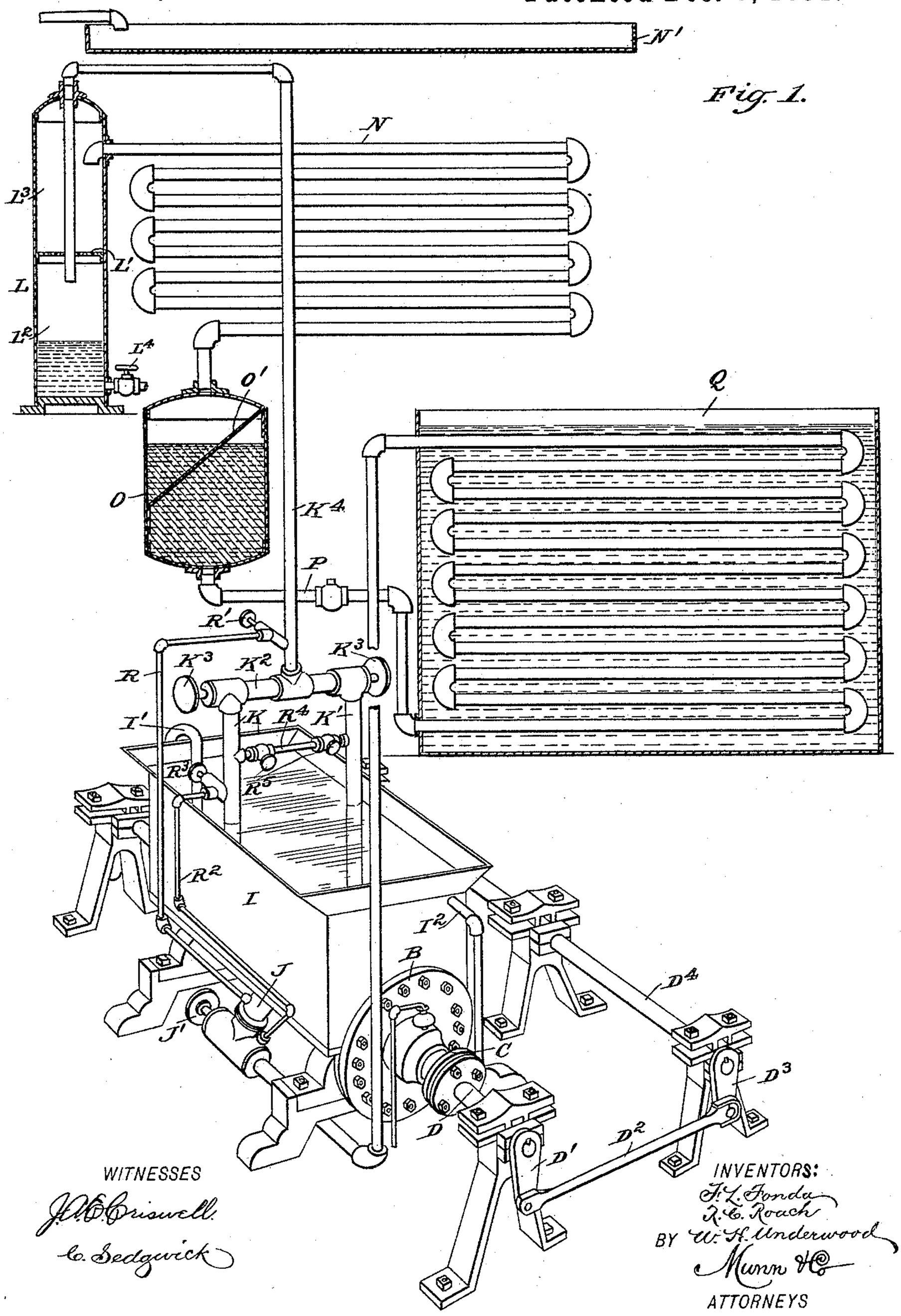
(No Model.) 3 Sheets—Sheet 1.

F. L. FONDA, R. C. ROACH & W. H. UNDERWOOD.

ICE MACHINE.

