(No Model.) 4 Sheets—Sheet 1.

N. W. WHEELER, Dec'd.

C. H. WHEELER, Administratrix.

MACHINE FOR ARTIFICIAL REFRIGERATION.

No. 441,995. Patented Dec. 2, 1890.

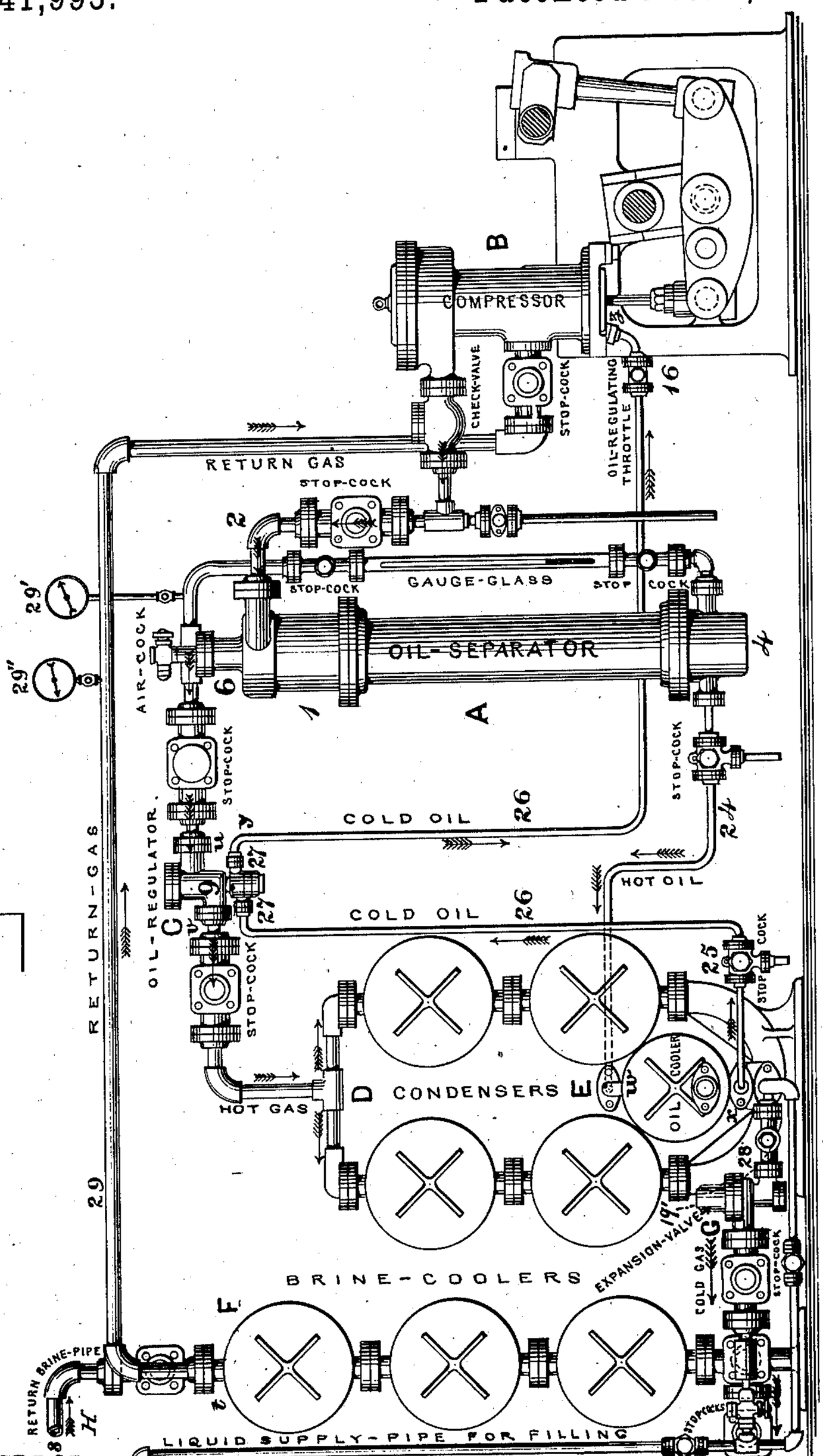

Fig. I.

Witnesses.
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John F. Helm

Clara Hope Wheeler, Admin.x Estate of
Norman W. Wheeler, Inventor (Dec.d)
By her Attorneys,
Knight Bros.

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Fig. III.

