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BY A. P. C.

I. ISAACHSEN

CRYSTALLIZERS

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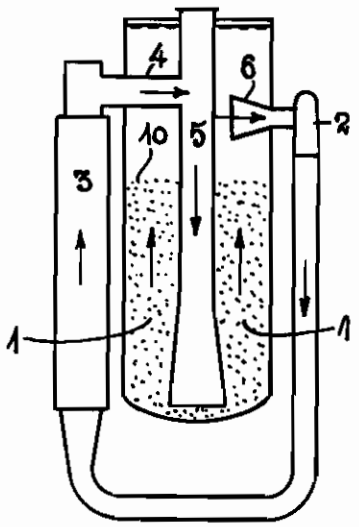

Fig. 1.

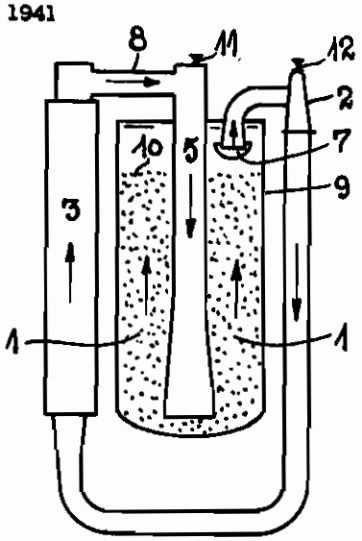

Fig. 2.

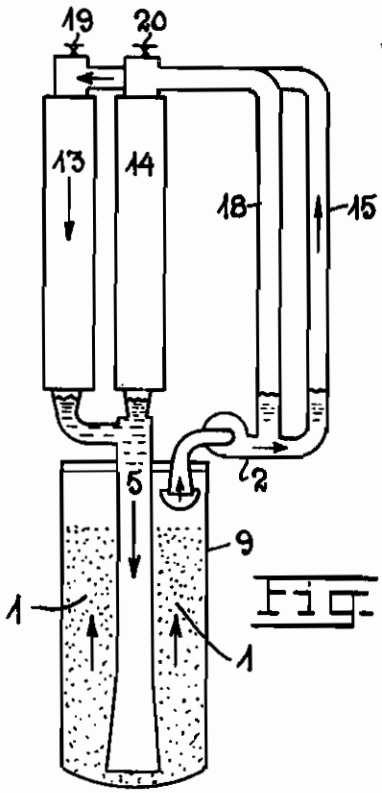

Fig. 3.

Inventor;
Isak Isaachsen

By: Glascock Downing & Seebold
Attys

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ALIEN PROPERTY CUSTODIAN

CRYSTALLIZERS

Isak Isaachsen, Oslo, Norway; vested in the Alien Property Custodian

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The present invention has for its object a crystallization apparatus of the type in which a solution is maintained in circulation by means of a pump through a crystallization vessel with a free level of liquid, through supersaturation means outside of the crystallization vessel and then in a supersaturated condition back into the crystallization chamber through a pipe downward to a point below a body of crystals in said chamber and thereupon in an upward direction through the said body of crystals.

As compared with known crystallizers of this type an important feature of the apparatus which is the object of the present invention consists therein that certain parts of the apparatus are arranged at such a level in relation to the free level of liquid in the crystallization chamber as to enable a reduced pressure to be maintained therein.

In the accompanying drawing, Fig. 1 is a diagrammatic sectional view of a crystallization apparatus of the known type outlined above. Fig. 2 is a diagrammatic sectional view of a crystallizer according to the invention.

Fig. 3 illustrates a modified arrangement.

By the use of the known type of crystallization apparatus as illustrated in Fig. 1, the operation is about as follows:

A body of crystals 1 is maintained in the suspension by forcing by means of a pump 2 a solution of the same substances as that of the crystals through some contrivance adapted to bring about a metastable supersaturation in the solution, such as for example a cooler 3, then through a horizontal connection pipe 4 and a tube 5 and therefrom up through the body of crystals 1 and back to the pump through the suction opening 6.

The present invention is based on the discovery that several important advantages can be attained by a modified arrangement, which has not previously been made use of, because at first glance it would seem to be only an unnecessary complication.

It is a characteristic feature of this arrangement that the pump is placed at such a height as will produce a partial vacuum in the same.

Another important feature of the arrangement consists therein that the cross section of the suction pipe at the inlet thereof below the level of the liquid has a substantially horizontal position.

Figures 2 and 3 of the drawing illustrate two different embodiments of the invention.

