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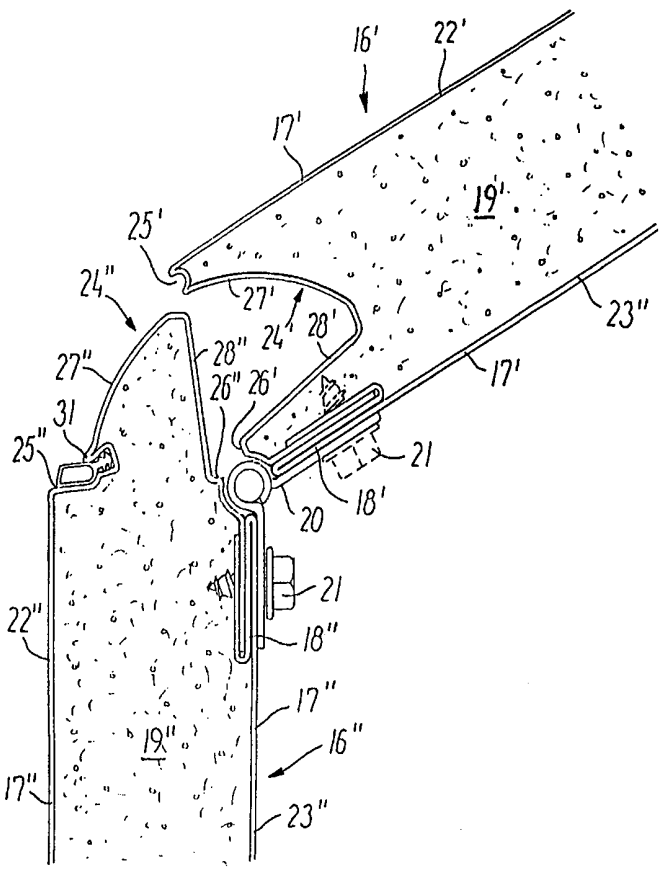
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(54) Title: A ROLL–UP DOOR

(57) Abstract

A roll–up door (1) is assembled by a number of preferably elongated sections (16', 16") each comprising a front (22', 22"), a back (23', 23"), and two edge sides (24', 24") extending transversely of the door. The sections are two by two pivotally connected by hinges (20) at adjacent edge sides. These edge sides are arranged in such a way that they are supporting against each other along a front and a posterior pair of supporting surfaces (25', 25") at the front and the back respectively of the sections in the closed position, and that they between these supporting surfaces are extending at a relatively small mutual distance over a predetermined arc angle along a front pair of mainly cylindrical flanks (27', 27") having mutual axes with or nearly mutual axes with the pivot axis and a posterior pair of flanks (28', 28"). The door is made secure against getting the fingers caught both at the front and at the back, and its sections are supported securely and stably during mounting. In the closed position, the hinges are effectively relieved of load, and the heat loss via the joint between the sections is reduced to a minimum.



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A roll-up door

The invention relates to a roll-up door assembled by a number of preferably elongated sections each comprising a front, a back, and two edge sides extending transversely of the door, and that two by two are pivotally connected by hinges at adjacent edge sides arranged in such a way that they are supporting against each other along a front and a posterior pair of supporting surfaces at the front and back respectively of the sections in the closed position, and that a part of the edge sides is extending at a relatively short mutual distance from the front pair of supporting surfaces over a predetermined arc angle along a front pair of mainly cylindrical flanks having mutual axes with or nearly mutual axes with the pivot axis.

Conventionally, hinged closing devices such as doors, windows, and roll-up doors have been arranged with substantially plane edge sides at the hinges whereby there is a risk of getting the fingers caught between the edge sides when the devices are closed.

This risk is effectively eliminated with the wagon door disclosed in German Patent No. 216816 where the part of the edge sides on the door and the frame respectively which is facing the front of the door is formed as cylinder surfaces having the same axis as the pivot axis of the door and a mutual distance so small that the fingers cannot enter and get caught between these surfaces. The posterior part of the edge sides are at first extending parallel with the back of the door and then out towards the back of the door along a pair of relatively narrow surfaces functioning as a stop when the door is being closed.

A similar structure with cylindrical edge sides for preventing fingers getting caught is furthermore disclosed in the French Patent No. 876.040. In this case, a longitudinal elastomeric sealing strip is fitted on the front of one of the parts, said

strip will hit the other part during closing. The patent states that the structure is suitable for e.g. doors and windows. However, the elastomeric sealing strip is not strong or stable enough to be able to absorb the load of the superjacent sections which are put on top of each other when a door is being mounted, and the sections will furthermore be likely to overturn or slide as a result of the one-sided support.

A door with edge sides arranged in exactly the same way as the one in the above German Patent No. 216816 is moreover disclosed in European Patent No. 0 370 376. The stop surfaces at the back of the door disclosed in this German patent serve for supporting the sections when they are put on top of each other at mounting and for the relief of the load on the hinges when the door is closed. However, the one-sided placing does also in this case mean that the sections will be likely to overturn or slide during mounting.

A balanced support at mounting is disclosed in Danish Utility Model No. 95 00353 where the sections are symmetrically arranged about a centre plane and are supporting each other along central parts on adjacent edge sides during mounting or in the closed position. However, the limited transverse extent of these central parts has the effect of the support being rather unstable.

