No. 738,107. PATENTED SEPT. 1, 1903.

W. W. HARRIS.

REFRIGERATING APPARATUS.

APPLICATION FILED DEC. 23, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

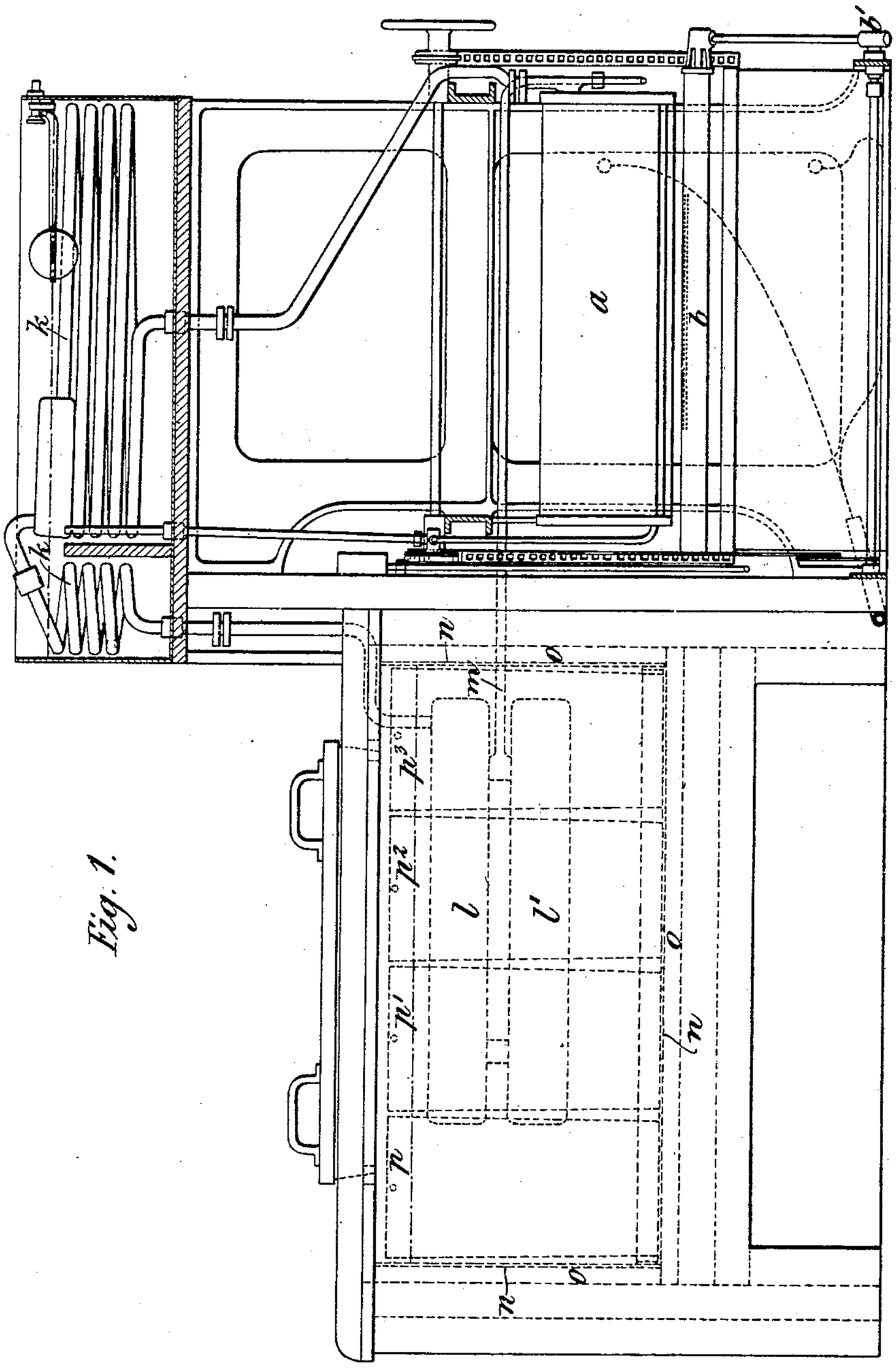

Fig. 1.