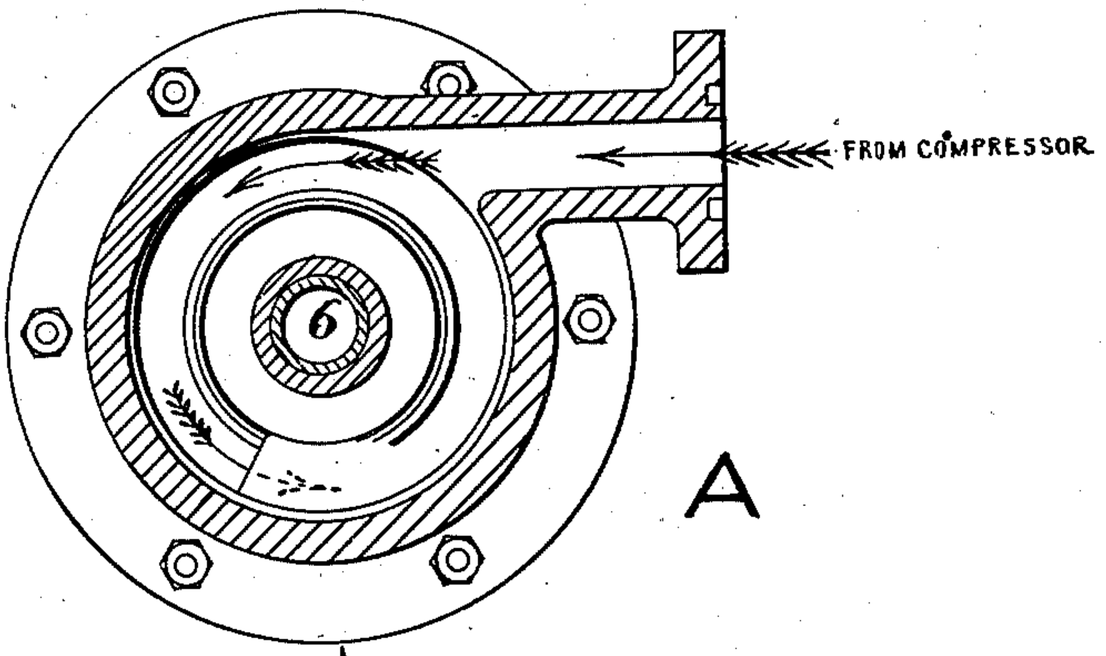
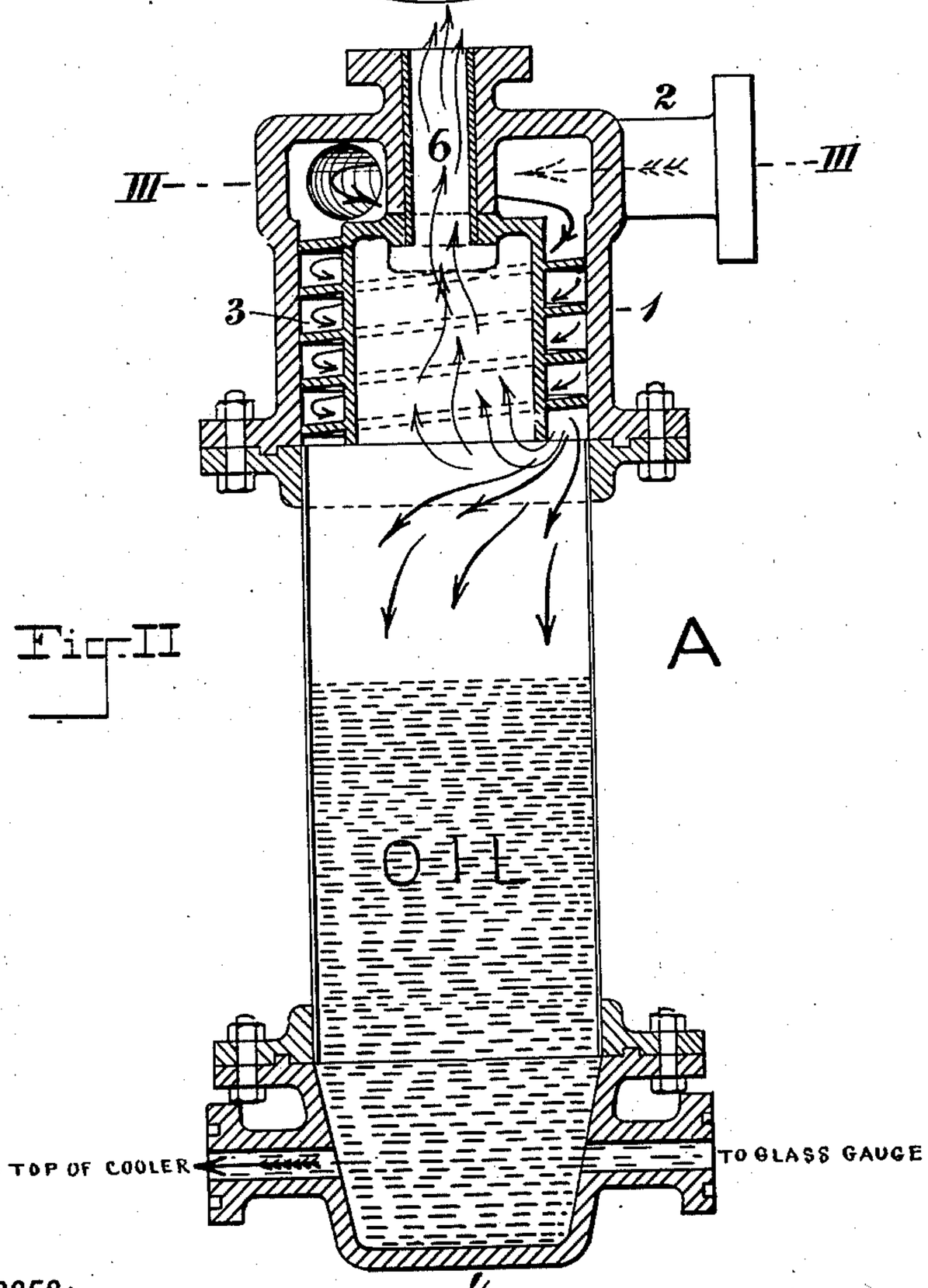


Fig. II



WITNESSES:

Maxie L. Bidgood
John F. Nelson

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Norman W. Wheeler Inventor (Dec.d)
By her Attorneys
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N. W. WHEELER, Dec'd.

