(No Model.) 3 Sheets—Sheet 1.

O. ANDRÉ.

SKYLIGHT.

No. 395,306. Patented Jan. 1, 1889.

Fig. 9

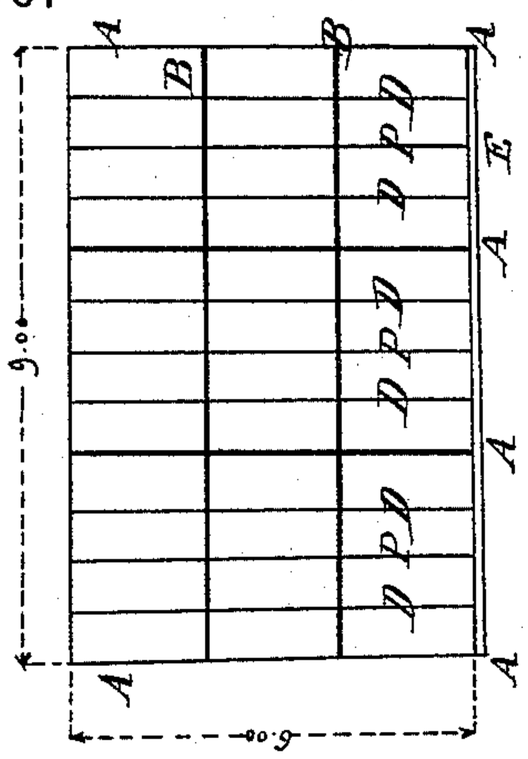


Fig. 4.

