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(54) **SLIDING ROOF AND METHOD FOR OPENING AND CLOSING THEREOF**

SCHIEBEDACH UND ENTSPRECHENDES VERFAHREN ZUM ÖFFNEN UND SCHLIESSEN

TOIT COULISSANT ET PROCEDE D'OUVERTURE ET DE FERMETURE DE CE DERNIER

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Description

Field of the Invention

[0001] The invention concerns a sliding roof. The invention also concerns a method for the opening and closing of such a sliding roof.

Description of the Prior Art

[0002] Sliding roofs for conservatories, awnings, atriums and the like are known. Such roofs generally consist of a roof frame with guiding channels and a number of moveable flat panels, e.g. opaque boards but mostly sliding window panels with glass to let in daylight.

[0003] The moving of the panels is usually done by means of wires and pulleys, see e.g. EP 612895 or US 6,138,417. The operating wires tend to stretch after some time, however. Moreover with wire operation there is no direct driving of the windows, neither during closing nor opening of the roof, and the positions of the sliding panels are therefore not always precisely defined.

Sliding roofs with a more direct operation of the sliding panels are also known, e.g. by means of a toothed belt, see e.g. EP 0723051 or by means of a rigid element like a spindle, see e.g. DE 9003148 U or DE 29722389 U.

BE 1006395 A describes a sliding roof with several sliding panels whereby a first, lower panel can take along a second upper panel when being opened, to which end a stop is provided. The second panel however is not directly driven which means that its position, especially when sliding down, is not sufficiently clearly defined.

[0004] Furthermore, due to the lack of sufficiently strong, slim, isolated riggers large spans are not possible with known sliding roof constructions, the use of (heavy) safety isolating glass is impossible, the roofs are not very well insulated and the access of light is unsatisfactory. Although BE 1006395 and EP 0723051 describe sliding roofs which comprise thermally interrupted profiles, with these only part of said requirements for strength, slimness, insulation and light access, are met.

Summary of the Invention

[0005] The purpose of the present invention is to provide a sliding roof that meets each of the following requirements: wind and water tightness, high insulation rate, good light access, mechanically sufficiently strong to allow large spans and the use of large and heavy panels with safety insulation glass, reliability, whereby the positions of thee sliding panels relative to the roof frame and to each other are always precisely defined, with sufficient power for driving the moveable panels to allow relatively steeply pitched roofs, short opening and closing times, and hidden propulsion components and guiding structures.

[0006] To this end, the invention provides a sliding roof of the type mentioned in the preamble of claim 1, characterised by the fact that the rotation of the first threaded spindle and the rotation of the second threaded spindle are mutually mechanically coupled.

Because of the spindle drive the movements of the involved sliding window panels or boards can be very well regulated. Due to the direct slip-free drive by means of a virtually stretch and creep free threaded spindle rod, the position of each panel or board is precisely defined, both during opening and closing of the roof Moreover, a threaded spindle rod is relatively strong, which allows for relatively steeply pitched roofs and heavy panels e.g. carrying heavy safety insulation glass.

Because of the mechanical coupling of the (rotation of the) spindles, also the movements of the panels relative to each other are coupled, assuring that the relative positions and the ratio of the moving rates of the panels or boards are always clearly defined.

[0007] To provide the mechanical coupling between the spindles a mechanical transmission can be used, such as a gear box, with which a fixed ratio of the rotation rates can be obtained, and therefore a fixed ratio of the moving rates of the involved panels or boards.

Also the first and the second threaded spindle can be both part of a single threaded spindle rod: thus their rotation rates are always the same.

The pitch of the first thrusting thread can differ from that of the second thrusting thread. The cooperation between mechanical transmission, rotation rates and thread pitches defines the ratio of the moving rates of the involved panels or boards.

[0008] In a preferred embodiment of a sliding roof according to the present invention the first and second spindle are both driven by a single motor. Thus, the rotation rates of the spindles relative to each other can be coupled, and the use of a single motor saves space and manufacturing costs. The motor is preferably electric, with electronic or remote control, to allow fully controlled and safeguarded movements of the driven sliding panels or boards.

