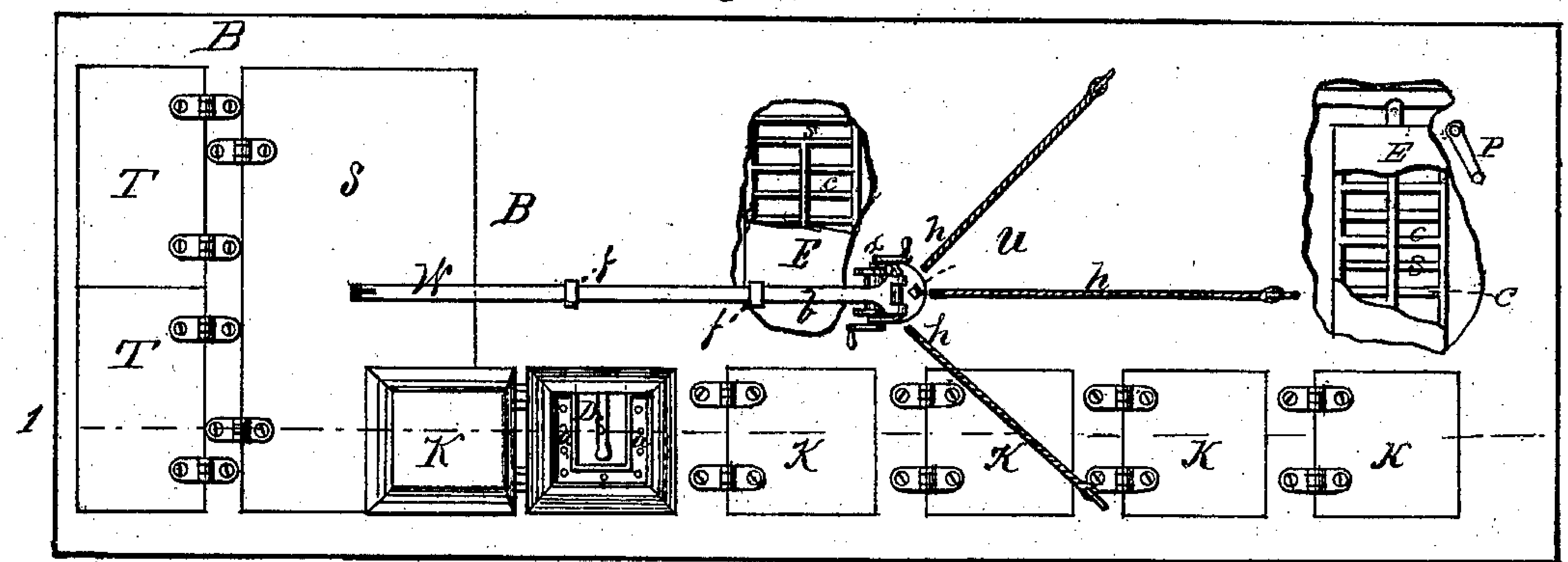
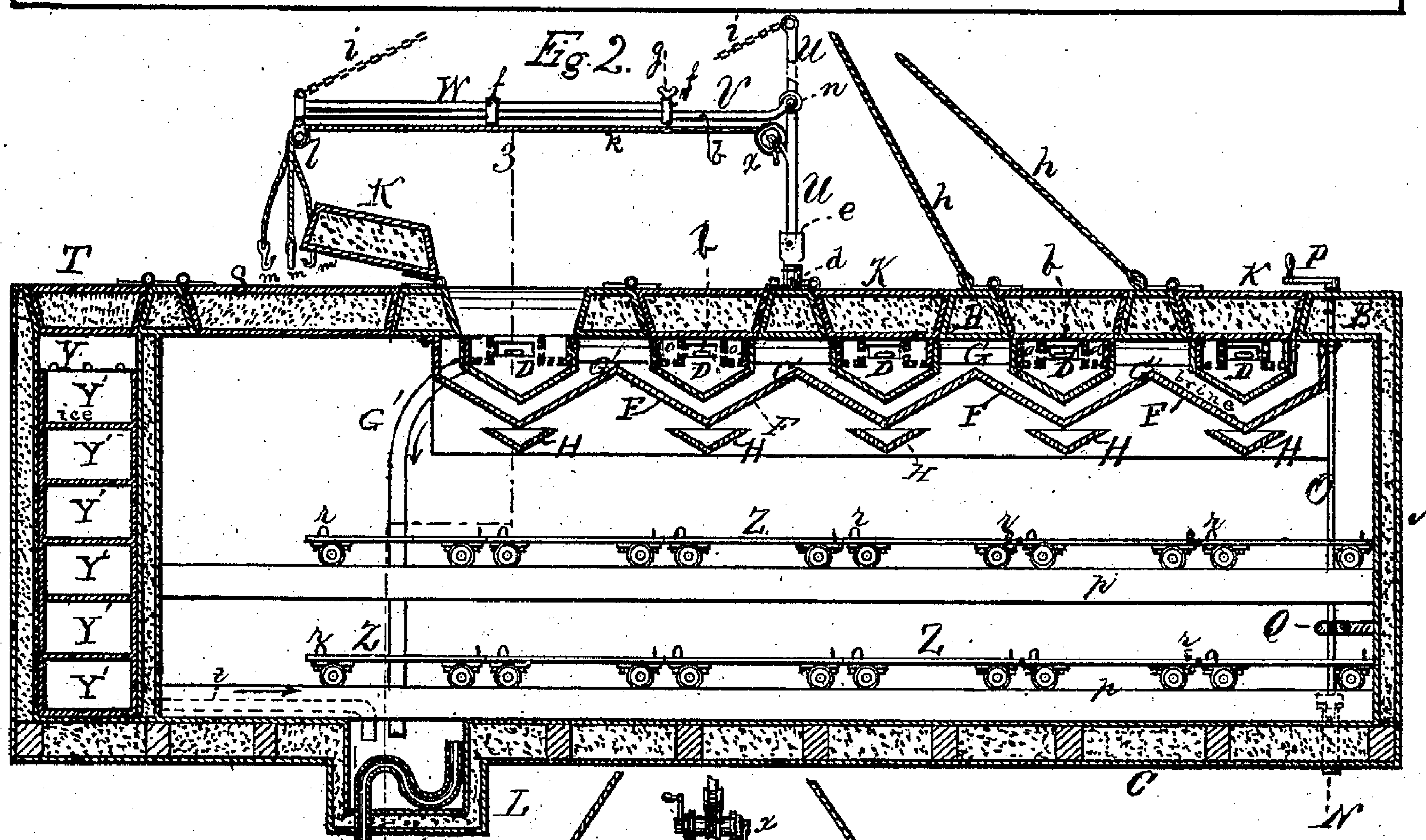
L. B. WOOLFOLK.