No. 464,862. Patented Dec. 8, 1891.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

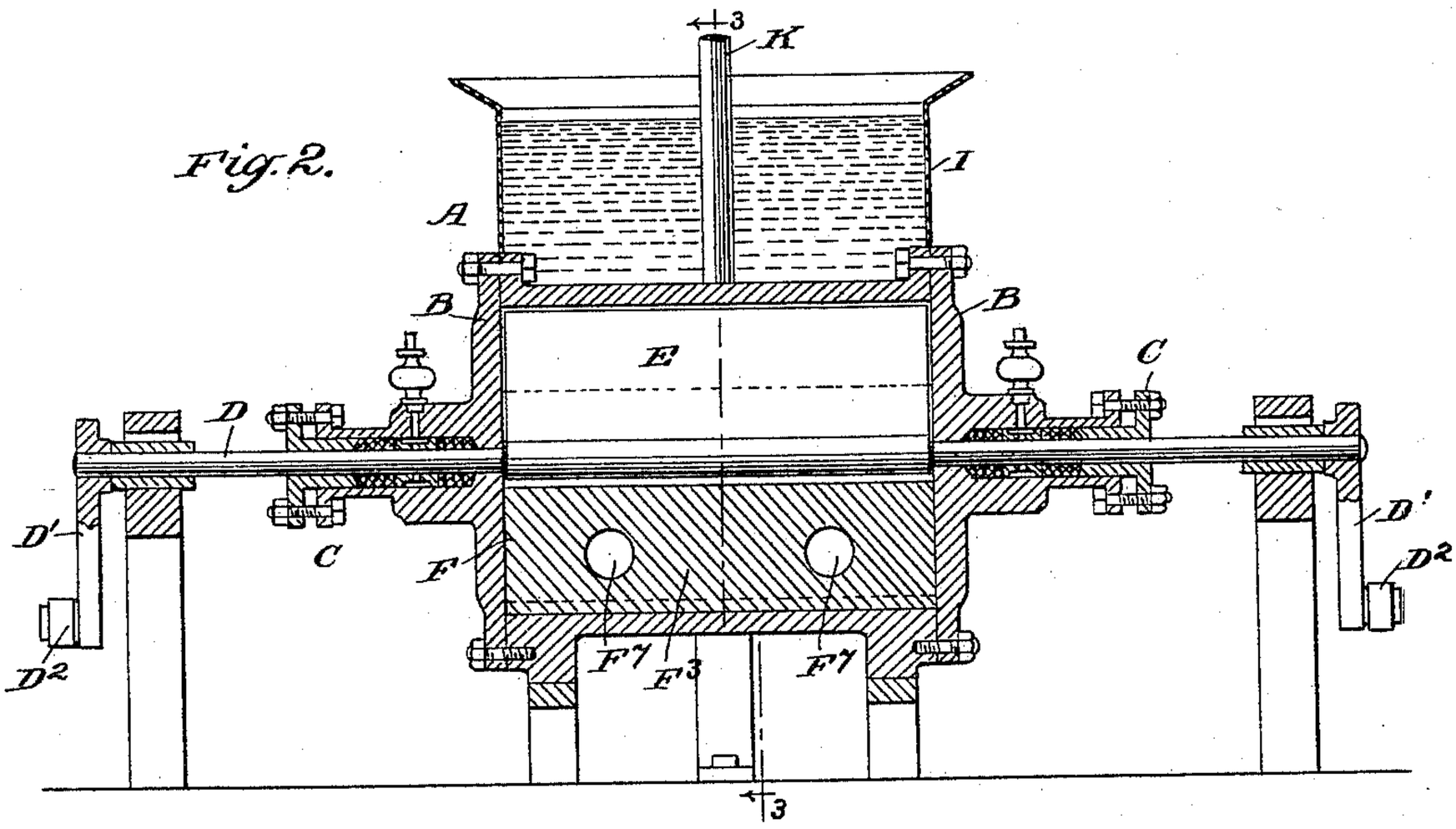

Fig. 3.

