D. H. SCOTT.

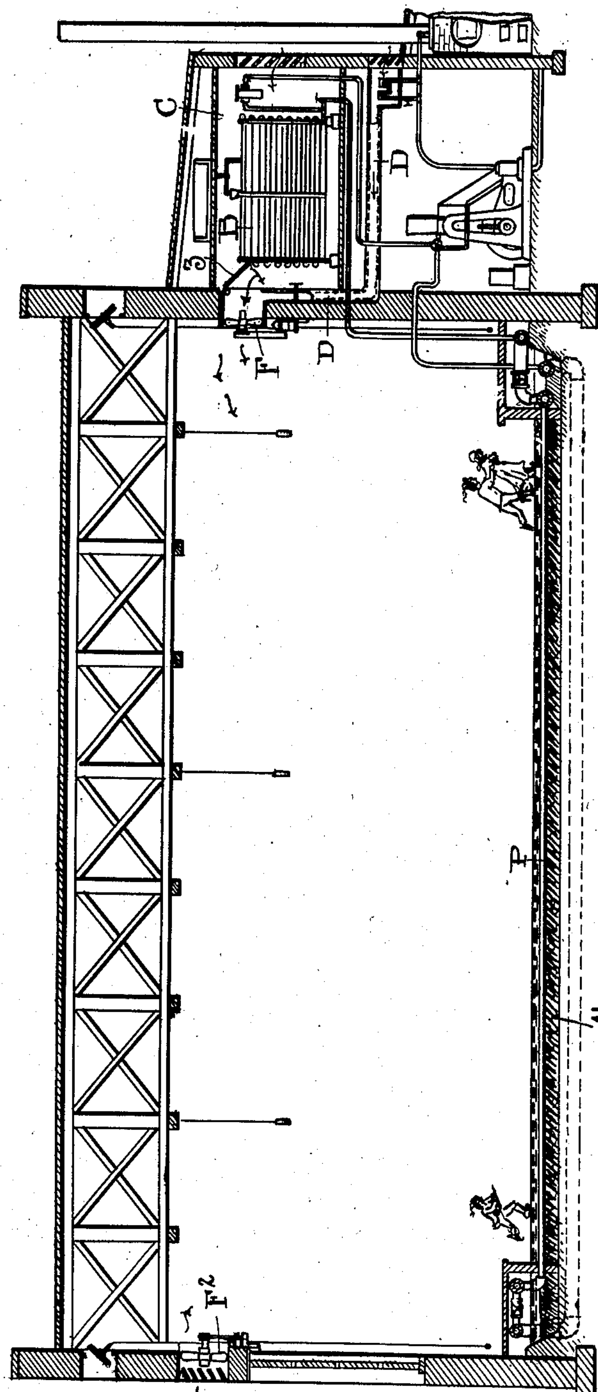
METHOD OF MAKING AND MAINTAINING ICE IN SKATING RINKS.

APPLICATION FILED JULY 23, 1909.

1,053,443. Patented Feb. 18, 1913

2 SHEETS—SHEET 1.

Fig. I.



ATTEST
E. M. Fisher
E. B. Wright

INVENTOR
Dudley H. Scott.
BY Fisher & Moser ATTYS.