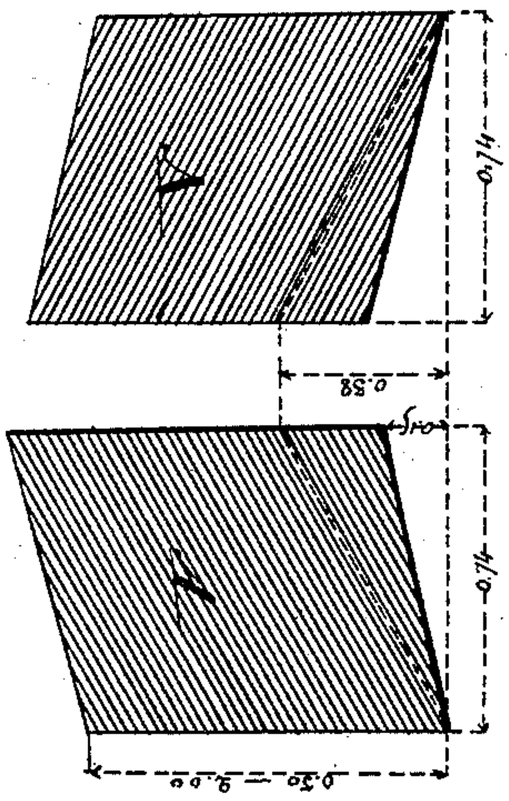


Fig. 7

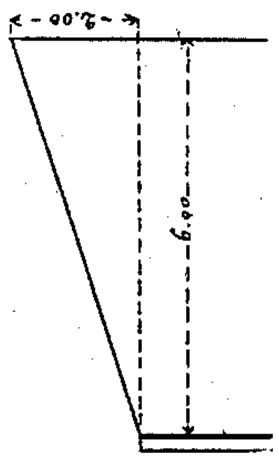


Fig. 6

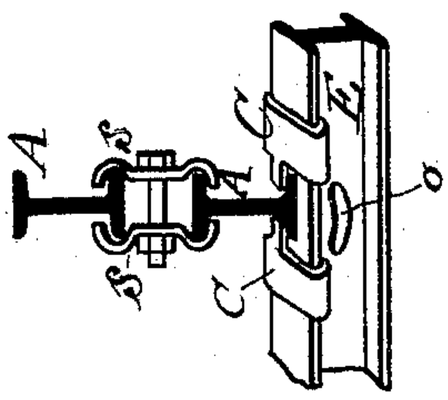


Fig. 3

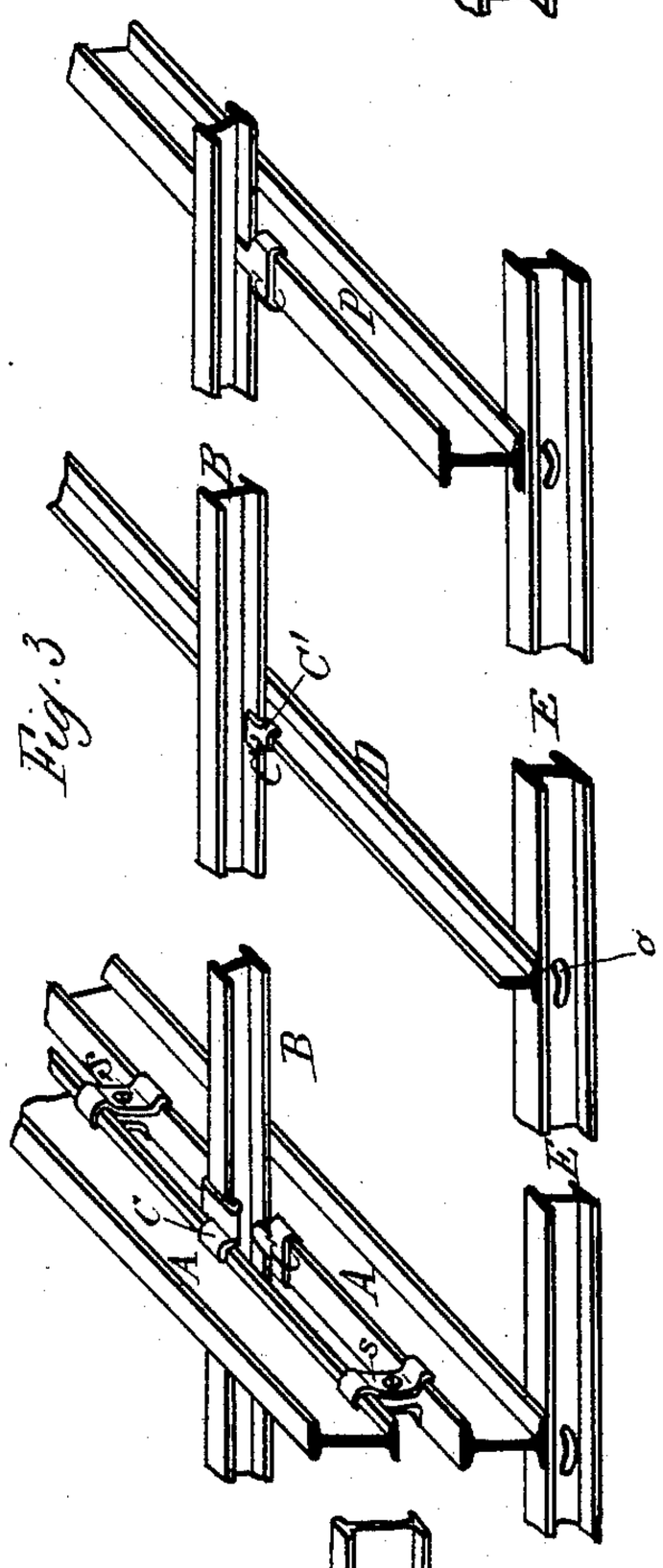
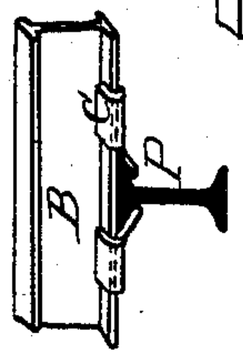


Fig. 5



Witnesses:
Wm. J. Donner
Wm. F. Frankam

Inventor:
Oscar André
By his Attorneys
Arthur G. Fraser & Co.

(No Model.)

3 Sheets—Sheet 2.

O. ANDRÉ.

SKYLIGHT.

No. 395,306. Patented Jan. 1, 1889.

Fig. 8.

