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<td>Applicant(s)</td>
<td>Moonbush Pty Ltd</td>
</tr>
<tr>
<td>(72)</td>
<td>Inventor(s)</td>
<td>Henry, Tasman Norman John</td>
</tr>
<tr>
<td>(74)</td>
<td>Agent / Attorney</td>
<td>Davies Collison Cave, Level 3 303 Coronation Drive, Milton, QLD, 4064</td>
</tr>
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ABSTRACT

A method for securing an infill material, such as a screen, to a frame, wherein the infill material (18) is positioned on a ledge (12). The ledge is continuous with and inwards of a frame member (13) and is preferably formed integrally therewith. The screen is held in position by a retention member (20) which is locked into engagement with the frame member through a male/female coupling. In a preferred embodiment, a malleable settable composition is positioned between the screen and the ledge and/or between the screen and the retention member, dispersed and allowed to cure. Preferably, the ledge has at least one longitudinal recess for receiving the settable material. The recess may have a narrow neck and broad chamber in cross section. Most preferably, three recesses are formed in the ledge. Recesses may also be formed in the retention member and adapted to receive the settable material during assembly. The invention also extends to a screened frame formed according to the method and a frame member formed having an extending ledge. The ledge may have one or more recesses formed in it and adapted to receive settable composition.
Name of Applicant: Moonbush Pty Ltd

Actual Inventor: Tasman Norman John Henry

Address for Service: DAVIES COLLISON CAVE, Patent Attorneys, of Level 3, 303 Coronation Drive, Milton, Queensland, 4064, Australia.

Invention Title: “Screen Retention Arrangement”

Details of Associated Provisional Application No:

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The following statement is a full description of this invention, including the best method of performing it known to us:
SCREEN RETENTION ARRANGEMENT

FIELD OF THE INVENTION

This invention relates to arrangements and methods for retaining an infill material in a frame and, in particular, a screen infill material. The invention more specifically relates to an arrangement and method for fixing a screen, especially a security screen, in a frame to form a door, window, grating or similar screened closure for an opening.

BACKGROUND OF THE INVENTION

The reference to any prior art in this specification is not, and should not be taken as an acknowledgment or any form of suggestion that that prior art forms part of the common general knowledge in any country.

Traditionally, screen doors and windows were formed by fixing a mesh material to a wooden frame. The mesh material was retained by attaching it to the frame using nails or tacks, usually combined with wooden cover strips.

With the advent of widespread use of lightweight alloy materials, aluminium frames became the predominant structural form for hinged and sliding screen doors and windows, and other forms of grates. A screen mesh is usually fixed in place in a metal frame by forcing a compressible resilient cable into a recessed seat formed around a perimeter of an internal space in the frame. An edge of a flexible mesh is positioned and trapped between the cable and the seat. The structural retention strength achieved is suitable only to counter normal displacing forces such as those generated by wind and contact with people, especially children, and pets.

On disruption of an edge attachment, it is a relatively straightforward procedure to remove the cable and replace the piece of affected mesh. As the mesh is easily
breached by cutting implements such as Stanley knives, scissors or side cutters, these screens can never be considered a security device. If required for security, a screened door or window has traditionally required application of reinforcing bars across the framed opening.

The development of intruder resistant screens produced a demand for techniques to fix infill material, especially screens, into a frame in a strong, force-resisting manner. These resistant screens may be rigid, semi-rigid or flexible. They are often formed from strong synthetic fibres such as a long chain polyamides. Alternatively, the mesh may be formed from aluminium, stainless steel or similar materials.

WO 96/07006 (Pepperell) discloses an intruder resistant screen formed from a multi-component, assembled frame and an intruder resistant mesh having spacings no greater than 2.2 mm. A screen arrangement is described which uses a plurality of clamping members co-acting with fasteners to clamp the mesh to the frame. While the arrangement has certain advantages, it requires considerable input of labour to assemble.

WO 99/42694 (Security Inventions Pty Ltd) discloses a security screen assembly having a frame formed by a plurality of frame members. Gripping means are adapted to grip an edge portion of a sheet of mesh like material and at least one of the frame members has retaining means to receive the gripping means within an opening which does not permit the passage of the gripping means. Related Australian Application No. 697992 discloses a similar arrangement in which the gripping means is retained in a recess of the frame members by a suitable adhesive. The frame members include parallel opposing external side walls which are maintained in a spaced relationship by an intermediate external web thereby defining a slot. The method of production requires the frame to be assembled around the mesh which is labour and time intensive.
The prior art assemblies do not provide a frame and screen arrangement which may be easily manufactured with relatively low labour input.

**SUMMARY OF THE INVENTION**

Throughout this specification, unless the context requires otherwise, the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element or integer or group of elements or integers but not the exclusion of any other element or integer or group of elements or integers.

