(No Model.) 2 Sheets—Sheet 1.

W. L. ROWLAND.

AMMONIA DISTILLING APPARATUS.

No. 478,132. Patented July 5, 1892.

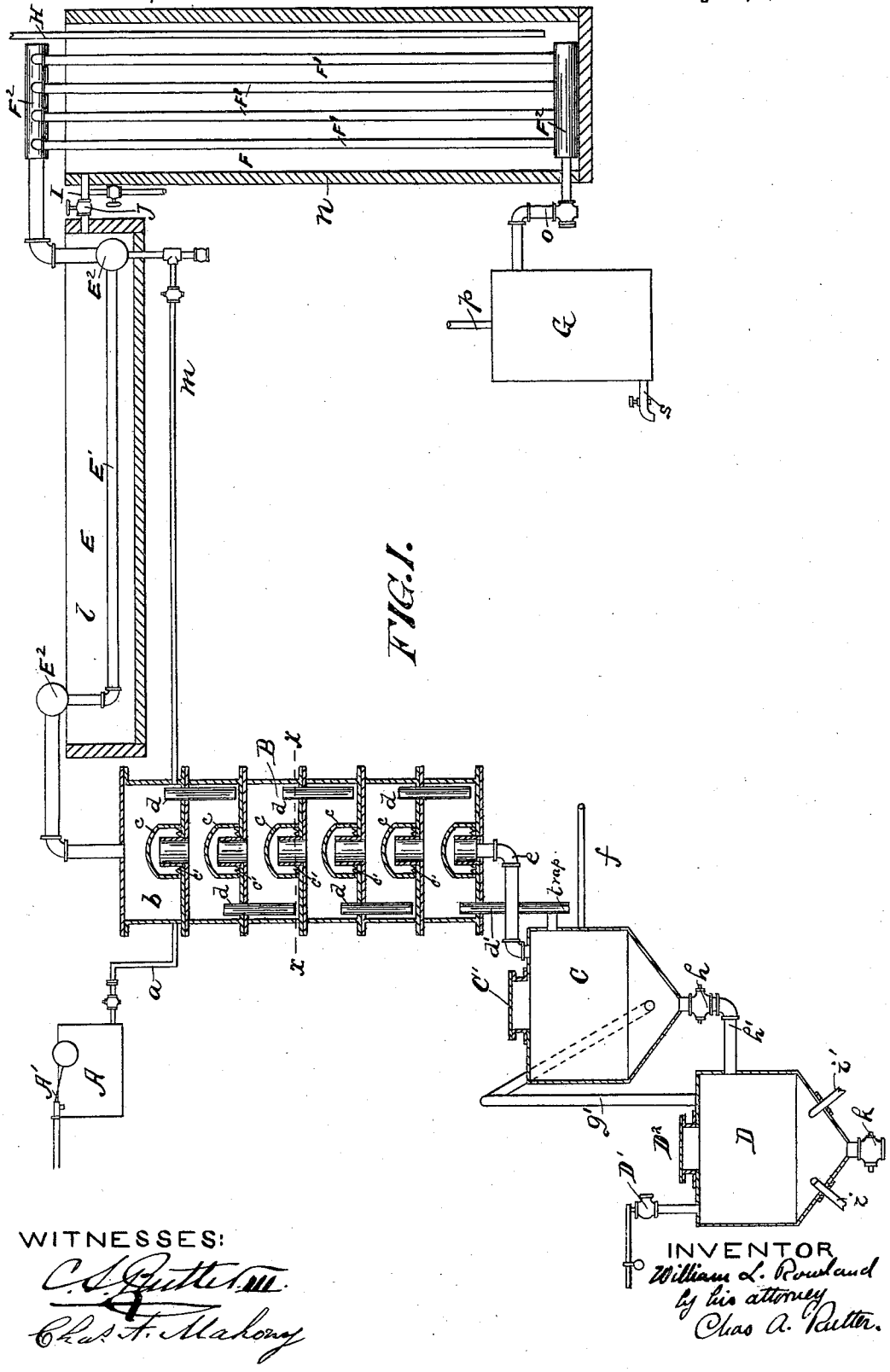

FIG. 1.

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(No Model.) 2 Sheets—Sheet 2.