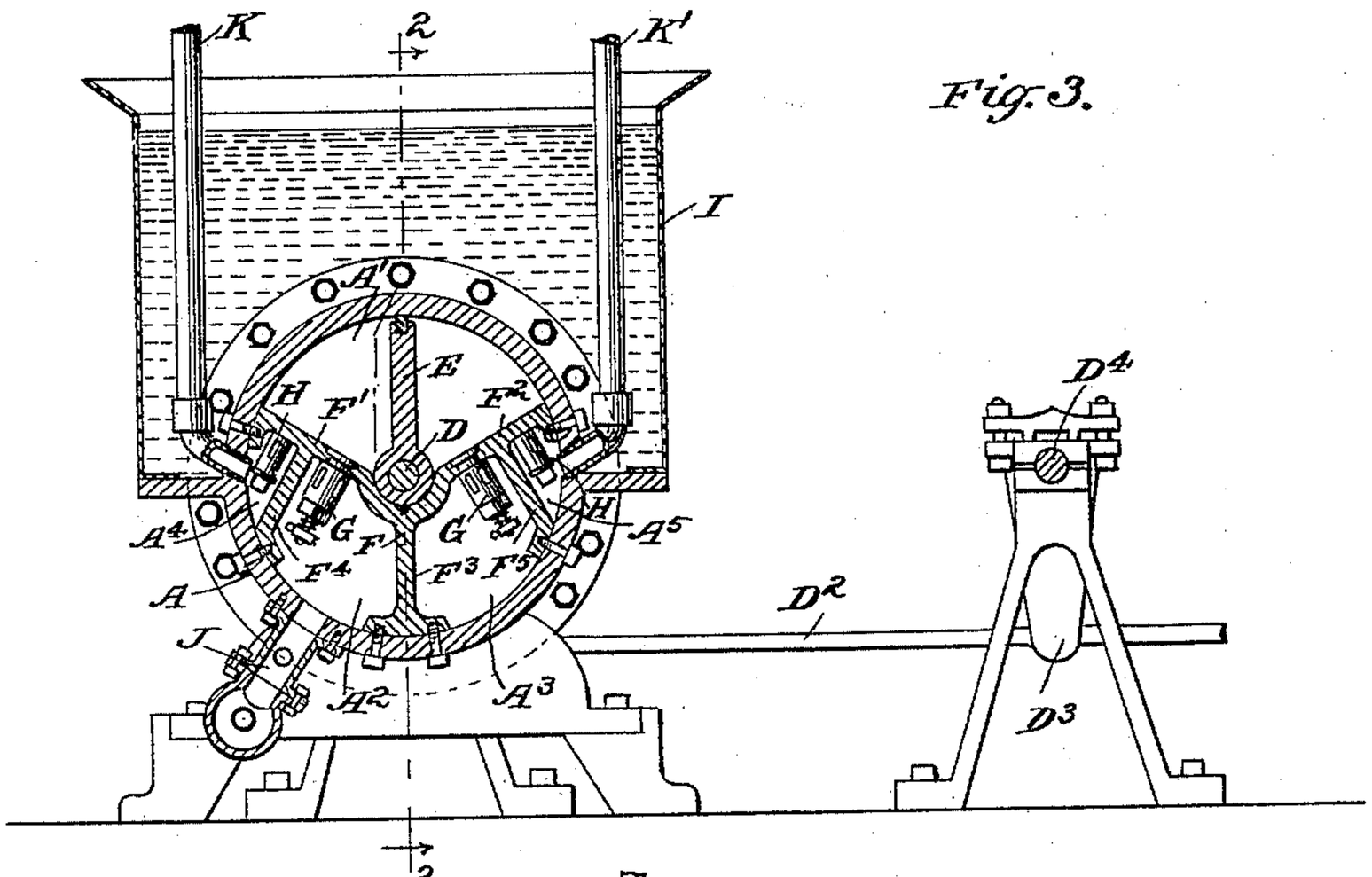

Fig. 4.

