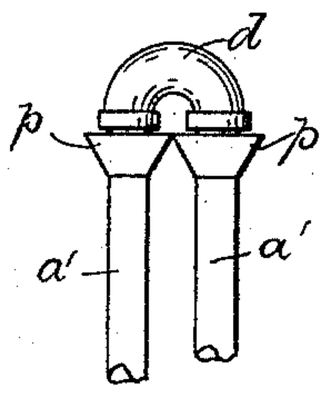
(No Model.) 2 Sheets—Sheet 1.

H. F. HODGES & D. J. HAVENSTRITE.

CONDENSER FOR REFRIGERATING OR ICE MAKING MACHINES.

No. 473,876. Patented Apr. 26, 1892.

Fig. 1A.



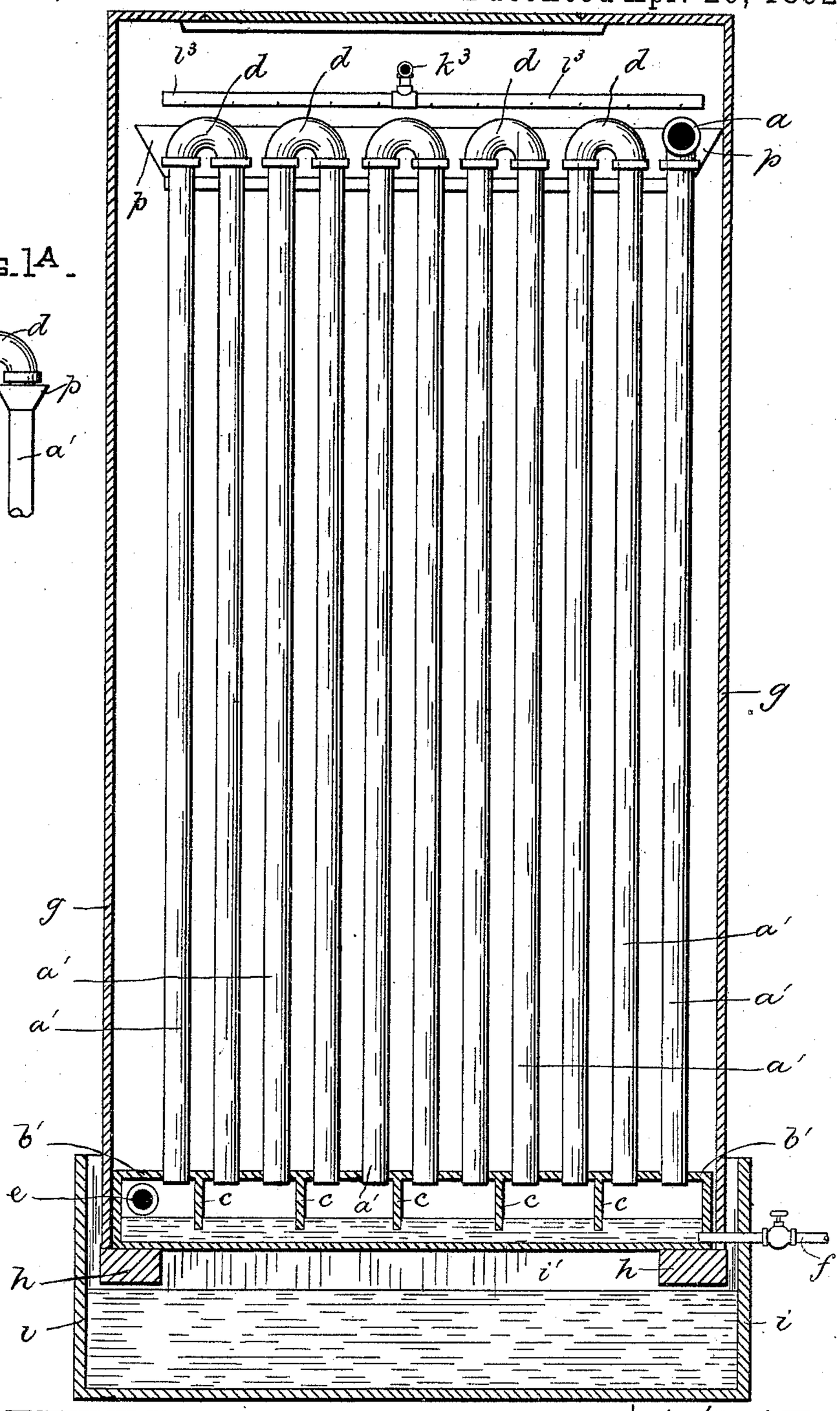


Fig. 1.

