

(No Model.)

3 Sheets—Sheet 1.

J. E. FULLER.
APPARATUS FOR FORMING, MAINTAINING, AND RENEWING THE ICE
FLOORS OF SKATING RINKS.

No. 489,227.

Patented Jan. 3, 1893.

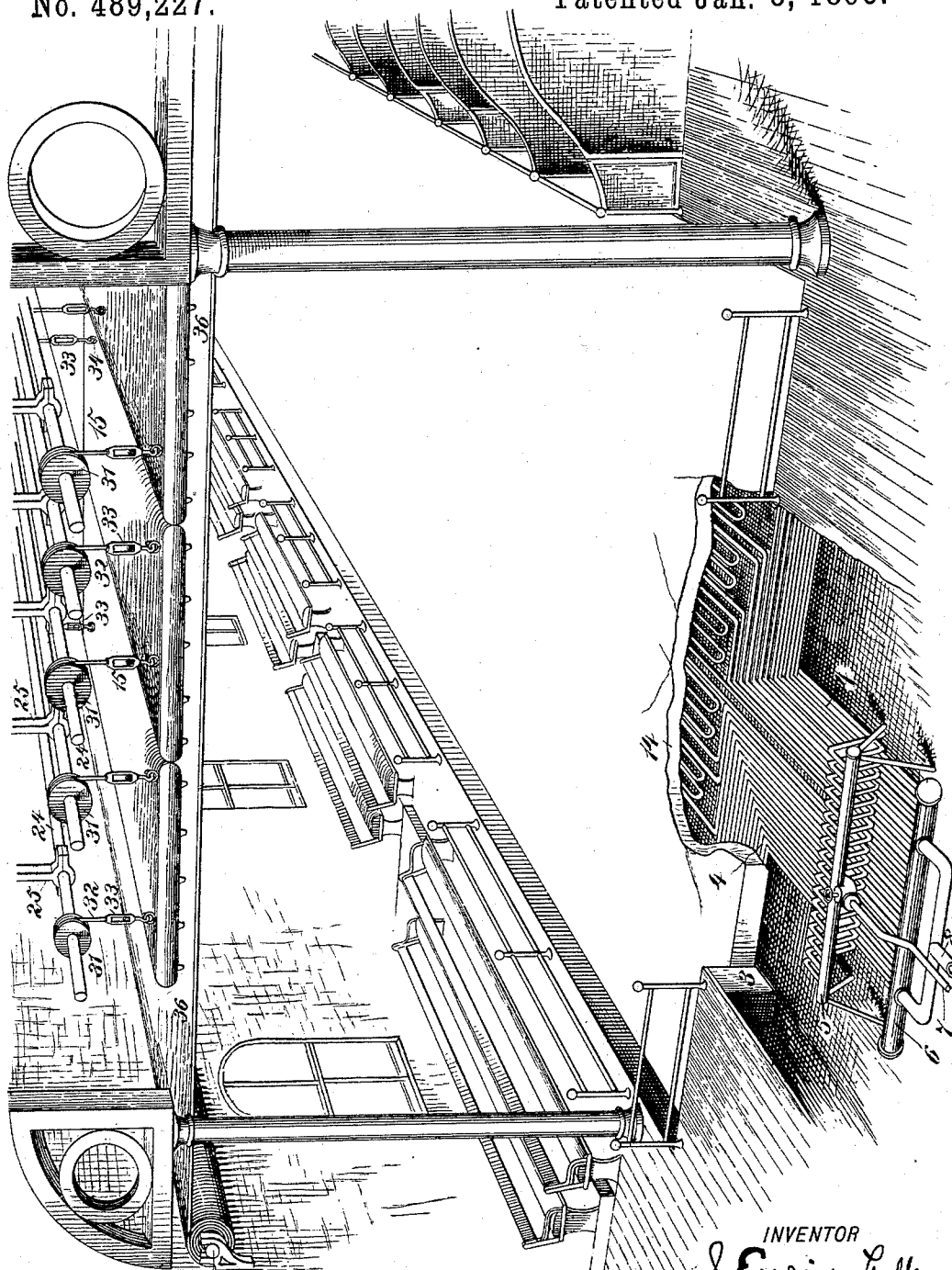


Fig. 1.

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(No Model.)

