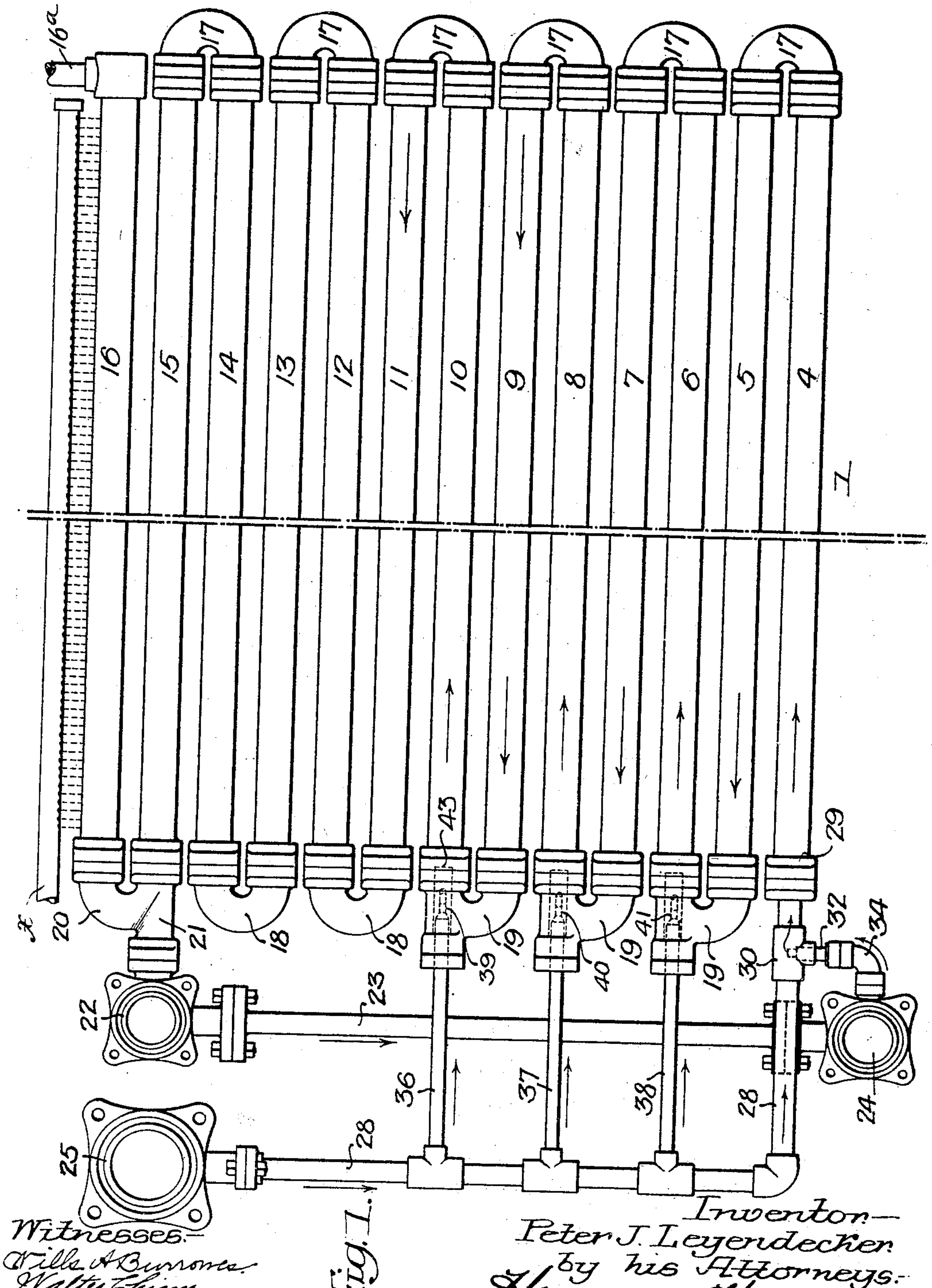
P. J. LEYENDECKER.
CONDENSER.
APPLICATION FILED JAN. 28, 1913.

1,109,434.

Patented Sept. 1, 1914.

