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ICE MACHINE.

No. 356,382.

Fig. 1.

Patented Jan. 18, 1887.

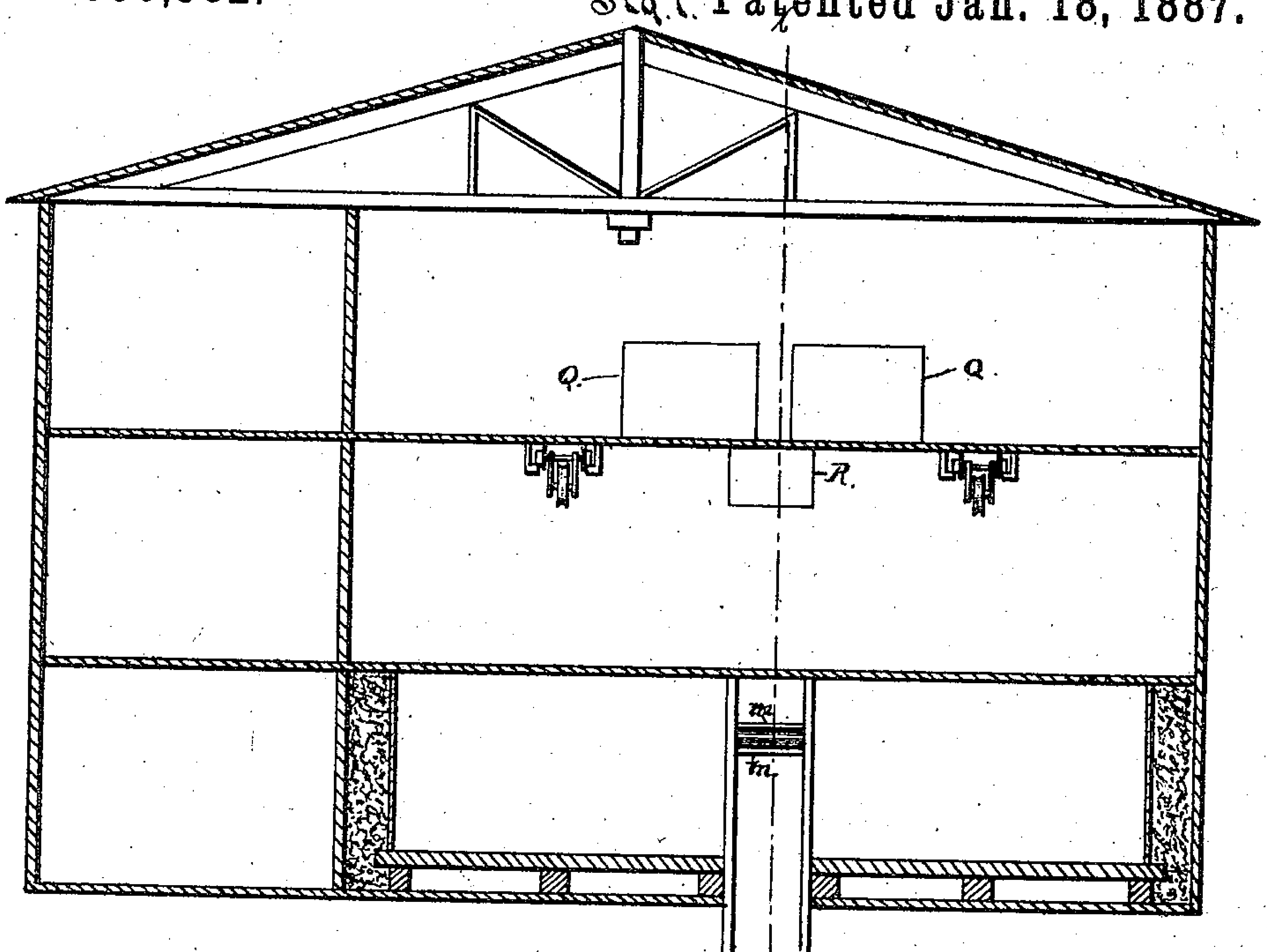
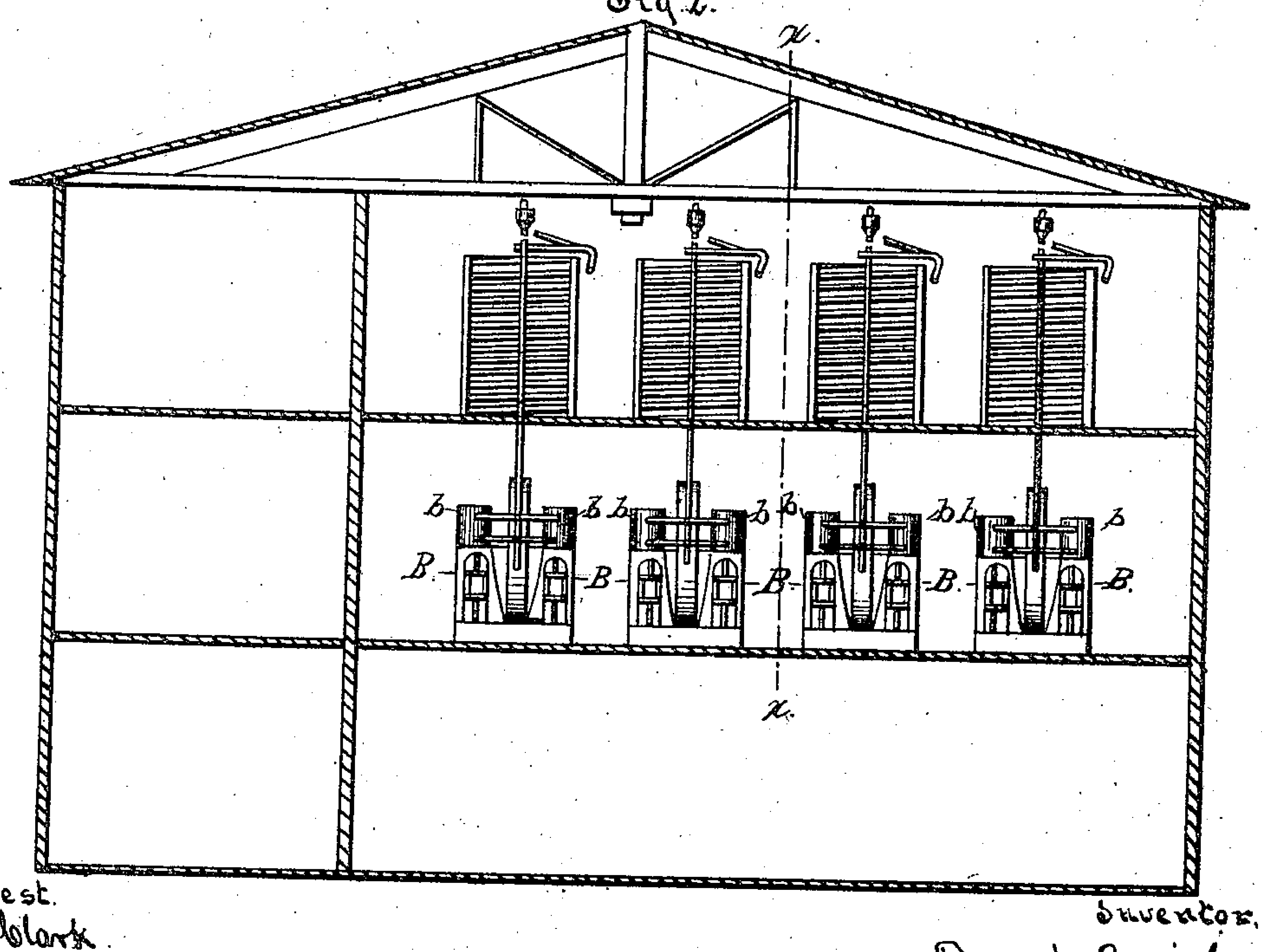



Fig. 2.

