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(54) **ADJUSTABLE ALL-SEASON WINDOW AWNING/LIGHT SHELF AND OPERATING MECHANISM THEREFOR**

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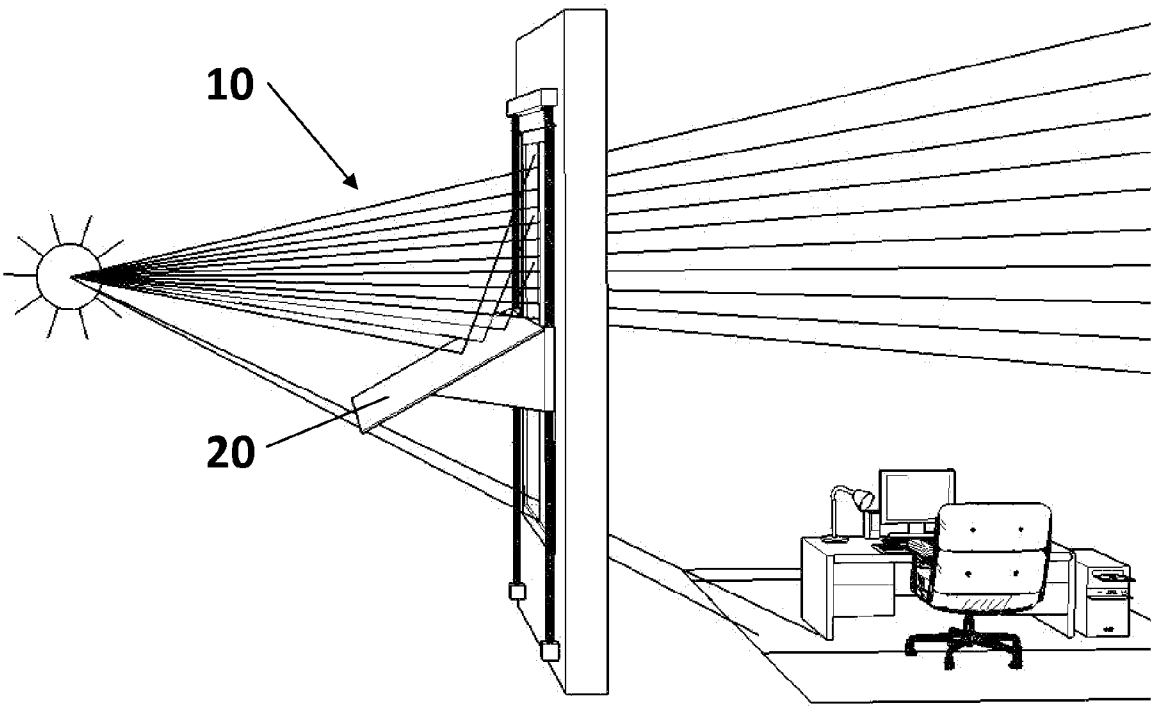
(57) **ABSTRACT**

An adjustable window awning/light shelf includes a canopy attached to support elements installed on both sides of the window. The support elements are engaged with vertical drive screws providing for the possibility of moving the canopy up and down. Each drive screw is connected with a common drive shaft. During the cooling season, when the window needs to be shaded, the canopy is disposed at the top of the window. When shade is not required, the canopy is brought down to the bottom of the window by rotating the drive shaft, which in turn rotates the drive screws and moves the support elements with the canopy down. When in the bottom position, the awning performs as a light shelf, reflecting sunlight from its top surface into the window and increasing the amount of sunlight and solar heat entering the building through the window.



