

A LOCKING SYSTEM FOR A LOUVRE ASSEMBLY

FIELD OF THE INVENTION

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This invention relates to a locking system for a louvre assembly. This invention also extends to a louvre assembly including the locking assembly and a method of locking a locking assembly.

- 10 This invention relates particularly but not exclusively to a louvre assembly that is a louvre window having glass blades and it will be convenient to hereinafter describe the invention with reference to this example application. However at the same time it must be recognized that the invention is capable of broader application. For example the invention could be used for louvre doors or louvre shutters which have non-transparent
- 15 blades.

DEFINITIONS

- 20 In the specification the term "comprising " shall be understood to have a broad meaning similar to the term "including" and will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps. This definition also applies to variations on the term "comprising" such as "comprise" and "comprises".

- 25 In the specification the term "bank of louvre blades" shall be understood to mean a vertically extending row of blades mounted on two spaced side channel members that are moved in unison with each other between open and closed positions.

- 30 In the specification the term "rocking surface" shall be understood to mean a surface that can roll or rotate over a curved surface thereby to travel along the surface. It is not unlike a camming action when that term is used in a broad sense.

BACKGROUND TO THE INVENTION

5 A louvre assembly comprises a louvre frame and a bank of louvre blades that is mounted on the frame. The louvre frame comprises two side frame members and top and bottom frame members interconnecting the two side frame members. Each louvre blade extends substantially horizontally between the two side frame members and is movably mounted thereto. Each blade is movable by means of a rotational movement between an open position which the major surfaces of each blade extends
10 substantially horizontally and a closed position in which the major surfaces of each blade extends substantially vertically. The blades are also capable of being positioned in any one of a number of positions intermediate said open and closed positions.

15 In use the blades in the bank are moved in unison between the closed position in which all the blades are substantially vertically extending and any one of a plurality of open positions in which openings are defined between adjacent blades through which air can pass for ventilation.

Each blade has two major blade surfaces that extend parallel to each other. Typically
20 the blade may have a length of about 30 to 100cm and a width of about 10 to 20 cm. Further the blades may have a depth or thickness between major surfaces of about 4mm to 14mm. Often the blades of the louvre assembly are made of glass and are thereby transparent so as to form a louvre window. Instead the blades of a louvre assembly may be formed of wood or metal thereby to be opaque thereby to form a
25 louvre shutter assembly.

Each end of each blade is mounted on a side frame member by means of a blade mounting element. Each blade mounting element has a channel mounting formation for rotatably mounting the blade mounting element on a channel forming the side
30 frame and a blade receiving formation or end clip that receives and holds an end region of the blade. In particular each blade mounting element has a rotatable mounting portion that is mounted on the side frame member. The rotatable mounting portion has a bearing which is rotatably received within a complementary opening in

the side frame member. In recent times the end clips have been moulded from plastic whereas previously the end clips were usually made of metal.

Typically the operating system includes a pair of operating bars received within the channel forming the associated side frame. The operating bars extend substantially the full height of the bank of louvre blades being operatively coupled to each of the louvre blades within the bank of blades.

The two operating bars are positioned on opposite sides of the rotational mounting of the end clip to the side channel. This way movement of the operating bars relative to each other effects a movement that is a rotation of the blades on their mounting to the channel and this has the effect of changing the orientation of the blades.

The louvre system includes a drive arrangement for facilitating movement of the bank of louvre blades in unison out of the closed position into any one of a plurality of open positions and then back into the closed position. The drive arrangement facilitates displacement of the louvre blades by driving the operating bars. In some louvre systems the drive arrangement includes a crank for enabling a user to physically and manually drive the bank of louvres between different positions. The crank includes a handle that is operatively coupled to each of the operating bars by means of a linkage and which projects out of the side channel within which the pair of operating bars is received.

In other louvre systems, the drive arrangement includes a mechanical source of drive for driving relative movement of the operating bars relative to each other that does not use manual power. The drive arrangement that is a mechanical drive is typically an electric motor that is operatively coupled to the operating bars in such a way that rotation of the electric motor effects the appropriate relative movement of the operating bars. In one form the drive arrangement in the form of an electric motor is received within the frame and is coupled to the operating bars on opposite sides of the axis of rotation.

In one prior art louvre assembly of which the applicant is aware which is illustrated in Figures A and B, the assembly has a manual crank mounted on the operating bars and

the channel. The lever is used to rotate the blade mounting element into an over-centre position to lock the bank of louvre blades.

5 However as illustrated in Figs A and B this locking mechanism requires progressively more force with more louvre blades in the bank of louvre blades. Further the force that is required to lock each louvre blade increases with the distance of the blade from the manual crank. Therefore at a practical level it is limited to a bank of about 6 to 9 louvre blades. Another handle crank is used to separately lock any additional louvre blades. Clearly therefore this is a limitation and it would be advantageous of a system
10 could be devised that was not limited in this way.

Clearly therefore it would be advantageous if a new and innovative system for effectively locking a bank of louvres could be devised. It would be particularly advantageous if the locking system could be applied to any bank of louvre blades
15 irrespective of the number of blades in the bank of louvre blades.

SUMMARY OF THE INVENTION

According to one aspect of this invention there is provided a locking system for a
20 louvre assembly including a pair of parallel extending operating bars received within a channel having a wall for displacing a bank of louvre blades between an open position and a closed position, the locking system locking the bank of louvre blades in the closed position, and comprising:

25 a pair of locking bars that are operatively connected to a drive arrangement to enable the locking bars to be displaced relative to each other; and

at least one locking element that is operatively coupled to the pair of locking bars in such a way that relative displacement of the locking bars causes each locking element
30 to rotate, and each locking element is in turn operatively coupled to the operating bars so that the relative displacement of the pair of locking bars in a certain direction causes the operating bars to displace the bank of louvre blades into the closed position at which point they are held against further displacement by a stop formation, and wherein further relative displacement of said locking bars in said certain direction,

rotates the locking element relative to the operating bars into a locked position in which the bank of louvre blades are locked in the closed position and cannot be moved out of the locked position by a force applied to the louvre blades or the operating bars.

