

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.03.2001 Bulletin 2001/10

(51) Int Cl.7: E06B 9/36

(21) Application number: 00307557.9

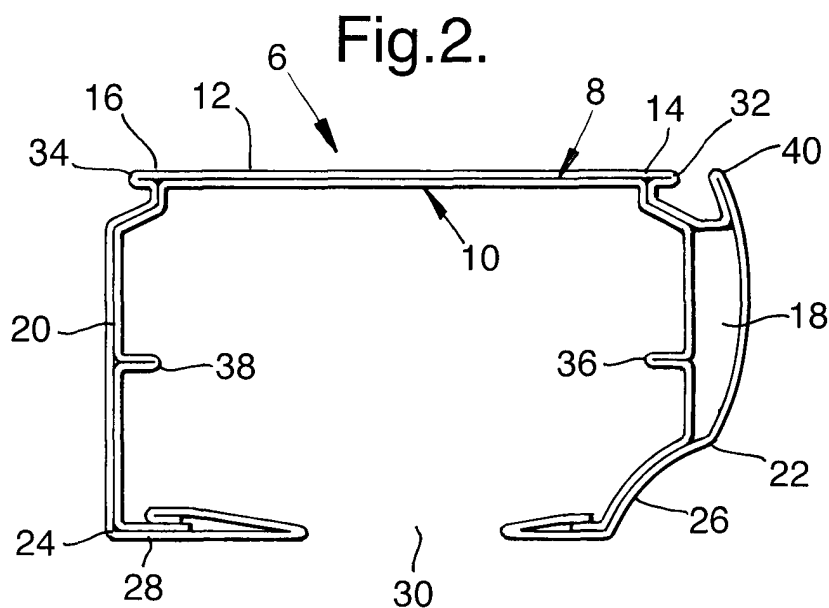
(22) Date of filing: 01.09.2000

(84) Designated Contracting States: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE Designated Extension States: AL LT LV MK RO SI (30) Priority: 01.09.1999 EP 99202831 (71) Applicant: HUNTER DOUGLAS INDUSTRIES B.V. 3071 EL Rotterdam (NL)	(72) Inventor: Welfonder, konrad 27574 Bremerhaven (DE) (74) Representative: Smith, Samuel Leonard J.A. Kemp & Co., 14 South Square, Gray's Inn London WC1R 5LX (GB)
--	--

(54) Blind Rail

(57) A vertical blind (2) rail having an elongate channel (6) including a base wall (12) extending widthwise in a first direction between first and second base edges (14,16), first and second side walls (18,20) extending respectively from the first and second base edges to respectively first and second side edges (22,24) in a second direction generally perpendicular to said first direction, first and second intumed flanges (26,28) extending inwardly in generally said first direction from the first and second side edges respectively so as to define a slot

(30) therebetween, wherein the vertical blind rail is formed by roll-forming a first elongate sheet into a cross-section partly conforming to the cross-section of an inner channel (10) of the blind rail, roll-forming a second elongate sheet into a cross-section partly conforming to the cross-section of an outer channel (8) of the blind rail, feeding the partly roll-formed first sheet for the inner channel into the partly roll-formed second sheet for the outer channel, and roll-forming the first and second sheets together to form the blind rail (Figure 2).



Description

[0001] This invention relates to a blind rail, in particular a modular blind rail having an elongate channel including an elongate inner channel for supporting or retaining blind components and an elongate outer channel including means for mounting the channel adjacent an architectural opening such as a window, and to an improved method of constructing such a channel.

[0002] It is known to provide a blind system for covering an architectural opening in which slats are suspended horizontally or vertically from a blind rail. The blind rail includes an elongate channel housing blind components. The elongate channel is of uniform continuous cross-section and is of a length appropriate to extend across the architectural opening.

[0003] In order to accommodate the blind components and the slats, the elongate channel includes, on one side, first and second inturned flanges which extend inwardly so as to define a slot therebetween. The elongate channel preferably includes further features in its cross-section for improved functionality. For instance, internally inwardly facing flanges can be provided to support the vertical blind carriers, such that the carriers can move along the channel on rollers. Similarly, the outer cross-section can include features to facilitate mounting of the channel.

[0004] To form the elongate channel, it has been proposed to roll-form a sheet aluminium into an appropriate cross-section. While this is very effective, it has certain limitations. In particular, functional features, whether internal or external, are visible on the elongate channel and determine the overall appearance of the vertical blind system.

[0005] Alternatively, the elongate channel can be formed as a single extrusion. However, this can be expensive and requires the use of materials which may not be ideal in terms of strength, appearance or cost.

[0006] US 2158656 relates to a method for manufacturing a slotted tubular bus duct. The duct itself is roll-formed into a channel section. During the roll-forming operation, insulating fibre ribbons are folded around ribbons of copper and then fed into the roll-formed section.

[0007] According to this invention, there is provided a blind rail having an elongate channel including an elongate inner channel for supporting or retaining blind components and an elongate outer channel having means for mounting of the rail, said inner channel being accommodated within said outer channel.

[0008] Also according to this invention, there is provided a blind rail, as defined above, wherein said elongate channel includes:

a base wall extending widthwise in a first direction between first and second base edges;
first and second side walls, extending respectively from said first and second base edges to respectively first and second side edges in a second direc-

tion generally perpendicular to said first direction; first and second inturned flanges extending inwardly from said first and second side edges respectively in generally said first direction so as to define a slot therebetween; and wherein

said base wall, said first and second side walls and at least part of said first and second inturned flanges respectively include an inner base wall, first and second inner side walls and first and second inturned inner flanges of said inner channel.

[0009] Further according to this invention, there is provided a method of forming a blind rail as defined above comprising:

roll-forming a first elongate sheet into a cross-section partly conforming to the cross-section of the inner channel;

roll-forming a second elongate sheet into a cross-section partly conforming to the cross-section of the outer channel;

feeding the partly roll-formed inner channel into the partly roll-formed outer channel; and

roll-forming the first and second sheets together to obtain the blind rail.