US Patent No. 3,941,180 discloses a door where narrow supporting surfaces are made on adjacent edge sides on the front and the back respectively for supporting the sections in the closed position and when they are set on top of each other during mounting. The supporting surfaces are on a plane which is perpendicular to the front and the back of the respective section. This kind of support is extremely stable and steady. A cylinder surface having the same axis as the pivot axis of the sections is made on a longitudinal guide rail rising from the subjacent edge side at the front. A corresponding surface is furthermore made on the superjacent edge side following the

subjacent cylinder surface at such a short distance that there is no risk of getting the fingers caught during closing. The disadvantage of this structure is that there is a large hollow space between the adjacent edge surfaces in the closed position, and this hollow space forms a thermal bridge that can cause a considerable heat loss in use.

The object of the invention is to show a roll-up door of the kind mentioned in the opening paragraph with edge sides that give the sections a stable, steady mutual support during mounting, and that effectively relieve the load on the hinges in the closed position, and at the same time to reduce the heat loss at the joints between the sections to a minimum.

The novel and unique features according to the invention, whereby this is achieved, is the fact that the front pair of flanks passes into a posterior pair of flanks extending to the posterior pair of supporting surfaces with a short mutual distance. Thereby, the sections obtain a stable and steady mutual support both during mounting and in the closed position, and at the same time the short distance between the edge surfaces effectively secures against thermal loss from a heated room when the door is closed.

At the same time, the arrangement of the cylindrical front pair of flanks ensures that there is no risk of getting the fingers caught at the front when the door is being closed.

The sections of the roll-up door are typically built up as sandwich structures with a metal-sheet coated insulation. The heat loss at the edge sides is advantageously reduced to a minimum when their flanks are placed on the exterior of the sheet coating.

The front and posterior flank on a subjacent and a superjacent edge side can advantageously delimit a tongue and a groove respectively whereby the forming of a water trap in one of the edge sides when the door is closed is prevented.

In an advantageous embodiment, a sealing strip can be fitted between the front pair of supporting surfaces having a sealing part and a fastening part for fastening the sealing strip in a dovetailed groove situated at the transition between the front supporting surface of the edge side and the front flank.

The result of the projecting placing of the sealing strip is that the slit extending freely between the front and posterior supporting surfaces in closed position is filled with warm air from a heated room almost to the outer side of the door whereby the risk of condensate forming between closed sections is minimised.

Another advantage which is obtained from the projecting placing of the sealing strip is the fact that influx of air and percolation of water into the vertical edge sides of the door via the slit between the horizontal edge sides is prevented as the sealing between the sections and at the door sides - seen transversely to the door - are placed on the same level.

The uninterrupted nature of the slit extending between the supporting surfaces in the closed position furthermore prevents that water can hang between the edge sides of closed sections as a result of the capillary effect. Thereby, the disadvantage of water running into the room behind the door when the door is opened is avoided.

To further ensure against water entering between the sections, all sides of the dovetailed groove for fastening the fastening part of the sealing strip can be arranged in such a way that any seeping water runs outwards when the door is closed.

In an especially advantageous embodiment, an outer longitudinal rib can be made, flush with the front of a superjacent section, on the front supporting surface of the superjacent edge side, and, at a relatively short distance

from this rib, an inner longitudinal rib can be made which is slightly lower than the outer rib.

When the sealing part of the sealing strip is formed as an elastomeric tube, the height difference between the two ribs can advantageously be twice the wall thickness of the tube. In the closed position, the outer rib will then support firmly against the subjacent supporting surface while the inner rib will keep the inner sides of the sealing tube pressed tightly together at the area near the inner rib. The sealing tube is arching up between the ribs and thereby forms an effective sealing against seeping water which in frosty weather would make the sections freeze together.

When closing the door, the outer rib will be the first to meet the sealing tube. The inner rib is therefore not able to inexpediently squeeze the sealing tube out in front of the door front and/or in between the edge sides of the sections. When the sealing tube is arched up between the two ribs, it is locked up on all sides and will therefore keep its full sealing capability under the influence of e.g. strong wind.

The supporting surfaces can be arranged in any suitable way and still be able to fulfil their purpose. But according to the invention, it is especially expedient when they are on a plane which is perpendicular to the front and back of the sections so that the sections automatically will assume a vertical position when they is put on top of each other during mounting.

Another advantage which is obtained from arranging the supporting surfaces in this way is the fact that the sealing strips during closing are subjected to a pressure which is perpendicular to the supporting surfaces. When the door is opened, the sealing strips will therefore expand in the opening direction without friction and thus without the consequent attrition, and the sealing strips will also support the opening process at the start.

When a longitudinal rib extending nearly to the front flank of the superjacent edge side in the closed position is made on the front flank of a subjacent edge side, sections put on top of each other during mounting can easily be made to flush mutually.

When the pivot axis of the sections is on or nearly on a plane which coincides with the back of the sections, the risk of getting the fingers caught at back of the door during closing of the door is eliminated. At the same time, the hinges will be partly hidden between the sections whereby the tendency of them collecting dust and dirt is advantageously reduced.

The heat loss through a closed door is reduced the smaller the slit space between the two pairs of supporting surfaces on edge sides of adjacent sections is in the closed position.

When the slit between the front pair of flanks is converging in the pivot direction, the tendency of water hanging in the outermost and thereby the coldest part of the slit is reduced, and at the same time will any collected water easily be able to run out of the slit.

To avoid the risk of getting the fingers caught at the exterior of the door, the overall width of the slit between the front pair of flanks must not exceed 8 mm.

The overall width of the slit between the posterior pair of flanks must also not exceed 8 mm in order to avoid the risk of getting the fingers caught at the back of the door. From a thermal point of view, it is however an advantage if this distance is as short as possible. Still, it should be no shorter than 0.1 mm on account of the natural occurring tolerance variations, and in order for the slit to be wide enough to allow warm air from a heated room to be to advance safely to the front of the door.