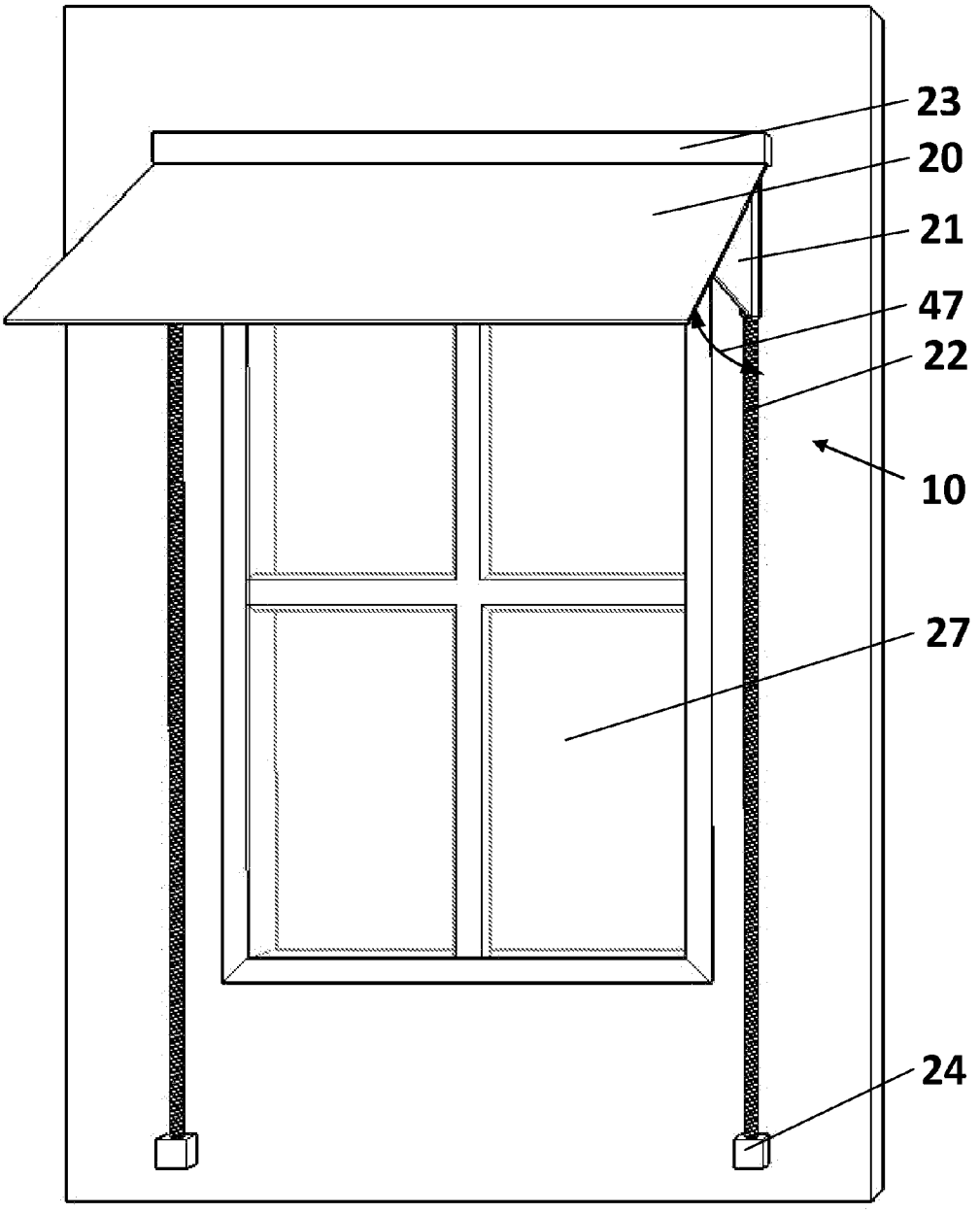


FIG. 1

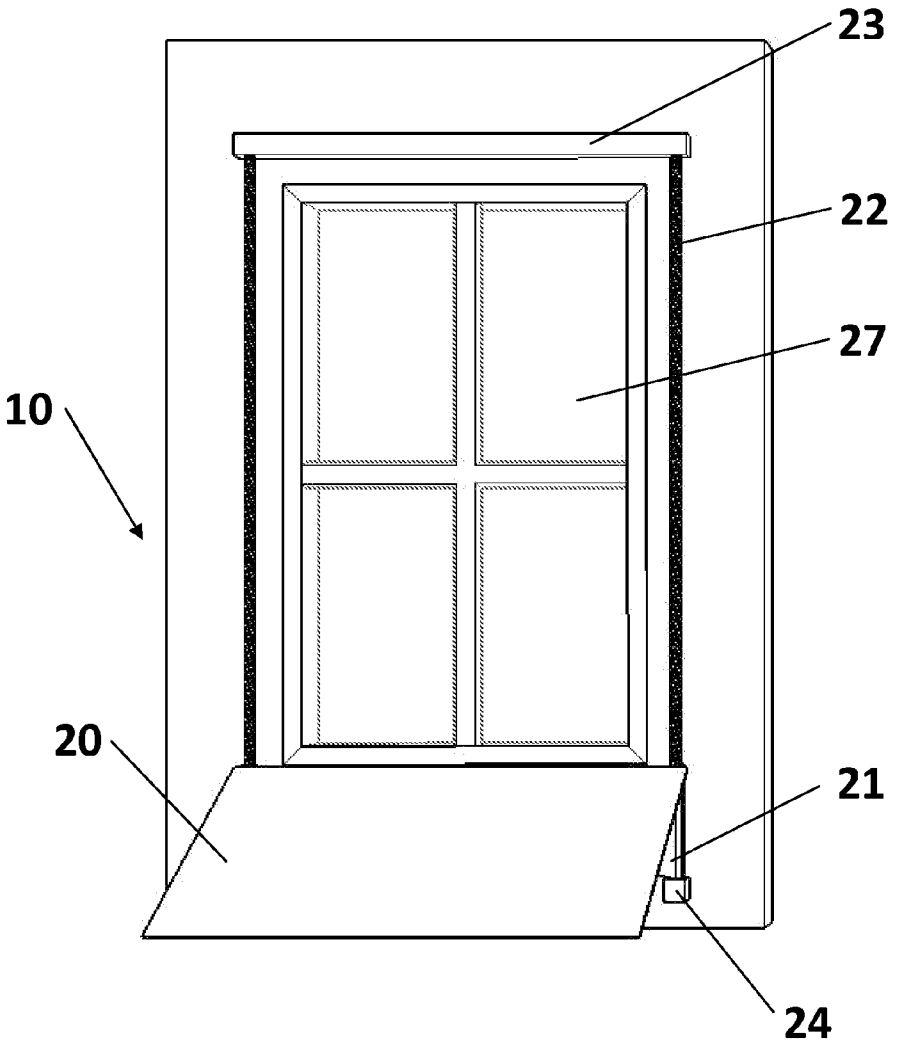


FIG. 2

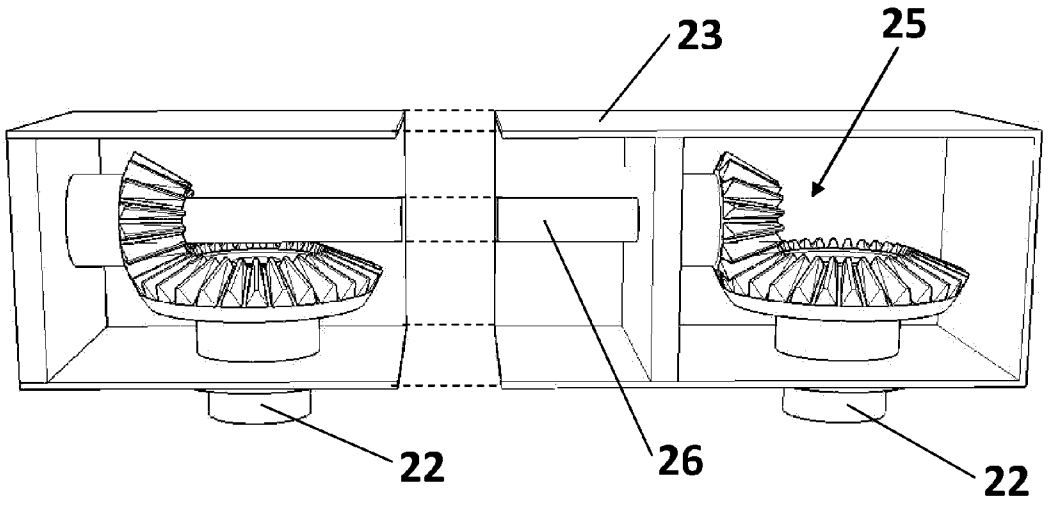


FIG. 3

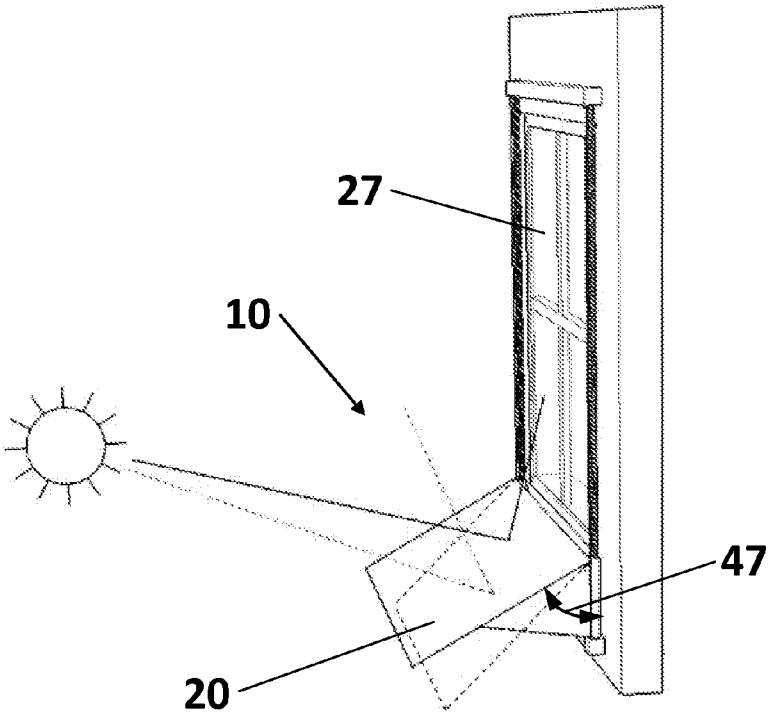


FIG. 4

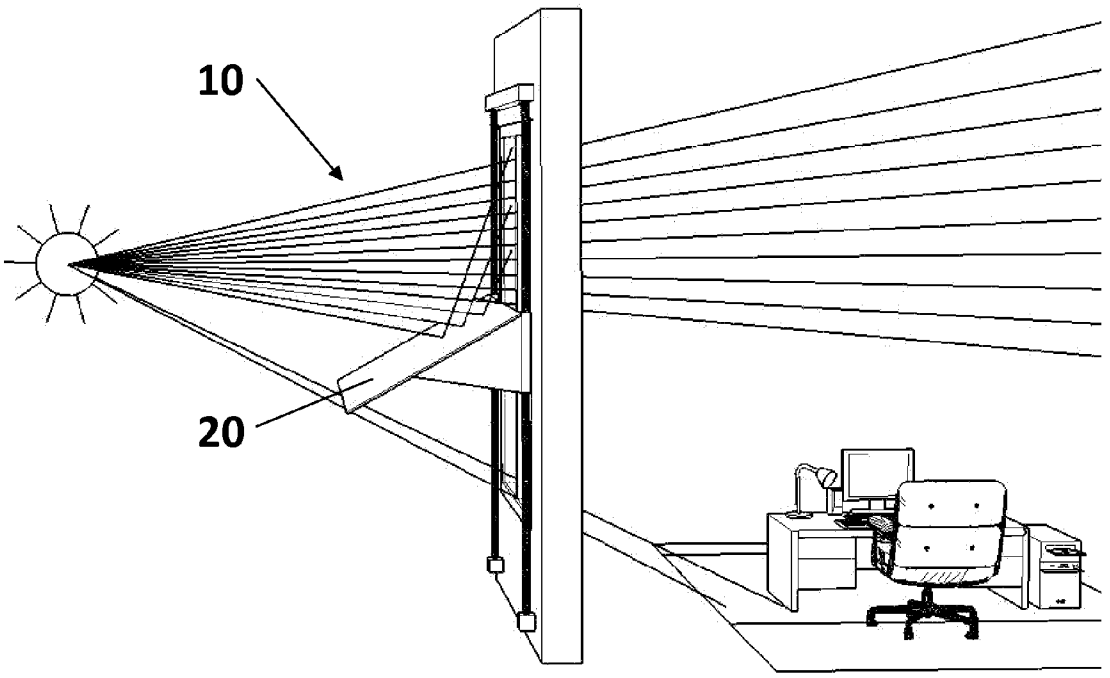


FIG. 5

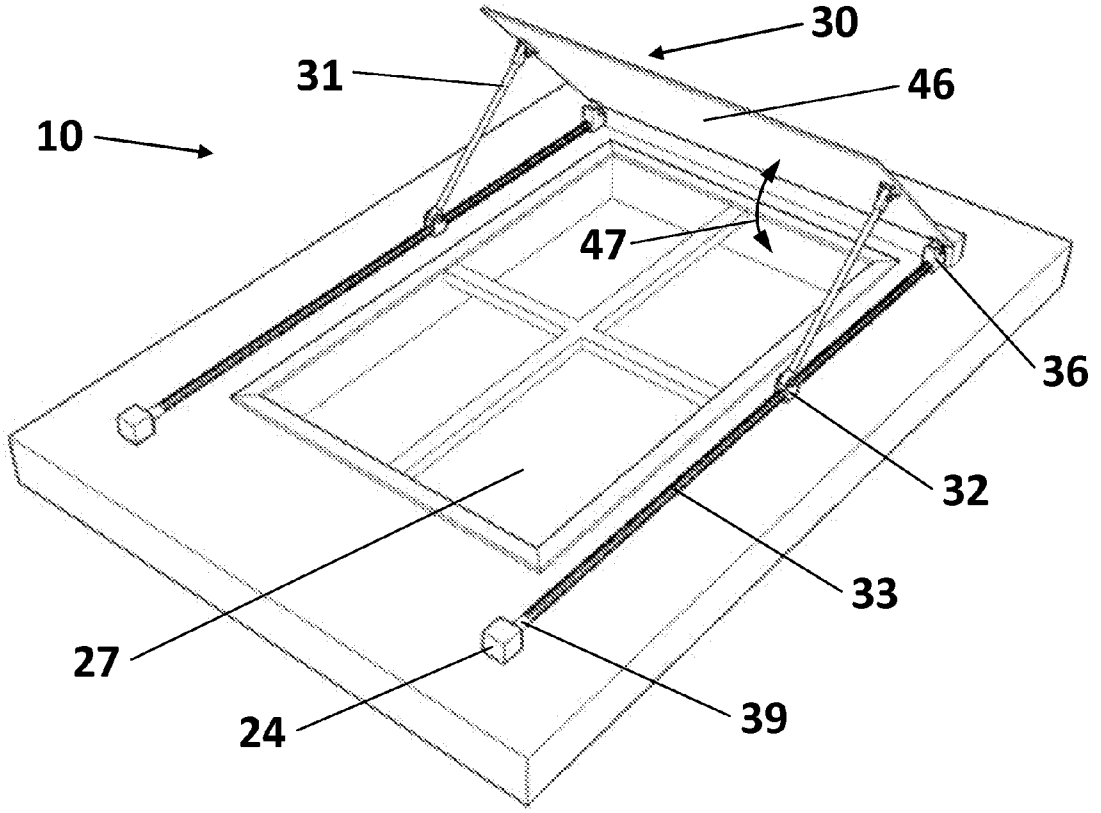


FIG. 6

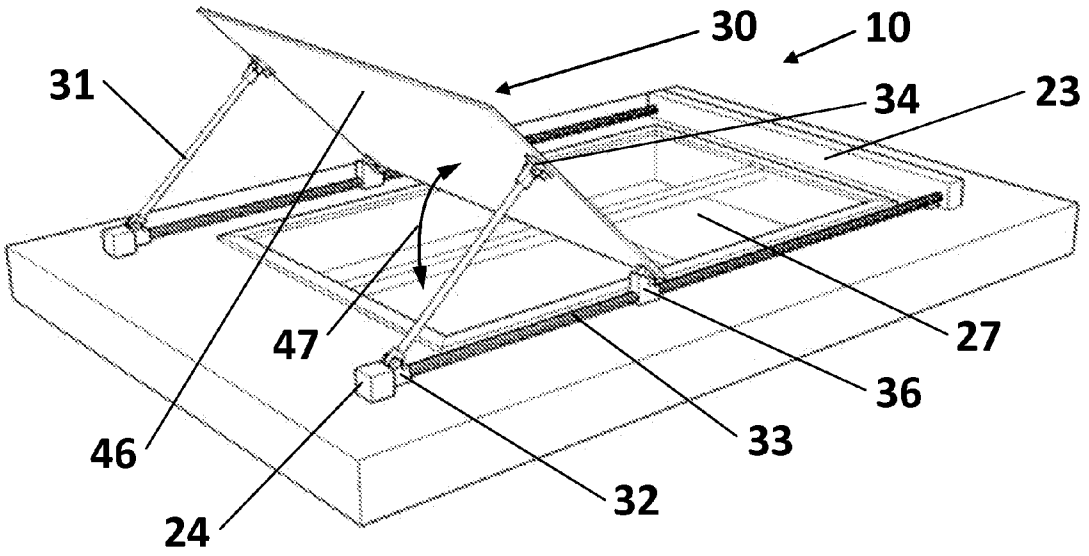


FIG. 7

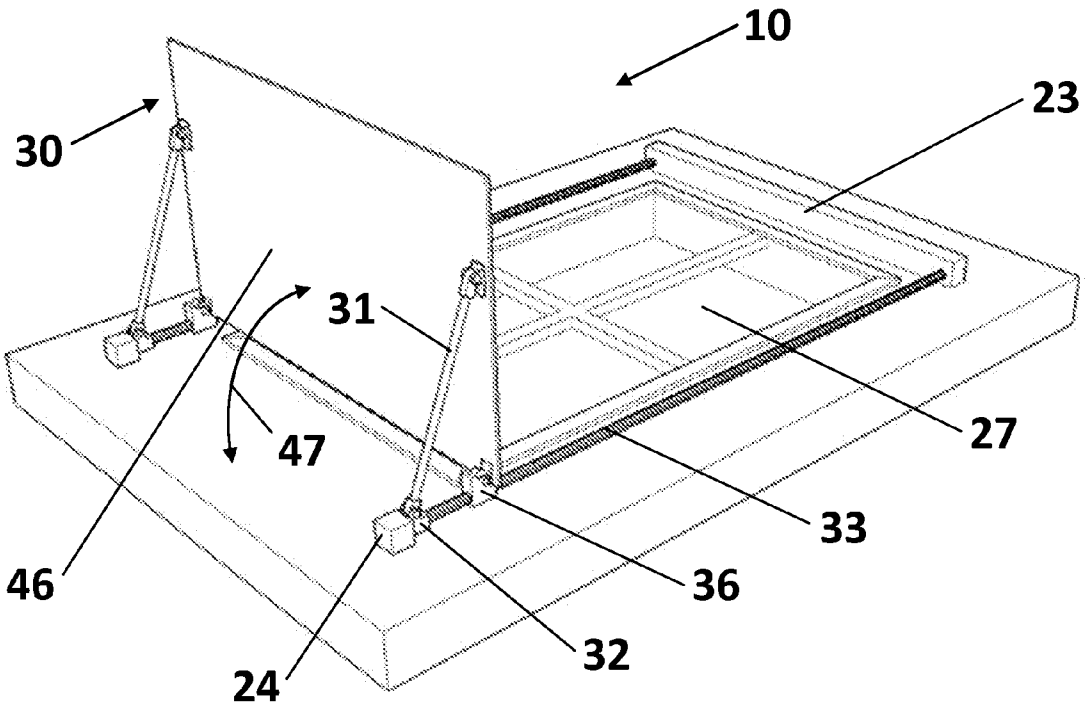


FIG. 8

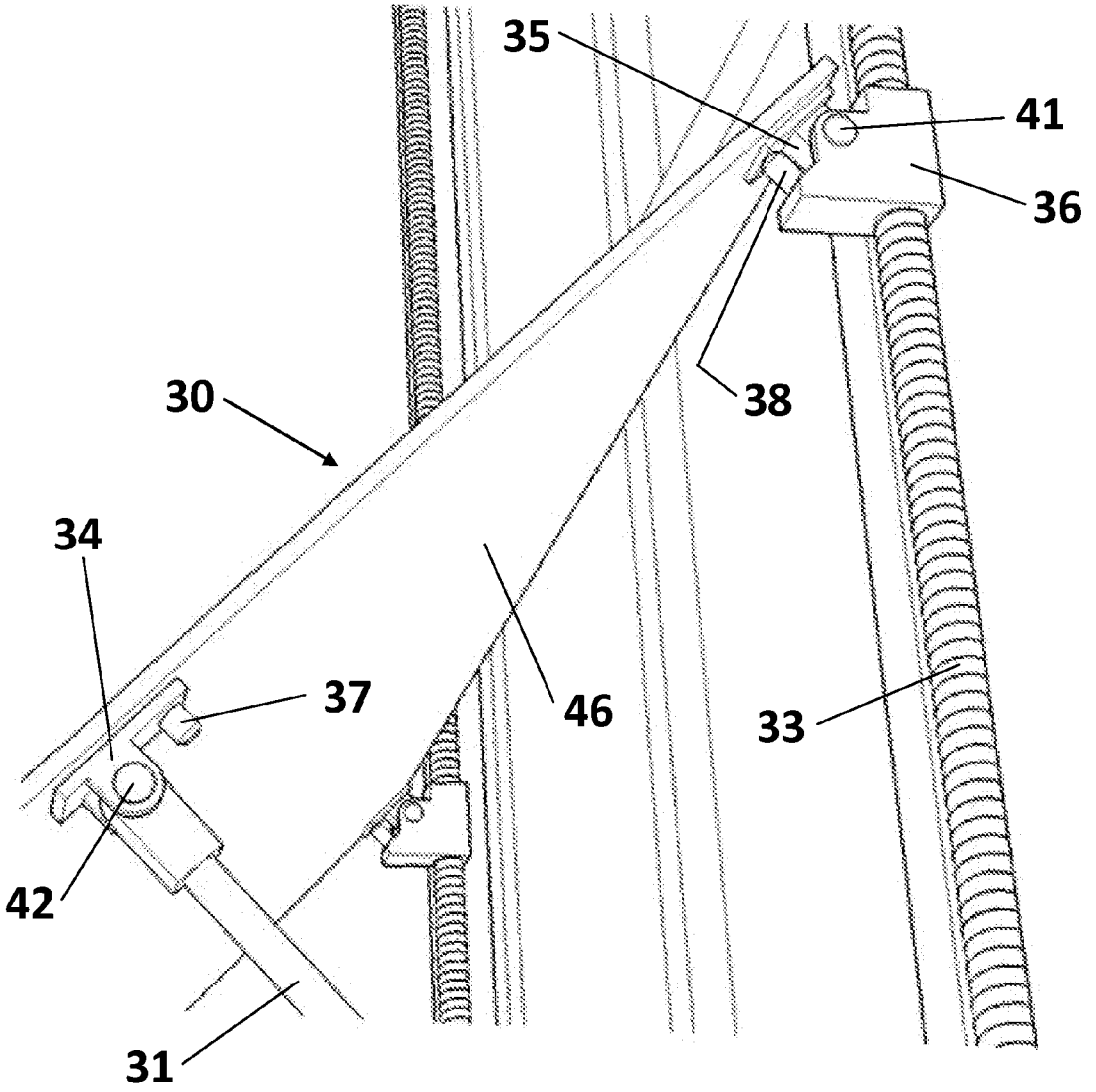


FIG. 9

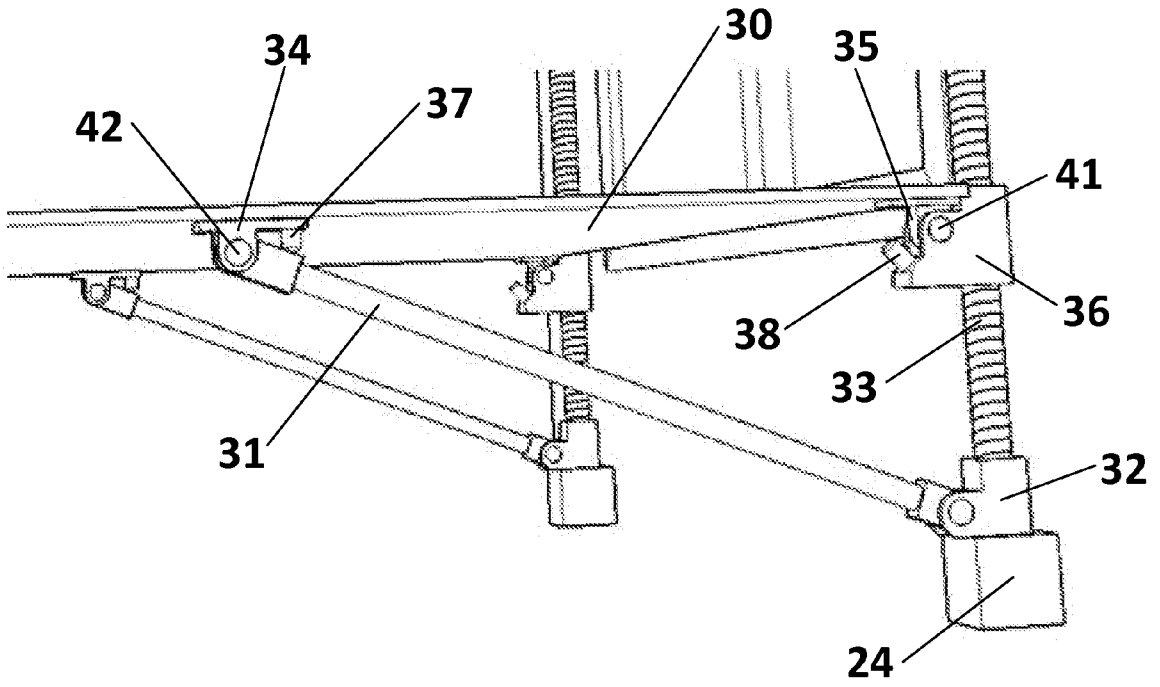


FIG. 10

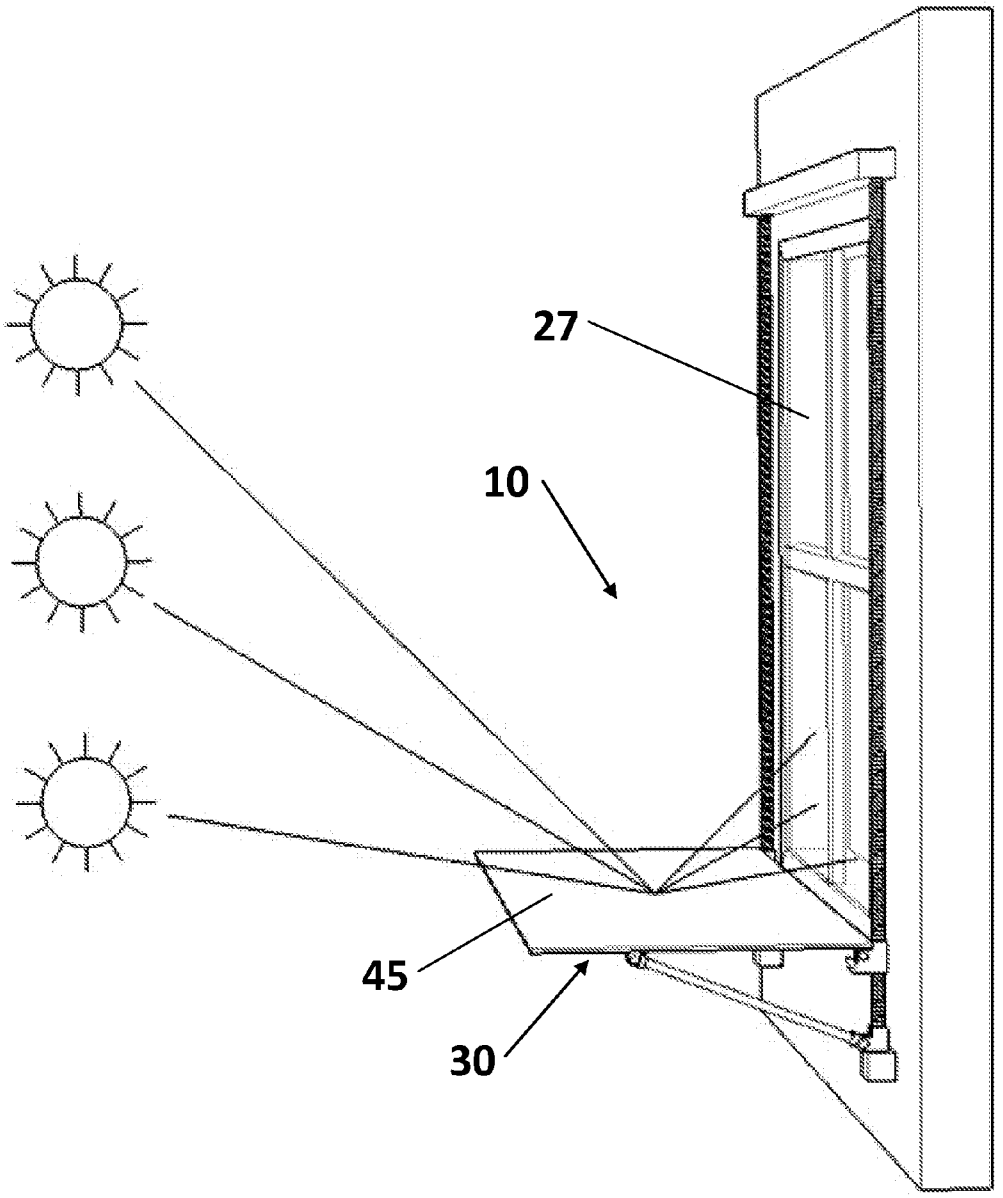


FIG. 11

ADJUSTABLE ALL-SEASON WINDOW AWNING/LIGHT SHELF AND OPERATING MECHANISM THEREFOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

REFERENCE TO SEQUENCE LISTING, A TABLE, OR A COMPUTER PROGRAM LISTING COMPACT DISC APPENDIX

[0003] Not Applicable

BACKGROUND OF THE INVENTION

[0004] This invention relates to window awnings and more particularly to adjustable window awnings.

[0005] Window awnings are used to protect buildings, including building interiors, from excessive gain of solar heat through windows, and also as architectural elements to enhance aesthetic appeal of building exteriors. Shading windows with awnings is one of the most popular methods of