Title: IMPROVED LOUVRE MECHANISM

Abstract

A louvre shutter mechanism is disclosed that is adapted to be assembled from kit form. The kit form is adapted so that the shutter dimensions can vary, enabling the shutter to be installed within a window frame that falls within a predetermined range of sizes. The side rails (2) of the shutter incorporate elongate channel portions (3) that are adapted to receive elongate support members (5). The support members (5) include a plurality of apertures (9) that locate pinion gears (6) projecting from the louvres (8). The support members (5) operate to support the louvres (8) as the pinion gears (6) do not engage the side rails (2). The combination of the support rails (5), louvres (8) and pinion gears (6) forms a sub-assemble that can be received with the side rails (2) and top rails (10) of the shutter. The support members (5) include a channel portion (3) that is adapted to receive a gear rack (4). The pinion gears (6) engage the gear rack (4) allowing synchronous rotation of the louvres (8). The pinion gears (6) perform the additional function of operating as spindles for the louvres (8). The use of dual functionality in the pinion gears (6) reduce the complexity of component parts in the kit and assists with ease of assembly.
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IMPROVED LOUVRE MECHANISM

Technical Field

This invention is in the field of moveable louvre structures, particularly but not necessarily window shutters with rotatable louvres.

Prior-Art description

Window shutters incorporating rotatable louvres are a popular alternative to curtains and blinds. This is especially true of wooden shutters.

However shutters incorporating rotatable louvres are involved items to manufacture. All the louvres must be cut to the correct width. They must be evenly spaced within the frame and positioned so that their axes are parallel.

Once this is accomplished, a rod which connects all the louvres together must be accurately positioned on the louvres and neatly stapled in place to effect simultaneous rotation of all louvres.

Once a louvre shutter has been manufactured, its size cannot be altered without substantial reconstruction. This presents the manufacturer with a problem because window dimensions and styles vary greatly from building to building. Window sizes are often non-standard, having been made to measure. Hence a manufacturer utilising present louvre shutter designs must either have a large inventory of stock in order to supply the many variations in window sizes or only manufacture louvre shutters to order.

Unfortunately neither of these options are ideal. A large inventory of stock inflates manufacturing and supply costs. Manufacturing to order significantly increases manufacturers lead time for delivery of the product over an inventory based system.

Economics of manufacturing have dictated that louvre shutter mechanisms be manufactured to order rather than supplied from a large inventory. This stems partly from the implementation of computer aided manufacturing systems. These systems enable the dimensions of the window to be entered so that the various components can be automatically cut to their appropriate sizes. This also enables accurate and even spacing of the louvres within the frame to be achieved relatively easily. Canadian specification CA 2,
063, 632 to DiGianni and Marocco has disclosed such a system which is custom manufactured by computer aided manufacturing.

CA 2, 063, 632 has also addressed a further problem with louvre shutters, namely that the requirement for a connecting rod which is placed in the centre of the louvre mechanism. This rod is difficult to attach and many manufacturers feel that this rod detracts from the aesthetic value of the shutter. CA 2, 063, 632 has proposed the use of a rack and pinion system which is internal to the shutter frame. US 5,216,832 to Lafayette, La May and Dusevic has also addressed this problem and similarly proposes the use of an internal rack and pinion system to facilitate rotation of the louvres.

CA 2, 603, 632 however is specifically directed to a shutter constructed from extruded plastic. It addresses specific problems inherent in the manufacture and supply of such louvre shutters. The ability of this design to be custom manufactured and factory assembled is one of its major advantages according to the authors.

US 5, 216,832 is a complex design comprised of many components that would be difficult to manufacture or assemble without the assistance of modern manufacturing facilities.

Neither of these specifications address the problems inherent in present designs that require louvre shutters to be either manufactured to order or that require the manufacturer to have an uneconomically large inventory.

Accordingly it is an object of the present invention to provide a design for a louvre shutter system that is adapted to fit a range of window sizes, that does not require excessive inventories, and that does not need to be manufactured to order.

