

INNOVATIVE DESIGN FOR ULTRA SLIM WINDOW GRILLES

[0001] The present application claims priority to Application No. 10201605574S filed with the Intellectual Property Office of Singapore on 01 July 2016, which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] The present invention relates generally to window grilles, and, more specifically, to a window grille that is less bulky than traditional grilles, sturdy and easy to assemble.

BACKGROUND

[0003] A window grille or grill is an opening of several slits side by side in a wall metal sheet or other barrier, usually to let air or water enter or leave but to exclude larger objects including animals. Grilles were commonly used in dwellings and other structures before glass and screens were available. In modern structures, grilles are often used in addition to glass windows for safety and security. For example, grilles can prevent intruders from entering a dwelling by climbing through a window.

[0004] In cities with high population densities, people often live in high rise buildings. For units above ground level, windows grilles can be particularly important for the safety and security of children and infants. Window grilles offer a barrier from glass and can prevent a child from falling out of a window.

[0005] Traditional window grilles are often made from iron or heavy sheets or tubes of metal. The Metal sheets or tubes are welded together to form a lattice structure. Thereafter, the grille is usually bolted or permanently fastened around a window or door. Attempts have been made to improve grilles mainly with efforts to make them more decorative and less expensive.

[0006] For example, U.S. Patent No. 6085481 describes a grille than can be assembled without being welded. Several bars are connected to each other at right angles to form a grid. However, like other traditional window grilles, it is bulky and aesthetically unappealing. Further, its design is similar to other grilles that are constructed from metal panels or thick metal tubes. It blocks incoming light and obstructs the view through the window of which it is attached.

[0007] Because traditional grilles have limitations, there is a need for an improved grille that overcomes these shortcomings. Specifically, there is a need for a grille that is composed of slim yet durable bars. The grille should also be easy to install, aesthetically pleasing and less obstructive than traditional grilles. It should also be slim or narrow so that it does not extend significantly out of the window parapet.

SUMMARY

[0008] The invention recognizes that exists a long felt need for a light, durable window grill that is not bulky, aesthetically pleasing and easy to manufacture and install.

[0009] The following summary is provided to facilitate an understanding of some of the innovative features unique to the disclosed embodiment and is not intended to be a full description. A full appreciation of the various aspects of the embodiments disclosed herein can be gained by taking into consideration the entire specification, claims, drawings and abstract as a whole.

[0010] We describe a cylindrical, hollow crossbeam for a window grille. The interior of the crossbeam is reinforced with an internal circular bar that extends the length of the crossbeam. The circular tube is connected to the interior of the crossbeam at both sides and the bottom to form three separate chambers. The top of the internal circular tube is open to form a c-shaped structure. The internal circular tube can form a screw port at each side of the crossbeam. The crossbeam is preferably made of aluminum of

a thickness of 1 to 1.5 millimeters.

[0011] We also describe a window grille comprising an outer frame assembly and at least two panels that form an inner frame assembly. The outer frame assembly includes an upper outer frame, a lower outer frame and side vertical frame bars. Grille outer corner joints can be connected to the outer top and bottom frames.

[0012] The panels include an inner top frame bar, inner lower frame bar, two inner side frame bars and crossbeams. The crossbeams include a hollow internal that is divided into three chambers that forms screw ports on each end. At least one panel from the inner frame assembly includes four track slide blocks. Further, we describe a window grille panel comprising a top frame bar, a bottom frame bar and side frame bars.

[0013] The horizontal crossbeams ("triple hollow bars") can include a hollow internal that divides the cross beam into three chambers that extend the length of the cross beam. The cross beam can include screw ports on both ends. The circular tube can be connected to the interior of the crossbeam at both sides and at its base. Further, the internal of the tube can be "c-shaped."

INTRODUCTION

[0014] A first aspect of the invention is a window grille with a "triple hollow bar" internal structure, a design that yields a lighter, stronger bar.

[0015] A second aspect of the invention is a screw port that can add functionality and rigidity to the grille and assist with assembly.

[0016] A third aspect of the invention is a window grille with an ultra slim inner frame assembly.