[0009] Preferably, the spindles are provided with a 4- to 8-fold, preferably 6-fold thrusting thread with a pitch of 10 to 50 mm per revolution, preferably 25 to 35 mm per revolution.

By using such a relatively large pitch the roof can be opened and closed relatively quickly, whereby relatively large forces can be taken by the large number of threads so as to allow the use of heavy panels or boards.

[0010] Preferably at least one of the panels comprises:

- a second frame, and
- an at least partially translucent plate, preferably a safety insulation glass plate, mounted in the second frame.

The application of safety insulation glass yields a sliding roof with a high insulation value that is also safer than conventional sliding roofs.

Preferably the second frame is provided with a second

space for receiving at least a part of the spindle drive mechanism.
Thus a part of the spindle drive mechanism can be integrated in the involved panel or board. Such a second space, besides a possible third receiving space in the roof frame, gives extra space for the integration or hiding out of sight of the spindle drive mechanism thus giving the sliding roof a neater look

[0011] Preferably the first frame comprises a first profile piece in which at least one first insulating element has been incorporated, preferably a first plastic strip, whereby the section of the first profile piece is generally similar to the section of profile piece 11 shown in figure 2. This way, thermal bridges can be avoided and the roof frame will be better insulated.
Preferably the second frame comprises a second profile piece in which at least one second insulating element has been incorporated, preferably a second plastic strip, whereby the section of the second profile piece is substantially similar to the section of profile piece 12 shown in figure 2.
The sliding panels or boards will then also be better insulated, thus further raising the total insulation value of the entire sliding roof structure.

[0012] The profile pieces depicted in figure 2 are both slim and strong as well as well-insulated, allowing large spans and the application of large windows with (heavy) safety insulation glass. Consequently, the roof is well-insulated and allows ample access of light.

[0013] The present invention also provides a method of the type mentioned in the preamble of claim 11, characterised by the fact that the method comprises rotating simultaneously the first and second threaded spindle, whereby the rotations are mutually mechanically coupled. As said, by mechanically coupling (the rotation of) the threaded spindles, the movements of the involved panels are also coupled, due to which the relative positions and the ratio of the moving rates of the panels are clearly defined.
Thereby, the rotation rates of the spindles can be different.
Again, the whole of mechanical transmission, rotation rates and thread pitches defines the ratio of the sliding rates of the involved panels or boards.

Description of a Preferred Embodiment

[0014] The present invention will be further clarified by means of a non-limiting example of an embodiment. To this end:

- figure 1 shows a perspective view of a preferred embodiment of a sliding roof according to the invention, and
- figure 2 shows a part of a section of a preferred embodiment of a sliding roof according to the invention.

[0015] Figure 1 shows a sliding roof 1 according to the invention constructed of a roof frame 2 with two sections 3,3' with per section 3,3' a fixed window 4,4' with a moveable middle window panel 5,5' and a moveable lower window panel 6,6'. By means of a shorter spindle rod 7 and a longer spindle rod 8 the middle window panel 5 and the lower window panel 6 respectively can be moved. The spindle rods 7,8 are driven by an electric motor (not shown) that is hidden out of sight in the roof frame 2. Thus the moveable window panels 5,6 can be moved simultaneously, whereby their positions mutually and relative to the roof frame 2 are always precisely defined. The rotation rate of the longer spindle rod 8 is twice that of the shorter spindle rod 7, causing the lower window panel 6 to move twice as fast as the middle window panel 5. During opening and closing of the sliding roof 1, the middle window panel 5 and the lower window panel 6 both simultaneously achieve their furthest closed or open positions. With a partially opened sliding roof 1 this gives a neat even view. Furthermore, window panels 4,5,6 are provided with glass 9, e.g. 6-15-4.4.2 safety insulation glass, giving the sliding roof 1 excellent safety and insulation values.