In one broad form, although it need not be the only or the broadest form, the invention resides in a method for securing an infill material such as a screen to a frame, the method comprising the steps of:

- forming a frame defining at least one opening and having a ledge extending into the at least one aperture;
- positioning an infill material such as a screen member, for fixing to the frame; and
- engaging a retention member with the frame to thereby fix the infill material in place between the ledge and the retention member.

The frame may be formed from a plurality of separate frame members. The frame members may be joined by welding or the use of corner stakes. The frame may define two or more openings.

The ledge may be continuous around a perimeter of the opening. Alternatively, the ledge may be formed by two or more sections with or without spaces intermediate the sections. Engaging the retention member with the frame preferably includes effecting a male/female coupling between the retention member and the frame. The coupling may be formed by locating one or more ribs in a co-operating slot or slots, each one of a rib and slot pair located on a
respective one of the frame and the retention member.

The coupling may comprise a friction fit, a snap lock fit or any suitable arrangement.

In one embodiment, the slot is formed adjacent to a periphery of the ledge remote from the opening.

The slot may be formed with an outer wider section and an inner narrower section. An inner wall of the slot may diverge inwardly towards the opening, preferably at a point approximately in the middle of the wall.

An outer wall of the slot may be substantially perpendicular to the ledge. The outer wall may form a shoulder adapted to locate behind a wall of the retention member and thereby lock it in position.

Two or more male/female couplings may be formed and used when engaging the retention member and frame.

The retention member may be formed as a substantially planar member with a rib or ribs extending therefrom and adapted for coupling as described above. The retention member may comprise contact means to increase purchase on the infill member. The contact means may be one or more longitudinal ribs positioned on an underside of the planar member.

The ledge may further be formed with one or more accessory recesses, preferably extending longitudinally and adapted to receive a settable material.

The method may further comprise the step of:

applying a settable composition in a manner to penetrate, and preferably fill, the one or more accessory recesses and also penetrate a plurality of voids in the
infill material such as a screen member; and
allowing the settable composition to cure and thereby strengthen the
fixation of the infill material to the frame.

5 The method may include the step of forming a frame member having the slot
associated therewith and forming the frame from a plurality of the frame members.
The method may include the step of forming the accessory recesses associated
with the frame member. Preferably, the method includes the step of forming the
ledge continuously with the frame members to surround the opening. The method
may include the step of forming at least three accessory recesses in the ledge and
preferably forming the ledge integrally with the frame members.

Positioning the infill material may include positioning the screen member with an
edge region located in proximity to the accessory recess or recesses. Preferably,
the method includes the step of positioning the screen member supported by the
ledge.

Applying the settable composition may include the step of positioning the
composition between the one or more accessory recesses and the screen
member and preferably adjacent the one or more accessory recesses. Preferably,
the step includes applying a flowable settable composition and may further include
the step of inducing malleability in the settable composition. Inducing malleability
in the settable composition may include the step of applying heat to the settable
composition.

25 The method may include applying heat to cure or assist in curing the settable
composition. Applying heat may include the step of baking the screened aperture.

Additionally or alternatively, the settable composition may be positioned between
the retention member and the infill material.
The settable composition may be any suitable material. Preferably, the settable composition is a heat activated material such as that used in a hot glue gun. Examples of suitable chemicals include polyamides, polyesters, urethane, EVA co-polymers, polyolefin and epoxy resins, silicon fillers and acrylic fillers. The settable composition may form a connecting medium for bonding the infill material to the frame.

Preferably, the method includes the step of applying the settable composition as a premoulded material.

The step of positioning the infill material may include the step of applying the screen material to the settable composition in the form of a heat activated material and which is positioned over the one or more accessory recesses, and pressing the screen material into engagement preferably simultaneously, with the application of heat to the heat activated material.

In another form, the invention resides in a method for securing an infill material, such as a screen, to a frame, the method comprising the steps of:

- forming a frame defining an internal opening, the frame having a ledge around a perimeter of the opening;
- supporting the infill material on the ledge; and
- pressing a retention member or members into locking engagement with the frame thereby fixing the infill material in position.

The method may further include:

- locating malleable settable material in contact with the ledge and/or the infill material before applying the retention member to thereby compress and/or disperse the malleable settable material on positioning the retention member and then allowing the malleable settable material to cure thereby strengthening the connection of the frame, the infill material and the compression member.
The method may further include the step of:

- forming a framing member with a ledge projecting from one side; and
- cutting frame members from the framing member, the frame members dimensioned to form the frame.

The ledge may be formed with one or more accessory recesses for receiving the malleable settable material. Preferably, the one or more accessory recesses are formed with an inlet aperture and a chamber wherein the chamber is broader than the inlet aperture. The one or more accessory recesses may have any suitable cross sectional shape including dove-tailed, circular, square, rectangular and pear-shaped.