[0017] A fourth aspect of the invention is an attachable bar secured to the side of the

inner framework assembly so that it fits securely within the outer frame.

[0018] A fifth aspect of the invention is a simplified process of assembly of a pre-fitted inner frame assembly of a window grille.

[0019] A sixth aspect of the invention is a joint attachable bar to reduce redundant movement when the inner frame assemblies.

BRIEF DESCRIPTION OF THE FIGURES

[0020] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0021] FIG. 1 is a perspective view of a window grille assembly that depicts several aspects of the invention.

[0022] FIG. 2 is a perspective view of a window grille assembly that depicts several aspects of the invention.

[0023] FIG. 3A is a perspective view of an individual panel of the inner framework assembly.

[0024] FIG. 3B is a close-up perspective view the bottom edge of an individual panel of the inner framework assembly.

[0025] FIG. 4A is a perspective view of the triple hollow profile bar.

[0026] FIG. 4B is a cross-sectional view the triple hollow profile bar.

[0027] FIG. 5A is a front view of an individual panel of the inner framework assembly.

[0028] FIG. 5B is side view of a portion of a vertical frame bar.

[0029] FIG. 6 is a perspective view of an individual panel of the inner framework assembly that depicts several aspects of the invention.

[0030] FIG. 7A is an exploded view of the outer frame assembly of the invention.

[0031] FIG. 7B is an exploded view of the inner frame assembly of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

[0032] While the invention is primarily described for use in residential dwellings, it is understood that the invention is not so limited and can be used on windows in business or commercial environments. It can also be used on doors or other passageways. Other applications include, for example, but not limited to, using the invention in aerospace, on ships, automobiles or other vessels, cages or other settings where a slim, durable grille can be used. The triple hollow bar can be used wherever a slim but strong structural bar is desired.

[0033] Reference in this specification to "one embodiment/aspect" or "an embodiment/aspect" means that a particular feature, structure, or characteristic described in connection with the embodiment/aspect is included in at least one embodiment/aspect of the disclosure. The use of the phrase "in one embodiment/aspect" or "in another embodiment/aspect" in various places in the specification are not necessarily all referring to the same embodiment/aspect, nor are separate or alternative embodiments/aspects mutually exclusive of other embodiments/aspects. Moreover, various features are described which may be exhibited by some embodiments/aspects and not by others. Similarly, various requirements are described which may be requirements for some embodiments/aspects but not other embodiments/aspects. Embodiment and aspect can in certain instances

be used interchangeably.

[0034] The terms used in this specification generally have their ordinary meanings in the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. For convenience, certain terms may be highlighted, for example using italics and/or quotation marks. The use of highlighting has no influence on the scope and meaning of a term; the scope and meaning of a term is the same, in the same context, whether or not it is highlighted. It will be appreciated that the same thing can be said in more than one way.

[0035] Consequently, alternative language and synonyms may be used for any one or more of the terms discussed herein. Nor is any special significance to be placed upon whether or not a term is elaborated or discussed herein. Synonyms for certain terms are provided. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any terms discussed herein is illustrative only, and is not intended to further limit the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

[0036] Without intent to further limit the scope of the disclosure, examples of instruments, apparatus, methods and their related results according to the embodiments of the present disclosure are given below. Note that titles or subtitles may be used in the examples for convenience of a reader, which in no way should limit the scope of the disclosure. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure pertains. In the case of conflict, the present document, including definitions, will control.

[0037] The term "flange" refers to an extension or edge that sticks out and is used for strength, for guiding, or for attachment to another object.

[0038] The term "cross beam" or "horizontal bar" refers to the central bars in the panel of a window grille. When describing the invention, they may also be referred to as "ultra slim grille bars" or "triple hollow bars."

[0039] The term "parapet" or "window parapet" refers to an extension of a wall around the edges or circumference of a window.

[0040] The term "recess" refers to an indentation or cleft.