[0016] Figure 2 gives a partial section 10 of the sliding roof 1 with an E-profile piece 11 and window panel profile parts 12 which have been developed especially by the applicant for the roof frame 2 and the sliding window panels 4,5,6. The E-profile piece 11 is relatively slim and has a large section modulus, it contains spaces 13 for receiving and guiding the moveable window panels 5,6 and comprises several insulating chambers 14 and plastic insulating strips 15. The window panel profiles 12 also comprise insulating chambers 14' and plastic insulating strips 15'.

[0017] Special characteristics and advantages of such a sliding roof 1 are among others:

- the direct (electrical) spindle drive mechanism;
- the driving of each separate window panel 5,6;
- the driving of several spindle rods 7,8 and window panels 5,6 by a single electric motor,
- the precisely defined relative positions of the sliding window panels 5,6 relative to the roof frame 2;
- the safety insulating glass 9 in the window panels 4,5,6;
- the insulating chambers 14,14' and the plastic insulating strips 15,15' both in the E-profile piece 11 of the roof frame 2 and in the window panel profile pieces 12;
- the slim, strong and well-insulated profile pieces 11,12 designed by the present applicant;
- the possibility to fully control the movements of the moveable window panels 5,5',6,6';
- the high insulation value, the absence of thermal bridges and consequently the absence of unwanted condensation;
- the feasibility of large spans;
- the optimal light access, and
- the parts of the drive mechanism being fully integrat-

ed in the structure.

[0018] It will be clear to a person skilled in the art that the invention is in no way limited to the described and depicted preferred embodiment and that many other variations and combinations are possible within the scope of the inventionas defined by the appended claims.

[0019] At last, we can mention as non-limitative examples, the use of a sliding roof according to the invention or a method for opening and closing of such a roof; for conservatories, greenhouses, shopping malls, terraces, atriums and parts of fixed roofs.

Claims

1. A sliding roof (1), said sliding roof (1) comprising:

- a first frame (2) provided with first spaces (13) for receiving and guiding:
  - a first panel-shaped part (5), such as a sliding window panel or board, able to move relative to said first frame (2), and provided with a first spindle nut, and
  - a second panel-shaped part (6), such as a sliding window panel or board, able to move relative to said first frame (2), and provided with a second spindle nut, and
- a spindle drive mechanism comprising:
  - a first threaded spindle (7) provided with a first thrusting thread for moving of said first panel-shaped part (5) in conjunction with said first spindle nut, and
  - a second threaded spindle (8) provided with a second thrusting thread for moving of said second panel-shaped part (6) in conjunction with said second spindle nut,

characterised by the fact that the rotation of said first threaded spindle (7) and the rotation of said second threaded spindle (8) are mutually mechanically coupled.

2. A sliding roof (1) according to claim 1, **characterised by** the fact that said sliding roof (1) also comprises a mechanical transmission, such as a gear box, to provide said mechanical coupling between said threaded spindles (7,8).

3. A sliding roof (1) according to claim 1 **characterised by** the fact that said first threaded spindle (7) and said second threaded spindle (8) are both part of a single threaded spindle.

4. A sliding roof (1) according to any of the preceding claims, **characterised by** the fact that the pitch of said first thrusting thread of said first threaded spindle (7) differs from the pitch of said second thrusting thread of said second threaded spindle (8).

5. A sliding roof (1) according to any of the preceding claims, **characterised by** the fact that said first threaded spindle (7) and said second threaded spindle (8) are driven by means of a single motor.

6. A sliding roof (1) according to any of the preceding claims, **characterised by** the fact that at least one of said threaded spindles (7, 8) is provided with a 4- to 8-fold, preferably 6-fold, thrusting thread with a pitch of 10 to 50 mm per revolution, Preferably 25 to 35 mm per revolution.

7. A sliding roof (1) according to any of the preceding claims, whereby at least one of said movable panel-shaped parts (5,6) comprises:

- a second frame, and
- an at least partially translucent plate (9), preferably a safety insulating glass plate, mounted in said second frame.

8. A sliding roof (1) according to claim 7, **characterised by** the fact that said second frame is provided with a second space for receiving at least a part of said spindle drive mechanism.

