N. RUEBEN.

AIRSHIP HALL WITH TEMPORARILY REMOVABLE ROOF.

APPLICATION FILED SEPT. 1, 1909.

956,428. **Patented Apr. 26, 1910.**

2 SHEETS—SHEET 1.

Fig. 1.

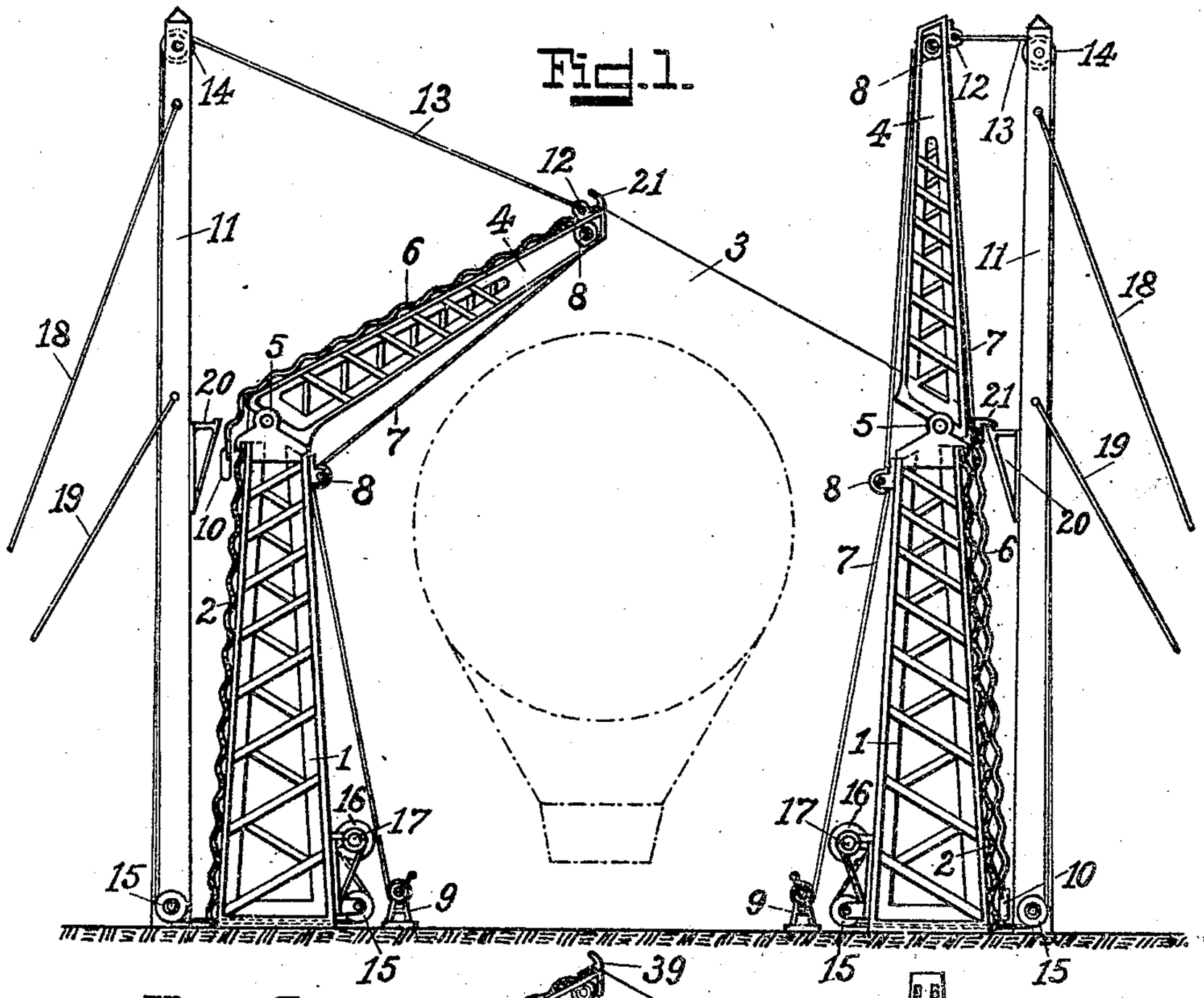
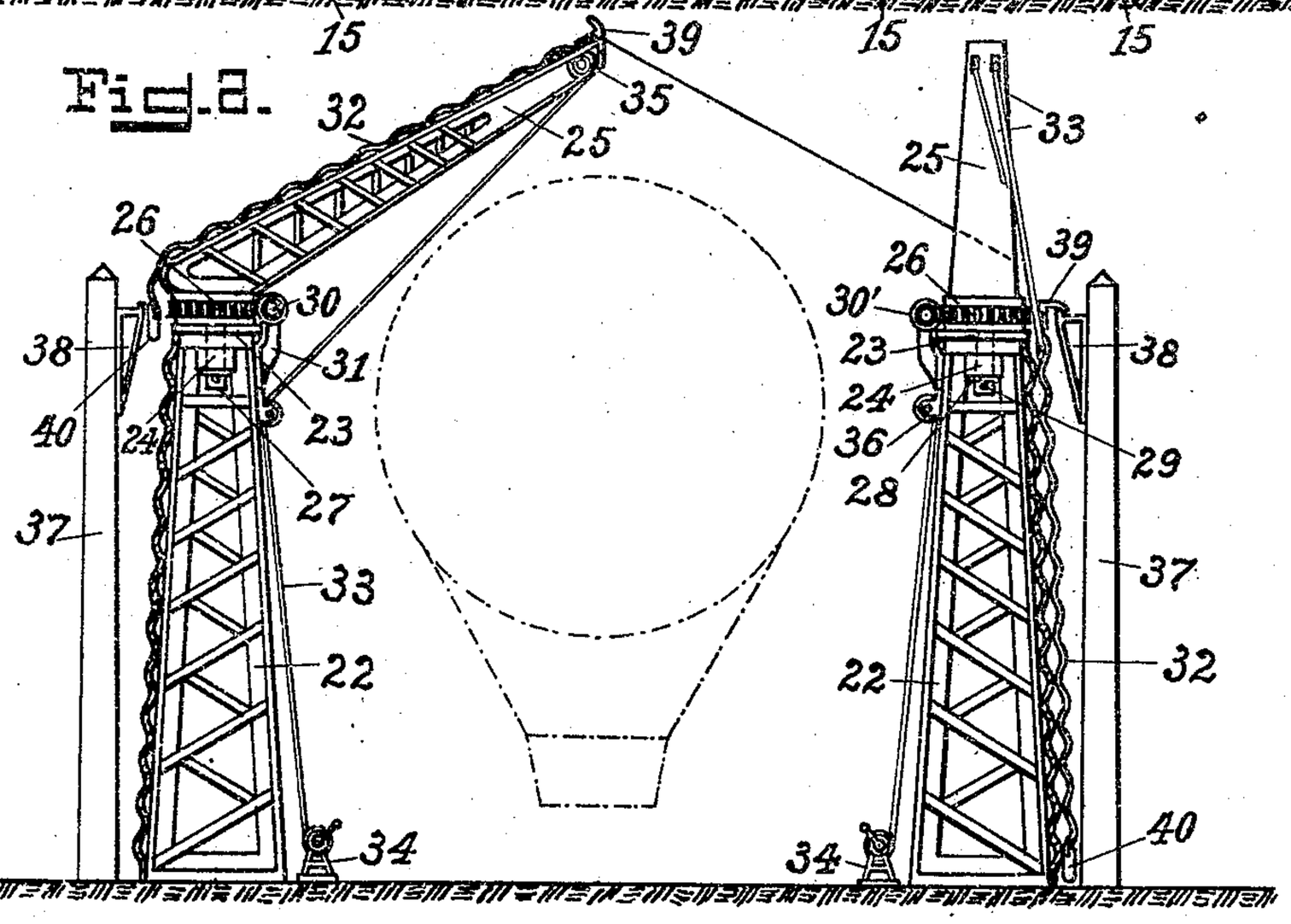