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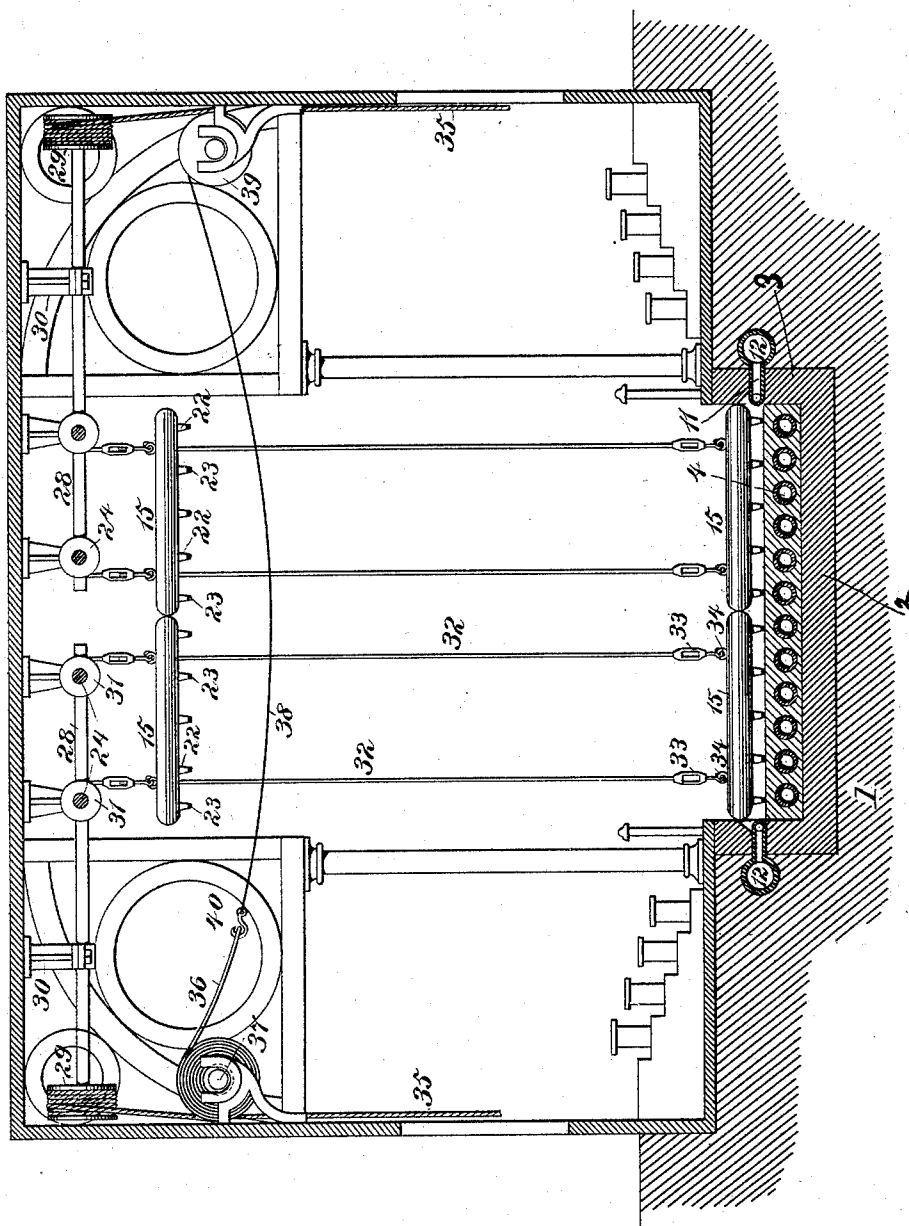
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Fig. 2.