**Summary of the Invention**

According to one aspect of the present invention there is provided a louvre shutter including a plurality of frame members adapted to locate at least one elongate support member with a plurality of apertures; said apertures adapted to axially locate and support at least a first end of a plurality of louvres; at least one gear rack located adjacent said at least one support member and engaged by a plurality of elongate pinion gears each of which is co-located with
one of said apertures and axially with one of said louvres such that said pinion gears are further adapted to operate as spindles for said louvres.

The provision of a support member that serves to support the louvres greatly simplifies constructional requirements as the apertures may be pre-drilled or moulded accurately into position. Preformed holes allow the support member and frame members to be cut to the required length. This construction allows the louvre to be sold in a kit based form as tailoring the louvre to the appropriate size for the window frame is relatively easy.

Provision of an elongate pinion gear further adapted to operate as a spindle simplifies constructional requirements over prior art arrangements.

According to a further aspect the present invention provides a kit arrangement for a louvre shutter mechanism including a plurality of frame members, a plurality of louvres, at least one elongate support member with a plurality of apertures, a plurality of pinion gears and at least one gear rack said frame members, support member, louvres and gear rack adapted such that their length can be altered so that said shutter when assembled can fit a window frame of a size within a predetermined range; said frame members adapted to locate said at least one support member; said at least one gear rack located adjacent said at least one support member and engaged by said pinion gears which are further adapted to operate as pinion gears for said louvres; each said pinion gear co-located axially with a first end of one of said louvres and with one of said apertures whereby said apertures support and locate said louvres within said frame members.

The support members provide a kitted louvre mechanism that can be readily assembled by non-professional persons as tolerances required in cutting and drill are reduced. The support members also allow a hidden rack and pinion system to be incorporated without onerous assembly requirements.

According to further aspect, the present invention provides a method of assembling a louvre shutter mechanism such that the louvre shutter mechanism can be located within a window frame of a size that is within a predetermined range; said method including the steps of

(1) providing a plurality of frame members, a plurality of louvres, at
least one gear rack, and at least one support member with a plurality apertures and a plurality of elongate pinion gears further adapted to operate as pinion gears for said louvres;

(2) adjusting the length of at least said frame members, support member, louvres and gear rack to fit within said window frame;

(3) locating said pinion gears axially with a first end of said louvres;

(4) locating said pinion gears within the apertures of said support members;

(5) locating said gear rack adjacent said support members to engage said pinion gears;

(6) locating the assembly of step (5) within said frame members.

**Brief description of the drawings**

Figure 1 is an exploded view of the louvre shutter illustrating assembly.

Figure 2 is a cut away view of the louvre shutter as assembled.

Figure 3 is a view of a support member.

Figure 4 is a view of an alternate support member that is adapted to receive a gear rack.

Figure 5 shows the support members being located onto the pinion gears of the louvres.

Figure 6 shows the pinion gears being located onto the gear rack.

Figure 7 shows the assembled louvres and gear rack being located in the recess of the side rails.

Figure 8 shows the arrangement of the frame members.

Figure 9 is an exploded view of the louvre shutter showing the arrangement of the components before assembly.

Figure 10 is a device to assist with correctly locating the pinion gears in the louvres.

Figure 11 is a detailed side view of the pinion gear and gear rack.

**Detailed description of the preferred embodiment**

The louvre shutter will now be discussed with reference to the drawings.

The reader will appreciate that the invention is not limited to the preferred embodiment discussed herein and that variations are possible within the spirit
and scope of the invention.

Figure 1 shows two frame members, an end rail 1 and a side rail 2. A longitudinal recess 3 is located in the side rail 2. A gear rack 4 is received within the recess 3 adjacent a support member 5. Elongate pinion gears 6 are located axially with louvre 8 and are further adapted to operate as spindles for said louvres. Preferably the pinion gear 6 is located within axial hole 7 of louvre 8. The pinion gear 6 protrudes from the louvre 8 and is received within hole 9 of the support member. The pinion gear 6 protrudes beyond hole 9 of the support member and engages gear rack 4.