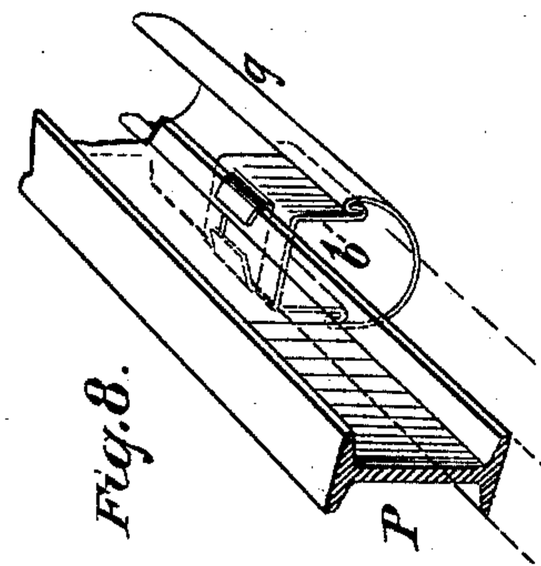


Fig. 9.

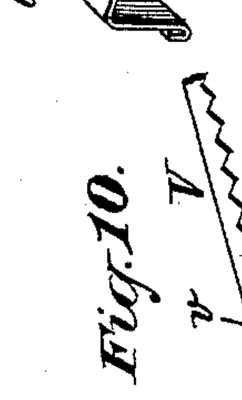


Fig. 11.

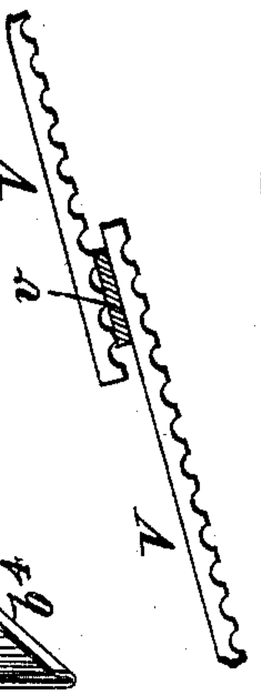


Fig. 18.