Fig. 2.



Witnesses:
G. T. L. Wright
Frank B. Hoffman.

Inventor:
Nikolaus Rueben,
per Victor J. Evans,
Attorney.

N. RUEBEN.

AIRSHIP HALL WITH TEMPORARILY REMOVABLE ROOF.

APPLICATION FILED SEPT. 1, 1909.

956,428.

Patented Apr. 26, 1910.

2 SHEETS—SHEET 2.

Fig. 3.

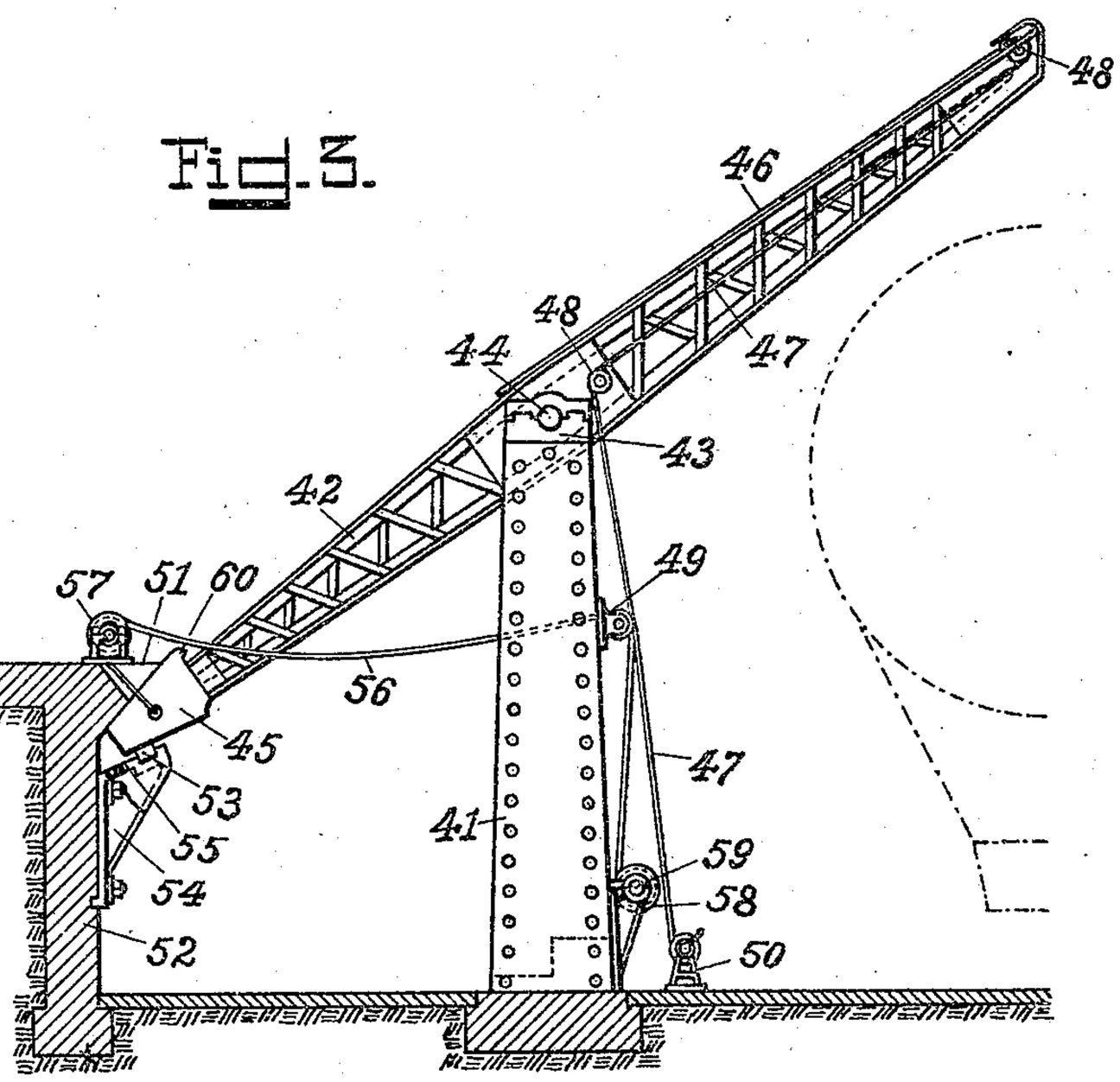
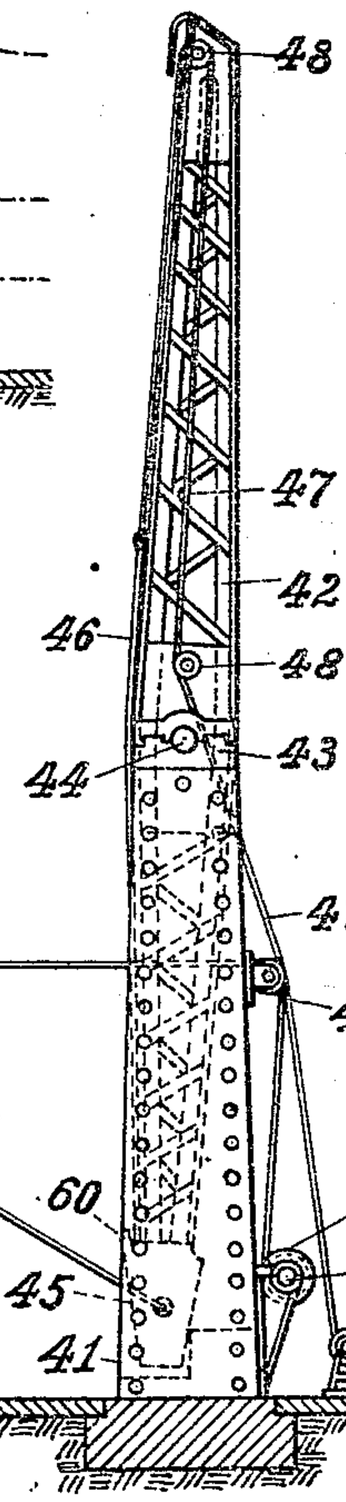