- 5 The operating bars may be operatively coupled to the locking element in such a way that when the locking element is in the locked position any opening force applied through the operating bars to the locking element holds the locking element in the locked position.
- 10 Thus when an opening force is applied to the blades or the operating bars of the louvre system, the opening force is directed in a way that holds the locking element in the locked position. It does not apply the force in a direction that will tend to move the locking element into an unlocked position.
- 15 The operating bars may be operatively coupled to the locking element in such a way that when the locking element is in the locked position, the direct or indirect coupling of the operating bars to the locking element has moved to an over-centre position.

- 20 The locking system may include two link members coupling each operating bar to the locking element and one link member may be mounted on the locking element in one position and extend to one operating bar, and the other link member is mounted on the locking element in a diametrically opposed position to said one link member and extends to the other operating bar. The link members may urge the locking element to rotate in one direction in response to a force applied to the operating bar when the
- 25 locking element is in the unlocked position, and the link members may urge the locking element to rotate in the opposite direction in response to the same applied force when the locking element is moved to the locked position.

- 30 The locking element may be configured such that it has two locking surfaces on opposite sides of the locking element and two rocking surfaces also on opposite sides of the locking element, and wherein the rocking surfaces may be positioned intermediate the locking surfaces.

The locking element may be sized and configured so that the locking surfaces bear against the walls of the channel when the locking element is in the locked position, and the rocking surfaces bear against the walls of the channel when the locking element is in the unlocked position.

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Thus the link members are mounted in positions on the locking element such that once the bank of blades are in the closed position, further rotation of the locking element into the locked position causes the link members to move to an over-centre position such that an opening force applied to the blades urges the locking element tightly against the wall of the channel in the locked position and the wall of the channel acts as a stop to hold the locking element against movement out of the locked position.

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The locking system may further include a locking support element on which the locking element is mounted and on which the locking element can rotate during operation of the locking system.

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The locking element support may comprise two major surfaces joined by a peripheral edge and the locking element support may include a spigot that is substantially centrally positioned on one major surface and which projects away from the surface.

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The locking element may define a corresponding substantially located opening within which the spigot is received to mount the locking element for rotation on the locking support element.

The locking system may include a plurality of locking elements and the locking elements may be located at spaced intervals along the length of the locking bars. For example the locking elements may be spaced three to five blades apart from each other along the length of blades.

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Each link member may be pivotally mounted to an operating bar towards one end thereof and pivotally mounted to the locking element towards the other end thereof.

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The locking system may further include a drive arrangement for facilitating driving of the locking bars whereby to move the bank of blades into and out of the closed

position on demand and also for moving the locking element into the locked position to lock the louvre assembly in the closed position.

5 The drive arrangement must have sufficient power to physically move the locking bars and the remainder of the drive train to rotate the bank of louvres between the open and closed positions. It must also be able drive further displacement of the locking elements into the locked position once the blades are in the closed position.

10 The drive arrangement may comprise a passive drive arrangement that requires human power to physically move the locking bars or the drive arrangement may comprise an active drive arrangement that provides the power to physically move the locking bars.

15 The passive drive arrangement may comprise a lever having one end that is operatively connected to the locking bars so that pivoting of the lever causes displacement of the locking bars. The lever may have an opposite end with a handle.

The active drive arrangement may comprise an electric motor having an output shaft that is driven to rotate.

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The output shaft may be coupled directly or indirectly to the locking bars in such a way that rotation of the shaft causes the locking bars to move in opposite direction relative to each other.

25 According to another aspect of this invention there is provided a louvre assembly including:

a perimeter frame comprising upper and lower transverse frame members and side frame members extending up each side of the frame;

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a bank of louvre blades mounted on each of the side frame members and extending between the side frame members, the bank of louvre blades moving together between a closed position in which they extend across the space defined by the frame side

frame members and one or more open positions in which they define a space between adjacent louvre blades;

5 a pair of operating bars extending vertically up the height of the bank of louvre blades in one of the side frame members that are operatively coupled to the louvre blades; and

a locking system that is operatively coupled to the operating bars including:

10 a pair of locking bars that are operatively connected to a drive arrangement to enable the locking bars to be displaced relative to each other; and

15 at least one locking element that is operatively coupled to the pair of locking bars in such a way that relative displacement of the locking bars causes each locking element to rotate, and each locking element is in turn operatively coupled to the operating bars so that the relative displacement of the pair of locking bars in a certain direction causes the operating bars to displace the bank of louvre blades into the closed position at which point they are held against further displacement by a stop formation, and wherein further relative
20 displacement of said locking bars in said certain direction, rotates the locking element relative to the operating bars into a locked position in which the bank of louvre blades are locked in the closed position and cannot be moved out of the locked position by a force applied to the louvre blades or the operating bars.

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The side frame members may comprise channels and each channel may include a side wall and end walls at each end of the side wall.

30 The louvre assembly may further include a drive arrangement for facilitating driving of the locking bars whereby to move the bank of blades into and out of the closed position on demand and also for moving the locking element into the locked position to lock the louvre assembly in the closed position.

The drive arrangement may be an active drive arrangement or a passive drive arrangement.

In particular the drive arrangement may include any one or more of the features of these drive arrangements described above with reference to the first aspect.