The invention will be explained in greater detail below, describing only embodiments by way of examples with reference to the drawing, in which

Fig. 1 shows a roll-up door according to the invention,

Fig. 2 is on a larger scale a fractional and side view in section of the roll-up door shown in fig. 1 in closed position,

Fig. 3 is the same view of the door in fig. 1 but in open position,

Fig. 4 is on a much larger scale a fractional and side view in section of the edge surfaces between two adjacent sections at the front of the door shown in fig. 1-3 in the final closing stage,

Fig. 5 is the same view of the door in fig. 1-3 in closed position,

Fig. 6 is a fractional view of a second embodiment of the roll-up door according to the invention, and

Fig. 7 shows a detail of the sector at the front supporting surfaces of the roll-up door in fig. 6.

In fig. 1 is seen a roll-up door generally designated 1 and which with rollers 2 runs on guide rails 3 placed on each side of the door frame and further in under the ceiling of the room and which are fastened to the ceiling with mountings 4. The door can be lifted or lowered by means of wires 5 fastened at the bottom of the door and via pulleys 6 carried to wire barrels 7 on a driving shaft 8. This driving shaft is via a transmission 9 connected to a motor 10 which can be activated from below by means of an electric control 11 when the door is to be opened or closed.

In fig. 1, the roll-up door is partly lifted. In completely opened condition, the door hits stop springs 12. Torsional springs 13 put around the shaft 8 serve for balancing the dead load of the door. A shaft coupling 14 joins the driving shaft.

In order to be able to carry out a motion where the door 1 is able to run over a curve from a vertical to a horizontal or inclined position, it is divided into a number of longitudinal sections 16 interconnected by hinges 15.

A segment of a superjacent section 16' and a subjacent section 16'' is shown in fig. 2 and 3 on a larger scale and from the side in section where fig. 2 shows the sections in closed position and fig. 3 in open position.

The superjacent section 16' is made up of iron or aluminium sheets 17' joined by a fold 18' and foamed with an insulating mass 19' of polyurethane or similar plastics.

The subjacent section 16'' is similarly made up of iron or aluminium sheets 17'' joined by a fold 18'' and foamed with an insulating mass 19'' of polyurethane or similar plastics.

The two sections 16' and 16'' are pivotally connected by hinges 20 screwed on the sections near their folds 18' and 18''.

The superjacent section 16' furthermore comprises a front 22' and a back 23', and a superjacent edge side 24', and the subjacent section 16'' similarly comprises a front 22'' and a back 23'', and a subjacent edge side 24''.

At the front, the superjacent edge side 24' has a front supporting surface 25' and at the back a posterior supporting surface 26', and the subjacent edge side 24'' similarly has a front supporting surface 25'' at the front, and a posterior supporting surface 26'' at the back. The supporting surfaces serve for supporting the sections mutually when the door is

being mounted and for relieving the stress on the hinges when the door is closed.

In the shown case, the supporting surfaces are in a plane which is perpendicular to the front and the back of the sections, and as they at the same time are placed with the largest possible mutual distance - seen in cross section - they give the sections an especially stable support that automatically ensures a vertical orientation of the sections when they are put on top of each other during mounting.

Between the supporting surfaces, the superjacent edge side 24' is extending along a mainly cylindrical front flank 27' having mutual axis with or nearly mutual axis with the pivot axis and a posterior flank 28', and the subjacent edge side 24'' is similarly extending between the supporting surfaces along a mainly cylindrical front flank 27'' having mutual axis with or nearly mutual axis with the pivot axis and a posterior flank 28''.

The front flanks 27' and 28' together delimit a front slit 29 in the closed position, while the posterior flanks 27'' and 28'' together delimit a posterior slit 30 constituting a continuation of the front slit 29.

As the width of the front slit 29 is relatively narrow, e.g. less than 8 mm, and as the flanks 27' and 27'' delimiting the slit 29 are mainly cylindrical with mutual axis with or nearly mutual axis with the pivot axis, there will be such a narrow space at the mouth of the slit in any of the pivot positions that the respective sections of the door are intended to assume mutually during use that the fingers cannot get caught in the slit.

In order to simultaneously ensure against the fingers getting caught at the back when the door is being closed, the width of the posterior slit 30' is also relatively narrow, e.g. less than 8 mm. The risk of getting the fingers caught at the back

of the door is further reduced as a result of the pivot axis of the sections being close to the back and a little below the plane of the supporting surfaces when the door is closed. Thereby, an advantage is obtained at the same time in that the hinges will not inexpediently project too much on the back of the door where they might be in the way and will collect dust and dirt.

As shown, there is an unbroken slit 29,30 between the narrow supporting surfaces that ensures that almost the entire space between two closed sections is filled with warm air from a heated room so that condensate only with difficulty arise between the sections just as water cannot hang in the slit as a result of the capillary effect.

The front slit 29 is converging in the pivot direction whereby an advantage is obtained in that the risk of capillarity is slightest on the extreme and thereby usually coldest spot of the slit, and that water that might have entered the slit easily can run out again.

A longitudinal locking rib 31 is made on the front flank 27'' of the subjacent edge side 24''. In the closed position, this rib is extending nearly to the front flank 27' of the superjacent edge side 24'. The rib ensures that the sections 16' and 16'' easily are made to flush mutually in the vertical direction when they are put on top of each other during mounting.