The retention member may be formed with a rib adapted to engage a co-operating recess or slot in the frame member. The frame member may be formed with a shoulder positioned to locate behind a corner of the retention member and thereby fix it in place.

The method may further include the step of forming the retention member. The retention member may be formed as an elongate member having one or more additional accessory recesses. The additional accessory recesses are preferably formed with an inlet aperture and a chamber wherein the chamber is broader than the inlet aperture. The cross sectional shape of the additional accessory recesses may be any suitable shape including dove-tailed, circular, rectangular, square and pear-shaped.

Supporting the infill material on the ledge may include the step of positioning the infill material on the ledge by moving it in a direction transverse to a plane of the ledge. Preferably, the infill material is located with an edge section of the infill material extending substantially across a full width of the ledge.

The infill material is preferably of a form that is substantially void such as
expanded metal, woven material, punched sheet metal or composite material. However, it should be noted that solid material with perforations and/or distortions along the perimeter may also fit within the scope of the infill material. Any suitable material known to a skilled addressee may be utilised.

The malleable settable material is preferably selected with a viscosity suitable to provide a flowing response to application of the retention member. The settable malleable material may be any suitable material but is preferably an epoxy resin, a cyanoacrylate, a contact adhesive, latex adhesives a polyamide, an EVA copolymer, urethane or Polyolefin.

The material may be formed or mixed in any convenient consistency with a desirable working time. Although any curing time may be suitable, it is preferable to have a relatively short curing time to facilitate assembly line processes.

Locating the malleable settable material may include one or more of locating material between the ledge and an edge of the infill material and locating the material between the infill material and the retention member. Preferably, the settable malleable material is located both between the ledge and the infill material and also between the infill material and the retention member.

Engaging the retention member may include forming a male/female coupling between the frame member and the retention member. The male/female coupling may be formed by inter-engagement of a recess or slot and a projection or rib wherein the recess or slot and the projection or rib each linearly extend along a respective one of the frame member and the retention member. The projection and/or at least part of a border of a recess may be resiliently deformable to provide a snap fit coupling.

Preferably, the method further includes engaging a lock means to maintain the relative position of the compression member and the frame member. Engaging
the lock means may include the step of locating a ridge in a recess, each of the ridge and the recess located in a respective one of the compression member and the frame member.

5 In a further aspect, the invention resides in a method of forming a screened closure, the method comprising the steps of:

forming a frame defining at least one opening;

locating a malleable settable composition on a ledge of the frame, said ledge located around a perimeter of the at least one opening;

placing a mesh screen on the settable composition and supported by the ledge; and

distributing the settable composition to penetrate receiving recesses in the ledge and also penetrate voids in the mesh screen, preferably in a peripheral band.

10 Additionally, or alternatively, the method may include the step of:

urging a retention member into engagement with the frame thereby compressing and/or distributing the settable material and causing it to flow into receiving recesses in at least one of the ledge and the compression member as well as penetrating one or more available apertures in the mesh screen; and allowing the settable composition to cure.

The method may include the step of placing additional settable composition above the mesh screen before urging the retention member into engagement with the frame.

25 The method may include the step of removing any excess settable composition. Forming the frame may include the step of connecting frame members to form the frame. Connecting the frame members may include the step of welding abutting frame members. Alternatively or additionally, the frame members may be connected by corner stakes.
In another aspect, the invention resides in a framed opening with infill material covering the opening, said framed opening formed according to any of the above methods.

In a yet another aspect, the invention resides in a screened opening comprising:

an outer frame defining the opening and having an inwards directed ledge,
an infill member, and a retention member coupled to the outer frame;

wherein:

the infill member is fixed in position between the ledge and the retention member.

The outer frame may be formed from a plurality of frame members.

The retention member may be coupled to the frame by a male/female coupling.

The coupling may be formed through interengagement of a rib and slot, each located on a respective one of the frame and the retention member. The retention member may be snap locked into engagement with the frame. A slot may be positioned adjacent an outer edge of the ledge relative to the opening. The retention member may be substantially planar with a rib extending from the plane.

The retention member may have one or more additional accessory recesses, preferably formed as longitudinal channels.

The retention member may also have contact enhancement means for increasing the grip on the infill material. The contact enhancement means may be one or more longitudinal ribs adapted to contact the infill material.

The ledge may have at least one accessory recess preferably with a necked inlet aperture. The at least one accessory recess may be any suitable shape in cross section but is preferably dove tailed, circular, square, rectangular or pear shaped.

Preferably, the retention member has two or more additional accessory recesses. Most preferably, the retention member has three additional accessory recesses.
The at least one accessory recess may be continuous around the frame. Alternatively, the at least one accessory recess may be interrupted and may be formed as a series of spaced sections.

A cured composition may be present in the at least one accessory recess and/or in the at least one additional accessory recess and in a plurality of voids around an edge of the infill material.