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MACHINE FOR ARTIFICIAL REFRIGERATION.

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Fig. IV.

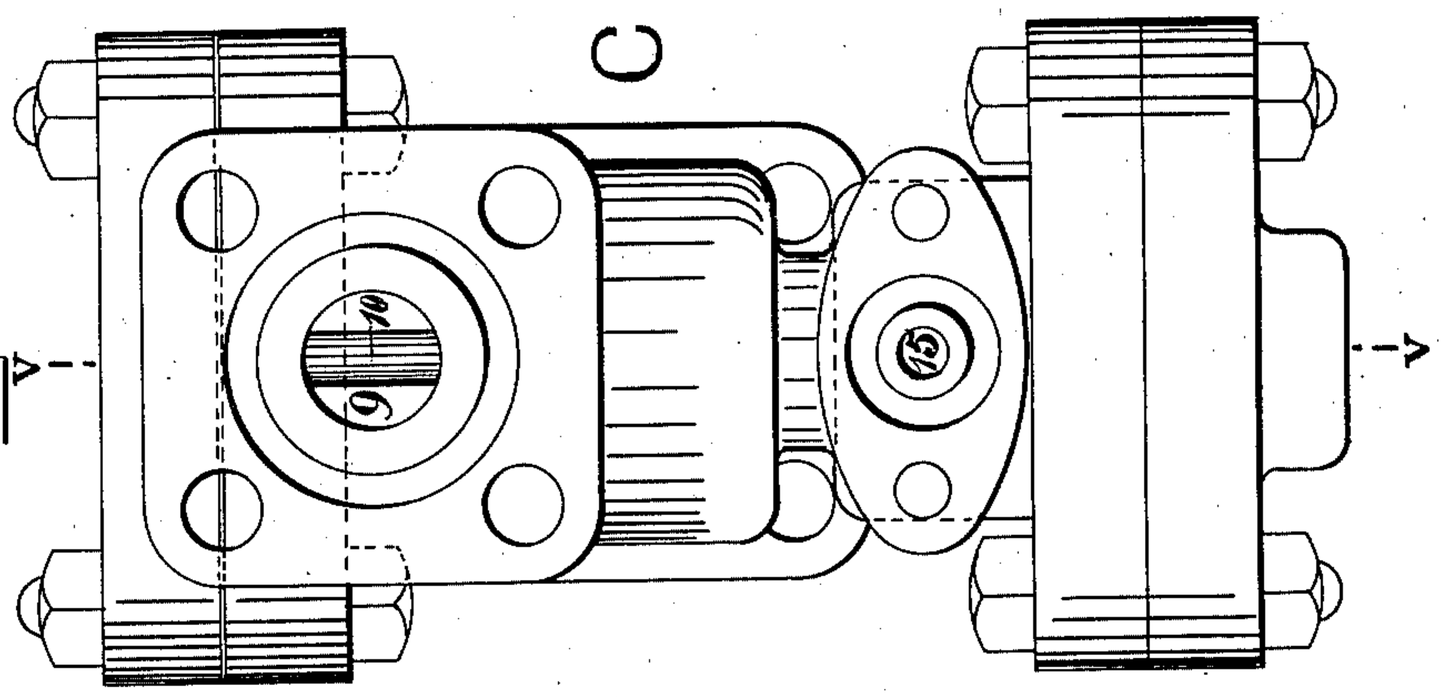
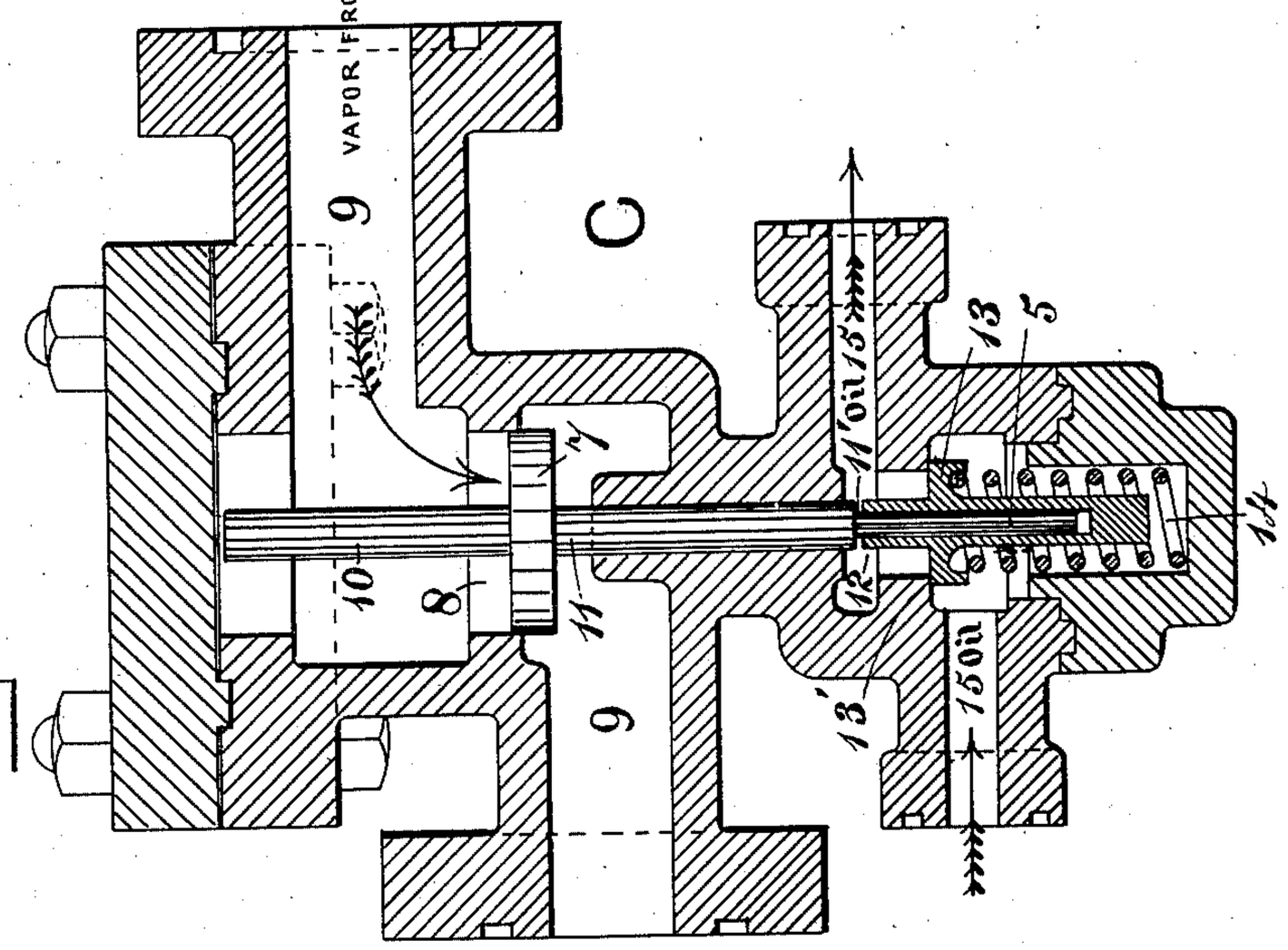