[0010] In this way, the elongate channel of a blind rail can be formed by roll-forming and yet still have the inner cross-section formed independently of the outer cross-section. Internal functional features can be provided without being apparent on the outside of the channel and the external section can be shaped for a pleasing appearance without affecting the functional internal features. An inner channel can be formed from an elongate sheet of preferably metal material. An outer channel can likewise be formed from an elongate sheet of preferably metal material. Also the external section or channel can be shaped for different mounting methods while at the same time having a pleasing appearance. The inner and outer sheets together provide improved strength. Furthermore, they can be made of different materials according to requirements for internal and external features. Indeed, the outer sheet forming the outer channel can be coated for a pleasing appearance, without coating the sheet forming said inner channel.

[0011] Preferably, at a position intermediate said first and second base edges and said first and second side edges respectively, the sheet forming the inner channel at at least one of the first and second inner side walls is folded back on itself so as to form an inwardly facing support flange extending inwardly in generally said first direction, whereby blind components can be supported or retained by the support flange. In the case of a vertical blind head rail these support flanges can be formed to support slat carriages. In the case of a horizontal blind the support flanges can be formed to accommodate the tilt-supports. In the case of a curtain the flanges can be formed to accommodate the curtain gliders, and in the

case of a roller blind, provisions can be made to carry the central shaft.

[0012] In this way, internal support provisions can be created by the sheet forming said inner channel, such as for supporting vertical blind carriers, without any effect on the outer appearance of the elongate channel.

[0013] Preferably, at at least one of said first and second base edges, the sheet forming the outer channel is folded back on itself so as to form a mounting flange extending outwardly in generally said first direction, whereby the mounting flange can be used to mount the head rail adjacent to an architectural opening.

[0014] Hence, the sheet forming said outer channel can be folded so as to provide means for connecting to a mounting bracket.

[0015] Preferably, the sheets forming a first outer side wall of said outer channel, between the first base edge and the first side edge, is spaced apart from said first inner side wall. Between the first base edge and the first side edge, said first outer side wall can have a generally convex or outwardly curved outer form.

[0016] Thus, at parts of the cross-section of the elongate channel, the outer channel can take a different form to the inner channel and leave a space therebetween. Hence, the outer sheet formed into the outer channel can form a pleasing outwardly curved surface, whilst leaving the internal functional channel wall flat.

[0017] Preferably, adjacent said mounting flange, the sheet of said outer channel forming said first outer side wall is folded back on itself forming an extension extending in generally upward direction so as to hide or cover said mounting flange.

[0018] In this way, the sheet forming said outer channel can conceal features of the inner elongate channel. In particular, where the first base edge is provided with a mounting flange, by folding the outer sheet of the first side wall of said outer channel back on itself forming said extension in generally upward direction it covers or hides the first base edge, and thus the mounting flange will be also be concealed when the blind rail is installed adjacent an architectural opening.

[0019] The innermost sections of the inturned flanges defining the slot are formed only from the sheet forming said outer channel, by being folded back on itself so as to overlap on the inside of the sheet forming the inner channel.

[0020] In this way, the inner channel is securely fixed within the outer channel and the outer channel provides a complete concealment of the inner channel.

[0021] At least one edge of the sheet forming the outer channel can be folded back on itself so as to be sandwiched between the respective sheets forming said outer channel and said inner channel.

[0022] This provides a secure fixing and prevents there being any sharp edges within the channel.

[0023] The sheet forming said inner channel of at least one of the first and second inturned flanges can include an inwardly facing deflection against which an

edge of the sheet forming said outer channel abuts.

[0024] In this way, where the sheet forming said outer channel is folded onto the inside of the inturned flanges, it is prevented from sliding relative to the sheet forming said inner channel, since its edge abuts the inwardly facing deflection.

[0025] The invention will be more clearly understood from the following description, given by way of example only, with reference to the accompanying drawings, in which:

- Figure 1 illustrates a vertical blind system;
- Figure 2 illustrates the cross-section of an elongate channel for the head rail of the blind system of Figure 1 according to a first embodiment of this invention;
- Figures 3(a) and (b) respectively illustrate the cross-sections of inner and outer roll-formed sheets, forming inner and outer channels of the cross-section of the elongate channel of Figure 2;
- Figure 4 illustrates the cross-section of an elongate channel for the head rail of the blind system of Figure 1 according to a second embodiment of the invention;
- Figures 5(a) and (b) respectively illustrate the cross-sections of inner and outer roll-formed sheets, forming inner and outer channels of the cross-section of the elongate channel of Figure 4;
- Figure 6 illustrates the cross-section of an elongate channel for the head rail of the blind system of Figure 1 according to a third embodiment of the invention;
- Figure 7 illustrates schematically a roll-forming apparatus for making the elongate channel of the invention from two metal sheets;
- Figure 8(a) illustrates the stages of partly forming the outer channel of the elongate channel of Figure 6;
- Figure 8(b) illustrates the stages of partly forming the inner channel of the elongate channel of Figure 6; and
- Figure 8(c) illustrates the stages of forming together the partly formed inner and outer channels of Figures 8(a) and (b) to form the elongate channel of Figure 6.

[0026] Figure 1 illustrates a vertical blind system, generally 1, which includes a vertical blind head rail 2 for mounting above an architectural opening and conventional slats 4 hanging vertically down from the head rail so as to cover the architectural opening. The head rail 2 comprises an elongate channel 6 from which the slats 4 hang. In particular, the elongate channel 6 includes a slot (not shown) along its lower surface, through which the vertical slats can be movably suspended. Within the elongate channel 6, conventional carriers (not shown) are provided for the vertical slats 4. The carriers can be provided with conventional rollers such that they and

their respective slats 4 can be moved along the length of the elongate channel 6. Furthermore, a conventional mechanism (not shown) can be provided within the head rail 2, which can be used to operate the carriers to tilt the slats 4 and extend and retract them to close and open the system.