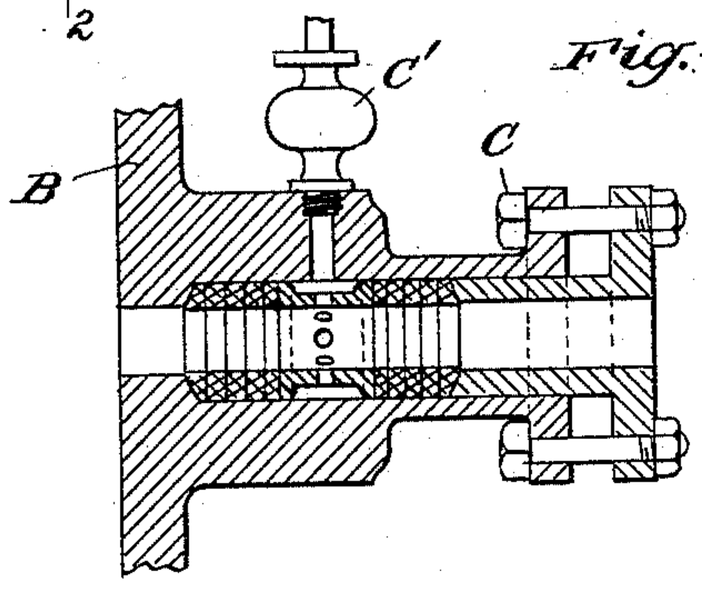

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Fig. 5.

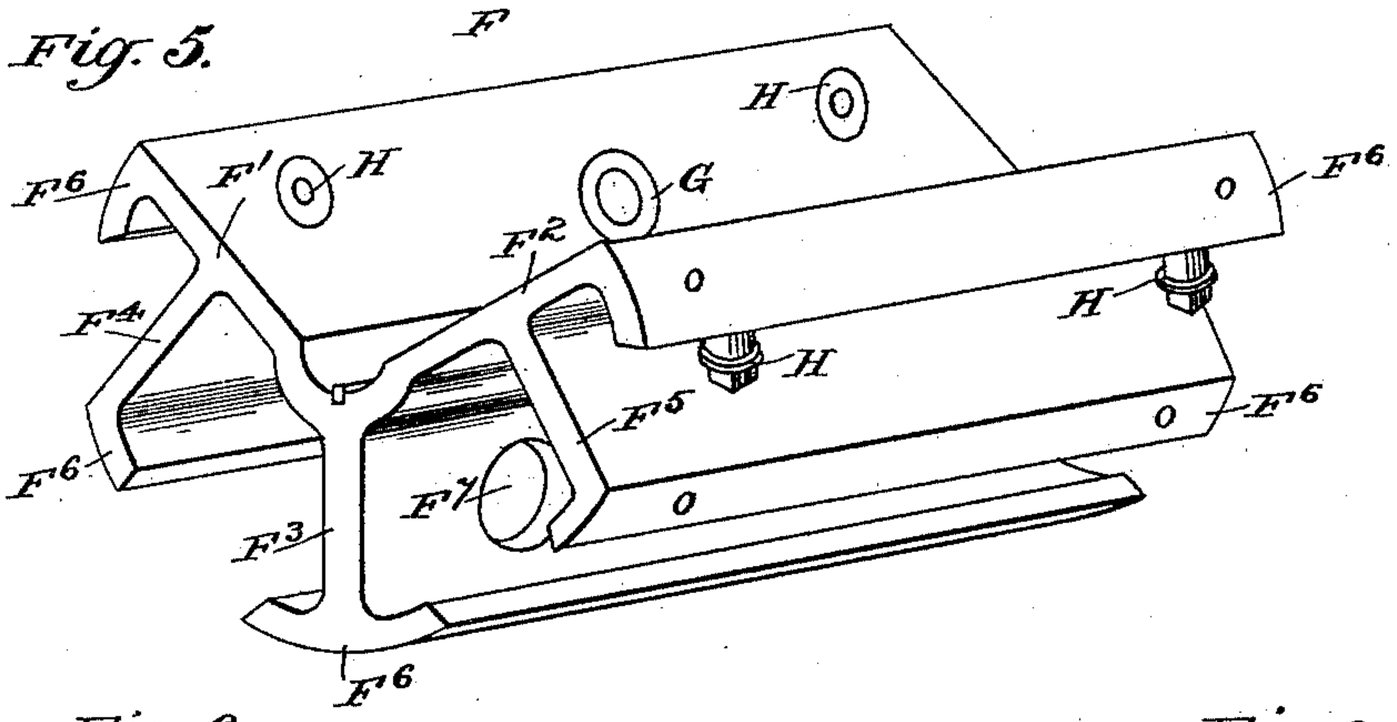


Fig. 6.