The locking system may include any one or more of the features of the locking assembly described above according to the first aspect of the invention.

10 The bank of louvre blades may have 5 to 50 louvre blades. In particular in one application the bank of louvre blades may have 5 to 15 louvre blades. In another application the bank of louvre blades may have 20 to 30 louvre blades.

15 According to one aspect of this invention there is provided a locking system for a louvre assembly including a pair of parallel extending operating bars received within a channel having a wall for displacing a bank of louvre blades between an open position and a closed position, the locking system locking the bank of louvre blades in the closed position, and comprising:

20 a pair of locking bars that are operatively connected to a drive arrangement to enable the locking bars to be displaced relative to each other; and

at least one locking element that is operatively coupled to the pair of locking bars in such a way that relative displacement of the locking bars causes each locking element to rotate, and each locking element is in turn operatively coupled to the operating bars so that the relative displacement of the pair of locking bars in a certain direction causes the operating bars to displace the bank of louvre blades into the closed position at which point they are held against further displacement by a stop formation, and wherein further relative displacement of said locking bars in said certain direction, rotates the locking element relative to the operating bars into a locked position in which the bank of louvre blades are locked in the closed position and cannot be moved out of the locked position by a force applied to the louvre blades or the operating bars,

two link members coupling the operating bars to the locking element, one link member being pivotally mounted on the locking element in one position and extending to one operating bar, and the other link member being pivotally mounted on the locking element in a diametrically opposed position to said one link member and extends to the other operating bar, the link members urge the locking element to rotate in one direction in response to a force applied to the operating bar when the locking element is in the unlocked position, and the link members urge the locking element to rotate in the opposite direction in response to the same applied force when the locking element is moved to the locked position, and wherein the link members are positioned on the locking element such that when the locking element is in the locked position, an opening force applied through the operating bars and the link members to the locking element holds the locking element in the locked position.

The link members may be positioned on the locking element such that once the bank of blades is in the closed position, further rotation of the locking element into the locked position causes the link members to move to an over-centre position such that an opening force applied to the blades and transmitted through the operating bars and the link members to the locking element, urges the locking element tightly against the wall of the channel in the locked position which holds the locking element against movement out of the locked position.

The locking element may be configured such that it has two locking surfaces on opposite sides of the locking element and two rocking surfaces also on opposite sides of the locking element, and wherein the rocking surfaces may be positioned intermediate the locking surfaces.

The locking element may be sized and configured so that the locking surfaces bear against the walls of the channel when the locking element is in the locked position, and the rocking surfaces bear against the walls of the channel when the locking element is in the unlocked position.

The locking system may further include a locking support element on which the locking element is mounted and on which the locking element can rotate during operation of the locking system.

The locking element support may comprise two major surfaces joined by a peripheral edge and the locking element support may include a spigot that is substantially centrally positioned on one major surface and which projects away from the surface.

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The locking element may define a corresponding substantially located opening within which the spigot is received to mount the locking element for rotation on the locking support element.

10 The locking system may further include a drive arrangement for facilitating driving of the locking bars whereby to move the bank of blades into and out of the closed position on demand and also for moving the locking element into the locked position to lock the louvre assembly in the closed position.

15 The drive arrangement may comprise a passive drive arrangement such as a lever that requires human power to physically move the locking bars or the drive arrangement may comprise an active drive arrangement such as an electric motor that provides the power to physically move the locking bars.

20 The invention also extends to a louvre assembly including the locking arrangement defined above in the preceding aspect of the invention.

According to another aspect of this invention there is provided a louvre assembly including:

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a perimeter frame comprising upper and lower transverse frame members and side frame members extending up each side of the frame;

30 a bank of louvre blades mounted on each of the side frame members and extending between the side frame members, the bank of louvre blades moving together between a closed position in which they extend across the space defined by the frame side frame members and one or more open positions in which they define a space between adjacent louvre blades;

a pair of operating bars extending vertically up the height of the bank of louvre blades in one of the side frame members that are operatively coupled to the louvre blades; and

- 5 a locking system as defined above according to the first aspect of the invention.

The invention also extends to a method of locking a louvre assembly as described above in the preceding aspects of the invention.

- 10 In particular the method may include rotating a locking element into an over-centre position after the a bank of louvres have been closed so that an opening force is directed to holding the locking element in the closed position rather than opening the bank of louvres.

15 DETAILED DESCRIPTION OF THE INVENTION

A locking system for a louvre assembly and a louvre assembly in accordance with this invention may manifest itself in a variety of forms. It will be convenient to hereinafter describe several embodiments of the invention in detail with reference to the
20 accompanying drawings. The purpose of providing this detailed description is to instruct persons having an interest in the subject matter of the invention how to carry the invention into practical effect. However it is to be clearly understood that the specific nature of this detailed description does not supersede the generality of the preceding broad description. In the drawings:

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Fig 1 is a three dimensional view of a louvre assembly having a locking system in accordance with one embodiment of the invention;

Fig 2 is a three dimensional view of a locking element support for interacting with a
30 locking element in the louvre assembly of Fig 1;

Fig 3 is a front view of the locking element support of Fig 2;

Fig 4 is an end view of the locking element support of Fig 2;

Fig 5 is a perspective view of a locking element that is mounted on the locking element support of Fig 2 which assists in locking the operating bars when the louvre blades are in the closed position in the louvre assembly of Fig 1;

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Fig 6 is a front view of the locking element of Fig 5;

Fig 7 is an end view of the locking element of Fig 5;

10 Fig 8 is a three dimensional view of a locking element assembly, with some parts omitted for clarity, formed by a locking support element and a locking element that is mounted on the locking support element, and also showing link members, which extend between the locking element and the operating bars;