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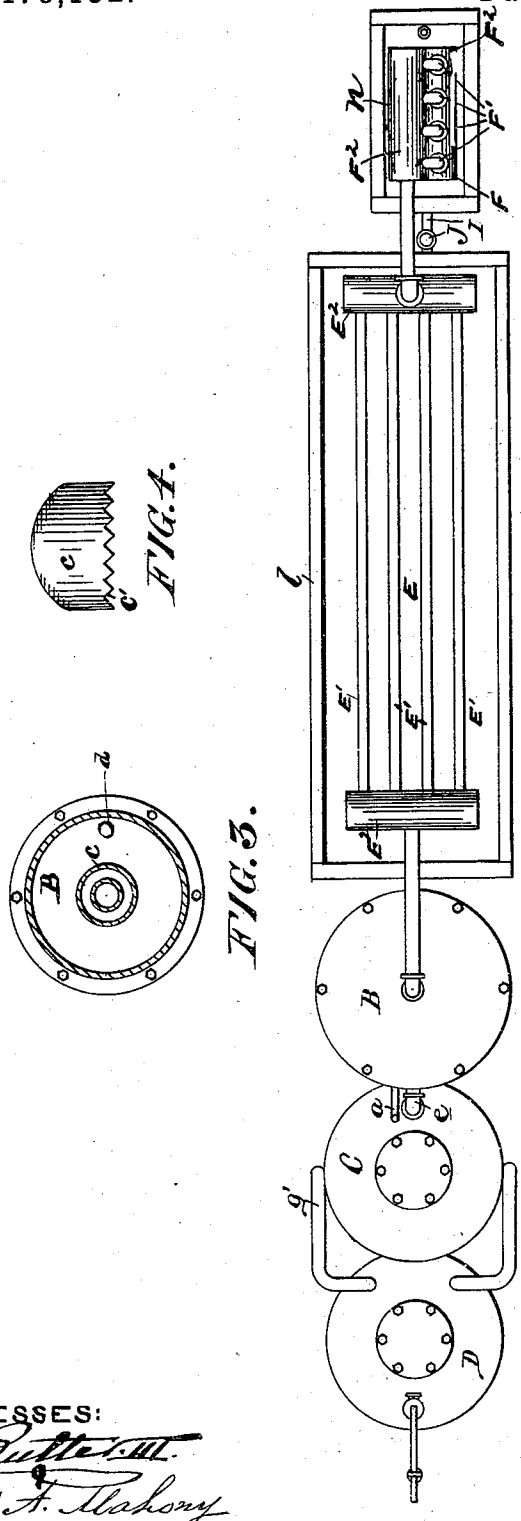

FIG. 2.

FIG. 4.

FIG. 3.

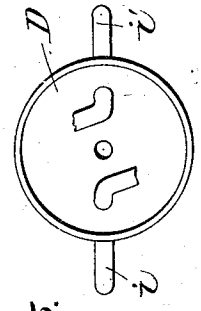

Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM L. ROWLAND, OF PHILADELPHIA, PENNSYLVANIA.

AMMONIA-DISTILLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 478,132, dated July 5, 1892.

Application filed July 3, 1891. Serial No. 398,319. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. ROWLAND, a citizen of the United States, and a resident of the city and county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Ammonia-Distilling Apparatus, of which the following is a specification.

The object of my invention is to furnish an apparatus to distill water containing ammonia in weak solution—such as ammoniacal liquor from gas-works—and to concentrate the same to a much stronger solution containing less water in proportion to the ammonia.

My apparatus consists of a primary and a secondary still, a distilling-column, and two manifold condensers with connections, as hereinafter described.

In the accompanying drawings, forming part of this specification, and in which similar letters of reference indicate similar parts throughout the several views, Figure 1 is a central sectional elevation of my ammonia-distilling apparatus; Fig. 2, a plan of the same; Fig. 3, a horizontal section through the distilling-column on line *x x*, Fig. 1; Fig. 4, an enlarged side elevation of one of the cups in the distilling-column; and Fig. 5, a plan of the primary still, the top being removed to show the steam connections.

A, Fig. 1, is a feeding-tank, into which the ammoniacal water flows through a float-cock A′ and by means of which the supply of liquor to the apparatus may be regulated.

B is the well-known distilling-column, which is made of cast-iron sections bolted together, as shown.

C is the secondary still, connected by the pipes *e* and *d′* with the column B. *f* is a pipe by means of which lime may be introduced into this still.

D is the primary still, connected to the secondary still C by the pipes *g*, *g′*, and *h*.

k is a blow-off by means of which the waste may be drawn off from still D.

D′ is a safety-valve, by which the pressure in still D is relieved, if it exceeds a fixed limit, which limit is of course regulated by the weight on said valve, and D^2 and C^2 are the manholes in stills D and C, respectively, by which access is had to the interior of said stills for cleaning or the like.

The steam-pipes *i i′* pass into the primary still D, their ends forming jets, which are parallel to the conical bottom of the still and are pointed in opposite directions, as shown, and thus when they are discharging steam a rapid circular movement of the ammoniacal water takes place, and such ammoniacal water is thus readily heated by the steam coming in contact with different portions of it in rapid succession.