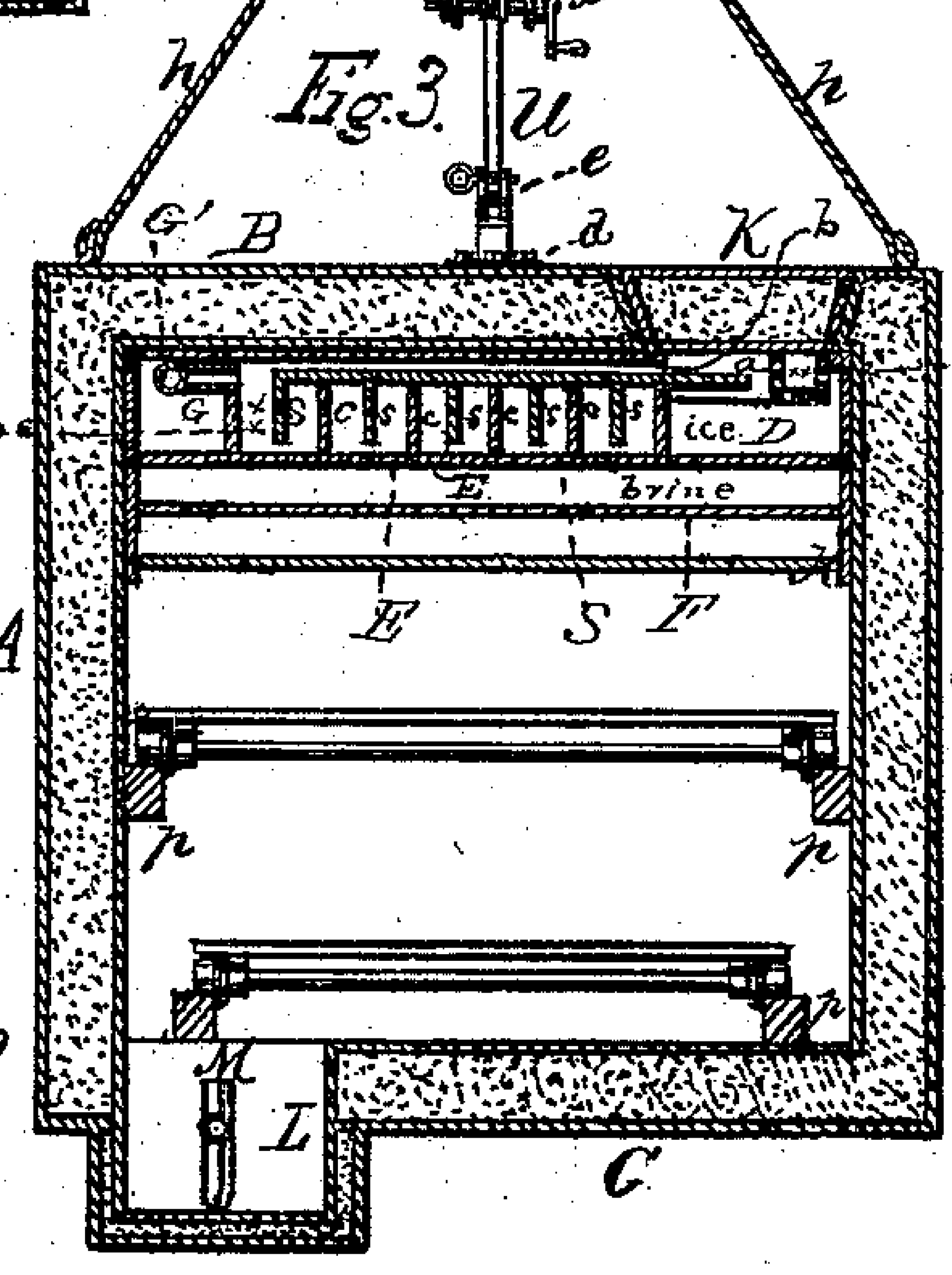
REFRIGERATOR CAR.