Fig. V.



WITNESSES:

Frazie & Bidgood

John F. Nelson

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By her Attorneys

Knight Bros.

(No Model.) 4 Sheets—Sheet 4.

N. W. WHEELER, Dec'd.

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MACHINE FOR ARTIFICIAL REFRIGERATION.

No. 441,995. Patented Dec. 2, 1890.

Fig. VII.

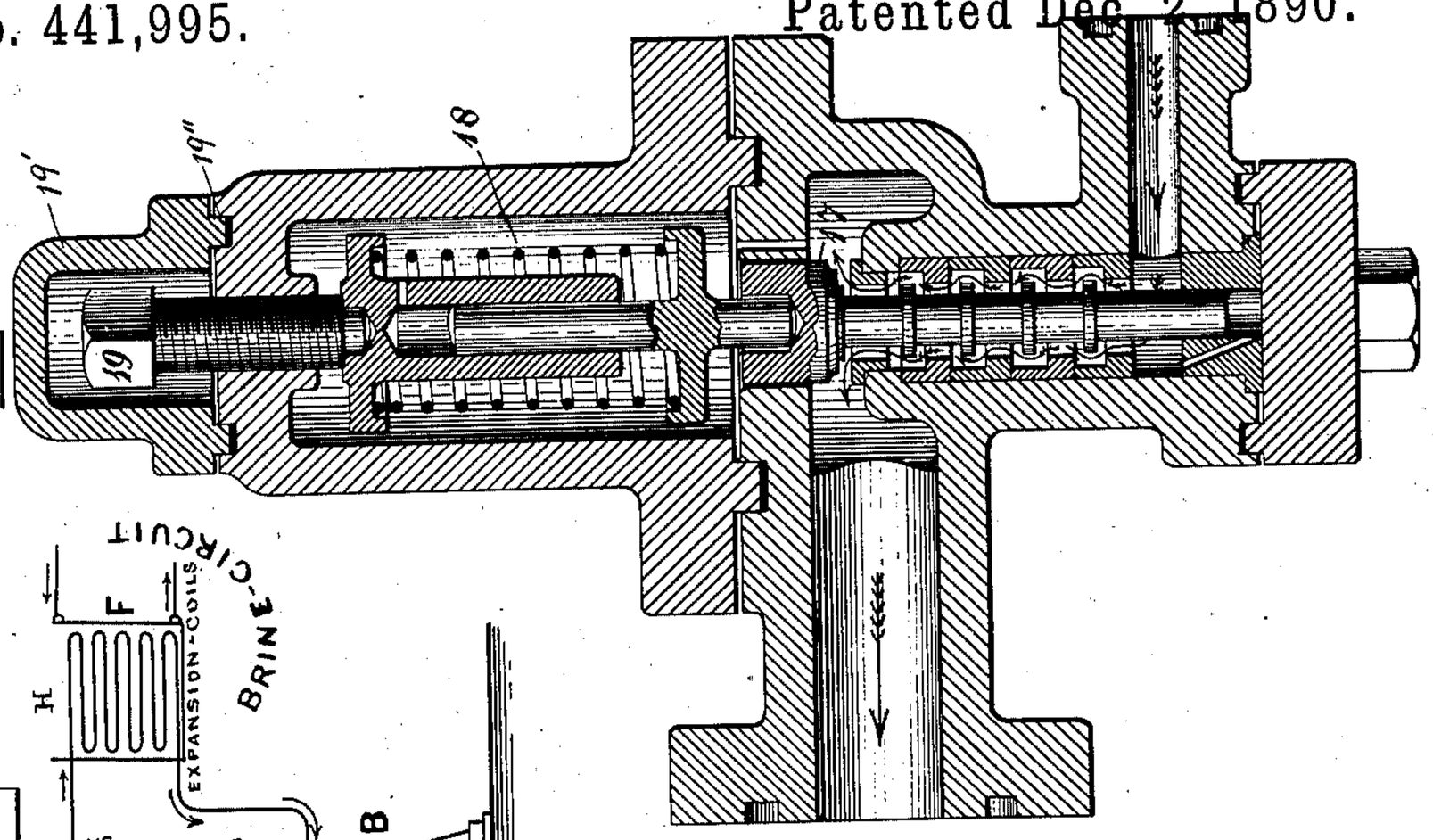


Fig. IX.

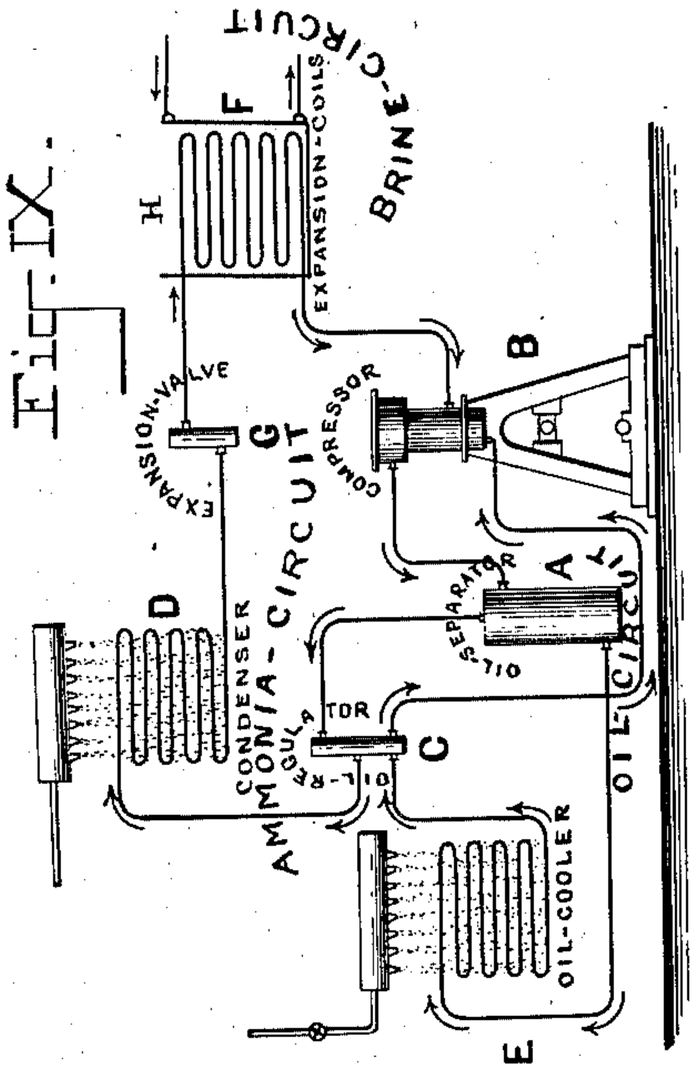


Fig. VIII.