The cured composition may be selected from epoxy resins, EVA co-polymers, urethane, polyolefins, polyamides, polyesters hot melt material or any other suitable material. The cured composition may be a heat activated material. Preferably, the cured composition is distributed to fill the at least one accessory recess and a band of peripheral voids in the infill material, preferably a screen member. The cured composition may fill at least one additional accessory recess in the retention member.

The screened opening is preferably a security screen door.

The screened opening may be formed with two screened subopenings each bonded to an intermediate frame member having recesses arranged to simultaneously join with a peripheral band of each of two separate screen members two and retention members.

In a further aspect, the invention resides in a screened frame comprising:

a frame defining at least one internal opening;
a ledge formed on an internal edge of the frame having one or more accessory recesses;
an edge of an infill material panel supported by or abutting the ledge;
the infill material substantially covering the opening;
a retention member engaged with the frame;
wherein:
the frame, the edge of the infill material and the retention member are engaged together by a coupling between the frame or ledge and the retention member. The coupling may be a cured material penetrating at least one aperture in the infill material and one or more accessory recesses.

Alternatively or additionally, the coupling may be a male/female coupling between the frame or ledge and the retention member wherein the infill material is fixed therebetween.

Preferably, the frame is formed by frame members fixed to each other. The frame members may be fixed in any conventional manner. Preferably the frame members are welded. Alternatively, the frame members may be connected by corner stakes.

The ledge may extend around an entire perimeter of the opening. Alternatively the ledge may be formed by a plurality of ledge sections with intervening spaces. The ledge may have one or more accessory recesses containing the cured material. The one or more accessory recesses may be parallel to a longitudinal axis of the ledge. A cross-sectional shape of the accessory recesses preferably comprises a neck and a chamber wherein the neck is narrower than the chamber. The shape of the recess may be in any suitable form which may include any one of dove-tailed, rectangular, round, square or pear shaped. There are preferably three accessory recesses formed on the ledge.

The retention member may have additional accessory recesses containing the cured material. The additional accessory recesses may be parallel to a longitudinal axis of the retention member. The retention member additional accessory recesses may have a cross sectional shape comprising a neck and a chamber wherein the chamber is broader than the neck. The shape of the additional accessory recesses may be any one or more of dove-tailed, square, rectangular, circular, pear shaped or other suitable shape. The retention member
is preferably formed with an elongate substantially planar configuration. Opposed surfaces of the retention member and the ledge may be formed to substantially mirror each other.

The retention member may be engaged, at least in part, with the frame through the means of a male/female coupling. The male/female coupling may comprise a ridge and a corresponding recess each located on a respective one of the compression member and the ledge. The male/female coupling may be formed to provide a snap lock fit between the ridge and the recess. The ridge and the recess preferably extend linearly along a longitudinal axis of the ledge and retention member respectively. The male/female coupling may incorporate a locking means. The locking means may include a protrusion or edge configured to co-operate with a channel or shoulder to thereby releasably lock the retention member in place. Each of the protrusion or edge and the channel or shoulder may be located on a respective one of the compression member and the frame. The infill material is preferably a mesh material and, in particular, a security mesh.

In yet a further aspect, the invention resides in a frame member or members as described herein.

**BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a side sectional view of the components of a preferred embodiment, aligned for engagement.

Figure 2 shows the arrangement of Figure 1 when engaged.

Figure 3 is a perspective view of the arrangement of Figure 2.

Figure 4 is a cross sectional view of one embodiment of the frame member of the present invention.
Figure 5 is a perspective view of the frame member of Figure 4.

Figure 6 is a cross sectional view of the frame member of Figure 4 with malleable settable material positioned to receive an edge of infill material.

Figure 7 is a perspective view of the arrangement of Figure 6.

Figure 8 is a cross sectional view of the arrangement of Figure 6 further incorporating a mesh infill material.

Figure 9 is a perspective view of the arrangement of Figure 8.

Figure 10 is a cross sectional view of the arrangement of Figure 8 further including additional malleable settable material.

Figure 11 is a perspective view of the arrangement of Figure 10.

Figure 12 is a cross sectional view of the arrangement of Figure 10 further including a retention member aligned for engagement.

Figure 13 is a perspective view of the arrangement of Figure 12.

Figure 14 is a cross sectional view of the arrangement of Figure 12 after the retention member is urged into engagement with the frame member.

Figure 15 is a perspective view of the arrangement of Figure 14.

Figure 16 shows a malleable settable material or composition formed as a ribbon.

Figure 17 shows a malleable settable material or composition formed as a continuous enclosure for an edge of an infill material.
Figure 18 is a cross sectional view of an alternative frame member of the present invention.

Figure 19 is a perspective view of the frame member of Figure 18.

Figure 20 is a cross sectional view of the frame member of Figure 18 with settable composition and infill material positioned for assembly.

Figure 21 is a perspective view of the arrangement of Figure 20.

