

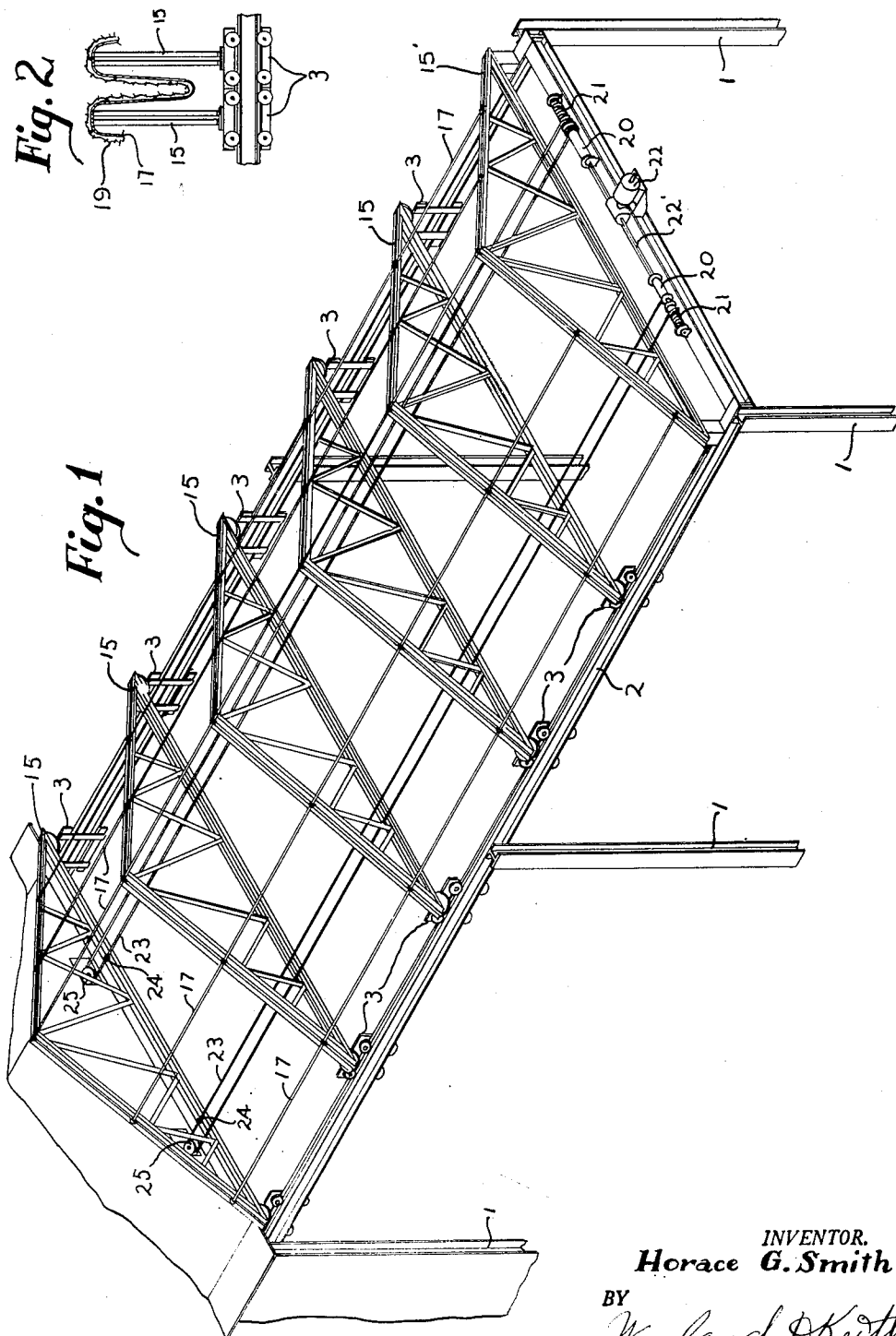
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BUILDING STRUCTURE