Fig. 4.



Witnesses:
J. L. Wright,
Frank B. Hoffman.

Inventor:
Nikolaus Rueben,
per Victor J. Evans,
Attorney

UNITED STATES PATENT OFFICE.

NIKOLAUS RUEBEN, OF AIX-LA-CHAPELLE, GERMANY.

AIRSHIP-HALL WITH TEMPORARILY-REMOVABLE ROOF.

956,428. Specification of Letters Patent. Patented Apr. 26, 1910.

Application filed September 1, 1909. Serial No. 515,590.

To all whom it may concern:

Be it known that I, NIKOLAUS RUEBEN, architect, a subject of the King of Prussia, residing at Aix-la-Chapelle, No. 25 Krefelderstrasse, in the Kingdom of Prussia, Empire of Germany, have invented certain new and useful Improvements in Airship Halls with Temporarily-Removable Roofs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Halls whose roofs consist of two halves, which may be run out on rails lengthwise of the hall in order to lay open the interior of the hall are known. Likewise have smaller halls been built whose roofs are in part balanced and connected with doors in such a manner that on opening the door the balanced part of the roof will be opened and returned to its normal position when the door is closed again; and finally have halls been constructed in such a manner that both lateral halves of the roof can be swung back and returned again to their normal position by swinging each half of the roof around an axis lying parallel to the major axis of the hall. All these constructions are, however, not suitable for halls designed for housing air-ships of modern type because the gigantic dimensions of the halls necessary for this purpose would, if executed as indicated above, make it impossible to cover or uncover the interior of such halls with any ease by the aid of comparatively simple mechanical means.

The object of my present invention is to avoid all the drawbacks shown by the above-mentioned kinds of halls, to which end each lateral half of the roof-covering is divided into a number of suitable lengths or divisions, of which each is slidingly arranged upon rafters not rigidly connected at the ridge of the roof and capable of being swung in and out in a vertical plane around an axis of rotation arranged on top of and in alinement with the side-walls of the hall; or capable of being swung on top of said walls around a vertical axis in a horizontal plane until coinciding with said side-walls. In this manner the whole area of the hall can be covered or uncovered during calm or stormy weather without trouble and with the aid of comparatively simple mechanical means, in order to let an airship enter or leave the hall.

In the accompanying drawings diagrammatically illustrating my present invention, Figure 1 is a cross-sectional view of the new air-ship hall, wherein the rafters are swung in and out in a vertical plane. Fig. 2 is a similar view wherein the rafters are swung around their pivots in a horizontal plane. Fig. 3 is a modification of the arrangement of the roof-covering and rafters shown in Fig. 1 in a closed position. Fig. 4 is a similar view of the modification shown in Fig. 3 showing rafters and roof-covering in an elevated position.