Figure 22 is a cross sectional view of the arrangement of Figure 20 after finishing.

Figure 23 is a perspective view of the arrangement of Figure 22.

Figure 24 is a cross sectional view of a further embodiment of a frame member of the present invention.

Figure 25 is a perspective view of the frame member of Figure 24.

Figure 26 is a schematic plan of an assembly line for the method of the present invention.

Figure 27 is a perspective view of a completed security screen door.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to Figure 1, there is seen a sectional part view of components aligned to form a screened aperture according to the present invention.

A frame member 10 formed with a hollow section 11 and inwardly facing ledge 12. The hollow section 11 is formed with continuous walls defining a central void 13.
An inner wall 14 of the hollow section 11 forms a shoulder 15.

A recess 16 is formed adjacent the inner wall 14. The recess has an outer wall 17 which is angularly offset around its middle portion. The recess 16 has an outer wider section and inner narrower section.

The recess may be considered as adjacent or part of the ledge 12.

Infill material is provided in the form of screen 18 which is aligned to abut the outer wall 17.

A retention or compression member 19 is formed with a substantially planar section 20 and a transverse rib 21. The rib preferably forms an acute angle with the planar section.

Ridges 22 are provided on an underside of the planar section 20 to enhance grip of the screen 18.

In Figure 2, the retention member 19 has been pressed into engagement with the rib 21 and recess 16 forming a male/female coupling. Of course, the rib and recess may each be positioned on the other of the frame member and retention member. While it is preferred if the ridge and slot are continuous, other arrangements such as interrupted sections may be suitable.

Preferred material for the frame member is aluminium. The retention member may be formed from any suitable material but is preferably durable with some resilience. Metal or a polymeric substance may be preferred. Rigid PVC is particularly suitable. The rib 21 may be deformed along the outer wall 17 leading to rotation of the substantially planar portion downwards and into contact with the screen 18. Further progression will lead to a leading edge of the rib 21 sliding over the angular deflection in the outer wall 17 snugly nestling in the inner recess.
Meanwhile, a top corner 23 of the retention member 19 may snap into position under the shoulder 15 for strong and positive engagement of the two components with the screen 18 fixed, preferably compressed between the retention member 19 and the ledge 12.

Figure 3 shows a perspective view in which the components are combined to form an aesthetically pleasing finish. It is preferred if the components are formed from material sufficient to give strong holding capacity to the finished product and thereby resist intruders.

Referring to Figure 4, there is seen a cross sectional view of a frame member 30 having an internal channel 31 formed by surrounding walls 32. The frame member 30 also has a ledge 33 projecting from a corner 34 formed by the walls 32 around the internal channel 31. The ledge 33 has three additional recesses 35 which are formed with a cross sectional dove-tail shape. The dove-tail shape results in a neck 36 and chamber 37 wherein the chamber is broader than the neck. The frame member 30 also includes a female channel 38 formed by one of the walls 32A defining the internal channel 31 and a ridge 39.

Further a groove 40 is formed in the wall 32A above the upper limit of the channel 38.

The same features are seen in perspective view in Figure 5 which highlights the linear extension of the recesses 35, channel 38 and the groove 40. The ledge terminates in a bull nose shaped edge 41 to provide an aesthetically satisfying finish. The same arrangement as shown in Figures 4 and 5 is seen in Figure 6 with the addition of solid cylinders of malleable settable material 42 placed over the recesses 35 and generally coextensive with the recesses as seen in Figure 7. Malleable may include the properties of being flowable, ductile, plastic or pliable such that the material may be deformed into a desired arrangement.
Figure 8 shows the next step in forming a screened aperture with a cured resin. An infill material in the form of an intruder resistant screen 43 is located with an edge section 44 located in contact with the settable material 42 and supported by the ledge 33. As is now apparent the opening to be screened is in the direction of arrow 45 and the ledge 33 is positioned inwardly of internal channel 31 and walls 32. A real advantage arising from the present method relates to the ability to drop the screen 43 into position in relation to the frame formed by frame members such as that shown 30. The screen 43 may be moved in a direction substantially transverse to the planar shape of the screen and generally perpendicular to the ledge 33. As a result of this method, the frame can be formed in its entirety prior to insertion of the screen, unlike some other methods which may require the frame to be mounted around the screen to allow insertion of a screen edge into a receiving channel. The frame may be solidly constructed using welding or other solid form techniques to create a very strong skeleton which may be positioned to have a corresponding screen infill simply dropped into position after location of the malleable settable material.

The malleable settable material is preferably a material such as an epoxy resin, a cyanoacrylate, a contact adhesive, latex adhesives a polyamide, an EVA co-polymer, urethane or Polyolefin or other suitable substance. Figure 9 provides a perspective view and highlights the close proximity of the edge section 44 to the ridge 39 thereby occupying the totality of available space and leading to a strong, braced framed screen on completion.

