W. D. JONES.

Apparatus for Manufacturing Hydrated Sulphurous Acid.

No. 197,474. Patented Nov. 27, 1877.

Fig. 1.

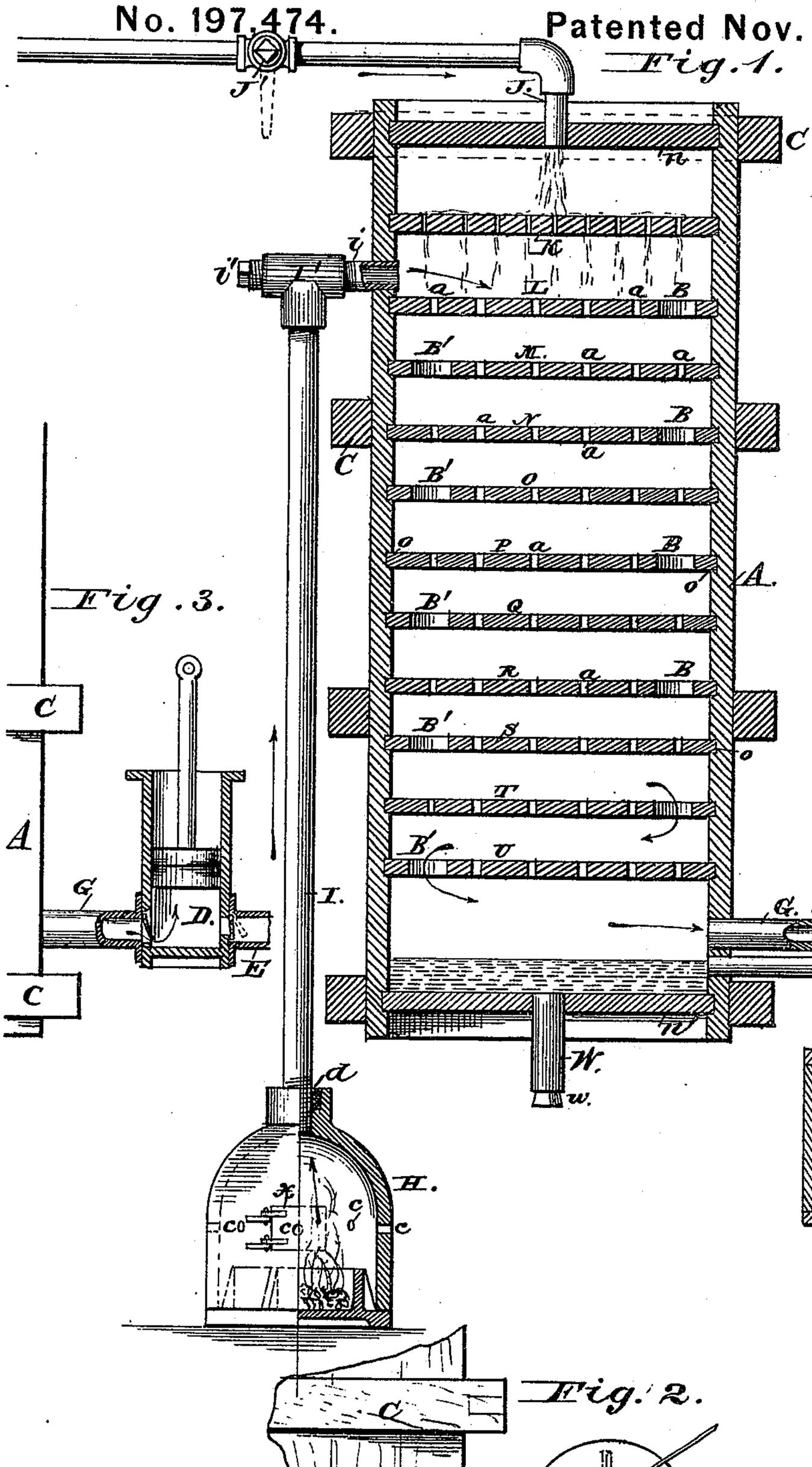


Fig. 3.