[0027] Figure 2 illustrates a cross-section through an elongate channel 6 embodying the invention. The elongate channel 6 comprises an elongated inner channel 10 of roll-formed sheet metal, illustrated independently in Figure 3(a), and an elongated outer channel 8 of roll-formed sheet metal, illustrated independently in Figure 3(b).

[0028] The elongate channel 6 includes a base wall 12 which, in use, is positioned uppermost above the suspended blind slats. The base wall 12 includes an inner base wall 12a and an outer base wall 12b, which co-extend widthwise between first and second base edges 14, 16 that extend along the length of the elongate channel 6.

[0029] The elongate channel 6 is also provided with first and second side walls 18, 20 on either side of the base wall 12. The first and second side walls 18, 20 are each formed by first inner and outer side walls 18a, 18b, as well as second inner and outer side walls 20a, 20b respectively. At the bottoms of the side walls 18, 20 are first and second side edges 22 and 24 from which first and second inturned flanges 26 and 28 extend inwardly. The relevant portions of the inner and outer channels 10, 8 in Figures 3(a) and 3(b) are referred to by similar reference numerals, with indices "a" and "b" respectively.

[0030] The first and second inturned flanges 26, 28 define the slot 30 which runs along the elongate channel 6 at its lower surface. As explained above, the slot 30 provides an opening through which the slats 4 can be movably suspended.

[0031] As illustrated, at the first and second base edges 14, 16 of the inner channel 10, the sheet metal of the outer channel 8 is folded back upon itself so as to form mounting flanges 32, 34. The mounting flanges extend outwardly in approximately the same direction as the extent of the base wall 12. In this way, clips can be provided to extend beneath the mounting flanges 32, 34 so as to support the blind rail and the suspended blind slats. Furthermore, the mounting flanges can be used to mount, to the blind rail, additional add-on components.

[0032] Along the inner surface of the first and second inner side walls 18a, 20a, the sheet forming the inner channel 10 is folded back upon itself so as to form inwardly facing support flanges 36, 38. The support flanges thus run inwardly of the inner channel 10 and the elongate channel 6 along the length of each. The support flanges 36, 38 can be used to support or retain components of the blind mechanism within the elongate channel 6. In particular, where movable blind slat carriers are used, the rollers of the blind slat carriers can be supported by the support flanges 36, 38.

[0033] As illustrated, formation of the support flanges 36, 38 on the inside of the inner channel 10 is independent of the outer form of the outer channel 8 and thus of the elongate channel 6. In particular, with its inner channel 10 forming functional features such as the support flanges 36, 38, the outer channel 8 of the elongate channel 6 can be formed with a more aesthetic appearance. As illustrated, at the first outer side wall 18b, the outer channel 8 has a generally curved or convex form along the length of the elongate channel 6. Thus, it curves away from and is spaced apart from the inner channel 10. In this way, with the blind rail mounted adjacent an architectural opening, the outer side wall 18b facing the user can have a decorative and more pleasing appearance that is independent of the functional requirements of the inner side wall 18a.

[0034] In the illustrated embodiment, the first outer side wall 18b of the outer channel 8 is further folded back upon itself in the vicinity of the inner first base edge 14. The resulting extension 40 thereby covers or conceals the mounting flange 32.

[0035] In order to provide a desired appearance, it is not necessary for the inturned flanges 26, 28 to extend in a planar form inwardly of the side walls 18, 20. Thus, as illustrated in Figure 2, the first inturned flange 26 has a curved or concave form along a transitional portion lengthwise of the elongate channel 6 before then extending directly towards the second inturned flange 28.

[0036] At the innermost part of the outer inturned flanges 26b, 28b, the outer channel 8 is folded back on itself to sandwich the inner inturned flanges 26a, 28a of the inner channel 10 therebetween. Thereby, the folded back portions of the outer inturned flanges 26b, 28b cover and protect the free edges of the inner inturned flanges 26a, 28a. Because the outer channel 8 is of double thickness at its innermost part, i.e., at the folded back portions of the outer inturned flanges 26b, 28b, it is not necessary for the inner inturned flanges 26a, 28a to extend all the way to the innermost part of the outer inturned flanges 26b, 28b.

[0037] Indeed as illustrated in Figure 2, mechanical support for the blind slats 4 is intended to be provided internally by the support flanges 36, 38 of the elongate channel 6, and although its inturned flanges 26, 28 can have significant mechanical strength, such strength is not necessary. Thus, the inturned flanges 26, 28 are formed substantially only from the sheet metal of the outer channel 8 folded back on itself. To avoid concern regarding sharp edges on the inturned flanges 26, 28 of the outer channel 8, these flanges can be folded back on themselves as illustrated for the second inturned flange 28 in Figure 2. Such an arrangement also makes it easier for the edge of the second inturned flange 28a of the inner channel 10 to be slid between the folded over portion of the second inturned flange 28b of the outer channel 8.

[0038] Figure 4 illustrates an elongate channel 106 which is an alternative embodiment to that of Figure 2,

and Figures 5(a) and (b) illustrate respectively its inner and outer channels 1 10, 108 of roll-formed metal sheets. Like features have like reference numerals supplemented by "100", and the corresponding portions of the inner and outer channels 1 10, 108 in Figures 5(a) and 5(b) are referred to using indices "a" and "b" respectively.

[0039] The elongate channel 106 of Figure 4 differs from the elongate channel 6 of Figure 2 in that, for the first side wall 118, the outer channel 108 has a generally planar outer side wall 118b, which conforms to the planar form of a first inner side wall 118a the inner sheet metal channel 110. Furthermore, both outer and inner inturned flanges 126 and 128 are substantially planar and both include a sheet metal portion of the outer channel 108 which is folded back over the inner channel 110.

