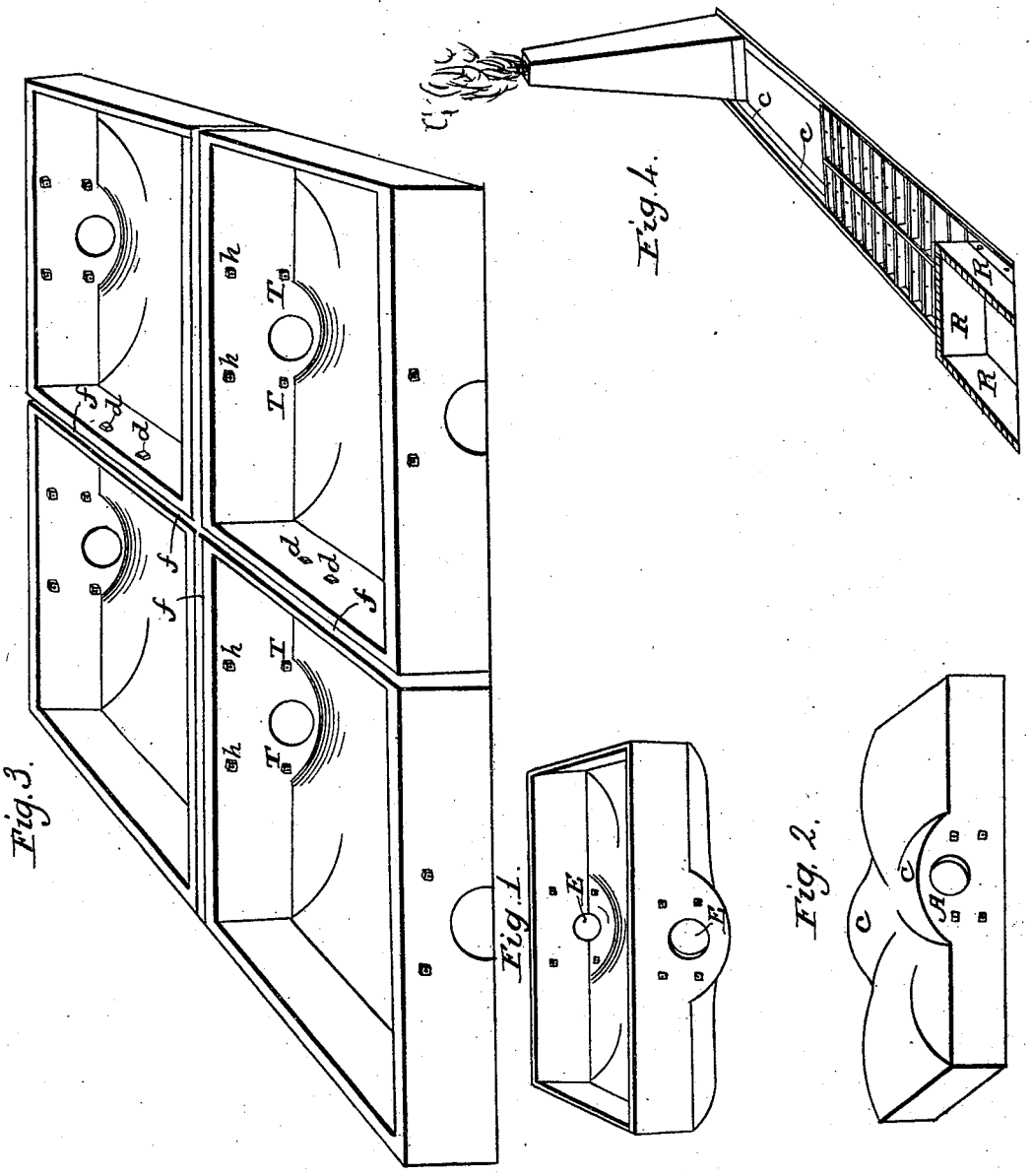
C. H. REYNOLDS.

Evaporating Pan.

No. 619. Patented March 3, 1838.



UNITED STATES PATENT OFFICE.

CHARLES G. REYNOLDS, OF KANAWHA SALINE, VIRGINIA.

IMPROVEMENT IN THE APPARATUS FOR MAKING SALT.

Specification forming part of Letters Patent No. **619**, dated March 3, 1838.