increasing energy efficiency of buildings. By lowering temperature inside the building during the air conditioning season, awnings create savings in cooling energy. According to a 2007 study by the University of Minnesota entitled "Awnings in Residential Buildings," awnings may reduce consumption of cooling energy by up to 69% and peak electricity demand by up to 49%, depending on the building location and some other factors.

[0006] During the heating season, however, window awnings may block desirable passive gain of solar heat, partially offsetting energy savings achieved during the cooling season. Therefore, to achieve the highest energy savings, it is advisable to remove or retract window awnings during the period when the building needs to be heated. Because removing awnings for the winter season is inconvenient and could be expensive, it is preferable to use awnings that may be retracted or adjusted to allow desirable solar heat to reach the building interior through windows.

[0007] Such retractable or adjustable window awnings are well known in the industry and usually are made of fabric. A retractable fabric awning is retracted by rolling the fabric up onto a roller rotatably attached to the building. Even though retractable fabric awnings have been in use for decades, they are not sufficiently durable and require periodic replacement of the fabric. Fabric colors are prone to fading, reducing the aesthetic appeal of such awnings.

[0008] Also known are retractable or adjustable rigid awnings. An example of such adjustable awnings is described in U.S. Pat. No. 2,791,009 to Wagner. It is a louver type awning where louvers are operated by a link mechanism. Among the disadvantages of such awning is the existence of an excessive number of movable parts subject to weather elements, which makes it prone to malfunction. Also, such awning cannot be retracted for the winter season and therefore inevitably creates shade when it is not needed. A collapsible rigid awning is described in U.S. Pat. No. 6,202,363 to Chang. It may be collapsed when shade is not required, however its operating mechanism is complicated, consisting of many movable parts subject to weather elements, and also is prone to malfunction. In addition, when in the collapsed position, such awning requires substantial additional side space approximately equal to the length of its panels. Another type of retractable rigid awnings is available on the