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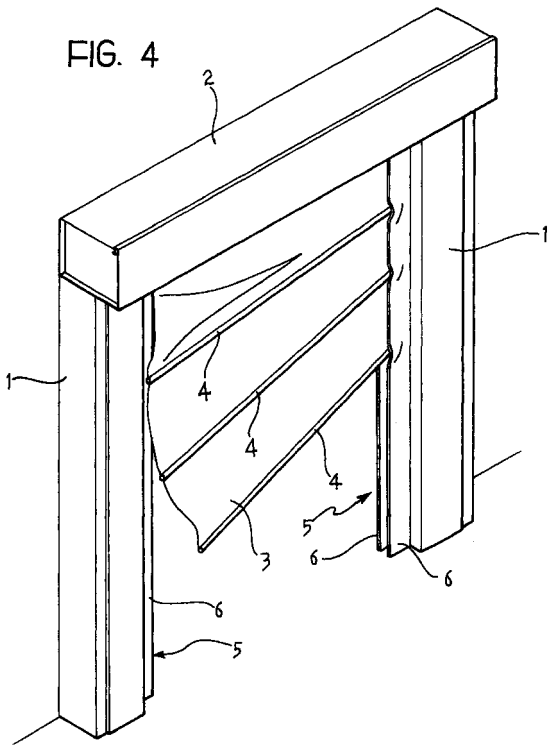
(54) Flexible door

(57) A flexible door comprises two metal posts (1) connected by an upper cross-member (2) in which a winding roller is housed. The movable closure element of the door is constituted by a flexible sheet (3) of plastics material having at least one transverse reinforcing bar (4). The side edges of the flexible sheet (3) slide in vertical guides (5) carried by the two posts (1) and each comprising two facing flexible vertical strips (6). Each strip (6) is constituted by at least one layer of fabric made of synthetic fibres which has a high transverse stiffness much greater than its longitudinal stiffness. The outer longitudinal edge of each strip (6) is fixed to the respective metal post (1) and the strip (6) projects inwardly from the post (1), relative to the door opening. In the event of a knock, the guide (5) deforms resiliently to allow the flexible sheet (3) to come out, the sheet (3) subsequently going back into the guide automatically.

FIG. 4



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Description

[0001] The present invention relates to flexible doors of the type comprising:

- a metal support structure constituted by two vertical posts connected by an upper cross-member,
- a winding roller mounted rotatably in the upper cross-member and driven so as to rotate in two senses,
- a pair of vertical guides each of which is associated with one post and faces the guide associated with the other post,
- a movable closure element of the door, which is constituted by a flexible sheet of plastics material having at least one transverse reinforcing bar, and which has one end connected to the winding roller so as to move vertically in two directions as a result of the rotation of the operating roller in the two senses, the two side edges of the flexible sheet being guided in the vertical guides.

[0002] Flexible doors of the above-mentioned type include both known rolling doors in which the upper edge of the flexible sheet is fixed to the winding roller so that the sheet is rolled onto the roller, and known doors known as folding or stacking doors, in which the upper edge of the flexible sheet is connected to a fixed upper portion and the flexible sheet has a plurality of reinforcing cross-members of which the bottom one is connected to the winding roller by means of a plurality of vertical straps each of which is guided through through-holes of alternate reinforcing cross-members so that, when the straps are rolled around the winding roller, the flexible sheet is piled up in successive folds, forming a bundle beneath the winding roller.

[0003] In particular, the invention relates to doors of the above-mentioned type in which the vertical movement of the flexible sheet is performed at high speed in order to satisfy requirements due to heavy traffic of people and vehicles through the doorway.

[0004] This does not, however, suffice to prevent vehicles knocking against the posts or the flexible sheet quite frequently so as to damage the door in a manner such as to prejudice its operation and to cause injury or damage to the people and vehicles passing through.

[0005] The main object of the present invention is to provide a flexible door of the type indicated above which - in the event of a knock either against the flexible sheet or against the posts - does not have the disadvantages indicated above, and which is of simple and economical construction.

[0006] This object is achieved by means of the characteristic which forms the subject of Claim 1.

[0007] Further characteristics of the door according to the invention will become clear from Claims 2 to 16.

[0008] The invention will now be described with reference to the appended drawings, provided purely by way of non-limiting example, in which:

Figure 1 is a front elevational view of a flexible door according to the invention,

Figure 2 is a perspective view of the upper portion of one of the metal posts of the door and of the guide associated therewith,

Figure 3 is a cross-section taken on the line III-III of Figure 2,

Figure 4 is a perspective view of the door of Figure 1, showing the flexible sheet coming out of the guide as a result of a knock,

Figure 5 shows a first variant of Figure 3,

Figures 6, 7 and 8 show schematically three further variants of Figure 3,

Figure 9 shows schematically a fifth variant of Figure 3, and

Figure 10 is a detail showing the portion indicated X in Figure 9, on an enlarged scale.