Witnesses.
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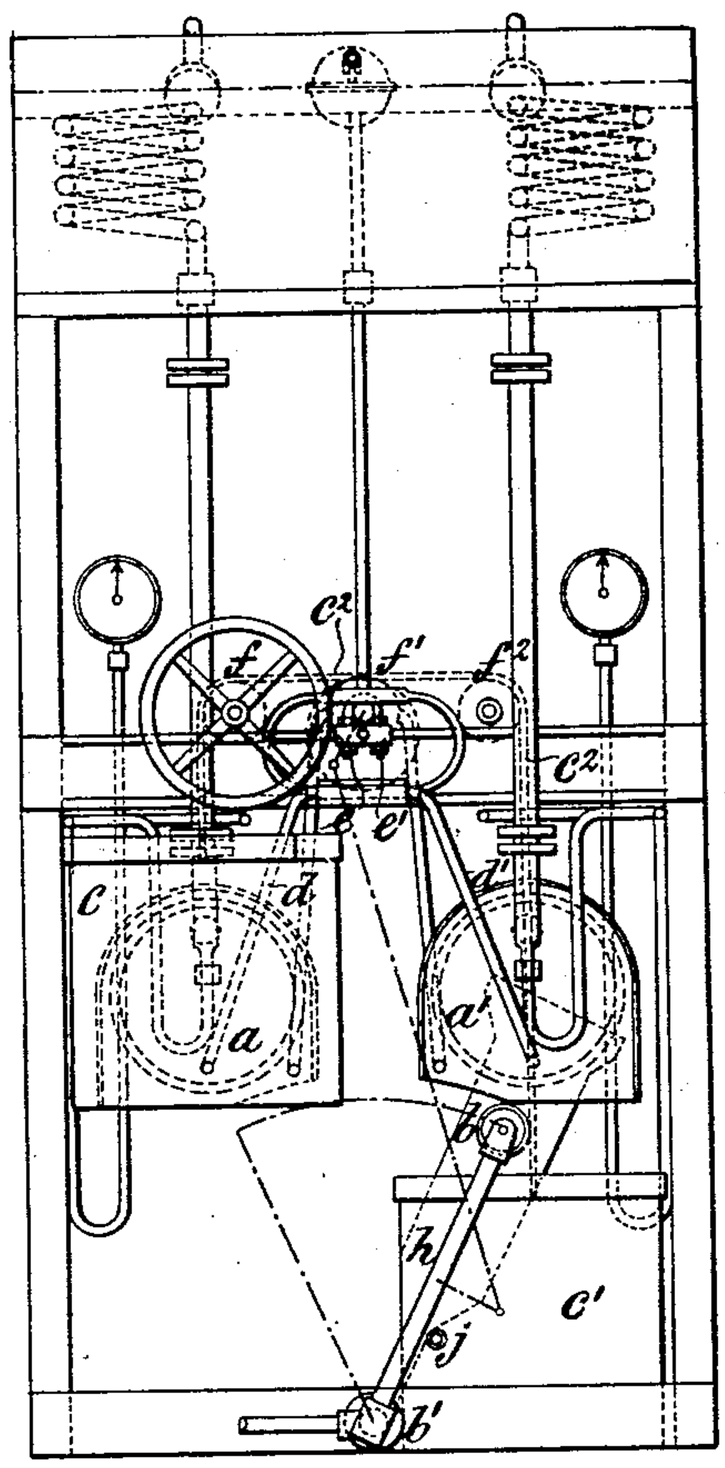
NO MODEL. 5 SHEETS—SHEET 2.

Fig. 2.