[0040] Figure 6 illustrates an elongate channel 206 which is another alternative embodiment to that of Figure 2 and in which like features to those of Figure 2 have like reference numerals, but supplemented by "200".

[0041] The general form of the elongate channel 206 is similar to that of Figure 4. However, at each of the inturned flanges 226, 228, the inner channel 210 includes an inwardly facing deflection 250, 252. Each deflection is formed at an appropriate position on the inner inturned flanges 226a, 228a, relative to the outer channel 208, such that the edges of the folded back portions of its outer inturned flanges 226b, 228b come into abutment with the deflections 250, 252. This is particularly useful when the inner and outer sheets, forming the inner and outer channels 210, 208, are roll-formed together. This is because, as the elongate channel 206 is roll-formed into its final cross-section, the edges of the sheet forming its inner channel 210 are prevented from sliding towards the side edges 222, 224. Thereby, the outer channel 208 is maintained adjacent to the inner channel 210 along the side walls 218, 220.

[0042] The elongate channels 6, 106, 206 of the head rail 2 of the vertical blind 1 of this invention can be formed by roll-forming, using three sets of mechanically conventional, roll-formers 300, 400, 500 as illustrated schematically in Figure 7.

[0043] A first roll-forming apparatus 300 receives a continuous supply of an elongated first sheet 70 of a metal such as aluminium. The apparatus includes a number of roll-forming stages which progressively form the first sheet 70 into a precursor 70A of an outer channel 8, 108, 208. For example, such roll-forming stages can form the sheet 70 into the fourteen cross-sections of the precursor 70A of the outer channel 208 illustrated in Figure 8(a), going from its stage 1 to stage 14. In this respect, it should be noted that Figure 8(a) shows only one of the symmetric halves of the cross-sections of the precursor 70A during the roll-forming stages.

[0044] Similarly, a second roll-forming apparatus 400 receives a continuous supply of an elongate second sheet 80 of a metal such as aluminium or steel and, using a number of roll-forming stages, forms the second

sheet 80 into a precursor 80A of an inner channel 10, 110, 210. For example, such roll-forming stages can form the sheet 80 into the eleven cross-sections of the precursor 80A of the inner channel 210 illustrated in Figure 8(b), going from its stage 1 to stage 11. In this respect, it should be noted that Figure 8(b) shows only one of the symmetric halves of the cross-sections of the precursor 80A during the roll-forming stages.

[0045] At this time, after the first and second roll-forming apparatuses 300, 400 in Figure 7, the elongate sheets 70, 80 have each been formed into the precursor 70A, 80A having a cross-section partly conforming to that of the outer and inner channels forming the elongate channel 6, 106, 206 of the invention. The precursor 80A of the inner channel 10, 110, 210 is then guided into the precursor 70A of the outer channel 8, 108, 208. For example, this stage of making the elongate channel 206 is illustrated in stage 1 of Figure 8(c), which again shows only one of the symmetric halves of the cross-sections of the precursors 70A, 80A.

[0046] The combined precursors 70A, 80A are then subjected to a third roll-forming apparatus 500 with a number of stages which roll-form the precursors together to produce the elongate channel 6, 106, 206 of the invention. For example, these roll-forming stage of making the elongate channel 206 are illustrated in Figure 8 (c), going from its stage 1 to stage 5, which again show only one of the symmetric halves of the cross-sections of the precursors 70A, 80A.

Thus, with the three sets 300, 400, 500 of roll-formers, the desired cross-sections of the elongated channels of the invention can be formed with elongated inner and outer channels, such as 8, 108, 208 and 10, 110, 210, and with any desired length and shape.

[0047] The two metal sheets 70, 80 for forming the inner and outer channels can each be made of different materials and/or have different thicknesses. For instance, the sheet 80 for the inner channel can be made of steel, preferably galvanised, whereas the sheet 70 for the outer channel can be made of a lighter material such as aluminium. Indeed, the outer material can also be a surface-coated material.

[0048] If desired, the inner and outer channels 10, 110, 210 and 8, 108, 208 can be adhesively bonded together, using a conventional glue, to make the resulting elongate channel 6, 106, 206 more rigid or otherwise enhance its properties.

[0049] Likewise, a single shape of an inner channel 10, 110, 210 can be combined with several different shapes of outer channels 8, 108, 208 to obtain a choice of different blind rails, all having the same functional features but differing in exterior shape or decoration as the case may be. This option can be part of a modular system in which portions of the roll-forming equipment can be interchangeable for obtaining and joining a different outer channel with a predetermined form of inner channel. For the modular option, it is also conceivable that the inner and outer channels are roll-formed into their

respective end shapes by independent roll-forming processes and are separately assembled by endwise sliding of the inner channel into a selected form of the outer channel.

[0050] Although the embodiments described above are particularly for head rails of vertical vane blinds, the invention is equally suitable for head rails of other types of blinds, such as venetian blinds with horizontally arranged slats, pleated blinds, Roman shades, roller blinds or draw curtains. Indeed, the invention would be suitable for any kind of rail or profile structure, such as ducts or the like.

Claims

1. A blind rail (2) having an elongate channel (6) including an elongate inner channel (10;110;210) for supporting or retaining blind components and an elongate outer channel (8;108;208) having means for mounting of the rail, said inner channel being accommodated within said outer channel.

2. A blind rail, according to claim 1, wherein said elongate channel (6) includes:

a base wall (12) extending widthwise in a first direction between first and second base edges (14,16);

first and second side walls (18;118;218, 20;120;220), extending respectively from said first and second base edges (14,16) to respectively first and second side edges (22;122;222,24;124;224) in a second direction generally perpendicular to said first direction;

first and second intumed flanges (26;126;226,28;128;228) extending inwardly from said first and second side edges respectively in generally said first direction so as to define a slot (30) therebetween; and wherein

said base wall, said first and second side walls and at least part of said first and second intumed flanges respectively include an inner base wall (12a;112a;212a), first and second inner side walls (18a;118a;218a, 20a;120a;220a) and first and second intumed inner flanges (26a;126a;226a, 28a;128a;228a) of said inner channel (10;110;210).