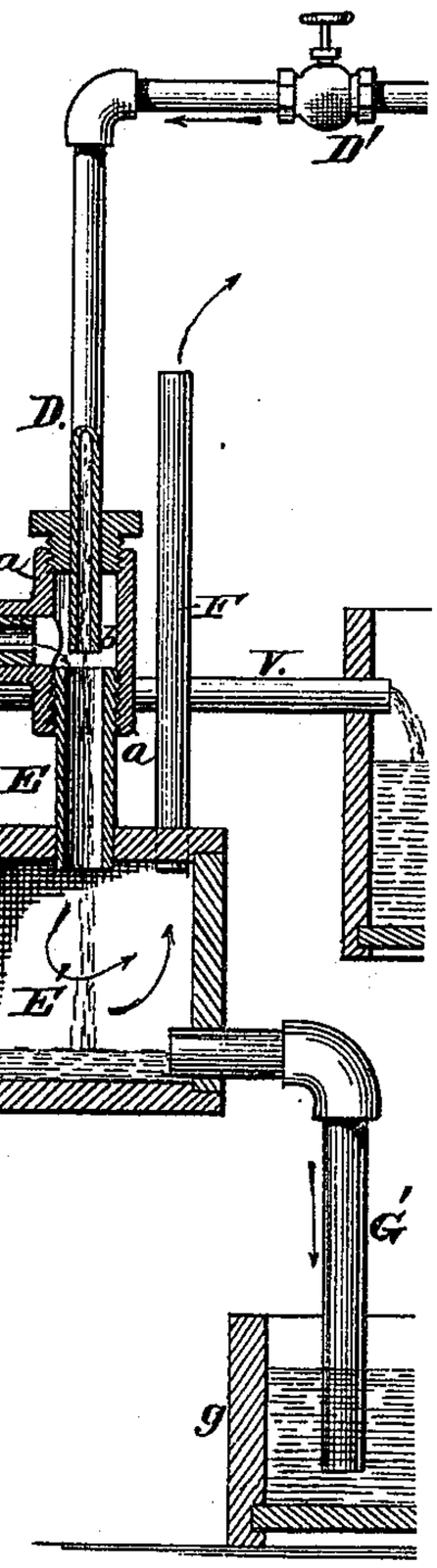
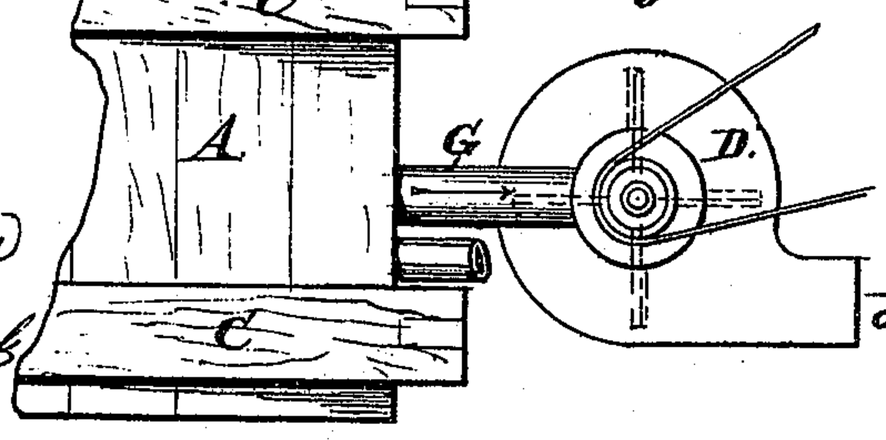


Fig. 2.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN APPARATUS FOR MANUFACTURING HYDRATED SULPHUROUS ACID.

Specification forming part of Letters Patent No. **197,474**, dated November 27, 1877; application filed November 3, 1877.

To all whom it may concern:

Be it known that I, W. DAVIDSON JONES, of Hagaman's Mills, in the county of Montgomery and State of New York, have invented new and useful Improvements in Apparatus for Manufacturing Hydrated Sulphurous Acid, of which the following is a full, clear, and exact description.