D. H. SCOTT.

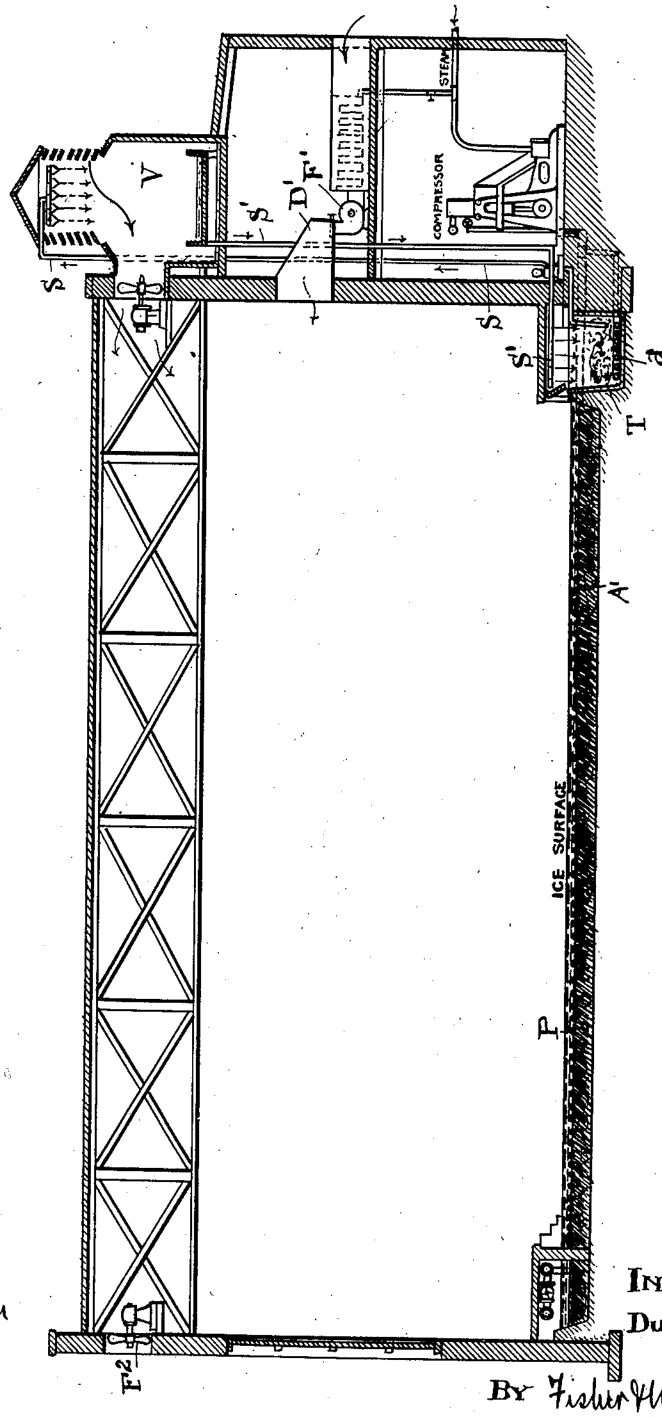
METHOD OF MAKING AND MAINTAINING ICE IN SKATING RINKS.

APPLICATION FILED JULY 23, 1909.

1,053,443. Patented Feb. 18, 1913.

2 SHEETS—SHEET 2.

Fig. 2.



ATTEST

E. M. Fisher

E. P. Wright

INVENTOR.

Dudley H. Scott.

BY Fisher & Moser ATTYS.

UNITED STATES PATENT OFFICE.

DUDLEY H. SCOTT, OF CLEVELAND, OHIO.

METHOD OF MAKING AND MAINTAINING ICE IN SKATING-RINKS.

1,053,443. Specification of Letters Patent. Patented Feb. 18, 1913.

Application filed July 23, 1909. Serial No. 509,120.

To all whom it may concern:

Be it known that I, DUDLEY H. SCOTT, citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Methods of Making and Maintaining Ice in Skating-Rinks, of which the following is a specification.

My invention relates to a method of making and maintaining ice in skating rinks to effect a more successful and economical operation of their refrigerating plants than has been possible heretofore, and by which the ice surface is kept in a perfect skating condition all the time at approximately one-fourth the ordinary power cost. In the past fifteen years, or since artificial refrigeration for skating rinks has become known, there have been several dozen of this character of ice rinks established in the larger cities of the United States and other of the more advanced countries, and during the past winter but three of all this number were running, and one of these only one-half the winter. It would seem from this experience that people do not care for this form of amusement, but except in a few cases where these places have been established too far south, or outside the frost belt, this is not believed to be actually true. On the contrary, when ice rinks have been started in the more favored or skating territory, the patronage has been fine at first both in number and quality of attendance, and while slack management invites failure, yet I am led to believe that the worst drawback lies in not being able to maintain a perfect ice surface for more than a comparatively small portion of the time in the skating sessions. Besides, in the ordinary way of operating, the power expense is so great, especially in the warmer weather or during a thaw, and which periods occur as often as four or five times a month, or oftener, that the management becomes discouraged and adopts small economies that tend to disappoint customers and loss of patronage follows.

My invention contemplates a remedy for these conditions, and is found in certain auxiliaries or accessories which supplement the old or original installation and manner of operation and in a general way comprise an arrangement of fans or blowers adapted to force either cold or warm air into the rink as conditions of temperature and of the ice may require, and thereby so affect the surface of the ice and the temperature of the room as to maintain perfect conditions of atmosphere as well as of ice surface all the time.