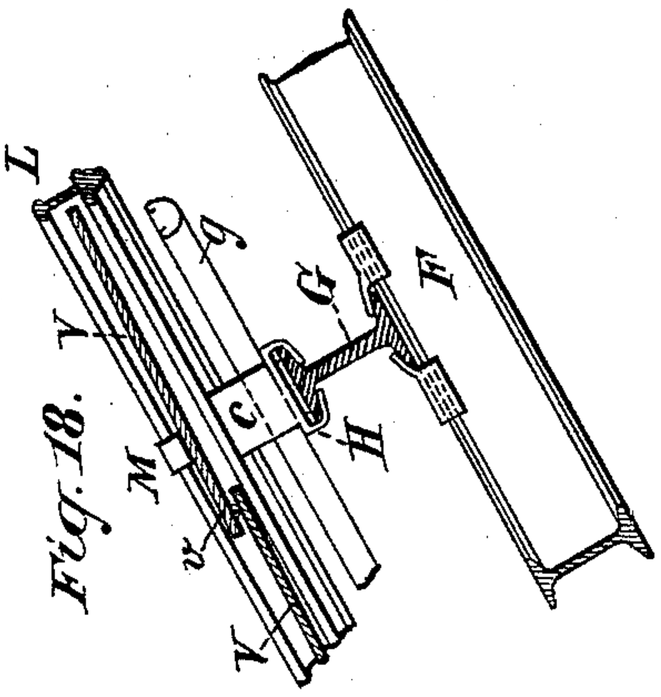
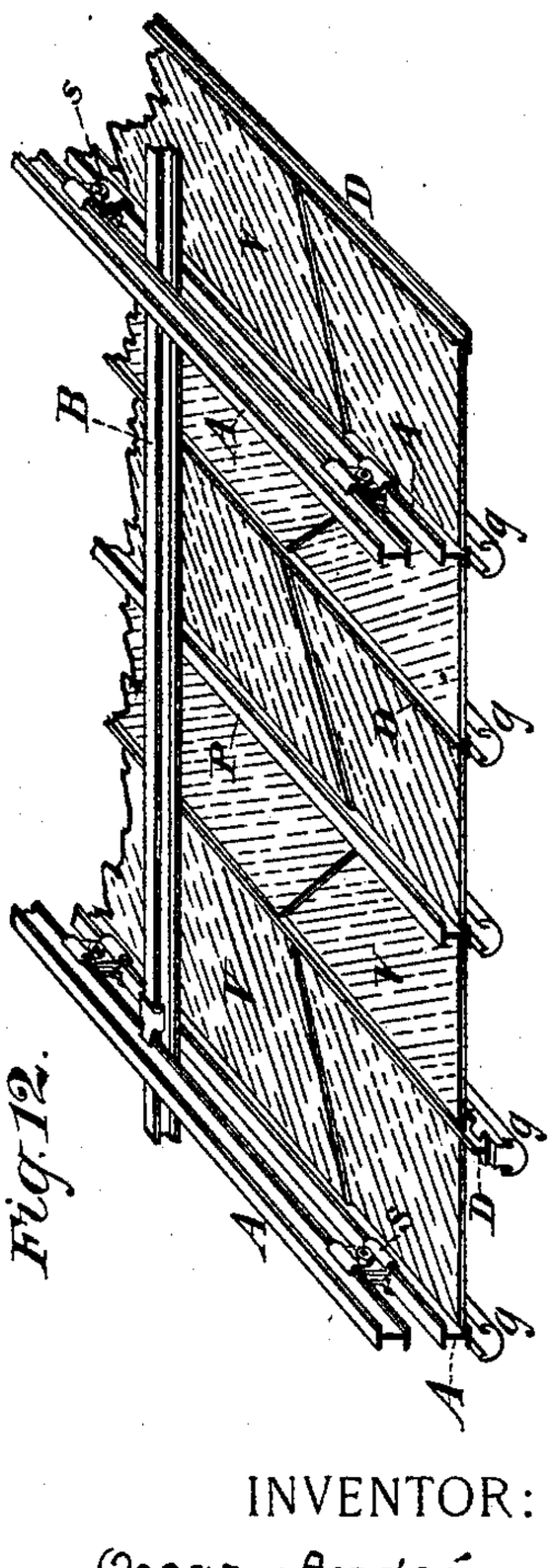


Fig. 10.

Fig. 7.

Fig. 12.



WITNESSES:

John Becker

C. K. Fraser.

INVENTOR:

Oscar André

By his Attorneys,

Arthur G. Fraser & Co

(No Model.)

3 Sheets—Sheet 3.

O. ANDRÉ.

SKYLIGHT.

No. 395,306. Patented Jan. 1, 1889.

Fig. 13.