market in the form of roll-up awnings. Such awning consists of narrow aluminum strips connected to each other with ropes or bands and is retracted by rolling these strips up onto a roller, similarly to retractable fabric awnings. This design does not allow for any side panels that may be desired, has many small movable parts and requires constant tension to be applied to the connecting ropes or bands to maintain the awning in a taut condition, which reduces the awning's durability. An adjustable sunshade is described in U.S. Pat. No. 6,421,966 to Braunstein, et al. The sunshade is adjustable only at the time of its installation and creates shade during the heating season, thereby greatly reducing any energy savings obtained during the cooling season.

[0009] All the above mentioned known retractable or adjustable window awnings provide no energy savings benefit during the heating season. Even when retracted or adjusted to prevent or reduce undesirable shading, they continue to age and deteriorate under the influence of weather without providing any benefits.

[0010] An awning design that aims at providing an opportunity to use the awning as both a shading device and a sunrays reflection device that would aid in heating the interior of the building in winter is described in U.S. Pat. No. 4,309,981 to Briggs, et al. In this design, the procedure to switch the awning function from shading to heating is cumbersome and requires direct access to the awning's canopy from the outside, but adjustment of the canopy's angle of inclination, on the contrary, may only be made from the inside of the building, which requires serious modifications of an existing window. Another embodiment of the same invention also allows canopy adjustment to be performed only from the inside requiring extensive modifications of an existing window.

[0011] Another combination window awning and solar heat unit is provided in U.S. Pat. No. 4,043,316 to Arent. In this combination unit, the lower part of the window is continually closed during the summer months, reducing the amount of daylight entering the building. The awning may be adjusted only by direct manual access from the outside. During winter, snow and ice will accumulate behind the upper awning panel when it is rotated up into its heating position. Neither of these last two inventions allows for the entire process of changing the awning function between shading and heating to be motorized.