The rack 4 is located within the recess 3 and preferably adjacent the rear wall of the recess and the side wall of the recess. The placement of the gear rack 4 adjacent these walls, under the pinion gears 6 and adjacent the support member enables the rack 4 to be held within the recess 2 without the need for complex retaining mechanisms.

A further embodiment is shown in figure 4. It provides the support member 5 with an additional channel portion 12 adjacent apertures 9 of said support member. The gear rack 4 is preferably received within this channel portion 12. The pinion gears 6 operate by protruding through the support member 5 and into the cavity created by the channel 12. In this way the pinion gears perform the additional function of a spindle for said louvres.

With the rack and pinion system, rotation of a louvre causes the pinion gear to rotate which in turn causes the rack to slide within frame channel 3 or channel 12 in the support member. Sliding of the gear rack causes any other pinion gear engaged with the rack to rotate. In this way synchronous rotation of the louvres is achieved.

Locating the gear rack 4 in such a channel 12 simplifies assembly particularly of the kitted embodiment. It enables the pinion gears 6 once located in the louvres 8 to be further located in the support holes 9 and located in engagement with the gear rack 12. This enables construction of a functional sub-assembly louvre mechanism that can be readily located within frame members containing channel portions.

In figure 4c, a support member 5 with additional channel portion 12 is
disclosed, that further include part-cylindrical collar mechanism 50. These collars 50 are arranged so that apertures 9 extend over the gear rack 4 without interfering with the lateral movement of the rack within channel 12. In operation, these collars 50 further support the pinion gears 6 against flexing which has been found to occur when the gear rack 4 slides within channel 12. This sliding of the rack in turn moves against additional pinion, which it has been found causes lateral flexing in the gears before rotation occurs. Accordingly the collar 50 is provided to reduce this lateral flexing of the pinion gears so that a more efficient operation results.

Preferably, the inside diameter of the collar is 0.02mm larger than the outside diameter of the pinion gear, which preferably is 5.54mm.

In an alternative arrangement of the support member, the channel portion may be located intermediate the aperture of the support member such that the pinion gear is located within an aperture on either side of said gear rack. By supporting the pinion gear on either side of its engagement with the gear rack, lateral flexing will be reduced.

The support member 5 is preferably divided into a plurality of sections 14 by marking 13. The number of sections preferably corresponds to the number of holes 9 in the support member 5. These markings are preferably used as a guide to cut the support member to the desired length. The holes 9 of the support member 5 are preferably not located centrally within the sections 14. Non-central location of these holes enables leading and trailing edge portions of the louvres to abut when the louvres are located in the closed position.

In such an embodiment, offset of these holes 9 from the centre of the section 14 in the support member 5 is determined by the thickness of the end rails 1. The louvre 8 adjacent the end rail 1 needs to be offset slightly so that it does not abut the end rail 1 as it is rotated. The location of these holes 9 and the sections 14 in the support member 5 is shown in figure 3. In the particular embodiment shown the centres of the holes 9 in the support member 5 are 46mm centre to centre. Each section 14 is therefore 46mm wide. Each hole 9 is positioned 20mm from one end each section 14 and 26mm from the other end. These 46mm sections will enable a 50mm louvre 8 to overlap adjacent louvres 8
by 2mm at either edge 15.

It is preferable that in the kitted embodiment one end of the support member 5 will be marked as a "no cut end" 16. This end is shown in fig 3. The section 14 containing the no cut end 16 is 52mm wide. It contains an offset of 6mm additional to the 46mm wide section. Reference to figure 3 will demonstrate that in this preferred embodiment, louvres 8 adjacent end rails 1, will have their axes positioned some 26mm from either end rail allowing end louvres to rotate without interfering with the end rails.