[0009] With reference to Figure 1, a flexible rolling door comprises a metal support structure constituted by two vertical posts 1 connected by an upper cross-member 2 in which a winding roller (not shown), driven so as to rotate in two senses, is mounted rotatably in known manner.

[0010] Associated with each of the posts 1 is a guide, generally indicated 5, in which the side edges of a flexible sheet 3 slide, the flexible sheet 3 having transverse reinforcing bars 4 and constituting the movable closure element of the door. The flexible sheet 3 has its upper edge connected to the winding roller so as to move vertically in two directions as a result of the rotation of the operating roller in the two senses.

[0011] Each guide 5 terminates at the top a predetermined distance, indicated A in Figure 1, from the top of the post 1.

[0012] As shown in Figures 2 and 3, each metal post 1 has a box-shaped cross-section and has a flat vertical wall 1a facing inwardly relative to the door. A vertical slot F formed in the wall 1a extends throughout the height of the post 1, its edges being parallel to one another for the major portion of the height of the post and being inclined so as to diverge outwardly in the upper end portion. At each edge of the slot F, the wall 1a of the post has a flange 1b bent inwardly at 90°.

[0013] Each guide 5 comprises two facing, parallel, flexible, vertical strips 6 each of which is fixed, at its

outer longitudinal edge, to the metal post 1, and projects from the post towards the door opening.

[0014] This fixing is achieved by the clamping of the longitudinal outer edge of each strip 6 against the bent flange 1b of the post by means of a metal strip 7 superimposed on that edge of the strip and fixed to the bent flange 1b by means of screws, bolts, rivets or the like, as indicated at 8.

[0015] As a result of this fixing, each strip 6 has an upper end portion 6a which is bent outwardly relative to the guide 5.

[0016] The bent portion 6a of each strip 6 has an end edge 9 which is inclined downwardly and inwardly relative to the strip from the upper end of the strip which is fixed to the post 1.

[0017] As can be seen from Figures 1 and 2, the uppermost point of the end edge 9 of each strip 6 is spaced vertically from the top of the post 1 (and hence from the cross-member 2) by a predetermined distance, indicated A.

[0018] Each strip 6 is made of plastics material and is constituted by at least one layer of fabric which is made of synthetic fibres and has a high transverse stiffness much greater than its stiffness in the direction of the length of the strip, and which is impregnated with synthetic resin.

[0019] This differentiated stiffness is achieved by virtue of the fact that the or each synthetic-fibre fabric layer comprises warp threads arranged longitudinally and each constituted by a plurality of filaments and weft threads arranged transversely and each constituted by a monofilament having a diameter of between 0.1 and 1 mm, preferably between 0.2 and 0.3 mm.

[0020] The synthetic resin of which the threads of the fabric are made is preferably constituted by a polyester resin and the impregnation resin may be polyvinyl or polyurethane resin.

[0021] As a result of the above-described particular structure of the reinforcing fabric or fabrics, each strip 6 deforms resiliently to allow the flexible sheet 3 to come out of the respective guide 5 when the sheet or one of the posts 1 is subjected to a knock, the strip 6 snapping back to its normal position immediately after the flexible sheet has come out.

[0022] The resilient deformation which the strips 6 undergo in the event of a knock to the flexible sheet 3 or to one of the posts 1 is shown schematically in Figure 4.

[0023] During the opening of the door after a knock which has caused the flexible sheet 3 to come out of the guides 5, the flexible sheet is rolled onto the winding roller, sliding upwards outside the guides 5.

[0024] During this movement, the flexible sheet 3 moves in contact with the outer surface of one of the two strips 6 of each guide 5 until, upon completion of the rolling, the lower end portion of the sheet 3 passes beyond the tops of the guides 5. The distance A between the tops of the guides 5 and the upper cross-member 2 is such as to allow the lower end portion of the sheet 3 which hangs from the winding roller to be arranged in the normal vertical sliding plane between the two guides 5.

[0025] The flexible sheet 3 thus automatically re-enters the guides during the subsequent closure movement of the door 5. The fact that each of the two strips 6 which form each guide 5 is bent outwardly at its upper end 6a facilitates the above-mentioned re-entry of the sheet 3 into the guides 5.