No. 176,727. Patented April 25, 1876.

Fig. 1.







Witnesses.
Herm. Lauten.
Leo VanRiswick

Inventor.
Lucien B. Woolfolk.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE

LUCIEN B. WOOLFOLK, OF LEXINGTON, KENTUCKY.

IMPROVEMENT IN REFRIGERATOR-CARS.

Specification forming part of Letters Patent No. **176,727**, dated April 25, 1876; application filed August 24, 1874.

To all whom it may concern:

Be it known that I, LUCIEN B. WOOLFOLK, of Lexington, Fayette county, Kentucky, have invented an Improved Refrigerating Apparatus for Cooling Railroad-Cars, made practically air-tight, for the purpose of preserving animal substances, vegetables, fruits, and other commodities, of which the following is a specification:

My invention consists in cooling substances in air-tight cars, by means of ice and salt used in an apparatus placed in the top of the compartment to be cooled, said apparatus consisting of a refrigerating box and tube, used either singly or in a combined series, and incased in a casing-box containing water, either fresh or slightly salt, according to the degree of cold it is desired to maintain, so that the excessive cold of the ice and salt is modified and regulated in its effect by being passed through the medium of water; also, in the employment of a rake for clearing the tube from sediment, and in the use of a crane revolving in a hinged foot, and jointed to fold over onto the roof of the car when not in use. This crane has at its upper end an arm, upon which a horizontally-adjustable extension slides, to facilitate the placing of articles in the desired positions.

One or more tiers of tracks are laid along the interior of the car for the reception of small cars containing the articles transported, said cars being provided with suitable eyes, within which hooks on the end of the ropes or chains of the crane engage when it is desired to raise said cars from the interior of the main car.

Figures 1, 2, and 3 represent a refrigerating railroad-car, illustrating my invention. Fig. 1 is a plan, with the top of the car broken in several places to show the refrigerating apparatus. Fig. 2 is a longitudinal section taken through the line 1 2 of Fig. 1. Fig. 3 is a cross-section taken through the line 3 4 of Fig. 2, with the door K closed.

A B C is the car, the air in the interior of which is to be cooled, A representing the sides, B the top, and C the bottom. The car, in Figs. 1, 2, and 3, is constructed with double walls, filled between with some non-conducting material.