As can be seen best in fig. 4 and 5, the sections are mutually sealed in the closed position by means of a projecting sealing strip 32 extending with a sealing part 33 in between the front supporting surfaces 25' and 25'' of the sections, while it is fastened with a fastening part 34 with hooks 35 to a dovetailed groove 36 made at the transition between the front subjacent supporting surface 25'' and the front subjacent flank 27''.

The locking rib 31 delimits a part of the dovetailed groove 36, and as can be seen, all the surfaces in the area of the sealing strip are oriented in such a way that water that might enter the groove will have a tendency to run out when the door is closed.

The projecting position of the sealing strip advantageously means that the strip conveniently can be replaced without having to disassemble the door sections to do it.

An outer longitudinal rib and an inner longitudinal rib 37 and 38 respectively are made on the superjacent front supporting surface 25', the ribs are separated by a narrow channel 39 with a curved cross section.

The sealing part 33 of the sealing strip 32 is formed as a sealing tube 33 with a wall thickness t, and the height of the inner rib 38 is about twice this thickness t shorter than the height of the outer rib 37.

As indicated with the arrow, the door is in fig. 4 being closed, and the front supporting surface 25' with the ribs 37 and 38 and the channel 39 of superjacent section 16' is approaching the sealing tube 33.

As the outer longitudinal rib 37 is higher than the inner longitudinal rib 38, it is the first to touch the sealing tube 33, and during the continued closing movement of the door, it thereby forms a blocking for preventing the sealing tube from getting pushed out between the supporting surfaces.

In the closed position in fig. 5, the outer rib 37 is supporting against the subjacent front supporting surface 25'', while the inner rib 38 is pressing the sealing tube 33 down towards the subjacent supporting surface. At the same time, the tube region between the two ribs 37 and 38 is arced up into the curved channel 39 and is thereby locked up on all

sides so that the sealing tube keeps its full sealing capability even under the influence of strong wind.

When the door is opened, the sealing strip 33 expands in the same direction in which the two sections 16' and 16' are moving in relation to each other. Thereby, the sealing tube 33 will advantageously, without friction and thus without the consequent attrition, contribute to the opening of the door.

Fig. 6 shows a second embodiment of the roll-up door according to the invention. This variant corresponds in the main to the roll-up door shown in fig. 2 - 5, and equivalent components are thus similarly referenced.

Fig. 7 shows a fragment of the sector at the front supporting surfaces 40' and 40'' of the roll-up door on a larger scale. In this case, the sealing strip 41 has a slightly different configuration than the sealing strip 32 shown in fig. 4 and 5. The sealing part 42 is a little higher, and the fastening part 43 is tubular. The outer longitudinal rib 44 is wider and is therefore advantageously supporting against the lower supporting surface 40'' with a larger contact face in the closed position of the door or during mounting where the sections are put on top of each other. Furthermore, the inner longitudinal rib 45 mainly attacks the sealing strip 41 of the sealing part 42 transversely of the door and thereby ensures the sealing strip 41 against getting caught between the two supporting surfaces 40' and 40'' when the door is being closed.

The roll-up door according to the invention has the advantage over the roll-up door disclosed in US Patent No. 3,941,180 in that there is no thermal bridge between the front and the back of the door. In the embodiment of the roll-up door according to the invention shown in fig. 2 - 5, the folds 18' and 18'' between the metal sheets 17' and 17'' respectively of the two sections still form a thermal bridge that in the long run

might cause a considerable heat loss from the building which is being closed by the roll-up door.

This disadvantage is effectively rectified by the embodiment of the roll-up door according to the invention shown in fig. 6 as the mentioned thermal bridge is now interrupted by insulating strips 46' and 46'' of e.g. plastic in joints 47' and 47'' that replace the folds 18' and 18''.

The joints 47' and 47'' are strengthened by angular webs 48' and 48'' made on the innermost of two metal sheets 17' and 17'' respectively of the sections, and which are extending into the insulating mass 19' and 19''. The webs 48' and 48'' ensure that the hinge connection 20 is firmly fastened in this mass, and that this and the metal sheets 17' and 17'' in the area of the hinge connection do not undergo any permanent deformation under a stress, and when the door is lifted and lowered.

C L A I M S

1. A roll-up door (1) assembled by a number of preferably elongated sections (16',16'') each comprising a front (22',22''), a back (23',23''), and two edge sides (24', 24'') extending transversely of the door, and that two by two are pivotally connected by hinges (20) at adjacent edge sides arranged in such a way that they are supporting against each other along a front and a posterior pair of supporting surfaces (25',25'') at the front and the back respectively of the sections in the closed position, and that a part of the edge sides is extending at a relatively short mutual distance from the front pair of supporting surfaces over a predetermined arc angle along a front pair of mainly cylindrical flanks (27',27'') having mutual axes with or nearly mutual axes with the pivot axis **characterised** in that the front pair of flanks (27',27'') passes into a posterior pair of flanks (28',28'') extending to the posterior pair of supporting surfaces at a short mutual distance.

2. A roll-up door (1) according to claim 1, and where each section (16',16'') is built up as a sandwich structure consisting of an insulation of e.g. polyurethane coated by a sheet of e.g. metal **characterised** in that the flanks of the respective edge sides are on the exterior of the plating.

3. A roll-up door (1) according to claim 1 or 2 **characterised** in that the front and the posterior flank (25'',26'') on a subjacent edge side (24'') together form a - seen in cross section - convex configuration, and that the front and the posterior flank (25',26') on a superjacent edge side (24') together form a concave configuration.

4. A roll-up door (1) according to claim 1, 2, or 3 **characterised** in that an elastomeric sealing strip (32)

of e.g. rubber is placed over the front supporting surface (25'') on a subjacent edge side (24'').