This invention is in the nature of an improvement in apparatus for manufacturing hydrated sulphurous acid, for which Letters Patent of the United States were granted to me (and Henry Haskell Pawling as part assignee) on the 27th day of March, A. D. 1877, and numbered 188,801.

The invention consists, in part, of the combination of a furnace wherein the sulphur is ignited, a condensing-chamber wherein the sulphurous fumes are combined with the water, and a line of piping leading from the retort to the upper part of the condensing-chamber to convey the heated fumes directly into contact with the fresh water in its coolest condition, the said line of piping being so constructed that the sediment forming therein is easily removed.

The invention also consists in combining, with a condenser for hydrating sulphurous-acid gas, a mechanical device for producing an artificial draft, so as to prevent the escape of the gases into the room wherein it is used, to insure the combustion of the sulphur, and cause the uncombined vapors and non-condensed portions to be driven off into the atmosphere.

In the drawings illustrating my invention, Figure 1 is a sectional elevation, showing the retort H, pipes I and *i*, with the elbow I′, having the removable plug *i′*, the condenser-case A, bands C, top *n*, bottom *n′*, diaphragms K L M N O, &c., pipes W, V, and J, valves J′ and D′, exhaust-pipe G, conveying the non-combined vapors and gases to the exhauster, which consists of the cylindrical case *a*, having within the annular space *b* its water-injection pipe D, outlet-pipe E, separating-chamber E′, water-discharge pipe G′, with its lower end sealed by dipping into a drain or box, *g*. Fig. 2 shows an analogous device for producing an artificial draft through an apparatus for manufacturing hydrated sulphurous acid, which consists of a rotary fan. Fig. 3 exhibits another modification for producing an artificial draft through an apparatus for manufacturing hydrated sulphurous acid, by the employment of a reciprocating pump.

Like letters of reference indicate like parts in each drawing or section thereof.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A (see Figs. 1, 2, and 3) is the condenser, made of wood or other material, substantially as shown, bound together by bolting through the bars C, care being taken that no iron enters the inside of the condenser, so as to come in contact with the liquid.

The vertical sides of the condenser are grooved horizontally, as indicated at *o* (see Fig. 1) at intervals. In the upper one is placed the top *n*, which is provided with a central hole to receive the water-supply pipe J; and it may be also provided with hand-holes to allow access to the diaphragm K. In the lower groove is placed bottom *n′*, which is provided with the flow-pipe W, which may be placed in any convenient part of the bottom.

In the second groove from the top is placed the minutely-perforated distributing-diaphragm K. In the next one below is placed the diaphragm L, and then, in succession, the diaphragms M, N, O, P, Q, R, S, T, and U, all of these diaphragms being perforated, substantially as shown and described in Letters Patent of the United States No. 188,801, heretofore referred to.

J (see Fig. 1) is a pipe, provided with a valve, J′, to convey and regulate the supply of water to the condenser A.

H (see Fig. 1) is a furnace, in which the sulphur is burned. The supply of sulphur is fed in through the door *x*, and the supply of air to support the combustion passes in through the small holes *c*.

I is a pipe connected to the top of the furnace, and packed, as indicated at *d*, with any suitable packing, as, for instance, stove-putty, and extending upward a little above diaphragm L. It is provided at this point with a T-elbow. A pipe, *i*, leads from this elbow

into the condenser-case, between diaphragms K and L. The outer end of this T-elbow is provided with a removable plug.

The pipe W (see Fig. 1) is provided with a cork, *w*. The hydrated sulphurous acid discharge-pipe V (see Fig. 1) enters the case A, a short distance above the bottom *n'*, but at a lower level than the pipe G, two or three inches being sufficient between pipes V and G. Said pipe V discharges into any suitable reservoir or tank, all substantially as shown.

The exhaust-pipe G enters the case a short distance below the lowest diaphragm, and a suitable distance above the discharge-pipe V, and makes a connection with the cylindrical chamber *a*. This cylindrical chamber *a* is provided with a water-injection supply-pipe, D, said pipe D being provided with a valve, D', to regulate the supply of water.

