(No Model.) 2 Sheets—Sheet 1.

R. S. PENNIMAN.

APPARATUS FOR DRYING FUSIBLE SALTS.

No. 321,636. Patented July 7, 1885.

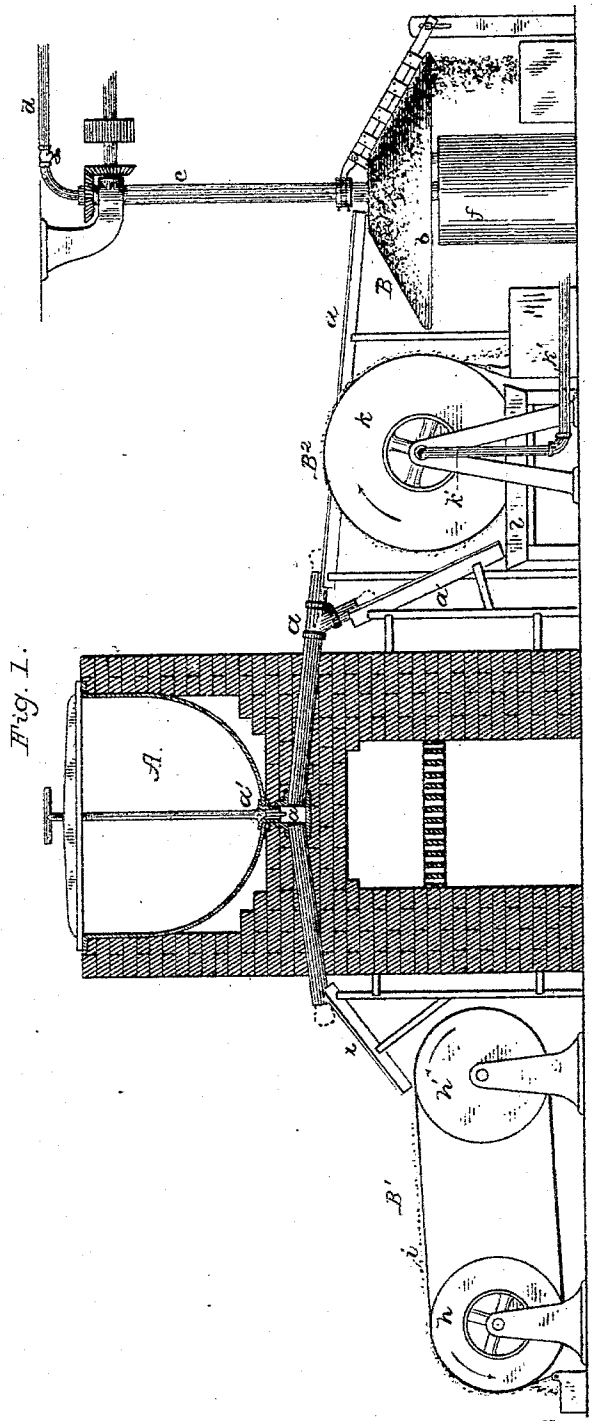

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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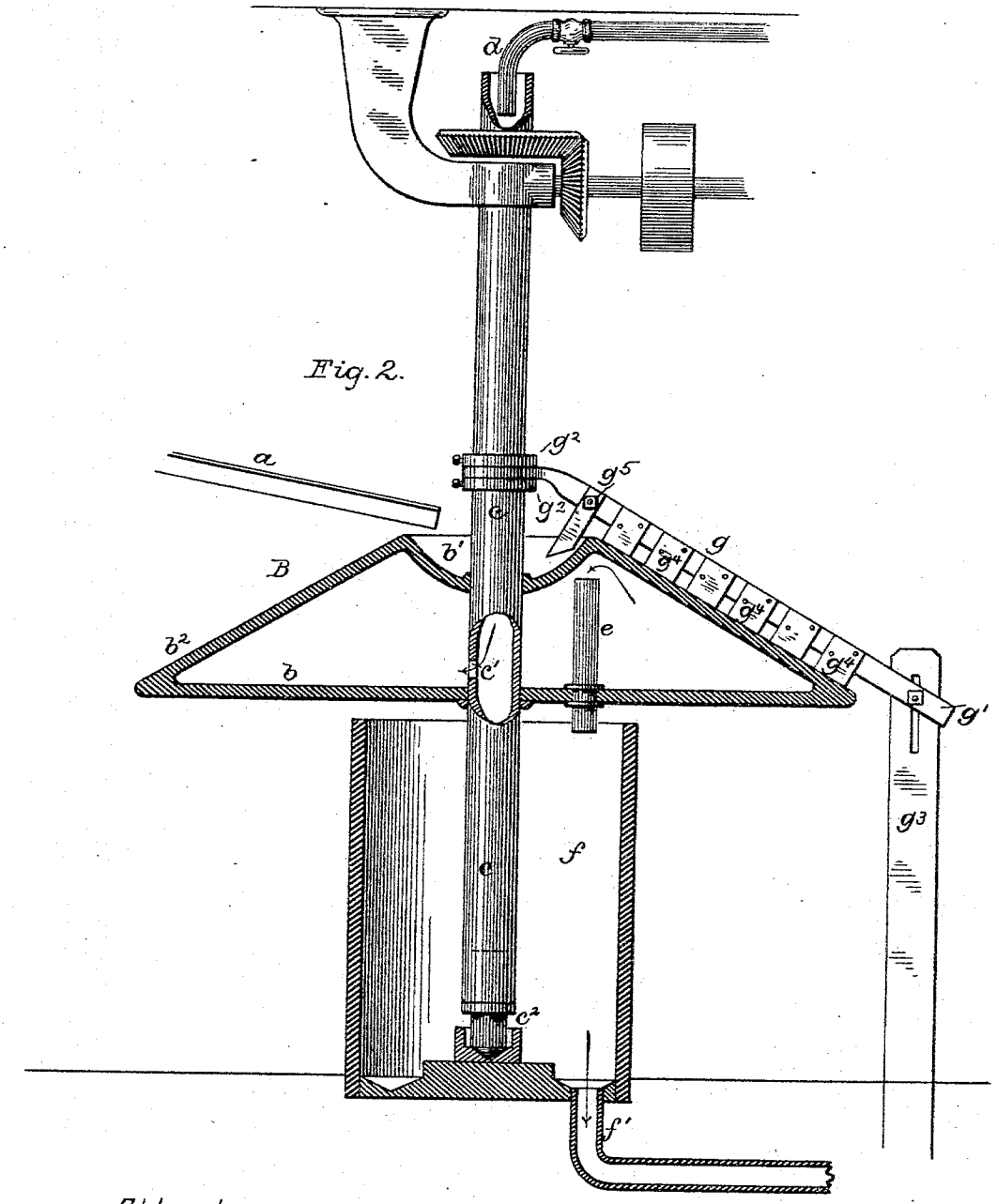
Fig. 2.



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UNITED STATES PATENT OFFICE.

RUSSELL S. PENNIMAN, OF JENKINTOWN, PENNSYLVANIA.

APPARATUS FOR DRYING FUSIBLE SALTS.

SPECIFICATION forming part of Letters Patent No. 321,636, dated July 7, 1885.

Application filed February 4, 1884. (No model.)

To all whom it may concern:

Be it known that I, RUSSELL S. PENNIMAN, of Jenkintown, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Drying Fusible Salts; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part thereof, is a clear, true, and complete description of my invention.