In Figure 10, additional settable material is laid out in a defined formation such as the cylinders shown. Although material is shown above and below the screen 43, it is possible to apply the settable material on one side only within sufficient quantity to suitably penetrate the screen 43 and recesses 35.

Figure 11 shows the cylinders of additional material supported in position by the weave of the screen 43.
In Figure 12 a compression or retention member 47 is aligned for engagement with the frame member. The compression member comprises a substantially elongate planar body 48 and additional accessory recesses 49 formed in a lower surface and in cross section defining similar shapes to those described for the recesses 35 of the ledge 33. In the present configuration, the additional accessory recesses 49 of the retention member 47 substantially mirror those of the ledge 33. However, this is not essential and the additional recesses of the ledge member may be a different shape and in different relative position to each other than those of the ledge. A projecting rib 50 is complementary to and aligned with channel 38.

Figure 13 highlights the elongated and linearly extending nature of the compression member 47 which is also formed with a bull nose edge 51.

In Figure 14, the process has proceeded to urging of the retention member 47 into engagement with the frame member 30 with a resulting compression and dispersal or distribution of the settable material 46 and additional settable material 42 to fill the recesses 35, 49 and also penetrate recesses in the screen 43. The material 42 and additional material 46 flow together and also flow around the ridge 39 and into the channel 38 filling any space between the channel 38 and rib 50.

An additional locking or engagement means is provided in the form of convex projection 52 which mates with groove 40. The rib 50 and channel 38 may have a snap fit arrangement in that one or more of the components may be slightly resiliently deformable to allow clipping of the device together. Likewise the convex protection 52 and groove 40 may snap fit together.

Once all the components are in place the screened frame may be left for the settable material to cure or set. Varying rates of setting may be achieved by using different materials or different combinations of epoxy resins and hardeners as required. Excess material is of course removed from around edges 41, 51 prior to setting. Figure 15 shows the finished product with the screen 43, retention
member 47 and frame member 30 bonded together.

In a preferred embodiment, the ledge and compression member extend entirely around the perimeter of the framed aperture. However, this is not essential and the retaining mechanism may be used in episodic manner with spaces between adjacent sections. Likewise, the use of a settable composition provides a preferred embodiment.

The invention also extends to a framing member comprising the features of Figure 1 and Figure 4 and, preferably, extruded for use in the present method.

The advantage of the bull nose completion 51 is seen in Figure 15. The curve of the edge minimises the ability of an intruder to gain purchase on either the ledge or the retention member when seeking to distract one or both from the screen 43.

The present method provides a process for rapid assembly of screens into pre-manufactured frames such as doorframes, window grill frames and grates. In setting up a production line, it may be arranged for the frame members to be pre-cut to size and assembled. Additionally, the infill material and clamping members may also be pre-cut to a required size.

Referring to Figure 16, there is seen the malleable material formed as a ribbon 55 which may be configured with ribbing 56 to approximate the recesses in the ledge or compression member. Alternatively, the settable composition may be applied as a viscous cylinder.

In Figure 17, the malleable settable material 57 or composition may be formed as an enclosure for the infill material and may be applied to the infill material prior to assembly.

Referring to Figure 18, there is shown a further embodiment of a frame member
70 with an internal channel 71 and external walls 72a, 72b, 72c and 72d. A flange or ledge 73 is formed integrally with the walls and extends linearly from wall 72c. The ledge 73 has a series of recesses 75 formed to extend linearly along the ledge. The recesses 75 are dovetailed with an inlet aperture wider than the chamber. A recess with parallel side walls may in certain circumstances provide adequate retention power for the present invention. An outer recess 76 is also formed with wall 72b defining one side wall and a sloped wall 77 defining the opposite side wall.

Figure 19 highlights the linearly extending nature of recesses 75, 76.

Figure 20 shows settable material or a settable composition 82 in an extruded cylindrical form positioned above the recesses 75, 76. Infill material in the form of screen 83 is located in turn above the settable composition 82. Pressure is applied to the screen 83 to urge it into abutting contact with the ledge 73. The settable composition 82 may be located above the screen 83 and urged into penetration of voids in the screen into the recesses. The settable composition 72 should be malleable in this process. Malleable may include the concept of flowable. Preferably the material is soft enough to fill the recesses and also penetrate a plurality of voids in the screen.

Figure 21 is a perspective view of the arrangement of Figure 20 showing the close approximation of an edge of the screen member with wall 72b.

Figure 22 shows the settable material 82 urged into final position and finished with a smooth top surface 84 which may be provided by an automated heated blade passing over the material, by molding or any other suitable means. The material 82 is selected to provide suitable flowability to fill the recesses 75 and penetrate a plurality of voids in a peripheral band 85 around an edge of the screen member 83. The set or cured material 82 forms a mechanical bridge or bond between the frame member 70 and screen member 83. If selected with adequate strength, the
settable material will act as a strong, security link between the screen member and frame member. Figure 23 is a perspective view of the finished product highlighting penetration of the voids in a peripheral band.