15 Fig 9 is a sectional plan view through an end frame and blade mounting element of the louvre assembly showing the locking bars operatively coupled to the locking element and the locking element in turn operatively coupled to the operating bars through the link members, section through IX-IX in Fig 1;

20 Fig 10 is a sectional plan view through an end frame of the louvre assembly showing the locking element and locking element support and also showing the locking bars operatively coupled to the locking element, section through X-X in Fig 1;

Fig 11 is a three dimensional view of the louvre assembly of Fig 1 showing a bank of
25 louvre blades in an open position with the blades in a substantially horizontally extending orientation;

Fig 12 is a three dimensional view of the louvre assembly of Fig 1 in which the blades have been moved from the open position in Fig 11 into an intermediate position in
30 which they are inclined at an angle of about sixty degrees;

Fig 13 is a three dimensional view of the louvre assembly of Fig 11 in which the blades have been moved from the intermediate position shown in Fig 12 into a vertically extending closed position;

Fig 14 is an end view showing some detail of part of the louvre assembly of Fig 1 showing the locking element in a substantially closed but unlocked position;

- 5 Fig 15 is an end view showing some detail of part of the louvre assembly of Fig 14 showing the locking element in a locked position in which the locking element has been rotated to a point where the link members are in an over-centre position;

Fig 16 is a combined end view and perspective view of a louvre assembly in
10 accordance with a second embodiment of the invention showing the bank of louvre blades in an open position;

Fig 17 is a combined end view and perspective view of the louvre assembly of Fig 16 showing the bank of louvre blades in a closed position; and

15 Fig 18 is a schematic front view of two high bank of louvres containing 27 to 30 louvre blades arranged side by side having a locking arrangement in accordance with the invention with each bank having a different type of drive arrangement.

20 In Fig 1 reference numeral 10 refers generally to a louvre assembly in accordance with one embodiment of the invention.

The louvre assembly 10 in turn comprises broadly a basic louvre structure and a louvre
25 locking system indicated generally by numeral 14 mounted on the basic structure.

The basic underlying louvre structure 12 in Fig 13 comprises a perimeter frame 16 in Fig 11 including top and bottom frame members 17 in Fig 11 and two side frame members 18. Each side frame member 18 is in the form of a U-shaped side channel
30 having a major side wall 20 and two end walls 22. The louvre assembly 10 also includes a bank of louvre blades 24 extending between the two side frame members 18. Each louvre blade 24 may have a length of about 30 to 120 cm and a width of 10 to 15 cm and may be made of a transparent glass.

Each end of each louvre blade 24 is mounted on the side frame member 18. Each end of each blade is mounted on the channel forming the associated side frame member 18 by means of a blade mounting element 26. The blade mounting element 26 has a rotatable mounting including a bearing that securely mounts the louvre blade 24 on the side frame member 18 and permits rotation of the blade mounting element to adjust the orientation of the louvre blade 24 relative to the orientation of the side frame member 18. The blade mounting element 26 also has blade receiving formations or end clips projecting away from the rotatable mounting that receive and hold an end region of the louvre blade 24.

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The underlying louvre structure 12 also includes a pair of operating bars 30, 32 that extend up the height of the bank of louvre blades 24 within the side channel member 18 on one side of the perimeter frame 16. The operating bars 30, 32 are mounted to each blade mounting element 26 and thereby to each louvre blade 24 as shown in Fig 1. The operating bars 30 and 32 are moved relative to each other in opposite directions to change the orientation of the louvre blades 24. The movement of the operating bars drives rotation of each blade mounting element 26 and the associated blade 24 on its mounting to the side frame member 18.

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The interaction of the blade mounting element with the operating bars 30, 32 causes the louvre blades 24 within a bank to be moved together and in unison. A characteristic of louvre systems generally is that the blades in the bank move together and by the same amount so that moving one blade has the effect of moving all the blades in the same way. It exhibits synchronous movement of the blades rather than independent movement of the blades.

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As shown in Fig 1, one operating bar 30 is operatively coupled to the blade mounting element 26 on one side of the rotational axis thereof, and the other operating bar 32 is mounted thereto on an opposite side of the rotational axis. This way when the operating bars 30, 32 are displaced in opposite directions they work together to rotate the blade mounting element 26 in a certain direction and thereby alter the orientation of the louvre blade 24 which is directly mounted on the end clip 27 and blade mounting element 26 in the same way.

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The blade mounting element 26 is shown in some detail in Fig 1. The operating bars 30, 32 and their mountings to the blade mounting element 26 on opposite sides of the axis of rotation thereof are also shown in Figures 12 to 14.

- 5 The louvre locking system 14 comprises a pair of locking bars 40, 42 that extend parallel to the operating bars 30, 32 in proximity thereto. The locking bars 40, 42 are similar in structure and appearance to the operating bars 30, 32 and extend in a similar direction to the operating bars 30, 32 along the side frame member 18 received within the channel formed by the side frame member 18. The locking bars 40, 42 are
10 operatively connected to a drive arrangement which either facilitates drive or directly provides the drive which causes the locking bars to be displaced relative to each other and which will be described in more detail below.

- The locking system 14 also includes a plurality of locking element assemblies that are
15 operatively coupled to the pair of locking bars 40, 42 at spaced intervals along its length. Only one such locking assembly is shown in Fig 1 but it will be appreciated that further locking element assemblies are located at intervals along the bank of blades. Typically the locking elements are spaced about 3 to 5 blades apart from each other. Thus if a bank of blades has about 10 blades there might typically be two locking
20 element assemblies along the length of the bank.

