R. D. Birch,

Manf Copperas.

No. 111,305. Patented Jan. 31. 1871.

Fig. 1.

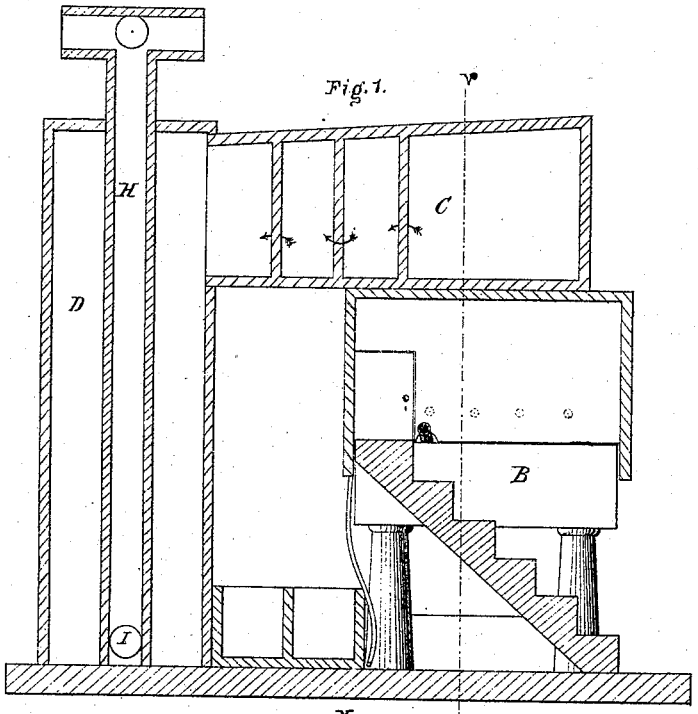

Fig. 5.

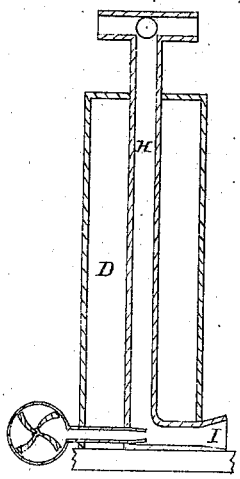

Fig. 2.

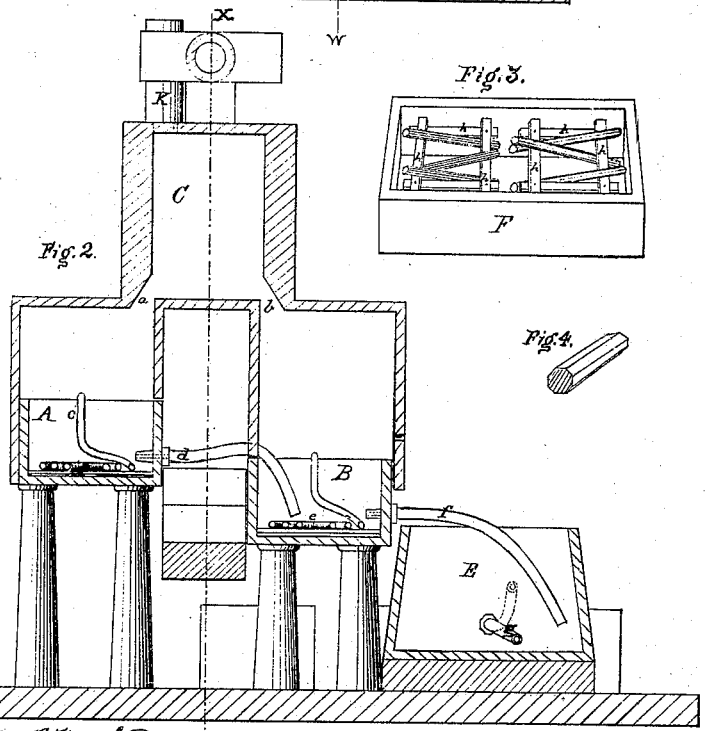

Fig. 3.

Fig. 4.

Witnesses { Wm. R. Wright, Thos. S. Burtt.

Inventor, R. de Witt Birch, by his atty, Horace Binney, 3rd.

UNITED STATES PATENT OFFICE.

R. DE WITT BIRCH, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN THE MANUFACTURE OF COPPERAS.

Specification forming part of Letters Patent No. **111,305**, dated January 31, 1871.