[0026] The foregoing description relating to a flexible rolling door also applies to a flexible folding (or stacking) door for which it suffices to increase the width of the guides 5 and the distance A between the upper ends of the guides 5 and the upper cross-member 2 in comparison with those shown in Figures 1 to 4, to take account of the greater bulk resulting from the fact that the flexible sheet is piled up in successive folds forming a bundle beneath the winding roller housed in the cross-member 2 during the closure of the door, instead of being rolled onto the winding roller.

[0027] In the variant shown in Figure 5, the two side walls of each guide 5 are constituted by three superimposed strips 6_1, 6_2, 6_3 of decreasing width, starting from the inner strip 6_1.

[0028] In the variant of Figure 6, the outer longitudinal edges of the two strips 6 are clamped by means of screws or the like between two outer strips 10 and an intermediate bar 11 which in turn is fixed to the flat face 1a of the post 1, which may have a closed cross-section, as shown, or an open cross-section.

[0029] In the variant of Figure 7, the two strips 6 constitute the side walls of a bent, U-shaped element, generally indicated 12. The outer edges of the two strips 6 are clamped, by means of screws, rivets or the like between the flanges of an outer channel-section profile 13 and the flanges of an inner channel-section profile 14. The base 12a of the bent, U-shaped element 12 is interposed between the base walls of the two sections 13 and 14 which are fixed to the wall 1a of the post 1 by means of screws, rivets or the like.

[0030] In the variant of Figure 8, each strip 6 has, at its outer longitudinal edge, a portion 15 which is bent at 90° and faces towards the other strip. The outer end and the bent portion 15 of each strip 6 are interposed between two angle-sections, indicated 16 and 17, respectively.

[0031] The flanges of the two sections 16 and 17 which are parallel to the strips 6 are clamped together by fixing means and the flanges which are perpendicular to the strips 6 are clamped together and to the wall 1a of the post 1 by further fixing means, the axes of which are indicated, as in Figures 6 and 7, by chain lines.

[0032] In the variant shown in Figures 9 and 10, each of the strips 6 which constitute the two guides 5 has an enlarged portion 18 at its outer edge, and the respective post 1 has a vertical slot 19 having a seat 19a of corresponding shape. In this embodiment, each

strip 6 is fixed to the respective post 1 simply by the slipping of the outer edge of the strip into the corresponding slot in the post.

Claims

1. A flexible door, comprising:

- a metal support structure, constituted by two vertical posts (1) connected by an upper cross-member (2),
- a winding roller mounted rotatably in the upper cross-member (2) and driven so as to rotate in two senses,
- a pair of vertical guides (5) each of which is associated with one post (1) and faces the guide associated with the other post,
- a movable closure element of the door, which is constituted by a flexible sheet (3) of plastics material having at least one transverse reinforcing bar (4) and which is connected to the winding roller so as to move vertically in two directions as a result of the rotation of the operating roller in the two senses, the two side edges of the sheet (3) being guided in the vertical guides (5),
  characterized in that
- each of the two vertical guides (5) comprises two facing, vertical, flexible strips (6) of plastics material each of which is constituted by at least one layer of fabric which is made of synthetic fibres and has a high transverse stiffness much greater than its stiffness in the direction of the length of the strips (6), and which is impregnated with a synthetic resin,
- the longitudinal outer edge of each strip (6) is fixed to the respective metal post (1) and the strip (6) projects from the post (1) inwardly, relative to the door opening, so that the strip (6) deforms resiliently in order to allow the flexible sheet (3) to come out of the respective guide (5) when the sheet or one of the guides (5) is subjected to a knock, the strip (6) snapping back to its normal position after the flexible sheet (3) has come out of the guide (5).

2. A flexible door according to Claim 1, characterized in that the synthetic-fibre fabric of each strip (6) comprises warp threads arranged longitudinally and each constituted by a plurality of filaments, and weft threads arranged transversely and each constituted by at least one monofilament having a diameter of between 0.1 and 1 mm.

3. A flexible door according to Claim 1, characterized in that the diameter of the monofilaments is between 0.2 and 0.3 mm.

4. A flexible door according to Claims 1 and 2, characterized in that the synthetic resin of which the warp and weft threads of the fabric are made is a polyester resin and in that the resin with which the fabric is impregnated is a polyvinyl or polyurethane resin.

5. A flexible door according to Claim 1, characterized in that the upper end of each strip (6) is spaced vertically from the upper cross-member (2) of the metal support structure by a distance (A) such as to permit automatic re-entry of the flexible sheet (3) between the guides (5) after it has come out of the guides (5) as a result of a knock against the sheet (3) or against the posts (1).