BRIEF SUMMARY OF THE INVENTION

[0012] The present invention provides an adjustable window awning that also may be used as a light shelf. The awning includes a canopy attached to support elements on both sides of the window. The support elements are threaded and engaged with vertical drive screws providing for the possibility of moving the support elements with the canopy up and down relative to the window. Each drive screw is connected via a transmission gear with a common drive shaft. During the cooling season, when the window needs to be shaded, the canopy is disposed at the top of the window. When shade is not required, the canopy is brought down to the bottom of the window by rotating the drive shaft, which in turn rotates the drive screws and moves the support elements with the canopy down. The top surface of the canopy is made reflective, which

increases the amount of sunlight and associated solar heat entering the building through the window by reflecting additional sunlight into the window when the awning is in its bottom or intermediate position and performs as a light shelf. Such reflective surface also provides benefits during the summer time when the awning is in its top position. It reflects sunlight from the awning to keep the air between the awning and the window at a lower temperature.

[0013] An object of the present invention is to provide a simple, convenient and durable adjustable window awning that would reduce gain of solar heat through windows during the cooling season and may be moved out of the way and permit access of desirable solar heat into the building during the heating season.

[0014] Another object of the present invention is to provide an adjustable window awning that would increase gain of solar heat through windows during the heating season to provide additional energy savings.

[0015] A further object of the present invention is to provide an adjustable window awning that may be used as a light shelf.

[0016] A further object of the present invention is to provide an adjustable window awning that may be adjusted to shade a portion of the window, while allowing desired sunlight to enter the building through the window above and under the awning.

[0017] A further object of the present invention is to provide an adjustable window awning that may be easily operated either from inside or from outside of the building.

[0018] A further object of the present invention is to provide an adjustable window awning that may be easily operated manually or by power.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Other advantages of the present invention will be apparent to those skilled in the art from the following description of its embodiments with reference to the accompanying drawings wherein:

[0020] FIG. **1** is an isometric view of an adjustable window awning constructed in accordance with the present invention in its top position;

[0021] FIG. **2** is an isometric view of the adjustable window awning in its bottom position;

[0022] FIG. **3** is an isometric view of an operating mechanism of the awning of the present invention with the front panel removed;

[0023] FIG. **4** is a schematic of sunrays reflecting from the inclined top surface of the awning's canopy;

[0024] FIG. **5** is a view of the awning stopped in an intermediate position to block undesirable sunrays from a workstation;

[0025] FIG. **6** is a view of another embodiment of the present invention where the awning with an adjustable canopy angle is in its top position;

[0026] FIG. **7** is a view of the embodiment shown in FIG. **6** with the awning in the intermediate bottom position;

[0027] FIG. **8** is a view of the embodiment shown in FIG. **6** with the awning in the final bottom position;

[0028] FIG. **9** is an enlarged view of a top slider connected with a top panel bracket and a support arm connected with a bottom panel bracket when the awning in the position shown in FIG. **7**;

[0029] FIG. **10** is an enlarged view of both top and bottom sliders, top and bottom panel brackets and a support arm when the awning is in the position shown in FIG. **8**;

[0030] FIG. **11** is schematic of sunrays reflecting from the top surface of the awning's canopy into the window when the canopy is disposed substantially perpendicularly to the window plane and performs as a light shelf.

DETAILED DESCRIPTION OF THE INVENTION

[0031] Referring to the drawings, in particular to FIGS. **1** and **2**, where an adjustable window awning constructed in accordance with the present invention is generally designated by a numeral **10**, the awning includes a canopy **20** supported by support elements **21**. The support elements **21** are engaged with drive screws **22** connected with a housing **23** at the top and with bottom supports **24**.

[0032] As shown in FIG. **3**, each drive screw **22** is connected via a transmission gear **25** with a drive shaft **26**.

[0033] To lower the canopy **20** from its top position depicted in FIG. **1** to its bottom position depicted in FIG. **2**, the drive shaft **26** is rotated by using a manual drive gear or an electric motor (not shown). Rotation of the drive shaft **26** causes the drive screws **22** to rotate simultaneously and move down the support elements **21** along with the canopy **20**.

[0034] FIG. **4** shows sunrays reflecting from the canopy **20** into a window, when the canopy is in its bottom position, thereby increasing the amount of sunlight and solar heat entering the building through the window.

[0035] FIG. **5** shows the awning, which may be stopped in any intermediate position between its top and bottom positions, adjusted so that it blocks undesirable sunrays from a workstation while allowing desirable sunlight to enter the room through the window above and under the canopy **20**. At the same time, sunrays blocked by the awning reflect from the canopy's top surface into the window and partially compensate for the amount of daylight blocked by the awning.

[0036] In order for the awning to be effective both as a shading device during the cooling season and a sunlight reflective device, or light shelf, during the heating season, its canopy **20** should be inclined at a relatively large angle **47**, for example 60 degrees, to the window plane **27**, as shown in FIGS. **1** and **2**, and also in FIG. **4** in solid lines. Otherwise, if the canopy is inclined at a lesser angle, for example 45 degrees, sunrays will not reflect into the window when the awning is in its bottom position, and will instead reflect into the empty space in front of the window, as shown in FIG. **4** in dashed lines.

[0037] However, the awning would be more effective in its top position, as a shading device, if inclined at a lesser angle, for example 45 degrees, and more effective it its bottom position, as a sunlight reflective device, if inclined at a greater angle, ideally 90 degrees, to the window plane **27**. Such perpendicular disposition would ensure the reflection of sunrays from the canopy's top surface **45** into the window regardless of the sun's angle above the horizon, as shown in FIG. **11**. The awning would perform as an exterior light shelf increasing desirable solar heat gain and providing additional daylight during the winter season. In practice, the angle of awning inclination would be slightly less than 90 degrees, to provide for water drainage.

[0038] FIGS. **6-11** show another embodiment of the present invention where the angle **47** of the awning canopy **30** inclination relative to the window plane **27**, i.e. the angle between the canopy's bottom surface **46** and the window plane,

changes from approximately 45 degrees in the top position to 90 degrees in the bottom position.

[0039] This embodiment includes a canopy **30** supported by support arms **31**. Bottom ends of the support arms **31** are rotatably attached to bottom sliders **32** engaged with drive screws **33**. Top ends of the support arms **31** are rotatably attached to bottom canopy brackets **34** affixed to the canopy **30**. Top canopy brackets **35** are affixed to the canopy **30** and rotatably attached to top sliders **36** engaged with the drive screws **33**.

[0040] To lower the canopy **30** from its top position depicted in FIG. **6** to its bottom position depicted in FIG. **8**, the drive shaft **26** is rotated by using a manual drive gear or an electric motor (not shown). Rotation of the drive shaft **26** causes the drive screws **33** to rotate simultaneously and move down the sliders **32** and **36** along with the support arms **31** and canopy **30**.