5. A roll-up door (1) according to claim 4 **characterised** in that the sealing strip (32) has a preferably tube-shaped sealing part (33) extending in over the front supporting surface (25'') of the subjacent edge side (24''), and a fastening part (34) for fastening the sealing strip in a dovetailed groove (36) situated at the transition between the front supporting surface of the edge side and the front flank, and that at least the lower side of the dovetailed groove is inclining downwards in the closed position.

6. A roll-up door (1) according to each of the claims 1 - 5 **characterised** in that an outer longitudinal rib (37) is made on the front supporting surface (25'') of the superjacent edge side (24''), the rib is flush with the front of a superjacent section (16'), and that an inner longitudinal rib (38) is made at a relatively short distance from the outer rib, the inner rib (38) is slightly lower than the outer rib.

7. A roll-up door (1) according to each of the claims 1 - 6 **characterised** in that a longitudinal rib is made preferably at the bottom of a front flank (27'') of a subjacent edge side (24''), the rib is extending closely to the front flank of the superjacent edge side (24') in the closed position.

8. A roll-up door (1) according to each of the claims 1 - 7 **characterised** in that the front and the posterior supporting surfaces (25',25'';26',26'') on an edge side (24',24'') are in a plane that preferably is perpendicular to the front (22',22'') and/or the back (23',23'') of the respective section (16,16',16'').

9. A roll-up door (1) according to each of the claims 1 - 8 **characterised** in that the pivot axis of the sections (16) is on a plane or nearly on a plane that coincides with the back (23',23'') of the sections (16).

10. A roll-up door (1) according to each of the claims 1 - 9 **characterised** in that the front flanks (27',27'') on a superjacent and a subjacent edge side (24',24'') respectively together delimit a slit (29) in the closed position, and that this slit is converging in the pivot direction.

11. A roll-up door (1) according to each of the claims 1 - 10 **characterised** in that the front flanks (27',27'') on a superjacent and a subjacent edge side (24',24'') respectively together delimit a slit (29) in the closed position, and that this slit has an overall width of 8 mm.

12. A roll-up door (1) according to each of the claims 1 - 11 **characterised** in that the posterior flanks (28',28'') on a superjacent and a subjacent edge (24',24'') side respectively together delimit a slit (30) in the closed position, and that the largest and smallest width of this slit are 8 mm and 0.1 mm respectively.