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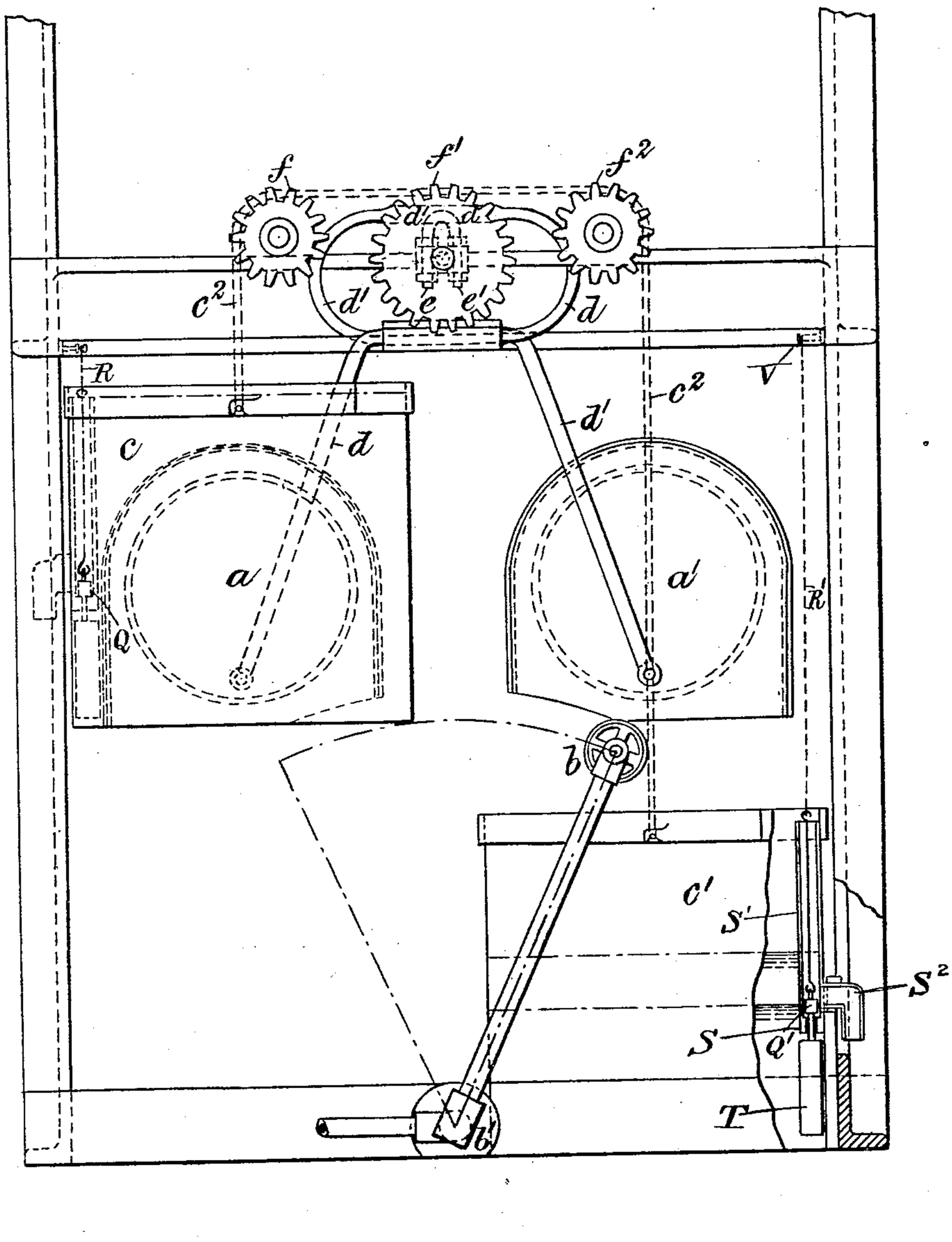
NO MODEL. 5 SHEETS—SHEET 3.

Fig. 3.