3. A blind rail according to claim 1 or 2 wherein, said outer channel (8;108;208) is formed from an elongate sheet of preferably metal material.

4. A blind rail according to claim 1, 2 or 3 wherein, said inner channel (10;110;210) is formed from an elongate sheet of preferably metal material.

5. A blind rail according to claim 4 wherein, at a posi-

tion intermediate said first and second base edges (14,16) and said first and second side edges (22,24) respectively, the sheet forming the inner channel at at least one of the first and second inner side walls (18a,20a) is folded back on itself so as to form an inwardly facing support flange (36;38) extending inwardly in generally said first direction, whereby blind components can be supported or retained by the support flange.

6. A blind rail according to claim 3 wherein, at at least one of said first and second base edges (14,16), the sheet forming the outer channel is folded back on itself so as to form a mounting flange (32;34) extending outwardly in generally said first direction, whereby the mounting flange can be used to mount the head rail adjacent to an architectural opening.

7. A blind rail according to claim 3 or 6 wherein, the sheet forming a first outer side wall (18b) of said outer channel, between the first base edge (14) and the first side edge (22), is spaced apart from said first inner side wall (18a).

8. A blind rail according to claim 7 wherein said first outer side wall (18b) has a generally convex or outwardly curved outer form.

9. A blind rail according to claim 6 wherein, adjacent said mounting flange (32), the sheet of said outer channel (8) forming said first outer side wall (18b) is folded back on itself forming an extension (40) extending in generally upward direction so as to hide or cover said mounting flange (32).

10. A blind rail according to claim 2, 3 or 4 wherein said first intumed flange (26) has a concave transition section connecting it to the first side wall (18) and wherein said transition section is at least partly of concave outer form.

11. A blind rail according to claim 3 wherein innermost sections of said intumed flanges (26,28) are formed only from said sheet forming said outer channel, by being folded back on itself so as to overlap on the inside of the sheet forming said inner channel.

12. A blind rail according to claim 11 wherein at least one edge of the sheet forming the outer channel (8;108;208) is folded back on itself so as to be sandwiched between the respective sheets of the outer channel and inner channel (10;110;210).

13. A blind rail according to claim 11 or 12 wherein at least one of said first and second intumed flanges (26a,28a;126a,128a;226a,228a) of said inner channel (10;110;210) includes an inwardly facing deflection (250;252) against which an edge of the

sheet of said outer channel (8;108;208) abuts.

14. A blind rail according to any preceding claim wherein the inner and outer channel (8;108;208,10;110;210) are each formed from a different material. 5
15. A blind rail according to any preceding claim wherein at least one of the inner and outer channels (8;108;208,10;110;210) is made of aluminium. 10
16. A blind rail according to any preceding claim wherein the inner channel (8;108;208) is made of steel. 15
17. A vertical blind rail according to any preceding claim wherein the outer channel (8;108;208) is coated. 15
18. A method of forming a blind rail according to any preceding claim comprising:

roll-forming a first elongate sheet into a cross-section partly conforming to the cross-section of the inner channel (10;110;210);
roll-forming a second elongate sheet into a cross-section partly conforming to the cross-section of the outer channel (8;108;208); 25
feeding the partly roll-formed inner channel into the partly roll-formed outer channel; and
roll-forming the first and second sheets together to obtain the blind rail. 30

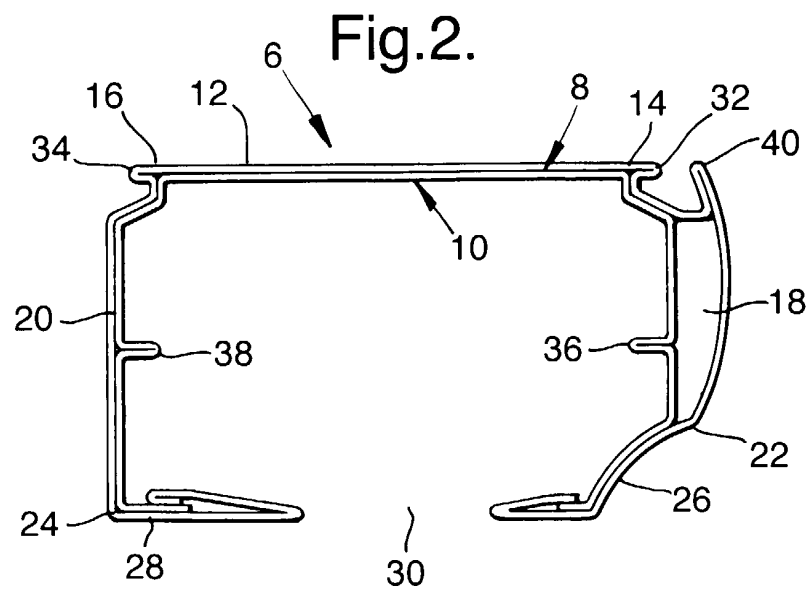
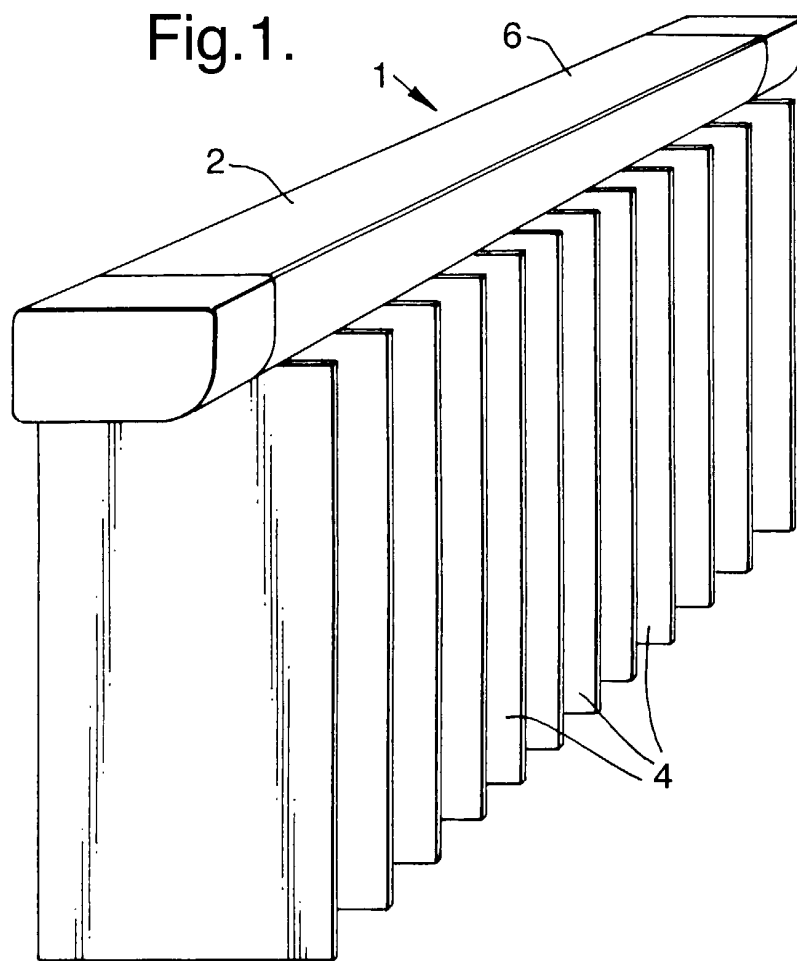
35

