Jan. 13, 1942. A. H. CHILTON 2,269,579

WINDOW AND BLIND ARRANGEMENT

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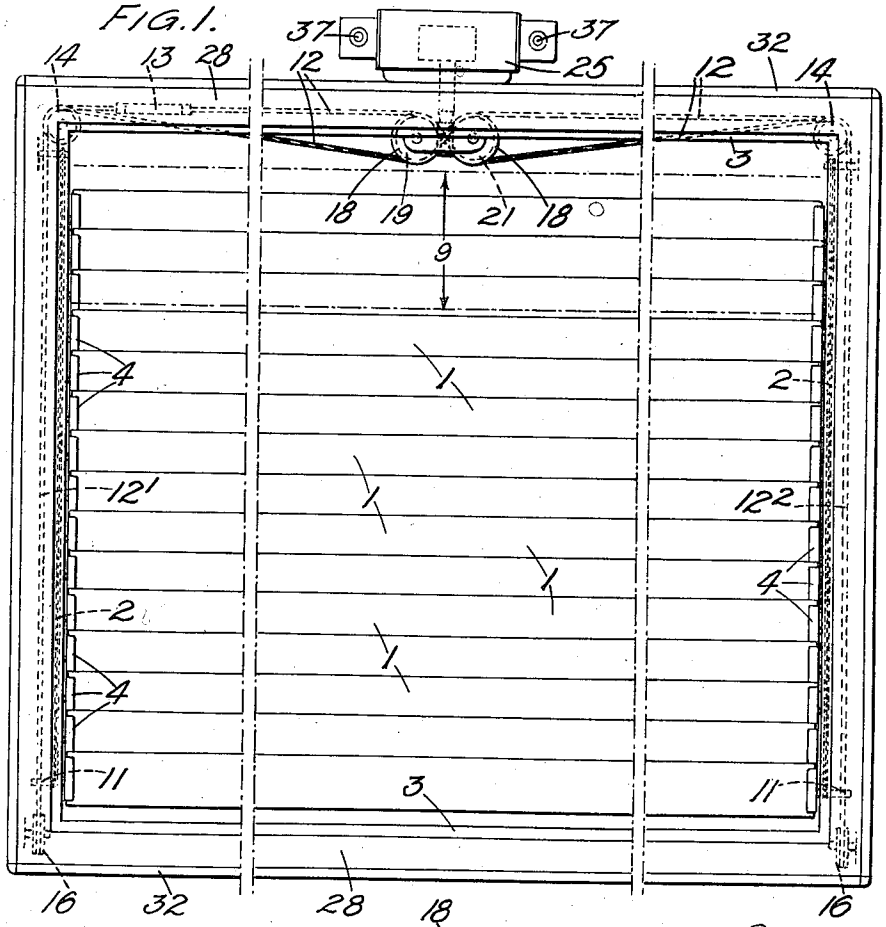
FIG. 1.



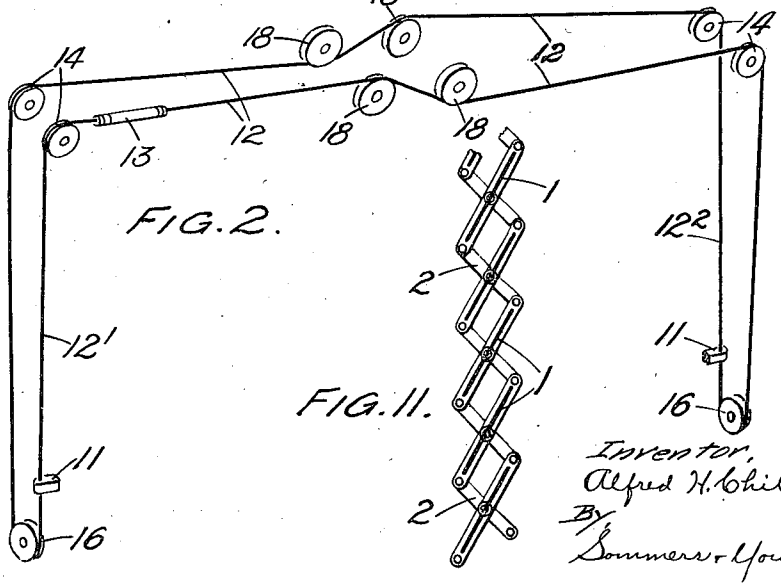


FIG. 2.

FIG. 11.

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FIG. 3.

