Dec. 21, 1943. W. H. EGGERT 2,337,317

COOLING APPARATUS

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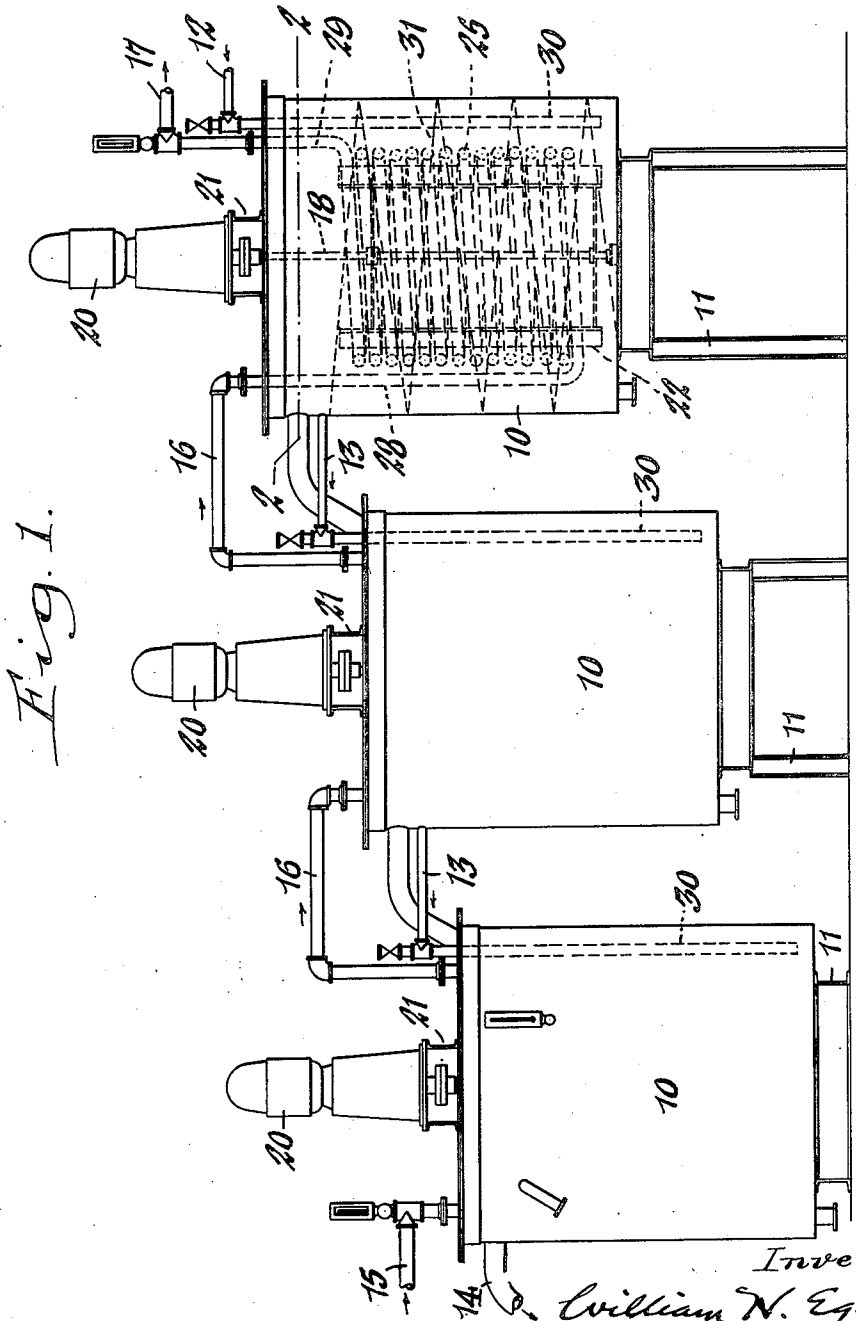


Fig. 1.

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Fig. 2.

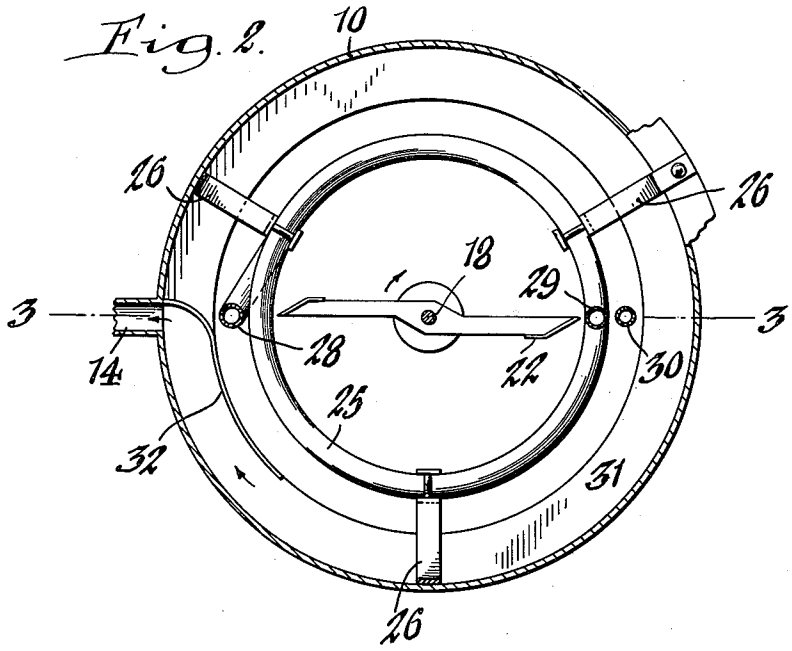


Fig. 3.