An alternative embodiment of the support member 5, depicted in figure 3b, utilises at least one and preferably two Tags 60 instead of a no-cut end 16. In use the tag 60 is folded onto surface 61 via a hinge 62 located (and preferably moulded) at the interface of surface 61 and tag 62. The thickness of tag 60 should be sufficient to provide clearance so that the louvre adjacent the end rail can rotate without interference. With this embodiment aperture 9 can be located centrally within each section 14 of support member 5.

Where the length of the support member 5 is less than the length of the side rail, the tag 60 can be removed so that a number of support members can be located within each side rail 2 of the shutter frame. Where it is desired for all the louvres to operate synchronously, an additional gear rack 4 can span the 20 joins in the support members 5 on one side rail 2 of the frame while the remaining gear racks 4 are located within the support member 5 located within the side rail 2 on the opposite side of the frame. In this way the additional gear racks 4 translate the rotational movement of the louvres within the first support member 5 to the louvres located by the adjacent support members. It is not essential to join the abutting support members 5, as the end rails, when assembled, operate to retain the support members within the channel in the side rail 2.

A further feature that may be incorporated into the support member 5 is the provision of washers 20 around the holes 9 which receive the pinion gears 6. These washers 20 may be additional portions of plastic 20 that are raised off the edge of the support member 5. In such an embodiment, the louvres 8 will abut these raised portions 20 and during rotation the louvres will bear against these
raised portions. Being raised these portions 20 will prevent the entire edge 17 of the louvre from wearing against the support member 5.

The frame is preferably comprised of four members. Two side rails 2 and two end rails 1. When assembled the side rails 2 are opposing each other and the end rails 1 are opposing each other as demonstrated in figure 9. In the kitted embodiment the side rails will be preferably be 1 metre long and the end rails will preferably 0.5m wide. It is envisaged that a range of kitted embodiments will be employed. Each embodiment will provide side rails of a specific length and end rails of specific width. The range of kits should enable a wide variety of window and other openings to be covered. The length of the support members and the gear racks will preferably be varied according to the length of the side rails.

Alternatively the second side rail may have a recess 3 of narrower depth than the first side rail as this second recess need only accommodate a support member 5. Alternatively it may be of the same depth of the first recess and operate with a gear rack as described above.

The frame preferably utilises mortice and tenon joints. The end rail preferably forms the tenon 10 portion of the joint. Tenon joints 10 are preferably utilised in the kitted embodiment as they may be shaped relatively easily by non-professional persons. This enables the width of the frame to be cut to size by reducing the end rail to the desired length and cutting an additional tenon joint 10 in the end rail.

In the kitted embodiment the recess 3 of the side rails preferably form mortice joints. This enables the side rails 2 to be cut to the desired length with no further shaping required. These mortice joints 3 have the further advantage that they may extend the length of the side rail and correspondingly provide the recess which operates to receive the gear rack and support member. This dual function of the mortice joint further simplifies manufacturing requirements.

The mortice and tenon joints may be simply glued and clamped in place once the remainder of the louvre shutter mechanism has been assembled.

When the frame is assembled each support member 5 preferably abuts both end rails 1 so that it is positively located within the recess 3. The preferred
width of the support member 5 is such that it is flush with the external edge of the side rail 2 when located in recess 3. The preferred width and positive location between the end rails prevents the support member from moving within the recess 3, when the frame is assembled. This enables the support member 5 to support the weight of the louvres 8. Preferably the holes 9 in the support member 5 will operate as bearing surfaces for the pinion gears 6. The support member 5 is preferably manufactured of self lubricating plastic, such as self lubricating acetal.

The gear rack 4 is preferably of shorter length than the recesses 3. This is to enable the gear rack 4 to slide within the recess when the louvres are rotated without engaging the end rails 1 of the frame.