[0041] It will be appreciated that terms such as "front," "back," "top," "bottom," "side," "short," "long," "up," "down," and "below" used herein are merely for ease of description and refer to the orientation of the components as shown in the figures. It should be understood that any orientation of the components described herein is within the scope of the present invention.

[0042] Other technical terms used herein have their ordinary meaning in the art that they are used, as exemplified by a variety of technical dictionaries.

Description of Preferred Embodiments

[0043] The invention provides a window grille that is not bulky and obstructive like traditional grilles. It includes slim but durable bars crossbars so that it are sturdy as well as aesthetically pleasing. Further, it is less obstructive than traditional grilles and narrow so that it does not extend significantly out of the window frame. Thus, the invention is particularly well suited to use on windows in conjunction with curtains, shades or blinds.

[0044] FIG. 1 depicts a perspective view of a window grille assembly of the present

invention. The height and length of the grille can be determined by the size of the window and window parapet. In a preferred method of design and installation, the dimensions of the parapet are measured so that the grille can be constructed at the factory. The grille is then delivered and installed by an installer in the parapet by conventional construction methods.

[0045] The main components of the outer frame of the window grille assembly include the top outer frame bar **101**, bottom outer frame bar **108**, vertical or outer side frame bars **106** and grille outer joints **129**. The design depicted in FIG.1 includes two inner frame work assemblies **110** that can slide independently of one another on tracks. Alternative designs can include one or more fixed inner frame work assemblies that swing open on grille inner pivot (not shown). For large or wide windows, the assembly can include three or more inner frame assemblies.

[0046] In a preferred design, the outer frame width of the grille assembly measures 32 millimeters wide **143** as illustrated in FIG. 1. Traditional grilles are typically more than 50 millimeters wide. The design and construction of the present invention allows for a narrower window grille than traditional grilles without compromising durability. Each inner frame assembly includes a track slide block in the top and bottom corners.

[0047] FIG. 2 also illustrates a perspective view of a window grille assembly of the present invention. The outer frame bar **108** sits inside the window parapet **109**. The top bar and right side vertical bar of the outer frame are not shown so that the window panel **111** and the top surfaces of the inner framework assemblies **110** can be illustrated. The complete outer frame assembly includes grille outer joints on four corners and tightened screws.

[0048] Horizontal grille bars or crossbeams **104** are joined with inner side frame bars **118** by track slide blocks and screws (not shown) to form each panel of the inner framework assembly **110**. The grille bars **104** ("ultra slim grille bars") connect with the inner side frame bars **118**. In a preferred design, the maximum distance between grille

bars is 135 millimeters **107**. Here, the two inner frame work assemblies **110** are positioned so that the grille can be locked using a conventional grille lock **132**.

Attachable bar

[0049] The grille assembly can include an “attachable bar” **117** on both sides to provide a more secure fitting grille framework. A piece (or two pieces joined together) of attachable bar can be used by slotting into the center slot of the inner frame side bar on both sides as shown to match the height of the inner panel. This is preferably done during installation. The molded or aluminum attachable bars can be produced in a width range of between 14 to 30 millimeters. The design can come with one or two pieces to match the height of the inner frame bars. The bars can be manually inserted into the slot of the inner frame bar and secured with screws. The main function of the attachable bar is to get rid of redundant movement when the inner frame assemblies.

[0050] As shown in FIG.2, the attachable bar **117** can be secured to the side of the inner framework assembly so that it fits securely within the outer frame. The track slide block **112** is illustrated on each corner of the inner framework assembly **110**.

[0051] In a preferred design, the individual panels **110** measure 12 millimeters in width **145** as illustrated in FIG. 3A and 3B. Traditional grille panels are typically more than 20 millimeters wide.

Triple Hollow Bar Construction

[0052] In a preferred design, the inner framework assembly of the grille includes “ultra slim grille bars” with the “triple hollow profile bar construction.” FIG. 4A depicts a perspective view of a grille bar **104** of this design. The diameter is cylindrically shaped with an internal “c-shaped” structure that extends through the length of the bar. The design allows the grille bars to be narrower, lighter and stronger than traditional grille bars. The bars are preferably produced by extrusion process.

