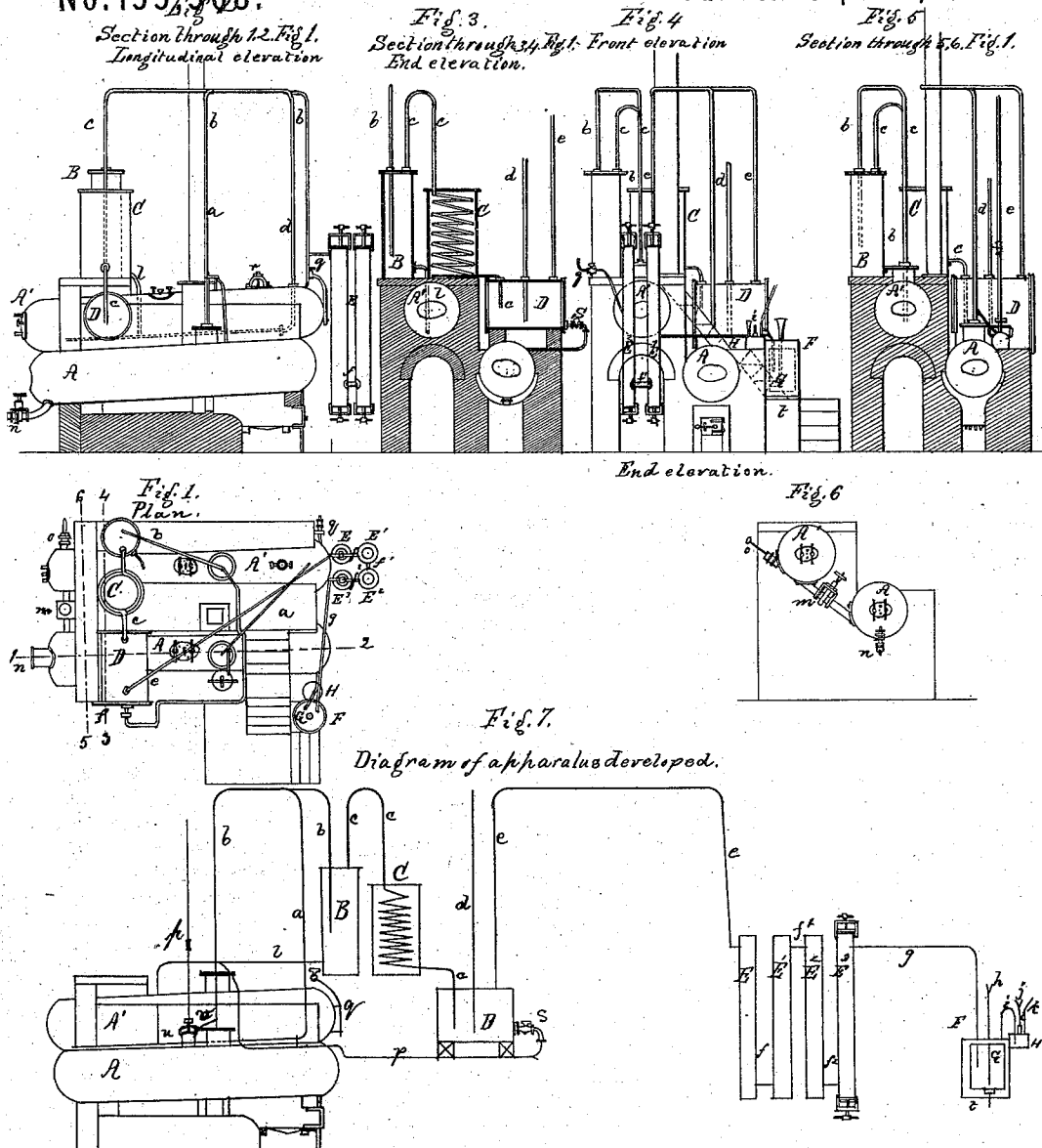


J. H. ELWERT & J. J. M. PACK.
Apparatus for Treating Ammonia.

No. 155,508.

Patented Sept. 29, 1874.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN APPARATUS FOR TREATING AMMONIA.

Specification forming part of Letters Patent No. 155,508, dated September 29, 1874; application filed
October 18, 1872.