6. A flexible door according to Claim 5, characterized in that each of the two strips (6) which constitute each guide (5) has an upper end portion (6a) which is inclined outwardly relative to the guide so that each guide (5) has an enlarged upper end for facilitating the automatic re-entry of the sheet (3) between the guides (5).

7. A flexible door according to Claim 6, characterized in that the outwardly-bent upper end portion (6a) of each strip (6) has an end edge (9) which is inclined downwardly and inwardly relative to the strip, from the upper end of the strip (6) which is fixed to the post (1).

8. A flexible door according to Claims 1 to 7, characterized in that:

- each metal post (1) has a box-shaped cross-section and has a flat wall (1a) facing inwardly relative to the door,
- the flat wall (1a) has a vertical slot (F) which extends substantially throughout the height of the post (1) and the edges of which are parallel for the major portion of the height of the post (1) and are inclined so as to diverge outwardly in the upper end portion,
- the post (1) has a flange (1b) bent inwardly at 90° at each edge of the slot (F), and in that
- the longitudinal outer edge of each guide strip (6) is clamped against the bent flange (1b) by means of a metal strip (7) superimposed on that edge of the strip (6) and fixed to the bent flange (1b) of the post (1) by means of screws, bolts, rivets or the like (8).

9. A flexible door according to Claim 1, characterized in that the side wall of each guide (5) is constituted by a plurality of superimposed strips (6_1, 6_2, 6_3).

10. A flexible door according to claim 9, characterized in that the superimposed strips (6_1, 6_2, 6_3) have decreasing widths, starting from the inner strip (6_1).

11. A flexible door according to Claim 1, characterized in that the outer longitudinal edges of the two strips (6) are fixed to an intermediate bar (11) which in turn is fixed to the respective post (1).

12. A flexible door according to Claim 1, characterized in that the two strips (6) constitute the side walls of a bent, U-shaped element (12), the base (12a) of which is interposed between two channel section profiles (13, 14) which are fixed to the post (1) in their central portions, the flanges of the channel section profiles (13, 14) being fixed together with the interposition of the outer edges of the two strips (6).

13. A flexible door according to Claim 1, characterized in that each strip (6) has, at its outer edge, a portion (15) which is bent at 90° towards the other strip and is interposed, together with the outer end of the strip, between a pair of angle sections (16, 17) of which the flanges which are parallel to the strips (6) are clamped together and the flanges which are perpendicular to the strips (6) are clamped together and fixed to the post (1).

14. A flexible door according to Claim 1, characterised in that each strip (6) has an enlarged portion (18) at its outer edge, and in that the respective post (1) has a slot (19) having a seat (19a) of corresponding shape, so that each strip (6) is fixed to the respective post (1) simply by the slipping of the outer edge of the strip into the corresponding slot (19, 19a) of the post.

15. A flexible door according to Claim 1 and one or more of Claims 2 to 14, characterized in that it is of the rolling type.

16. A flexible door according to Claim 1 and one or more of Claims 2 to 14, characterized in that it is of the folding or stacking type.