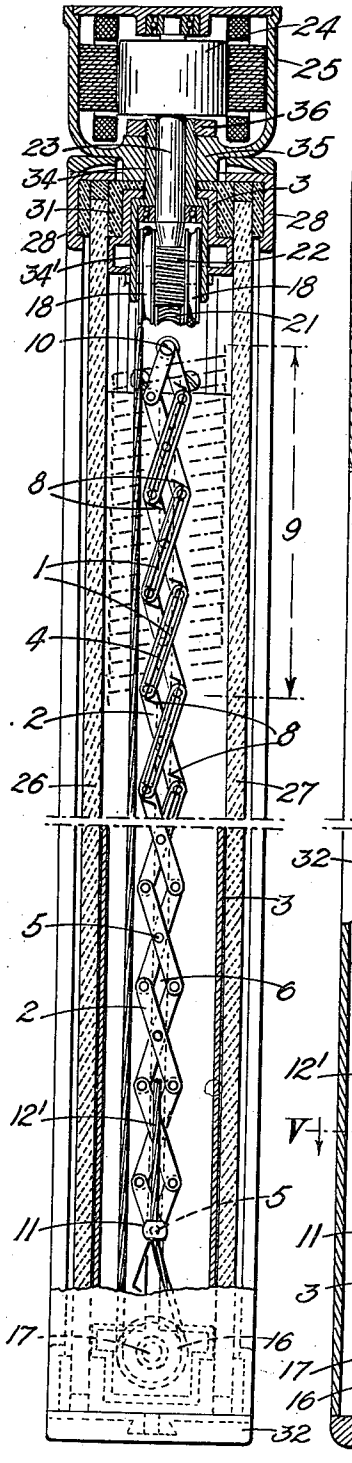

FIG. 4.

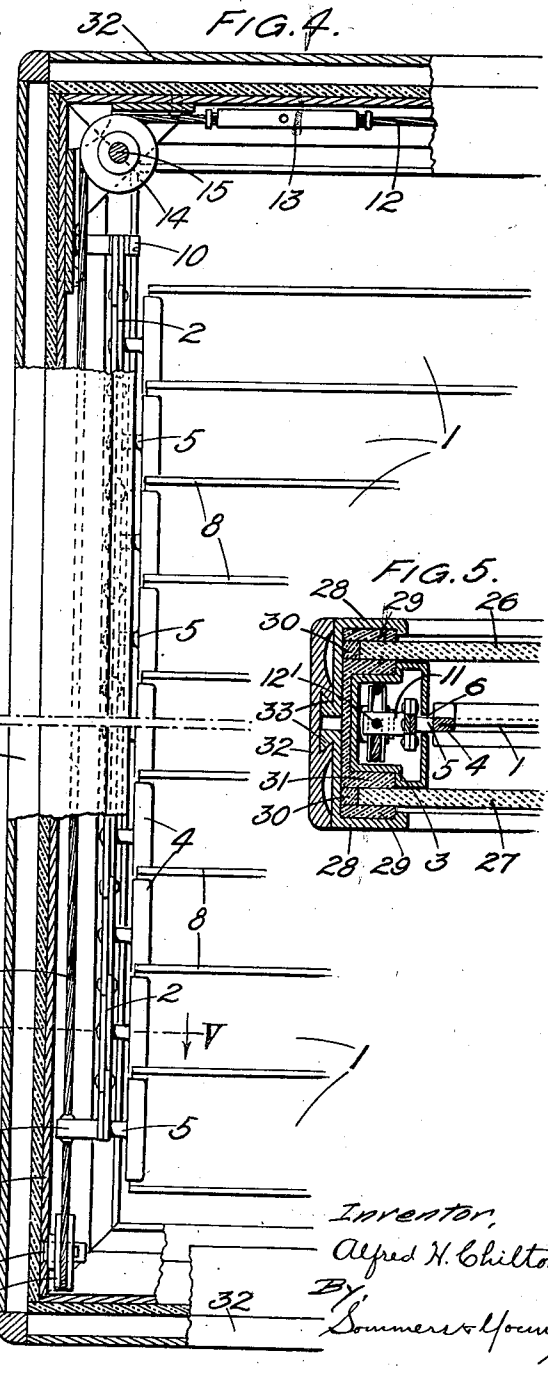

FIG. 5.

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WINDOW AND BLIND ARRANGEMENT

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FIG. 7.