9. A sliding roof (1) according to any of the preceding claims, **characterised by** the fact that said first frame (2) comprises a first profile piece (11) in which at least one first insulating element (14, 15) has been incorporated, preferably a first plastic strip 15 whereby the section of said first profile piece (11) is generally similar to an E-profile.

10. A sliding roof (1) according to any of the claims 7-9, **characterised by** the fact that said second frame comprises a second profile piece (12) in which at least one second insulating element (14', 15') has been incorporated, preferably a second plastic strip (15'), whereby the section of said second profile piece (12) is generally similar to an U-profile.

11. A method for opening and closing of a sliding roof (1), said sliding roof comprising:

- a first frame (2) provided with first spaces (13) for receiving and guiding:
  - a first panel-shaped part (5), such as a sliding window panel or board, able to move relative to said first frame (2) and provided with a first spindle nut and
  - a second panet-shaped part (6), such as

a sliding window panel or board, able to move relative to said first frame (2), and provided with a second spindle nut, and

- a spindle drive mechanism comprising:

  - a first threaded spindle (7) provided with a first thrusting thread for moving of said first panel-shaped part in conjunction with said first spindle mit, and
  - a second threaded spindle (8) Provided with a second thrusting thread for moving of said second panel-shaped part in conjunction with said second spindle nut,

characterised by the fact that said method comprises rotating simultaneously said first threaded spindle (7) and said second threaded spindle (8), whereby said rotations are mutually mechanically coupled.

12. A method according to claim 11, **characterised by** the fact that the rotation rate of said first threaded spindle (7) differs from the rotation rate of said second threaded spindle (8).

Patentansprüche

1. Ein Schiebedach (1), besagtes Schiebedach (1) umfasst:

- einen ersten Rahmen (2) der mit ersten Zwischenräumen (13) versehen ist, zur Aufnahme und Führung von:

  - einem ersten plattenförmigen Teil (5), wie zum Beispiel einem Schiebefenster oder eine Platine, das relativ zu besagtem ersten Rahmen (2) bewegt werden kann, und mit einer ersten Spindelmutter versehen ist, und
  - einem zweiten plattenförmigen Teil (6), wie zum Beispiel einem Schiebefenster oder eine Platine, das relativ zu besagtem ersten Rahmen (2) bewegt werden kann, und mit einer zweiten Spindelmutter versehen ist, und

- einen Spindelantriebsmechanismus, der umfasst:

  - eine erste Gewindespindel (7), die mit einem ersten Druckgewinde versehen ist, zum Bewegen des besagten ersten plattenförmigen Teils (5) gemeinsam mit der besagten ersten Spindelmutter, und
  - eine zweite Gewindespindel (8), die mit einem zweiten Druckgewinde versehen ist, zum Bewegen des besagten zweiten plattenförmigen Teils (6) gemeinsam mit der besagten zweiten Spindelmutter,

dadurch gekennzeichnet, dass die Rotation der besagten ersten Gewindespindel (7) und die Rotation der besagten zweiten Gewindespindel (8) mechanisch miteinander gekoppelt ist.

2. Ein Schiebedach (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** besagtes Schiebedach (1) auch eine mechanische Kraftübertragung, wie zum Beispiel ein Getriebe, umfasst, um die besagte mechanische Kopplung zwischen den besagten Gewindespindeln (7, 8) zu ermöglichen.

3. Ein Schiebedach (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** besagte erste Gewindespindel (7) und besagte zweite Gewindespindel (8) beide Teil einer einzigen Gewindespindel sind.

4. Ein Schiebedach (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Gewindesteigung des besagten ersten Druckgewindes der besagten ersten Gewindespindel (7) von der Gewindesteigung des besagten zweiten Druckgewindes der besagten zweiten Gewindespindel (8) abweicht.

5. Ein Schiebedach (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die besagte erste Gewindespindel (7) und die besagte zweite Gewindespindel (8) mit Hilfe eines einzigen Motors angetrieben werden.

6. Ein Schiebedach (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** mindestens eine der besagten Gewindespindeln (7, 8) mit einem 4- bis 8-fachen, vorzugsweise 6-fachen Druckgewinde mit einer Gewindesteigung von 10 bis 50 mm je Umdrehung, vorzugsweise 25 bis 35 mm je Umdrehung versehen ist.