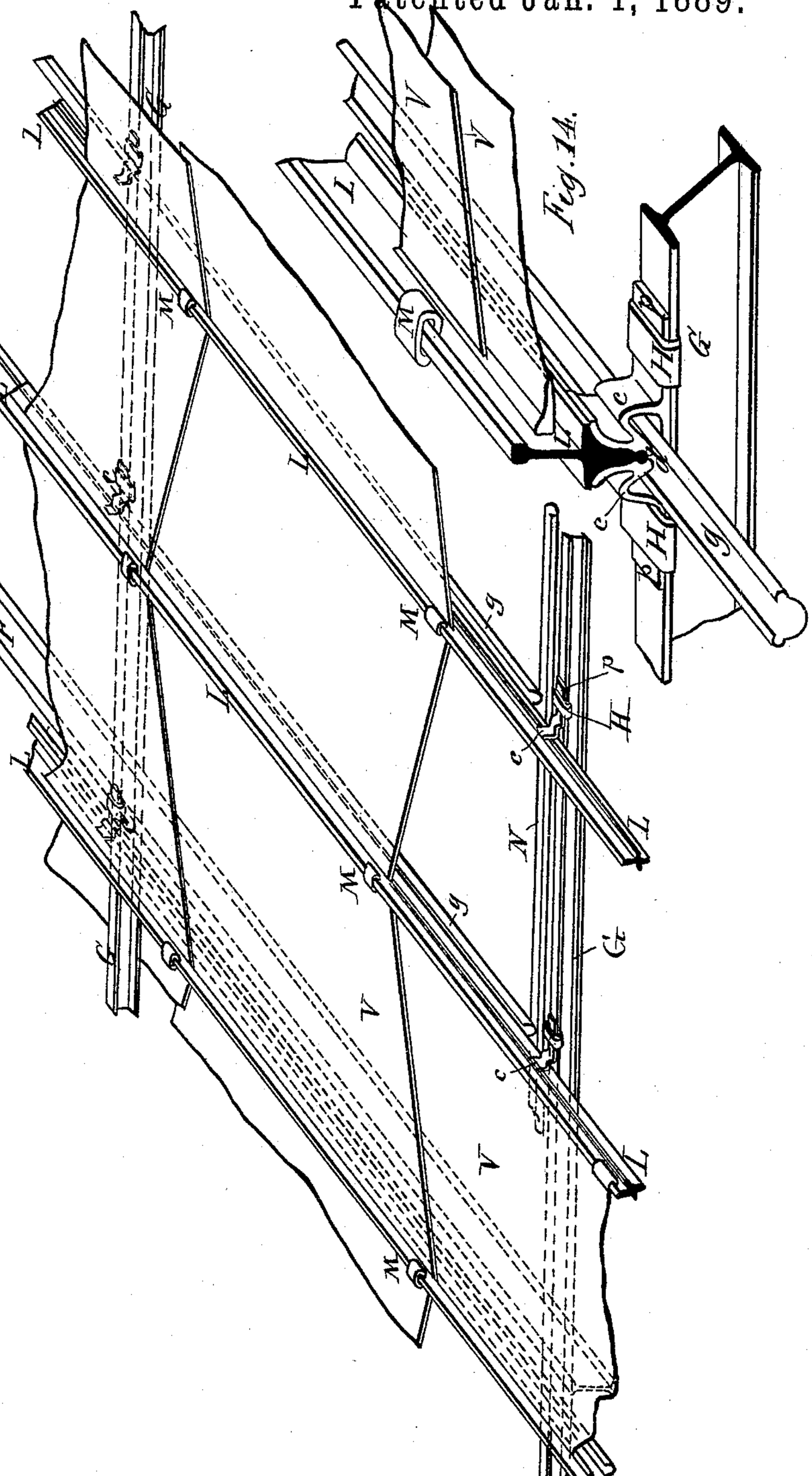


Fig. 14.

Fig. 15

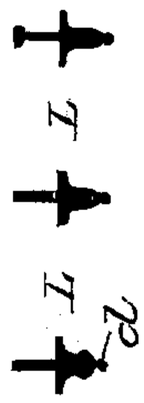


Fig. 16

Fig. 17

Witnesses
Wm. J. Tanner
Wm. H. Hannam.

Inventor:
Oscar André
By his Attorneys
Arthur G. Fraser & Co.

UNITED STATES PATENT OFFICE.

OSCAR ANDRÉ, OF PARIS, ASSIGNOR OF ONE-HALF TO GEORGES VICTOR ALFRED BERTEAUX, OF NEUILLY, FRANCE.

SKYLIGHT.

SPECIFICATION forming part of Letters Patent No. 395,306, dated January 1, 1889.

Application filed November 3, 1887. Serial No. 254,236. (No model.) Patented in France February 26, 1887, No. 181,841.

To all whom it may concern:

Be it known that I, OSCAR ANDRÉ, a citizen of the French Republic, residing in Paris, France, have invented certain new and useful Improvements in Skylights, of which the following is a specification.

This invention is the subject of French Patent No. 181,841, dated February 26, 1887.

This invention is designed to improve the construction of glass roofs or skylights.