[0053] FIG. 4B depicts a side view of the ultra slim grill bar **104** with the “triple hollow profile bar construction” and illustrates its three distinct cavities. As show, the interior of the grille bar or crossbeam is reinforced with an internal circular or “c-shaped” structure that extends throughout the length of the crossbeam. The circular tube is connected to the interior of the crossbeam at both sides and the bottom to form three separate chambers. The top of the tube is open to form a c-shaped structure and the base extends vertically to contact the surface or shell of the bar.

[0054] The sides of the grille bar **104** can include screw ports. The screw ports add functionality to the grille bars as they can be directly fastened to vertical frame bars with bolts or screws. No additional components are necessary. Traditional designs typically require rivets to secure components to one another. Rivets require an air riveting gun and compressor unit and inevitably increase costs. Further, should disassembly be necessary, rivets must be destroyed and are difficult to remove.

[0055] In a preferred design, the ultra slim grille bars are constructed with the following dimensions: 16 to 18 millimeters (mm) in height, 8 to 9 mm in width. The “c-shaped” structure forms the screw port and is centered so that the top and bottom portions of the “c” contact the bar. The “c” is elongated to contact the base of the bar so that it is joined at three points.

[0056] The length of the grille bars will depend on the size of the grille assembly needed to fit a particular window. The grille bars can be constructed of aluminum or other durable, light weight material. In a preferred design, they are constructed with aluminum that is 1 to 1.5 mm thick and are produced by extrusion process. The grille bars are resistant to bending with 15 kilograms of force. The grille bars are tested with a resistance to bending with a range from 17 to 22 kilograms of force. However, in load deflection test report (no: 11164-0916-02809-MEME/2) the grille bars have demonstrated with a resistance of load at maximum load of range from 23 to 30 kilograms of force and no sign of fracture.

Inner Framework Assembly

[0057] FIG. 5A further illustrates the track slide block one embodiment of the invention. The horizontal frame bars **104** are joined with inner side frame bars **118** using track slide blocks **112** that can be secured with conventional stainless steel screws. The attachable bar **117** is also illustrated and can be used to create a snug fit of the inner frame work assembly **110** into the outer frame assembly.

[0058] FIG. 5B depicts a portion of the inside edge of and inner side frame bar. **118** In a preferred design, 2 mm and 7.5 mm slots are created on the the inner frame side bars **118** as shown in FIG. 5B. The 2 mm and 7.5 mm slots are used for sliding clearance and track slide block clearance. The hole **120** is used for securing the inner frame side bar to the horizontal frame bar with a screw. The profile hole **116** is also depicted which includes a hole **137** for securing the triple hollow bar to the frame side bar with a screw. Four pieces of track slide blocks can be tapped into the edge of the inner frame at the four joint ends and secured with stainless steel screws.

[0059] FIG. 5B illustrates a profile hole **116** in the inner frame. The size should correspond with the area of the grille bar so that each grille bar fits firmly in place. Here, the size of the holes is 8 to 9 millimeters wide and 16 to 18 millimeters in height to complement grille bars of the same dimensions.

[0060] The vertical or inner frame side bars **118** are subjected to a "pre-punching" process to create the elongated profile holes **116** on the wall of first surface and a center hole through **137** on the wall of the second surface. Thereafter, the grille bars can be inserted into the profile holes and secured using with conventional stainless steel screws to tighten into the screw ports of the grille bars from the opposite side of the inner side frame bars

[0061] In a preferred design, bar material is made of Aluminum grade 6063 tempered

T3 or T5. The bar can be produced by extrusion method and tempered to specification. Plastic material (e.g. attachable bar and track slide blocks) is preferably made of acrylonitrile butadiene styrene (ABS) or equivalent. The plastic parts can be produced by injection mold. Self-Tapping screw material can be made of stainless steel. The nominal size use is no.6 and no.8. The screw head can be Pan or Countersunk and the length can vary from 0.5 to 2 inches. In a preferred method of design and production, the inner frame **110** assembly is constructed at a factory or workshop based on desired dimensions.