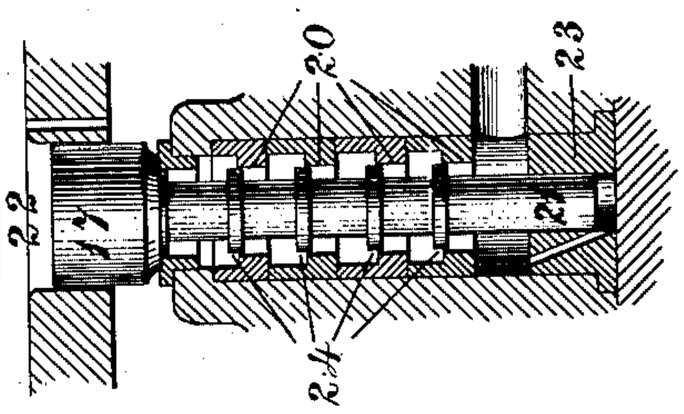
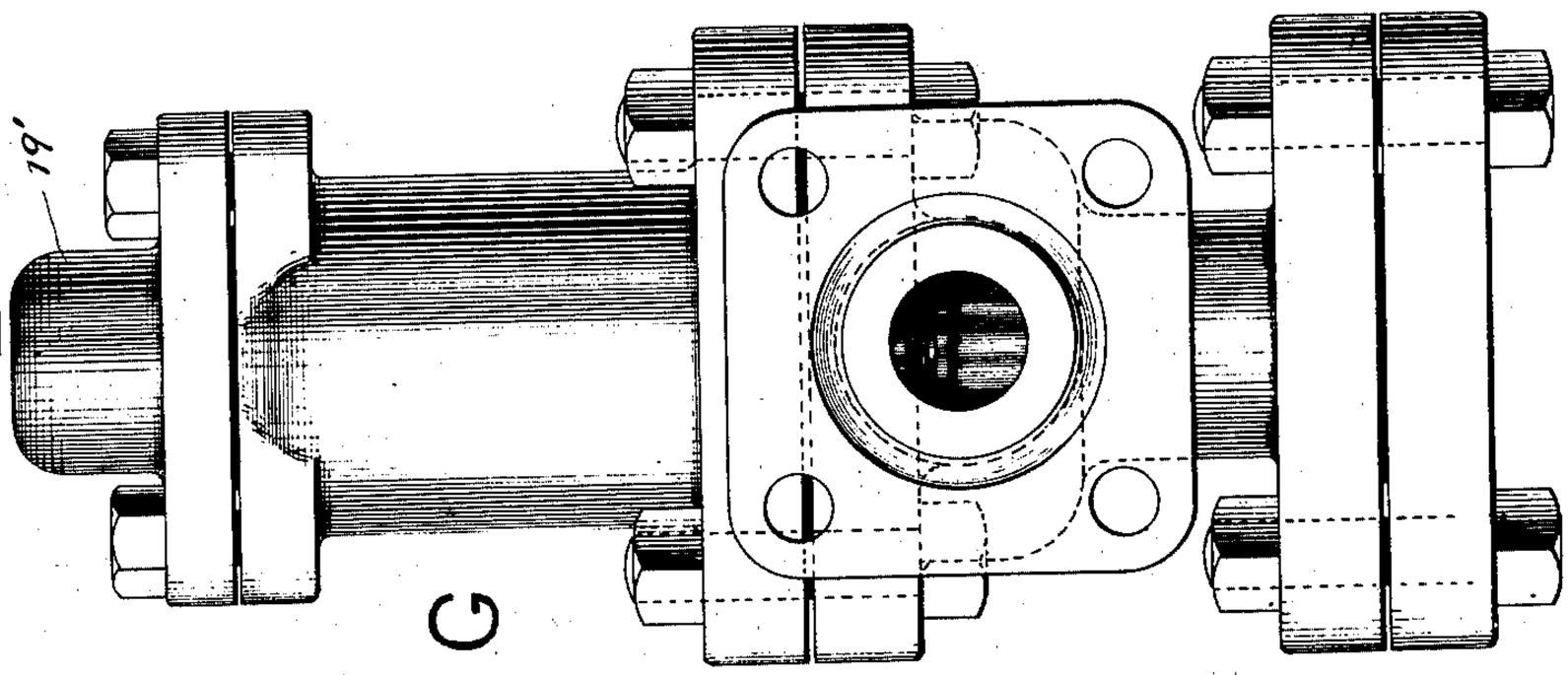


Fig. VI.



WITNESSES:
Mazie K. Bidgood
John F. Nelson

Clara Hope Wheeler, Admin^x. Estate of
Norman W. Wheeler, Inventor, (Dec^d.)
By her Attorneys:
Knight Bros.

UNITED STATES PATENT OFFICE.

CLARA HOPE WHEELER, OF NEW YORK, N. Y., ADMINISTRATRIX OF NORMAN W. WHEELER, DECEASED.

MACHINE FOR ARTIFICIAL REFRIGERATION.

SPECIFICATION forming part of Letters Patent No. 441,995, dated December 2, 1890.

Application filed November 18, 1889. Serial No. 330,697. (No model.)

To all whom it may concern:

Be it known that NORMAN W. WHEELER, (deceased,) late a citizen of the United States, and a resident of the city of New York, in the county and State of New York, did in his lifetime invent certain new and useful Improvements in Refrigerating Apparatus, of which the following is a specification.

The said invention relates to improvements in those refrigerating apparatus in which an anhydrous ammonia or other liquefiable but highly-volatile fluid, having been compressed by a pump, has the heat, rendered sensible by such compression, abstracted by a cooling medium, the fluid being then permitted to expand, so as to develop an intense cold.

The apparatus is especially designed to be mainly automatic in its operation, so as to dispense with the constant services of a skilled engineer, and from its compactness of construction it is peculiarly adapted for use in confined spaces, such as between decks on shipboard. Small interjections of mineral oil or other suitable lubricant are employed to prevent gas-leakage at the numerous joints required in such apparatus to lubricate the compressor-piston, &c., to take up, absorb, or render latent a portion of the heat developed by compression and to occupy "dead-space" in front of the compressor-piston. In order that said lubricant may not by its partial volatilization impair the vacuum on the suction side of the compressor piston, it must, when it enters the compressor-cylinder, be cold and almost completely divested of ammoniacal vapor, and that the condenser and expansion coils may not become lined with lubricant a necessity equally rises that the ammonia, after escaping from the compressor, shall be completely purified from lubricant. Suitable means are therefore provided by me whereby immediately after each discharge the ammoniacal vapor is relieved of its atomized lubricant.