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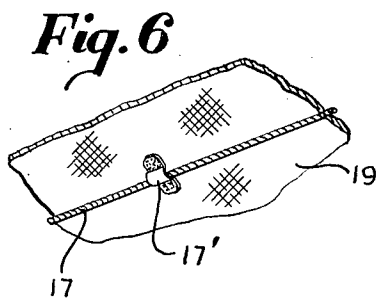
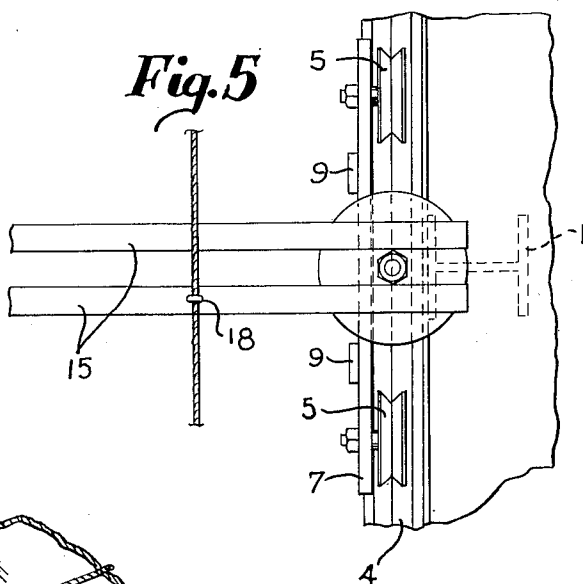
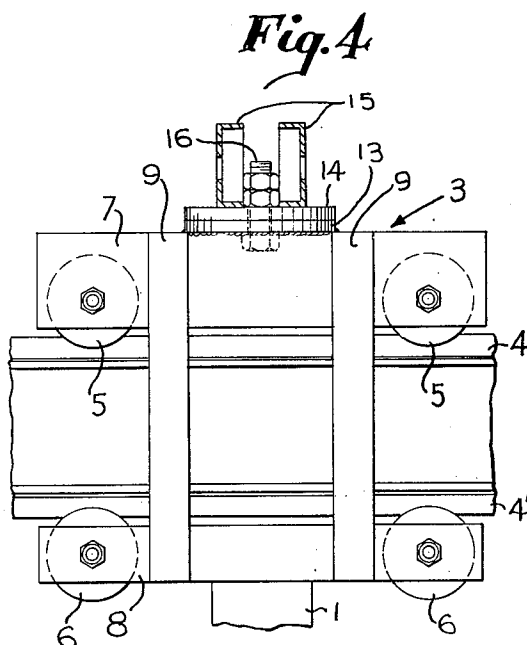
2 SHEETS—SHEET 1



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2 SHEETS--SHEET 2



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BUILDING STRUCTURE

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11 Claims. (Cl. 108—2)

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This invention relates to improvements in building structures, and more particularly, to roofs for buildings of the character adapted to be opened and closed with respect to the interior of the building.

Such movable roofs as have been proposed heretofore, usually have required trackage so disposed that the roof may be moved in its entirety into and out of a covering position over the building area, and moved onto separate supporting standards externally of the building when it is moved from the latter. This would not be satisfactory or practical particularly where the building is erected in close relation to adjoining buildings.

One object of this invention is to improve the construction of the roof structure whereby it may be collapsed to present an open top for the building area to admit sunshine or a clear view of the sky either during the day or night, and yet may be closed readily to provide a covering or protection over the building area whenever desired.

Another object of the invention is to improve the super-structure of a building or the building trusses supporting the roof covering whereby the trusses may be moved readily to open or closed positions without binding or difficulty of moving from one position to another, and which may be added to the building structure at little additional cost or expense.

These objects may be accomplished in one form of the invention by the provision of trusses extending over the building area and so mounted on the building structure as to be moved relative to each other to open and closed positions, which trusses support the covering material that may be flexible if desired for collapsing action when the trusses are moved into collapsed relation. These trusses are mounted on tracks to facilitate the relative rolling actions of the trusses to open or closed positions, and are supported on the tracks by means of carriages or trolleys adapted for rolling therealong. Provision is made preferably for pivotally connecting each truss with the trolley or carriage so as to prevent binding action between the trolley or carriage and the track upon movement of the truss, whereby the rolling action may be accomplished easily and readily in moving the carriage along the trackway.

This form of the invention is illustrated as one embodiment thereof in the accompanying drawings in which:

Fig. 1 is a perspective view of the roof structure

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of a building showing the application of this invention thereto.

Fig. 2 is a detail side elevation of a portion of the roof structure with the trusses and roof covering in collapsed position.

Fig. 3 is an enlarged detailed cross section through one of the tracks and carriages.

Fig. 4 is a side elevation thereof partly in section taken on the line 4—4 of Fig. 3.

Fig. 5 is a top plan view thereof.