To all whom it may concern:

Be it known that I, CHARLES G. REYNOLDS, of Kanawha Saline, in the county of Kanawha and State of Virginia, have invented, constructed, made, and applied to use a new and useful improvement in the mode of manufacturing salt in furnaces from brine by substituting pans for grainers in lieu of kettles, which are used in the ordinary mode of manufacture, of which the following is a specification.

For the more distinct understanding of the improvement I think it proper to describe, first, the plan of operation now in use. The plan of operation at the Kanawha Saline, Virginia, and now in use there, is perhaps the best in the United States, and for that reason will be described as embracing all the most useful parts of the methods in use elsewhere.

The ordinary furnaces on the Kanawha are constructed after the manner following: A large chimney is built, from the base of which a ditch is dug the length of the proposed furnace, increasing in depth as it recedes from the chimney. The length varies from eighty to one hundred and thirty-five feet. The depth at the chimney is about fifteen inches and from five to six feet at the other end. The width, after walling, is from six to eight feet. This ditch is called the "rake" on the Kanawha, and by that name will be hereinafter denominated. For a furnace of one hundred feet in length a large boiler of twenty-five feet in length is constructed of cast-metal pieces put together with screw-bolts and cements for the bottom and four-inch plank for the sides and ends, and is placed on the end of the rake most remote from the chimney. From the boiler to the chimney the rake is covered with a double row of kettles, generally of two sizes, sometimes three, the smallest being nearest to the chimney. The rake thus covered connects with the flue of the chimney by an opening left in it, which is called the "throat." In the large boiler the salt water is first boiled, and when evaporated near to saturation is drawn off into a settling-cistern placed along the rows of kettles. The fire is placed on grates under the end of the boiler most remote from the chimney, and, striking through the rake to the chimney, boils both the large boiler and the kettles, they being filled with the brine drawn from the settling-cistern. There is no communication between the kettles, and their brines never mingle after they are filled unless by bailing from one to the other, which is often done in order to reduce the brines to salt in each kettle at the same time.

My improvement consists in the substitution of a double row of cast-metal pan-pieces for grainers in lieu of kettles. The rake of the furnace I have constructed on this improved plan is about eight feet wide between the walls.

My pan-pieces, which may be larger or smaller or modified in shape, as may suit the fancy of the manufacturer and still preserve the principle of the improvement, are constructed as follows:

First. Each piece of pan in the furnace I have erected is five feet long and three feet wide, with perpendicular flanges of seven and one-half inches. (See Drawings Nos. 1 and 2, which give a top and bottom view of said pan-pieces.)

Second. The bottom of each piece of pan is in the form of one side of an ellipse from end to end, two and one-half inches deep, and of circular form from side to side, and of equal depth. The depth is measured from the point where the perpendicular flange commences and the circular part terminates. (See Drawings Nos. 1 and 2.)

Third. At the sides of each piece and in the center there is a semicircular depression of the bottom on the inside and a corresponding protrusion on the outward part thereof of two and one-half inches, and running so far from each side toward the center of the piece as to draw to it any fluid which may be in it if placed in a level position. (See Drawing No. 2, C C.)

Fourth. At the middle of the pan-piece and within the semicircular depressions a hole of three and one-half inches in diameter is made through the flanges, and so low in them as to drain the fluid, or nearly so, from the depression. (See Drawings No. 1, E E.)

Fifth. These pan-pieces are put over the rake in two rows, one foot or more of each piece, at the extreme end, resting on the walls, and united in the center of the rake by two screw-bolts passing through the flanges of each piece. (See Drawing No. 3, *d d d d.*) After two pieces next the boiler are thus united,

two other pieces are placed in juxtaposition to them, so that the holes in them will fairly meet and permit a ready communication of the fluid between them, and so on until the entire rake from the boiler to the chimney is covered with pieces of the like kind, united in like manner. When so constructed, the brines drawn into the two pieces next to the boiler will flow back through the holes in each row to the chimney until all the pieces are filled. To effect this, the combination of pieces must be on a common level. (See Drawing No. 4. R R R represent the end of the boiler next the pan-pieces. From the boiler to C is a section of furnace or rake covered with the pan-pieces, united as before described. C C show a section of the wall on one side of the furnace or rake. From the pan-pieces to the chimney shows a section of the rake uncovered.)

Sixth. The pieces at the sides in each row must be united by screw-bolts—one on each side of the hole—as low as possible and yet give room for the turning of screw-taps, (Drawing No. 3, T T,) and one other on each side about the top thereof, (same drawing, H H.) After thus bolting them together, a suitable cement should be forced in between the pieces around the hole, so as to prevent the escape of the brine between the pieces in passing from one piece to the other. As a more certain security against a leak, a wrought-iron tube the size of the hole may be passed through and clinched on the inside of each flange.