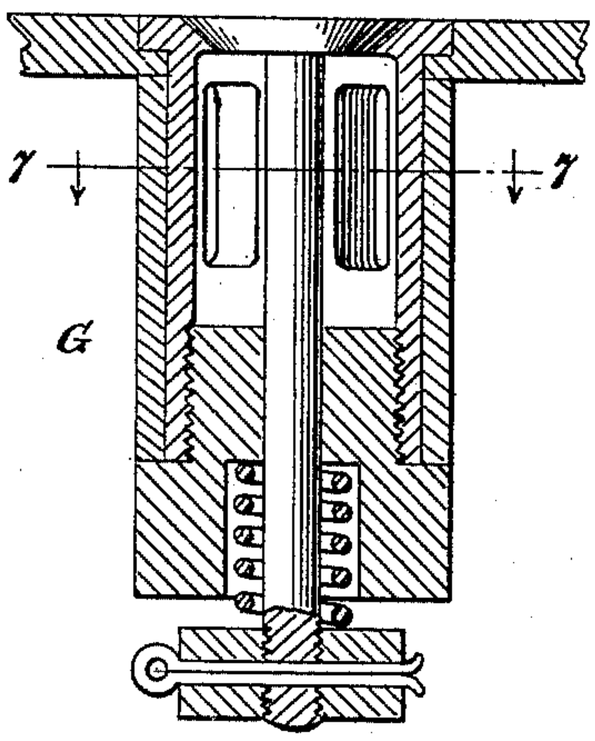


Fig. 7.

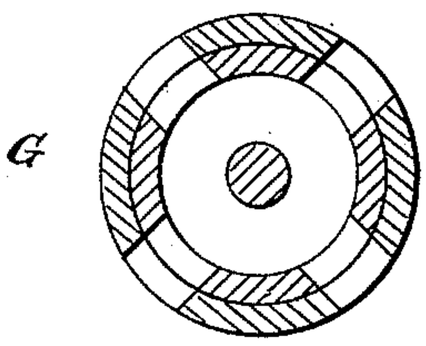


Fig. 10.

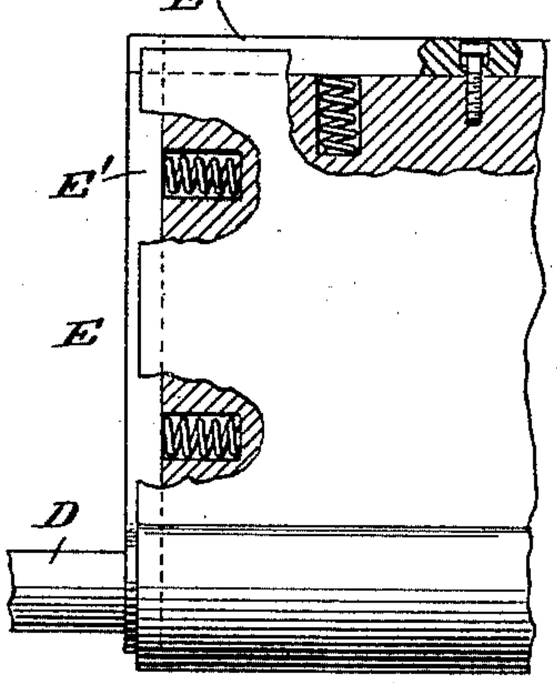


Fig. 11.

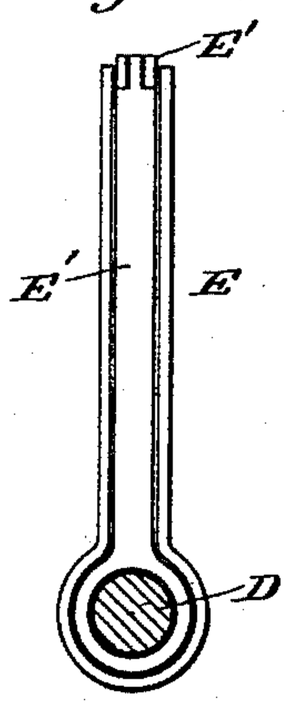


Fig. 8.