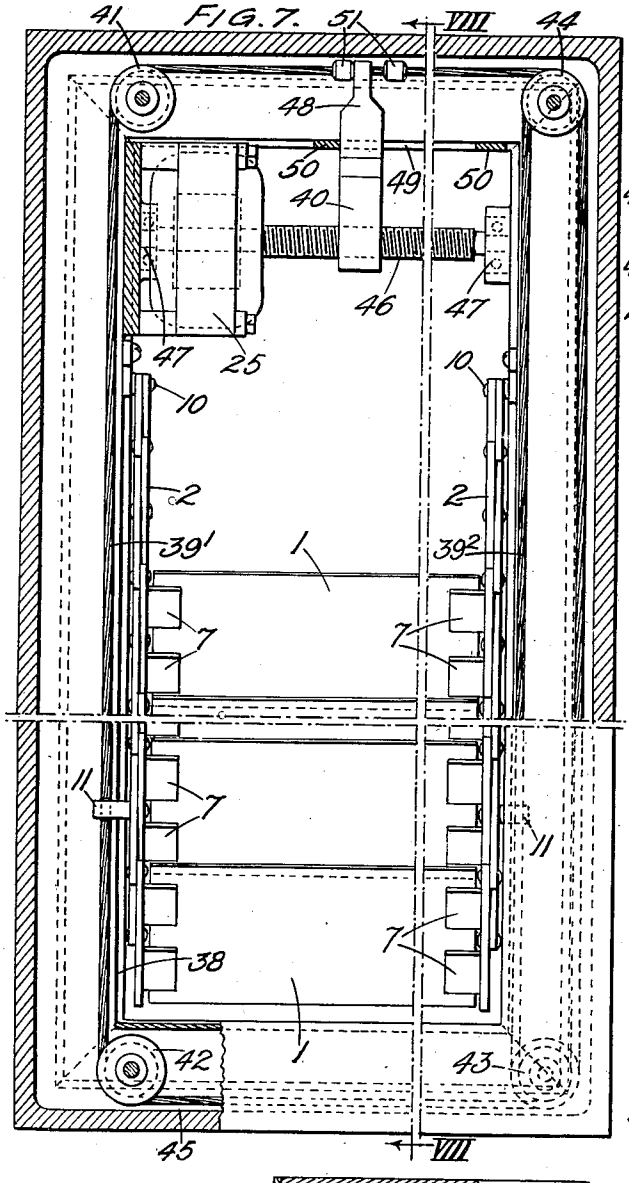

FIG. 8.

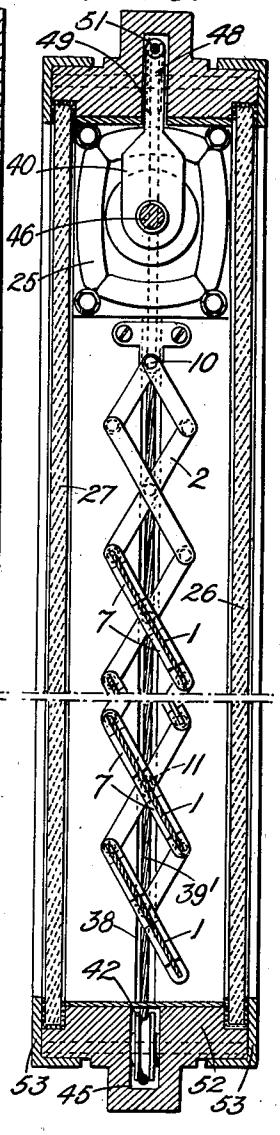

FIG. 6.

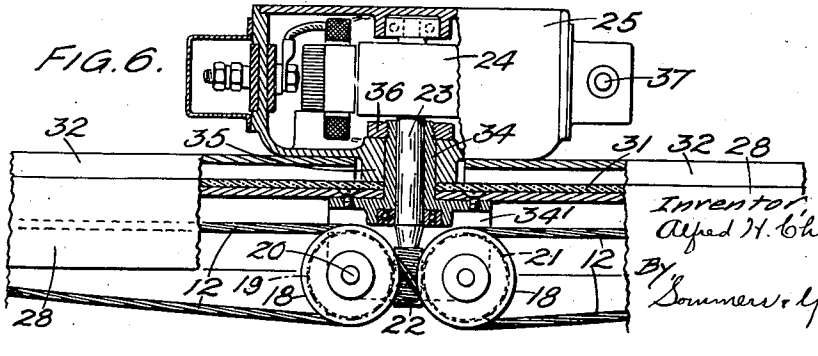

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FIG. 9.

