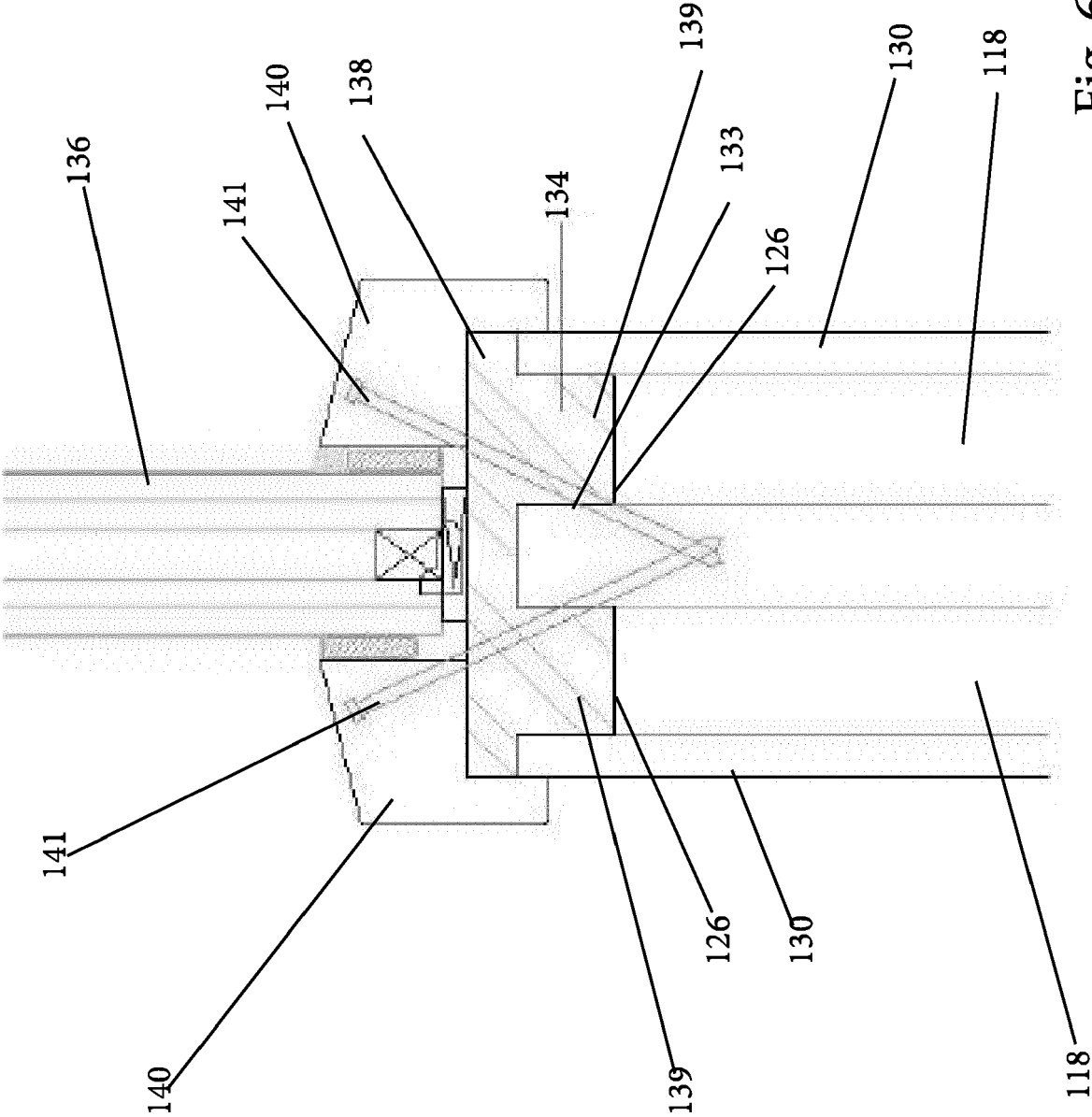


Fig. 6

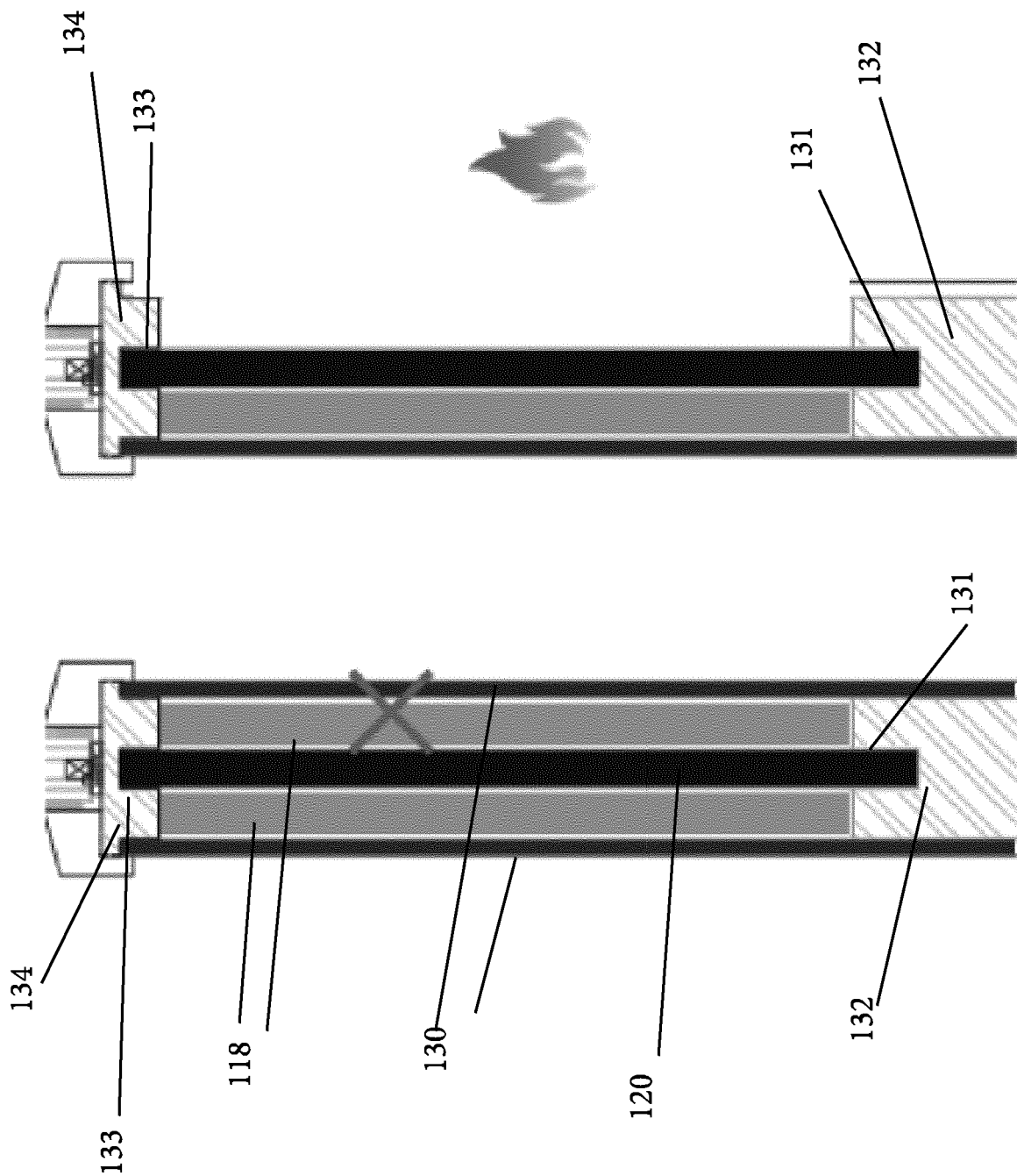


Fig. 7



EUROPEAN SEARCH REPORT

Application Number

EP 23 27 5142

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 20 2013 000903 U1 (DUPP ALEXANDER [DE]) 20 February 2013 (2013-02-20) * figure 1 * * paragraph [0010] - paragraph [0019] * -----	1-15	INV. E06B3/58 E06B3/82 E06B5/16 E06B3/70
Y	CN 105 927 127 A (ANHUI ANWANG DOOR SHARES CO LTD) 7 September 2016 (2016-09-07) * figures 1-3, 6 * * claims 1, 4, 6 * -----	1-3, 8-15 4-7	
Y	GB 2 308 400 A (KOVACS LAURENCE KEITH [GB]) 25 June 1997 (1997-06-25) * figures 3, 4 * * page 2, line 1 - page 5, line 2 * -----	1-3, 8-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E06B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		31 January 2024	Blancquaert, Katleen
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

2
EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 23 27 5142

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

31-01-2024

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	DE 202013000903 U1	20-02-2013	NONE	
15	CN 105927127 A	07-09-2016	NONE	
	GB 2308400 A	25-06-1997	NONE	
20				
25				
30				
35				
40				
45				
50				
55				

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82