Seventh. The interstices at all points where the pieces are in juxtaposition should be filled with clay mortar at the top, but care should be taken to prevent it from passing down between the flanges more than two inches, so as to leave room for the expansion of the metal which the intense heat at the bottom will occasion. (Drawing No. 3, *f f*, &c., represents the interstices filled with mortar, as aforesaid.)

Eighth. The sides of the pieces next to the boiler and of those next to the chimney should be cast without holes, they being end pieces, and consequently the brines are not required to pass through those sides; but the two pieces at the end next the chimney should be cast with similar holes at the ends where they unite in the middle of the rake, whereby a like communication may be formed at that point between the rows.

Ninth. There should be a metallic faucet inserted in the end of one of the pieces next to the chimney and in the end which rests on the wall, so as to draw the fluid from the bottom of the pans. To receive the fluid, a wooden cistern should be constructed running from the chimney to the boiler, through which a steam-pipe may be conducted leading from the boiler. Over this cistern a platform may be erected to drain the salt lifted from the pans and to carry the drainage into the cistern.

The advantages to be derived to the manufacturer by the adoption of my pan-pieces in lieu of kettles, and which he cannot enjoy by the ordinary mode now in use, are various, to wit:

First. By letting on the brine from the settling-cistern into the pieces next to the boiler they are soon filled above the hole which communicates with the next piece, and so on from piece to piece to the chimney, and while so filling the impurities in the brine, from their specific gravity or other cause, being nearest the bottom, are carried through the hole which forms the connection between the pieces, and by the time all the pans are filled most of the impurities are found in some three or four pieces next to the chimney, which impurities thus concentrated by my pans in the ordinary mode of manufacturing are boiled down in the kettles and mingled with the salt.

Second. Much less heat is required to precipitate the salt in the salt-water on Kanawha than most of the impurities which it contains, and the pan-pieces concentrating them being the most remote from the fire are so much the less likely to granulate, while at the same time the salt or most of it is precipitated. The impurities being left in solution may be drawn off through the faucet described in Specification No. 9, into the cistern therein described, where such portions of salt as remain with the impurities may be precipitated by the steam passing through the steam-pipe connected with the boiler, as aforesaid.

Third. By using the double row of pans, and placing the extreme ends one foot or more each on the walls, the more intense heat of the fire passing in the center of the rake causes the boiling or ebullition of the brine to proceed from the ends in the center of the rake, and a continual flow to the other ends resting on the walls. By this operation the salt precipitated is carried and lodged on that part of the pan which rests on the walls, where there is less heat, therefore less "caking," and of course less danger to the metal.

Fourth. It is important in the manufacture of salt to reduce all the grainers at the same time, which cannot be done unless the heat is equally distributed among them—a perfection in furnaces very rarely, if ever, attained; but by my plan this difficulty is completely obviated, for however unequally the fire is distributed by means of the communication, the pieces boiling most rapidly are replenished from those boiling less, on the principle that fluids seek the same level. In the ordinary mode reducing the grainers at the same time is effected at the expense of nearly half the heat, which is ever lost, for the last kettle in the rake next to the chimney must boil as rapidly, or nearly so, as those nearest the boiler, and consequently much heat must pass up the chimney; but by adopting my pan-pieces the rake may be extended to any length which the fire will reach with any effect, and by the reflux all are reduced at the same time and much more salt be made with the same amount of fuel.

Fifth. The salt made by my plan is of a quality very superior to that made in the ordinary way.

The principle of this improvement may be advantageously applied to any business or manufacture where the evaporation of large quantities of any fluid is required.

I do not claim any part of the boiler aforesaid, or settling-cistern, or any other part of the old furnace in ordinary use hereinbefore described as my invention.

I claim only the pan-pieces and their mechanical structure, as hereinbefore described, upon a principle calculated to produce the useful results and benefits hereinbefore specified, by the use of them as grainers in lieu of kettles, as my own invention.

My pan-pieces may be used as the boiler before described by elevating the flanges, and may be used in that way beneficially.

In testimony that the above is a true specification of my said improvement, as above described, I have hereunto set my hand the 18th day of December, 1837.

CHAS. G. REYNOLDS.

Witnesses:

BENJ. H. SMITH,

C. E. DOORIDGE.