FIG. 1

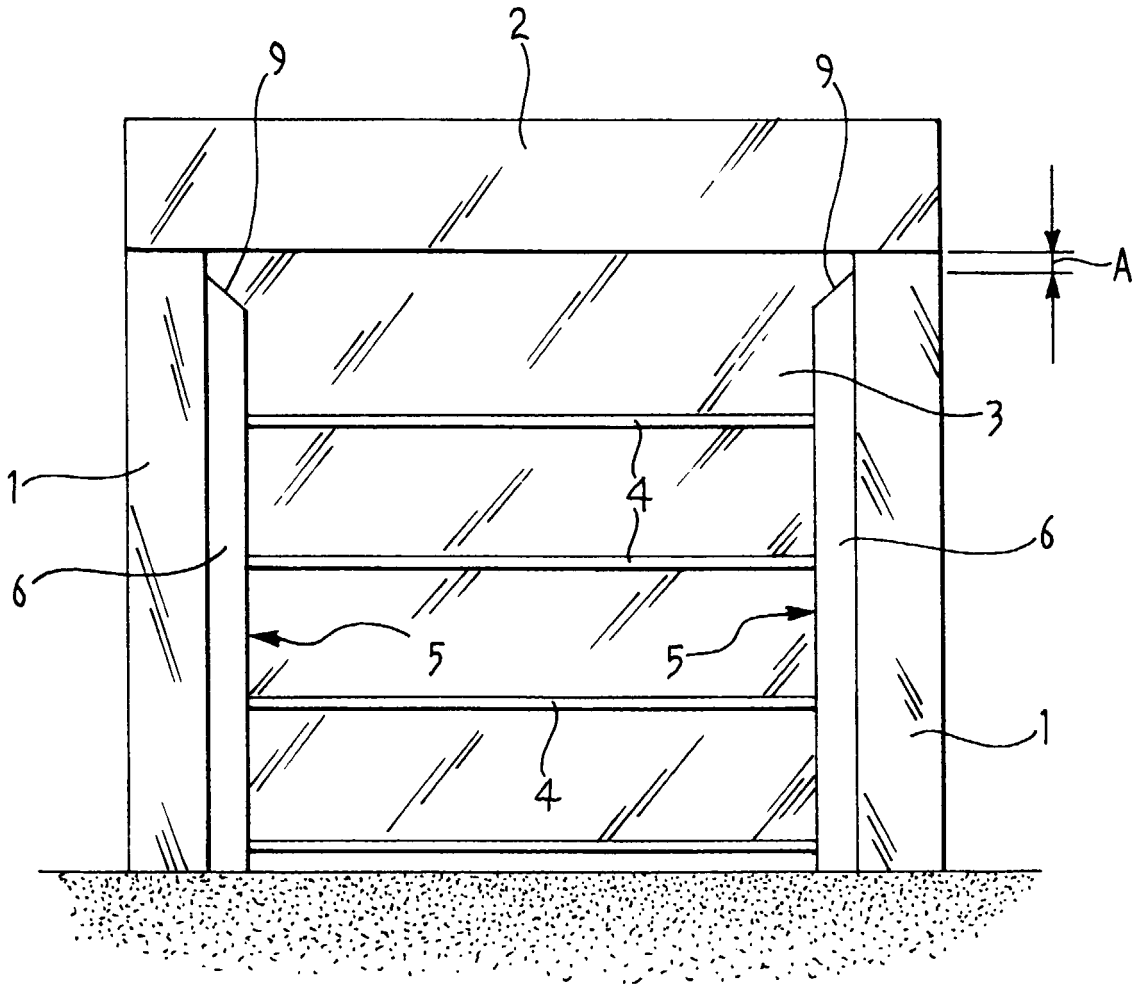

FIG. 2

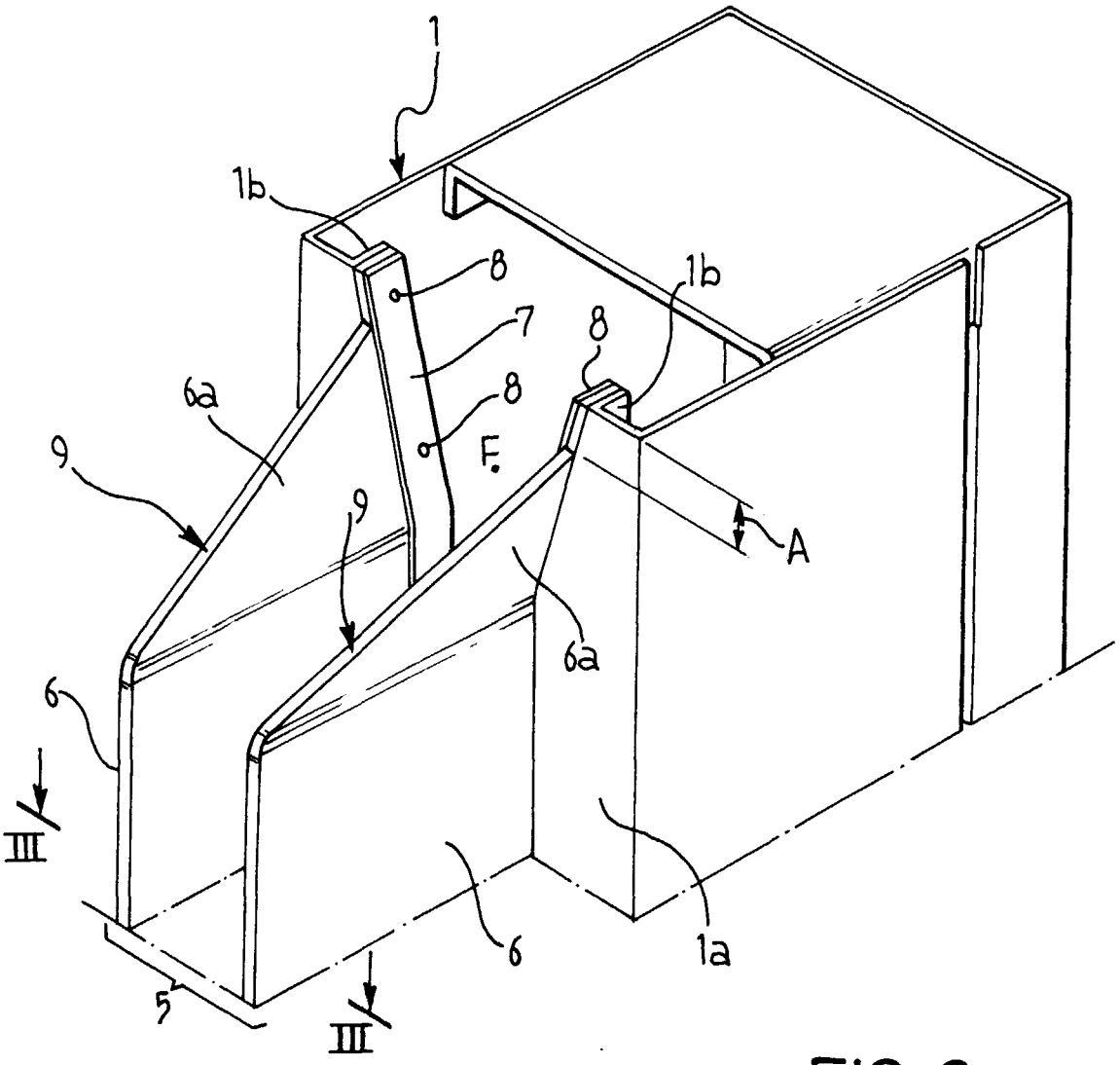

FIG. 3