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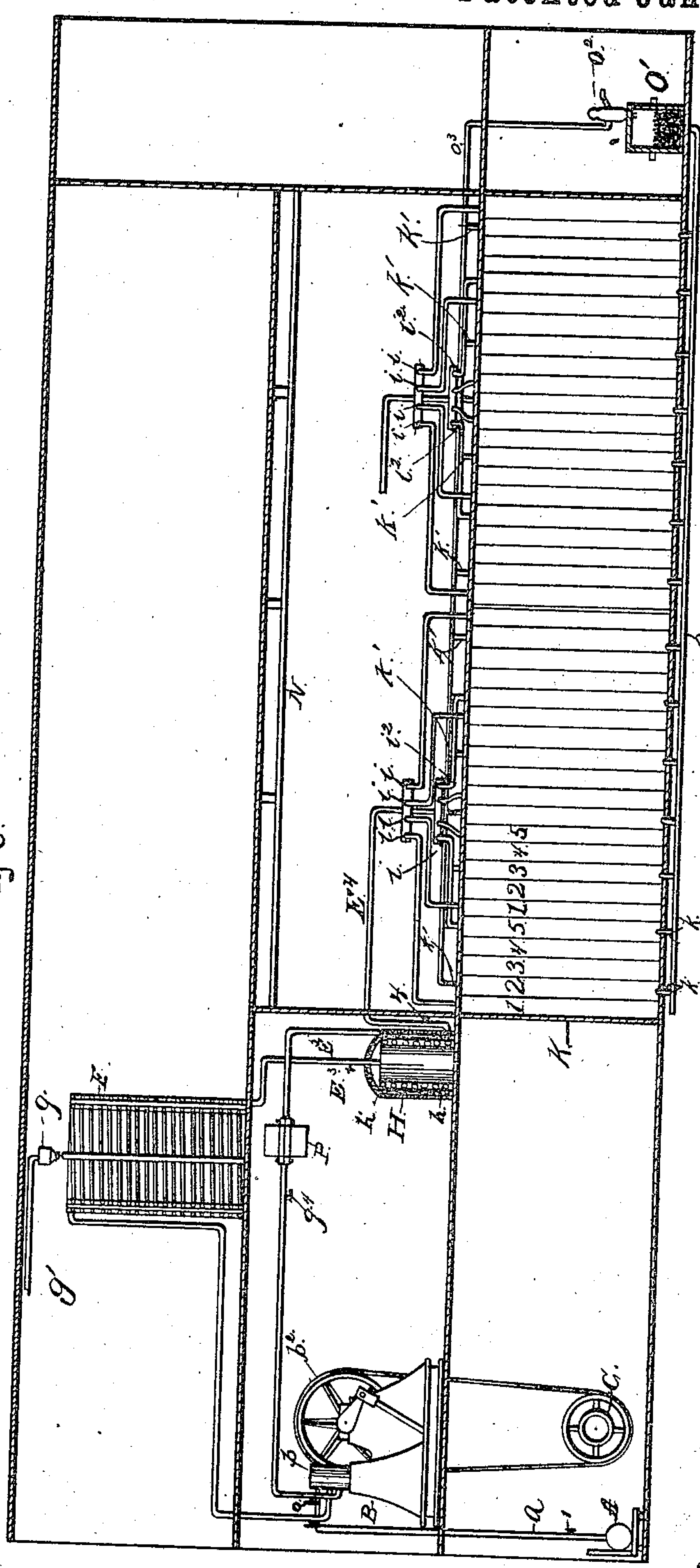
# D. SMITH.

## ICE MACHINE.

No. 356,382. Patented Jan. 18, 1887.

Fig. 3.



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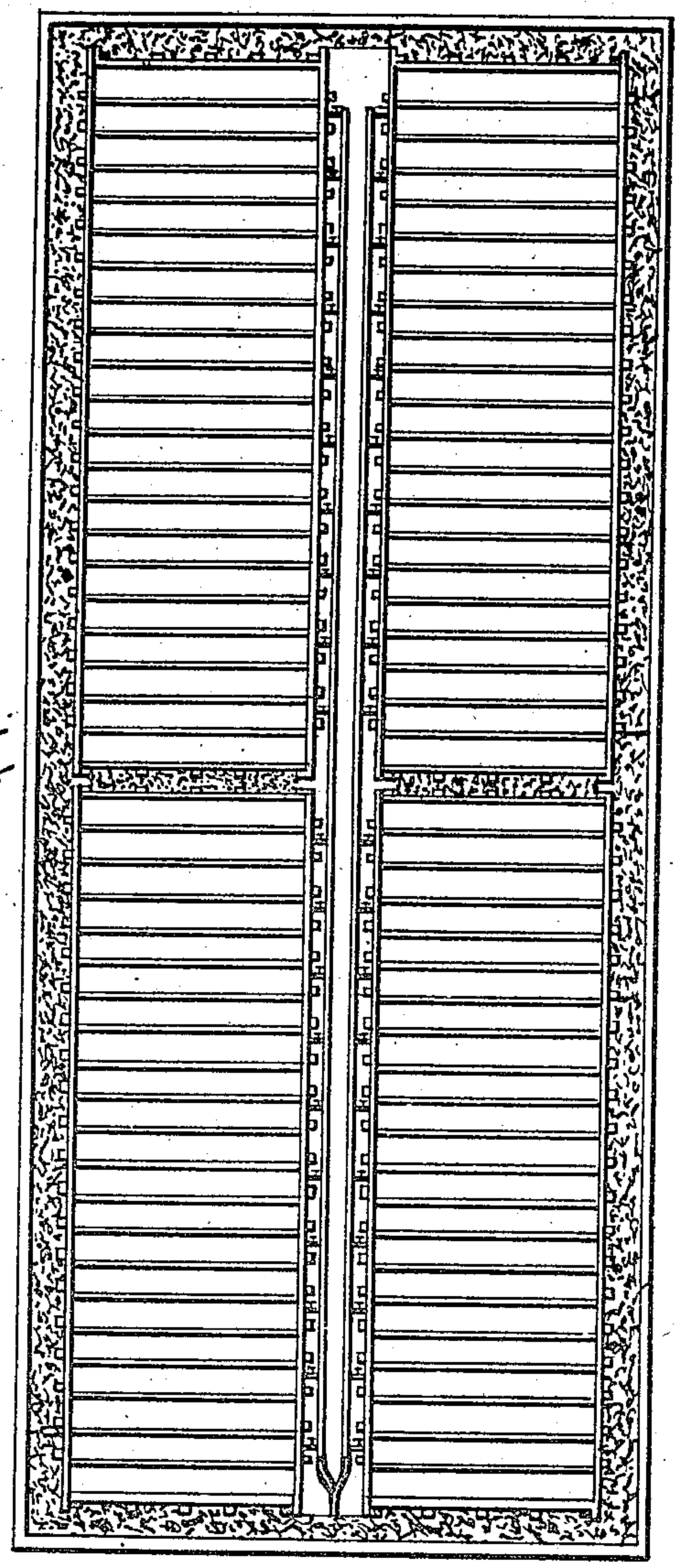
ICE MACHINE.