Preferably the pinion gears 6 are extruded of slightly flexible plastic such as nylon. This enables the pinion gear to twist should the louvres be rotated beyond any particular stop position of the louvres. In this way the pinion gears 6 perform five functions. They operate as axles for the louvre 8, as anchors for the pinion gears in louvre hole 7, as pinion gears for the rack 4, as bearings within the holes 9 of the support member and as shock absorbers for torsional overload.

When one louvre 8 is manually or otherwise rotated, the pinion gear 6 of that louvre 8 will engage the rack 4 and cause linear movement of the rack 4 within the recess 3. This linear movement will cause the other pinion gears 6 to rotate. This in turn causes the other louvres 8 to rotate. In this way synchronous movement of the louvres 8 is achieved through the rotation of only one louvre 8.

The intermeshing teeth on the gear rack and the pinion gear are preferably continuously curved. This provides the system with smooth operation. The pinion gear 6 of figure 11 is preferably 40mm long and preferably has an outside diameter 33 of 5.54mm and the radius from the centre of the pinion gear to the centre of the teeth 34 is preferably 2.20mm. The gear rack 4 is preferably 9mm wide with its length shorter than the support member 5 by two or more pitch lengths. The depth 36 of the gear rack 4 is preferably 2.105mm. The pitch of the rack 4 and pinion gear 6 is preferably 2.3mm and the radius of each tooth is preferably 0.575mm.
It is preferable that the rack and pinion gear be manufactured with tolerances of 0.02mm as the potential movement of up to 0.04mm between the rack and a pinion gear is magnified by the 25mm radius of the louvre. With this tolerance it has been found that the magnified movement seen in the louvre is acceptable for quality operation.

Where the second support member 5 does not have an adjacent gear rack 4, the pinion gears projecting into the support member may be cylindrical. In another embodiment an alternative mechanism for allowing rotation of the louvre off the second side rail may be employed. Such a mechanism may locate rotatable pinion gears on the second side rail. Alternatively rotatable pinion gears may be integrally incorporated into a support member.

Figures 5 through 9 are the assembly drawings that may accompany a kitted embodiment. These instructions will now be recited with reference to these drawings.

The kit will preferably include components of pinion gear pinions 6, two support members 5, two gear racks 4, louvres 8, two side rails 2 and two end rails 1. The kit will preferable include the following assembly aids: two elastic bands, four G-clamps and one pinion gear inserter and wood glue.

The window or opening onto which the shutter is to be located should first be measured. The shutter may be shortened by removing slats. Firstly calculate the number of slats that need to be removed and cut the support member 5 at the marks 13 placed intermittently on its surface so that the same number of holes 9 remaining in the support member 5 equals the number louvres 8 required. The support member 5 should only be cut from the end indicated. An equivalent length to that removed from the support member 5 should also be removed from the gear rack 4 and the side rails 4.

Where the height is to be adjusted by an amount less than the one louvre, the width of one of the end rails may be reduced.

The width of the shutter may also be reduced. Once the required width is determined, the width of the end rails 1 should be correspondingly reduced. This is best achieved by re-cutting the tenon joint 10. The width of each louvre 8 will also need to be reduced by an equivalent amount.
With reference to figure 9, it is preferable that the components be arranged onto a flat surface before commencing assembly of the shutter.

With reference to figure 5 the first step is to preferably insert each pinion gear 6 into a pre-drilled holes 7 at each end of each the louvre 8 using the pinion gear insertion aid 75. This insertion aid 75 will push the pinion gears 6 into the louvre 8 so that 20mm of pinion gear 6 protrudes from the end of the louvre 8. The insertion aid, figure 10, will is preferably shaped to receive the pinion gear 6. The orientation of the planar portion adjacent the top surface of the insertion aid 75 and the shaped aperture adapted to receive the pinion gear ensures that each gear 6 is located within each louvre with substantially identical orientation.

The support members 5 are then located onto the pinion gears 6.