Fig. 6 is a fragmentary perspective view of the roof covering showing cable attachment to the underside thereof.

The invention is shown in Fig. 1 as applied to a building structure including spaced side supports 1, upon which the roof is adapted to be mounted. These supports are shown in the form of columns although the roof may be mounted on supporting walls or other structures as desired, according to the area to be enclosed by the roof.

Extending longitudinally of the area on opposite sides thereof are tracks 2, each of which is shown as in the form of an I-beam as illustrated in Fig. 3. The I-beams 2 are shown as being disposed laterally of the columns 1, but securely mounted thereon as by bolts or suitable clamps, so as to leave the upper and lower edge portions of each I-beam free for mounting of a trolley or carriage thereon.

The track formed by each I-beam 2 is shown as supporting a plurality of carriages or trolleys generally designated at 3, normally spaced along the tracks 2 when the roof is in covering position as indicated generally in Fig. 1, but capable of being moved along the track relative to each other for opening or closing the roof with respect to the building enclosure. Each trolley or carriage 3 is shown as riding on the track 2, being guided by the upper and lower portions thereof. In the form illustrated, the I-beam 2 is provided with track guides 4 and 4' on the respective upper and lower edges as illustrated in Fig. 3, which guides are shown as formed by angle bars welded to the edge faces of the I-beam, although other forms of guides may be used as desired, such as semi-round bars.

The trolley or carriage 3 is shown as constructed with upper and lower rollers 5 and 6, arranged in pairs and supported by a trolley framework comprising longitudinal bars 7 and 8 connected together by cross bars 9. The rollers 5 and 6 are shown as of V-groove form to fit in complementary relation on the track guides 4 and 4' respectively, although other shapes may be

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used according to the shapes of the guides. The rollers 5 and 6 are journaled on stub-axes 10 and 11 mounted in the respective bars 7 and 8 and retained on the stub-axes by enlarged heads 12 thereon as shown in Fig. 3.

The rollers 5 and 6 are arranged in a vertical plane laterally disposed with respect to the upright mounting bars 9 so as to embrace the track 2. These rollers are spaced apart a distance according to the width of the track to roll freely thereon but are sufficiently close so the flanges thereof will not permit accidental separation of the trolley 3 from the track. Furthermore, as shown in Fig. 4, the rollers 5 and 6 are spaced from the adjacent ends of the bars 7 and 8 so the peripheries of the rollers do not project beyond the ends of the bars, whereby the carriages or trolleys 3 mounted on each track 2 may be moved into abutting relation with each other without binding of the rollers or danger of injury thereto.

Each trolley or carriage 3 is constructed with a turntable or pivotal mounting which is shown as formed by thrust plates 13 and 14 arranged in superposed abutting relation and connected together by means of a pivot bolt 16. The thrust plate 13 is shown as fixed, as by welding, to the upper bar 7 and these thrust plates preferably are arranged in horizontal positions in the form shown. It is preferable that the bolt 16 be so constructed as to form a free pivot for the relative turning movement of the plates 13 and 14, and by being shouldered or provided with double locked nuts as indicated, although a journal bushing may be used if desired around the bolt.

Mounted in bridging relation between a pair of carriages or trolleys 3 on opposite sides of the roof structure is a truss member 15 which may be of any suitable form according to the character of roof covering to be provided. In the form illustrated, however, each truss member is formed with a bottom girder having a skeleton superstructure thereon arranged to form a peak roof. At one or both ends of the roof of the building, is a truss member fixed relative to the building structure as indicated at 15' in Fig. 1 to form a fixed support for the roof covering.

The several truss members are connected together through flexible devices such as cables 17, that extend between the truss members 15, preferably at opposite end portions thereof, and are secured thereto as by bolts 18 (Fig. 3), so as to limit relative longitudinal movement between the truss members and the cables. These cables 17 serve to limit the relative extending movement of the truss members with respect to each other, while permitting the collapsing movement of the truss members toward each other, as shown in Fig. 2.

A roof covering is shown at 19 extending over the truss members 15. This roof covering 19 preferably is of flexible material such as fabric or canvas with suitable provisions for water-proofing thereof, or it may be formed of resilient material such as sheet rubber, capable of accommodating itself to the relative opening or closing movements of the truss members. The roof covering 19 should be anchored at 17' to the truss members 15 at points such that the covering material will be stretched taut when the truss members are laterally spaced from each other the desired distances and yet will yield sufficiently for collapsing action when the members are moved substantially into abutting relation.