No. 356,382.

Patented Jan. 18, 1887.

Fig. 4.



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ICE MACHINE.

No. 356,382. Patented Jan. 18, 1887.

Fig. 5.

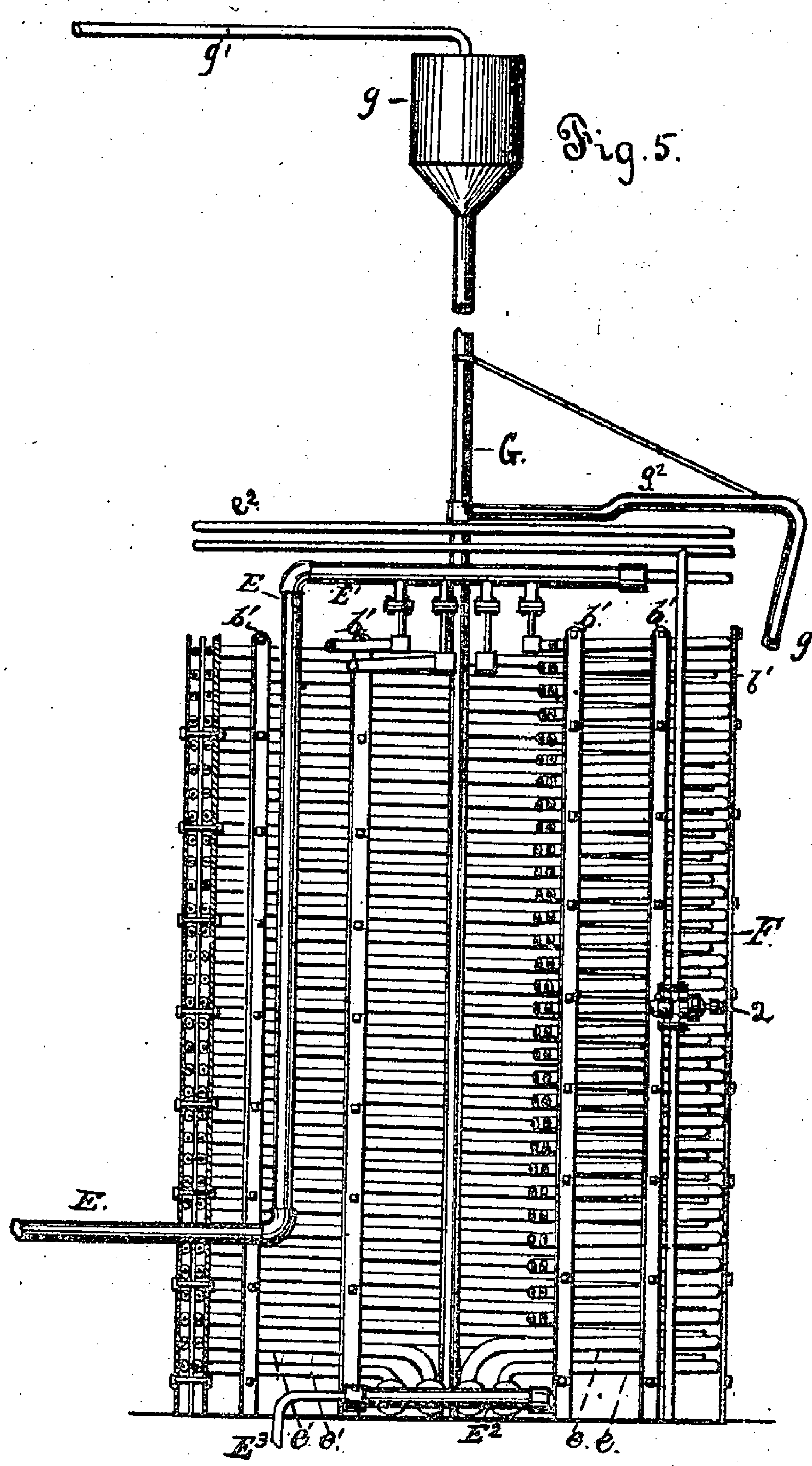
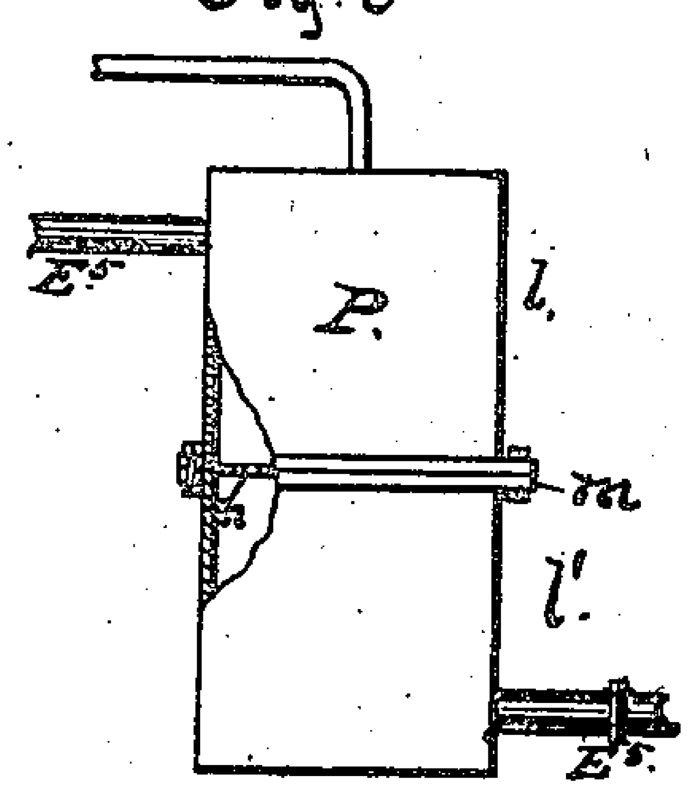



Fig. 6

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# D. SMITH.

## ICE MACHINE.

No. 356,382. Patented Jan. 18, 1887.

Fig. 7.