With reference to figure 6, stage 2 of the assembly procedure, the second step is to ensure that the louvres 8 are in the open position and at right angles to the support member 5 and the work surface. This is best achieved by elevating the support member 5 off the work surface, so that the louvres can be aligned relative to the surface preferably in a vertical orientation.

The gear racks 4 are now located onto the pinion gears 6. Preferably the gear rack 4 is located equidistant from each end of each support member 5. This is best achieved by keeping the support members 5 elevated and resting the tooth side of the gear rack 4 on end of the pinion gears 6, ensuring that the teeth of the pinion gears engage the teeth of the rack.

In this way a self supporting sub-assembly consisting of the support members, louvres, pinion gears (and gear rack where support members include channel 12) is provided. This sub-assembly can then be located within side rails 2.

With reference to figure 8, the end rails 1 may now be located into place. The tenons 10 of the end rails are aligned with the recesses 3 of the side rails 2. The end rails 1 are slid into place until they are aligned with the side rails 2. In this position, the support member 5 should be firmly located between the end rail 1 and bottom rail 2 and retained laterally within the recesses 3.

Affixing the frame members using suitable means and glue will lock the sub assembly into place without use of separate affixing means.
CLAIMS:

1. A louver shutter including a plurality of frame members adapted to locate at least one elongate support member with a plurality of apertures; said apertures adapted to axially locate and support at least a first end of a plurality of louveres; at least one gear rack located adjacent said at least one support member and engaged by a plurality of elongate pinion gears each of which is co-located with one of said apertures and axially with one of said louvres such that said pinion gears are further adapted to operate as spindles for said louveres.

2. A louver shutter as claimed in claim 1 wherein said frame members are adapted to locate at least a second elongate support member with a plurality of apertures; said apertures adapted to axially locate and support a second end of said plurality of louveres by co-locating a plurality of pinion gears with said louveres.

3. A louver shutter as claimed in claim 2 including a second gear rack located adjacent said second member and wherein said pinion gears located in said second member are further adapted to engage said gear rack.

4. A louver shutter as claimed in claim 3 wherein said louvres, first and second support members, pinion gears and said rack operate as a self supporting sub-assembly which said frame members are adapted to locate thereby forming said shutter.

5. A louver shutter as claimed in any preceding claim wherein at least one support member includes an elongate channel portion adjacent said apertures; said channel adapted to locate said gear rack within said member in engagement with said pinion gears.
6. A louvre shutter as claimed in claim 5 wherein said rack is located below collar means projecting from said apertures into said channel portion; said collar means adapted to support said pinion gear in engagement with said rack.

7. A louvre shutter as claimed in any preceding claim wherein each said frame member is affixed relative to said other frame members whereby said support members are locked within said frame members.

8. A kit arrangement for a louvre shutter mechanism including a plurality of frame members, a plurality of louvres, at least one elongate support member with a plurality of apertures, a plurality of pinion gears and at least one gear rack said frame members, support member, louvres and gear rack adapted such that their length can be altered so that said shutter when assembled can fit a window frame of a size within a predetermined range; said frame members adapted to locate said at least one support member; said at least one gear rack located adjacent said at least one support member and engaged by said pinion gears which are further adapted to operate as pinion gears for said louvres; each said pinion gear co-located axially with a first end of one of said louvres and with one of said apertures whereby said apertures support and locate said louvres within said frame members.

9. A kit arrangement for louvre shutter as claimed in claim 8 further including a plurality of pinion gears and at least a second elongate support member with a plurality of apertures; said frame members further adapted to locate said second support member and said apertures of said second support member adapted to axially locate and support a second end of said of said louvres by co-locating said plurality of pinion gears with said louvres and said apertures.

10. A kit arrangement for louvre shutter as claimed in claim 9 further including a second gear rack located adjacent said second member and wherein said pinion gears located in said second member are further adapted to engage said gear rack.
11. A kit arrangement for a louvre shutter as claimed in claim 9 or claim 10 wherein said louvres, first and second support members, pinion gears and said rack operate as a self supporting sub-assembly which said frame members are adapted to locate thereby forming said shutter.