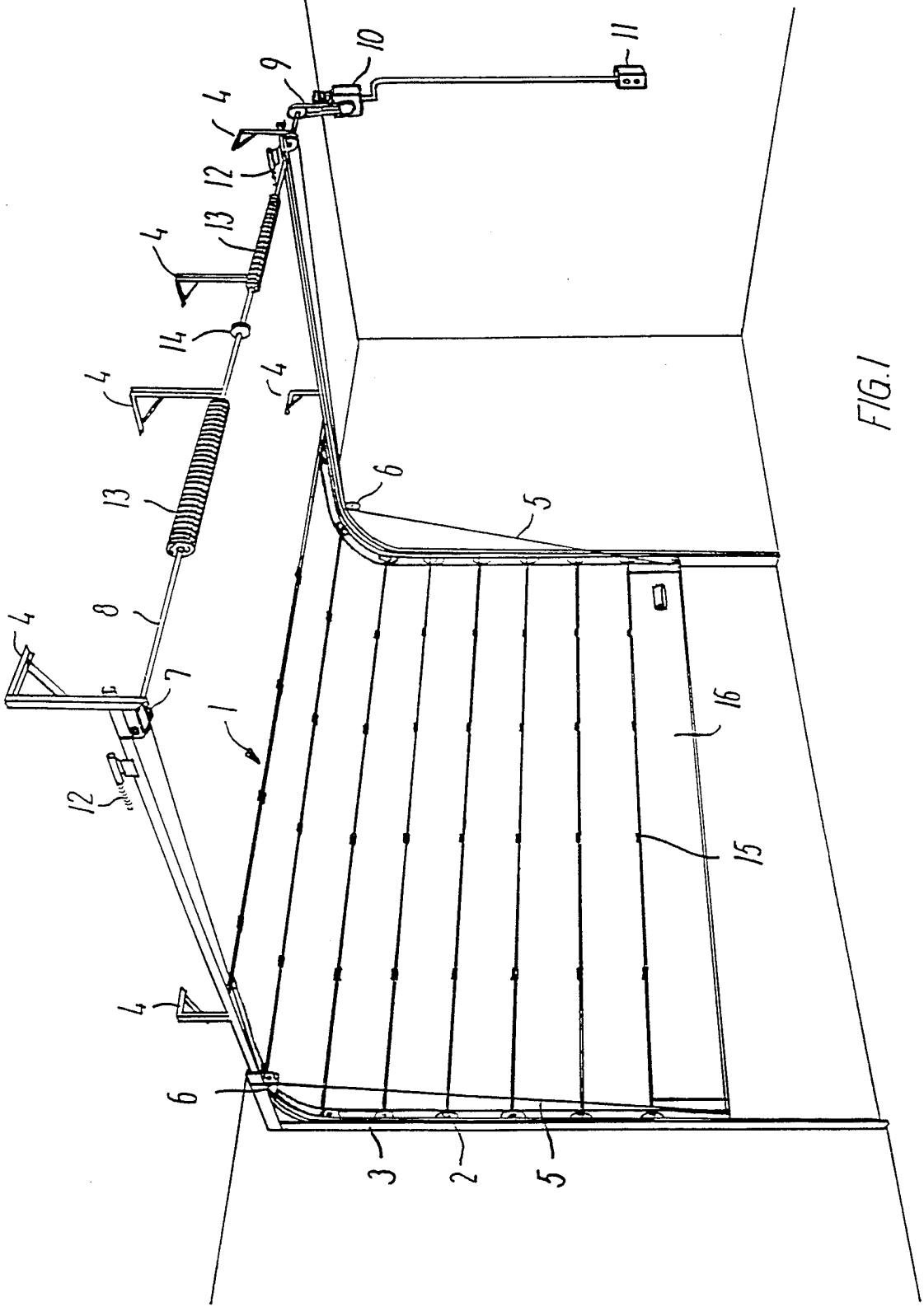


FIG.1

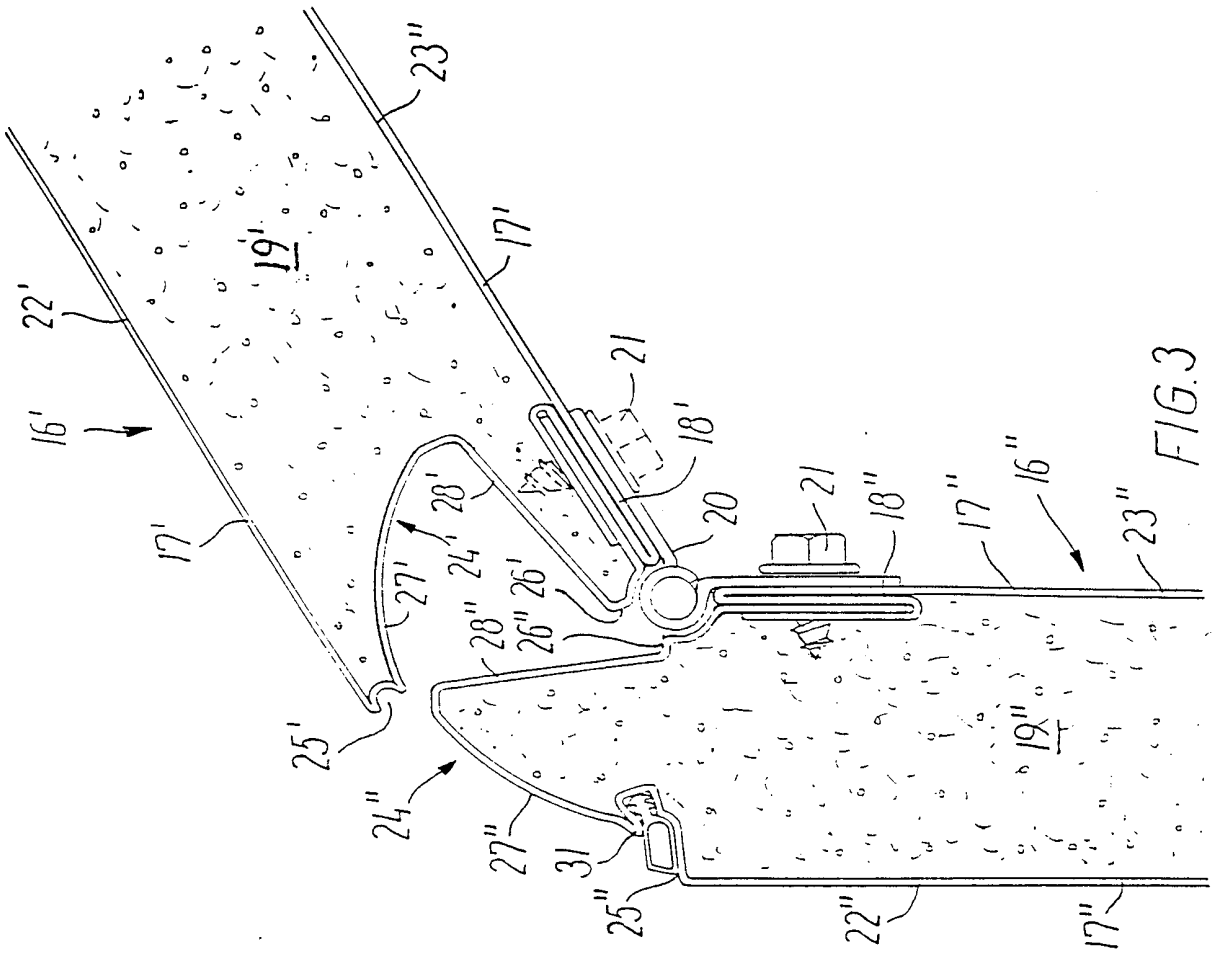

16'
17'
19'
22'
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18'
20
21
18''
17''
16''
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28'
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26'
28''
26''
25'
24''
27''
31
25''
22''
17''
19''