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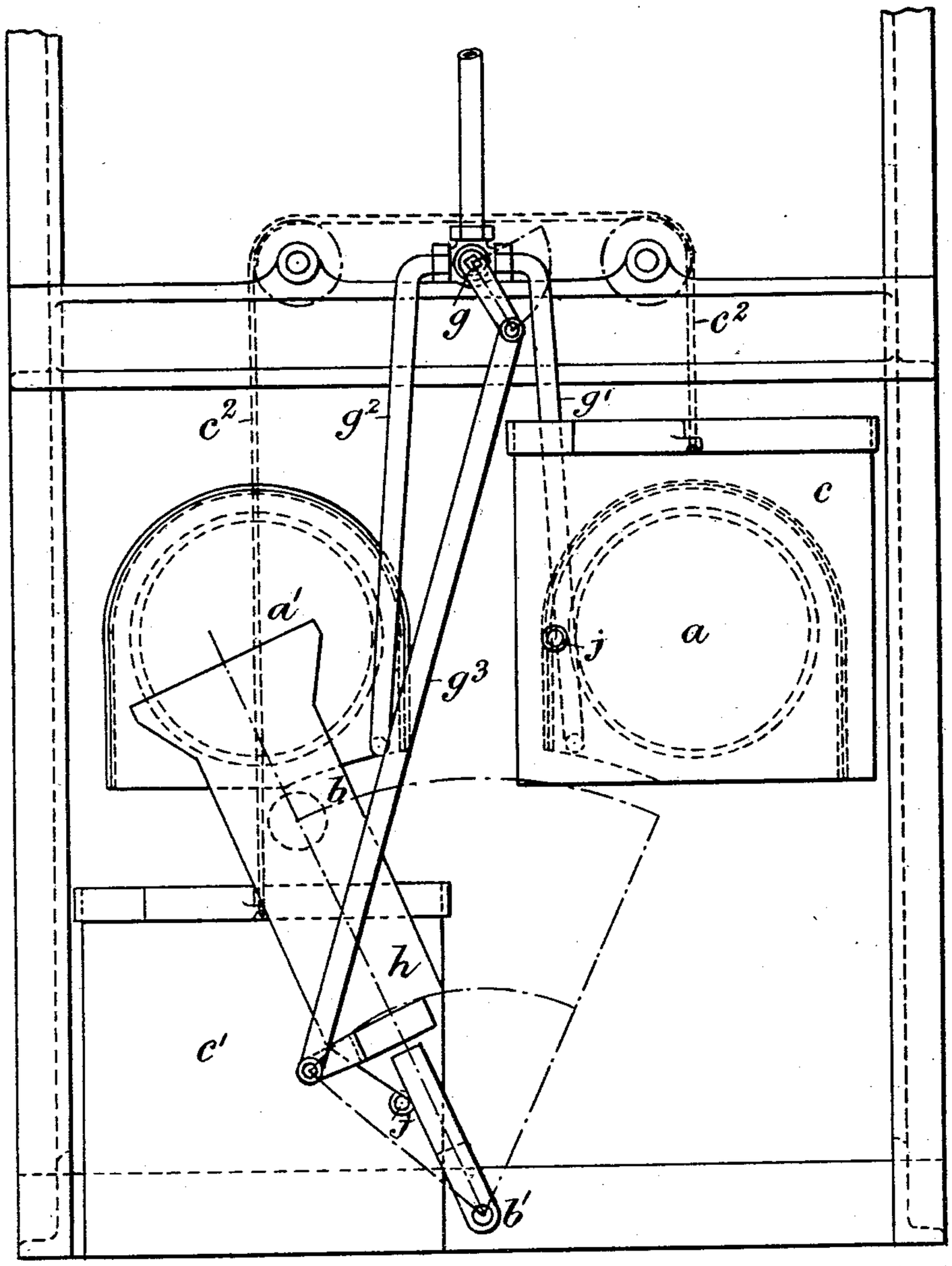
NO MODEL. 5 SHEETS—SHEET 4.

Fig. 4.