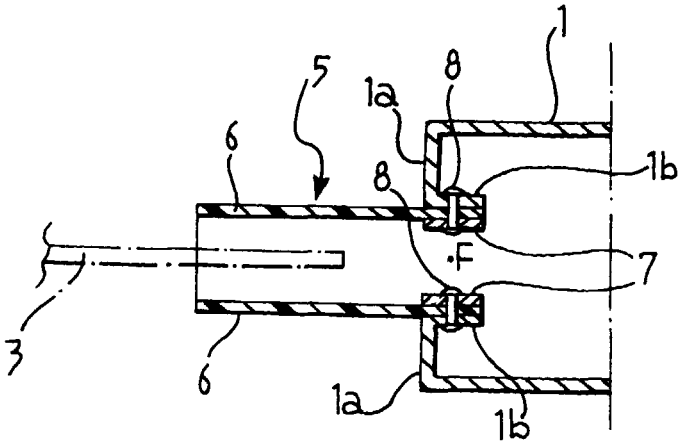

FIG. 4

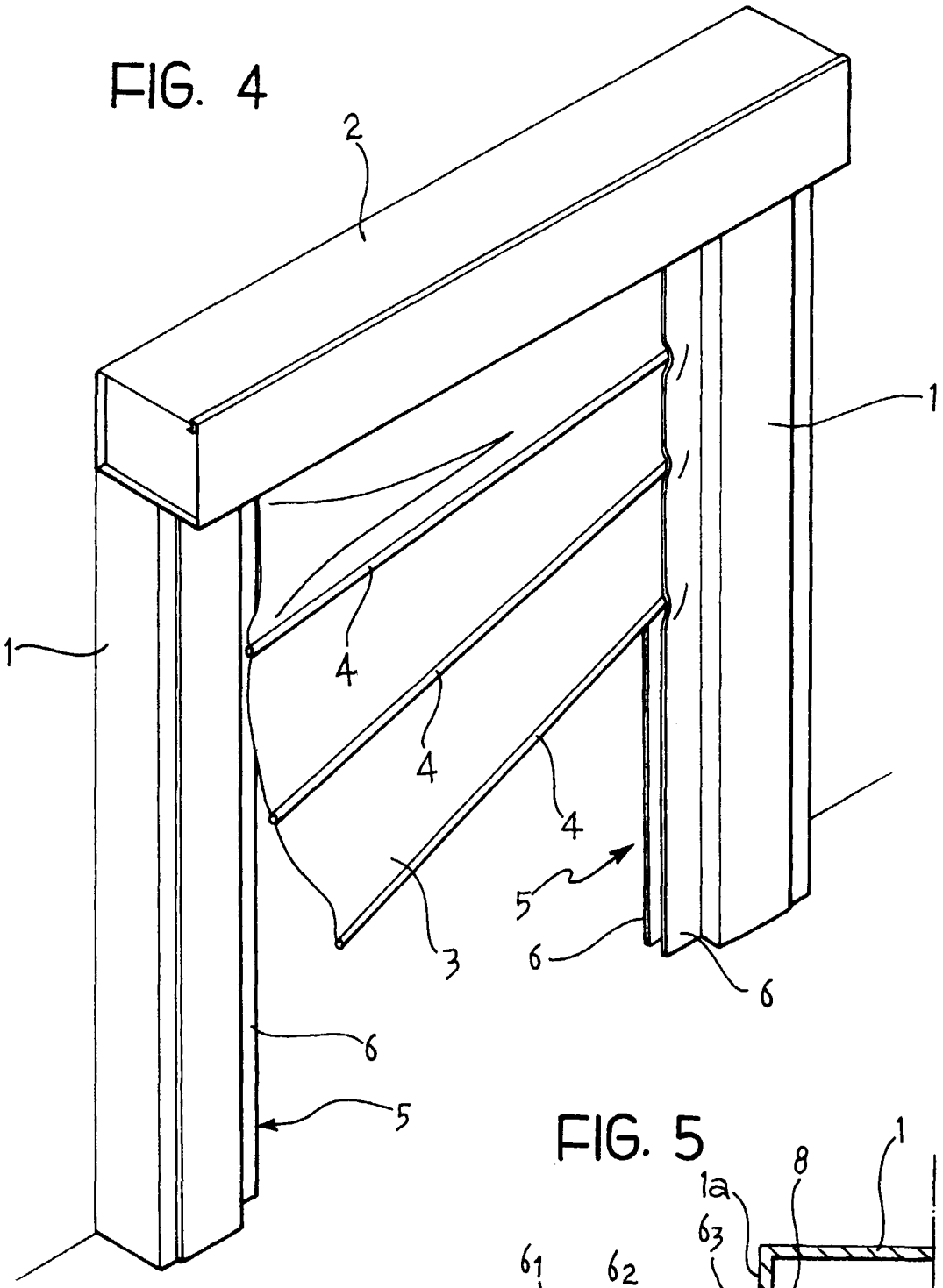

FIG. 5