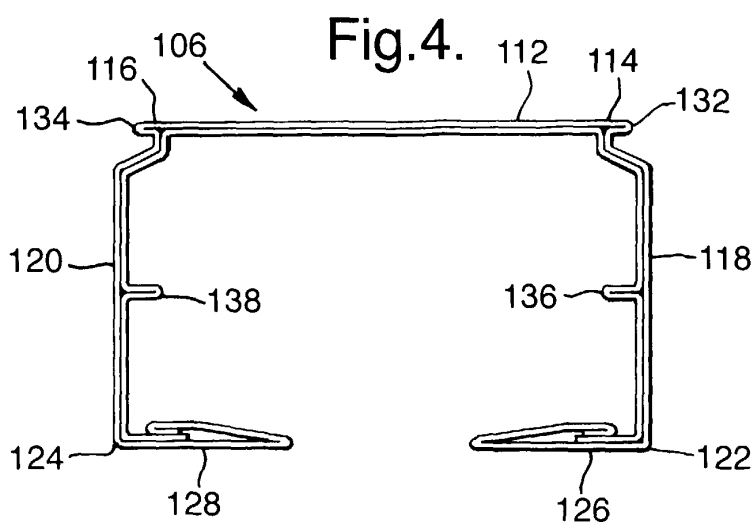
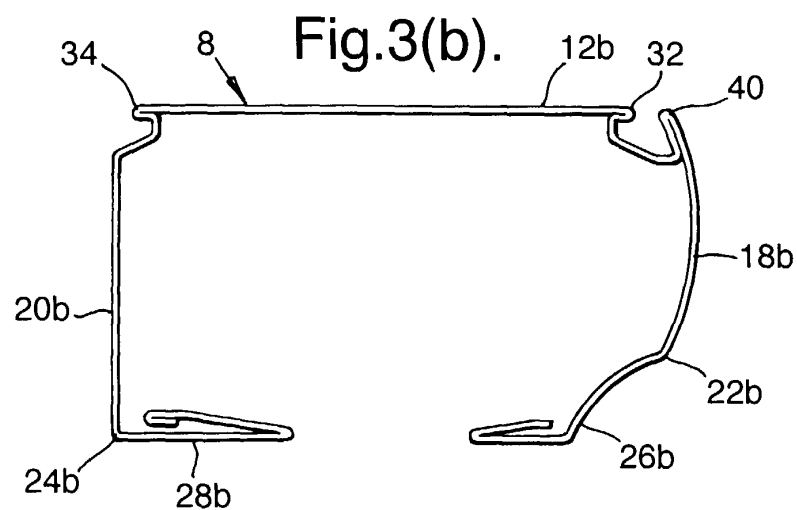
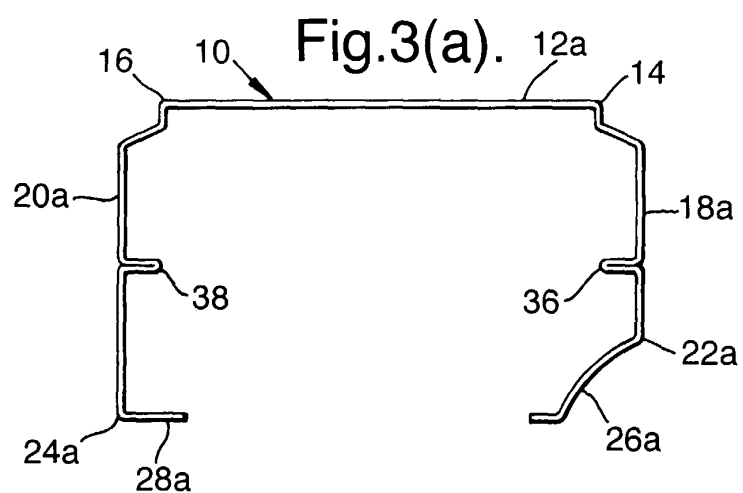
40