It relates chiefly to the construction of the frame-work for supporting the glass. The rafters and purlins comprising the frame-work are arranged to cross each other and are fastened together by suitable clamps or otherwise, the sheets of glass being arranged in the preferred construction in a plane beneath and separated from the purlins. In a modified construction the glass sheets are arranged in a plane above the purlins. In either case double rafters are employed, consisting each of two parallel beams, one above the other and spaced apart by the purlins, which are arranged to cross the rafters between the upper and lower beams. The spaces between the double rafters are subdivided by the arrangement of single rafters or glazing-bars between them, the sheets of glass being supported by the single rafters and by the corresponding beams of the double rafters. At the intersection of the rafters and purlins clamps are applied engaging the respective flanges. An improved means is also provided for suspending drainage-gutters beneath the rafters for carrying off the water of condensation and discharging it at the eaves.

My system will be easily understood by referring to the accompanying drawings, which show it both when applied to a skylight with its frame-work on top and to one whose frame-work is beneath.

Figure 1 is a diagrammatic transverse section of a roof, showing the slope. Fig. 2 is a diagrammatic plan of the roof. Fig. 3 is a fragmentary perspective view of the roof-framing for a skylight having the framing above the glass. Fig. 4 is a plan of two of the glass panes, showing the method of cutting the grooved glass. Fig. 5 is a fragmentary perspective showing the means for connecting two crossed beams at their intersection. Fig. 6 is a similar fragmentary view, showing the method of uniting the twin rafters. Fig. 7 is a fragmentary perspective view showing the construction of the gutters and the eaves. Fig. 8 is a fragmentary perspective view showing the means for hanging the gutters beneath the rafters, and Fig. 9 is a perspective view of one of the hangers. Figs. 10 and 11 are longitudinal sections of the glass panes, showing their overlapping joints. Fig. 12 is a perspective view showing the completed and glazed roof. The remaining views illustrate the construction wherein the roof-framing is mainly beneath the glass. Fig. 13 is a perspective of a part of the roof. Fig. 14 is a perspective view on a larger scale, showing the details of construction. Fig. 15, 16, and 17 are cross-sections of different shapes of glazing bars or rafters. Fig. 18 is a fragmentary section cut down the slope of the roof.

I will first describe, with reference to Figs. 1 to 12, the application of my invention to a skylight with exterior framing.

Let us suppose that it is required to construct a g'ass roof of any length whatever and of a width of, say, six meters and a height of, say, two meters, (see Fig. 1,) giving a slope of about one in three, more or less. The length should be divided into equal spaces of about two or three meters by laying rafters A A, which are double rafters, at about that distance apart, (see Fig. 2,) and the width should be divided into three spaces by laying two (more or less) purlins, B B, Fig. 2, crossing the rafters A.

The spaces of two or three meters between the rafters A A are subdivided by laying single rafters P P midway between each two double rafters A A, and the spaces of about one and a half meter thus formed are again subdivided by laying rafters or glazing-bars D D, all as indicated in Fig. 2. As shown in Fig. 3, the main or double rafters A A are of I-beams of rolled iron, laid in pairs one above the other, spaced apart by the passage of the purlins B B between them. These purlins are also I-beams, and at their intersection with the rafters A A they are united to the latter by bent clamps or clips C C, of iron,

which are bent down at opposite sides to embrace the flange of one of the I-beams, and have a nose or lip which takes over the flange on the intersecting beam, as shown in Fig. 3. The twin beams A A are held together by clamps *s s*, consisting each of two plates engaging the flanges of the beams from opposite sides and drawn together and into firm contact with the beams by a bolt, as shown in Figs. 3 and 6. The single rafters P P are also I-beams and are fastened to the lower flange of the purlins B B at their intersection therewith by means of clamps C C, as shown in Fig. 5. The rafters D D may be of angle-iron or I-beams, as preferred, and these also are connected to the purlins B B by clamps C′, as shown in Fig. 3. The rafters A, P, and D rest on ledges or supports at their upper and lower ends. In Figs. 3 and 6 is shown a false sill, E, consisting of an I-beam, to which the rafters are fastened by clamps C C.