12. A kit arrangement for a louvre shutter as claimed in any one of claims 8 to 11 wherein at least one support member includes an elongate channel portion adjacent said apertures; said channel adapted to locate said gear rack within said member in engagement with said pinion gears.

13. A kit arrangement for a louvre shutter as claimed in claim 12 wherein said rack is located below collar means projecting from said apertures into said channel portion; said collar means adapted to support said pinion gears in engagement with said rack.

14. A louvre shutter as claimed in any one of claims 9 to 13 wherein each said frame member is affixed relative to said other frame members whereby said support members are locked within said frame members.

15. A method of assembling a louvre shutter mechanism such that the louvre shutter mechanism can be located within a window frame of a size that is within a predetermined range; said method including the steps of

(1) providing a plurality of frame members, a plurality of louvres, at least one gear rack, and at least one support member with a plurality apertures and a plurality of elongate pinion gears further adapted to operate as pinion gears for said louvres;

(2) adjusting the length of at least said frame members, support member, louvres and gear rack to fit within said window frame;

(3) locating said pinion gears axially with a first end of said louvres;

(4) locating said pinion gears within the apertures of said support members;
(5) locating said gear rack adjacent said support members to engage said pinion gears;
   (6) locating the assembly of step (5) within said frame members.

16. A method of assembling a louvre shutter as claimed in claim 15 further including the steps of:
   (7) providing at least a second support member with a plurality of apertures and a plurality of pinion gears;
   (8) according to step 2, adjusting the length of said second support member;
   (9) co-locating said pinion gears axially with a second end of said louvres and with said apertures of said second support member;
   (10) locating said second member within said frame members.

17. A method of assembling a louvre shutter as claimed in claim 16 and further including the steps of:
   (11) providing a second gear rack and further providing pinion gears of 7) adapted to operate as pinion gears;
   (12) locating said second gear rack adjacent said second support member.

18. A method of assembling a louvre shutter as claimed in claim 17 and further including the steps of:
   (13) providing said louvres, pinion gears, gear rack and support members such that a self supporting sub-assembly can be formed;
   (14) locating said sub-assembly within said frame members.

19. A method of assembling a louvre shutter as claimed in any one of claims 15 to 17 and further including the steps of:
   (14) according to steps 1 and 7 providing support members further including elongate channel means adjacent said apertures;
   (15) locating said gear rack within said channel such that said rack
engages said pinion gears.

20. A method of assembling a louver shutter as claimed in any one of claims 15 to 19 and further including the steps of:
   (16) affixing said frame members relative to each other such that said support members are locked within said frame members.
Fig 1.
Fig 2.
Fig 4a.
Fig 4b.

Fig 4c.
Fig 8.

Fig 9.

Top Rail

GLUE

Slide Down

Slide Up

Bottom Rail

Stile

Top Rail

Tenon

Carrier Strip

Bottom Rail

Spindles

Rack
Fig 10.

Fig 11.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl: E06B 7/096

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)
IPC E06B 7/096, 7/084

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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| A        | US, 5419082 A (LI) 30 May 1995
          | Col 1, line 58 - col 2, line 14, Figs 2,3                                        |                       |
| A        | US, 3350814 A (DUFRENE) 7 November 1967                                          |                       |
|          | Col 3, lines 29-61, Fig 4                                                       |                       |
| A        | US, 3188074 A (REVITZ et al) 8 June 1965                                         |                       |
|          | Col 2, lines 11-26, Fig. 2                                                      |                       |

X Further documents are listed in the continuation of Box C

See patent family annex

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Date of the actual completion of the international search
24 November 1995

Date of mailing of the international search report
1 DECEMBER 1995

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<td>GB, 1035650 A (APPLETON PTY LTD) 13 July 1966 page 2, lines 60-71, Fig 3.</td>
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