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Ewing W. Hamlen.

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(No Model.)

2 Sheets—Sheet 2.

H. F. HODGES & D. J. HAVENSTRITE.

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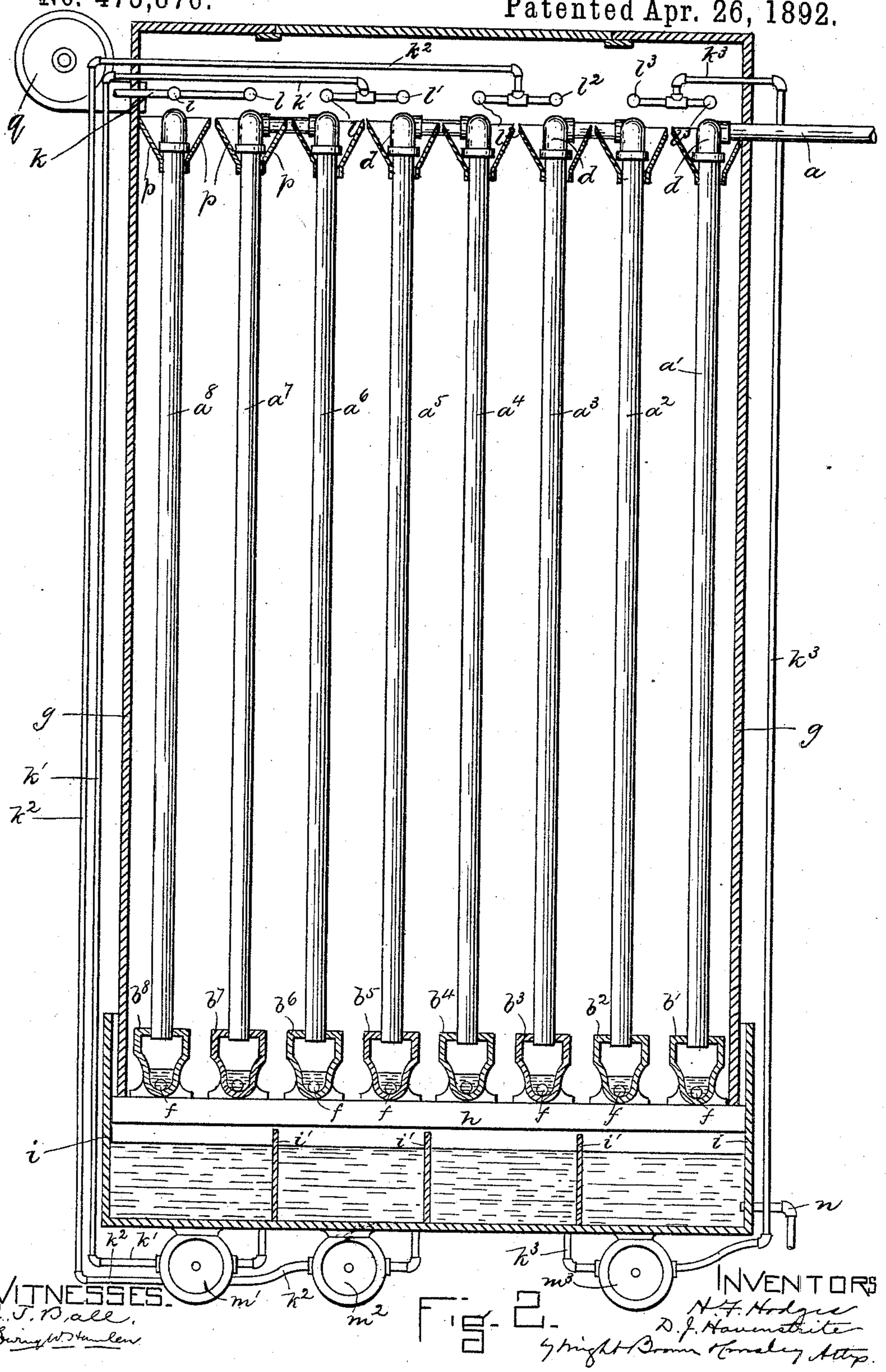

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FIG. 2.