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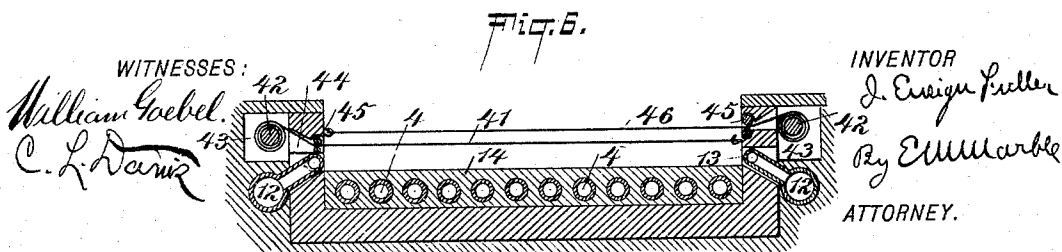
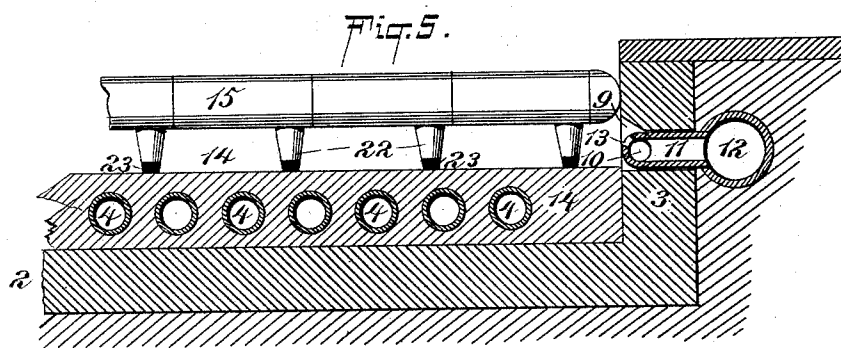
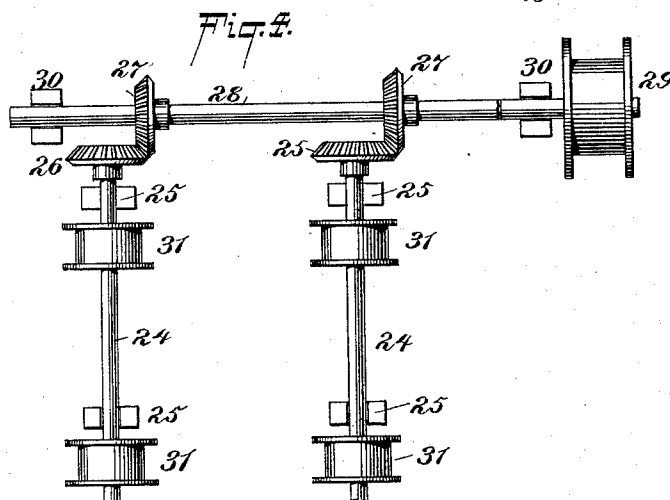
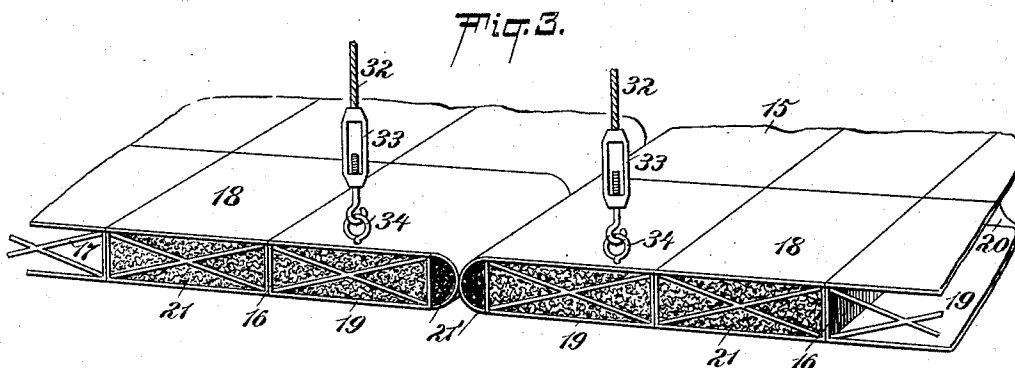
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William Goebel.
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INVENTOR

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UNITED STATES PATENT OFFICE.

J. ENSIGN FULLER, OF NEW YORK, N. Y.

APPARATUS FOR FORMING, MAINTAINING, AND RENEWING THE ICE-FLOORS OF SKATING-RINKS.

SPECIFICATION forming part of Letters Patent No. 489,227, dated January 3, 1893.

Application filed February 4, 1892. Serial No. 420,313. (No model.)

To all whom it may concern:

Be it known that I, J. ENSIGN FULLER, a citizen of the United States, and a resident of the city and county of New York, in the State of New York, have invented certain new and useful Improvements in Apparatus for Forming, Maintaining, and Renewing the Ice-Floors of Skating-Rinks, of which the following is a specification, such as will enable others skilled in the art to which it appertains to make and use the same.