The refrigerating apparatus consists of a metallic ice-box, D, having in it the box *a*, with perforated sides and bottom, for containing salt; a closed metallic refrigerator-tube, E, which communicates with the ice-box D through the hole *b*, placed at some height above the bottom of the ice-box D, and is divided into compartments by the partitions *c*, that do not extend to the top of the tube E, but leave a water-passage in the upper part of the tube; and a metallic casing-box, F, which is constructed about the refrigerating-box D and tube E, so as to inclose them, except at the top, and is filled with water, either fresh or somewhat salt, according to the degree of cold desired to be induced in the car to be chilled.

In Figs. 1, 2, and 3 several ice-boxes, D, and tubes, E, are combined in a single apparatus, all incased in the same water-case F; but the refrigerating apparatus is complete with a single ice-box, D, and tube E, with its metallic water-case F.

The number and the conformation of the ice-boxes D and refrigerating-tubes E may be changed and modified to adapt the apparatus to the dimensions and the arrangement of the car to be cooled.

The ice-box D and the salt-box *a* may be of any shape and arrangement that best adapts them to the area in which they are placed. The refrigerating-tube E may also vary in shape to suit the area in which it is placed, being either straight or, if necessary, turning at any angle to suit the arrangement of the car in which it is placed; and the casing-box F is conformed to the varying form and arrangement of the refrigerating-box D and tube E. It is shown in an unbroken continuation in Figs. 1, 2, and 3.

The salt-box *a* does not extend to the bottom of the ice-box D, the object being to keep the salt in contact with the brine near the top. This construction has great advantages. The lower the temperature of the refrigerating agent, the more efficient its action, and the more economical its use. To maintain a low temperature of the refrigerating agent, it is essential to keep the brine in contact with the ice floating in it as fully saturated with salt as possible. This saturation can only be maintained by keeping the salt near the surface of

the brine, inasmuch as when the salt once sinks to the bottom, as it soon does when not placed in a separate receptacle, it remains there in virtue of the superior gravity of saturated brine, while the water at the surface, freshened by the constant melting of the ice, contains so little salt that it is unable to melt the ice at a low temperature. G is the pipe through which the brine escapes from the tube E. Where a number of refrigerating boxes and tubes are combined into a battery, the pipes G conduct the brine from the tubes E into the common waste-pipe G′; but where there is but one refrigerating-box D and tube E used, the waste-pipe G′ passes out directly from the refrigerating-tube E. The waste-pipe G′ lies within the casing-box F in its whole longitudinal course in Figs. 1, 2, and 3. H H are conducting-troughs, to lead off the water precipitated upon the bottom of the casing-box F. I do not claim these troughs as my invention, and only have them in the drawings and model in order to represent the apparatus in complete order. K K are trap-doors in the top B, through which refrigerating materials are supplied to the ice-box D. The doors K should be made practically air-tight by being listed with cloth or lined with rubber around the edge. They are constructed with double walls, and the interior filled with non-conducting material. L is a recess in the bottom of the car, which receives the escape-water from the pipe G′, and also any water that may be in the compartment A B C from any other cause. The water in the recess L escapes through the pipe M, which is curved so as to form a water-seal. The sides and bottom of L below the level of the bottom of the car are made double, and the interval filled with non-conducting materials. N is a pipe placed in the bottom of the car A B C for purposes of ventilation, the cold air within readily passing down through N when it is open. O is a stopple worked by the crank P, and moved up and down by a screw working in the fixed nut Q. By leaving the stopple slightly open the ventilation of the compartment may be easily regulated. S is the door of the car A B C, placed in the top or roof B. It is practically air-tight, being listed with cloth or rubber. T T are doors of the chamber containing ice. U is the upright of a crane. It is set in the foot *d*, in which it revolves. By means of the joint *e* it may be laid backward when not in use. V is the arm, which has an extension, W, supported by the sliding collars *f*, and secured by the thumb-screw *g*. The upright U is supported by the ropes *h*, and the arm V is supported by the chain *i* attached to the extension W and the upright U. X is the windlass furnished with the rope *k*, the pulley *l*, and the hooks *m*. When the upright U is laid backward by means of the joint *e*, the arm V may also be laid back by means of the joint *n*, so that, when out of use, the crane may be laid down upon the top B.