7. Ein Schiebedach (1) nach einem der vorhergehenden Ansprüche, wobei mindestens eines der besagten beweglichen plattenförmigen Teile (5, 6) umfasst:

  - einen zweiten Rahmen, und
  - eine zumindest teilweise durchsichtige Platte (9), vorzugsweise eine isolierende Sicherheitsglasplatte, die in den besagten Rahmen eingesetzt ist.

8. Ein Schiebedach (1) nach Anspruch 7, **dadurch gekennzeichnet, dass** besagter zweite Rahmen mit einem zweiten Raum zur Aufnahme von zumindest

einem Teil des besagten Spindelantriebsmechanismus versehen ist.

9. Ein Schiebedach (1) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** besagter erster Rahmen (2) ein erstes Profilstück (11) umfasst, in das mindestens ein erstes isolierendes Element (14, 15) eingearbeitet worden ist, vorzugsweise ein erster Kunststoffstreifen (15), wobei der Abschnitt des besagten ersten Profilstückes (11) generell einem E-Profil ähnelt.

10. Ein Schiebedach (1) nach einem der Ansprüche 7-9, **dadurch gekennzeichnet, dass** besagter zweite Rahmen ein zweites Profilstück (12) umfasst, in das mindestens ein zweites Isolationselement (14', 15'), vorzugsweise ein zweiter Kunststoffstreifen (15'), eingearbeitet worden ist, wobei der Abschnitt des besagten zweiten Profilstückes (12) generell einem U-Profil ähnelt.

11. Ein Verfahren zum Öffnen und Schließen eines Schiebedaches (1), wobei besagtes Schiebedach umfasst:

- einen ersten Rahmen (2), der mit ersten Zwischenräumen (13) zur Aufnahme und Führung versehen ist, von:
  - einem ersten plattenförmigen Teil (5), wie zum Beispiel einem Schiebefenster oder eine Platine, das relativ zu besagtem ersten Rahmen (2) bewegt werden kann, und mit einer ersten Spindelmutter versehen ist, und
  - einem zweiten plattenförmigen Teil (6), wie zum Beispiel einem Schiebefenster oder eine Platine, das relativ zu besagtem ersten Rahmen (2) bewegt werden kann, und mit einer zweiten Spindelmutter versehen ist, und
- einen Spindelantriebsmechanismus, der umfasst:
  - eine erste Gewindespindel (7), die mit einem ersten Druckgewinde versehen ist, zum Bewegen des besagten ersten plattenförmigen Teils gemeinsam mit der besagten ersten Spindelmutter, und
  - eine zweite Gewindespindel (8), die mit einem zweiten Druckgewinde versehen ist, zum Bewegen des besagten zweiten plattenförmigen Teils gemeinsam mit der besagten zweiten Spindelmutter,

dadurch gekennzeichnet, dass das besagte Verfahren die gleichzeitige Rotation der besagten ersten Gewindespindel (7) und der besagten zweiten Gewindespindel (8) umfasst, wobei die besagten Rotationen mechanisch miteinander gekoppelt sind.

12. Ein Verfahren nach Anspruch 11, **dadurch gekennzeichnet, dass** die Rotationsgeschwindigkeit der besagten ersten Gewindespindel (7) von der Rotationsgeschwindigkeit der besagten zweiten Gewindespindel (8) abweicht.

