March 31, 1936. R. SIEGLER 2,035,990

PROCESS FOR MECHANICALLY PRODUCING COARSE CRYSTALLINE DEPOSITS

Filed April 6, 1934

Fig. 1.

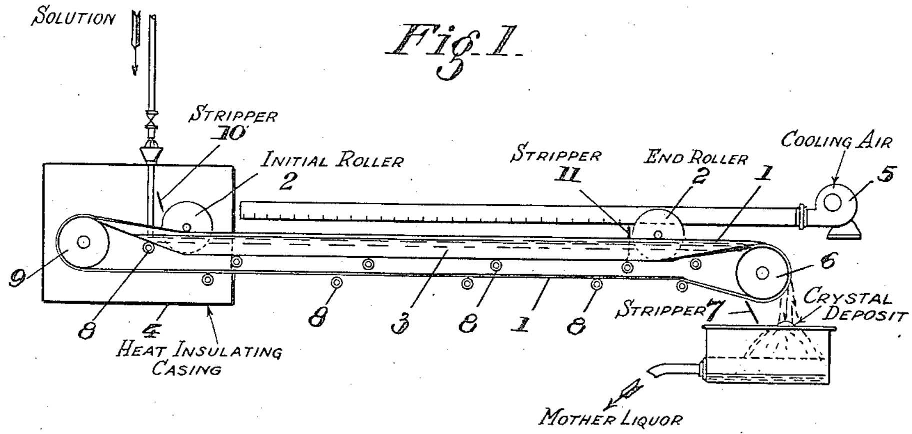


Fig. 2.

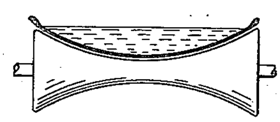


Fig. 3.

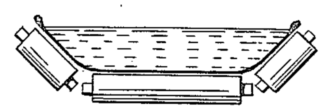
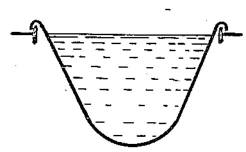


Fig. 4.



Inventor:
R. Siegler
By Marks & Clerk
Attys.

Patented Mar. 31, 1936

2,035,990

UNITED STATES PATENT OFFICE

2,035,990

PROCESS FOR MECHANICALLY PRODUCING COARSE CRYSTALLINE DEPOSITS

Robert Siegler, Stettin-Pommerensdorf, Germany, assignor of one-half to Aktien-Gesellschaft der Chemischen Produktenfabriken Pommerensdorf-Milch, Stettin, Germany

Application April 6, 1934, Serial No. 719,415
In Germany January 3, 1933

2 Claims. (Cl. 23—1)

According to the present state of the art if it is desired to obtain a fine crystalline deposit and individual crystals up to about pea size the crystallization operation is carried out with the liquid in motion, whilst in order to obtain coarse crystals the crystallization is effected from an absolutely tranquil liquid.

For carrying out tranquil crystallization a comparatively large quantity of solution is required, and a correspondingly large vessel capacity for the cooling. The growth of large crystals requires a long time, usually days and weeks. The completion of the deposition of crystals is followed, in separate operative stages, by the separation of the crystal deposit from the mother liquor, crushing, drying and sorting out of the large crystal lumps formed by crystals growing together. It has long been impossible directly to obtain large crystals from solutions by tranquil crystallization or crystallization with moving solutions while avoiding these bothersome manipulations.

The present process fills the gaps existing in the crystallization art as regards the crystal size of crystal deposits prepared mechanically and in tranquility. For carrying out the process the basic conditions for the growth of large crystals, viz. time and tranquillity, are applied to crystallization with motion. This is attained by creating a large cooling surface in order to accelerate the crystallization, but during the cooling of the solution any motion of the same with respect to the cooling walls of the crystallizer is limited as far as possible.

In order to carry out the process an endless band or belt guided uniformly over rollers is used, the upper part of said band being mounted so that it forms a trough. The trough formed by mounting in this way may be cooled on all sides by gas and also from underneath by liquid. The cross section of the trough may be suitably formed according to the nature of the mounting employed; the cross section is preferably like the segment of a circle, or trapezium-shaped, or parabolic. In order to produce crystal deposition which is as uniform as possible the flat trapezium shape is to be preferred. The circle segment form requires the simplest under-support. The parabolic cross section is produced by suspending the transport belt at the edges, the under-supports being wholly dispensed with.