To all whom it may concern:

Be it known that we, JULES HENRI ELWERT, of Geneva, and JEAN JACQUES MÜLLER PACK, of Basel, both in the Confederation of Switzerland, have invented an Improved Apparatus for Extracting Ammonia in the form of Liquid Ammonia from Crude Ammoniacal Liquors, of which the following is a specification:

This invention of an improved apparatus for extracting ammonia in the form of liquid ammonia from crude ammoniacal liquors consists in an apparatus serving the purpose, at one operation, of separating the ammonia from gas-liquors, &c., and condensing it into a white liquid of any required strength.

Its advantages are these: First, that it furnishes at one operation of distillation a product perfectly white, which does not alter by time or exposure to the rays of the sun; second, that the apparatus, once charged, works continuously till the operation is finished, with no other care than the heating of the boiler employed; third, that the tubes for the passage of the ammoniacal gas do not get stopped up with naphthaline or other solid hydrocarbons, as the new charge of liquid always rinses out the tubes.

The apparatus is composed as follows, referring to the accompanying drawings, in which—

Figure 1 is a plan; Fig. 2, longitudinal elevation in section through 1 2, Fig. 1; Fig. 3, end elevation in section through 3 4, Fig. 1; Fig. 4, front elevation; Fig. 5, end elevation in section through 5 6, Fig. 1; Fig. 6, back elevation; Fig. 7, diagram of apparatus developed.

The same letters refer to the same parts.

A is the boiler, of wrought-iron or suitable material, mounted over a hearth or fire-place. On the dome or upper part of this boiler is arranged the tube *a*, which, passing upward for a certain distance, is then turned downward, and enters through a tight joint into the boiler A', nearly to the bottom. It is then carried along nearly the whole length of the boiler A', and is pierced with numerous holes for the escape of the gas passing from the boiler A into the pipe or tube *a*. On the

dome of the boiler A' is adapted the tube *b*, turned down as a siphon, the other branch going to within thirty centimeters of the bottom of the vessel B, which is in communication with the boiler A' by the tube *l*. On the cover of the vessel B is fixed the tube *c*, which leads the aqueous ammoniacal vapors into the coil of the refrigerator C. The tube *c*, when it leaves the refrigerator, is carried to within twenty centimeters of the bottom of the vessel D, which is fitted with a safety-tube, *d*, and a cock, *s*, opening a communication by the tube *p* between the vessel D and the boiler A'. In the vessel D are deposited the aqueous ammoniacal vapors condensed by the worm, while the ammoniacal vapor passes by the tube *e* to traverse the four tubes in cast-iron, E E¹ E² E³, communicating with each other by the tubes *f* *f*¹ *f*². These four tubes open at each end, and are fitted with rims, so that each end may be closed by tight-fitting covers in cast-iron or other material. From the tube E³ the ammoniacal vapors are carried by the leaden tube *g* into the lead condensing-cistern G, fitted with a funnel-shaped safety-tube, *h*, and a cock for emptying at *t*. The bent tube *i* takes the non-condensed gas into the vessel H, also fitted with a tap for emptying, a funnel-shaped safety-tube, *j*, and a tube, *k*, for the last uncondensable portions of the gas, and by which it may be led away from the factory.

The crude ammoniacal liquors are introduced by the tube and cock *q*, which is in communication with a reservoir above the level of the boiler A'. The capacity of the boiler A' is one thousand liters—the quantity for one charge. To this is added the quantity of milk of lime, thrown in hot by the hole *r*, sufficient to decompose the ammoniacal salts in each charge.

The emptying of the boiler A' into the boiler A is done by the tube and valve *m*, Fig. 6. To clear the tube *m* of any matter which might choke it, the rod *o* is fitted in a stuffing-box, which allows it to be passed along the pipe without loss of any vapor or liquid. The boiler A is fitted with a tube and valve, *n*, by means of which it can be emptied.

To prevent the formation of a vacuum in the boiler A, there is fitted on the tube *a* a small tube in connection with the vessel *u*

which latter is fitted with the safety-tube and cock *v*.

The vessel *G* is placed in a reservoir made of sheet-iron, *F*, containing cold water, or a cooling mixture, as the vessel *G* becomes otherwise warm by the absorption of the ammoniacal vapor by the water. On the face of the boiler *A*, about sixty centimeters from the bottom, a small hole is made, which is closed with a small wooden peg, by means of which it can be ascertained when the vapor of ammonia has been driven off.