Fig. 7 shows the construction at the eaves. On the top of the wall is a sheet of lead or zinc, *z*, turned up inside, and on this rests the false sill E. The web of this beam is pierced with curved holes *o o*. (Seen in Figs. 3, 6, and 7.) A bifurcated clamp, *a*, Fig. 7, engages the flange of the lower rafter, A, and its hooked end serves to support the gutter Z, of galvanized sheet-iron, zinc, or other material. After the completion of the metallic framing, as thus described, there is hooked on under each rafter a zinc gutter, *g*, from .050 to .055 millimeter wide and from .015 to .025 millimeter deep, flanged interiorly, Figs. 7 and 8.

A hanger, *b*, bent from galvanized sheet-iron, engages the flange of the I beam or rafter, and, extending down hooks, into the turned-in flanges of the gutter, thereby holding the latter in place. This hanger *b* is of inverted-U shape, with a flat plate, *b′*, lying against the under side of the bottom flange of the I-beam rafter, and having lips or ears b^2 projecting upwardly and inwardly over the rafter-flange, while its side portions, b^3, extend downwardly and are formed with hooks b^4 b^4, or other fastenings, for engagement with the gutter, all as shown in Figs. 8 and 9. The lower ends of the respective gutters project through the holes *o o* and discharge their water beyond the roof.

The glass should be of the kind which is transversely grooved or fluted on its under side, preferably five millimeters thick, and is cut in the manner shown in Fig. 4, which is a plan of two laterally-adjoining panes, V V. The side edges of the glass are cut at such an angle that the flutes will cross the pane obliquely—preferably at an angle of approximately sixty degrees with the sides, as shown in Fig. 4. The angle should be such that the length of the grooves will not exceed one and one-quarter time the width of the pane, so that the drops of condensed water in running along the grooves will not run far enough to accumulate sufficient weight to cause them to lose their capillary hold and drop off into the apartment. This, however, will be governed somewhat by the slope of the roof. The panes should be cut with inclined top and bottom ends, (with the exception of the first and last, which have only one end thus inclined,) the inclination of the ends being in the same direction as that of the grooves, but of a less pitch—say at an angle of from seventy-five to eighty-three degrees with the sides. In Fig. 4 the panes are shown with a width of 0.74 meter, and a length of 0.20 to 2.00 meters. The ends have an inclination of 0.15 to a base of 0.74, and the grooves have an inclination of 0.38 to 0.74. These proportions are suitable for the slope of roof shown in Fig. 1—namely, an elevation of 2.00 meters for a base of 6.00—and for the subdivision of panes shown in Fig. 2, where a length of 9.00 meters is subdivided by eleven rafters or glazing-bars into spaces of equal width. These proportions are given merely as examples.

The packing between the overlapping ends of the glass is effected by means of a cord covered with white lead or by putty or any other substance, as shown at *v* in Figs. 10 and 11, only a very slight lap—say, .010 to .015 millimeter for example, varying according to the incline of the roof—being necessary.

The panes of glass are laid with their lateral edges resting on the lowermost flanges of the rafters A, P, and D, so that almost the entire roof frame-work is above the plane of the glass, as shown in Fig. 12. The edges of the glass may be laid in a bed of putty, and be puttied over, or any other suitable packing may be used, such as india-rubber or lead.

As the entire frame-work is outside, the condensation that may take place on its exterior surface will run off from the outside of the glass. The gutters themselves being suspended by means merely of thin strips of metal, substantially no condensation takes place in them. In very severe climates all that is necessary is to render them porous on the outside, in which event they would convey the merely infinitesimal quantities of condensed water that would collect.

I will now, with reference especially to Figs. 13 to 18, describe the application of my invention to a skylight with interior framing.

Although from an economical and technical point of view the external frame-work presents a good many advantages, this method of construction has some drawbacks, among which may be mentioned that in certain cases they do not look well architecturally; that the iron has to be periodically painted to prevent rust, &c. By making use of the same method of distributing the material I construct an internal frame-work combining all the more important advantages which my system offers.