My apparatus is intended for use in the process of eliminating water from or "drying" such fusible salts as nitrate of soda, nitrate of potash, and nitrate of ammonia, &c. Heretofore such salts have been dried in various ways—as, for instance, on tables or plates heated directly from a fire or by steam, or within a revolving barrel traversed by currents of heated air, or by fusing the salts under a temperature as high as, say, 600° Fahrenheit, this latter method being the most effective of any known to me—it being well known that salts dried by other methods indicate the presence of water when thrown into a mass of melted salt. My apparatus is operated under the melting method, and includes as a part thereof one or more suitable kettles and furnaces, and means whereby the melted salts are discharged, hardened by cooling, and delivered in a desirable and convenient form for use. Heretofore such melted salts have been dipped from the kettles into small iron molds, from which the salts are removed, when cold, in the form of blocks or ingots. This mode of handling these salts is well known to be slow, laborious, and expensive, and the object of my invention is to expedite the drying operation and otherwise economize therein; and to those ends I employ, in connection with one or more kettles, one or more cooling-tables, each having a movable surface to which the melted salts are delivered from the kettle through suitable spouts, and from which said salts in a solid condition are readily displaced. This cooling-table may be variably constructed without departure from certain features of my invention, provided the surface of the table is capable of movement while the salts are being delivered thereon, and also provided said table be constructed and arranged for facilitating a rapid radiation and convection of heat from the salt. For obtaining the best results I employ cooling-currents of water for carrying off the heat radiated from the salt to the table. The salt may be scraped from the table by hand-tools without departure from certain features of my invention; but for greater economy in labor I have provided for its automatic clearance, and this can be effected with or without scraping devices, although such devices, in combination with a cooling-table, constitute one portion of my invention.

To more particularly describe my invention, I will refer to the accompanying two sheets of drawings, in which—

Figure 1, Sheet 1, is a view of my apparatus, partially in side elevation and partially in vertical section, as when in operation. Fig. 2, Sheet 2, is a central vertical section of one of the cooling-tables shown in Fig. 1.

As seen in Fig. 1, the melting-kettle A is located at a convenient distance from the cooling-tables B, B′, and B², and at such an elevation above them that the melted salts can flow from an outlet at the bottom of the kettle, and preferably at one end thereof, down inclined pipes, troughs, or spouts *a* to the surface of one or more cooling-tables. Any number of these kettles may be grouped at convenient distances from each other and from the one or more cooling-tables, the spouts being movable or fixed, as may be desired. Each kettle has a plug-valve, as at *a′*, provided with a threaded stem in a manner well known, and the pipe *a* at its junction with the kettle is protected by a housing of fire-brick, or any other suitable casing material, for preventing the heat of the fire-bed from injuring said pipe and its connections. The kettles are usually rectangular in form, but have a concave bottom, and the valve is preferably located at one end of the kettle.

The cooling-table B is fully shown in Fig. 2, Sheet 2. It consists, mainly, of a hollow truncated cone, *b*, mounted upon a revolving vertical hollow shaft, *c*. I have found that extensive service can be performed by this table

when about four feet in diameter, and, say, one foot high near its center. It can be made of cast-iron, and its walls should generally be as thin as it is practicable to make them. The center of the top of the table, as at b', is in the form of a cup, for the reception of the melted salt from a kettle by way of the spout a. The cooling-surface b^2 is annular and inclines downwardly and outwardly from the edge or lip of the receiving-cup b'. Within the table the hollow shaft c is provided with an aperture, c', through which water is delivered from the shaft, the latter being supplied therewith at its top from a pipe, d, communicating with a source of supply under proper fall or pressure, as the case may be. Within the table there is also a vertical outlet-pipe, e, so that the water is discharged from the interior of the table from a level near its top, which insures a full supply of water and a constant circulation thereof. Below the table is a waste-tank, f, within which the table-shaft is stepped, as at c^2, and the lower end of the outlet-pipe e, as the table revolves, is always so situated that water therefrom is discharged into said tank and flows therefrom by way of a suitable drain-pipe, f'.

As thus far described, it will be understood that the melted salt delivered into the cup b' flows over its top edge or lip in a thin film upon the inclined cooling-surface of the table, whereon it is hardened or solidified and from which it may be removed, as with a hand-scraper operated at either side of the table. To obviate such hand work, however, I employ the scraper g, which includes an inclined rod or bar, g', supported at its upper and inner end by the revolving shaft c, on which are two collars, g^2, provided with set-screws, and at its outer or lower end said bar is supported by a post, g^3, which is slotted to receive a clamping-bolt. On said bar there are a series of scraping-plates, g^4, the edges of which are in proximity to the cooling-surface. Near the upper end of the bar g there is a scraper-plate, g^5, which is longer than the others, and projects into the cup b' and serves to keep its edge or lip free and clean, so that the salt can properly flow from the cup. The collars g^2 and the slot in the post g^3 enable accurate vertical adjustment of the scraping-plates, and as a rule it will be advisable that the lip-scraper g^5 be pivoted on the bar and provided with a clamp nut or screw, as indicated, for enabling it to be properly set at all times with relation to the lip of the cup. In operation, this table delivers the hardened salt below the lower end of the scraper in flakes or scales and lumps of small size, and in a convenient form for grinding.