The action of the apparatus is as follows: The man-holes of the boiler are closed; the valve *n* of the boiler *A* is closed; the valve *m* is opened; the refrigerators *C* and *F* are filled with cold water; the tubes *E* *E*¹ *E*² *E*³ are packed or filled with freshly-burnt charcoal of soft wood, of the size of nuts, (preferably the refuse from the baker's ovens,) the covers screwed on, and luted with linseed meal. In the vessel *G* is placed sixty to sixty-five liters of pure water, and in the vessel *H*, by *j*, one and a half liter. After these preparations, the cock *q* being opened, one thousand liters of crude ammoniacal liquor is run into the boiler *A'*, and at the same time, by the hole *r*, enough milk of lime to decompose the ammonia in the one thousand liters. When the crude liquor, mixed with the milk of lime, has run into the boiler *A*, the cock *v*, the valve *m*, and the hole *r* are closed, and the fire is lighted. As soon as the contents of the boiler obtain the degree of ebullition, the air driven out begins to bubble in the vessels *G* and *H*, the boiler *A'* and the tubes *b* and *c* commence to heat, and when the tube *c* at the entrance to the refrigerator *C* is well hot the air has been expelled, and it is time to charge the boiler *A'*. The cock *q* is then opened. The condensation of the air, cooled by the liquor running into *A'*, produces a vacuum, and the aspiration draws the surplus liquid in *D* along the tubes *c* and *p* into the boiler *A'*; at the same time the air enters by the tube *d*. The boiler *A'* now charged with one thousand liters of crude liquor, the cock *q* is closed, the cock *v* opened, and through the hole *r* the charge of milk of lime is added. The contents of the boiler *A'* are well stirred with a baton, the hole *r* then closed, and the fire made active. The aqueous ammoniacal vapor in the boiler *A*, escaping by the small apertures in the horizontal part of the pipe *a*, agitates the liquor in the boiler *A'*, and rises charged with more ammonia from the liquid and richer in ammoniacal vapor. The vapor passing by the tube *b* into the vessel *B* partially condenses or loses its aqueous vapor, and with some of the ammoniacal salts deposits in the vessel *B*, from whence it flows back to the boiler *A'* by the tube *l*. The concentrated vapor passes by the tube *c* into the worm, where the aqueous vapor is entirely condensed, retaining a portion of the hydrocarbons, free ammonia, and ammoniacal salts, and falls into the vessel *D*.

The liquid accumulating in the vessel *D* assists (toward the end of the operation, when the vapors are more charged with ammoniacal salts) to wash the vapors and retain the salts. The uncondensed vapors pass by the tube *e* to the charcoal purifiers *E* *E*¹ *E*² *E*³. The charcoal or *braise* absorbs (besides a small portion of ammonia) all the matters that would injure the alkali, principally the hydrocarbons, and the pure ammoniacal vapor escapes from the last purifier by the pipe *g* into the vessel *G*, where the pure water absorbs the vapor till the liquid has acquired the desired strength. The vapors not condensed in the vessel *G*—for instance, atmospheric air—escape by the tube *i*, and then pass into the liquid in the vessel *H*, which absorbs the small quantity of ammoniacal vapor escaping from *G*, and the last uncondensable portions pass by the tube *k* outside the factory.

During the operation, the refrigerator *C* and *F* must be kept constantly cooled to condense in the first vessel all the non-ammoniacal vapors, and to condense as much as possible of the ammoniacal vapor in the vessel *G*.

When the boiler *A* is discharged of its ammonia the liquid is let out by the valve *n*, it is again charged from the boiler *A'*, the cock *v* shut, as before, and the crude charge let into *A'*. Again the aspiration draws the liquid from the vessel *D* by the tube *p* and the tube *c*, thus clearing away any deposit in the tubes at every time of charging the boiler.

During the time the boiler *A'* is being charged, some or all of the charcoal purifiers are repacked, and the liquid ammonia is drawn off from the vessels *G* and *H* and replaced with pure water, as before. If the water used in *G* and *H* is not distilled water, the charge, when drawn from *G* and *H*, must be set aside to deposit the salts of lime, alum, and magnesia; but with pure water the charge is ready for delivery at once.

The time occupied in the operation is from four to five hours; the product of one thousand liters of crude liquors of 3° Baumé is from one hundred to one hundred and ten kilograms; white liquid ammonia, 22° Baumé.

We are aware that it is not new to purify ammonia by means of charcoal. This, therefore, we do not claim; nor do we claim any apparatus for such purpose other than that shown and described in the above specification; but

What we do claim as new, and desire to secure by Letters Patent, is—

The described combination of the boilers *A* *A'*, their connecting-tube *a*, perforated in part, as described, tube *b*, vessels *B*, *C*, *D*, *E*, *F*, *G*, and *H*, and their connections, all as shown, and for the purpose set forth.

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