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UNITED STATES PATENT OFFICE.

HORACE F. HODGES AND DAVID J. HAVENSTRITE, OF BOSTON, MASSACHUSETTS.

CONDENSER FOR REFRIGERATING OR ICE-MAKING MACHINES.

SPECIFICATION forming part of Letters Patent No. 473,876, dated April 26, 1892.

Application filed May 2, 1891. Serial No. 391,335. (No model.)

To all whom it may concern:

Be it known that we, HORACE F. HODGES and DAVID J. HAVENSTRITE, both of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Condensers for Refrigerating or Ice-Making Machines, of which the following is a specification.

This invention has for its object to provide an improved condenser for ammonia-refrigerating or ice-making machines in which the amount of water used to cool the pipes through which the ammonia circulates may be reduced to a minimum and the water used as economically as possible.

The invention consists in the combination, with a condenser having its condensing-pipes arranged in ranks, of a series of troughs arranged at the bottom of the condenser under the bases of the ammonia-pipes, there being one trough to every two rows of ammonia-pipes, each trough being disconnected from the other and pipes and pumps connected therewith, whereby water from the first trough is carried to the upper end of the row of ammonia-pipes over the second trough, and so on, the water from each trough being carried to the upper end of the ammonia-pipes over the next trough, as we will now proceed to describe and claim.

In the accompanying drawings, forming a part of this specification, Figure 1 represents a partial side view and partial section of a condenser for an ammonia-refrigerating apparatus embodying our invention. Fig. 2 represents a partial front view and partial section of the same. Fig. 1^a represents a modification.

In the drawings, a represents the pipe, through which the ammonia enters the condenser from the compressor, the said pipe a communicating with the system of pipes a' a^2 a^3 a^4 a^5 a^6 a^7 a^8. The said pipes are arranged in ranks, and the pipe a communicates with the first pipe a' in the rank, the pipes of one rank communicating with each other and each rank communicating with the next, as presently described.

Each rank of pipes is provided with a base, the rank a' having the base b', the rank a^2 the base b^2, and so on. Said bases are provided with the partitions c c c, which project downwardly from the upper side thereof and reach nearly to the bottom thereof, thus partially dividing the base into chambers, as shown in Fig. 1. From this figure it will be seen that the ammonia-gas entering through the pipe a passes through the first pipe a' into the first chamber of the base b', thence upwardly through the second pipe a' through an elbow d to the third pipe a' and into the second chamber of the base b', thence up the fourth pipe a', and so on, in a manner which will be readily understood, the pipes in each rank connecting with the pipe next to them at the top by the elbows d or at the bottom by the base alternately, as shown in Fig. 1. The last chamber in the base of one rank communicates with the first chamber of the next by a pipe e. (Shown only in Fig. 1.)

As the compressed ammonia-gas condenses readily there will always be a certain amount of liquid ammonia in the lower or uninterrupted portion of the bases, and said liquid may be kept at about the level shown in Fig. 1, at any rate coming up to the lower end of the partition c, thus dividing the air or gas space of said bases into compartments and causing the gas to follow the course above described.

From the foregoing it will be seen that the compressed ammonia-gas passes through the whole series of pipes in the condenser. As the gas liquefies it collects in the bases b', b^2, &c., and may be drawn off by the outlets f at the ends of said bases.

q represents an exhaust-fan, communicating with the interior of the condenser-casing g, by means of which a current of air is induced in said casing, the air entering over and around the water-trough and tending to cool the condenser.

In carrying out our present invention we place the condenser-casing g and the bases b', b^2, &c., and pipes a', a^2, &c., therein contained on suitable supports h h in a casing i. Said

casing is divided into troughs or compartments by partitions i' i'. We prefer to make the said troughs wide enough to extend under two of the bases, as shown in Fig. 2, and to receive water flowing down the sides of the ranks of pipes supported thereby. The troughs in the said casing i do not communicate with each other.

k represents the pipe by which the water which is used to cool the ammonia in the pipes of the condenser is introduced. Said pipe has two cross-pieces l l, extending over the upper ends of the rows of pipes a^8 a^7 and arranged to deliver the water so that it will run down the outside of the said pipes a^8 and a^7 and will drop into the first trough in the casing i, whence it is pumped by the pump m' through the pipe k', and is distributed from the cross-pieces l' l', with which said pipe k' is provided, over the ranks of pipes a^6 and a^5, flowing down the latter and dropping into the second trough of the casing i. From the second trough the water is pumped by pump m^2 through pipe k^2 and cross-piece l' over pipes a^4 and a^3, and falls into the third trough in the casing i, whence it is pumped by pump m^3 through pipe k^3 and cross-pieces l^3 over pipes a^2 and a' and drops into the fourth trough in the casing i, whence it may run off through the outlet n.