In some refrigerating apparatus heretofore employed the lubricant is allowed to escape from the original high pressure of compression, and is then passed through a separate pump actuated from some moving part of the compressor, and is so passed back into the compressor. In other such apparatus the oil is simply allowed to flow back into the compressor, escaping from the pressure of compression existing in the system through a throttling device. In yet others it is allowed to flow back, as aforesaid, in an interrupted stream whose pulsations are so regulated as to deliver the desired quantity by means of intermittent devices actuated from the compressor-driving machinery. In all these cases the flow of lubricant is restrained or retarded by the customary normally-open throttling device, and when the compressor ceases its motion the oil flow nevertheless continues until stopped by the engineer in charge. Unless thus stopped by the intendent, oil may continue to flow into the now quiescent compressor, and even fill the same with non-compressible liquid, which prevents restarting of the machinery or subjects it to the liability to rupture on starting, so that even in those forms which have intermittent oil-flow there is no assurance that these defective actions will not take place because the compressor-pump is as likely to be stopped at the open as at the closed condition of the valves.

The invention is designed to avoid the above and other defects, hereinafter stated.

In the accompanying drawings, making part of this specification, Figure I represents a refrigerating apparatus embodying the said NORMAN W. WHEELER'S improvements, the same being for convenient illustration developed on a common vertical plane. Fig. II is a vertical section, and Fig. III is a horizontal section on the line III III, of the said NORMAN W. WHEELER'S device for elimination from the compressed vapor of the atomized lubricant. Fig. IV is an end elevation of the automatic oil-regulator and cut-off. Fig. V is a section of the same on the line V V. Fig. VI is an end elevation of the expansion-valve. Fig. VII is a section of the same on the line VII VII, the valve being represented open. Fig. VIII is a detached representation of the expansion-valve in its closed condition. Fig. IX is a diagrammatic representation of the compressor and of the connected ammonia, oil, and brine circuits.

One important feature of the said NORMAN W. WHEELER'S system is the device A for

eliminating from the compressed ammonia-vapor the atomized lubricant that has become mechanically suspended in it within the compressor. With this object in view a portion 1 of the discharge-way 2 of a compressor-pump of any suitable construction consists of a vertically-arranged closed spiral passage 3, which communicates above with the said discharge-way and below with an oil well or receptacle 4, which at or near its lower end communicates by a pipe 24 with the oil-cooling system B at *x*. The said spiral passage entirely incloses an ascending vertical flue or neck 6, which has below free communication with the upper portion of the said oil-well and has above free communication with the passage 9. The mingled ammonia-vapor and atomized oil flowing rapidly along and down the spiral passage 3 acquires a centrifugal force which avails the momentum of the oil to project it outward against the wall of the said passage which is farthest from the axis of the coil, causing attrition of the oil globules, their retention by capillary attraction on said passage-wall, and their precipitation thence into the oil-well. At the same time the comparative levity of the thus-clarified vapor causes it to ascend and escape through the vertical central flue 6 into the passage 9 for compressed ammonia. The passage 9 has a check or piston valve 7 in a constricted portion or throat 8, which valve (by means of the pressure in front of it, aided by a spring 14) operates to close the said passage, except when the pulsation output from the compressor momentarily increases the pressure above said valve sufficiently to open said throat and to pump an additional charge of ammonia-vapor out at the point *v* and into the condenser D.

The office of the valve 7 is threefold. It operates in the first place to periodically check the outflow of the hot and highly-compressed ammonia-vapor to the condenser system. In case of rupture or leakage of any part of the ammonia-circuit back of it the valve 7 operates as a check-valve to prevent the escape and explosion of liquid ammonia, which has been the cause of the most serious casualties in refrigerating plants, and in addition to these primary functions it is utilized to dominate another valve, which regulates the injection of cold oil into the compressor-cylinder and by its return to effectually shut and keep shut the said oil flow into the compressor until a forward stroke of the compressor-piston regulates the above action. A stem 10 serves to limit the upstroke of the valve 7, and thus insure its efficiency as a check-valve, and a stem 11, which extends downward to contact with the oil-valve 15, causes said valve to be dominated by the said valve 7 in the manner stated. The liquid ammonia is retained in the U-shaped well 28 at the bottom of the condenser and is admitted to the expansion-coils B through the expansion-valve G, in which coils, being permitted to expand, it absorbs and renders latent heat from the surrounding brine, so as to cool the latter, whence it returns through pipe 29 to the compressor, thus completing the ammonia-circuit. A pipe 30 from a source of liquid ammonia is tapped from time to time to make good the loss of ammonia by leakage, &c. A pipe *r* conveys cold brine from the brine-tanks F to the room, tank, or inclosure to be cooled, and a pipe S receiving back the spent brine, thus completing the brine-circuit II. From the bottom of the oil-chamber the refrigerated oil passes through stop-cock 25, cold-oil pipe 26, and junctions 27 of the gas and oil regulator C at each opening of the valve 13, as above explained. The oil thence flows out at *y* and through a continuation of the pipe 26 by throttle 16 back into the compressor-cylinder at *z*, thus completing the oil-circuit. The oil, being cold and free from occluded gas and its injection occurring only after the compressor has received its full complement of gas from the expansion-coils, does not interfere with the suction-vacuum and suction action.