I take the main rafters F of any length desired, from two to four meters apart, or more. On these main rafters I secure, by means of gripping-clamps or otherwise, purlins G of I-beam, having wide flanges, with a space between these purlins of 1.50 to 3 meters, the same as in Figs. 1, 2, and 3, according to the

space between the iron supports, and in the axis of each of them I secure a chair, *c*, of malleable galvanized iron or any other suitable material. These chairs are fastened to the purlins by means of two bent clamps, H H, holding fast frictionally the two feet *p p* of the chair. (See Figs. 13 and 14.) The clamping-faces of the chair *c* are inverse reproductions of the glazing-bars L which I employ, and which must have a bead, *d*, beneath, but are otherwise of any dimension or shape that may be desired, Figs. 15, 16, and 17. The chair is made in halves to facilitate the insertion of the glazing-bars in their respective places, and the clamps H H, driven onto their feet *p p*, secure at the same time the chair on the purlin and the bar L in the chair by drawing tightly together the two halves.

The upper rib of the bar L may be constructed with a flanged head, (see Fig. 17,) whereby it will be possible to apply a clamp, M, which will prevent the wind from lifting the panes of glass.

Between the two feet of the chair is inserted the gutter *g*, which measures between .020 and .035 millimeters in width, of any material or shape—for instance, zinc. The drops of water will follow the incline of the girder until they reach the lower projections of the chairs, which come together beneath the bead, when they fall into the gutter, and will run down the gutter and fall from its lower end into a transverse gutter, N, Fig. 13, which conducts the water away to any convenient place. In other respects the construction is the same as first described. In this construction the rafter F and glazing-bar L, being fastened together with the purlin G between them, constitute a twin rafter substantially like that first described.

It should be mentioned that since the surface of the glass is from fifty to seventy-five millimeters higher than the iron frame-work F G, the latter is in an atmosphere which is warm, or at any rate not as cold as the temperature of the outside air, so that the cooling process through conductibility cannot take place except through the feet of the chairs, and as the amount of metal there congregated is a mere trifle in comparison with the metallic mass of the roof the inconvenience of having a frame-work underneath, so far as the condensation of water is concerned, does not exist, and all the advantanges of the system are preserved. This system may be applied to all sorts of roofs, galleries, halls, museums, concert-halls, studios, offices, schools, artists' and photographers' studios, winter-gardens, hot-houses, verandas, &c.

In the construction first described the lower rafter A to which the glass panes are connected, constitutes the glazing-bar, whereas in the construction last described this glazing-bar is specially constructed and mounted above the rafter. In either case the rafters are double, of two beams one above the other, and one of which serves also as a glazing-bar. In either case the purlins cross between the two rafters, so that they serve to hold them apart.

I claim as my invention the following-defined improvements in skylights or glazed roofs, substantially as hereinabove specified, namely:

1. A roof-framing consisting of rafters and purlins crossing each other and fastened together, in combination with the sheets of glass secured to said framing and arranged in a plane beneath and separated from the purlins.

2. The combination, to form a glazed-roof structure, of double rafters at intervals consisting each of two parallel beams, one above the other, purlins crossing said rafters and embraced between the upper and lower beams thereof, single rafters arranged parallel with and subdividing the spaces between said double rafters and crossing said purlins, and the glass panes supported by said single rafters and the corresponding beams of said double rafters, all fastened together.

3. In a glazed-roof structure, the combination of a double rafter consisting of the flanged iron beams, one above the other, a flanged purlin crossing said rafter between the upper and lower beams thereof, with clamps for fastening together the upper and lower beams of the double rafter and embracing the purlin between them, and clamps engaging the flanges of the respective beams at their intersection.

4. In a glazed-roof structure, the combination, with a flanged rafter of **I**-beam and a gutter extending longitudinally beneath it, of a hanger for said gutter of inverted-**U** shape having a flat plate against the bottom flange of the **I**-beam and lips turned upwardly and inwardly from said plate over the flange on the rafter, and said hanger extending down at both sides and fastened to the gutter.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

OSCAR ANDRÉ.

Witnesses:
ROBT. M. HOOPER,
AMAND RITTER.