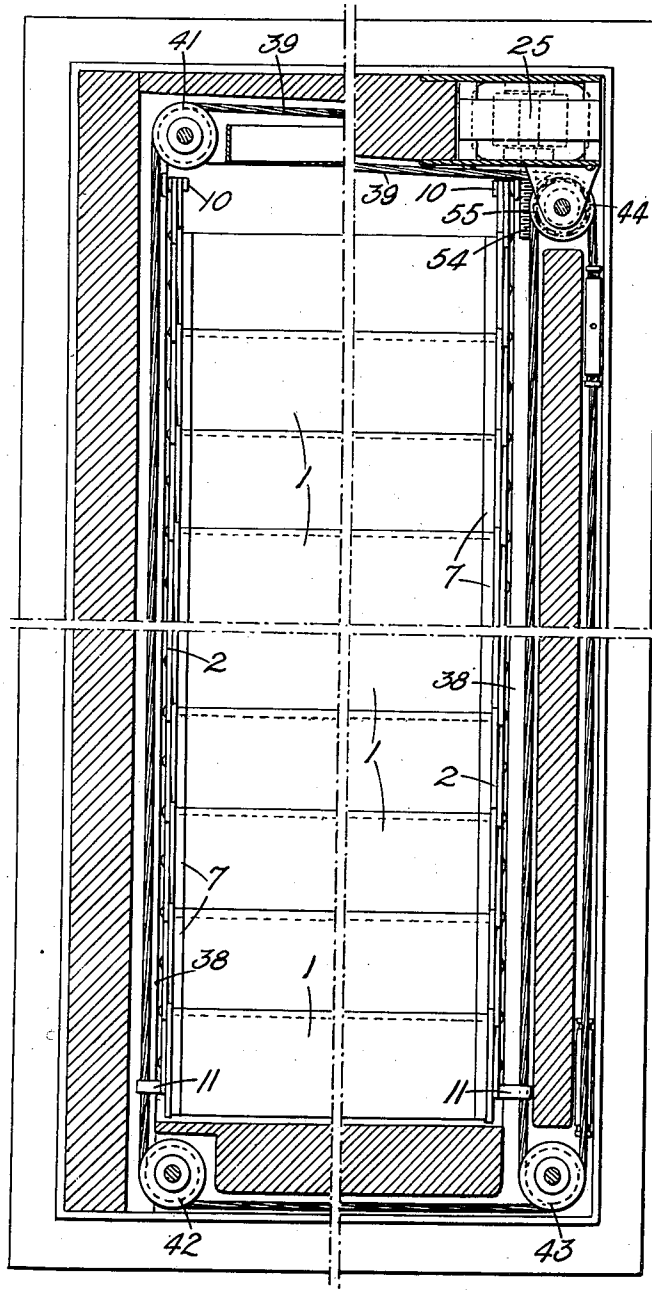
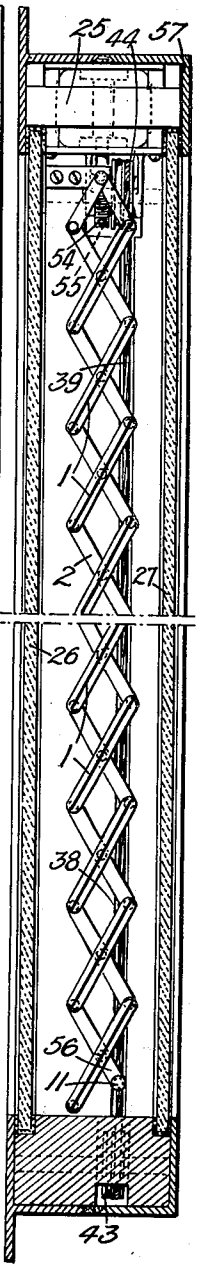


FIG. 10.



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Patented Jan. 13, 1942 2,269,579

UNITED STATES PATENT OFFICE

2,269,579

WINDOW AND BLIND ARRANGEMENT

Alfred Henry Chilton, London, England, assignor, by mesne assignments, to The Safety Car Heating & Lighting Company, Inc., New York, N. Y., a corporation of Delaware

Application May 24, 1938, Serial No. 209,825
In Great Britain May 28, 1937

18 Claims. (Cl. 189—64)

This invention concerns improvements relating to windows and window blinds, screens or shutters (hereinafter termed blinds) and has for its principal object to provide an effective arrangement for use in cases where it is desired to limit the penetration through the window of thermal radiation.

An example of a case where the effective solution of this problem is of especial importance is that of railway coaches provided with air-cooling equipment for use in hot climates. For practical reasons, there are limits to the capacity of the cooling equipment and it is therefore essential that the leakage of heat into the coach should be reduced to a minimum. Thermal insulation of the body of the coach leaves the windows as vulnerable points by which considerable heat can enter.

The use of double windows cuts down the entry of heat to some extent and better results can be obtained by the use of external shutters in conjunction with such double windows. In practice, however, there are various objections to the latter arrangement, particularly on railway coaches. For example, it would be difficult to make satisfactory provision for adjustment of the shutters. Also it would be difficult to keep the window-arrangement clean and in good order.

The last-named objection applies also to arrangements, as proposed heretofore, in which a blind is provided between the panes of a double window. Particularly in the case of railway coaches which are exposed for unlimited periods not only to every kind of adverse weather condition but also to constant steam, smoke and dirt, the proposed arrangements would allow moisture and dust to enter the space between the panes, obscuring the latter and fouling the means for operating the blind.

With the object of overcoming these difficulties, the arrangement according to the invention comprises a double window with the space between the panes hermetically sealed and a blind adapted for being lowered or extended in the said space by means operated from outside the said space. Preferably, the panes are hermetically sealed around the entire peripheries thereof by sealing means held tight by removable mechanical means. With this arrangement, not only can the penetration of thermal radiation be reduced to a minimum and satisfactory provision made for adjusting the blind in the space between the panes, but also the said blind and the adjusting means will be completely protected, so that they will remain unaffected by the influences of the weather, steam and so forth for indefinite periods.

In a preferred form of the invention, the blind is preferably composed of slats which, in the lowered or extended condition of the blind, are spaced from one another in inclined overlapping relationship so as substantially to prevent the direct entry of thermal radiation but permit the entry of a certain amount of light. In the other extreme position, the slats are collected together to leave the window substantially unobstructed.