In compressing such vapors as are commonly used in artificial refrigeration complete compression is reached as the compressor-piston approaches the terminus of its effective stroke, and just before the opening of the efflux-valve permits escape of compressed vapor into the passage for compressed ammonia, and hence the operation of the controlling-valve and cut-off 13 in the return-oil pipe takes place only after compression at the pump is completed and discharge into the compressed-vapor passage has begun at any stroke of the compressor-pump. It therefore follows that when equipped with my said automatic regulator the oil injection will necessarily possess the intermittent or pulsative character which, by atomizing the injection, has the effect of distributing the oil equably and economically over the interior surfaces of the compressor-cylinder. Preferably the oil is thus forced in intermittent jets into the compressor-cylinder through a nozzle (not here shown) of size just sufficient to pass the greatest injection required, and means of diminution of injection at the intendant's discretion is furnished by a throttle 16.

29′ 29″ are pressure indicators or gages for the outgoing and returning vapor passages, respectively.

The invention of the said NORMAN W. WHEELER further relates to a device G to replace the common hand-worked expansion-cock in a refrigerating plant. This device is essentially an adjustable automatically-operating reduction or expansion valve 19, which valve is held down to its seat partly by the pressure of the already-entered and expanding ammonia and partly by the agency of a spring 18, whose downward stress is capable of being increased or diminished by means of a screw 19, and which valve is opened by the pressure of the accumulating liquid ammonia acting to momentarily overcome said spring

and said back-pressure. Escape of ammonia at screw 19 is prevented by any suitable means—such, for instance, as a cap and luting-gasket 19′ 19″. The office and action of the adjustable spring 18 are to automatically arrest the entrance of liquid ammonia to the expansion-coils whenever the pressure, and consequently the temperature therein, rises beyond a predetermined point, such as to interfere with their heat-abstracting functions on the brine or other surrounding medium. Generally the adjustment is such as to keep down the pressure in the expansion-coils to just such slight excess over that of the atmosphere for the time being as to prevent the entrance into the circulation of any air or moisture. A further necessity for means of adjustment of tension of the spring 18 arises from the considerable vicissitudes of working-pressure in the condensers, varying as much as eighty pounds per square inch, consequent on the varying temperatures of the tank-water at different seasons and changing atmospheric conditions.

To lessen the rapidly-destructive wear or scour of the expansion-valve whenever great differences of pressure exist on its opposite sides, the invention of said WHEELER includes a provision as follows: A downwardly-extending stem of said valve occupying guides 22 23 holds the valve to proper alignment while permitting its proper play. The valve-seat entrance is prolonged and contains a series of constricted portions or throats 20, which coact with a series of collars 24 on said valve-stem to partially close or "wire-draw" the entrance-passage in proportion to the violence of the entering stream of liquid ammonia.

The invention of said NORMAN W. WHEELER has been described in its application to that class of refrigerating devices in which an intervening brine-circuit, cooled by contact with the expansion-coils, is made the medium of refrigerating action in the room or other inclosure to be cooled; but said invention is manifestly applicable to those forms of refrigerators in which such expansion-coils themselves occupy such inclosure without the intervention of a brine-circuit.

The invention having thus been described, what is claimed as new therein is—

1. In machines for artificial refrigeration which depend on the expansion of a previously compressed and cooled ammoniacal or equivalent vapor, the means for separating the liquid from the gaseous portions, which consist of the combination of an oil-receptacle 4, into whose upper part the vapor and its occluded oil are forced continuously downward, with a closed spiral duct or passage 3, which surrounds and communicates at its lower end with a central vertical neck or flue 6 for the escape of vapor, substantially as set forth.

2. In a machine for artificial refrigeration, the combination, with a compressor, of a spring-closed ammonia-valve through which is discharged compressed ammonia intermittently under the pulsative action which proceeds from the compressor output, and an integrally-attached oil-return valve dominated by said ammonia-valve, in the manner and for the purpose explained.

3. In a refrigerating plant fit for the use of a liquefiable refrigerant and of a lubricant, the combination of a vapor-compressor, a valve for outgoing ammonia, operated automatically by the compressor output, and a valve for returning lubricant integral with and dominated by said ammonia-valve, substantially as set forth.

4. In a refrigerating-machine, the combination, with ammonia-passage having a series of constricted portions 20, of spring-depressed ammonia-valve 7, whose stem 21 has a series of collars 24, which slide loosely within said constricted portions, as set forth.

5. The automatic throttle for the liquid ammonia, consisting of valve 17, normally closed by spring 18, having regulating-screw 19, said valve having a stem 21, which is encircled by one or more collars or short pistons 24, that slide loosely within corresponding contracted barrels or throats 20 in the ammonia-passage, substantially as set forth.

CLARA HOPE WHEELER,
Administratrix of Norman W. Wheeler, deceased.

Witnesses:
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HERBERT KNIGHT.