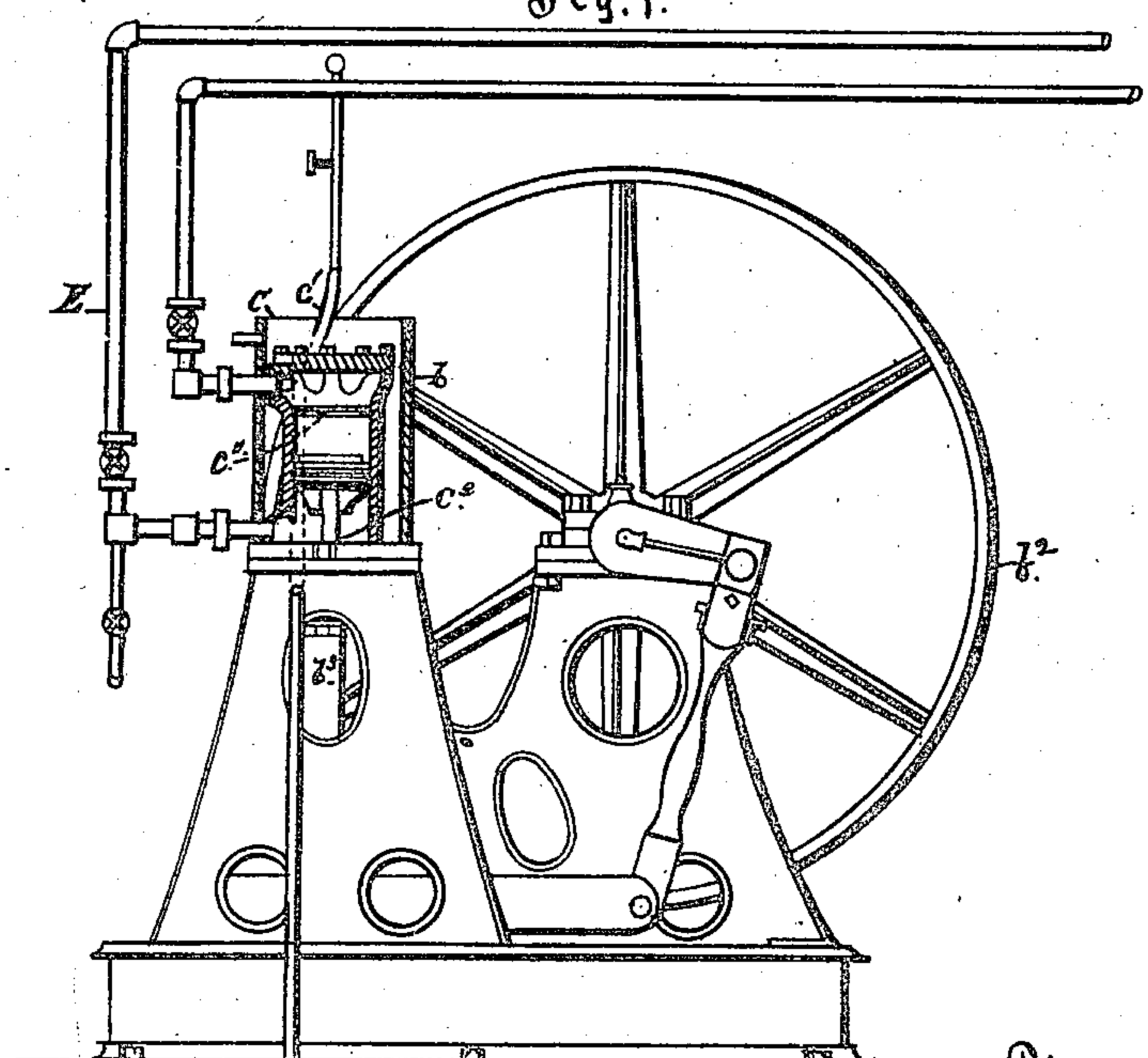


Fig. 9.

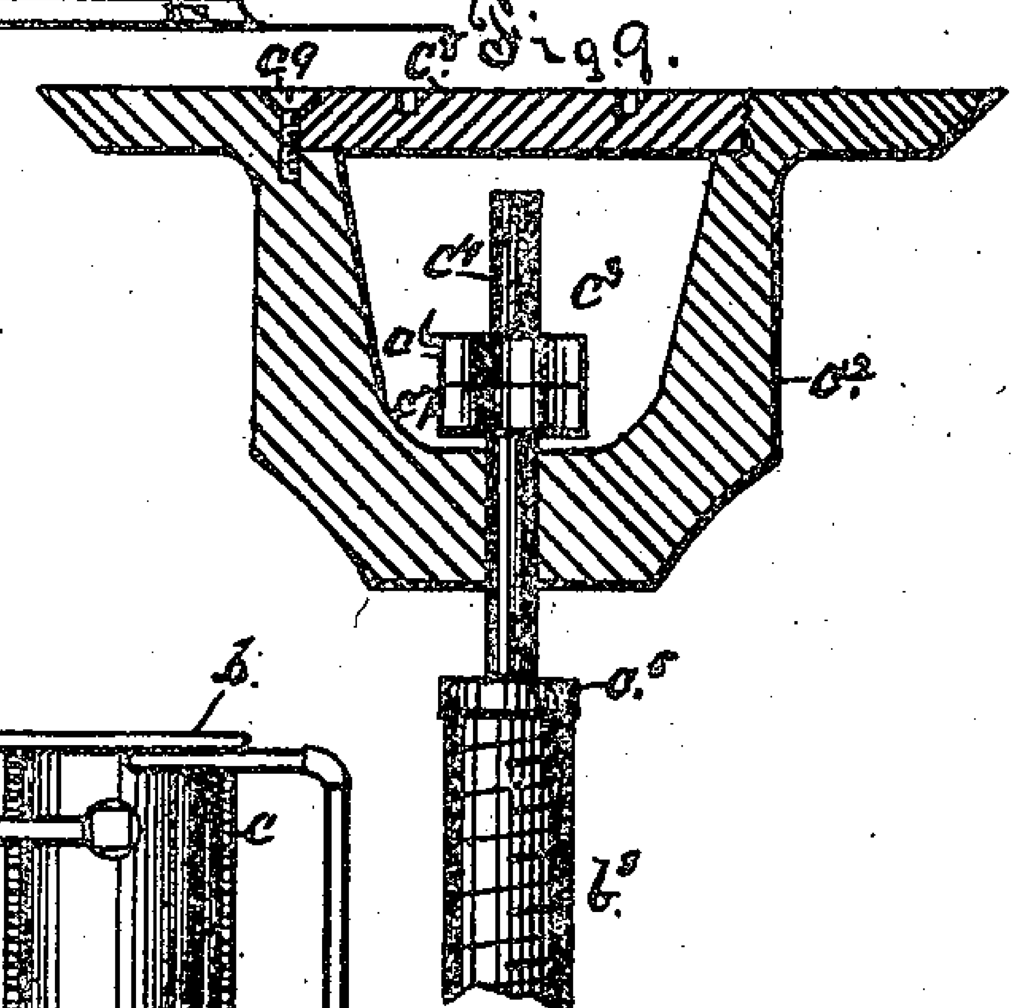
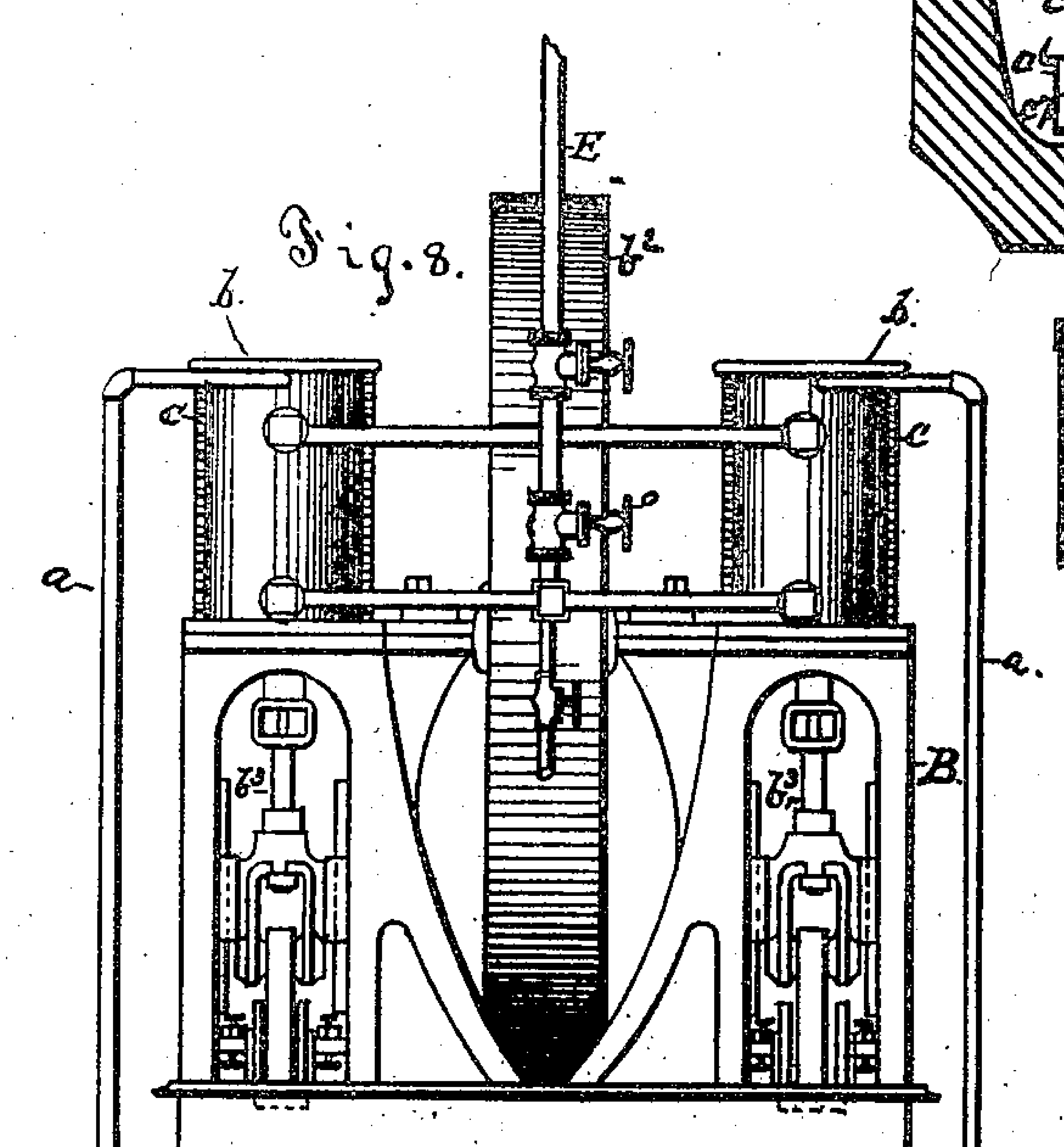