- Each locking arrangement comprises a locking element 46 and a locking element support 48 that both have a broadly similar extent as shown in the drawings. The locking element 46 is mounted for rotation on the locking element support 48 but is
25 otherwise free to move within the channel. The locking element assembly floats in the side frame channel 18 in the sense that it is free to find its own position within the channel 18. This assists the locking operation as will be described in more detail below.

- 30 Each of the locking element 46 and locking support element 48 will now be described in more detail below.

The locking element support 48 has a circular disk shaped body having two major surfaces. The support 48 has a spigot 50 projecting from one major surface that is centrally positioned on which the locking element 46 is mounted.

5 The locking element 46 has two major surfaces and a peripheral edge joining the two major surfaces. The peripheral edge comprises two rocking or rolling or camming surfaces 68 on diametrically opposed sides of the peripheral edge which are capable of travel along a surface of the channel 18 when the locking element 46 is urged to rotate. The two rocking surfaces 68 in Fig 5 are gently curved and do not undergo any
10 abrupt changes in direction. The peripheral edge also comprises two locking surfaces 69 in Fig 5 on opposing sides of the peripheral edge for locking the element 46 against the channel walls 22 when the locking element 46 is urged to rotate in a certain direction. The locking surfaces 69 comprise two linear sections of the peripheral edge joined by a sharp change on direction of the peripheral edge of about ninety degrees.

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One locking bar 40 is operatively coupled to the locking element 46 on one side of the axis of rotation and the other locking bar 42 is operatively coupled to the locking element 46 on an opposite side of the axis of rotation. In this way movement of the locking bars 40, 42 in opposite directions promotes rotation of the locking element 46
20 on the locking element support 48 in a certain direction.

Each locking element has two locking bar spigots 60, 62 projecting away from the major face thereof from which the spigot projects. Each locking bar spigot includes a spacer section and then a mounting section. Each locking bar 40, 42 defines an
25 opening which is passed over the locking bar spigot 60, 62 and sits on the mounting portion thereof. A fastener 63 that can be in the form of a rivet is then mounted over the end of the mounting section to hold the locking bar 40, 42 in position mounted on the spigot 60, 62. The mounting portion of the spigot 60, 62 passes through the locking element opening with some clearance to enable the locking element 46 to pivot freely
30 relative to the locking bar 40 or 42 in use.

Each locking element 46 in turn is operatively connected to the operating bars 30, 32 which drive the louvre blades 24 in the manner described below.

The locking element 46 is indirectly coupled to each operating bar 30 or 32 through a link member 52, 54. Each link member 52, 54 has one end that is rotatably mounted on the operating bar 30 or 32 and another end that is rotatably mounted to the locking element 46. The locking element 46 has two link spigots 66 projecting up from the major face thereof for operatively coupling to one end of a link member 52 or 54. Each link spigot 66 has a low profile and only has a mounting portion. The link member 52 or 54 has an opening within which the link spigot 66 is received and the other end of the link member 52 or 54 has an opening defined therein through which the link spigot 66 is passed with some clearance to enable it to freely rotate. A fastener such as a rivet is then mounted over the free end of the link spigot 66 to capture the link member 52 or 54 on the locking element 46. This arrangement is shown in some detail in Fig 8.

The other end of the link member 52 or 54 has an opening defined therein which is aligned with a similar opening on the operating bar 30 or 32 through which a pin is passed. This enables the link member to rotate on its mounting to the associated operating bar 30 or 32. This arrangement is shown in some detail in Figure 1. The ability of each end of each link member 52, 54 to rotate on its mounting is well known to those skilled in the art and will not be described further in this description.

The arrangement described above enables a displacement of the locking bars 40, 42 to be transferred through the locking elements 46 to the operating bars 30, 32. As described above the operating bars 30, 32 are operatively coupled to the blade mounting elements 26 on the ends of each of the louvre blades 24 and this displacement is then transmitted to the louvre blades 24 to drive movement of each of the louvre blades 24. Thus drive of the locking bars 40, 42 in one direction moves the louvre blades 24 one way, and drive of the locking bars 40, 42 in another direction moves the louvre blades 24 the other way. This moves the louvre blades 24 between the open and closed positions in use, without activating or operating the locking feature.

The operation of the locking system to lock the louvre blades in the closed position will now be described below.

The locking element 46, the link members 52, 54 and the operating bars 40, 42 basically interact in a certain way to lock the bank of louvre blades 24 in a locked position. When in the locked position any opening force that is applied to the louvre blades 24 will urge the locking system 14 generally and more specifically the locking element 46 more tightly into the locked position and no matter how high the force it will not cause the bank of louvres to move into an open position.

Fig 14 shows the bank of louvre blades in a closed position but an unlocked position. The link member 54 is mounted on the locking element 46 towards the top thereof and the link member 52 is mounted on the locking element 46 towards the bottom thereof. If an opening force is applied to the bank of louvre blades it will apply a downward force to operating bar 32 and to link member 54, and a corresponding but opposed upward force to operating bar 30 and the link member 52. In such a case this force will tend to rotate the locking element 46 in a clockwise direction. The locking element 46 is configured such that this force will cause the locking element 46 to rotate within the channel 18 with the curved rocking surfaces 68 rolling over a surface of the end walls 22 of the channel 18. This therefore permits the louvres blades 24 to be opened from this unlocked position by an opening force on the blades.