[0062] Four bars are cut to according to the length and height of the design dimensions. Thereafter, the inner side frame bars can be sent to the pre-punching process. The process should create elongated profile holes **116**, center hole **137**, slots & hole **120** punch out on the inner side frame bars **118** as shown in FIG. 5B. The size of the profile holes should correspond with the dimensions of the hollow profile bars.

Assembly

[0063] The inner frame bars can be arranged in a rectangle position ready for assembly. The hollow profile bars are pushed through into the profile holes. Four track slide blocks can be tapped into the laid out inner frame at the four joints ends and secured with stainless steel screws. The hollow profile bars are then secured with stainless steel screws. This allows proper alignment of the framework while allowing the inner framework assemblies to slide on the track with the track slide blocks. During production the functional quality of the assembly complete can be checked on the sliding movement fixture (sliding type model) to ensure the smoothness.

[0064] The spacing between each grille bars is a maximum of 135 mm, providing structural strength and good visibility through the window. This also helps allow more light into the room.

[0065] FIG. 6 illustrates a panel of the inner frame assembly in greater detail. The

track slide blocks **112** are illustrated in the top frame and side frames. Self-tapping screws (pan head type no. 8 x 1½") **131** at the four corners secure the framework and self-tapping screws no.6 x ½" (not shown) to secure triple hollow profile bars to the inner side frame bars. The attachable bar **117** can be present on both sides of the panel. The attachable bars are secured with self-drilling zinc plated steel screws (pan head no.6 x ½") **133**. The inner side frame bar and horizontal bar/triple hollow profile bar **104** are also illustrated.

[0066] Another aspect of the invention is an "attachable bar." In both commercial and residential developments, architects will often use identical dimensions in their design of building frames, rooms, doors and windows. Accordingly, windows and window parapets are often the same size throughout a building or complex. However, variation in size is inevitable. Traditional window grilles will typically have some "give" or redundant sliding movement as they do not fit securely into an outer frame. The attachment bar of the present invention solves this problem.

[0067] The attachment bar can be used when the inner framework panel assembly does not fit snugly into the grille outer frame assembly. In a preferred design, the attachment bar is made of ABS plastic that is dense and fire resistant. The attachable bar can be affixed to the inner side frame bars of the grille using conventional self-drilling zinc-plated steel screws no.6 x ½". **133** The end result is a sliding inner frame that feels sturdy and does not display redundant sliding movement. An Attachable Extension Attachment Bar (not shown) can be used for frame heights that are greater than 800 mm. It allows the installer to join the length of the attachment bar when necessary.

[0068] FIG. 7A is an exploded view of the outer frame assembly **100** of the invention. The outer frame assembly is constructed and installed similar to conventional designs. The frame bars are joined using grille outer joints (four corners) **129**.

[0069] FIG. 7B is an exploded view of the inner frame assembly of the invention. The horizontal or top/bottom frame bars **115** are joined with vertical or inner side frame bars **118** using track slide blocks **112** that can be secured with conventional stainless steel screws. The “attachable bar” is also illustrated **117** as well as the ultra slim grille bars. **104** Self-tapping stainless steel screws (pan head type no.8 x 1½”) **131** can be used to secure the inner frame bars together. Self-tapping stainless steel screws (pan head type no.6 x ½”) **139** can be used to secure the triple hollow bars to the inner side frame bars. Self-drilling zinc plated steel screws (pan head type no.6 x ½”) **133** can be used to secure the attachable bars to the inner side frame bars **118** Self-drilling zinc plated steel screws (flat head type no.6 x ½”) **141** can be used to secure the track slide block to the top and bottom inner frame bars **115** A standard lock is also illustrated. **132**

[0070] Because of the qualities of each component, obstruction through the view of a window is minimal. Further, the grille assembly is aesthetically pleasing and easy to install.

Working Example – Assembly of slim, durable window grille

[0071] The invention includes a window grille that offers better protection than traditional designs despite being slimmer and more cosmetically appealing. In a preferred method of installation, the dimensions of a window parapet are accurately measured for factory construction of the window grille assembly. The assembly, including the bars, can be produced in a range of colors as desired by a customer or designer. The surface of the components can be anodized or powder coated. Common installer skills are sufficient for installation of the grille.