Fig. 8.



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# UNITED STATES PATENT OFFICE.

DAVID SMITH, OF WASHINGTON, DISTRICT OF COLUMBIA.

## ICE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 356,382, dated January 18, 1887.

Application filed March 5, 1883. Serial No. 87,036. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID SMITH, of Washington, in the District of Columbia, have invented a new and useful Improvement in Ice-Machines; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

What I desire to describe in this specification are methods and systems for refrigerating and ice-making, and apparatus suitable for refrigerating and ice-making purposes.

The invention consists, primarily, in the methods and systems employed, and in details of apparatus, and in the combinations of the several operative parts and devices which, employed together, constitute an ice-machine or refrigerating apparatus, all as more fully hereinafter described and claimed.

In the manufacture of artificial ice it is of great consequence to have the ice not only dense and heavy, but perfectly transparent, which means that it shall contain no earthy particles or other coloring-matter; and to this end, when the freezing-tanks have been once filled with water, various chemical and mechanical devices have been employed to create and maintain the purity of this body of water during the act of congealation, but with little practical success, for this reason:

A body of water exposed to freezing-surfaces in a freezing-tank in the act of congealation will purify itself next to the freezing-surfaces, and will deposit upon them a certain thickness of pure transparent ice. By the act of congealation all earthy or other coloring matter is driven away from the freezing-surfaces into the unfrozen water in the tank, and as the act of congealation goes on the unfrozen water becomes more and more clouded or dirty in appearance, and this effect follows even if the water in the freezing-tanks has previously been filtered. As the act of congealation goes on and the ice is more and more thickly deposited upon the freezing-surfaces the water unfrozen becomes more and more turbid and less in quantity until the act of congealation will not expel the earthy and coloring matters, and consequently cannot produce solid clear ice, but instead produces ice which is clouded more or less and has hardly more consistency or compactness than firm snow. This necessitates, in practice, the scraping or removal from the cakes of ice of all of this worthless and unsalable outer surface, which of course increases the cost of producing the ice commercially. The chemical and mechanical devices before referred to have failed therefore of beneficial effect, as they were applied to the same body of water in the tank, apparently for the reason that the force of the act of congealation in throwing off earthy or other coloring matter overcame or destroyed in some way the desired effects of such artificial chemical or mechanical devices.

In my former practice—using filtered water in the freezing-tanks—I have been accustomed to draw off more or less of the freezing water from time to time from the tanks as soon as it became turbid and replace it with fresh filtered water from the reservoir or water-supply. This method, however, involved great loss, inasmuch as the water drawn off had been at considerable expense reduced in temperature to near the freezing-point, and the new supply was necessarily of a higher temperature, frequently at that of the air in summer, and therefore when admitted to the tank it checked the operation of congealation until it was in turn reduced to a freezing-temperature.

I have found by later observation and practice that the earthy or other coloring matter in the congealing water in the tanks as thrown off by the act of freezing by its greater density tends to fall to the lower part of the tank, and that this turbid water can be withdrawn from the bottom of the tank, passed through a suitable filter, and returned to the top of the tank without sensible loss in temperature and without injuriously affecting the tranquility of the freezing water in the tank, and in this way water which was previously unfiltered can be used to great advantage in making clear transparent ice. By thus keeping the water in the tanks continually at a freezing unvaried temperature and in a very pure state there results an ice which is not only perfectly transparent, but uniformly more dense and heavier than the best Northern commercial natural ice. This system of circulation of the freezing water in an ice-machine constitutes the most important part of my new methods or systems.

In the system employed by me I use pure anhydrous fluid ammonia, which is now a commercial article, and is furnished in wrought-iron cylinders of suitable size, capable of resisting a great internal pressure, which cylinders are furnished with an outlet-pipe adapted for convenient coupling with another pipe. To the outlet-pipe of the ammonia-cylinder is coupled a pipe which leads to the inlet side of the ammonia-pump, and has between the pump and the ammonia-cylinder a cut-off valve. In starting up work in an ice-machine, I open all the valves in all of the ammonia-pipes in the system of pipes, except the valve which cuts off the flow of ammonia from the cylinder, and start up the ammonia-pump and draw out all the air in the entire system of ammonia-pipes. This being done and the pump stopped, the valve between the cylinder and the pump is opened, and the ammonia being released and under the pressure of the cylinder vaporizes and passes through the pump and all the ammonia-pipes of the system until they are filled with ammonia-gas under the same pressure as the ammonia in the cylinder. There are two pressure-gages in the pump-room, one connected with a receiver and one connected to the pipe which leads from the outlet side of the pump to the congealer-coils. When the pressure upon both gages reaches about sixty, I close the valve between the receiver and the congealing-coils and then start up the ammonia-pump, which withdraws the ammonia-gas from the congealing-coils into the condenser, where it is liquefied and flows down into the receiver. The ammonia-pump is kept running slowly until a charge for a ten-ton machine, preferably about one hundred and twenty-five pounds, is forced into the condenser and receiver, where it is in liquid form and ready for use. Then the valve between the ammonia-cylinder and the pump is closed, and if need be secured in position, and the valve between the receiver and the congealing-coils is opened sufficiently and the liquid ammonia flows from the receiver into the congealer-coils, vaporizing in its passage, and absorbs heat from the non-congealable liquid in which said coils are immersed, or from the air, should the apparatus be used for refrigerating purposes, in which case the particular construction of the congealer-coils need not be used. Thence the vaporized ammonia returns by a proper pipe around and through the cooling-coils of the receiver, and through a dirt-catcher to the inlet side of the pump; thence through the pump again to the condenser, where it is again liquefied, and thence to the receiver; thence to the congealer-coils in a second circulation, and so on, the pump working all the time at a pressure of about twenty pounds in the congealing-coils and at the condensing-point of ammonia in the condenser. This system of the circulation in an ice-machine of ammonia and ammonia-gas constitutes another portion of my invention.