When the ice-floor of a skating rink, in which the same is produced by artificial means, is first frozen, it is almost impossible to produce a perfectly level skating surface thereon by the process of freezing alone; and it is usually found necessary to plane off the inequalities of such surface before the same is in a condition to allow skating thereon. As soon, however, as the rink has been used for a few hours, the ice surface becomes so cut up and roughened by the sharp skates of those using the same, that it is no longer fit for use, and it is necessary to renew such skating surface in some manner. Heretofore this has been accomplished either by flooding the ice-floor to the depth of an inch or two and then freezing the film of water so added to the ice-floor beneath it, or by allowing the ice-floor to wholly melt, and then refreezing it. By either of these processes it has been found practically impossible to produce a skating surface which is fit to be used without being first planed to a level, and by the latter, the expense of operating the rink is much increased, by reason of the great quantity of refrigerant, which it is necessary to use each day, in order to freeze the entire body of water, which when turned to ice, constitutes the skating surface. It has also been found that after the ice-floor has been formed, and is ready for use, except in exceedingly cold weather, it is necessary to constantly use a large quantity of refrigerant in order to prevent such ice-floor from melting, and as the larger the rink the greater the amount of air which must be cooled in order to prevent such melting, the expense of maintaining rinks with large skating surfaces is enormous, by reason of the large quantity of refrigerant which must thus be used in maintaining as well as forming the ice-floors thereof.

By reason of the several difficulties before

mentioned, which have been encountered in the running of skating rinks in which the ice-floors therein are produced by artificial means, hitherto it has been a practical impossibility to make a financial success of the operation thereof; but all of said difficulties I overcome by means of an apparatus extremely simple in construction, and easy of operation, which is fully disclosed in the following specification, of which the accompanying drawings form a part, wherein similar numerals of reference designate like or equivalent parts wherever found throughout the several views, and in which:—

Figure 1, is a view in perspective of the interior of a rink provided with my improved apparatus, and ready for skating, parts being broken away in order to more fully show the construction thereof; Fig. 2, a view, in central vertical cross-section, of a rink provided with my improved apparatus, showing part of that portion of the apparatus used for covering and preserving the ice-floor when not in use, in position, Fig. 3, a view in central vertical section of a portion of two of the sections of such insulating cover by which the ice-floor is preserved, showing the manner of attaching the hoisting ropes thereto, Fig. 4, a plan view of the arrangement of the gearing by which the various sections of such insulating cover are hoisted from the ice-floor so that the same be used for skating, Fig. 5, a detail view on an enlarged scale of one side of the ice-floor of the rink, with the insulating cover in position thereon, showing the device for renewing the skating surface of the ice-floor, and Fig. 6, a view of the ice-floor in cross section, showing a modified form of cover to be used in renewing the skating surface in position thereon.

Referring to the drawings:—The numeral 1, designates a water-tight basin, having a thick floor 2, and thick side walls, 3, made of any suitable insulating and water-tight material. Within this basin 1, are arranged a series of pipes 4, preferably in the form of loops, as shown in Fig. 1, which communicate at one end with a small header 5, and at the other with a larger header 6. The small header 5, is in communication with a supply of liquid anhydrous ammonia, or other refrigerant, supply through a pipe 7, and the large header 6,

is in communication with any anhydrous ammonia absorber, or compressing pump, or other receptacle for the refrigerant, through a pipe 8.

5 Along the inside of the walls 3, of the basin 1, and preferably placed in a groove 9, formed therein for that purpose, as shown in Fig. 5, are situated pipes 10, in communication by means of short pipes 11, passing through the
10 walls 3, of the basin, with larger pipes 12, which are in communication with a steam or hot air supply, for the purpose hereinafter stated. The upper side of the groove 9, preferably slants upward as shown, and the pipe
15 10, is provided with perforations 13, on the upper outward side thereof, through which the hot air or steam may be projected therefrom in an upward and outward direction.