The crystallizers according to the invention are operated in substantially the same manner as the known crystallizer illustrated in Fig. 1, but the arrangement—as will be seen—differs therein that the suction pipe of the pump is passed up to above the surface of the liquid, as well as therein that the cross section of said pipe at its inlet opening 7 is not vertically, but horizontally disposed. Further the connection pipe 8, Fig. 2, between the cooler 3 and the pipe 5 is also situated above the level of liquid in the suspension vessel 9.

Obviously considerable drawbacks are involved by the necessity of operating at a reduced pressure (partial vacuum) in the centrifugal pump 2.

The arrangement involves the risk of air being sucked into the liquid at untight points; and in addition auxiliary air suction devices for use when starting the operation are necessary. These obvious inconveniences have hindered the experts from recognizing the below specified advantages attainable by the arrangement according to the invention. These advantages greatly outweigh the inconveniences involved:

I. The cross section area 7 of suction intake need not be situated much higher above the upper boundary 10 of the crystal suspension than the bottom edge of the vertical suction inlet opening 6 illustrated in Fig. 1, where the locally greater velocities of liquid cause small crystals to be drawn up from the suspension surface 10. The suspension vessel therefore already for this reason can be built approximately so much lower as what corresponds to the diameter of the suction opening 6 of Fig. 1.

II. The horizontal edge of the suction inlet 7 will cause no whirls about a vertical axis to be produced, and is much less capable of sucking air down from the surface of the liquid than is the opening in Fig. 1, which has a strong tendency in this respect. Also for this reason, therefore, it will be possible to keep the liquid at a substantially lower level, and this again means a saving in the height of the suspension vessel. Such reduction in height does not only involve a direct saving in cost in view of the expensiveness of the material of which the suspension vessel must frequently be made when corrosive liquids are treated, but there is involved also an indirect saving in plant and manufacturing costs, because smaller quantities of liquid are needed to fill the apparatus. In addition smaller containers are needed for temporary storage of the liquid during operation pauses for cleaning or repair of the apparatus.

What has been said with relation to an apparatus with cooler is pertinent also in connection

with apparatus with other means for creating supersaturation, for example by means of evaporation under vacuum or by a chemical process.

III. The circulating liquid frequently has a tendency to form coatings in the cooler pipes, so that it is of great importance to be able to cleanse these pipes without long lasting interruption of operation. By the arrangement hitherto known this has not been the case, because the cooler through pipe 4 (Fig. 1) and the suction pipe 6 of the pump communicated with the liquid in the suspension vessel. It would be necessary either to draw out large quantities of solution from the suspension vessel in order to have the cooler completely or partly emptied, or stop valves would have to be inserted in the pipes 4 and 6. Apart from the increased cost, this latter arrangement would be undesirable in view of the supersaturated solution which has to be employed in all crystallizers, because such valves lead to the formation of dead spaces wherein small crystals may be retained, grow and cause obstructions.

When using applicant's arrangement according to Fig. 2, one needs only, after shutting down the pump 2, to let air into pipe 5 through the cock 11 in order to lower the surface of liquid in the cooler 3 to the extent that the upper end of the pipes becomes visible. It is usually at this end of the pipes that the greatest risk of coatings being formed is experienced. It is then also easy to cleanse the pipes and to control the cleansing operation.

Further, if air is also let into pump 2 by means of a cock 12, it is possible when required to withdraw the solution from the cooler 3, without it being necessary to draw off liquid from the suspension vessel 9.

Fig. 3 of the drawing illustrates by way of another example how the advantages mentioned under point III may be attained with still greater perfection than by the arrangement of Fig. 2.

In order that a complete cleansing can be performed without interruption of the operation, two coolers 13 and 14 are arranged, of which one may be in operation while the other one is cut out.

By the arrangement of the pump above the level of liquid, the necessity of inserting stop valves in the circulating pipes is avoided. From the pump 2 the liquid may be forced either through pipe 15 and cooler 13 or through pipe 18 and cooler 14, or also through both coolers in parallel.

Cutting out one of the coolers is simply done by opening the air cock 19 or 20 respectively of the cooler in question. If, for example, the air cock 20 is opened, the solution in the cooler 14 and pipe 18 sinks right down to the level of the liquid in container 8 plus a height which corresponds to the resistance caused by the pump continuing to force liquid through pipe 15, cooler 13, pipe 3 and suspension 1. Through the cooler 14 nothing passes, because the liquid in pipe 18 does not rise high enough to reach the upper end of the cooler.

An arrangement according to Fig. 2 as well as one according to Fig. 3 is contingent upon a contrivance being available for sucking air out through the air cocks, when the circulation is to be started.

ISAK ISAACHSEN.