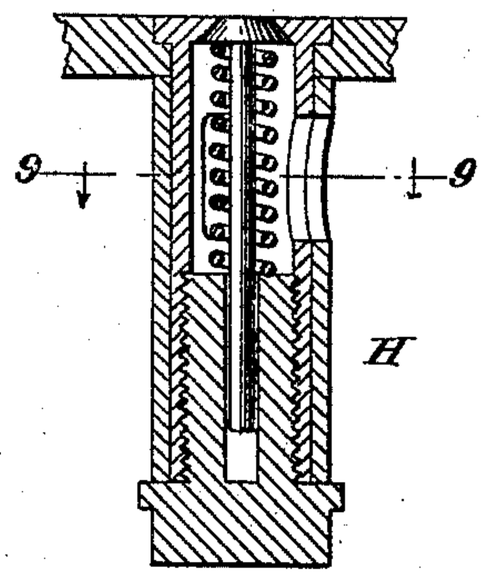
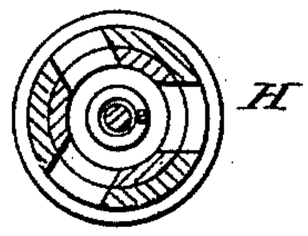


Fig. 9.



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UNITED STATES PATENT OFFICE.

FRANK L. FONDA, ROBERT C. ROACH, AND WALTER H. UNDERWOOD, OF HUTCHINSON, KANSAS.

ICE-MACHINE.

SPECIFICATION forming part of Letters Patent No. 464,862, dated December 8, 1891.

Application filed February 7, 1891. Serial No. 380,589. (No model.)

To all whom it may concern:

Be it known that we, FRANK L. FONDA, ROBERT C. ROACH, and WALTER H. UNDERWOOD, all of Hutchinson, in the county of Reno and State of Kansas, have invented a new and Improved Ice-Machine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved ice-machine which is simple and durable in construction, very effective in operation, requiring a small amount of motive power for driving it, and preventing leakage of the gas.

The invention consists of certain parts and details and combinations of the same, in which similar letters of reference indicate corresponding parts in all the figures.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view of the improvement, parts being in section. Fig. 2 is a sectional side elevation of the cylinder on the line 2 2 of Fig. 3. Fig. 3 is a transverse section of the same on the line 3 3 of Fig. 2. Fig. 4 is an enlarged sectional side elevation of one of the cylinder-heads and the stuffing-boxes. Fig. 5 is a perspective view of the spider for the cylinder. Fig. 6 is an enlarged sectional side elevation of the suction-valve. Fig. 7 is a sectional plan view of the same on the line 7 7 of Fig. 6. Fig. 8 is an enlarged sectional side elevation of the discharge-valve. Fig. 9 is a sectional plan view of the same on the line 9 9 of Fig. 8. Fig. 10 is an enlarged side elevation of the cylinder-shaft and its wing, parts being in section; and Fig. 11 is an end elevation of the same.

The improved ice-machine is provided with a cylinder A, formed with heads B B, having each a stuffing-box C, in which is journaled the cylinder-shaft D, on which is secured within the cylinder A a radial wing E, serving to compress the gas. The outer ends of the shaft D are mounted to turn in suitable bearings and are provided with crank-arms D′, connected by links D^2 with crank-arms D^3, secured on a main driving-shaft D^4, receiving a rotary motion in any suitable manner, so as to impart an oscillating motion to the cylinder-shaft D and its wing E.

In the cylinder A is secured a spider F, formed with three radial arms F′ F^2 F^3 and two angular arms F^4 and F^5, extending from the arms F′ F^2 to the inner surfaces of the cylinder A, as is plainly shown in Fig. 3. Each of the arms F′ F^2 F^3 F^4 F^5 is formed at its outer end with a flange F^6, bolted or otherwise secured to the inner surface of the cylinder A to prevent leakage in the cylinder. The several arms of the spider F extend from one end of the cylinder to the other, so as to form longitudinal chambers A′, A^2, A^3, A^4, and A^5, of which the chamber A′ is the compressing-chamber and extends between the arms F′ and F^2, which are arranged at or nearly at right angles to each other. The wing E oscillates in this chamber A′, its sides moving close to the top surfaces of the arms F′ and F^2, so as to fully expel all the contents of the chamber A′. The chambers A^2 and A^3 are formed at the sides of the wing F^3, and the said chambers are connected with each other by apertures F^7, formed in the said wing F^3. The chambers A^2 and A^3 thus form a single suction-chamber. The chambers A^4 and A^5 are the discharge-chambers for the compressed fluid. The suction-chambers A^2 and A^3 are connected with the compressing-chamber A′ by suction-valves G, (see Figs. 3, 6, and 7,) secured in the arms F′ and F^2. The discharge-chambers A^4 and A^5 are also connected with the compressing-chamber A′ by the discharge-valves H. (Shown in Figs. 3, 8, and 9.) The said valves G and H are located at opposite sides of the arms F^4 and F^5, and are secured in the arms F′ and F^2, as is plainly indicated in Figs. 3 and 5. As shown in Figs. 6 and 8, the suction-valve G opens inward, while the discharge-valve H opens downward, the valves proper when seated being flush with the top surfaces of the arms F′ and F^2, respectively.