The act of locking the bank of louvre blades 24 from the position shown in Fig 14 will now be described. A further drive applied to the locking bars in the direction of closing of the louvre blades 24 cannot displace the operating bars 30, 32 any further because the louvre blades 24 are already in the closed position. The geometry and structure of the louvre blades 24 and blade mounting elements 26 and the frame 18 acts as a stop that resists any further movement of the blades 24 past their closed position. As a result this further force applied through the locking bars 40, 42 acts to rotate the locking element 46 relative to the operating bars 30, 32 which are held against movement as described above. This displaces the link members 52, 54, and in particular their mounting on the locking element 46 to the point where they are in an over-centre position. As a consequence a downward force applied through operating bar 32 and link member 54, and an upward force applied through the operating bar 30 and the link member 52 urges the locking element 46 to rotate in a different direction to that in Fig 14, namely an anti-clockwise direction. That is it urges one locking surface 69 against one end wall 22 of the channel 18 and the other locking surface 69

against the other end wall 22 of the channel 18. This force therefore reinforces the locked condition and does not encourage the bank of louvres to open at all.

To unlock the locking system to move the bank of louvres to the open position, the locking bars 40, 42 have to be driven in an opposite direction, to cause the locking element 46 to rotate in a clockwise direction. That is the locking bar 40 has to be displaced in an upward direction and the locking bar 42 has to be displaced in a downward direction. This causes the locking element 46 to rotate on the rocking surfaces 68 and move from the position shown in Fig 15 back to the position in Fig 14.

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Naturally each locking element 46 is sized and configured so that its peripheral edge, and in particular the rocking surface 68 and locking surface 69 thereof, is configured to complement the wall of the channel 18 with which it engages. In particular it has a locking surface 69 that bears against the end wall 22 of the channel 18 when the locking element 46 is in the locked position. It also has a rocking surface 68 that is sized and configured to rock or roll over the surface of the end wall 22 when the locking system 14 is moved between the unlocked and locked conditions.

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The floating nature of the locking element assembly within the channel 18 enables it to centralise itself within the channel 18 and find its position within the channel 18 where the locking surfaces 69 or rocking surfaces 68, as the case may be, bear evenly against the end walls 22 of the channel 18.

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The locking system 14 also includes a drive arrangement for enabling the locking bars to be displaced relative to each other and thereby displace the components directly and indirectly coupled thereto.

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In the illustrated embodiment the locking bar drive arrangement comprises an electric drive motor 70 that rotates an output shaft 72. The output shaft 72 in turn is operatively coupled to the two locking bars 40, 42 in such a way that rotation of the motor 70 drives the locking bars 40, 42 relative to each other. A rotation of the motor 70 causes relative movement of the locking bars 40, 42 which in turn drives the locking element 46 to rotate. This in turn displaces the two link members 52, 54 which in turn drives relative movement of the operating bars 30, 32. As the operating bars 30, 32

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are coupled through the blade mounting elements 26 to each of the blades 24, the blades 24 are rotated and their orientation is altered by this movement of the operating bars 30, 32.

- 5 In use the bank of louvres can be moved between the open and closed positions as required by a user. Figures 12 to 14 are a sequence of drawings that illustrate progressive movement of the bank of louver blades from a wide open to a closed position.
- 10 In Figure 11 the bank of louver blades is in a wide open position. Relative movement of the locking bars 40, 42 effects a rotation of the locking element 46 which in turn effects a related movement of the operating bars 30, 32 and thereby the blade mounting elements 26 and louver blades 24.
- 15 Figure 13 shows rotation of the drive arrangement and consequent relative movement of the locking bars 40, 42 that moves the blades 24 towards their closed position. Rotation of the locking element 46 effects a displacement in the link members 52, 54, and the operating bars 30, 32 to which they are coupled, thereby moving the louver blades 24 towards their closed position.
- 20 In Figure 14 the louver blades 24 have reached the closed position. When the louver blades initially reach the closed position the locking element is not in a locked position. The louver blades 24 physically are held against further rotation by the fact that they bear against each other and this acts as a stop formation. Consequently the operating bars 30, 32 are held against movement relative to each other.

Thus a movement of the motor 70 and the locking bars 40, 42 sufficiently far in one direction moves the bank of louver blades into the closed position. However in the closed position the blades 24 bear up against each other and thus the blades 24 act as a stop resisting any further movement of the blade mounting elements 26 and the operating bars 30, 32 in this direction.

The locking system is locked by effecting a further movement of the locking bars 40, 42 in this direction. This causes the locking element 46 to rotate relative to the

operating bars 30, 32, and the ability to do this is provided by the link members 52, 54. This further movement moves the link members 52, 54 to an over-centre position on the locking element 46 which then locks the operating bars 30, 32 in their position with the bank of louvre blades 24 in the closed position. In this position the peripheral edge
 5 of the locking element 46 has its locking sections bearing against the end walls 22 of the channel 18 thereby keeping the locking element in this locked position. In this position an opening force applied to the blades will be directed through the mechanism to urge the locking element 46 more fully and forcefully in the locked position.

10 in the locked position the link members 52, 54 are coupled to the locking element 46 in the locked position such that an application of an opening force to the blades 24 is not able to move the bank of louvre blades 24 out of their locked position as shown in some detail in Figures 14 and 15.

15 Therefore when further drive is applied to the locking bars to cause them to rotate relative to each other, the locking element 46 is rotated relative to the link members 52, 54 and the operating bars 30, 32 to a position where the louvre assembly is locked with the bank of louvre blades in the closed position. By contrast when the locking bars 40, 42 are moved in an opposite direction this applies an opening force to the locking
 20 element 46 that urges it to rotate in a direction that opens the louvre blades 24 and the rocking surface 68 on the locking element 46 permits it to do so.

Figures 16 and 17 illustrate a louvre assembly in accordance with another embodiment of the invention. As the louvre assembly is similar to that described above with
 25 reference to Figures 1 to 15 the same reference numerals will be used to refer to the same components unless otherwise indicated. The following description will focus on the differences between this embodiment and the earlier embodiment.