2 SHEETS—SHEET 1.



Witnesses:
Willis A Burrows
Walter Chism

Inventor—
Peter J. Leyendecker
by his Attorneys:
Howson + Howson

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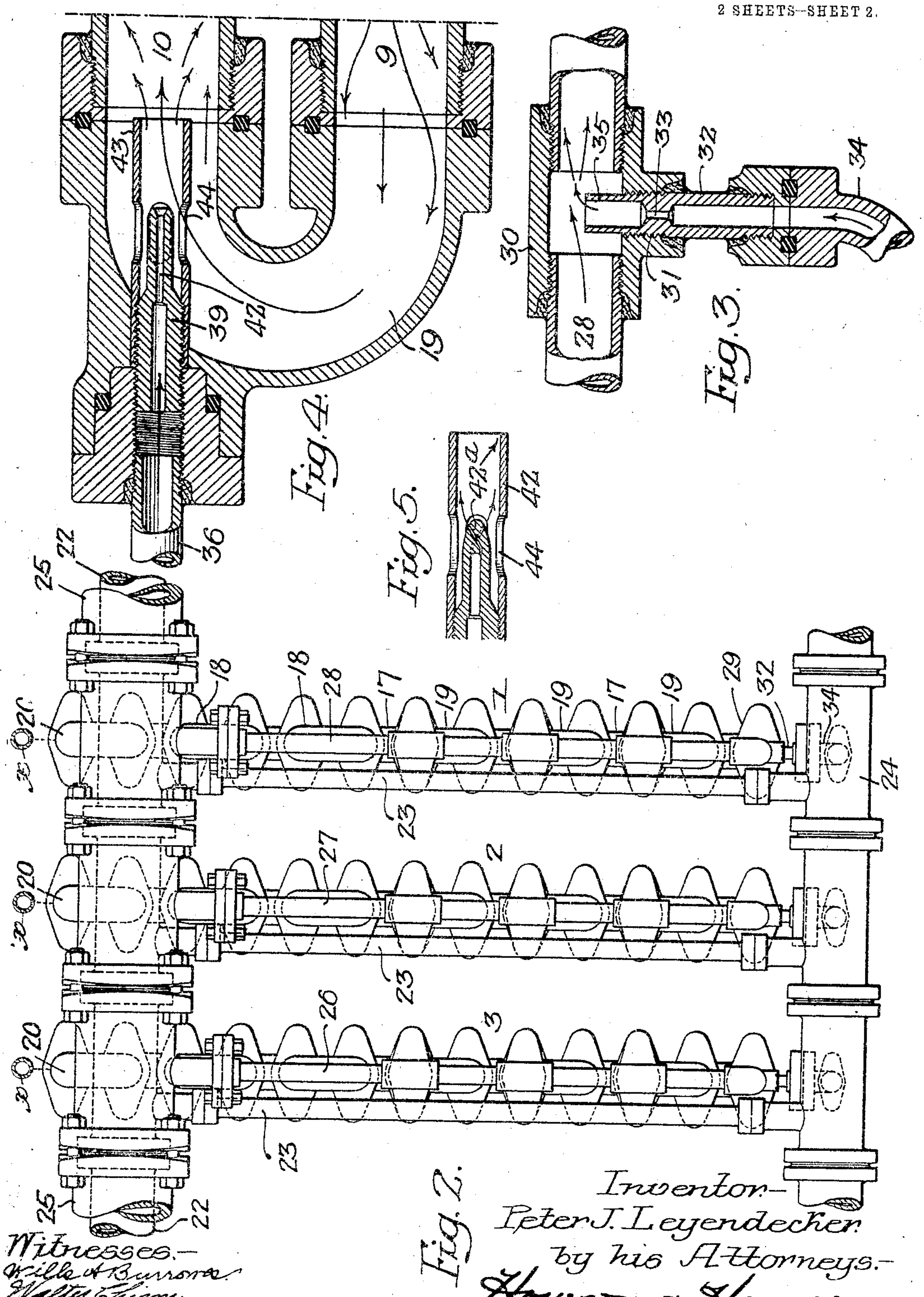

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UNITED STATES PATENT OFFICE.

PETER J. LEYENDECKER, OF HADDONFIELD, NEW JERSEY.

CONDENSER.

1,109,434. Specification of Letters Patent. Patented Sept. 1, 1914.