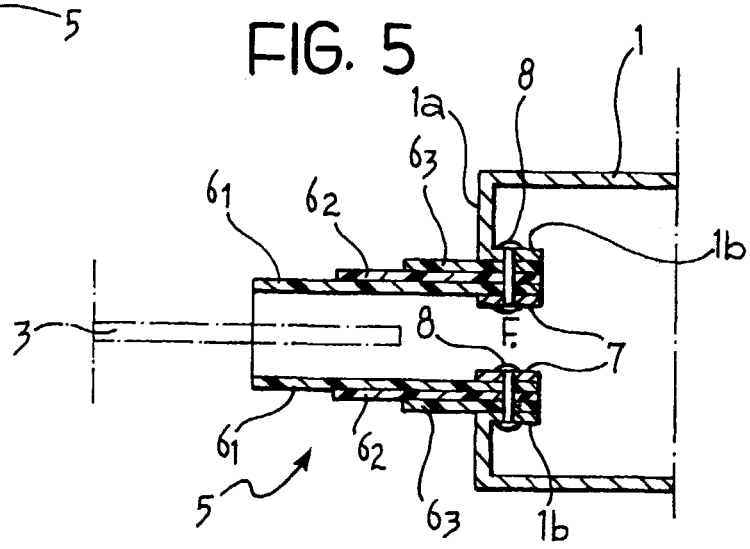

FIG. 6

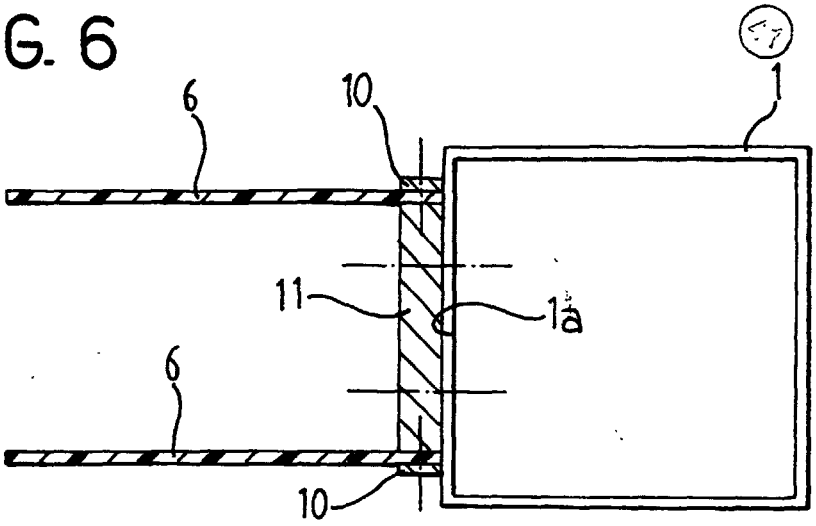

FIG. 7

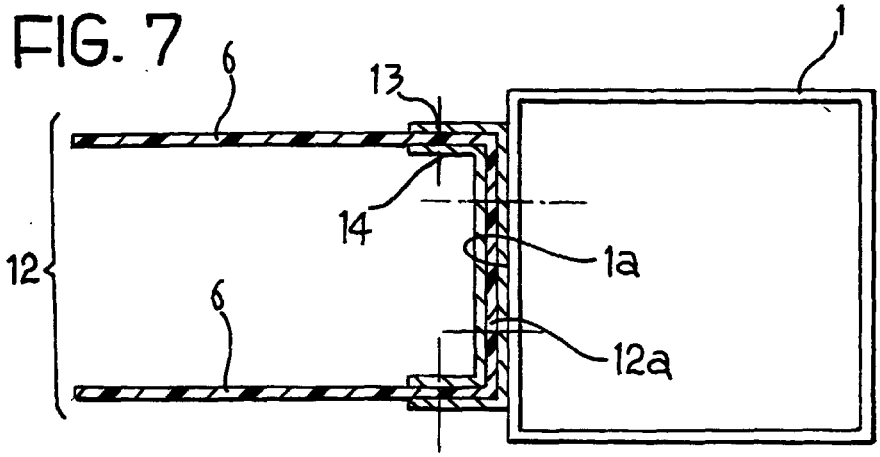