In this embodiment the drive arrangement 70 for driving the bank of louvres between
 30 an open and closed position and back again is a hand operated lever indicated generally by the reference numeral 100. This uses manual force from a user to provide the drive energy to move the bank of louvre blades 24 between the open and closed positions.

The lever 100 has a handle end 102 and a driving end 104. The lever 100 is pivotally mounted to the side wall 20 towards its driving end 104. This enables it to rotate freely on the side wall 20. Further on one side of the pivotal mounting the lever 100 is pivotally mounted to the locking bar 40 and on the other side of the pivotal mounting the lever 100 is pivotally mounted to the other locking bar 42. The manner of attachment of the lever 100 to the locking bars 40, 42 which applies a force to the locking bars 40, 42 and permits rotation of the lever 100 relative to the locking bars 40, 42 would be well known to persons skilled in the art.

10 The drive arrangement further includes a handle member 106 on the handle end of the lever 102 which projects laterally away from the lever 100 perpendicularly thereto. The handle member 106 is sized to be comfortably gripped by a user's hand and is also able to rotate on its mounting to the lever 102.

15 The lever 102 effects a relative movement of the locking bars 40 and 42 that is the same as that described above with reference to Figures 1 to 15 that uses an electric motor to drive the locking bars 40 and 42. This in turn operates the remainder of the louvre assembly 10 in the same way as that described above for the earlier embodiment.

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Figure 18 illustrates a louvre assembly having two tall banks of louvre blades each of which contains about thirty louvre blades is indicated generally by the reference numeral 110 in the drawings.

25 Each bank of louvre blades has a single locking system 114 as described above with reference to the earlier drawings although it is not shown in the schematic drawing. Each locking system 14 is operated by a single drive arrangement 170 towards the bottom of the bank of louvre blades.

30 In the illustrated embodiment one bank of louvres is driven by a drive arrangement 170 that includes an electric motor. The other bank of louvre blades is driven by a drive arrangement 170 that includes a hand operated lever. The purpose of illustrating both of these types in this drawing is to show that both drive arrangements are equally capable of being used to drive a tall bank of louvre blades.

Each locking system 114 is able to effectively move the entire bank of louvres between the open and closed positions and also to lock the bank of louvres in the closed position. It does not require multiple drive arrangements with individual locking mechanism at spaced intervals up the height of the bank of blades. This is because the system works on multiple locking elements 46 with a single drive arrangement, and does not require increased force to lock the louvres as the distance from the louvre blade to the drive arrangement 170, e.g. the handle or motor, increases.

10 This is particularly advantageous as tall banks of louvres having twenty or more louvre blades are becoming more popular and it is extremely useful to have a single locking system that can be used to move and then lock all of the louvres in the bank.

One advantage of the louvre assembly described above with reference to the drawings is that the locking system locks a locking element against rotation within the channel of a side frame member. Flowing from this is the advantage that the locking system can be applied to a tall bank of louvre blades. This is particularly advantageous as tall banks of louvres having twenty or more louvre blades are becoming more popular and it is extremely useful to have a single locking system that can move and then lock all the louvres in the bank.

An advantage of the locking system described above is that, an opening force produces a downward force on link 54 and an upward force on link member 52 which urges the locking surfaces of the locking elements more firmly against the end walls of the channel. This firmly and securely resists movement of the operating bars to move the bank of blades out of the locked position and provides a very effective locking mechanism.

By contrast some prior art locking systems are limited to a locking a bank of up to 9 louvre blades at one time and requires an external link to more than one drive arrangement to synchronise its locking and this arrangement can be unsightly. This is particularly advantageous because as louvres become more popular there is a need for high banks of louvres having in the region of 15-30 louvre blades and it is desirable to be able to lock such a bank of louvre blades.

Another advantage of the louvre assembly described above with reference to the drawings is that the locking system is quite separate and distinct from a hand crank for the louvre blades. Instead it forms part of the drive train for driving the louvre blades between open and closed positions. Further the locking system is received within a channel that forms one of the side frame members of the peripheral frame of the louvre assembly.

Yet another advantage of the louvre assembly described above with reference to the drawings is that the mechanical mechanism is not unduly complex. Yet further it is conducive to reliable operation with minimal maintenance. Further the locking arrangement is fully received within the side frame member and is not visible from the outside of the side frame member.

Yet another advantage of the louvre assembly described above with reference to the drawings is that it is capable of being operated with a variety of drive arrangements for driving the louvre blades between open and closed positions. For example a hand crank can be used to drive the locking bars to move relative to each other. Further an electric motor can also be used to drive the locking bars to move relative to each other. Thus the basic underlying locking mechanism and the manner in which it interfaces with the operating bars of the louvre assembly remains the same no matter what drive arrangement is employed.

It will of course be realized that the above has been given only by way of illustrative example of the invention and that all such modifications and variations thereto, as would be apparent to persons skilled in the art, are deemed to fall within the broad scope and ambit of the invention as is herein set forth.

CLAIMS

1. A locking system for a louvre assembly including a pair of parallel extending operating bars received within a channel having a wall for displacing a bank of louvre
5 blades between an open position and a closed position, the locking system locking the bank of louvre blades in the closed position, and comprising:

a pair of locking bars that are operatively connected to a drive arrangement to enable the locking bars to be displaced relative to each other; and

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at least one locking element that is operatively coupled to the pair of locking bars in such a way that relative displacement of the locking bars causes each locking element to rotate, and each locking element is in turn operatively coupled to the operating bars so that the relative displacement of the pair of locking bars in a certain direction
15 causes the operating bars to displace the bank of louvre blades into the closed position at which point they are held against further displacement by a stop formation, and wherein further relative displacement of said locking bars in said certain direction, rotates the locking element relative to the operating bars into a locked position in which the bank of louvre blades are locked in the closed position and cannot be moved out of
20 the locked position by a force applied to the louvre blades or the operating bars.