The primary and secondary stills are preferably constructed of wrought-iron, and are furnished with conical bottoms, as shown.

E, Figs. 1 and 2, is a manifold condenser composed of wrought-iron pipes E′, connected with manifolds E^2, as shown.

l is a tank containing water in which the condenser E is immersed.

F is a manifold condenser consisting of pipes F′ and manifolds F^2. This condenser is preferably set vertically in a tank of water *n*.

The condenser E, which is preferably set horizontally, is known as the "primary" condenser, and the condenser F as the "secondary" condenser.

m is the drip-pipe from condenser E, and *o* the drip-pipe from condenser F.

G is the receiver for the concentrated ammoniacal water, with the draw-off *s* and vent *p*.

The operation of the apparatus is as follows: The ammoniacal water passes continuously from tank A through pipe *a* into the upper chamber *b* of the column B, and gradually fills this compartment to the level of the overflow *d*, thus sealing the gas-openings *c′* on the bottom of the inverted cup *c*, and passes through overflow *d* to the next compartment, and so on through the column. Steam is admitted through the steam-pipes *i i′* to the primary still, passes through this still to the secondary still through pipes *g g′*, thence by pipe *e* to column B, and bubbles up through the water in the several compartments of this column by passing through the serrated openings *c′* in the bottoms of cups *c*. Milk of lime is added periodically to the secondary still through the pipe *f* in sufficient quantity to liberate the "fixed" ammonia which cannot be volatilized by boiling alone. The ammoniacal water enters the secondary still *c* continuously through the trapped pipe *d′* and mixes with the lime, added as above, until a

suitable charge is obtained, usually about one-half of the total contents of the still, when the cock *h* is opened and the charge let down through pipe *h'* to the primary still D. The cock *h* is then closed and the charge in the primary still D boiled by the steam entering through steam-pipes *i i'* until all the ammonia has been vaporized and driven forward, when the waste-cock *k* is opened and the contents run away. The cock *h* is again opened and the contents of secondary still *c* let down into primary still D, and the operation continued as before. The gases and steam in still D pass through pipes *g g'* to still *c*, thence through pipe *e* to column B, parting with a portion of the steam by condensation as they meet with the cold liquor in the column, and enter the horizontal condenser E in the tank *l*. The object of this condenser is to partially condense the steam and to allow only such a proportion of steam to go forward with the uncondensed ammoniacal gases as will produce a strong solution of ammonia when condensed completely in the condenser F. The portion of ammonia condensed in condenser E flows away by the pipe *m* and may be returned to the column B or drawn off, as desired. In the vertical condenser F, surrounded by water in the tank *n* the remaining steam and gases are condensed to a strong ammoniacal liquor which flows by the pipe *o* into the receiver G, from which it can be drawn off, as desired.

H is a pipe by means of which water is introduced into tank *n*, and I is a pipe fitted with a stop-cock J, from which water passes from tank *n* to tank *l*.

Having thus described my invention, what I claim is—

1. In an apparatus for distilling ammonia, the combination, with the primary still D, provided with steam-pipes *i i*, blow-off *k*, and safety-valve D', of a secondary still C, connected to said still D, a lime-inlet pipe *f*, connected to said still C, a distilling-column B, connected to still C by pipes *e* and *d'*, the latter being provided with a trap to catch any impurities, a tank provided with a float-controlled valve and discharging into the top of said column B, a horizontal primary condenser consisting of a tray containing a pair of drums connected by a series of pipes, a vertical secondary condenser formed like said primary condenser, pipes connecting the top of column B to the primary condenser and the latter to the secondary condenser, and the tank G, into which the secondary condenser discharges, and devices for supplying cold water to said condensers, all substantially as and for the purpose set forth.

2. In an apparatus for distilling ammonia, the combination, with the primary still D, provided with a conical bottom, a blow-off *k*, steam-pipes *i i*, a safety-valve D', and manhole D^2, of the secondary still C, connected to said still D by pipes *g*, *g'*, and *h'*, the latter being provided with cock *h*, said still C being provided with a conical bottom, a lime-supply pipe *f*, and a manhole C', a distilling-column B, connected to still C by trapped pipe *d'* and pipe *e*, a tank A, provided with float-valve A' and discharging into the top of column B, a horizontal primary condenser consisting of a pair of drums united by a series of pipes, a secondary condenser similarly constructed, but placed in a vertical position, tanks for containing water, surrounding said condensers, connections between the top of column B and said primary condenser and between the latter and the secondary condenser, an auxiliary pipe *m*, connecting said primary condenser to said column B, pipes for supplying water to said water-tanks, and a tank G, into which said secondary condenser discharges, all substantially as and for the purpose set forth.

WILLIAM L. ROWLAND.

Witnesses:
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CHAS. A. RUTTER.