In order to keep the compression-chamber A′ cool, a water-receptacle I is provided, secured on top of the cylinder A and receiving its water-supply through a pipe I′, connected with a suitable source of water-supply. An overflow-pipe I^2 also leads from the reservoir I to carry off the surplus water, the pipes I′

and I^2 being arranged in opposite ends of the reservoir I, as is plainly shown in Fig. 1.

Into one of the chambers A^2 or A^3 leads the fluid-inlet pipe J, provided with the valve J′ for regulating the amount of fluid to be sucked into the said chambers A^2 and A^3. From the discharge-chambers A^4 and A^5 lead the two pipes K and K′, extending upward through the water in the reservoir I, both connecting with a transversely-extending pipe K^2, provided on one end with a valve K^3 for connecting or disconnecting the pipes K and K′ with or from the pipe K^2. From the latter extends upward a pipe K^4, which discharges into an oil-trap L, provided with a strainer or sieve L′, so as to divide the oil-trap into two compartments L^2 and L^3, of which the lower one serves to catch the oil and is provided with a draw-off cock L^4, while the upper one is connected with the end of a coil of pipe N, forming a condenser in connection with a spraying-tank N′, having a perforated bottom and located over the said coil of pipe N. The other end of the coil of the pipe N connects with a filter O, having a strainer O′ and filled with a suitable filtering material to purify the fluid or freezing-mixture.

From the bottom of the filter O leads a pipe P, formed into a coil extending in the brine-tank Q to cool the brine therein in the usual manner. The pipe after leaving the tank Q leads to the suction-pipe J, to be returned to the compressor and used over again. The pipe K^4 can be directly connected with the suction-pipe J by means of a pipe R, containing a valve R′. A similar pipe R^2 is formed to connect the pipe K with the suction-valve J, the said pipe being also provided with a valve R^3. The pipes K and K′ can also be connected with each other by a small pipe R^4, containing valves R^5.

In order to prevent leakage in the wing E, the latter is provided with spring-pressed packing-strips E′, projecting from the ends and pressed in contact with the heads B and the inner surface of the cylinder. One of these spring-pressed packing-strips is also provided in the longitudinal groove formed in the spider at the juncture of the arms F′ F^2 to press against the inner edge of the wing or piston E.

The stuffing-box C (shown in detail in Fig. 4) is provided with an oiler C′, connected with an oil-pump to force a lubricant through the said oiler and through apertures in the stuffing-box onto the cylinder-shaft D, so as to lubricate the latter.

The operation is as follows: When the several parts are in the position shown in Figs. 1, 2, and 3 and the main driving-shaft D^4 is rotated, then an oscillating motion is given to the cylinder-shaft D, so that the wing E swings from one radial arm F′ or F^2 to the other, and vice versa, thereby sucking in the fluid through the suction-valves G, compressing the fluid on the return stroke, and finally discharging the compressed fluid through the discharge-valves H into the chambers A^4 and A^5, from which the fluid passes through the pipes K K′ to the pipe K^2 and from the latter to the pipe K^4 into the oil-trap L. The fluid passes from the oil-trap L through the coil of pipe N of the condenser, and after being cooled passes through the filter O into the coil of pipe in the tank Q, there cooling the brine contained in the tank in the usual manner. The suction in the chambers A^2 and A^3, caused by the oscillating wing E, draws the used gas from the coil of pipe in the tank Q back to the cylinder A to be again compressed in the manner above described. Thus a continuous operation is carried on, the fluid being used over and over again. By constructing the cylinder in the manner described the leakage usually occurring in cylinders and reciprocating pistons is entirely avoided. The upper part of the cylinder A, containing the chamber A′, is kept cool by the water circulating in the reservoir I, while the lower part of the cylinder is cooled by the gas coming into the chambers A^2 and A^3. Thus the chambers A^2 and A^3 are always full of gas, and a rush of the latter through the suction-valves is avoided.