45

50

55





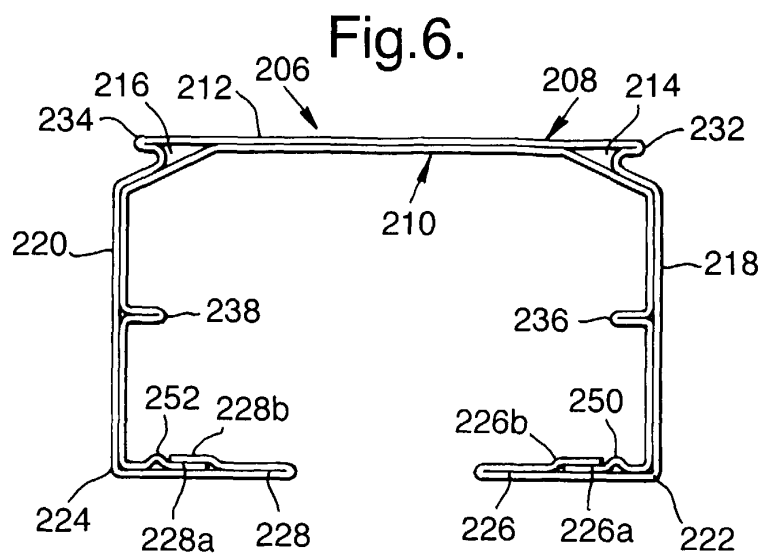
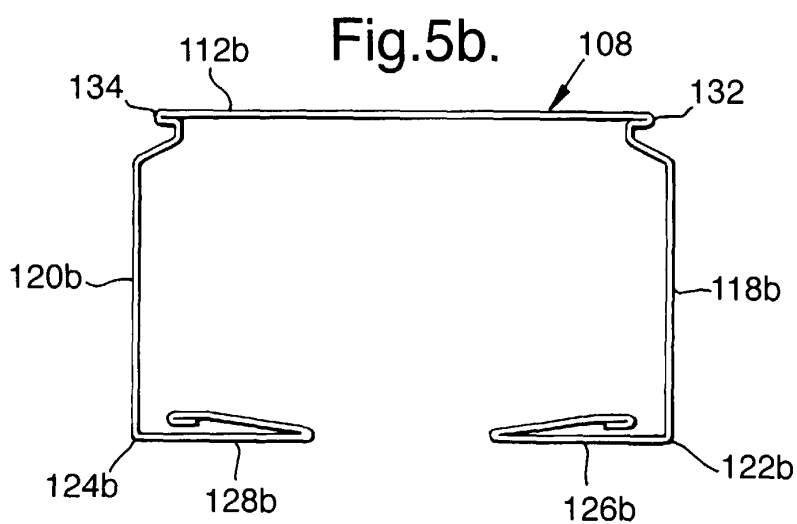
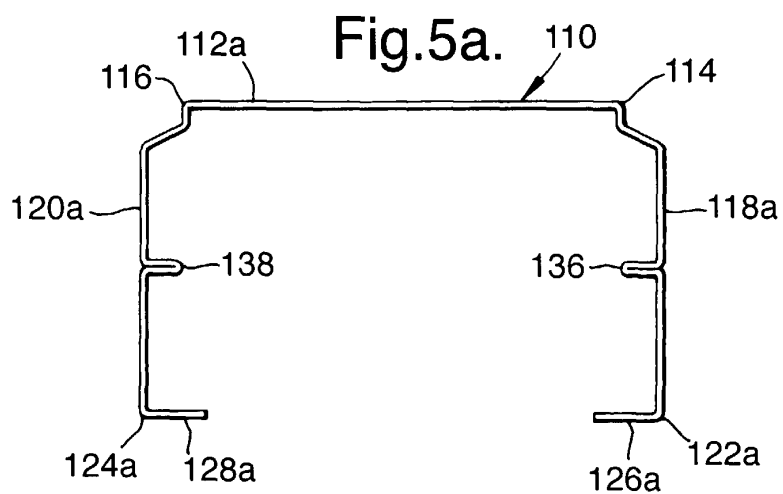


Fig.7.

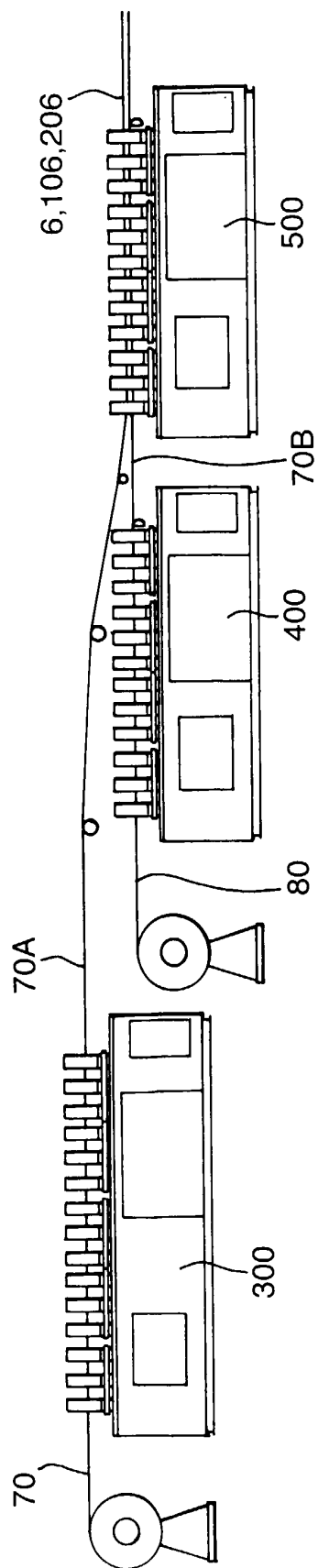


Fig.8(a).