Heretofore in the construction and arrangement of ice-machines, by which I mean a complete system of gas-pumps, condensers, receivers, tanks, and other essential apparatus, the practice has been to construct such machines of various sizes to meet the expected demand—*i. e.*, for a small demand a small machine would be furnished, for a large demand a large machine would be furnished, and these machines have been arranged in respect to their constituent parts in such order as convenience would dictate. I have discovered from much trial and experience that a uniform system as to sizes of ice-machines and their arrangement as to constituent parts is most economical and productive of the best results. I take as a standard of capacity for an ice-machine a tank about forty-five feet long, seventeen feet wide, and nine feet deep, in which are placed side by side twenty congealing-boxes, extending vertically from side to side of the tank. Each of these boxes being eight by sixteen feet, has a surface on either side of one hundred and twenty-eight square feet, on both sides of two hundred and fifty-six square feet, and the twenty congealing-boxes in the tank have thus a freezing-surface of five thousand one hundred and twenty square feet, upon which the ice is formed in forty sheets, each of which is sixteen feet long and eight feet wide, and of sufficient commercial thickness, preferably about one foot, which size I find the most convenient for portable subdivision into masses about two feet long and two feet wide. Taking this tank as a standard, I have found by experience that, with proper power, pumps, condensers, and other suitable parts of an ice-machine, I can produce ten tons of ice per day of twenty-four hours with the least cost per ton, and I have also found that when a less quantity per day is needed it is the best economy to let the machines be idle and use the ice already made until the same is nearly or quite exhausted, and when a greater quantity than ten tons per day is needed to increase the number of ice-machines, each of ten tons capacity per day and complete in every particular.

With regard to the arrangement of the separate parts which form an ice-machine, I have found it most convenient to arrange the pumps on a line near the power-supply, and to have all the pumps driven from the same shaft with suitable connecting-gear, so that one or more of the pumps may be disconnected without stopping the others, and to take power derived from the same shaft to operate the condensers, sprinklers, the endless belt and other parts of the machine, and to arrange the condensers between the ammonia-pumps and the congealing-tanks, and as far as possible to have the pumps and the tanks nearly upon the same level, to have the receivers upon a lower level than the condensers, and to use the pump-room as the engineer's room, whether steam or water power is used, and to have arranged in said room all the gages and some of the principal valves, to have the water-supply tank, the brine-tank, and the cutting-up platform all in the same room where the congealing-tanks are placed, and this arrangement possesses the following advantages, viz: any pump, condenser, or tank may be repaired without affecting the others, and the work of congealation be carried on in one machine while another is at rest or the ice is being removed from one of the tanks *i e*.

Placing the receiver below the condensers gives the force of gravity in aid of the flow of ammonia from the condenser to the receiver. Placing the parts named upon the same level affords convenience in superintendence. Making the machines of ten tons capacity is the smallest size which can be constructed or managed economically and fills the greatest requirements of demand. This system of construction and arrangement of an ice-machine constitutes another part of my invention.

For the better instruction of those skilled in ice-making I refer to the drawings connected with this application, in which—

Figures 1 and 2 are end elevations of buildings containing four of my machines; Fig. 3, a vertical longitudinal section through lines *x x* of Figs. 1 and 2; Fig. 4, a detail plan view from above of a group of four refrigerating-tanks; Fig. 5, a detail vertical section of a condenser with an elevation of a sprinkler; Fig. 6, a separate view of a dirt-catcher; Fig. 7, a side elevation with a cylinder in section of an ammonia-pump; Fig. 8, an end elevation of an ammonia-pump; Fig. 9, a detail of the valve of the same.

The drawings illustrate particularly a desirable form of a forty-ton machine composed of four ten-ton machines, and corresponding parts in each figure are shown by similar letters of reference.

In the drawings, A represents the ammonia cylinder or vessel in which ammonia is supplied commercially, which is preferably placed upon a platform-scale, so that the precise weight of ammonia drawn from it may be noticed by inspection. A pipe, *a*, with a cut-off valve, 1, leads from this cylinder to the inlet side of one of the ammonia-pumps B.

B B B B represent four ammonia-pumps, arranged in line and driven by a shaft, C. Each pump is composed of two single-acting cylinders, *b b*, placed on one bed-plate, *b'*, with a fly-wheel, $b^2$, between the cylinders. This fly-wheel is also the driving-wheel, and is belted to a pulley on the shaft, preferably fitted with clutches, which hold it to the shaft and release it upon a certain pressure, or, at will, release it altogether. From the shaft of this fly-wheel motion is communicated through crank-arms and pitmen on each side to levers pivoted at the ends opposite the pitmen ends, and to them in turn are pivoted the piston-rods $b^3$, which actuate the pistons of each cylinder. To adapt this pump especially for use in an ice-machine or refrigerating apparatus, there is a jacket, *c*, around each cylinder, with a water-chamber supplied by a pipe, *c'*.

The piston is furnished with packing-rings constructed and arranged in a usual manner, and at the head of the piston is a valve, $c^2$, with a recessed center, $c^3$, through which passes an extension, $c^4$, of the piston-rod, and the valve $c^2$ has a limited movement up and down upon this extension. This limit in the downward direction is made by shoulders $c^5$ upon the piston-rod, which is threaded up to such shoulders, and thereby held in place within the piston. Above these shoulders the extension $c^4$ of the piston-rod is smaller than below, and adapted for a sliding movement of the valve $c^2$ up and down upon it. The upper end of this extension is also screw-threaded, and has a couple of right and left jam-nuts, $c^6$ $c^7$, which screw down upon it, the lower one of which limits the upward movement of the valve.

It is important to get access to the jam-nuts, and to this end a central portion, $c^8$, of the top of the valve $c^2$ is provided with screw-threads and is screwed down into place. To prevent the movement of this central portion, separate screws $c^9$ are passed down through the screw-threads of said central portion into the body of the valve below and hold said central portion firmly. By the removal of the small screws $c^9$ the central portion, $c^8$, can be readily removed, and with a suitable hand-tool the jam-nuts $c^6$ $c^7$ can be taken off, and the piston-rod is unscrewed and removed from the piston.

In the descent of the piston the gas or ammonia rushes up through suitable openings in the body of the piston and raises the valve $c^2$ from its seats $c^{10}$, and passes into the cylinder above such valve and between it and the valve $c^{11}$. Upon a reverse movement of the cylinder the valve $c^{11}$ is raised in turn and the ammonia or gas is forced into the pipe.