[0072] The components of the outer frame and inner frame are cut to fit the dimensions of the window parapet. For common sizes of windows, two panels of inner frame assemblies are adequate. With wider windows, three or more panels of similar inner frame assemblies can be used.

[0073] The process of inner frame assembly involves joining four bars that are cut to the custom measurement into a rectangle shape. The inner frame side bars are subject to the "pre-punching" process to create the 2 mm and 7.5 mm slots and a hole as shown (FIG. 5B). The punched profile holes and a center hole are use for the hollow profile bars assembly and tightened by screw sitting. The 2 mm and 7.5 mm slots are used for sliding clearance and track slide block clearance.

Assembly of Inner Frame

[0074] The inner frame bars (top, bottom and sides) are arranged together in a rectangular configuration. The hollow profile bars are pushed through into the profile holes and secured in position. Four individual track slide blocks are placed into the corners of the inner frame at the four joints ends and secured with screws. The hollow profile bars are then secured with stainless steel screws.

[0075] A powered tool screw driver with torque control setting can be used to drive in and tighten the screws into the four corners of the inner frame bar. Next, the screws to the screw ports of the hollow profile bar can be driven in and tightened from behind of the inner frame bar. Thereafter, one can check the quality of the completed inner frame work to ensure that it is securely in place. The functional quality can be checked by sliding the inner frame assemblies onto the outer track bar.

[0076] Another benefit of the invention are a slimmer components used for the grille assembly. The invention can be compared with traditional design is as follows:

- the size of the new Triple Hollow Bar is reduced by 33% compared to traditional designs,
- the size of the Inner Frame Bar is reduced by 40%,
- the size of the Outer Frame Bar for two tracks is reduced by 36%, and
- the size of the Outer Frame Bar for three tracks is reduced by 26%.

Further, the new slim grille connecting plastic corner joints can be compared with traditional designs is as follow:

- the size of the new inner track slide block is reduced by 43%,
- the size of the corner joints on outer frame for 2 tracks is reduced by 36%, and
- the size of the corner joints on outer frame for 3 tracks is reduced by 26%.

[0077] Further, the invention requires fewer components than traditional designs. The quantity of various shape of bars to assemble a framework is reduced from seven to four types. A Traditional Type of window grille typically requires seven types of metal or aluminum components: (1) Hollow Grille Bar, (2) Inner Frame Side Bar, (3) Inner Frame Side Cover, (4) H-Bar, (5) H-Bar Cover, (6) Outer Frame Bar (sides) and (7) Outer Frame Bar (Top & Bottom). Whereas, the invention requires just four of such components: (1) Triple Hollow Grille Bar, (2) Inner Frame Bar (Top, Bottom, Sides), (3) Outer Frame Bar (Top & Bottom) and (4) Outer Frame Bar (Sides).

[0078] The method of processes and assembly work for the complete assembly of the invention can be compared to the traditional type as follows. The new slim grille requires a total of two sets of punching dies for punching the profile holes and as well as for the holes and slots needed. The punching is done on the Inner Frame Bar and ready for assembly work. In contrast, a traditional grille needs a total of three sets of punching dies which are used for punching the profile holes on Inner Frame Side Bar and Cover and also punch holes and slots on the Inner Frame Side Bar. Thus the new punching process has a saving of reducing one die set and eliminating one punching process.

[0079] Further, the assembly of the framework of the grille of the present invention entails a simpler, more straight-forward assembly and less effort than traditional designs.

Working Example – Detailed Assembly of Slim, Durable Window Grille compared to a Traditional Window Grille

[0080] Steps in the Assembly Process of the Present Invention

1. The inner frame bars are placed on the working table and aligned (in a C-shape)

so that the one vertical/side bar is absent (one piece of the side bar is needed for complete assembly).