In my studies of these refrigerating systems I have noted several things which arise almost daily, even at each session, and which must be overcome in order to make the system successful. For instance, the surface of the ice usually is too cold at the beginning of the session and therefore cuts badly for the first half hour, making it so rough and accumulating so much snow that the natural warmth from the lungs and bodies of the customers has no effect in warming the surface. Hence good skating is out of the question for that session, as nothing can be done until the people are off the ice. Besides, the ice has to be all scraped or planed down before the surface can be again frozen with fresh water, and a large quantity of water must be used in order to make a smooth surface, thus entailing a heavy expense. Nor can one afford to start with anything but very cold ice under the practice of the old system. For example, if the temperature in the room be middling high, say 37 or 38°, and the crowd is quite large, the temperature of the room will rise so rapidly, going up to 42 or 44°, that the ice will melt in spite of the fact that the machines are working overtime to keep the ice in condition, and the expense incurred in this extra work is great. So it follows very naturally that there is sure to be either rough or wet ice, under the conditions just recited, and until my invention there was no remedy for this, so far as I am aware.

Now, referring to the drawings for an illustration of my invention, Figures 1 and 2 are sectional elevations lengthwise of a building showing a refrigerating plant with my improvements added, but varying somewhat in details as will be seen further along.

In these views refrigerating pipes P are shown in both figures within or beneath the ice as usual. These pipes are about $4\frac{1}{2}$ inches apart and $1\frac{1}{4}$ inches in diameter, and a solution of chlorid of calcium or its equivalent as a refrigerating medium is circulated through the same to freeze the surface as well as to maintain a temperature that will keep the surface from melting, the ice being about $2\frac{1}{2}$ inches above the pipes. This brine in turn runs through what are called "brine coolers" B, shown herein as located in an insulated room or compartment C, and the air in this room being cool I utilize the same for cooling the air in the rink when cool air is wanted, and which is drawn off by fan F. These coolers B are double piped as usual, and rapidly evaporating ammonia or water goes through at the same time, thus cooling the brine and getting it ready for another trip through the ice floor as well as cooling the air in the said room. The only means employed heretofore to offset the high temperature of the skating room caused by the numerous customers was to work the compressors hard enough to make the brine cold enough to keep the ice from melting. This was very expensive as well as frequently abortive in results.

Now, by my present invention and method of operation I am enabled to avoid working the machines excessively and also the injuring of the ice by cutting the surface. This is accomplished, first, by blowing warm air into the room by means of the large fan F, or its equivalent, at a carefully determined elevation above the ice surface to get the best effects and mixing the same with the cold air before it comes in contact with the ice.

When the air in the room is tranquil, the air next to the ice is naturally at about the same temperature as the ice or less than 32°, but the action of the warm air fan puts the entire air of the room in rapid circulation and brings the air next to the ice up to say 44°, thus mellowing the surface so that the ice will not be cut by skating thereon. This operation takes about five minutes and generally occurs just before the skating session begins. The warm blast through either duct or flue D by fan F, or by duct D′ from fan F′, Fig. 2, is then stopped and one or more fans blowing in cold air are then started, and sufficient cold air is blown in from any available source to reduce the temperature of the room to meet the temperature of the brine. This may be by fan F from over the brine cooler with flue D closed and damper 3 open, or by any other suitably arranged fan or fans, say F^2 from low temperature outside the building or any equivalent of these. Now, as to the matter of these temperatures, I find that the most advantageous results are obtained when the brine is approximately at 18° and the air in the rink will be say 41°. However, this relative difference between refrigerating extremes may be varied to meet changing conditions and to promote economical and efficient results. For example, if the brine becomes colder; the temperature of the air may be varied; and vice versa, if the brine becomes warmer, the temperature of the air may be lowered.

As to the source of air, cold or warm, any available source may be used, and the warm air may be supplied to one or more fans by electric, gas, or steam heaters, situated in or near the air shafts or intakes of fans. The cold air may be had in any one or more of several ways, from outside, from water cooled air shafts, or from the brine cooler room of refrigerating plant. Air of 32 to 34° can be obtained from cooler room at any time without raising the temperature of the brine more than one or two degrees, according as to whether the outside air drawn in is warm or very warm. Then by losing one or two degrees of brine, I gain tenfold in holding the ice surface and get the benefit almost instantly, while lowering the temperature of the brine is a slow process and expensive.