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To all whom it may concern:

Be it known that I, PETER J. LEYENDECKER, a citizen of the United States, residing in Haddonfield, New Jersey, have invented certain Improvements in Condensers, of which the following is a specification.

My invention consists of a condenser such as is employed for refrigerating purposes where ammonia gas is liquefied and used as a cooling agent.

The chief object of my invention is to effect a quicker condensation of ammonia or other gases than has been accomplished heretofore and to do the same with a less number of coils or pipes.

Another object is to produce a cooler liquid than has heretofore been produced by condensers of the same size.

These objects, and other objects which will be described hereinafter I attain in the following manner, references being had to the accompanying drawings in which,

Figure 1, is a side elevation of a tube condenser constructed in accordance with my invention; Fig. 2, is an end elevation of my invention looking from the left of Fig. 1; Fig. 3, is an enlarged section of a detail of my invention showing a liquid-ejecting nozzle which I employ; Fig. 4, is an enlarged section of a portion of my invention showing a gas-ejecting nozzle; and Fig. 5, is an enlarged sectional detail of a modified form of ejecting nozzle which I may employ.

Referring to the drawings Fig. 2 shows a series of three stacks of condensing coils 1, 2 and 3, and as all of the said stacks are of a similar construction I will describe only one of the same in detail. Each stack or coil comprises a plurality of tubes 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16, which are connected at their rear ends by bends 17 of any well known construction and the tubes 11 and 12, and 13 and 14, are respectively connected together at their forward ends by bends 18 which may be similar in construction to the bends 17. Bends 19 connect the forward ends of the tubes 5 and 6, 7 and 8, and 9 and 10 respectively, and are of a special construction which will be more fully described hereinafter. The bend 20 which connects the tube 15 with the tube 16 is of such a construction as to allow a pipe 21 connected thereto to lead to a header or liquid ammonia take-off pipe 22 which extends transversely of the stacks 1, 2 and 3, or any number of stacks which may be employed in the condenser. The pipe 16ª extending upwardly from the rear end of the tube 16 and which is shown broken off in Fig. 1 may be led to an equalizing chamber in a manner which is in common practice in the art and may also be connected to a foul gas reservoir in any well known manner. The tube 16 communicates with the discharge pipe 21 and provides a space or chamber permitting the contents of the condenser to freely fluctuate, as will be more fully described hereinafter.

A pipe 23 connects the header 22 with a liquid supply pipe or header 24 which extends transversely to and at the base of the said stacks. The main supply inlet for the ammonia gas consists of the large header 25 which extends transversely of the stacks (Fig. 2) and has a series of take-off pipes 26, 27 and 28, preferably one for each stack of tubes. These take-off pipes 26, 27, and 28 connect respectively with the forward ends 29 of the bottom tubes 4 and supply the ammonia gas, which is under pressure, to the coils so that it can pass or circulate through the several tubes comprising each coil or stack.

Each of the pipes 26, 27 and 28 is provided with the T-joint 30 which is bored at 31 (Fig. 3) for the reception of a nozzle 32 having an opening 33 of small diameter. These nozzles 32 are each connected by piping 34 to the liquid supply pipe or header 24. The nozzles 32 are so arranged that their upper ends 35 extend and open into the interior of the pipes 26, 27 and 28 respectively and are in free communication therewith.

Each of the pipes 26, 27 and 28 is connected to certain pipes of the stacks by relay pipes 36, 37 and 38 which respectively pass through the bends 19 and are provided with nozzles 39, 40 and 41; each having an ejection bore 42 of small diameter. The nozzle 39 is so arranged as to project into the interior of the pipe 10 and is surrounded by a sleeve 43 having an inner diameter greater than the outer diameter of the end of the nozzle. This sleeve is provided with ports 44 which are adjacent the end of the nozzle. In like manner the nozzles 40 and 41 respectively are connected to deliver to the tubes 8 and 6 and are each surrounded by a sleeve 43 similar to that just described. Regulating valves may be placed in all or any of the several pipes if desired.

Heretofore, in condensers of this general type where ammonia gas under pressure was admitted into the lower pipe of a condenser coil which was cooled on its outer surface by water running thereover, the gas circulated through the tubes of the pipe with practically no agitation, and only the gas which was directly adjacent the cold inner wall of the tube became cooled. The gas passed through the tubes in substantially cylindrical form and as ammonia gas is a poor conductor it was only after the gas adjacent the said inner walls of the tube became condensed that the core or inner volume of gas came in contact with the inner surface of the condenser tubes and was thereby cooled and condensed.