The ice-floor 14, of the rink, when not in
20 use for skating, is preserved and kept from melting, by being covered with a cover 15, which is preferably of the form of construction shown in detail in Fig. 3, and for convenience in handling is preferably made in sections.
25 Each section thereof consists of a light frame-work of boards 16, suitably braced, and held together, by rods of iron 17, provided with a cover 18, and bottom 19, of thin boards, canvas, tarred-paper, sheet metal, or any other
30 suitable material, either singly or in combination with others. However, the bottom, and preferably both sides, of each of said sections of the cover 15, should have an outer covering, at least, of some material which is thor-
35 oughly waterproof, in order that no dampness may penetrate to the filling of such sections. The longitudinal chambers between the boards 16, of the frame-work, are also preferably cut up into squares by cross-partitions
40 20, and the spaces thus left are packed with a filling 21, of light insulating material such as mineral-wool, or ground cork; the purpose of the partitions 20, being to prevent such insulating material from shifting, as the cover
45 is from time to time moved.

A tight-joint is formed between the edges of the cover 15, and the side walls 3, of the basin 1, and between the abutting edges of the various sections of such cover, in any desired manner, preferably by having such edges
50 formed rounded as shown, of canvas or other flexible material, filled with an elastic filling 21', such as cotton, or the like, which will be compressed so as to form an air-tight joint,
55 when the various sections are lowered into position on the ice-floor. On the under side of this insulating cover 15, are preferably secured short-legs 22, provided with rubber feet 23, which rest upon the ice-floor 14, when the
60 cover is in position thereon, and serve to support said cover at a short distance above the surface thereof, as shown in Figs. 2 and 5.

Although the various sections of the insulating cover 15, may be placed upon and re-
65 moved from the ice-floor 14, in any desired manner, and by means of any suitable mechanism, I prefer to use the form of device

shown in Figs. 1, 2, 3 and 4, for that purpose. This mechanism consists of two or more rev-
70 oluble shafts journaled in hangers 25, which are suspended from the ceiling of the rink. These shafts are each provided with bevel-gear wheels 26, meshing with corresponding bevel-gear-wheels 27, mounted upon a shaft
75 28, having a driving pulley 29, through which power is transmitted thereto, such shaft 28, being also supported by hangers 30, similar to those which support the shaft 24. Each of the shafts 24, has rigidly mounted thereon, so as to be rotated therewith, two or more
80 drums 31, adapted to receive and wind upon themselves when rotated, ropes or chains 32, the lower ends of which are secured to the top of a section of the cover 15, by means of a hooked turn-buckle 33, and ring 34, secured
85 to such section in any desired manner.

It will be seen that a hoisting apparatus of the form described, is provided for each of the various sections of the cover 15, and as each of them is operated separately, the cover
90 may be hoisted or lowered, with but a small expenditure of power. The two gear wheels 27, are of the same diameter, as are also the two-gear-wheels 26, meshing therewith, consequently a rotation of the shaft 28, causes a
95 synchronous rotation of the two shafts 24, carrying the drums 31, which being also each of the same diameter, wind up the same quantity of rope at each revolution, and thus the section of the cover 15, hoisted thereby,
100 is kept in a level position at all times; any departure from a level position, caused by uneven stretching of the hoisting ropes 32, being easily corrected by a manipulation of the turn-buckles 34. Power may be applied to
105 this hoisting apparatus, by means of a rope 35, coiled upon the pulley 29, or in any other convenient way.

The bottom of the cover 15, being somewhat unsightly, the same is preferably hidden
110 from view when the various sections thereof are raised, by a flexible curtain or false ceiling 36, of any suitable material, such as bunting or canvas, which may if desired be decorated in a suitable manner, which is drawn
115 beneath the raised cover 15, and there supported, by any convenient means. This curtain or false ceiling 36, when not in use is preferably rolled upon a revoluble roller 37, located at the side of the rink, as shown,
120 in Figs. 1 and 2, and is preferably drawn across the rink beneath the raised cover 15, and held in position when desired, by means of wires or ropes 38, reeled upon drums 39, located at convenient points along the rink,
125 upon the side thereof opposite to that upon which is located the roller 37. These wires or ropes 38, are secured to the edge of the curtain or false ceiling 36, in any convenient manner, preferably by means of hooks 40, secured to such wires or ropes, and hooking
130 into grommets formed in said curtain for that purpose as shown. These wires or ropes 38, may be unhooked and coiled upon the drums

39, when it is desired to lower the cover 15, or they may be so placed as to correspond to the spaces between the ends of the various sections of the cover 15, in such manner that said sections may slip by them when raised or lowered; and if the rink be a large one, the curtain or false ceiling 36, for convenience in handling, may be made in sections.