FIG.3

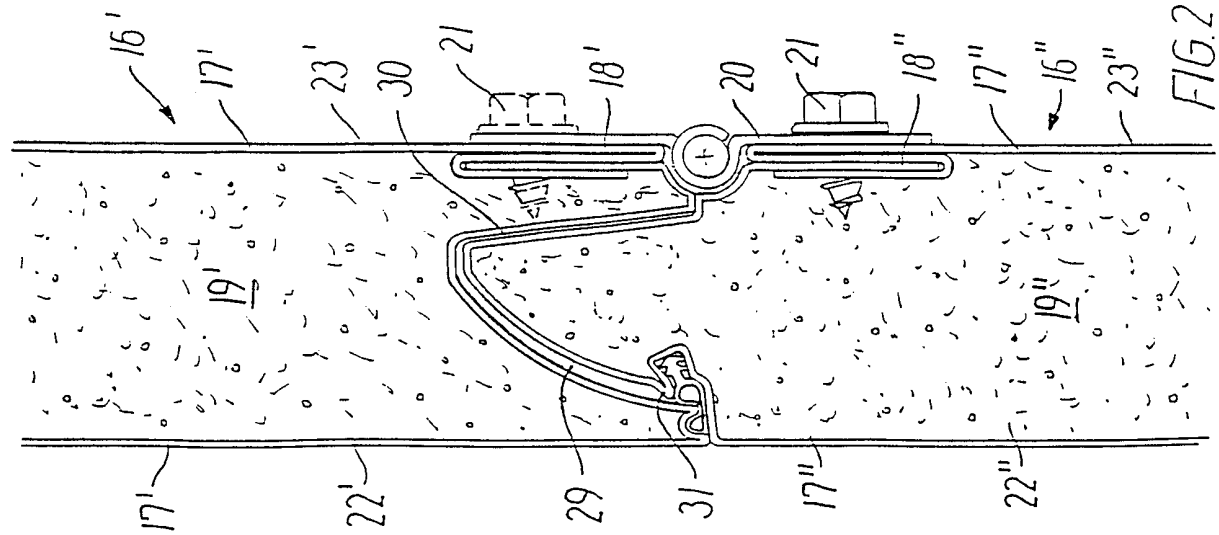

16'
17'
23'
30
21
18'
20
21
18''
17''
16''
23''
19'
19''
17'
22'
29
31
17''
22''

FIG.2

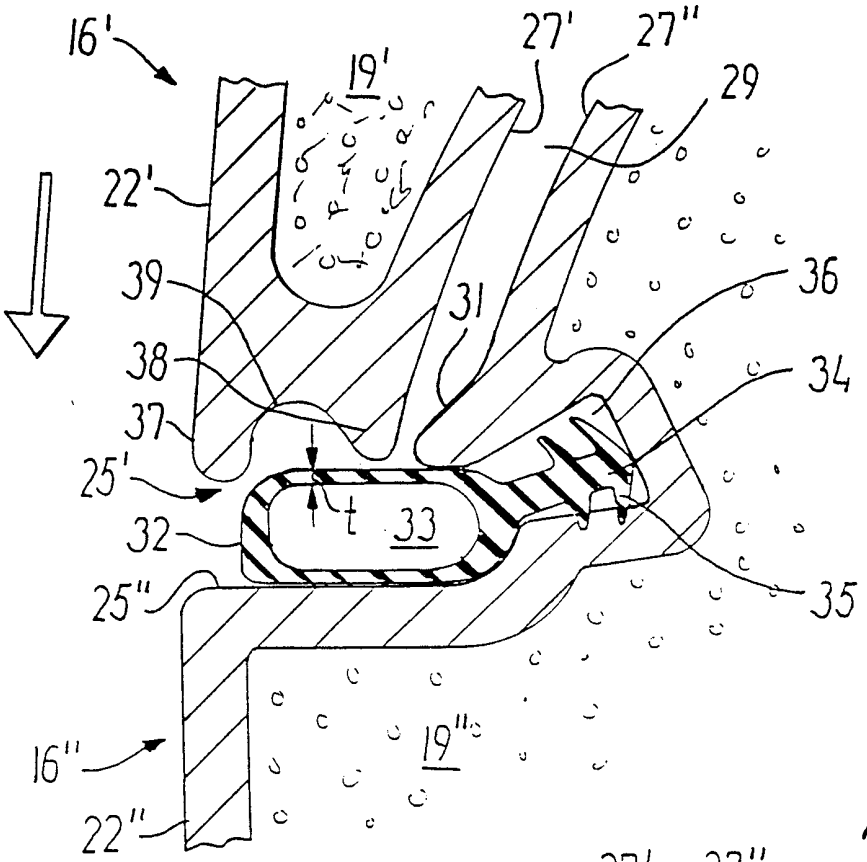

16'
19'
27'
27''
29
22'
39
31
36
38
34
37
25'
t
33
32
35
25''
19''
16''
22''