While the relative movement of the truss mem-

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bers 15 may be accomplished manually or by any suitable means such as a block and tackle, power mechanism may be used for the purpose if desired as illustrated in Fig. 1. In this form, winches are shown at 20, 21 in the form of drums operated by a power motor 22 through a shaft 22' shown as mounted on the building support at one end of the roof. Winch lines or cables 23 extend from the winch drums 20, 21 longitudinally of the roof to the opposite end thereof. A line 23 preferably is arranged adjacent each opposite side of the roof to be connected with an end portion of the truss member at the opposite end of the roof from the fixed truss member 15'. Each cable 23 is fixed or anchored at 24 to the remote truss member 15 and extends over a pulley 25 secured to a fixed part of the building as a beam or wall thereof. Each cable 23 has its opposite ends wound on the winch drums 20, 21 in opposite directions, so that one end of the cable will unwind while the opposite end is being wound up on the drum.

The motor 22 may be operated in either direction so as to wind up on the corresponding drum 20 or 21, one end of each cable 23. Thus, with the parts in the relation shown in Fig. 1, the winding up of the cable on the drums 20 will cause a pulling action on the endmost movable truss member 15 drawing it along the tracks 2 toward the fixed truss member 15'. This will continue, successively moving the truss members 15 into abutting relation with each other at the opposite ends of the trolleys or carriages 3, until all of the truss members have been drawn into nested relation at one end of the roof. The roof covering 19 which initially extended over the entire length of the roof being attached to all of the movable truss members 15 and to the fixed truss member 15', so as to form an effective roof covering, has now been drawn clear of the space enclosed by the roof to leave this space exposed. This is often desirable to present an open top for admitting sunshine or a view of the sky during the day or night.

A reversal of this operation will cause the separation of the truss members 15 to the position shown in Fig. 1 and at the same time extend the roof covering 19 over the truss members to form an effective roof covering for the building. The cables 17 limit the separation of the truss members relative to each other, which cables may be used as desired although the roof covering 19 may serve as a sufficient limiting means if formed of sufficiently strong material.

Due to the normal erection of the building structure including the tracks 2, a certain amount of misalignment is likely to occur so that accuracy is not always maintained in the trackways. Likewise, the trusses 15 are not always accurately manufactured which contributes further to some misalignment of the parts. Furthermore, the collapsing movement of the truss members as well as the pulling actions exerted thereon may not be entirely uniform whereby these may move relative to each other at the respective opposite ends, which would cause some binding action of the trolleys or carriages 3 on the tracks 2 if the carriages were rigidly secured to the respective truss members. However, the pivotal connection provided therebetween at 13-16 permits some swiveling action of each truss member with respect to the carriage or trolley to prevent such binding action and to allow for free and uniform rolling of the carriages or trolleys along the tracks. Moreover, the holes

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formed in the thrust plates 13 and 14 may be larger than the outside diameter of the bolt 16 so as to provide for some lateral shifting of the plates with respect to each other to compensate for relative lateral shifting of the carriage or trolley with respect to the truss member 15, due to misalignment or irregularity of the track 2.

By the arrangement herein set forth, it is possible to erect a movable roof structure without the necessity for erecting or operating the mechanism according to precision standards, and yet the roof structure will open and close readily as desired. Thus, it is possible to provide a portable roof over an enclosed area which may be opened and closed readily without the necessity for extending the roof beyond the building area when opened. The opening, however, may be accomplished by a collapsing of the roof within the building area and yet the roof may be moved to its covering position readily and quickly when desired.

While the invention has been illustrated and described in one embodiment, it is recognized that variations and changes may be made therein without departing from the invention except as specified in the claims.

I claim:

1. In a building structure, a pair of trackways, wheeled carriages mounted on the trackways, truss members extending transversely in bridging relation between said trackways and mounted at opposite end portions of said truss members on a pair of carriages on said trackways, and a flexible covering attached to said truss members and extending thereover to form a roof covering when said truss members are spaced from each other.

2. In a building structure, a pair of trackways, wheeled carriages mounted on said trackways, truss members extending transversely in bridging relation between said trackways, which truss members have their opposite end portions mounted on a pair of carriages on said trackways, a flexible covering attached to said truss members and extending thereover to form a roof covering when said truss members are spaced from each other, and cables connecting said truss members together for limiting the relative separation of said truss members with respect to each other.