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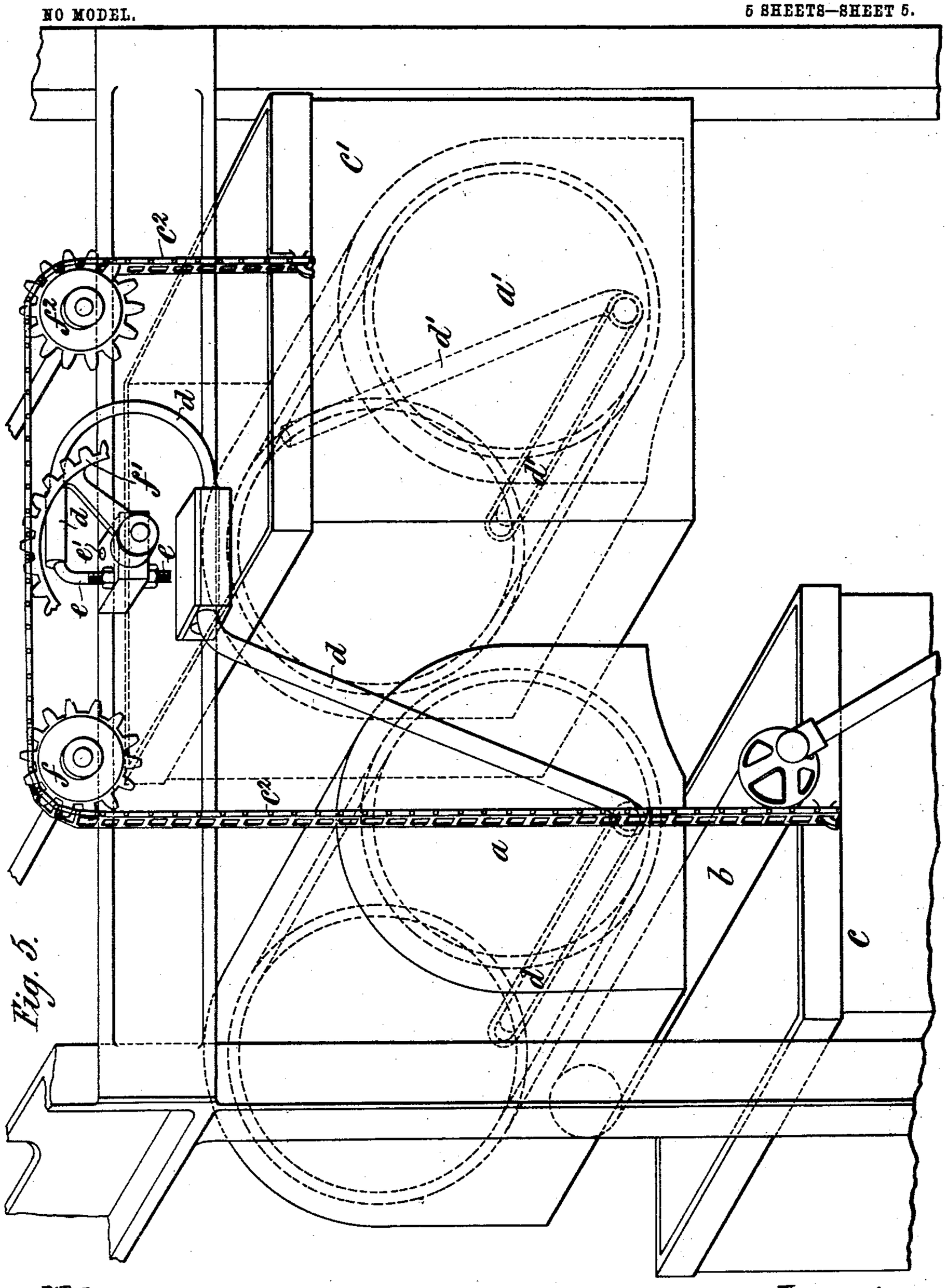
NO MODEL. 5 SHEETS—SHEET 5.



Witnesses
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No. 738,107. Patented September 1, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM WALLINGTON HARRIS, OF GRAYS INN ROAD, COUNTY OF MIDDLESEX, ENGLAND, ASSIGNOR TO PAUL PFLEIDERER, OF GRAYS INN ROAD, COUNTY OF MIDDLESEX, ENGLAND.

REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 738,107, dated September 1, 1903.