Revendications

1. Toit coulissant (1), ledit toit coulissant (1) comprenant :

- un premier cadre (2) pourvu de premiers espaces (13) pour recevoir et guider :
  - une première pièce en forme de panneau (5), telle qu'un panneau ou plaque de glace coulissant, capable de se déplacer par rapport audit premier cadre (2), et pourvue d'un premier écrou d'axe, et
  - une seconde pièce en forme de panneau (6), telle qu'un panneau ou plaque de glace coulissant, capable de se déplacer par rapport audit premier cadre (2), et pourvue d'un second écrou d'axe, et
- un mécanisme d'entraînement d'axe comprenant :
  - un premier axe fileté (7) pourvu d'un premier filet de poussée pour déplacer ladite première pièce en forme de panneau (5) conjointement avec ledit premier écrou d'axe, et
  - un second axe fileté (8) pourvu d'un second filet de poussée pour déplacer ladite seconde pièce en forme de panneau (6) conjointement avec ledit second écrou d'axe,

caractérisé par le fait que la rotation dudit premier axe fileté (7) et la rotation dudit second axe fileté (8) sont mutuellement couplées mécaniquement.

2. Toit coulissant (1) selon la revendication 1, **caractérisé par le fait que** ledit toit coulissant (1) comprend aussi une transmission mécanique, telle qu'une boîte d'engrenages, pour fournir ledit couplage mécanique entre lesdits axes filetés (7, 8).

3. Toit coulissant (1) selon la revendication 1 **caractérisé par le fait que** ledit premier axe fileté (7) et ledit second axe fileté (8) font tous les deux parties d'un seul axe fileté.

4. Toit coulissant (1) selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** le pas dudit premier filet de poussée dudit premier axe fileté (7) diffère du pas dudit second axe de poussée dudit second axe fileté (8).

5. Toit coulissant (1) selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** ledit premier axe fileté (7) et ledit second axe fileté (8) sont entraînés au moyen d'un seul moteur.

6. Toit coulissant (1) selon l'une quelconque des revendications précédentes, **caractérisé par le fait qu'**au moins l'un desdits axes filetés (7, 8) est pourvu d'un filet de poussée quadruple à octuple, de préférence sextuple, ayant un pas de 10 à 50 mm par tour, de préférence de 25 à 35 mm par tour.

7. Toit coulissant (1) selon l'une quelconque des revendications précédentes, au moins l'une desdites pièces mobiles en forme de panneau (5, 6) comprenant :

   - un second cadre, et
   - une plaque au moins partiellement translucide (9), de préférence une plaque en verre isolant de sécurité, montée dans ledit second cadre.

8. Toit coulissant (1) selon la revendication 7, **caractérisé par le fait que** ledit second cadre est pourvu d'un second espace pour recevoir au moins une partie dudit mécanisme d'entraînement d'axe.

9. Toit coulissant (1) selon l'une quelconque des revendications précédentes, **caractérisé par le fait que** ledit premier cadre (2) comprend une première pièce profilée (11) dans laquelle au moins un premier élément isolant (14, 15) a été incorporé, de préférence une première bande en plastique (15), la section de ladite première pièce profilée (11) étant globalement similaire à un profilé en E.

10. Toit coulissant (1) selon l'une quelconque des revendications 7-9, **caractérisé par le fait que** ledit second cadre comprend une seconde pièce profilée (12) dans laquelle au moins un second élément isolant (14', 15') a été incorporé, de préférence une seconde bande en plastique (15'), la section de ladite seconde pièce profilée (12) étant globalement similaire à un profilé en U.

11. Procédé pour ouvrir et fermer un toit coulissant (1), ledit toit coulissant comprenant :

   - un premier cadre (2) pourvu de premiers espaces (13) pour recevoir et guider :

     - une première pièce en forme de panneau (5), telle qu'un panneau ou plaque de glace coulissant, capable de se déplacer par rapport audit premier cadre (2), et pourvue d'un premier écrou d'axe, et
     - une seconde pièce en forme de panneau (6), telle qu'un panneau ou plaque de glace coulissant, capable de se déplacer par rapport audit premier cadre (2), et pourvue d'un second écrou d'axe, et

   - un mécanisme d'entraînement d'axe comprenant :

     - un premier axe fileté (7) pourvu d'un premier filet de poussée pour déplacer ladite première pièce en forme de panneau (5) conjointement avec ledit premier écrou d'axe, et
     - un second axe fileté (8) pourvu d'un second filet de poussée pour déplacer ladite seconde pièce en forme de panneau (6) conjointement avec ledit second écrou d'axe,

   caractérisé par le fait que ledit procédé consiste à faire tourner simultanément ledit premier axe fileté (7) et ledit second axe fileté (8), lesdites rotations étant mutuellement couplées mécaniquement.