The side-walls of the air-ship hall preferably consists of the pillars 1 and the corrugated sheet-metal plates 2, but might of course be constructed as solid walls if so desired. The gable-walls 3 may be of any suitable construction. The rafters 4 here shown like the pillars 1 consist of lattice-work to combine strength with lightness. The rafters 4 are rotatably connected with the pillars 1 by means of powerful hinges 5 and sustain the roof-covering 6 which preferably consists of corrugated sheet-metal, because the latter combines lightness, flexibility and strength, so that the pillars 1 and the rafters 4 may be arranged at comparatively large distances apart from each other. The roof-covering 6 consists of lengths or divisions, which preferably reach from the middle of one rafter to the middle of the next, but may, if so desired, extend across more than two rafters. Each division of the roof-covering thus arranged upon and supported by the rafters may be slid up or down on the latter by means of wire-ropes 7, or the like, which are attached near the upper edge of each division and then led over sheaves or rollers 8, of which one, or more if convenient, are arranged in the upper end of the rafter 4 sustaining said division, whereas another is arranged at the upper end upon the inside of the pillar 1, as by way of illustration shown in Fig. 1. The lower ends of said ropes, or the like, are attached to drums of windlasses 9. The lower edge of each division of the roof-covering is preferably provided with a heavy bar 10 to assure a perfect sliding action when a division of the roof-covering is to be slid from its rafters in order to let the latter offer the least resistance to the wind when elevated.

To lower a division of the roof-covering 6 the ropes 7 or the like, are unwound from the drums of the windlasses 9, whereby the division in question takes up the position shown at the right-hand side of Fig. 1.

Near the side-walls 2 of the hall masts 11 are erected which in Fig. 1 reach above the ridge of the hall and aid in swinging the rafters 4 in and out. To this end eyes 12 are secured to the rafters 4 to which wire-ropes 13, or the like, are attached and then led over sheaves or rollers 14 journaled in the upper end of said masts. The ropes 13 are then led downward and passed over sheaves or rollers 15, arranged at the foot of the masts and pillars respectively, whence they are led to the drums 16 of the shaft 17, which preferably passes from end to end of the hall to elevate or lower all rafters of the same side of the roof in one operation, to which purpose said shaft 17 may be coupled to any suitable prime mover (not shown). To prevent the masts 11 from bending, bracing-ropes 18, 19 are provided, but may be avoided by making the masts sufficiently rigid. The masts 11 are provided with brackets 20 to support the divisions of the roof-covering when lowered, to which end each division is provided with ears 21, which rest upon said brackets when the roof-covering has been completely slid from the rafters, as indicated at the right-hand side of Fig. 1, which part of Fig. 1 also shows the rafters in their elevated position.

To return the rafters and the divisions of the roof-covering into their normal position the rafters 4 are lowered first and then said divisions drawn up one by one until the whole roof is completely closed again. The handling of the divisions of the roof-covering one by one offers the advantage, that the whole roof-covering can be lowered even during a storm by the aid of comparatively weak mechanical means, which would be extremely difficult, if not impossible at all, when an attempt were made to lower or elevate one half of the whole roof-covering in one operation. Instead of swinging the rafters in or out of the way in a vertical plane, as indicated in Fig. 1, they may be swung around vertical pivots in a horizontal plane. To this end each pillar 22 forming a part of the side-wall of the hall is capped by a base-plate 23 provided with a downwardly projecting extension 24, whereas the lower end of each rafter 25 is provided with a worm-wheel segment or worm-wheel 26 and a pivot-pin 27 which latter passes through said plate and its extension and is protected against accidental removal by means of the washer 28 and the pin 29. The shaft 17 of Fig. 1 is here replaced by the shaft 30 journaled in the brackets 31 which are secured to the pillars 22. This shaft, like shaft 17 of Fig. 1, preferably runs from end to end of the hall and receives its motion from any suitable prime mover (not shown), so that on rotating the shaft 30 all the rafters of the same side of the hall may be simultaneously swung in or out around their pivots by means of the worms on shaft 30, which mesh with the worm-wheel segments or worm-wheels 26. The flexible roof-covering 32 can be elevated and lowered in the same manner as the flexible roof-covering 6 shown in Fig. 1, by means of the wire-ropes 33, or the like, and windlasses 34. The ropes 33 are here led over the sheaves or rollers 35 and 36 respectively.