Another plan is to use hydrant water in cooling towers, V, see Fig. 2, city water being cold enough for this purpose after the middle of December to first of January. As a means of cooling air before this time as well as after, a large tank or vat T, Fig. 2, perhaps ten feet wide, six feet deep, and thirty or forty feet long, is placed at one end or at one side of the ice surface and below it, so that the ton or more of ice planed off after each skating session may be pushed into it. By having the tank large these shavings may accumulate for several days or during a cold spell. Then as the weather becomes warm again, the water may be pumped from this tank through the air cooling towers, such as V, Fig. 2, thus cooling the air for use in the rinks and in this way making refuse ice economize power expense. For this purpose I show how the water is delivered by pump or otherwise in a spray in tower V by pipe S from tank T. A pipe S′ is also provided for the return of the waters to tank T. A system of brine coils *a* are also placed in the bottom of this tank, so that if a warm spell lasts longer than the snow or ice in the tank the brine may be turned through these coils, thus cooling the water for the towers. The economy of this arrangement is apparent to any one with ice rink experience, for after the brine becomes colder than the ice needs to be, it can be turned through these cooling tank coils to accumulate ice on these coils for future use. Or, in other words, there are periods of time when coils may be storing up ice or frost thereon without any additional expense or cost as when the main brine coils P are not drawn upon for their fullest yield, and coils *a* may be regarded as storage coils for ice that might otherwise go to waste. And, again, when cheap power is used, the compressors can be run for this purpose between sessions. Otherwise, by my plan of holding ice, the ice machines will be standing still between sessions and the skating condition of the ice will be preserved wholly by atmospheric temperatures in the room over the ice.

Now, incident to the foregoing, I have found that thermometers are also a vital part of handling the ice economically and well. Three kinds may be used, mercury, alcohol and electric. The mercury and alcohol instruments for taking outside temperature should be carried through and placed on the inside of the outside wall where the operator can see them at any time by means of a glass. Several of these should also be placed in different parts of the rink and where they may all be seen from the same point. A large electric resistance thermometer, consisting of a system of platinum or nickel wires having the appearance of a wire bread-toaster and sensitive to one-tenth of a degree, is, according to my carefully made tests, at its most desirable elevation when suspended in the center of the rink proper, twenty to forty feet above the ice surface, according to the height of ceiling. If the ceiling be fifty feet the said instrument should be thirty feet above the ice. This, in operation, is connected by wire to a switchboard in front of the operator, not shown. Several branches from both outside and inside should be brought by wire to the same point. The reason for this elaborate use of thermometers is to provide against mistakes. One or two of these branches should take the temperature of the brine just before it goes into the pipe in the ice surface, and another branch take the temperature off from the return brine pipe before it empties into the tank. Also a mercury and alcohol thermometer should be attached to each of these pipes and be in view of the operator. One of each kind may be in the foyer of the rink also, that the operator may look after it as well. Again, a system of ventilation in the roof or windows in the gable ends and operated by hand or by electric or hydraulic motors and wired to switch-board should be employed.

So far as I know and believe the foregoing is an entirely new and original method of governing the condition of the ice and of accomplishing desired results in ice rink work. Formerly the warmth was extracted from the air next to the ice by refrigeration in or through the pipes, or, to phrase it differently, the warmth had to be sucked down through two, three or more inches of ice, a process too slow and costly for practical use. By my method of air treatment beneficial results are obtained in two or three minutes, and in this work speed and despatch are paramount and imperative. And where formerly the plan was to lower the temperature of a large building by exposing the air therein to the brine coils and the ice surface formed thereby at the floor alone, and whereby the initial freezing of the water to form a good and sufficient body of ice for skating purposes took from one to two weeks at a great cost, I with my method am enabled to form this required initial result in about twenty four hours for the single reason that I charge the building full and completely and also uniformly with a body of air of very low temperature and maintain this charge independently by auxiliary means and thereby relieve the brine coils from this duty so that freezing of the water on the floor will proceed swiftly and with despatch. In brief, I do not rely on the floor brine coils and ice surface formed thereby to lower the temperature in the necessarily large building or room to the proper working temperature to form and maintain the ice, but accomplish this result by separate or auxiliary cooling means as described at a great saving in time and cost with far better results as must be obvious.