The use of the spouts or pipes is obviously important for obtaining the most economic results; but I make special claim to this cooling-table, as shown and described, whether it be employed with or without said pipes, it being obvious that the melted salts may be transferred from the kettle to the table by means of a hand-ladle, and result in material economy, as compared with the prior use of stationary molds.

The cooling-table B′ is shown only in side elevation in Fig. 1; but its construction is so simple as to require but little explanation. It embodies two drums, h h', which may be skeletonized; or they may be hollow and water-tight and mounted upon hollow trunnions for the induction and eduction of water at available low temperatures. With this machine, however, good results will accrue if it be operated slowly, even if the cylinders be merely skeletonized, or if they be ordinary drums, because of moving the salt through the air, and also because of the capacity for rapid radiation and convection of heat by the endless belt or band i, the top of which affords the movable cooling-surface. This band is preferably composed of very thin metal, and the melted salts are slowly deposited on its surface from a spout in a broad thin sheet, and the bending of the belt or band in passing over the drum h causes the hardened salt to break, flake off, and fall upon the floor or into a suitable receptacle. As a rule, however, I prefer to employ with this type of cooling-table a scraper for keeping the surface of the table reasonably smooth and clean, and therefore, if a scraper be used, it can be placed at any point below the center of the drum h. The cooling-table B^2 has for its moving cooling-surface the smooth periphery of a large revolving water-tight cylinder, k, which has hollow trunnions and an induction cold-water pipe, k', at one bearing, and at the other bearing an eduction water-pipe. (Not shown.) Below the cylinder there is a shallow tank, l, into which at one end the melted salt is slowly delivered by way of the spout a from the kettle, so that as the cold cylinder revolves it takes up a film of the melted salt, and near the opposite end of the tank a scraper, g, is employed for removing the hardened salt from the cooling-surface. Of these three types of cooling-tables I prefer the table B, and make special claims thereto; but it is to be distinctly understood that I do not limit myself under the main feature of my invention to any precise construction of cooling-table, provided it embodies a movable cooling-surface and is organized, substantially as described, with kettles and pipes or tubes to operate as a labor-saving salt-drying apparatus.

It will be seen that with a group of kettles and one or more cooling-tables, as described, the drying process can be extensively carried on as a continuous operation, and that one or two persons only will be actually required to tend the fires, charge the kettles, and control the discharging-valves.

It is to be understood that I do not limit myself to smooth cooling-surfaces, it being obvious that they may be recessed or provided with cavities from which the salts will be dis-

charged in the form of cakes or ingots, because the gist of the main feature of my invention consists in the combination, with the melting-kettles, of means whereby the melted salts are hardened while moving from one point to another and the heat freely radiated and convected therefrom in transit, it being obvious that the movement of the salt after its deposit, as described, is conducive to a much more rapid radiation of heat than when the salt is deposited as heretofore in stationary molds.

With my apparatus two men can properly dry from fifteen to twenty thousand pounds of salt in ten hours, one cooling-table like that shown in Fig. 2 being employed.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The apparatus for drying fusible salts, substantially as hereinbefore described, and consisting of the combination of one or more suitable melting-kettles and furnaces, one or more mechanically-operated cooling-tables, and pipes or tubes for delivering the melted salts from the kettles to said tables.

2. The combination of the conical cooling-table having a central receptacle for melted salts and a scraper for keeping the edge or lip of said receptacle free from hardened salt, substantially as described, whereby the melted salt may freely flow over said lip and upon the inclined cooling-surface of the table, as set forth.

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Witnesses:

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ALBERT M. LYONS.