Since at the reversal points the drive of the conveyor belt is effected from the inside, the upper side of the belt is naturally stretched out straight and consequently must be artificially shaped to acommodate a greater quantity of liquid. This is most simply effected by inserting rollers which press the transport belt against the roller under-supports or the suspension. Belt and rollers are protected when required by suitable strippers which keep the first rollers free from crystal deposit or remove the resulting crystal deposit from the belt prior to the end rollers in order to avoid the said deposit being spoiled by the rollers.

The crystallization operation is perfectly uniform and automatic. Owing to the very slow motion of the conveyor belt the power consumption is extraordinarily small. The endless belt, suitably shaped at the edges, may be made of rubber or some suitable metal, according to the chemical properties of the solution to be crystallized.

The accompanying drawing shows schematically by way of example an apparatus for carrying out the process according to the invention. In the drawing

Fig. 1 shows a longitudinal section through the apparatus,

Fig. 2 shows a cross section through a belt mounted so as to form a trough which in section is shaped like a segment of a circle having a corresponding under-support,

Fig. 3 shows a cross section through a belt mounted so as to form a trough which is trapezium shaped in section, having roller under-supports (cf. Fig. 1), and

Fig. 4 shows a cross section through a belt mounted with parabolic suspension.

The suspension shown in Fig. 4 is adapted for the production of particularly coarsely granular material, as well as for use when water cooling is to be employed.

The upper part of the belt **1** is brought into the necessary trough shape **3**, which ensures the maintenance of a certain liquid level throughout the whole length of the trough, by means of inserted rollers **2**. In this way the formation or growth of crystals corresponding to the depth of the liquid is rendered possible. The shape of the cross section of the trough affects the uniformity of the crystal deposit and the production of a uniform crystal deposit of definite size is best ensured by the use of a cross section of flat trapezium shape (Fig. 3).

In order to prevent undesired crystallization occurring at the place where the solution runs directly on to the band, the latter is protected from heat loss at this place by an enclosing structure **4** made of wood or the like. Water cooling is preferably accomplished by dipping the crystallization trough into a vessel, likewise trough-shaped, adapted to the shape of the crystallization trough, the cooling liquid advantageously moving in counter-current to the solution. The spontaneous surface cooling of the solution by the outer air may be promoted by means of a fan or blower **5**; it is also possible to cool down the belt at its under surface in the same way. The removal of the crystal deposit from the belt is effected automatically by change in shape of the trough e. g. its conversion into a flat belt and the curvature of the same over the driving or conveying pulleys **6**. Residues of crystal deposits and mother liquor still adhering to the belt are removed by a scraper **7**. The guiding rolls for the belt are indicated by **8**, the driving pulleys at the commencing end by **9**, the scraper at the commencing end by **10**, whilst **11** indicates a scraper before the second inserted roller **2**.

The substances to be crystallized (particularly in the case of the growth of crystal individuals) are obtained in the characteristic forms corresponding to their particular nature; for example, potassium chlorate is obtained in plates, sodium sulphate and magnesium sulphate in needles, that is to say, the salts are obtained with the typical characteristics of tranquil crystallization.

The size of the crystals is a function of the depth of the liquid layer in the belt and the nature of the cooling; by employing water cooling or air cooling, or a combination of both, the crystal size may be varied within wide limits, as a result of which the individual crystallographic properties of the body are sharply brought out.

The continuous operative nature of the process is still preserved even if the supply of solutions is temporarily interrupted in order to grow particularly large crystals.

It has already been proposed to use belts forming trough-shaped individual containers for the discontinuous production of crystals, the crystallization in the said containers proceeding tranquilly. At the conclusion of the crystallization in order to remove the resulting crystal deposit the shape of the belts, made partly of elastic or resilient material, was changed.

Such devices were still unsuited for the uniform uninterrupted production of coarse crystalline deposit by mechanical means.

What I claim is:—

1. A method of crystallizing a solution with continuous production of a coarse crystalline deposit consisting in supplying the solution to a continuously moving surface which is temporarily given a trough-like shape near the point at which the solution is supplied, and at a point removed from this in the path of the surface, changing the direction of the latter and simultaneously depriving it of its trough-like shape, and continuously removing the crystals from said surface at the place where the surface changes its direction.

2. A method of crystallizing a solution with continuous production of a coarse crystalline deposit consisting in supplying the solution to a continuously moving surface which is temporarily given a trough-like shape near the point at which the solution is supplied, conducting the trough shaped surface supporting the solution supplied past means adapted to promote cooling of the solution, and then changing the direction of the surface and simultaneously depriving it of its trough-like shape, and continuously removing the crystals from said surface at the place where the surface changes its direction.

ROBERT SIEGLER.