FIG. 8

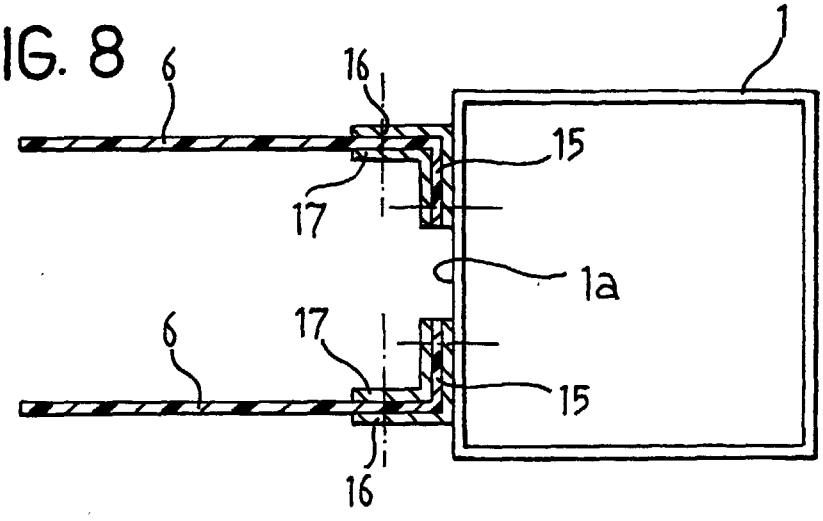

FIG. 9

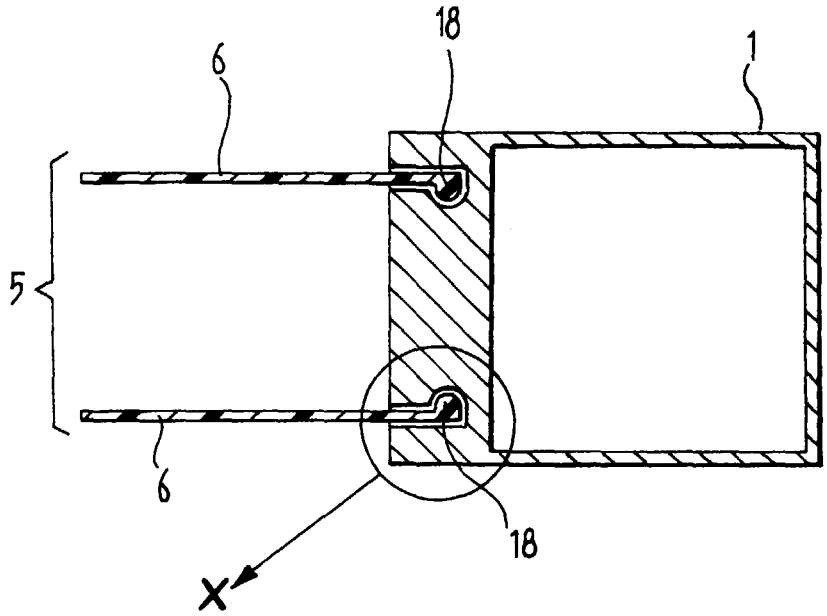

FIG. 10