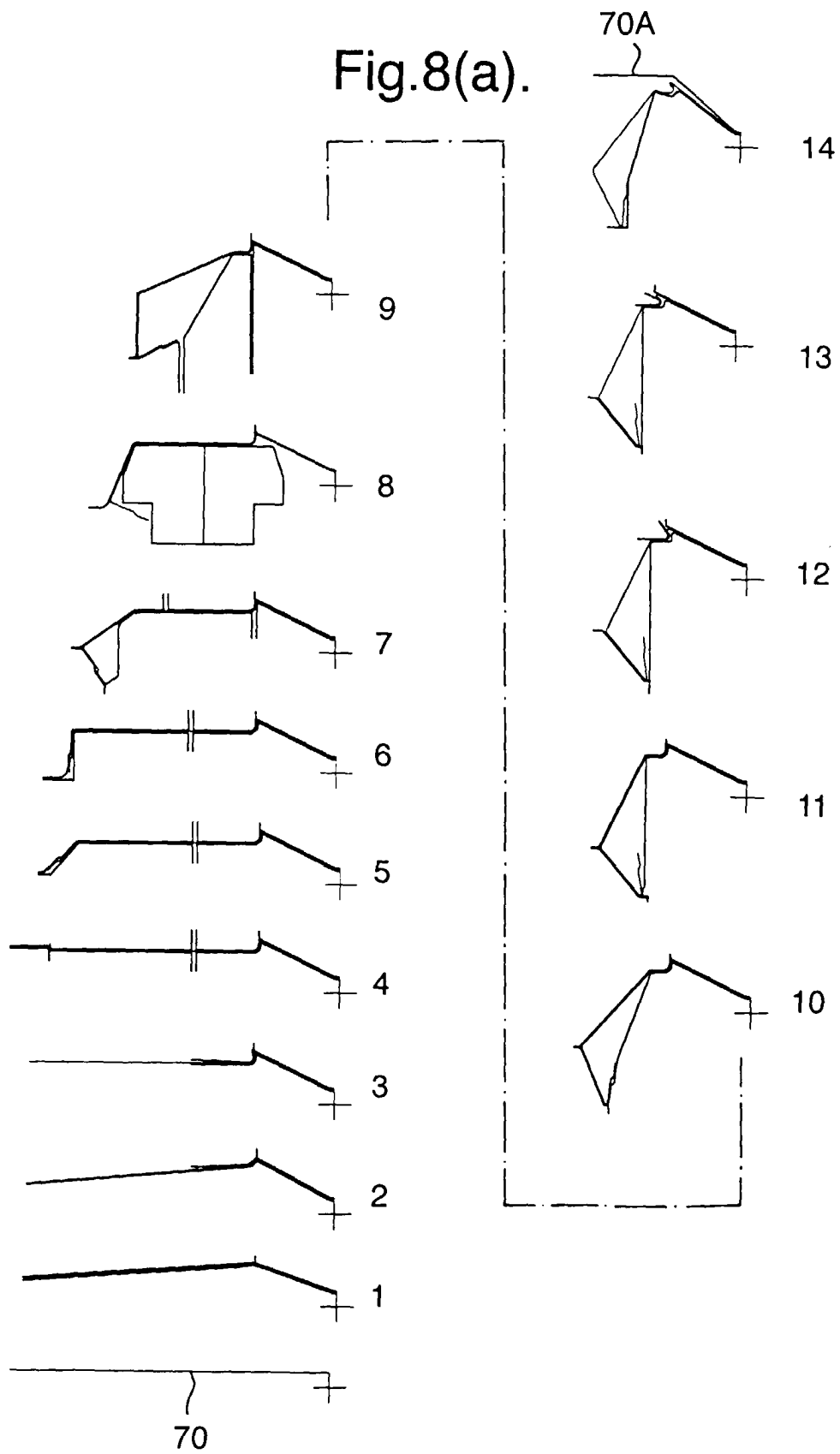


Fig.8(b).

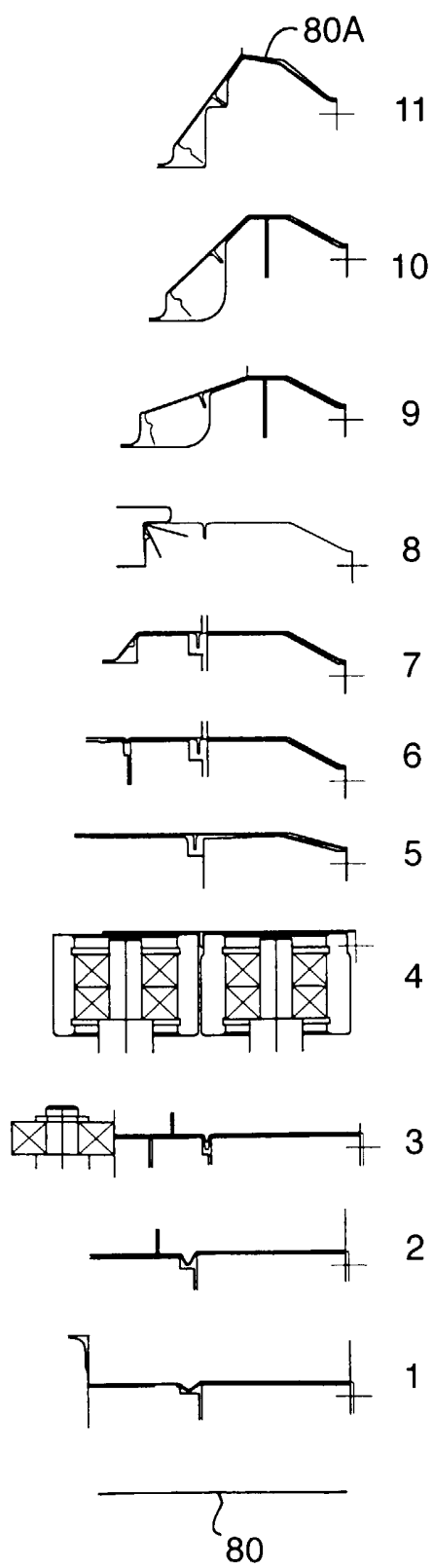


Fig.8(c).