12. Procédé selon la revendication 11, **caractérisé par le fait que** la vitesse de rotation dudit premier axe fileté (7) diffère de la vitesse de rotation dudit second axe fileté (8).

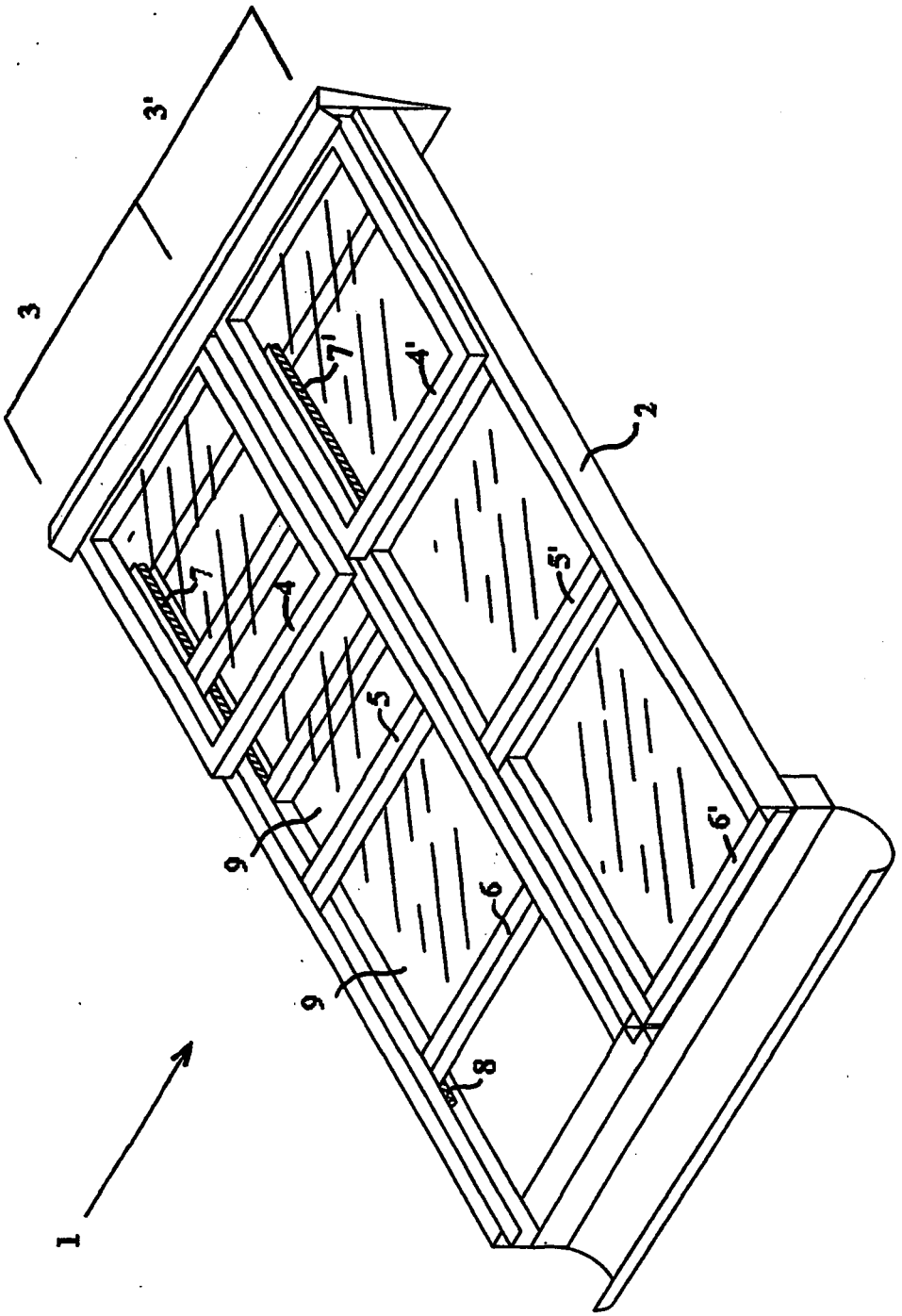


FIG. 1

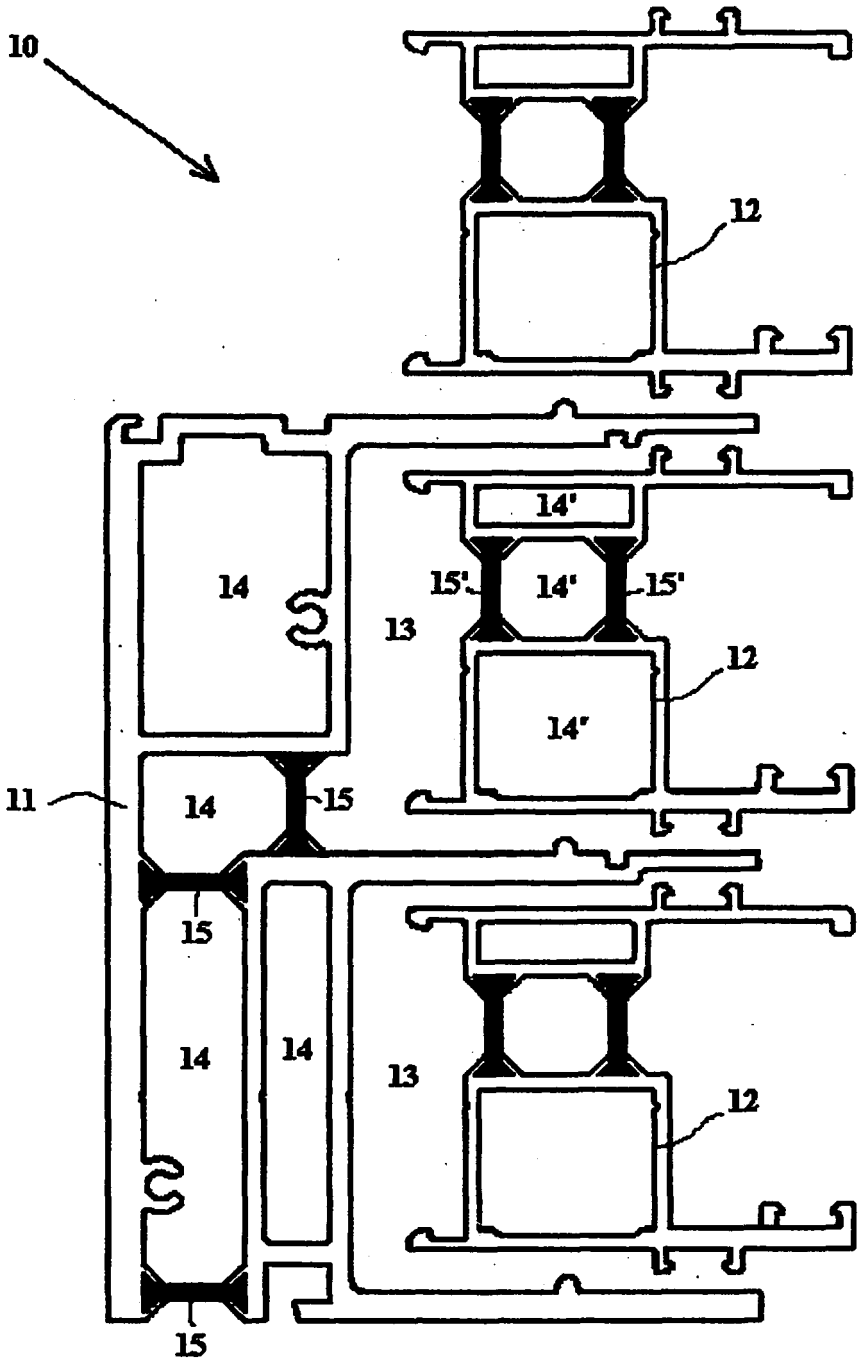


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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