Application filed December 23, 1902. Serial No. 136,366. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WALLINGTON HARRIS, engineer, a subject of the King of Great Britain, residing at 43 Regent Square, Grays Inn road, in the county of Middlesex, England, have invented certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

This invention has for its object improvements in the construction and working of refrigerating apparatus whereby an automatic and continuous action is produced. The apparatus is so constructed that it dispenses with the necessity of personal attention altogether. It requires only to be started and will then run on for any desired length of time. All the functions usually performed by hand for the production of cold are executed and controlled by a very simple combination of thermostatic and hydrostatic gear. The thermostatic gear controls the time when the motion is made, the hydrostatic the motion itself. This gear is applied to the class of apparatus which derives its cooling effect from the separation and absorption of ammonia (or other similar fluid) in a vessel which is alternately heated and cooled and where the cycle of operations is such that valves and pumps are not required, as is the case of the apparatus described in the specifications of the Patents Nos. 652,210 and 681,314.

The apparatus consists of two refrigerating plants placed side by side a short distance apart, one being heated, while the other is cooled, and vice versa. The motive force which reverses the action is obtained from an unbalanced weight. The tanks employed in cooling the absorber (which is alternately absorber or separator, depending upon whether it is heated or cooled) are provided with an arrangement of water-valves, which are shut when the tanks are up and open when they are down to allow water to accumulate in the upper and run away to a certain level from the lower, making the top tank always the heavier. The difference of the weight of the water in the two tanks is sufficient to overcome the resistance of the moving parts and produce the necessary motion when the time has arrived for its application. The thermostatic gear prevents any motion taking place until the desired temperature has been reached in the separator. When this occurs, it releases the check it has held up to this moment and allows the unbalanced weight to come into play. The top tank then descends and the bottom ascends. The movement of the tanks up and down pushes the atmospheric burner from side to side—*i. e.*, from under one separator to a corresponding position under the other.

Figure 1 is a sectional elevation of the complete apparatus. Fig. 2 is an end elevation. Fig. 3 is a front end elevation of the automatic gear to a larger scale. Fig. 4 is a back end elevation of the same. Fig. 5 is a perspective view of the automatic gear belonging to the separator that is being heated. The other is identical, but left out, so as to make the drawings clearer.

a and *a'* are cylindrical vessels, which act alternately as separators and absorbers, depending upon whether they are heated or cooled.

b is an atmospheric gas-burner, which rocks on swivel-joints *b'*.

c and *c'* are cooling-tanks.

d and *d'* are hermetically-sealed heat-regulating tubes similar to those described in my specification No. 681,314, one end of which is formed after the manner of the tube in a Bourdon pressure-gage. The remainder of the tube is plain and is charged with a suitable quantity of fluid and hermetically sealed, a part of its length being inserted into a stopped end tube in the lower part of the separator. The movable ends of the tubes rest when cold against adjustable stops *e* and *e'*, attached to the sprocket-wheel *f'*.

f, *f'*, and f^2 are sprocket-wheels gearing with chains c^2, on which the tanks *c c'* are suspended.

g is a three-way water-valve for diverting the current of cooling-water alternately through the pipes g' g^2 into the tanks *c* and *c'*.

h is the back carrier of the atmospheric burner, so shaped that the studs *j*, fixed to the tanks, give the correct motions to it. The first part of the upward movement of one

tank brings the burner into a vertical position, and then when the other tank has descended out of the way the last part of the movement of the first tank tilts it so that it will drop by its own weight into place under the separator and rest there on the stud *j* on the lower tank ready to reverse in a similar manner at the proper time.

g^3 is a connecting-rod by which the valve *g* is operated by the carrier *h*.

The remainder of the apparatus is of ordinary construction and only needs a brief description.

k and *k'* are the condensing-coils; *l* and *l'*, the liquefiers and refrigerating-surface submerged in brine; *m*, the overflow; *n*, the brine-tank; *o*, a layer of insulating material; *p*, *p'*, p^2, and p^3, ice-molds.