Although in Fig. 1, I have shown the cover 15, as in sections which are one-third the width of the basin 1, and in Fig. 2, as in sections which are one-half the width thereof, it is evident that the number of such sections may be increased or diminished, and that if the basin 1, be small enough, such cover may be made in but one section of sufficient size to cover the entire basin, without departing from the scope of my invention.

The operation of the apparatus is as follows:—The basin 1, being first flooded with water to a depth of say from six to eight inches, and sufficient to cover the pipes 4, to at least a depth of two inches, the cover 15, is lowered so as to cover the water in the basin 1, but not sufficiently far for the legs 22, to reach the water therein. Liquid anhydrous ammonia being then admitted to the small header 5, through the pipe 7, passes therefrom through the pipes 4, to the large header 6, from whence it passes through a pipe 8, to an absorber or compressing pump, not shown, located at any convenient point. In its passage through the pipes 4, this liquid anhydrous ammonia is expanded into a gas or vapor so rapidly that it takes up the latent heat in the water in the basin 1, and in consequence such water is soon frozen into a solid sheet of ice 14. The cover 15, being then raised and the inequalities of the surface of the ice, caused by the bulging and heaving of certain parts of the ice-floor, invariably present in the freezing of large surfaces, being scraped or planed off, until the entire surface is reduced to a level, the rink will be ready for skating. A few hours use of this ice-floor will so cut up and roughen the same, that it will no longer be fit for use, and it is then necessary to replace the roughened surface thereof by a new surface of smooth ice, which shall be fit for skating. In order to do this, the fine particles of ice which have been cut therefrom by the sharp skates, together with the grit and dirt which have necessarily collected on such ice-floor, are first removed by sweeping with stiff brooms, or in any other convenient way, and the cover 15, is then lowered into position so as to completely cover the basin 1, but so that the rubber feet 23, of the legs 22, thereof, are from two to three inches above the surface of the ice-floor 14. Steam or hot air under pressure being then admitted to the pipes 12, passes therefrom through the pipes 11, to the pipes 10, from which it escapes through the perforations 13, into the confined space between the bottom of the cover 15, and the top of said ice-floor 14. During this operation, there being

no anhydrous ammonia passing through the pipes 4, the hot air or steam soon melts the surface of the ice-floor, to say the depth of an inch or so, throughout the entire basin 1; when the hot air or steam being shut off, and if desired a small quantity of fresh water admitted to the basin 1, to take the place of the ice removed by sweeping, anhydrous ammonia is admitted to the pipes 4, as hereinbefore described, and the thin film of water on top of the ice-floor is soon converted into ice, and frozen solidly to the six or eight inches of ice already below it, but inasmuch as this large body of ice below, has bulged and heaved all that it possibly can when originally frozen, this renewed surface will be found to be substantially level, and ready for use as soon as frozen, without being scraped, planed or otherwise leveled.

Sometimes when steam is used to melt the surface of the worn and roughened ice floor, as hereinbefore described, the same is not turned off when the anhydrous ammonia is admitted to the pipes 4, and when it is thus allowed to continue to flow into the space between the top of the ice floor and the bottom of the cover 15, during the operation of freezing the new surface, such steam is condensed, and falling upon the ice-floor in the form of a mist, freezes quickly thereto, and thus assists in forming a perfect glare-ice skating surface, as well as in making up for the loss occasioned by the removal of the sweepings of ice, cut from the floor by the skaters.

When not in use for skating, and when not undergoing the process of renewal, the ice-floor 14, is kept preferably covered by the cover 15, which is lowered so that the rubber feet 23, of the legs 22, rest upon the surface thereof, thus taking the strain from the hoisting apparatus, and when so covered by this insulating cover 15, it will be found that the ice-floor may be preserved intact for days, with the use of but little, if any refrigerant.