Advantageously the slats are fixedly connected to respective links of lazy tongs whereby the said blind is operated. With this arrangement, as will be understood, the slats are positively set in the inclined overlapping relationship, as well as lowered or extended, by the lazy tongs. Furthermore, the slats are collected together by even closing up throughout the length of the blind and not progressively from one end. Consequently, the window is not inconveniently obstructed in intermediate positions of the blind.

The blind may be operated through the intermediary of endless cable means so devised that the blind is both opened and closed by a positive driving action. Reliance upon gravity or spring-action can then be avoided. The blind may be operated by the power of an electric motor enclosed in the sealed space between the panes of the window or enclosed in a sealed casing connected to the said space.

Examples of applications of the invention to the windows of railway coaches will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a general inside elevation of a preferred window and blind arrangement,

Fig. 2 is a diagrammatic view showing the cable disposition in the said arrangement,

Fig. 3 a composite view to a larger scale, the lower half being a side elevation with part of the frame broken away to show the lazy tongs and the upper half a vertical section at the middle of the window,

Fig. 4 an inside elevation of one side of the window, also to a larger scale and with parts of the frame broken away,

Fig. 5 a section on the line V—V in Fig. 4,

Fig. 6 a vertical section showing the mounting and driving arrangement for the motor,

Fig. 7 an inside elevation (with parts of the frame broken away) of a second arrangement,

Fig. 8 a section on the line VIII—VIII in Fig. 7,

Figs. 9 and 10 are views similar to Figs. 7 and 8 of a third arrangement, and

Fig. 11 is a diagrammatic elevation showing a modification.

In all of the arrangements illustrated, the blind is of the nature of a Venetian blind, but has the individual slats 1 carried by lazy tongs 2 located at the sides of the window. The slats are conveniently of metal, for example aluminium or a light alloy, or of wood or artificial resin with a cellulose finish and are mounted upon corresponding inner links of the lazy tongs. In the arrangement illustrated in Figs. 1–6, in which the lazy-tongs are to be concealed from view by a housing 3, the ends of the slats are forced tightly into slots in the inner faces of slat-holders 4 which extend substantially parallel to the inner links and are connected centrally thereto by necks 5 passing through a vertical slot 6 in the housing 3. As in the arrangements of Figs. 7–10, the slats may alternatively be forced into slots between cheeks 7 on the faces of the inner links themselves or into slots cut in the said links. These modes of mounting the slats are not only simple and inexpensive, but permit of easy assembly of the said slats with the lazy tongs.

As shown in Figs. 1–6, the slats 1 are preferably provided with oppositely directed narrow flanges 8 at their longitudinal edges. These flanges not only stiffen the slats and assist in locating them in the parts 4 or 7, but also, by their overlapping in the lowered condition of the slats (Fig. 3), make it impossible to see through the blind. For merely stiffening the slats, these may alternatively be beaded or rolled at the longitudinal edges or a slat having a shallow W-shaped or curved cross-section may be employed.

The raised blind is to occupy a comparatively slight depth 9 (Fig. 3) at the upper part of the window (say one tenth of the total depth) and is to be lowered to a condition in which the slats slope downwardly and outwardly in slightly overlapping relationship at a small angle to the vertical, for example 15° in Figs. 1–6 and 30° in Figs. 7–10. The fixed pivot 10 of each lazy tongs is secured to the respective side of the window-frame nearly at the top thereof, but leaving a space for driving mechanism to be described. For the sake of simple manufacture, the pivots between the links of the lazy tongs are preferably so-called drive screws.

In Figs. 1–6, the lowermost pivot of each lazy tongs is extended as a lug 11 in the forked end of which one fall 12^1 or 12^2 of an endless cable 12 is secured. The course of this cable is illustrated in Fig. 2: Proceeding, say, to the left from the tensioning device 13, the cable passes round a pulley 14 which is located parallel to the window and is free on an axle 15 (Fig. 4) mounted in the window frame. The cable then passes down the side of the window, round a pulley 16 which is at right angles to the window and is free on an axle 17, and up to a second pulley 14 free on the axle 15. From this pulley, the cable passes across the top of the window to the upper side of a pulley-groove 18 on one flange of a wheel-body 19 mounted on an axle 20. Thence the cable passes round the under side of a similar groove 18 on the same flank of a second wheel body 21. The path of the cable on the right-hand side then duplicates that on the left hand side. The returning cable finally passes over a groove 18 on the opposite flange of the wheel body 21 and under a groove 18 on the opposite flank of the wheel body 19.

The grooves 18 serve to drive the cable 12 for raising and lowering the lazy tongs 2. Between the said grooves, each of the wheel bodies 19, 21 is formed as a worm-wheel meshing with a worm 22 on a shaft 23 extending vertically between the said wheels. The upper end of the shaft 23 carries the rotor 24 of an electric motor 25.