Brine coils P are preferably laid upon or half embedded in a sand bottom A′ instead of a hard floor or upon supports and this arrangement for expediting freezing of the ice is also believed to be new and original with me when taken in connection with my separate air cooling steps and is of material advantage, as I have found that by having a wet sand bottom or an equivalent granular bottom the spread of the frost at the beginning of operations is very rapid, sand being in its very nature the best medium for obtaining this reuslt.

I am aware of previous attempts to apply heat directly to the surface of the ice to melt the same and to provide a sheet of water over the ice which may be eventually frozen to produce a level skating surface, but all such plans contemplated a step or steps which necessarily could not proceed during skating sessions or when the ice was occupied. Nor do such plans anticipate my idea of raising and lowering temperatures in the rink above the ice to temper the ice surface and to maintain it in the best possible skating condition during sessions regardless of the size of the attendance, variations in temperature (outside and inside), and other uncontrollable changes in conditions. I am also aware that it is not broadly new to circulate the air in a rink about coolers to abstract moisture and maintain a dry atmosphere, but the idea as expressed by this method is to dispel or prevent mists or fog above the ice and no further step or steps is contemplated, such as lowering the temperature in the rink independently of the refrigerating means employed to bring about economical freezing conditions at the ice surface, or in other words, to control refrigeration at the ice surface by independently controlled refrigerating means; nor was this process as stated ever intended to raise or lower the temperatures in the rink over the ice according as the ice itself required heat or cold at the surface to temper or preserve the same for skating, or more specifically, to maintain the ice surface without cutting or melting during skating sessions. I am also aware of the use of apparatus for circulating either warm or cold air as desired through buildings to offset atmospheric conditions outside, but neither the idea nor the steps that I follow are suggested by their disclosures, as the results sought for are radically different and the steps used by me must necessarily be related and worked in conjunction with other steps involving refrigeration to produce improved results never heretofore obtained in a skating rink in so far as I know and believe.

What I claim is:

1. The method herein described of maintaining the top surface of a body of ice in a permanently tempered condition during occupancy thereof by skaters, consisting in passing a refrigerating medium through suitable conductors beneath the ice surface to maintain the main body of ice at a nontracting and non-melting temperature, and in circulating cold air and heated air at intermittent intervals to maintain a temperature in proper tempered condition for skating.

2. The method herein described, consisting in maintaining the top surface of a body of ice in a closed skating rink at a temperature of approximately 32° Fahrenheit by circulating a refrigerating medium through the body of ice to maintain its temperature below 27° Fahrenheit and circulating cold air and heated air through the rink at intermittent intervals to produce an equable air temperature to maintain the ice surface in a proper tempered condition for skating.

3. The method of artificially maintaining a tempered top surface in a body of ice in a closed skating rink, consisting in first passing a refrigerating medium through the body of ice to lower its temperature without causing the ice to crack open at its top surface, then circulating heated air within the rink to mellow the top surface of the ice without flooding, and then circulating air of different temperatures at intervals through the rink to maintain a temperature above the ice surface in proper tempered condition for skating.

4. The method substantially as herein described consisting in storing up a low temperature in an ice floor of a closed skating rink and then circulating a volume of warm air in the rink at a suitable elevation above the ice to raise the general temperature in the rink and thereby mellow the top surface of the ice, and then holding the top surface of the ice in this mellowed state while skating proceeds by circulating air of different temperatures at intermittent intervals through the rink.

5. The method of artificially maintaining an ice body and its top surface in a noncracking, non-flooding and non-cutting condition during skating sessions in a closed ice skating rink, consisting in circulating a refrigerating medium through the ice and in lowering and raising the atmospheric temperature in the rink to combine with the temperature of the refrigerating medium in maintaining the top surface of the ice at the necessary hardness and elasticity for permanent skating under variable and trying conditions.

6. The method of artificially maintaining an ice floor and its top surface at a fixed temperature in a closed skating rink, consisting in storing up a low temperature in the body of the ice, then forcing outside air into the rink at intervals while the rink is occupied by skaters and heating the air when introduced at a freezing temperature.

7. The method of artificially maintaining the top of an ice floor in a closed skating rink at a predetermined temperature during continuous occupancy thereof by skaters, consisting in maintaining a refrigerating medium within the ice floor and concurrently charging the rink uniformly with a body of air adjusted in temperature to that of the ice body to constantly maintain the ice top in an elastic tempered condition for skating.

In testimony whereof I affix my signature in presence of two witnesses.

DUDLEY H. SCOTT.

Witnesses:

F. C. Mussun,
E. M. Fisher.