If the steam or hot air were admitted to the space between the top of the ice-floor and the bottom of the cover 15 in a downward or even a horizontal direction, it would have a tendency to plow or furrow out the surface of the ice, and to avoid this difficulty I prefer to have such steam or hot air issue from the pipe 10, at the upper outer side thereof, as shown in Fig. 5, so as to strike either against the under side of the cover 15, or the upper wall of the groove 9, and thus be deflected toward the center of the rink. By this means, as the pipes 10 and 12, are preferably arranged on all four sides of the basin 1, and the hot air or steam, is thus directed from all sides toward the center at once, the hot air or steam will come into contact with the ice at the center almost as soon as it does with that at the sides, and in consequence the melting of the surface of the ice-floor will be practically equal at all points, and the renewed surface when frozen therefore substantially level.

When steam is used in this process of re-

newing the surface of the ice-floor, and the same is allowed to issue from the pipes 10, during the process of freezing, much of the water condensed therefrom will be deposited and frozen upon the legs and under surface of the cover 15, and this melting and dripping upon the ice-floor after said cover is hoisted will annoy the skaters, when the curtain or false ceiling 36, is not used, and discolor and spoil the appearance of such curtain when it is. To overcome this difficulty, the modified form of construction shown in Fig. 6, may be used. In this form of the device, a flexible curtain 41, is stretched tightly across the basin 1, just above the pipes 10, and the steam or hot air is then admitted to the space between such curtain and the ice-floor, as hereinbefore described. This curtain 41, when not in use, is preferably rolled upon a roller 42, located in a recess 43, and passes through a slit 44, made for that purpose in the side wall 3, of the basin 1, and between rollers 45, which clear the same of the ice which has formed thereon from the water condensed from the steam, when the curtain is drawn back and rolled upon the roller 42. This curtain 41, may, of course, be used in connection with the cover 15, or separately therefrom, and when such insulating cover 15, is not used, a second flexible curtain 46, may be drawn across the basin 1, a short distance above the other, and these two curtains with the air space between them will also act as an insulating cover for the rink, when the same is not in use, and will protect the ice-floor from melting to a certain extent, although not near as effectively as will the cover 15, packed with insulating material.

It is evident that other refrigerant than anhydrous ammonia, and other means than the pipes 4, may be used for freezing the ice-floor, and that the same may be formed in any manner; also that many modifications in the construction, combination and arrangement of the various parts of my improved apparatus for forming, maintaining and renewing the ice-floors of skating rinks, other than those mentioned, may be made without departing from the scope of my invention, and I do not limit myself to any particular form or mode of constructing the same, but

Having described my said invention, its construction, and the manner of operating the same, what I claim and desire to secure by Letters Patent is:—

1. The combination with the ice-floor basin of a skating-rink, of a removable insulating cover therefor, a series of ropes or chains attached to such cover by which the same may

be hoisted from or lowered into position, a series of drums upon which the ropes or cables may be wound, and means for synchronously rotating said drums, so as to hoist or lower the cover and maintain the same in a horizontal position at all times, substantially as shown and described.

2. The combination with the ice-floor basin of a skating-rink, of a removable cover therefor, and means for introducing heated gases or vapors into the confined space between the surface of the ice-floor and the cover, substantially as shown and described.

3. The combination with the ice-floor basin of a skating-rink of a removable cover therefor, and perforated heating pipes arranged around the walls of the basin, and adapted to discharge their contents into the basin beneath the cover, but above the ice-floor, substantially as shown and described.

4. The combination with the ice-floor basin of a skating-rink, of a removable cover therefor, and heating pipes adapted to discharge their contents into the space between the ice floor and the cover, in an upward direction, arranged around the walls of such basin, substantially as shown and described.

5. The combination with the ice-floor basin of a skating-rink, of a cover therefor, mechanism whereby said cover may be hoisted and suspended above the basin, and a curtain or false ceiling adapted to be drawn under and held suspended beneath the raised cover, substantially as shown and described.

6. In a skating-rink, the combination with the ice-floor basin thereof, of a removable insulating cover therefor, provided with short legs secured thereto and adapted to support the same, and a heating pipe or pipes arranged along the walls of the basin, and adapted to discharge the contents thereof beneath the insulating cover and above the ice-floor when the cover is in position upon such ice-floor, substantially as shown and described.

7. A removable insulating cover for the ice-floors of skating-rinks, having a rigid body portion, and compressible elastic edges, as 21', whereby a tight joint may be formed between the same and abutting surfaces, substantially as shown and described.

Signed at the city and county of New York, in the State of New York, this 1st day of February, A. D. 1892.

J. ENSIGN FULLER.

Witnesses:

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C. L. DAVIS,