The pipe E enters the cylindrical case *a*, and its upper end extends up to about the level of the lower part of the pipe G, and its lower end makes a connection with and into the separating-chamber E'. This chamber E' has a discharge-pipe, F, leading from its upper part, to convey away the vapors and uncombined gases into the atmosphere, and a discharge-pipe, G', with its lower end sealed in water, as indicated at *g*, leading from near the bottom of the separating-chamber E, to convey away the water.

The induction water-pipe D extends down into the chamber *a*, to within about one-half of an inch of the pipe E, and the pipe D is much smaller than the pipe E, usually in the diameter proportion of one to three.

It is necessary that the condenser should set, when placed for use, so that the diaphragms will be level.

The operation of my invention is as follows: The arrows indicate the direction of motion of the gases and liquid.

The pipe W is secured with the cork *w*, so that no liquid can escape.

The cock J' is opened, so as to allow a suitable supply of water to enter by the pipe J into the upper part of the condenser, where it falls upon the center of the distributing-diaphragm K. The stream is broken and spreads over the level surface of the diaphragm K, and passes equally through the small perforations in small streams upon diaphragm L. As the water falls upon diaphragm L, it is spattered or broken into many small particles or globules, and, running over the edges of the holes *a*, strikes upon the interspaces between the holes in diaphragm M, thereby repeating the same breaking up of the water into many small particles, globules, or spray, as above recited.

This repetition of the action of the water or liquid just recited is repeated from diaphragm to diaphragm until it passes the lower one, and, as it cannot escape through the pipe W, it accumulates in the bottom of the case to the height indicated, and is discharged, through pipe V, into any suitable reservoir. By the accumulation of the liquid in the bottom of the condenser, as indicated, all sediment that may be carried in by the water or by the vapor-pipe I will be precipitated to the bottom, and be held there until washed out, the clear liquid passing out through pipe V.

The globe-valve D' in the water-pipe D is opened, thereby letting in water from a proper and suitable supply so as to give sufficient force to the stream, which is thrown through the center of the pipe E to the bottom of the separating-chamber E', where it runs out through the pipe G' into a drain, the end of the pipe G' dipping into the water, so as to water-seal the end, thereby preventing the escape of gases into the mill wherein it is used. Or the pipe E may be extended so as to convey the water and gases or vapors outside of the manufactory in which it is used. In this latter case the vapor-pipe F is dispensed with, and the end of the pipe E must be left perfectly free and open.

As the water passes from the end of the pipe D into and through the center of the pipe E, it expands into a broader and broken stream, carrying with it the particles of air, non-combined gases, and vapors that mix with it, which non-combined gases, vapor, and air are set free from the water in the chamber E', and are driven off, through the pipe F, into the atmosphere, thereby creating a partial vacuum, which partial vacuum is supplied by the atmospheric pressure through the furnace connecting pipes I *i*, condenser-case A, and pipe G, thereby creating a suitable and proper draft.

As the products from the combustion of the sulphur in the furnace H pass up through the pipes I *i* into the condenser below the distributing-diaphragm K, as they cannot pass through this diaphragm, on account of the minute perforations being filled, or nearly filled, with water, they are diffused throughout the whole space, and are largely absorbed by the fresh, cool, falling water. While a small portion of the unabsorbed gases passes down through the small holes *a*, the larger portion passes down through the series of large holes B in diaphragm L, and is diffused throughout the space between diaphragms L and M, and passes horizontally toward the series of holes B' in diaphragm M, thereby coming again in contact with the falling water, and having another portion condensed and absorbed.

The larger portion of the remaining uncombined gases, that passes down through the series of holes B' in diaphragm M, comes in contact with the water falling from the perforations *a* in diaphragm M, as it passes laterally in the space between diaphragms M and N to and down through the series of holes B in diaphragm N, and horizontally in the direction of the holes B' in diaphragm O, it is again submitted to a like action to that above recited, and this is repeated from diaphragm to diaphragm until the uncondensed and non-

combined portions of the products of combustion reach the space between diaphragm U and the liquid in the bottom, when they are drawn out through the pipe G, by the artificial draft above described, and are driven out through the pipe F into the atmosphere.