2. The frame bars are aligned in position and self-tapping screws no.#8 x1½" are inserted into the holes located at each corner.
3. The screws are tightened onto the screw port of the inner frame bars by using a powered tool screw driver with a control torque setting of 1.7 Nm to 2.0 Nm.
4. The triple hollow grille bars are push through the profile holes on the inner frame side bar in placed.
5. The assembler will take the last piece of the inner frame side bar and complete the assembly and it will be ready for tightening.
6. The last piece of the inner frame side bar is tightened using the same screw tightening process as mentioned above.
7. The inner framework is placed in an upright position for tightening the triple hollow grille bars onto the frame side bars.
8. The self-tapping screw no.#6 x ½" Pan Head Type is used and tightened toward the side frame bars onto the screw port of the triple hollow grille bar by a powered tool screw driver with a control torque setting of 1.7Nm to 2.0Nm.
9. The process is repeated for the rest of the grille bars assembly.
10. The assembler will have to check that all screws are properly engaged.
11. The track slide block is push into the inner frame bars on the 4 corners and stay in position.
12. An additional tightening process is done by using self-drilling screw no.#6 Flat Head to tighten the track slide block.
13. Tighten the screw by a powered tool screw driver with a torque control setting of 1.7Nm to 2.0Nm
14. Place 2 pieces of Attachable bars on each side of the inner frame bar (sides)
15. Insert a self-drilling screw (No. 6 pan head screw) on the allocated hole and tighten by a powered tool screwdriver with a setting of 1.7Nm to 2.0Nm. Repeat the same process for the rest of the holes.

16. The attachable extension bar (sub-component of attachable bar) is use only when the height is greater than 800mm. The process to attach the bar is the same process as above mentioned.
17. Quality Control inspection of the inner frame can be done upon completion.
18. The outer frame work bars are cut to customize measurement and assembled only during installation.
19. The completed inner framework is placed into the outer framework which is completed by assemble together using 4 pieces of grille outer 2T Joint UG32-0.
20. The framework is secured by a riveting method. Usually there is some redundant movement on the sliding type of the inner framework engaged with outer framework which is unable to resolve after installation.
21. A sub-component called attachable stacker bar of 3mm thick with the same width and length of the attachable bar is stacked below the attachable bar if necessary to control or remove any redundant movement.
22. The attachable bar is remove by unscrew the screw to add attachable stacker bar below it and screw back to the holding position.
23. The installer can check to confirm the redundant sliding movement is resolved.

[0081] Steps in the Assembly Process of the Traditional Window Grille

1. The installer places the inner frame side bars and hollow grille bars in position on the working table.
2. The hollow grille bar is push one by one into the profile hole of the inner frame side bars and align in position.
3. A hole is drilled of diameter of 3mm through one side at the engaged area between the hollow grille bar and the inner frame side bars. The installer must repeat the drilling process for the rest of the grille bars.
4. Each rivet is then placed into each the hole drilled and proceed to do riveting process by using an air operated riveting gun.
5. The assembler must then check that all riveted bars are properly engaged without any loose rivets.

6. The inner frame side cover bars are pushed through toward the riveted area.
The purpose of the cover bar is to cover the rivets from being seen.
7. The H-bars Cover and follow up with the H-bars align from top and bottom position by engaging onto the side frame bars.
8. The track slide blocks are push into the H-bars and stay in position.
9. Each self-tapping screw no.#8 x 2" is insert into the hole of each corner of the inner frame bar and tightened into the screw port of the H-Bar by a powered tool screw driver.
10. Quality control inspection of the inner frame assembly can be completed.
11. The outer frame work bars are cut to customize measurement and assembled only during installation.
12. The completed inner framework is placed into the outer framework which is completed by assemble together using 4 pieces of grille outer 2T Joint WSH 28-0.
13. The framework is secured by riveting method. Usually there are some redundant movement on the sliding type of the inner framework engaged with outer framework which is unable to resolve after installation.