The falls 12^1, 12^2 are selected so that, when the cable is driven in the one or other direction, the lugs 11 will move up or down together, their movement being identical. The lazy tongs 2 are thereby moved positively in both directions. Gravity and spring action are not relied upon in any way and the danger of jamming is minimised. The cable 12 may be prestretched and made of such ample strength that stretching in the course of time need not be feared. The cable will not slip and the blind will remain in the fully raised or a partially raised position even under conditions of train vibration.

In Figs. 1–6, the frame of the window is made wholly of metal, preferably of extruded sections. The outer and inner panes 26 and 27 are embraced between flanged outer frame parts 28 (Figs. 3 and 5) and the housing 3 which serves as a distance piece, a suitable spacing of the panes being 1¼–1¾ inches. Rubber gaskets 29 and 30 separate the outsides and the edges of the panes 26 and 27 from the frame parts 28. A channel-shaped gasket 31 separates the insides of the panes 26 and 27 from the housing 3. The gasket 31, in particular, may be connected to the panes by adhesive. When the above parts have been assembled, they are laid between two face plates by which the frame parts 28 are pressed together and a drift 32 is slid over hook-like formations 33 on the said parts 28 to lock the assembly together under a substantial compression. By this simple means, air tight joints are established all round the edges of the panes 26, 27 without the use of screws. Moreover, this construction of window is light and is simple to manufacture and assemble.

Where the shaft 23 penetrates the frame, it passes through a sleeve 34 integral with a bracket 34^1 which is seated in the top of the housing 3 and in which the axles 20 are mounted. A boss 35 on the casing of the motor 25 is mounted over the sleeve 34 and is clamped air-tightly against the gasket 31 by a nut 36 screwed on the sleeve. To enhance the tightness of the joint here, the end of the boss 35 may be recessed to fit over a compressible packing ring. The motor 25 is itself totally enclosed, all joints in its casing being carefully sealed, for example, by a bitumen compound. It will be seen that the blind and the mechanism, including the motor, are accommodated in a substantially hermetically enclosed space and consequently they remain always unaffected by the weather, clean and in good order. As moisture and dust cannot enter, internal steaming, frosting and fouling are prevented. The window does not require to be taken apart for cleaning of the glass or slats. These properties do not materially deteriorate with time and are unaffected by thermal expansion effects. Preferably the window, blind and mechanism are made up as a unit before being fitted to the coach, as air and weather tightness can thus be best assured. An advantage of the enclosure of the blind is that its operation is not impeded by the effects of wind or accidental obstruction; the blind may therefore be light and easy to operate.

The air which is sealed up in the double window may be dehydrated air. Alternatively or in ad-

dition, a small quantity of a dehydrating substance, such as silica gel, may be placed in the window before it is sealed up.

When the slat blind is fully lowered, it is effective, in combination with the double window, in intercepting a large proportion of thermal radiation incident upon the window. Some radiation is reflected or absorbed by the outer pane **26**. Of that which penetrates the pane **26**, a large proportion is reflected outwardly or absorbed by the slats **1**. In any case no direct rays of the sun can pass the slats. Such heat as may be passed by the slats has still to penetrate the inner pane **27**. Thus a very small proportion of the incident heat enters the coach. Nevertheless, a sufficient amount of diffused light enters the coach, such light passing the slats by repeated reflection. By raising the blind to an intermediate position, the slats are turned towards the horizontal and an increased amount of light is admitted at the expense of decreased heat insulation. The outer surfaces of the slats may be highly polished to enhance the outward reflection of the heat. In practice, however, it may be preferred to make both surfaces matt. The inner surface may be made thermally absorptive and finished to suit the interior of the coach.

If required, at least one of the panes, preferably the outer, may be made of thermally absorptive or tinted glass. Over the depth **9**, the panes may be internally "frosted". By this means, the raised slats can be concealed without the necessity for providing a special blind-storage housing.

The motor **25** is advantageously a simple two-phase squirrel-cage induction motor with which special starting switch-gear, limit switches and so forth are not essential. Such a motor can be designed so that, if it continues to be excited after complete raising or lowering of the blind, it simply stalls and, in this condition, carries its short-circuit current harmlessly for a considerable period. The motors **25** of all the windows of a coach may be controlled by a common press-button switch operated by an official on the train. Alternatively the motors may be individually controlled by press-button switches **37** which may conveniently be mounted on or beside the motor **25** (Fig. 1) to shorten the wiring necessary. The supply of two-phase current for the motors may be taken from a small rotary converter.