The liquid, as it passes from diaphragm to diaphragm, condenses, unites, and absorbs the condensable portions of the products of the burning sulphur, thereby forming hydrated sulphurous acid, which is conveyed by the pipe V into any suitable tank for use.

In Patent No. 188,801, above referred to, the hot gases from the retort enter the condenser just above the hydrated sulphurous acid discharge-pipe, and, in case of accident, either by the discharge-pipe becoming obstructed or an excess of water being let into the apparatus, the lower part fills with liquid so as to run out of the pipe leading from the furnace, putting out the fire, which retards the work; while with this improvement of conveying the fumes from the furnace to near the top of the condenser, and exhausting near the bottom, such an accident cannot occur with the most inexperienced workmen; also, the result or production of hydrated sulphurous acid is more satisfactory, on account of the heated gases becoming partially cooled in passing through the pipe I, and then, being first met and mingled with fresh cool water, thereby nearly cooling them immediately, they are more readily thereafter absorbed.

When necessary to remove the sediment in the pipes I *i*, remove the plug *i'* and scrape the short horizontal pipe *i* outward, and rap the vertical pipe I, thereby dropping the sediment into a small scoop, which may be introduced into the door of the furnace when the fires are extinguished..

When the operator is through with his work at the close of the day, or when desirable to wash out the machine, the fire in the furnace is extinguished, the cork in the pipe W is withdrawn, and a free supply of water let in at the pipe J, which washes out all sediment and cleanses the machine.

The condenser A may be made of any desired size, and the diaphragms below the distributing-diaphragm may be increased or diminished in number, as circumstances require, without changing the nature of my invention.

With this apparatus hydrated sulphurous acid can be cheaply and rapidly made. It occupies but little room, which in many mills is of very great importance, and deposits all sediment that may pass into the apparatus on the bottom of the condenser, and allows the clear liquid to escape by the pipe V for use.

The employment of an artificial draft, in combination with an apparatus for hydrating sulphurous acid, obviates the very serious objection of the escape of the sulphurous fumes from the furnace, pipes, &c., which fumes are detrimental to health and destructive to all iron-work with which they come in contact.

It is evident that an artificial draft can be produced in an apparatus for hydrating sulphurous acid by analogous devices, such as shown in Figs. 2 and 3, without changing the nature of my invention; but such devices require power to operate them, and, as hydrated sulphurous acid apparatuses are frequently required to be used when the machinery of a mill is not running, the hydraulic exhauster is preferred, as it costs nothing to operate it, and can be used at all times, irrespective of the machinery and fixtures in a manufactory.

The pipes G and V may enter on any side of the condenser-case, as may be most convenient to suit the conditions of the mill or factory wherein it is placed.

I am aware that devices for hydrating sulphurous acid, washing illuminating-gas, and making vinegar have been constructed and employed wherein the ascending currents of gases and air have been brought in contact with the descending fluids. All such I disclaim as old.

I am also aware that devices for producing artificial draft have heretofore been used in the distillation of coal-oil and other analogous arts. All such I disclaim.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in an apparatus for hydrating sulphurous-acid gas, of a hydrating-case, a furnace wherein the sulphur is burned, and the vapor-pipes so connected therewith as to conduct the vapors from the burning sulphur in the furnace directly to the action of the water near the upper part of the hydrating-case, so that in their descent the gas is hydrated, substantially as shown, described, and set forth.

2. In an apparatus for hydrating sulphurous-acid gas, consisting of the furnace wherein the sulphur is burned, a hydrating-case, and the pipes connecting the furnace with the hydrating-case, the combination therewith of a hydraulic exhauster, whereby a draft is created through the said apparatus, substantially as and for the purpose shown and described.

3. The combination of the case A, pipes G, D, E, F, and G′, chambers *a* and E′, as and for the purposes shown and set forth.

4. The combination of the case A, pipes G, D, and E, and chamber *a*, all substantially as shown, described, and set forth.

W. DAVIDSON JONES.

In presence of—
EFFINGHAM T. BOWEN,
GEO. W. KIRK.