FIG. 4

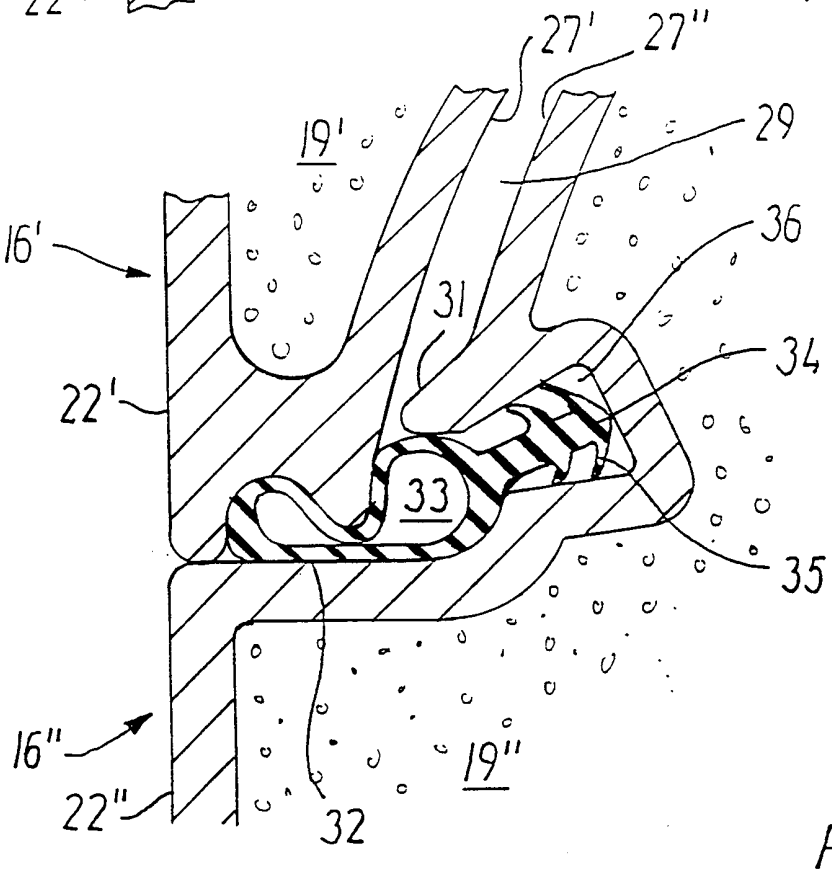

27'
27''
19'
29
16'
36
31
34
22'
33
35
19''
16''
22''
32

FIG. 5

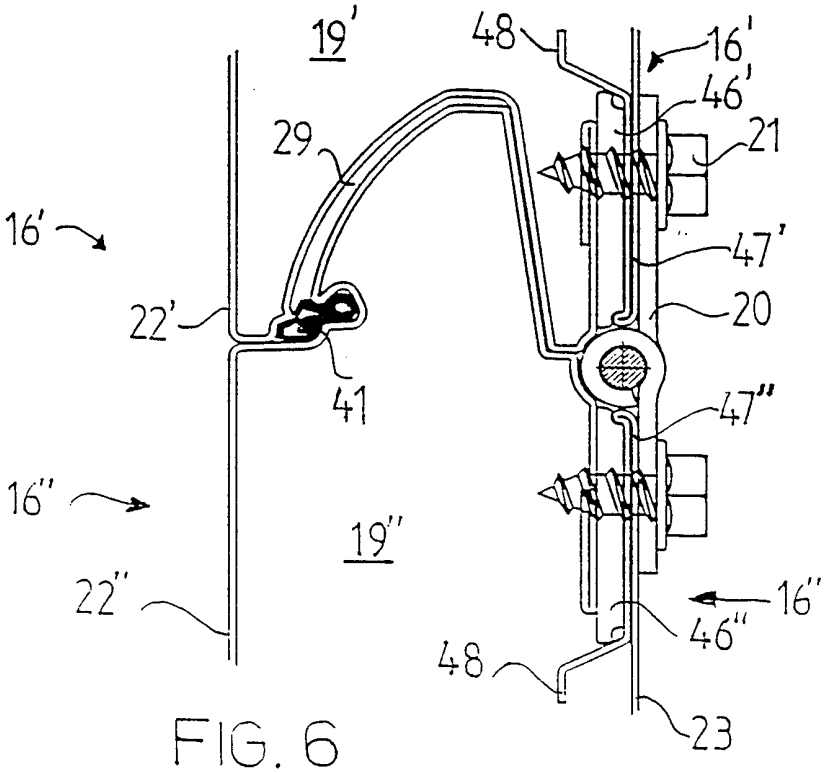

19'
48
16'
46'
29
21
16'
47'
22'
20
41
47"
16"
19"
22"
16"
46"
48
23

FIG. 6

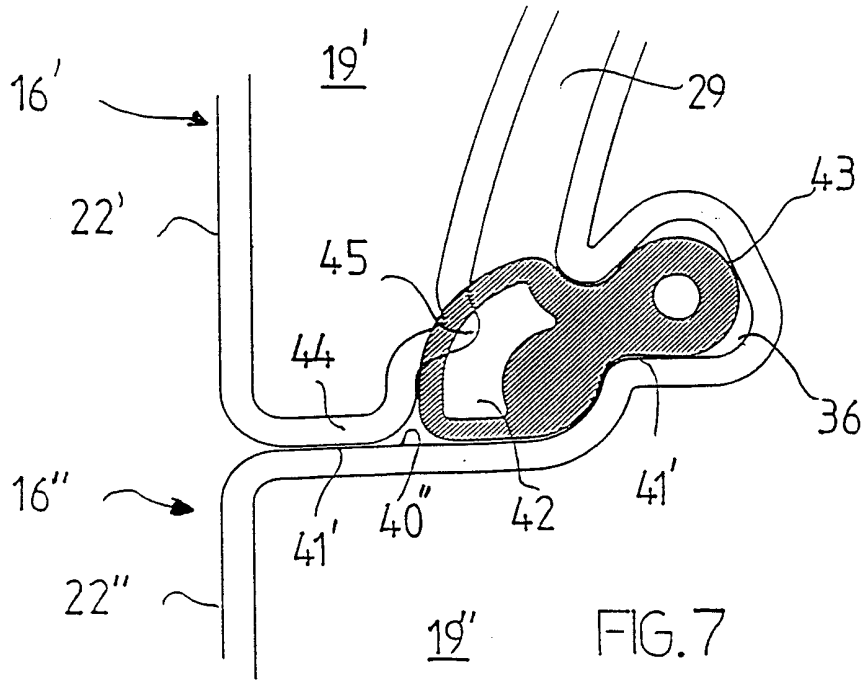

16'
19'
29
43
22'
45
44
36
16"
41'
40"
42
41'
22"
19'

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 98/00418

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E06B 3/48
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means
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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 December 1998	08 -12- 1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Johan Winther Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 98/00418

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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PCT/DK 98/00418

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