The water-jacket around the cylinder serves to keep it cool, and the arrangement of the piston and its valves serves to create and maintain close points, and to make all the parts convenient of access for repairs or renewals, and altogether adapt the pump for this special purpose. From each of these pumps on the outlet side a pipe, E, preferably of two inches diameter, leads to the condenser F, which is shown in sectional detail in Fig. 5. This condenser consists of four coils of pipe arranged so as to be about eight feet in diameter and nine feet high, composed of pipes *e e e' e'*, preferably of three-quarter inch diameter and each about eight hundred feet long. These coils all spring from a manifold, E', into which the pipe E enters at one end, and the other end is coiled upwardly over the condenser, and then is bent down upon one side and terminates in a valve, 2, these coils (marked $e^2$) constituting an air-chamber, and the valve serving to let off the air when needed.

The pipes *e e* are coiled to the right from the top to the bottom of the condenser in contiguous coils, and the pipes $e' e'$ are in like fashion coiled to the left, thin strips of iron separating the two sets of coils, and all the coils being contained between two sets of vertical bars, $b' b'$, which are bolted together in such a way as to hold both the bars together and support the coils suitably in position.

The vertical bars $b' b'$ stand upon a flooring and make a kind of frame-work, inclosing the coils upon the inside as well as the outside. All these pipes terminate at the bottom of the condenser in a manifold, $E^2$, which is closed at one end, and the other end is connected with a pipe, $E^3$, preferably about three-fourths of an inch in diameter, which leads to the receiver H. Within this condenser is placed a hollow shaft, G, the lower part of which is filled with wood and suitably stepped in a bed-piece, and the upper part supported in a vertical position by a beam or other support. At the upper end of this shaft is placed a funnel or other suitable vessel, $g$, into which a water-supply comes from a pipe, $g'$. Upon the shaft is placed a cross-arm, $g^2$, whose end is bent down and to one side, terminating in a sprinkler, $g^3$, which delivers water upon the top of the coils $e\ e\ e'\ e'$. The sprinkler-pipe is bent to one side at the end sufficiently to revolve by recoil around the condenser about once in a minute, and the water discharged upon the condenser-coils drips down, so that all parts of the coils are kept continually wet and are thereby cooled, so that the ammonia-gas entering therein is condensed and liquefied. The advantage of this construction is this, namely: By having the condenser vertical, and by having four coils arranged as described, a great length of coils is obtained with a larger pitch or incline in either coil and shorter coil. When, therefore, the gas is driven by the pump into the condenser, it is divided into four distinct currents, and flows through the four coils with less speed than it would through a single coil, as usually employed, and condenses more rapidly. At the same time much less work and very much less water are required from the sprinkler, and the expense of water and the cost of pumping the same are largely reduced. From this condenser the pipe $E^3$, before mentioned, connects with the ammonia-receiver H, preferably upon a lower level than the condenser, so that the ammonia will run in a liquid state into it from the condenser. This receiver is preferably made about four feet long, of twelve-inch iron pipe, with ends welded in, and is surrounded with a coil of two-inch pipe, $h$, into the upper end of which receiver the pipe $E^3$ from the condenser enters. Another three-quarter-inch pipe, $E^4$, leads from the bottom of the receiver to the congealing-coils, hereinafter to be described, and still another pipe, $E^5$, leads to a pressure-gage, $g^4$, conveniently arranged for inspection in the pump-room. The pipe $E^3$ has a valve, 3, and pipe $E^4$ has a valve, 4, each adapted to cut off.

The connections with the spiral pipe $h$ are as follows: At the top with a pipe, $E^5$, leading from the congealer-coils, and at the bottom with the same pipe $E^5$, which leads from the congealer-coils to the inlet side of the ammonia-pump, so that the spiral pipe $h$ is in the circuit of connection between the congealer-coils and the inlet side of the ammonia-pump and passes through the dirt-catcher. This receiver is covered with a jacket, $h'$, of wood or thin iron, and the space between the jacket and the receiver proper is filled in with sawdust, coal-dust, or other non-conducting material.

The advantage of this construction of the receiver is its constant coolness produced by the cold current, which circulates through the spiral pipe $h$. As before mentioned, the pipe $E^4$ leads from the receiver to the refrigerating or congealing coils, or, rather, to a manifold, from which the refrigerating-coils lead. These coils are constructed, substantially, in accordance with the description in Reissue No. 7,383, granted to me November 7, 1876, and are connected with a manifold, $i$—viz., a section of pipe of about two inches diameter closed at each end and having four short branch pipes, $i\ i\ i\ i$, of about one inch diameter, each with a valve, 5, for regulating the feed, into which branch pipes the congealing-pipes $i^2\ i^2$ enter. When these congealing-pipes are used for cooling the air and for other refrigerating purposes, these manifolds just mentioned may be dispensed with and the coils arranged as most convenient. These congealing-pipes in ice-machines are bent down inside of each congealing-box K to near its bottom, and are extended across in a horizontal plane, then bend up and extend in the other direction, and turn up again, the coils gradually approaching each other toward the top, where the pipe leaves the box, as shown in said Reissue No. 7,383. The congealing-boxes are preferably arranged in groups of five, as shown in Fig. 3, and boxes marked 1 and 2 preferably contain twenty convolutions of three-quarter-inch pipe each, and those marked 3, 4, and 5 eighteen convolutions of one-inch pipe each, the inlet-pipe going, as before explained, to the bottom of box 1, coming out of the top of the same, then bent down to the bottom of box 2, and so on until the outlet comes out of the top of box 5, the gas flowing in at the bottom of box 1 and coming out at the top of box 5, and all the pipes are connected with a manifold, $i$, and four of such groups are placed in each tank L in such a way that the top of each box is about three inches below the top of the tank and the outside boxes are about eighteen inches from the inside ends of the tank, and a space of about two feet is left between every two boxes and a space of about six inches is left between the ends of the boxes and the inside sides of the tank.

The congealing-boxes are composed of thin iron plates, preferably about eight pounds to the square foot, placed on each side of a frame about two and one-half inches thick, bolted together through the frame and plate on each side of it, so as to leave an interior space for the congealing-coils and the non-congealable liquid of about two and one-half inches wide, and extending the whole cross-area of the tank, or about sixteen feet, with about one-half of that depth. The spaces between the boxes $e^2$ contain the water to be congealed, and are about two feet wide.

From the manifold *i* the gases are drawn back by a pipe, $E^5$, preferably a two-inch pipe, which leads back to the top of the coil *h*, around the receiver, and, connecting with the bottom of said coil, passes through the dirt-catcher to the inlet side of the ammonia-pump.

The tank K, as before stated, is about forty-five feet long, seventeen feet wide, and nine feet deep, made strongly and water-tight of wood, is covered over with removable planks for a flooring, which planks should be numbered consecutively, so as to be properly replaced when taken up; and for convenience of handling two courses of planks, each about eight and one-half feet long placed end to end, should constitute the covering of each tank. These tanks for a forty-ton machine are four in number, as shown in Fig. 4, and are placed in pairs, end to end, and between these pairs is a space which is occupied by an endless belt, M, of planks, to which movement is given in any convenient way by gearing or belting with the main power-shaft. A rail, N, is supported or hung above each series of two tanks, upon which a traveling pulley enables a hoisting-tackle to be placed over any congealing-box, so as to hoist out the cake of ice. When thus hoisted, it is deposited upon the plank top of the tanks, which constitute a platform for that purpose. Upon this platform the large cakes, being subdivided into convenient sizes, are pushed upon the endless belt, which conveys them to the wagons.