[0041] Bottom sections **39** of the drive screws **33** are unthreaded, as shown in FIG. **6**, over a length not less than the length of threads inside the bottom sliders **32**. When the bottom sliders **32** reach the bottom supports **24**, the bottom sliders disengage from the threads of the drive screws **33**. FIG. **7** shows the intermediate bottom position of the awning when the bottom sliders **32** have reached the bottom supports **24** and are disengaged from the threads of the drive screws **33**. Continued rotation of the drive screws **33** causes the top sliders **36** to continue their movement down the drive screws **33** while the bottom sliders **32** remain stationary. The canopy **30** rotates around top pivots **41** installed in the top sliders **36** and bottom pivots **42** installed in the bottom canopy brackets **34**. The angle **47** between the canopy's bottom surface **46** and the window plane **27** increases. Such downward movement of the top sliders **36** continues until downward movement stops **37** attached to the bottom canopy brackets **34** reach the surface of the support arms **31** as shown in FIG. **10**. At this point, the canopy **30** is disposed at an angle of approximately 90 degrees to the window plane **27** as shown in FIG. **8**. It would be advisable to fix the bottom sliders **32** in this position with releasable locks (not shown) to prevent their movement under the influence of wind on the canopy **30**. Such locks are well known in the industry.

[0042] To raise the canopy **30** from its final bottom position depicted in FIG. **8** to its top position depicted in FIG. **6**, the drive shaft **26** is rotated in the opposite direction. Such rotation causes the top sliders **36** to move up the drive screws **33** pushing the top canopy brackets **35**. This causes the canopy **30** to rotate around the top pivots **41** and bottom pivots **42**. The bottom sliders **32** remain stationary until upward movement stops **38** attached to the top sliders **36** reach the surface of the top canopy brackets **35** as shown in FIG. **9**.

[0043] At this point, the rotation of the canopy **30** around the pivots **41** and **42** stops and the canopy continues to move up toward the housing **23**, retaining its angle of inclination relative to the window plane **27** and pulling the support arms **31**, which, in turn, pull up the bottom sliders **32**. The bottom sliders **32** reengage with the threads of the drive screws **33** and both top and bottom sliders, the canopy **30** and the support arms **31** continue moving up until the canopy **30** reaches the housing **23**.

[0044] It will be understood that this invention is not restricted to the embodiments described and illustrated above. A different mechanism may be employed to move the canopy between its top and bottom positions, for example a mechanism located at the bottom of the drive screws **22** or **33** or a mechanism employing a different method of moving the canopy between its top and bottom positions, such as a sliding motion mechanism as opposed to a screw drive. Stopping the canopy at the desired angle of inclination may be accomplished in a variety of different methods known in the industry. The drive shaft **26** may be rotated manually, either from the outside or from inside of the building, by using simple transfer mechanisms well known in the industry. The drive shaft **26** may be rotated by using a remotely controlled electric motor, also well known in the industry, which may be powered by solar panels. The stops **37** and **38** may be replaced with other devices known in the industry that would stop the canopy in its desired position during its respective downward and upward movements. The canopy may have a concave top surface shaped to maximize sunlight reflection into the window. The drive screws **22** and **33** may be screened with enclosures for aesthetic purposes. Any such modifications will remain within the scope of the present invention.

1-6. (canceled)

7. An adjustable window awning/light shelf, said awning comprising:

a canopy positioned, when in an awning position, near a top part of a window, comprising a top surface and a bottom surface and inclined at a certain angle between said bottom surface and said window;

an operating mechanism to move said canopy down into a light shelf position and back up into an awning position while maintaining said top surface facing up and said bottom surface facing down.

8. An adjustable window awning/light shelf of claim **7** additionally comprising means to increase said angle when bringing said canopy into a light shelf position and to decrease said angle when bringing said canopy into an awning position.

9. An adjustable window awning/light shelf of claim **7**, wherein said canopy is rigidly attached to support elements and said operating mechanism comprises vertical guides extending from top to bottom of said window and means to move said support elements together with said canopy along said vertical guides while maintaining said angle.

10. An adjustable window awning/light shelf of claim **9**, wherein said vertical guides are drive screws, said support elements are threaded and engaged with said drive screws, each of said drive screws is connected via a transmission gear with a common drive shaft, whereby rotating said drive shaft causes said drive screws to rotate simultaneously and move said support elements along said drive screws.

11. An adjustable window awning/light shelf of claim **7** additionally comprising:

top brackets and bottom brackets affixed to said canopy;

support arms, top ends of said support arms being attached to said bottom brackets;

top sliders, said top brackets being attached to said top sliders;

bottom sliders, bottom ends of said support arms being attached to said bottom sliders.

12. An adjustable window awning/light shelf of claim **11**, wherein said operating mechanism comprises vertical guides extending from top to bottom of said window and means to move said sliders along said vertical guides.

13. An adjustable window awning/light shelf of claim **12**, wherein said vertical guides are drive screws, said top and bottom sliders are threaded and engaged with said drive screws, each of said drive screws is connected via a transmis-

sion gear with a common drive shaft, whereby rotating said drive shaft causes said drive screws to rotate simultaneously and move said sliders along said drive screws.

14. An adjustable window awning/light shelf of claim **13**, wherein said top ends of said support arms are rotatably attached to said bottom brackets, said top brackets are rotatably attached to said top sliders, said bottom ends of said support arms are rotatably attached to said bottom sliders, said drive screws are connected with said drive shaft at their top ends and supported by bottom supports at their bottom ends, said drive screws have bottom sections adjacent to said bottom supports unthreaded, whereby rotating said drive shaft causes said drive screws to rotate simultaneously and move said top and bottom sliders down, said bottom sliders to disengage from threads of said drive screws, upon reaching said unthreaded bottom sections, and become stationary, and said top sliders to continue their downward movement, which causes said canopy to rotate and increase said angle to assume a bottom light shelf position, and rotating said drive shaft in an opposite direction causes said top sliders to move up, said canopy to rotate and decrease said angle, said bottom sliders to reengage with threads of said drive screws, said top and bottom sliders to move simultaneously upward and said canopy to assume a top awning position.

15. An adjustable window awning/light shelf of claim **14**, additionally comprising:

downward movement stops limiting canopy rotation during its downward movement to stop said canopy in a desired light shelf position;

upward movement stops limiting canopy rotation during its upward movement to stop said canopy in a desired awning position.

* * * * *