From the foregoing it will be seen that the water is first caused to run over the pipes of the condenser in which the ammonia-gas is coolest, or, in other words, the pipes which are farthest from the entering point of the gas into the condenser. After it has absorbed the heat still remaining in the gas at this point it is again used to cool the gas in the pipes a little nearer the entrance point of the gas to the condenser, and is, finally, after absorbing the heat from most of the pipes in the condenser and being in consequence somewhat warmer than when it first entered the condenser, though still colder than the ammonia-gas as it enters the condenser, it is used on the pipes through which the ammonia first passes on entering the condenser, thus, as it were, absorbing the rough heat from the ammonia on its first entering the condenser.

It will be readily seen that by the above apparatus water is used in a most economical manner and the full benefit of it as a cooling agent is obtained, a matter of considerable importance where the supply of water is limited.

To insure the water issuing from the cross-pieces l l' l^2 l^3 flowing down the pipes through which the ammonia is circulating, we provide each rank of pipes with a lip or trough p near the upper ends of the pipes, the said lip or trough being adapted to guide water falling therein to the pipes a', a^2, &c., thus causing the water to flow down the exterior of said pipes.

It will be obvious that our improved devices for the economical use of water in cooling ammonia in a condenser may be applied to any form of condenser having its condensing pipes arranged in ranks, and is not necessarily limited to a condenser of the exact construction here shown and described. It will also be seen that various changes may be made in the construction and arrangement of parts of our device without departing from the nature and spirit thereof.

We may provide each pipe with a funnel p, as shown in Fig. 1^a, instead of providing one long trough-shaped lip, as shown in Fig. 1. In cases where the form shown in Fig. 1 is used it will be understood that said lip or trough fits tight between each pipe and only allows water to flow down around each pipe, thus causing the water to flow down the exterior surface of the pipes and preventing it dropping down from top to bottom clear of the pipes.

We claim—

1. The combination, with a condenser having parallel ranks of vertical pipes through which the gas to be condensed circulates and a pipe adapted to deliver water over certain of said ranks of pipes, of a series of troughs under said ranks of pipes and pipes connected with said troughs, and pumps thereon adapted to raise the water in said troughs to the upper end of the next rank of pipes, whereby water having been used to cool one series of ranks will be caused to cool another series and will be used consecutively until the same water has been used upon every series of ranks of pipes, as set forth.

2. The combination, with a condenser having its condensing-pipes vertically arranged in parallel ranks, of a pipe arranged to deliver water onto the series of ranks farthest from the point of entrance into the condenser of the gas to be condensed, a trough arranged below said series of ranks, adapted to catch the water flowing down the same, a pipe provided with a pump adapted to raise the water from said trough and deliver it to the upper ends of the second series of ranks, and a similar trough, conducting-pipe, and pump for each series of ranks, whereby the same water is used consecutively on every series of ranks of the condensing-pipes, as set forth.

3. The combination, with a condenser having the ranks of condensing-pipes a' a^2 a^3 a^4 a^5 a^6 a^7 a^8 all suitably connected, of a pipe arranged to deliver water onto the first series of ranks of condensing-pipes, the casing i under said condenser divided into troughs, each trough corresponding with a given series of ranks of pipes aforesaid, so that water running down said ranks will fall into said troughs on said pipes, pipes connected with said troughs, delivering, respectively, to corresponding ranks, and pumps thereon whereby the water is pumped from the first trough and caused to flow over the second series of ranks

of pipes and from the second trough over the third series of pipes, and so on, until the same water has flowed over all the series of condensing-pipes, and the lips or troughs *p*, arranged near the top of each rank of condensing-pipes, as set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 25th day of March, A. D. 1891.

HORACE F. HODGES.
DAVID J. HAVENSTRITE.

Witnesses:
EWING W. HAMLEN,
C. F. BROWN.