Figure 24 shows a further embodiment of a frame member 90 in the form of a mullion to provide a divider in an opening or aperture. The mullion member 90 has recesses 91, 92 located on opposite sides of a central bar 93 which is formed with ribs 94 defining grooves 95. The grooves may act as seats for complementary ribs on a cover piece (not shown).

Screen members may be bonded on either side of the mullion member 93. A perspective view is seen in Figure 25.

Referring to Figure 26, there is shown one embodiment of an assembly line. The parts are assembled on a horizontal work surface with the parts being delivered in a vertically downward direction. Malleable settable material is applied to the frame, then the infill material is applied to the malleable settable material, then additional malleable settable material is applied to the infill material and lastly the retention or clamp members are applied to the infill material and engaging the frame. The assembly is completed with the application of vertical down pressure to fully engage the retention members with the frame member. The process is complete when the malleable settable material has set in a solid form. Of course, it is also possible to form the frames without the malleable settable material.

In an automated assembly, frames 145 are delivered by conveyor to the assembly point where they are secured by clamps 139 leaving the ledge clear to accept subsequent assembly parts.

A dispenser 140 is positioned by a motion control system, facilitating distribution in the required manner, and delivers malleable settable material. (The system may include a robotic manipulator arm 141 to pick up and position components.)
Infill material 138 is manipulated into position using a manipulator, such as the robotic arm 141, in conjunction with suitable handling attachments. The infill material 138 is positioned on the frame 145 which is held in position by clamps 139. Malleable settable material is again delivered as described above. Retention members are selected from the member bin 142 in turn by the above mentioned manipulator 141, with suitable handling attachments and placed on the assembly. When all clamp members are in place, the assembly is moved to press/heater 143 which applies vertically downward pressure progressively and sequentially along the retention members until they are fully engaged. The clamps are released and the conveyor transports the completed part from the assembly area to dispatch area 144. In an alternative embodiment, retention members are not required and the settable material may be finished to provide the outer surface.

Heat sensitive malleable settable material may be used and the malleable settable material is applied to the frame and the clamp members prior to assembly of the parts. The infill material is engaged with the frame and the retention members located over the infill material and in engagement with the frame.

In this case, the assembly is conveyed to press/heater 143 where the parts are heated to a temperature sufficient to melt the malleable settable material. The assembly may then pass through a series of rollers to secure the retention members in their respective home positions. The assembly may then move to a cool down dispatch area 144.

As noted, the malleable settable material may be heat sensitive and performed to make an enclosure around the edge of the infill material. The infill material is then placed upon the ledge of the frame and the clamp members are brought into engagement with the frame.

Figure 27 shows an assembled screen door 100 which may be mounted as a security door for resisting intruders. The door is lightweight, strong and
aesthetically pleasing in appearance.

The inventor has provided an effective and reliable method of automating assembly of screened frames such as doors, windows and security grills. In the simplest form, a retention member is clipped or pressed into place to fix the screen material. Superior bonding may be achieved with a settable ream but still relying in part on the presence of a retention member. A cheaper, strong device may be provided to the market for the advantage of consumers.

Throughout the specification the aim has been to describe the preferred embodiments of the invention without limiting the invention to any one embodiment or specific collection of features. Those of skill in the art will therefore appreciate that, in light of the instant disclosure, various modifications and changes can be made in the particular embodiments exemplified without departing from the scope of the present invention. All such modifications and changes are intended to be included within the scope of the appendant claims.
The claims defining the invention are as follows:

1. A method for securing an infill material, such as a screen, to a frame, the method comprising the steps of:
   - forming a frame defining an opening and having a ledge extending into the opening;
   - positioning an infill material such as a screen member, for fixing to the frame; and
   - engaging a retention member with the frame to thereby fix the infill material in place between the ledge and the retention member.

2. The method of claim 1, further including the step of forming the frame from a plurality of separate frame members joined by welding and/or corner stakes.

3. The method of either one of claim 1 or claim 2, wherein the frame defines two or more openings.

4. The method of any preceding claim, wherein the step of engaging a retention member with the frame involves effecting a male/female coupling between the retention member and the frame.

5. The method of claim 4, wherein the male/female coupling is formed by locating one or more ribs in a co-operating slot or slots, each one of a rib and slot pair located on a respective one of the frame and the retention member.

6. The method of claim 5, wherein the coupling comprises one or more of a friction fit or a snap lock fit.

7. The method of claim 5, wherein an edge of the retention member sits behind a shoulder formed in the frame to thereby lock the retention member in
position.

8. The method of any one of the preceding claims, wherein the retention member is formed as a substantially planar member with one or more ribs extending therefrom, the one or more ribs adapted to engage a slot in the frame, and includes one or more longitudinal ridges positioned on an underside of the planar member and adapted to contact the screen member.