The action of the apparatus is as follows: When the parts are in the position shown in Figs. 1 to 4, the tank *c* is raised, the vessel *a* being immersed in it and being cooled. The burner *b* is beneath and heating the vessel *a'*. Water is flowing into the tank *c* by the cock *g* and pipe *g'*, and water is flowing out of the tank *c'* by the valve Q'. The seat S of this valve is in a tube S', fixed in the tank and communicating with a spout S^2. The valve is normally held down onto its seat S by the weight T, but it is fixed to a chain R' of such a length that when the tank has almost reached its lowest position the chain prevents the valve from descending lower and lifts it off its seat, thus allowing the water to flow out of the tank through the spout S^2. The upper end of the chain R' may be wound on a spring-barrel V, so that the hanging portion of the chain is kept straight and so prevented from fouling any of the mechanism. The tank *c* is prevented from descending, although it now contains more water than the tank *c'*, by the stop *e'*, which engages with the end of the tube *d'*. As the vessel *a'* becomes heated the tube *d'* tends to straighten, and ultimately its end rises out of the way of the stop *e'*, thereby releasing the wheel *f'*. The tank *c* then descends by its superior weight, lifting the tank *c'*, which in its ascent pushes the burner *b* over to under the vessel *a*, as above described. The stop *e* springs the tube *d* to one side and then engages with its end, so preventing the parts from returning. The water-supply is cut off from the tank *c* and diverted to the tank *c'*, and water runs out from the top of the tank *c* by reason of the valve Q being lifted by the chain R, as described above with reference to the valve Q'. The parts are now in the position shown at Fig. 5.

What I claim is—

1. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, means for supplying water to the upper tank means for drawing water off from the lower tank, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

2. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, means for supplying water to the upper tank and for drawing it off from the lower tank, two thermostats one acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

3. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cock, means for drawing water off from the lower tank, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

4. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, means for supplying water to the upper tank, an outlet-valve in each tank, chains from which the valves are suspended, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

5. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, means for supplying water to the upper tank, means for drawing water off from the lower tank, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

6. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cock, means for drawing water off from the lower tank, two thermostats one

acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

7. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, means for supplying water to the upper tank, an outlet-valve in each tank, chains from which the valves are suspended, two thermostats one acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

8. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, means for supplying water to the upper tank, means for drawing water off from the lower tank, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

9. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cock, an outlet-valve in each tank, chains from which the valves are suspended, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

10. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cock, means for drawing water off from the lower tank, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

11. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, means for supplying water to the upper tank, an outlet-valve in each tank, chains from which the valves are suspended, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

12. In a refrigerating apparatus the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cock, an outlet-valve in each tank, chains from which the valves are suspended, two thermostats one acted on by the heat of each vessel engaging with the stops, and means for alternately heating the vessels.

13. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cock, means for drawing water off from the lower tank, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

14. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, means for supplying water to the upper tank, an outlet-valve in each tank, chains from which the valves are suspended, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

15. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks beneath the vessels, gearing connecting the tanks so that when one is raised the other is lowered, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cock, an outlet-valve in each tank, chains from which the valves are suspended, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

16. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks be-

neath the vessels, a chain connecting the tanks, a chain-wheel around which the chain passes, stops on the chain-wheel, a cock supplying water to the upper tank, means operated by the movement of the tanks for turning the cocks, an outlet-valve in each tank, chains from which the valves are suspended, two thermostats one acted on by the heat of each vessel engaging with the stops, a gas-burner, pivoted arms supporting the gas-burner, inclines on one of the arms, and lugs on the tanks engaging with the inclines.

17. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks, gearing connecting the tanks so that when one is raised the other is lowered, means for supplying water to the upper tank, means for drawing off water from the lower tank, and means operated by the movement of the tanks for alternately heating the vessels.

18. In a refrigerating apparatus, the combination of two vessels alternately acting as absorbers and separators, two water-tanks, gearing connecting the tanks so that when one is raised the other is lowered, means for supplying water to the upper tank, means for drawing off water from the lower tank, stops retaining the tanks in their extreme positions, two thermostats one acted on by the heat of each vessel engaging with the stops and means operated by the movement of the tanks for alternately heating the vessels.

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