The valve within the cylinder A can at any time be readily examined by simply removing one of the cylinder-heads B.

The construction of the entire machine is very durable and simple, and the machine requires only a small amount of power for operating, thus saving considerable fuel. As the gas returned from the brine-tank Q passes into the bottom chambers A^4 and A^3, no liquid ammonia is liable to flow into the compressing-chamber A′. As the discharge-pipes K and K′ pass through the water in the reservoir I, the temperature of the gas in the said pipes is reduced considerably previous to passing into the coil of pipe N of the condenser, so that considerable water is saved in the latter in cooling the coil of pipe M. As the wing E only oscillates, the machine can be run at a higher rate of speed than where the ordinary cylinder and a reciprocating piston are used.

The system of pipes and valves R′, R^2, R^3, R^4, and R^5 are used for pumping gas from the condenser N to the brine-tank Q. In order to do this, the valves K^3 on discharge-pipe K^2, as well as the valve J′ on the suction-pipe J, are closed and the valves R′, R^3, and R^5 are opened successively. The machine is now started in the ordinary manner, so that all the gas is pumped out of the condenser N. After this is accomplished the valves R′, R^3, and R^5 are again closed to cut out the condenser for repairs or other purposes without loss of gas.

When it is desired to repair or perform other work on the machine, then the valves K^3 are opened and valve J′ is kept shut, and as there is a vacuum in the condenser all or nearly all the gas will escape out of the compressing-chambers and pass through pipes

K, K′, K², and K⁴ to oil-trap L and from the latter to the condenser. The valves K³ are then closed. The compressor is now almost free of gas and can be conveniently examined or repaired, the gas being mostly contained in the brine-tank pipes and condenser.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the cylinder A, having removable heads B, provided with aligned stuffing-boxes, and a spider F, extending from end to end of the cylinder and formed of three radial arms F′ F² F³, arm F³ being apertured, and narrower arms F⁴ F⁵ along the under side of the arms F′ F², respectively, the outer edges of said arms being bolted to the cylinder, thus forming a compression-chamber A′, connected inlet-chambers A² A³ and separate outlet-chambers A⁴ A⁵, a supply-pipe leading into said inlet-chambers, spring-seated valves opening from chambers A² A³ into the compression-chamber, and outlet-valves opening from opposite sides of chamber A′ into the respective chambers A⁴ A⁵, of the rocking shaft extending through the compression-chamber and stuffing-boxes, and a piston or wing E, mounted on the shaft with its ends and longitudinal edges in close contact with the walls of said chamber, substantially as set forth.

2. In a gas-compressor, the chamber-forming spider F, formed in a single casting and comprising the three radial arms or webs F′ F² F³, having attaching-flanges along their outer edges, arms F⁴ F⁵, extending along the under sides of the arms F′ F², countersunk valve-openings in the arms F′ F² at opposite sides of the arms F⁴ F⁵, the arm F³ being provided with apertures F⁷ F⁷, and the longitudinally-extending groove at the juncture of the inner edges of the arms F′ F², substantially as set forth.

3. A gas-compressor for ice-machines, having a compression-chamber, an inlet-chamber having a valved connection therewith, and outlet-chambers having valved connections with the compression-chamber and the oscillating piston or wing in the compression-chamber, in combination with a valved supply-pipe J, leading into the inlet-chamber, outlet-pipes K K′, leading from the respective outlet-chambers, a pipe K², connecting the upper ends of said pipes K K′ and provided with end valves K³ K³, the pipe K⁴, connected with pipe K², the valved pipe R⁴, connecting pipes K K′ below pipe K², the valved pipe R², leading from K below pipe R⁴ to the inlet-pipe J, and the valved pipe R, connecting pipes K⁴ and J, substantially as set forth.

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ROBERT C. ROACH.
WALTER H. UNDERWOOD.

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Witnesses for Walter H. Underwood:
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