In Figs. 7 and 8, each of the lugs **11** is guided in a slot **38** in the frame and is connected therein to one fall 39^1 or 39^2 of an endless cable **39**. This cable extends from a driving member **40** at the top of the window to a pulley **41**, down the side of the window, round a pulley **42**, across the bottom of the window, round one groove of a double-grooved pulley **43**, up the other side of the window to one groove of a double-grooved pulley **44**, down the last-named side of the window, round the other groove of the pulley **43** and finally up the same side of the window and round the pulley **44** back to the driving member **40**. The pulleys are mounted on ball bearings in recesses **45** in the frame. Upon movement of the driving member, the two lazy tongs **2** will be moved equally and in the same direction, as in the previous example. The length of the movement of the driving member **40** can be co-ordinated to the required lazy-tongs movement in any particular case by appropriate selection of the lazy-tongs pivots to which the lugs **11** are connected.

The driving member **40** comprises a nut travelling upon a screw-spindle **46** mounted in ball-bearings **47** carried at the sides of the frame. The nut has an extension **48** which passes through a slot **49** in a part of the frame and prevents the nut from turning on the spindle. Travel of the nut is limited by stops **50** at the ends of the slot. Above the slot, this extension **48** is forked to embrace the cable **39** and engages, with some play, between stops **51** fixed on the said cable. The spindle is driven by an electric motor **25** whose rotor is mounted directly on the spindle **46**.

In this arrangement, the body-part **52** of the frame is made of hard wood and only the pane-securing parts **53** are made of metal. Both faces of the frame body are recessed round their edges to receive the panes and sealing material for making a tight joint all round them.

In Figs. 9 and 10, the motor **25** drives the cable **39** directly through a worm **54** and worm-wheel **55** connected to the pulley **44**. In this case, the lugs **11** are connected to pivots at the ends of shortened lowermost links **56** of the lazy tongs **2** and move in slots **38** to one side of the centre line of the said lazy tongs. This arrangement permits of the worm **54** and motor **25** being disposed centrally at the end of the frame-part **57** closing the top of the window. The off-centre disposition of the slots **38** also results in the lazy tongs and the blind as a whole having a slight inclination to the frame of the window when the said blind is lowered. This inclination assists in reducing the effect of vibration upon the blind.

With this arrangement, if desired, the cable may be replaced by two cables, one passing round the pulleys at the four corners of the frame and the other passing round the pulleys at the right-hand side of the frame only. The two cables are then adjustably coupled at a convenient point.

The links of the lazy tongs **2** in the arrangements described above may be made of unequal lengths as illustrated in Fig. 11, the slats **1** being carried on the longer links. In this case, the slats pack up at a larger angle when the blind is raised which is of advantage if it is desired to use comparatively wider slats **1** in relation to the space between the panes **26, 27**.

The above-described forms of mechanism, particularly the first-described, have many practical advantages: The operation of the blind is positive and silent. The mechanism comprises a few parts only and does not depend for its operation upon springs, automatic switches and so forth. It is therefore reliable and will give a long life. However, other forms of mechanism may be employed: Separate endless cables at the sides of the window may be driven from a motor at the top or bottom of the window through shafts extending from the motor to the adjacent pulleys and containing one or more flexible couplings. Or cables may be simply wound upon drums for raising the slats, gravity being relied upon to cause the slats to re-descend when required. Cable-transmission may even be dispensed with and lazy tongs may be driven from a motor through bevel gearing and screw-spindles. The lazy tongs may also be lever-operated: An example of this kind devised for direct manual operation will be briefly described: Corresponding uppermost links of the lazy tongs are extended upwardly beyond the fixed pivots and are connected together at their upper ends by a transverse horizontal bar. A rod connected to the middle of the said bar extends horizontally at right-angles thereto through a hole in an

inside part of the window frame. The projecting part of the rod is covered in air-tight manner by a metal bellows. The inner end of the rod is engaged through the flat end of the bellows by the end of a screw mounted in a bracket on the frame and having a handle turnable from inside the coach. The arrangement is made such that, upon turning the screw in one direction, the lazy-tongs are raised through the levers formed by the extended top links and, upon turning the screw in the other direction, the lazy tongs are lowered by the weight of the slats and other parts.

The blinds may also be actuated otherwise than electrically or manually, for instance pneumatically.

In the arrangements illustrated, the blind is substantially rattle-proof, it cannot be over-operated and its slats cannot interlock with each other or the frame. However, other forms of slat-blind may be employed, for example a fixed-angle Venetian blind or a blind composed of channel-shaped slats which are raised and lowered between an extended and a nested condition by means of chains or cables.

Other forms of shutter or blind device may be used, for instance a blind which is rolled and unrolled. In this case and also with cable transmission, use may be made of a long motor with an external rotor upon which the blind or the cable-means is rolled up.

As an alternative for manual switch control of the blinds, provision may be made for automatic control by a thermostat exposed at or near the outside of a window to the sun's rays. The thermostat may be arranged to energize motor-controlling relays for a given period and after a certain time-lag whenever the temperature rises above or falls below a predetermined value.

I claim:

1. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes while admitting a certain amount of light therethrough, and means including an operating device wholly disposed within said space for reciprocating said blind.

2. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes while admitting a certain amount of light therethrough, said blind comprising a plurality of parallel slats adapted to nest together when the blind is raised and adapted to lie in uniformly spaced relationship in any position of the blind, and means wholly disposed within said space for reciprocating said blind.

3. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, said blind comprising a plurality of parallel slats adapted to nest together when the blind is raised and adapted to lie in uniformly spaced relationship in any position of the blind, and means wholly disposed within said space and connected to each of said slats to effect operation thereof.

4. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, said blind comprising a plurality of parallel slats adapted to nest together when the blind is raised and adapted to lie in uniformly spaced relationship in any position of the blind, and means including an endless cable connected to said blind for raising and lowering said blind.

5. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, and lazy tong means connected to said blind and operable for raising and lowering said blind.

6. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, lazy tong means connected to said blind and operable for raising and lowering said blind, and endless cable means connected to said lazy tong means to effect operation thereof.

7. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, means wholly disposed within said space and operable for reciprocating said blind, and power means disposed exteriorly of said frame but hermetically connected to said space for operating said means.

8. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, means wholly disposed within said space and operable for reciprocating said blind, and power means disposed wholly within said space for operating said means.

9. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, and a lazy tong at each vertical side of said frame within said space connected to said blind and effective upon actuation for opening and closing said blinds.

10. In window construction, in combination, means forming a frame, a pair of panes, means for mounting said panes in said frame in sealed spaced relationship whereby an air-tight space is formed between said panes, a blind, means mounting said blind for extensible movement between open and closed positions within said space, blind operating mechanism disposed within said space and connected to said blind, said mechanism being actuatable to effect movement of the blind, and means for actuating said operating mechanism.

11. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind, means mounting said blind for extensible movement between open and closed positions within said space, said blind being adapted when closed to cut off thermal radiation through said panes, and means including an actuatable device wholly disposed within said space for effecting movement of said blind between its open and closed positions.

12. A window construction comprising a plurality of spaced sheets of glass disposed in a sash frame and being sealed about their edges to provide a chamber sealed to exclude atmospheric dust, spaced parallel louver bars disposed in the chamber and being provided upon one side with highly reflective surfaces, said louver bars being rotatable about their longitudinal axis to control the radiation passing through the construction and means operable while the chamber is completely sealed to change the positions of the louver bars about their axis.

13. A window construction comprising a plurality of spaced sheets of glass disposed in a sash frame and being sealed about their edges to provide a chamber sealed against atmospheric dust, spaced parallel louver bars disposed in the chamber and being provided upon one side with highly reflective surfaces, said louver bars being rotatable about their longitudinal axis to control the radiation passing through the construction and means operable while the chamber is completely sealed to change the positions of the louver bars about their axis, said means comprising an electrical motor sealed within the chamber and having operative driving connections with the louvers and being connected by conductors passing into the sealed chamber to means for supplying electrical current to the motor, said conductors also being in series with switch means for controlling the supply of current to the motor.

14. In window construction, in combination, means forming a frame, a pair of panes mounted in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes while admitting a certain amount of light therethrough, said blind comprising a plurality of parallel slats adapted to nest together when the blind is raised and adapted to lie in uniformly spaced relationship in any position of the blind, a lazy tong at each vertical side of said frame within said space and connected to said blind and effective upon actuation for raising and lowering said blind, an endless cable operatively mounted within said space, means for connecting each of said lazy tongs to said endless cable, and operating means connected to said cable and adapted upon actuation to raise and lower said blind.

15. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when lowered to cut off thermal radiation through said panes, a plurality of pulleys mounted on said frame within said space, an endless cable trained over said pulleys and connected to said blind, and electrically energizable driving means associated with said frame and connected to said cable to operate said blind.

16. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when closed to cut off thermal radiation through said panes, a plurality of pulleys rotatably mounted on said frame within said space, an endless cable trained over said pulleys, means forming a driving connection between said cable and said blind whereupon reciprocation of said cable moves said blind between its open and closed positions, and means for operating said cable.

17. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when close to cut off thermal radiation through said panes, a plurality of pulleys rotatably mounted on said frame within said space, an endless cable trained over said pulleys, means forming a driving connection between said cable and said blind whereupon reciprocation of said cable moves said blind between its open and closed positions, an electric motor secured to the outside of said frame, and means forming a driving connection between said motor and said cable for operating said cable.

18. In window construction, in combination, means forming a continuously peripheral frame, a pair of panes hermetically sealed in said frame in spaced relation to one another to form a space therebetween, a blind reciprocably disposed between said panes within said space and adapted when closed to cut off thermal radiation through said panes, a plurality of pulleys rotatably mounted on said frame within said space, an endless cable trained over said pulleys, means forming a driving connection between said cable and said blind whereupon reciprocation of said cable moves said blind between its open and closed positions, an electric motor secured to said frame within said space, and means forming a driving connection between said motor and said cable.

ALFRED HENRY CHILTON.