It is one of the chief features of my invention to agitate the ammonia gas while passing through the tubes so as to bring new and different portions thereof into contact with the inner surface of the condensing tubes. Also, another feature of my invention is to eject a small amount of liquid ammonia in a precipitated state into the pipes of the condenser so as to act as a better conductor to cause a more rapid cooling and condensation of the ammonia gas.

The operation of my invention is as follows: Water is allowed to trickle or run over the pipes of the condenser from the top to the bottom from a suitable source such as a perforated pipe *x* for example and at the same time ammonia gas under pressure passes downwardly through the pipes 26, 27 and 28 and into the bottom pipes 4 in the direction shown by the arrows in Figs. 1 and 2. At the same time a certain amount of the previously condensed or liquid ammonia, which passes from the pipe 21 into the header 22 and down through the pipe 23 to the header 24, passes through the nozzles 32 and is admitted into the interior of the respective pipes 26, 27 and 28. The movement of the gas passing through the said latter pipes carries the liquid ammonia, which has just passed through the nozzles 32, through the tubes of the coil in a precipitated form and forms a mixture of ammonia gas and of liquid ammonia. Simultaneously with this action ammonia gas under pressure passes through the relay pipes 36, 37 and 38 and the nozzles 39, 40 and 41 respectively and is ejected into the pipes 6, 8 and 10 in the direction of the arrows shown in Figs. 1 and 4. This latter ejection of the ammonia gas forms an agitating means for the ammonia gas and liquid mixture as just described, and as the same passes through the several tubes causes different portions of the ammonia mixture to be brought into contact with the inner surface of the condensing tubes as previously mentioned and greatly facilitates and expedites the condensation of the ammonia gas. The liquid ammonia passes out of the pipe 21 into the header 22 and a small part passes down the pipe 23 as heretofore described to again act as a conducting medium by being delivered through the nozzles 32. The greater part of the ammonia liquid passes out of the header 22 and is used for refrigerating purposes.

By having a plurality of nozzles as 39, 40 and 41 throughout the heights of the condenser coil, each successive nozzle acts as a relay to impart an additional agitation to the ammonia gas and liquid mixture which is passing through the tubes. Also, by having the sleeve 43 provided with the ports 44, suction is produced from the lower portions of the bends 19 into the upper portions and consequently the mixture is moved from a lower pipe to a high pipe, thus greatly accelerating the movement of the uncondensed ammonia gas. Three of these relay nozzles are shown for each stack in the drawings, but any number may be utilized; also they are shown as applied to the lower bends and lower pipes but they may be used at regular or irregular intervals throughout the height of the stacks.

The tube 16, which forms a continuation of the condenser coil beyond the discharge pipe 21, provides space for any variation or fluctuation of the contents of the condenser; such for example as is due to the intermittent pumping of the ammonia gas into the condenser, and allows a free movement of the contents of the condenser independently of the movement caused by the discharge of the condensed ammonia, thus permitting additional agitation of the contents of the condenser and thereby a more rapid condensation.

In the modification shown in Fig. 5, I have shown a nozzle which I may employ as a relay nozzle or liquid ammonia ejecting nozzle; the idea being that the gas or liquid will be ejected in a helical form or at an angle so as to be directed toward the inner wall of the condenser tube or pipe. In this case instead of having the ejection bore extending in the line of the axis of the nozzle throughout its length, the same is curved or otherwise deflected as shown at 42^a in Fig. 5 and one or more of these bores may be formed in the nozzle.

In the drawings I have shown the nozzles 32 projecting upwardly and at right angles to the pipes 26, 27 and 28 but it will be understood that the same may be run at any angle or arranged at any position with respect to each other. Also, while I have described my invention as being used for the condensation of ammonia gas, other gases or liquids than ammonia may be employed in connection therewith. Also, while I have shown the condenser comprising three stacks or coils, it will be understood that each coil is a condenser, and in instances where only a small amount of liquid ammonia is desired only one coil can be used.