Y is the ice-compartment, to contain the ice-boxes Y′, which are fitted with eyes *o*, in which the hooks *m* may be hitched, in order to lift them. Z Z are cars running on tracks *p*, and furnished with eyes *r*, by which the hooks *m* may fasten on them. The cars Z are made of such dimensions as to readily pass through the door S in the roof of the car, being lifted in and out by the crane. The tracks *p* are arranged with the lower track narrower than the upper, so that the cars Z may be lowered down upon it. *s* is a rake for clearing the refrigerating-tube E of any sediment in its bottom. By flooding the ice-box D with water, and at the same time using the rake *s*, the sediment will be stirred up and floated off by the running water. *t* is a pipe conveying the waste water from the ice compartment Y to the recess M.

The operation of the apparatus, by which it chills the air in the car A B C, is as follows: Water is placed in the casing-box F, care being taken to leave space for the expansion of the water in freezing. Then, when the ice-box D and salt-box *a* are respectively filled with ice and salt, the salt, being placed on a level with the top of the brine, keeps the whole of the brine fully saturated, and the strong brine, melting the ice at a very low temperature, makes the fluid excessively cold. With the melting of the ice and salt the brine overflows from the ice-box D, through the hole *b*, into the refrigerating-tube E, entering E at a very low temperature. The construction of the partitions *c* in E, having a water-passage at the top, is such as to keep the cold brine in the tube, and allow only that which has lost its chill to pass out. For, upon flowing into any compartment of E, the cold brine sinks to the bottom by its specific gravity, displacing the warmer brine already there, which rises to the top and flows off into the next compartment; but, being colder than the brine in this compartment, it, in turn, displaces the warmer brine. In this manner the coldest brine is always retained, while the warmer, which has lost its chill, flows out. The ice and salt and the cold brine in the refrigerating-box D and tube E expend all of their refrigerating force upon the water in the casing-box F. If the water in F be free from salt it will freeze solid at 32°, and will impart no greater degree of cold to the air in the car A B C; but, by making it more or less salt, its freezing-point will be lowered, so that it will communicate a greater degree of cold to the air. It will probably be found necessary to make the water in the casing-box F sufficiently salt to reduce its freezing-point to 29° or 30°. As this will be necessary to keep the air of the car A B C at a regular temperature of 33° to 34°, the rapid conduction of heat through the comparatively thin walls making it impossible to keep the compartment down to the temperature of the refrigerating medium. By the fluted construction of the bottom of the casing-box F, conformed to the shape of the refrigerating-box D and tube E, a system of

currents sets up in the water in the casing-box, which materially aids the refrigerating action. When the water in F comes in contact with the bottom of D E it is chilled, and rises to the surface, where it is away from contact with D E. By imparting its chill to the air below through the metallic bottom of the casing-box F its temperature rises, and it sinks down into contact with D E again. This fluted construction is adopted to promote this system of currents, and not for the purpose of catching the moisture precipitated upon the bottom of the casing-box F. The chilled air in the top of the car A B C sinks to the bottom, and a circulation sets up which maintains the air in A B C at an equable temperature.

By this apparatus it will be seen the excessive refrigerating force of the ice and salt is not applied to the air of the compartment to the injury of the substances stored therein, but it is imparted to the water in the casing-box F, and by this means a fixed temperature is secured, which can be regulated at will by keeping the water in the casing-box fresh, or making it more or less salt, as may be desired. By thus regulating the chill of ice and salt by applying it to the air of the compartment through the medium of water, it becomes an efficient agent in refrigerating air-tight chambers.

What I claim as new is—

1. The ice-box D, in combination with the trap-door K, the salt-box *a*, the refrigerating-tube E, and the casing-box F, substantially as described.

2. The refrigerating-tube E, divided into compartments by the partitions *c*, in combination with the ice-box D and salt-box *a*, substantially as set forth.

3. The rake *s*, in combination with the refrigerating-tube E, for the purposes mentioned.

4. The casing-box F for containing water for the purpose of modifying the excessive chill of the ice, in combination with the ice-box D and refrigerating-tube E, having compartments *c*, in the manner described.

5. The crane U revolving in the hinged foot *d*, and having a joint, *e*, to permit of its being folded backward when not in use, arm *b*, and a lengthwise-adjustable extension, W, in combination with the railroad-tracks *p* and cars Z, all constructed and arranged substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand and seal this 24th day of August, 1874.

LUCIEN B. WOOLFOLK. [L. S.]

Witnesses:
W. V. S. WILSON,
JOSEPH F. BARNES.