[0082] The lower cost of assembly of the grille of the present invention is also an important consideration. Traditional grilles require the following: cost of aluminum blind rivets, cost of riveting guns and maintenance, cost of electricity consumption which need air compressor unit to do riveting process, cost of air compressor unit and servicing, process method need to drill and complete with riveting process which is tedious, dirty and messy with material waste within the framework, time taken to clean up, the possibility of grille bars being loose when rivets are not properly engaged due to the compressed air irregularity as well as the cost of additional two cover bars to cover the rivets.

[0083] In contrast, a grille bar of the present invention has lower costs. For example,

the cost of screws are cheaper (can buy in bulk because one common type for the grille bars). There are fewer parts to assemble. The process and method is simple compared to traditional designs. The use of screws for engagement has another benefit. The assembler has tightening torque control on the screws able to adjust the rigidity of the framework. The process is more efficient, reducing the amount of time by approximately 30%. Further, it is viable to do pre-production on the inner framework with automation.

[0084] As mentioned, the invention also provides practical and functional benefits in addition to lower costs. The smaller dimensions of the grille components of the invention lead to a better view through the window. This is particularly beneficial for offices and residences with scenic views. The aesthetic grille designed also help to allow more lights into the house and look brighter, thus makes your home look more modern and elegant.

[0085] It will be appreciated that variations of the above disclosed and other features and functions, or alternatives thereof, may be desirably combined into many other different systems or applications. It can also be used on doors or other passageways. Other applications include, for example, but not limited to, using the invention in aerospace, on ships, automobiles or other vessels, cages or other settings where a slim, durable grille can be used. Also, various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

[0086] Although we have attempted to comprehensively describe the embodiments in detail to cover all possible aspects, those skilled in the art would recognize that other versions of the disclosure are also possible. For example, we describe the window grille as a conventional sliding type, where two inner frames slide upon tracks. However, the window grille can also be designed with fixed inner frames or inner frames

that are affixed with a grille inner pivot so that they open at a pivot point. Further, designs can include more than two inner frame assemblies.

What is claimed is:

1. A cylindrical, hollow crossbeam for a window grille,
 - wherein the interior of said crossbeam is reinforced with an internal circular tube that extends the length of the crossbeam;
 - wherein said circular tube is connected to the interior of the crossbeam at both sides and the bottom to form three separate chambers; and
 wherein the top of the internal circular tube is open to form a c-shaped structure, and the base of the c-shaped structure extends vertically to contact the interior of the crossbeam at the bottom,

 wherein the cross-section of the crossbeam is from 16 to 18 mm in height and 8 to 9 mm in width.
2. The crossbeam of claim 1, wherein the internal circular tube forms a screw port at each side of the crossbeam.
3. The crossbeam of claim 1 produced by extrusion process.
4. The crossbeam of claim 1, wherein the sides of the inner circular tube are both directly connected to the interior of the crossbeam.
5. The crossbeam of claim 1, wherein the crossbeam is made of aluminum with a thickness of 1 to 1.5 millimeters.
6. A window grille comprising:
 - a) an outer frame assembly; and
 - b) at least two panels that form an inner frame assembly, said panels comprised of an inner top frame bar, inner lower frame bar, two inner side frame bars and crossbeams according to claim 1.

7. The inner frame assembly of claim 6 wherein track slide blocks connect the inner top frame bar and inner lower frame bar with two inner side frame bars.
8. The window grille of claim 6, wherein the crossbeams are spaced at a maximum of 135 millimeters apart from each other.
9. The window grille of claim 6, wherein the crossbeams include a screw port on each end for being bolted or secured by screws to the inner side frame bars.
10. The window grille of claim 6, wherein the inner frame assembly with fitted attachable bars can be fitted into the outer frame assembly.
11. An inner frame assembly of a window grille comprising:
 - a) a top, bottom and two side frame bars;
 - b) horizontal crossbeams according to claim 1, wherein said crossbeams include screw ports on each end; and
 - c) track slide blocks that connect the top and bottom frame bars to the side frame bars.
12. The window grille of claim 11, wherein the crossbeams are spaced at a maximum of 135 millimeters apart from each other.
13. The window grille of claim 11, wherein the screw ports secure the horizontal cross beam crossbeam to the inner two side frame bars.