In some cases, if it is so desired, the sleeves 43 could be eliminated, and the nozzles 39 would then serve to eject the ammonia gas directly into the tubes 6, 8, 10, &c. Or some of the nozzles 39 could be provided with the sleeves 43, and others could be allowed to remain without the sleeve 43.

I claim:—

1. A condenser comprising a body portion; a main gas inlet pipe communicating therewith; an agitating nozzle for injecting additional quantities of gas into said body portion; means for delivering gas to said nozzle; and a condensed liquid discharge pipe for said body portion.

2. A condenser comprising a body portion; a main gas inlet pipe communicating therewith; a series of agitating nozzles connected to a source of gas and arranged to inject gas into the interior of said body portion at different points of the length thereof; and a condensed liquid discharge pipe for the said body portion.

3. A condenser comprising a coil; a main gas inlet pipe communicating therewith; an agitating nozzle connected to a source of gas and arranged with its delivery passage in position to direct gas into the coil at an angle to the line of the adjacent portion thereof; and a condensed liquid discharge pipe for the said coil.

4. A condenser comprising a body portion; a main gas inlet pipe communicating therewith; an agitating nozzle connected to a source of gas and mounted to inject additional gas into said body portion; a device coöperating with the nozzle to form a suction within the coil for accelerating the movement of the fluid therein; and a condensed liquid discharge pipe for the said body portion.

5. A condenser comprising a body portion; a main gas inlet pipe communicating therewith; an agitating nozzle connected to inject additional gas into said body portion; a sleeve provided with ports and surrounding said nozzle, said sleeve being open adjacent the discharge end of the nozzle; means for delivering gas to the nozzle and thence through said sleeve to form a suction through the ports thereof; and a condensed liquid discharge pipe for the coil.

6. The combination in a condenser of a coil; a main gas inlet pipe communicating therewith; a nozzle connected to a source of liquid for delivering the same into the gas in the coil to form a mixture therewith; a gas-injecting nozzle connected to a source of gas and to said coil; and a condensed liquid discharge pipe leading from said coil.

7. A condenser comprising a coil; a main gas inlet communicating therewith; a nozzle connected to a source of liquid for delivering the same into the gas in the coil to form a mixture therewith; a series of nozzles connected to a source of gas and arranged to inject the same into the interior of said coil at different points of the length thereof; and a condensed liquid discharge pipe leading from the coil.

8. A condenser comprising a coil; a main gas inlet pipe communicating therewith; a nozzle connected to a source of liquid for delivering the same into the gas to form a mixture therewith; a gas-injecting nozzle connected to a source of gas and to said coil with its delivery passage entering said coil in position to direct the gas at an angle to the inner surface thereof; and a condensed liquid discharge pipe leading from said coil.

9. A condenser comprising a coil; a main gas inlet pipe communicating therewith; a condensed liquid discharge pipe leading from said coil; a nozzle connected to a source of liquid for delivering the same into the gas to form a mixture therewith; a nozzle connected to a source of gas for injecting additional gas into the coil; and a pipe connecting the liquid discharge pipe with the first nozzle.

10. A condenser comprising a coil; a main gas inlet leading into the coil adjacent its bottom; a condensed liquid discharge pipe leading from the coil; a nozzle connected to a source of liquid for delivering the same into the gas in the coil to form a mixture therewith; and a nozzle connected to a source of gas for injecting additional gas into the coil in the direction of an ascending convolution thereof.

11. A condenser comprising a coil; a main gas inlet pipe connected to the coil adjacent its bottom; a condensed liquid discharge pipe leading from the top of the coil; a nozzle connected to a source of liquid for delivering the same into the gas in the coil to form a mixture therewith; and a plurality of nozzles connected to a source of gas for injecting additional gas into portions of

the coil between the top and bottom thereof in the direction of ascending convolutions.

12. A condenser comprising a plurality of coils; a main gas pipe connected to each of the coils; a nozzle for each coil for delivering liquid into the gas therein; a plurality of relay pipes connected to the main gas pipe; a nozzle connected to each of said relay pipes and extending into the inner portions of the coils respectively; a liquid take-off pipe; and pipes connecting said take-off pipe with the liquid delivery nozzles.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

PETER J. LEYENDECKER.

Witnesses:

AUGUSTUS B. COPPES,

WM. A. BARR.