The tanks K, in addition to the refrigerating-boxes and the intermediate spaces for the water to be congealed and the connections described in said Reissue No. 7,383, have the apparatus for making the ice transparent, dense, and heavy, as referred to in a former part of the specification. This apparatus consists in a pipe, O, which runs the whole length of each pair of tanks under their bottoms, having branch pipes *k k* preferably at each fourth water-space tapped into it, so as to draw off the turbid water from the bottom of each water-space. The turbid water thus taken from the tanks passes through a suitable filter, O′, from which it is drawn up by a proper pump, $o^2$, and discharged into another pipe, $o^3$, which passes along over the tanks, preferably at their outer edges, and by branch pipes *k′ k′* discharges into the water-spaces, preferably about every fourth water-space. By this means the turbid water is withdrawn from the bottom of the tanks, where it naturally gravitates, then through a filter, purified, and returned to the water-spaces without sensible increase in temperature. The frequency of this operation will depend of course largely upon the purity of the water used for ice-making.

It may be nearly continuous, as where unfiltered, impure, or turbid water is used for ice-making; but where filtered or very pure natural water is used the act of withdrawal may be conveniently performed at such intervals in the act of congelation, as the appearance of the unfrozen water may render necessary.

A dirt-catcher, P, (shown in Fig. 6,) placed in the circuit of the pipe $E^5$, running to the ammonia-pump from the coils *h* of the receiver, to prevent all dirt, scale, or other foreign matter getting into the pump, is essential for the preservation of the valves of the same. I prefer to make said dirt-catcher in two equal parts, *l l′*, with flanges *m m*, and secured together with bolts and nuts, so as to be easily taken apart, and having a wire strainer, *n*, between the two parts, to catch the dirt or other foreign matter. The pipe $E^5$ enters this dirt-catcher at the bottom and leaves it at the top, and it may be provided with a gage, *o*, displayed in the pump-room to indicate the pressure in the congealing-coils.

To fill the tank K with water for congealation, a water-tank, Q, is essential, and should be made of sufficient size and strength, with suitable inlets and outlets and overflow-pipes and indicator as to water-level preferably arranged so as to be visible in the pump-room. This tank, when possible, should be placed upon a higher level than the tank K′, so as to fill it by gravity. If this is not possible, it should be provided with suitable pumps and connections leading to tank K. Another tank, R, is required for the supply of the non-congealable liquid, preferably brine, to the congealing-boxes, and its size and construction will require no description, as it resembles in all respects, except size, the tank Q, and requires the same attachments substantially. It is preferably located below the tank Q, and most conveniently between two tanks, Q, as shown in Fig. 1, by means whereof fresh water may be readily admitted to it.

Pumps S and T, of proper size and construction, are employed to pump back water and brine from the tanks K to the respective tanks Q and R when necessary.

I have described in this specification ten-ton machines, either single or combined, as constituting the most preferable and economical use of my invention for furnishing ice for general consumption; but in so doing do not mean to restrict myself to any size of machines, as it is evident that for detached and local purposes much smaller machines, either singly or in combination, may be used to great advantage, and under peculiar circumstances even larger machines, singly or in combination, than those of ten tons capacity.

I am aware of the patent granted to Gamgee, September 14, 1878, No. 208,304, and disclaim the invention described therein, which differs from any invention described by me in the foregoing specification in essential particulars, to wit: I remove from time to time as needed the turbid water from the bottom of my freezing-tanks, pass it through a filter, and return it purified into the top of the freezing-tanks with the least loss of time or disturbance of the water in the freezing-tank or increase in temperature by means of a separate water-circuit, while Gamgee takes water from the top of his freezing-mold, passes it into a filter-tank, which is the general water-supply in the general water circuit, and then returns it to the bottom of the freezing-mold by a continuous process, and thereby does not accomplish the particular results which I desire.

Having thus described my invention, what I claim as new therein is—

1. The system of circulation in an ice-machine of the turbid water in the freezing-tanks, which consists in withdrawing said water from the bottom of the congealing-tanks as it becomes turbid, passing the same through a filter, and then returning the same water purified to the top of the freezing-tanks with the least loss of time and increase in temperature, substantially as described.

2. The system of ammonia circulation in an ice-machine or refrigerating apparatus, which consists in first filling all of the ammonia-pipes (previously exhausted of air) from the ammonia supply-vessel under its own pressure, then closing the valve between the receiver and congealing coils, then in withdrawing the ammonia-gas from the congealing-coils into the condenser, where it is liquefied and flows down into the receiver, until a whole charge is withdrawn from the ammonia-supply vessel, and then cutting off the flow of ammonia from the supply-vessel and circulating the ammonia-charge by the pump over and over again through the pump, the condenser, the receiver, and the congealing-coils, substantially as described.

3. In an apparatus of the character described, the combination of a gang or group of precisely similar ammonia-pumps with a single driving-shaft and separate systems of condensers, receivers, and pipe-connections, all precisely alike for each pump, adapted and arranged to be worked as independent machines or two or more together, substantially as described.

4. In an apparatus of the character described, a condenser composed of four spiral tubes arranged in pairs coiled in opposite directions, substantially as described.

5. In an apparatus of the character described, a receiver composed of cylindrical metal vessel surrounded by coiled pipes packed in non-conducting material, substantially as described.

6. In an apparatus of the character described, a dirt-catcher made in two parts with an intermediate wire strainer, substantially as described.

7. In an apparatus of the character described, an ammonia-pump composed of two single-acting cylinders on one bed-plate, each cylinder having a water-jacket, with a fly-wheel located between the cylinders, serving also as a driving-wheel, belted to a driving-shaft with releasing-clutches, substantially as described.

8. In an apparatus of the character described, the combination, with the pump, of the valve $c^2$, having a removable threaded central portion, $c^8$, locked in position by means of the screws $c^9$, substantially as described.

9. In an ice-machine, the combination, with the ammonia-pump, of the condenser, the receiver, the congealing-coils, the dirt-catcher, and their pipe-connections, substantially as described.

10. In an ice-machine, the combination, with the congealing-tank, of the congealing-boxes in groups with pipe-connections of different sizes and number of coils, substantially as described.

11. In an ice-machine having a general water-supply, the combination of a separate circuit for the withdrawal of the turbid water from the bottom of the freezing-tanks and for returning the same purified to the top of such tanks, and a filter in such water-withdrawal circuit, substantially as and for the purposes described.

12. In an ice-machine, the combination of congealing-tanks with removable plank platforms for ice-cutting, movable pulley for ice-lifting, and endless belt for ice-removal, substantially as described.

13. In an ice-machine, the combination, in the congealing-tank, of separate brine compartments and fresh-water congealing-boxes arranged alternately of the same width and depth, and composed of wooden ends and side walls, each of a single wrought-iron plate, substantially as described.

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

DAVID SMITH.

Witnesses:
FRANK O. MCCLEARY,
JNO. C. SCHROEDER.

Correction in Letters Patent No. 356,382.

It is hereby certified that Letters Patent No. 356,382, granted January 18, 1887, upon the application of David Smith, of Washington, District of Columbia, for an improvement in "Ice Machines," was erroneously issued to said David Smith after his decease on December 13, 1886, the said Smith having on May 3, 1883, assigned his invention and application to the Smith Ice Patent Company, of New Jersey; that the said Letters Patent should have been issued to the said *Smith Ice Patent Company, assignees*; and that the said Letters Patent should be so read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 12th day of April, A. D. 1887.

[SEAL.]

D. L. HAWKINS,
*Acting Secretary of the Interior.*

Countersigned:

R. B. VANCE,
*Acting Commissioner of Patents.*