3. In a building structure, a pair of trackways, wheeled carriages mounted on said trackways, a plurality of truss members extending in bridging relation between said trackways and each truss member being mounted on a pair of said carriages for rolling action along the trackways, said truss members being mounted for movement relative to each other, flexible means extending between said truss members for limiting the relative separation of said truss members with respect to each other, and power means for moving said truss members along said trackways.

4. In a building structure, a pair of trackways, wheeled carriages mounted on said trackways, a plurality of truss members extending in bridging relation between said trackways and each truss member being mounted on a pair of said carriages for rolling action along said trackways, said truss members being mounted for movement relative to each other, flexible means extending between said truss members for limiting the relative separation of said truss members with respect to each other, power means for moving said truss members along said trackways, said power means including cables connected with at least one of

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said truss members and a power winch operatively connected with the cables.

5. In a building structure, a pair of trackways, wheeled carriages mounted on said trackways, truss members extending in bridging relation between said trackways and each truss member being mounted on a pair of said carriages for rolling action along said trackways, flexible fabric extending between pairs of said truss members and attached to cables extending therebetween, which flexible fabric is arranged to fold between said truss members, in accordion relation, upon movement of said truss members toward each other, and means forming a pivotal connection between said truss members and each carriage for relative swiveling action therebetween.

6. In a building structure, a pair of trackways, wheeled carriages mounted on said trackways, truss members extending in bridging relation between said trackways and each truss member being mounted on a pair of said carriages for rolling action along said trackways, flexible fabric extending between pairs of said truss members and attached to cables extending therebetween, which flexible fabric is arranged to fold between said truss members, in accordion relation, upon movement of said truss members toward each other, means forming a pivotal connection between said truss members and each carriage for relative swiveling action therebetween, said pivotal means including a thrust plate fixed to each of said carriages and a thrust plate fixed to each of said truss members in opposed bearing relation with each other, and means pivotally connecting said thrust plates together.

7. In a building structure, a pair of trackways, wheeled carriages mounted on said trackways, truss members extending in bridging relation between said trackways and each truss member being mounted on a pair of said carriages for rolling action along said trackways, flexible fabric extending between pairs of said truss members and attached to cables extending therebetween, which flexible fabric is arranged to fold between said truss members, in accordion relation, upon movement of said truss members toward each other, means forming a pivotal connection between said truss members and each carriage for relative swiveling action therebetween, said pivotal means including a thrust plate fixed to each of said carriages and a thrust plate fixed to each of said truss members in opposed bearing relation with each other, means pivotally connecting said thrust plates together, each of said carriages including wheels mounted on said trackways and spaced on opposite sides of said pivot means.

8. In a building structure, spaced trackways, a plurality of wheeled carriages mounted on each of said trackways in end to end aligned relation, truss members extending in bridging relation between said trackways and having each end of each of said trusses mounted on one of said carriages for rolling action along said trackways, and flexible material extending between pairs of said trusses and arranged to fold between said trusses, in accordion relation, upon movement of said trusses toward each other.

9. In a building structure, spaced trackways, wheeled carriages mounted on said trackways, pairs of truss members extending in bridging relation between said trackways and mounted on said carriages for rolling action along said trackways, flexible material extending between pairs of said truss members and arranged to fold

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therebetween, in accordion relation, upon movement of said truss members toward each other, and means pivotally connecting an end portion of each of said truss members with one of said carriages for relative swiveling action.

10. In a building structure, spaced trackways, a plurality of wheeled carriages mounted on each of said trackways in end to end aligned relation, truss members extending in bridging relation between said trackways and mounted on said carriages for rolling action along said trackways, flexible material attached to said truss members and normally forming an apex, said material being arranged to fold between said truss members, in accordion relation, upon movement of said truss members toward each other, and each of said carriages having a pair of wheels mounted on said trackway and spaced on opposite sides of an upright plane passing through said truss members.

11. In a building structure, spaced trackways, a plurality of wheeled carriages mounted on said trackways in end to end aligned relation, truss members extending in bridging relation between said trackways and mounted on said carriages for rolling action along said trackways, flexible

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material attached to said truss members and normally forming an apex, said material being arranged to fold between said truss members, in accordion relation, upon movement of said truss members toward each other, and each of said carriages including a frame structure and a pair of wheels mounted thereon with the peripheries of said wheels spaced inwardly from the opposite ends of said truss members so said flexible material may extend over said wheeled carriages and said building structure for protection thereof.

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