The masts 37 shown in Fig. 2 are shorter than the masts 11 shown in Fig. 1, because simply employed for the support of the divisions of the roof-covering 32 when lowered, to which end said masts here too are provided with brackets 38 to receive the ears 39 attached to the upper edge of the divisions of the roof-covering. To aid said divisions in sliding from the rafters they are provided at their lower edge with a weighty bar 40 each.

In Figs. 3 and 4 another modification of my invention is shown. This modification is particularly adapted for an air-ship hall, which for the reason, to be as little as possible exposed to high winds or heavy storms, is partially sunk into the ground. Here the pillars 41 forming part of the side-walls of the hall are constructed in a manner to receive the lower end of the rafters 42, which in this instance extend rearwardly beyond their fulcrums. To both sides of the rafters 42 bearings 43 for the trunnions 44 of the rafters 42 are arranged on the top of said pillars. The lower end of each rafter is provided with a head 45, by means of which the rafter is balanced. The roof-covering 46 may in this instance consist of plain sheet-metal since it does not need to slide around a corner while being lowered or elevated as the roof-coverings shown in Figs. 1 and 2 are compelled to do. To each division of the roof-covering 46, ropes 47, or the like, are attached and then led over the sheaves or rollers 48, carried by the rafters 42, and over one of the sheaves or rollers 49, carried by the pillars 41, to the windlasses 50. When the divisions of the roof-covering are lowered, they rest against the heads 45.

In operative position each head 45 is held in position between the projection 51 of the wall 52 and a key 53 held in the bracket 54 provided with a slot 55 for the passage of the head 45. To each head 45 is secured a wire-rope 56, or the like, which passes over the sheave or roller 57 arranged upon the top of the wall 52 and is then led over one of the sheaves or rollers 49 to a drum 58 of the shaft 59, which, for the sake of elevating all the rafters of one side of the

hall-roof simultaneously, is preferably coupled to a prime mover (not shown).

To elevate the rafters of one half of the roof, the divisions of the roof-covering thereof are lowered one by one by paying out the ropes 47 until said divisions rest against the shoulders 60 of the heads 45. Hereupon the ropes 56 are paid out until the rafters 42 have attained the position shown in Fig. 4, thus uncovering the interior of the hall to let an air-ship leave or enter the latter. To close the roof the ropes 56 are wound upon the drums 58 of the shaft 59 until the rafters attain the position shown in Fig. 3 and are held therein by inserting the keys 53. After this the several divisions of the roof-covering are returned to their normal position by winding up the ropes 47 by means of the windlasses 50.

It is evident that minor changes in the arrangement and construction of parts may be executed without departing from the spirit of my present invention and therefore I claim as my invention all such constructions as plainly fall within the scope of the appended claims.

I claim:—

1. An air-ship hall with temporarily removable roof, comprising walls, rafters mounted on said walls and capable of being swung out of their operative position to leave the interior of the hall temporarily free, and a roof-covering divided into lengths or divisions and slidingly arranged upon said rafters.

2. An air-ship hall with temporarily removable roof, comprising gable-walls, side-walls, rafters mounted on said side-walls to be swung out of their operative position, means for swinging said rafters in and out of their operative position, divisions of the roof-covering slidingly arranged upon said rafters, and means for operating said divisions of the roof-covering independently of each other.

3. An air-ship hall with temporarily removable roof, comprising gable-walls, side-walls, pillars forming part of said side-walls, rafters rotatably connected with said pillars, means for simultaneously swinging said rafters in and out of their operative position, divisions of the roof-covering slidingly arranged upon said rafters, and mechanical means capable of removing said divisions of the roof-covering from their operative position before said rafters have been moved to leave the interior of the hall free and returning them again into their operative position after said rafters have been returned to their normal position.

4. An air-ship hall with temporarily removable roof, comprising gable-walls, side-walls containing pillars arranged at intervals therein, rafters rotatably sustained by said pillars and extending rearwardly beyond their fulcrums, means for securing the rearward extensions of said rafters when the latter are in their operative position, means for swinging said rafters in and out of their operative position, divisions of the roof-covering slidingly arranged upon said rafters, and means for sliding said divisions up and down on said rafters.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

NIKOLAUS RUEBEN.

Witnesses:

HENRY QUADFLIEG,

OSCAR FÄRGER.