To all whom it may concern:

Be it known that I, R. DE WITT BIRCH, of the city and county of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in the Manufacture of Copperas; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to practice my invention, reference being had to the accompanying drawing, which forms a part of this specification, and in which—

Figure 1 is a transverse section of the apparatus which I employ to carry out my invention, taken on the line *x y*, Fig. 2. Fig. 2 is a longitudinal section of the same, taken on the line *v w*, Fig. 1; Fig. 3, a perspective view of the crystallizing-vessel; Fig. 4, a perspective view of one of the crystallizing-sticks; and Fig. 5, a longitudinal section of the blowing apparatus and pipe connected therewith.

The same parts are denoted by the same letters in all the figures.

I take the waste liquor from any manufactory where sulphuric acid is employed to act on iron, such as galvanizing works, foundries where castings are cleaned with sulphuric acid, or other manufactories, and run this raw liquor into a cistern, where it is allowed to stand for two or three days to deposit impurities, and from which it is pumped into the neutralizing-vessel A. This neutralizing-vessel is lined with lead. Its capacity may be about one thousand five hundred gallons, and it is closed except at the outlet *a*. It has also a door, *b*, through which I throw in enough wrought-iron to neutralize the free acid, and then allow the whole to stand about four hours, during which it is heated to about 80° Fahrenheit by steam passing through a coil of copper pipe, *c*, within the neutralizing-vessel. I then run the liquid into the boiler B through the pipe *d*, (the boiler-end of which is hooked up when not in operation,) steam is passed through the copper coil *e*, and the liquid is thereby boiled down to from 28° to 40° Baumé.

The steam and vapors of copperas which escape through the outlets *a* and *b* during the operations heretofore described into the chamber C pass over a quantity of common lime in the said chamber, (with which the sulphuric acid unites to form sulphate of lime, depositing metallic iron on the lime,) and thence into the condenser D. By this means the greater part of the copperas vapor is intercepted and prevented from passing out into the open air and acting injuriously upon structures and facings of marble or similar stone.

When the liquid has been boiled down to the required density I run it from the boiler into the settling-vessel E by means of the pipe *f*, which is hooked up when not in use, as previously described. After the liquid has stood in the settling-vessel about eight hours I run it into the crystallizing-vessel F, elevating the upper end of the pipe *g* slightly each day, so that it shall always be clear of the previously-deposited sediment.

The crystallizing-vessel may be lined either with lead or with a composition of one part Trinidad pitch, three parts resin, two parts sulphur, and one part iron-dust.

Frames or slats *h h* are wedged or otherwise securely adjusted in the vessel F, so as to be just on the top of the liquid. The object of these frames is to keep the crystallizing-sticks (which are thrust between the slats, as shown in Fig. 3) immovable and prevent them from floating on the liquid.

I prefer to make the crystallizing-sticks of white oak. In shape they are octagonal prisms, which form I have found by experience to be the best adapted to the formation of the crystals on them.

When the crystallizing-sticks have been about six days in the crystallizer I remove them and knock off the crystals of copperas, which are afterward washed in the usual manner, and then laid on the floor to be dried by the following means: Within the condenser D is a pipe, G, communicating with the open air, and also with the blowing-machine H, by which a stream of air is forced through the orifice I. The cold air which enters this pipe is heated by the steam that escapes from the vessel A and boiler B into the condenser, so that while the steam is condensed and the copperas-vapor prevented, as previously described, from escaping in any considerable quantity, a current of warm air is continually issuing from the orifice I, in front of which the crystals are laid, and are thereby dried quickly.

An outlet, K, is provided for the escape of uncondensed steam and vapor. The quantity

of copperas-vapor escaping will, however, be inconsiderable.

The employment of separate vessels for neutralizing the free acid and boiling the liquid down to the required density is attended with important advantages. If only one vessel be used for these operations it will either be necessary to complete the neutralizing process before boiling, thereby incurring loss of time, or to perform both operations at once, in which case a large quantity of water will be driven off before the acid is neutralized, the resulting crystals will contain sulphuric acid, and the vessel and pipes will be coated with a hard deposit, difficult of removal.

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

1. The manufacture of copperas from waste liquor by the process described.

2. The process of neutralizing the free acid in a separate vessel from that in which the liquid is boiled to the required density.

3. The process of neutralizing, boiling, and settling the liquid in separate vessels, as described.

4. The above-described method of preventing the escape of copperas-vapor into the atmosphere.

5. The application of the vapor from the heated liquid to heat the drying-blast, as described.

6. The combination of the chamber C and condenser D with the pipe G and blowing-machine.

7. The frames or slats *h h*, arranged in the crystallizing-vessel, and operating as described.

8. The crystallizing-sticks, made in the shape and for the purpose described.

R. DE WITT BIRCH.

Witnesses:
WM. R. WRIGHT,
THOS. A. BURTT.