9. The method of any one of the preceding claims further comprising applying a settable composition to penetrate and preferably fill one or more accessory recesses in the ledge and a plurality of voids in the infill material and allowing the settable composition to cure.

10. The method of claim 9, wherein the ledge has three accessory recesses.

11. The method of claim 10, further comprising the step of positioning the settable composition between the ledge and the infill material and the infill material and the retention member, and wherein the retention member has one or more additional accessory recesses.

12. The method of either one of claim 9 or claim 10, further including the step of applying heat to cure the settable composition.

13. The method of claim 9, wherein the settable composition is selected from polyamides, polyesters, urethane, EVA co-polymers, polylefin, and epoxy resins, silicon fillers and acrylic fillers.

14. A method for securing an infill material, such as a screen, to a frame, the method comprising the steps of:

   forming a frame defining an internal opening, the frame having a
ledge around the perimeter of the opening;

supporting the infill material on the ledge; and

pressing a retention member or members into locking engagement

with the frame, thereby fixing the infill material in position.

The method of claim 14, further including the step of locating

malleable settable material in contact with the ledge and/or the infill material

before applying the retention member and allowing the malleable settable material
to cure after application of the retention member.

A method of forming a frame comprising the steps of:

forming a framing member with a ledge projecting from one side;

cutting the framing member into a plurality of frame members and

joining the members to form the frame, said frame defining at least one internal

opening in the frame, wherein the ledge is inwardly directed in relation to the

opening.

The method of claim 16, wherein the ledge is formed with one or

more accessory recesses adapted for receiving malleable settable material.

The method of claim 17, wherein the one or more accessory

recesses are formed with an inlet aperture and a chamber, wherein the chamber is

broader than the inlet aperture.

The method of claim 14, wherein the retention member is formed

with a rib adapted to engage a corresponding recess or slot in the frame member.

The method of claim 14, wherein the step of engaging the retention

member with the frame includes forming a male/female coupling between the

frame member and the retention member, preferably by inter-engagement of a

recess of slot and a projection or rib, wherein the recess or slot and the projection
or rib each linearly extend along a respective one of the frame member and the retention member.

21. The method of claim 20, wherein the one or more of the recess or slot and the projection or rib are resiliently deformable to engage by a snap fit coupling.

22. A method of forming a screened closure, the method comprising the steps of:

   forming a frame defining at least one opening;
   locating a malleable settable composition on or around a ledge of the frame, the ledge located around a perimeter of the at least one opening;
   placing a mesh screen on the settable composition and supported by the ledge; urging a retention member into engagement with the frame, thereby compressing and/or distributing the settable material causing it to flow into receiving recesses in at least one of the ledge and the retention member as well as penetrating voids in the mesh screen and allowing the settable composition to cure.

23. A framed opening with infill material covering the opening, the framed opening formed according to any one of the above methods.

24. A screened opening comprising an outer frame defining the opening and having an inwards directed ledge, an infill member and a retention member coupled to the outer frame, wherein the infill member is fixed in position between the ledge and the retention member.

25. The screened opening of claim 24, wherein the outer frame is formed from a plurality of frame members.

26. The screened opening of either one of claim 24 or claim 25, wherein
the retention member is coupled to the frame by male/female coupling.

27. The screened opening of claim 26, wherein the male/female coupling is formed through inter-engagement of at least one rib and at least one slot, each of a rib/slot pair located on a respective one of the frame and the retention member.

28. The screened opening of claim 27, wherein the retention member is snap locked into engagement with the frame.

29. The screened opening of claim 28, wherein the slot is positioned adjacent an outer periphery of the ledge relative to the opening and wherein the retention member is substantially planar having a rib extending therefrom.

30. The screened opening of claim 29, wherein the retention member has one or more additional accessory recesses formed as longitudinal channels.

31. The screened opening of any one of claims 24 to 30, wherein the retention member has contact enhancement means for increasing the grip on the infill material, said contact enhancement means comprising one or more longitudinal ribs adapted to contact the infill material.

32. The screened opening of any one of claims 24 to 31, further comprising a cured composition present in at least one accessory recess, a plurality of voids around an edge of the infill material and/or at least one additional accessory recess in the retention member.

33. The screened opening of claim 32, wherein the cured composition is selected from polyamides, polyesters, urethane, EVA co-polymers, polyolefin and epoxy resins, silicon fillers and acrylic fillers.
34. The screened opening of any one of claims 24 to 33, wherein the screened opening is a security screen door.

35. A screened door as described herein with reference to the Figures.

36. A frame member as described herein with reference to the Figures.

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Moonbush Pty Ltd

by DAVIES COLLISON CAVE

Patent Attorneys for the Applicants
FIGURE 12

FIGURE 13