2. A locking system for a louvre assembly according to claim 1, wherein the operating bars are operatively coupled to the locking element in such a way that when the locking element is in the locked position any opening force applied though the
25 operating bars to the locking element holds the locking element in the locked position.

3. A locking system for a louvre assembly according to claim 1 or claim 2, wherein the operating bars are operatively coupled to the locking element in such a way that when the locking element is in the locked position, the direct or indirect coupling of the
30 operating bars to the locking element has moved to an over-centre position.

4. A locking system for a louvre assembly according to any one of claims 1 to 3, wherein the locking system includes two link members coupling each operating bar to the locking element and one link member is mounted on the locking element in one

position and extends to one operating bar, and the other link member is mounted on the locking element in a diametrically opposed position to said one link member and extends to the other operating bar.

5 5. A locking system for a louvre assembly according to claim 4, wherein the link members urge the locking element to rotate in one direction in response to a force applied to the operating bar when the locking element is in the unlocked position, and the link members urge the locking element to rotate in the opposite direction in response to the same applied force when the locking element is moved to the locked
10 position.

6. A locking system for a louvre assembly according to claim 1, wherein the locking element is configured such that it has two locking surfaces on opposite sides of the locking element and two rocking surfaces also on opposite sides of the locking
15 element, and wherein the rocking surfaces are positioned intermediate the locking surfaces, and the locking element is sized and configured so that the locking surfaces bear against the walls of the channel when the locking element is in the locked position, and the rocking surfaces bear against the walls of the channel when the locking element is in the unlocked position.

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7. A locking system for a louvre assembly according to any one of claims 1 to 6, further including a drive arrangement for facilitating driving of the locking bars whereby to move the bank of blades into and out of the closed position on demand and also for moving the locking element into the locked position to lock the louvre assembly in the
25 closed position.

8. A louvre assembly including:

a perimeter frame comprising upper and lower transverse frame members and side
30 frame members extending up each side of the frame;

a bank of louvre blades mounted on each of the side frame members and extending between the side frame members, the bank of louvre blades moving together between a closed position in which they extend across the space defined by the frame side

frame members and one or more open positions in which they define a space between adjacent louvre blades;

5 a pair of operating bars extending vertically up the height of the bank of louvre blades in one of the side frame members that are operatively coupled to the louvre blades; and

a locking system that is operatively coupled to the operating bars including:

10 a pair of locking bars that are operatively connected to a drive arrangement to enable the locking bars to be displaced relative to each other; and

at least one locking element that is operatively coupled to the pair of locking bars in such a way that relative displacement of the locking bars causes each
15 locking element to rotate, and each locking element is in turn operatively coupled to the operating bars so that the relative displacement of the pair of locking bars in a certain direction causes the operating bars to displace the bank of louvre blades into the closed position at which point they are held against further displacement by a stop formation, and wherein further relative
20 displacement of said locking bars in said certain direction, rotates the locking element relative to the operating bars into a locked position in which the bank of louvre blades are locked in the closed position and cannot be moved out of the locked position by a force applied to the louvre blades or the operating bars.

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9. A louvre assembly according to claim 8, including a pair of parallel extending operating bars received within a channel having a wall for displacing a bank of louvre blades between an open position and a closed position, the locking system locking the bank of louvre blades in the closed position, and comprising:

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a pair of locking bars that are operatively connected to a drive arrangement to enable the locking bars to be displaced relative to each other; and

at least one locking element that is operatively coupled to the pair of locking bars in such a way that relative displacement of the locking bars causes each locking element to rotate, and each locking element is in turn operatively coupled to the operating bars so that the relative displacement of the pair of locking bars in a certain direction causes the operating bars to displace the bank of louvre blades into the closed position at which point they are held against further displacement by a stop formation, and wherein further relative displacement of said locking bars in said certain direction, rotates the locking element relative to the operating bars into a locked position in which the bank of louvre blades are locked in the closed position and cannot be moved out of the locked position by a force applied to the louvre blades or the operating bars,

two link members coupling the operating bars to the locking element, one link member being pivotally mounted on the locking element in one position and extending to one operating bar, and the other link member being pivotally mounted on the locking element in a diametrically opposed position to said one link member and extends to the other operating bar, the link members urge the locking element to rotate in one direction in response to a force applied to the operating bar when the locking element is in the unlocked position, and the link members urge the locking element to rotate in the opposite direction in response to the same applied force when the locking element is moved to the locked position, and wherein the link members are positioned on the locking element such that when the locking element is in the locked position, an opening force applied through the operating bars and the link members to the locking element holds the locking element in the locked position.

10. A louvre assembly according to claim 9, wherein the link members are positioned on the locking element such that once the bank of blades is in the closed position, further rotation of the locking element into the locked position causes the link members to move to an over-centre position such that an opening force applied to the blades and transmitted through the operating bars and the link members to the locking element, urges the locking element tightly against the wall of the channel in the locked position which holds the locking element against movement out of the locked position.

11. A louvre assembly including:

a perimeter frame comprising upper and lower transverse frame members and side frame members extending up each side of the frame;

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a bank of louvre blades mounted on each of the side frame members and extending between the side frame members, the bank of louvre blades moving together between a closed position in which they extend across the space defined by the frame side frame members and one or more open positions in which they define a space between

10 adjacent louvre blades;

a pair of operating bars extending vertically up the height of the bank of louvre blades in one of the side frame members that are operatively coupled to the louvre blades; and

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and a locking system as defined above according to any one of claims 1 to 7.