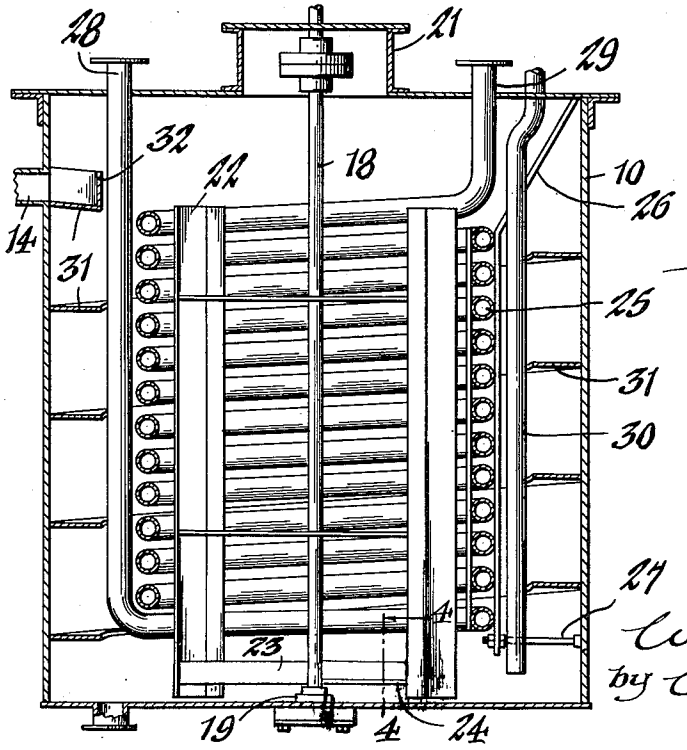
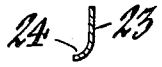


Fig. 4.



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UNITED STATES PATENT OFFICE

2,337,317

COOLING APPARATUS

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8 Claims. (Cl. 62—124)

This invention relates generally to certain new and useful improvements in cooling apparatus but more particularly to an apparatus designed for the cooling of liquors containing salts and in the separation of the crystals from such solution.

It has for one of its objects to provide an apparatus of this character which is so designed and constructed as to not only effectually cool the liquor undergoing treatment but at the same time circulate the liquor-content so that the crystals are built up to a maximum size and separated therefrom in a continuous process.

Another object of the invention is to provide a liquor cooling apparatus having novel means for continuously circulating the liquor into intimate contact with the cooling elements and to circulate the larger separated crystals upwardly to a point of discharge, while the smaller crystals remain in suspension in the liquor and are built up in size by their continuous circulation until separated out.

Other features of the invention reside in the construction and arrangement of parts hereinafter described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a side elevation of my improved cooling apparatus showing the same composed of a plurality of individual units. Figure 2 is an enlarged horizontal section of one of the cooling units taken substantially in the plane of line 2—2, Figure 1. Figure 3 is an enlarged vertical section thereof taken in the plane of line 3—3, Figure 2. Figure 4 is a cross section taken on line 4—4, Figure 3.

Similar characters of reference indicate corresponding parts throughout the several views.

By way of example, I have shown in Figure 1 a plurality of the improved cooling units operatively connected in series, although it is to be understood that my invention may, if desired, be operated as an individual unit, the advantage of the series arrangement being that the liquor is in the coolers a greater length of time and as the time element enters into the building of crystals, it is obvious that the crystals will be larger in size from the final cooler of the series. In this Figure, 10 indicates the tanks in which the liquor is cooled and agitated, the tanks being supported at successively lower elevations on base frames 11, the liquor being introduced at 12 to the tank of highest elevation, and, after undergoing cooling in that tank, it is circulated to the other tanks of the group through the overflow connecting pipes 13, the cold liquor with the built-up crystals being finally discharged through the outlet 14 of the tank of lowest elevation. The cooling medium, which may be cold water, is circulated in a counter direction through the tanks, being introduced at 15 to the tank of lowest elevation and circulated through the remaining tanks by connecting pipes 16 and finally discharged through the outlet 17 of the tank of highest elevation.

Each of these cooling tanks is so constructed as to carry the coarser-formed crystals upward to a point where they are entrained and then discharged, while the smaller crystals remain in suspension in the liquor solution and are built up in size by their continuous circulation in the liquor until they are of such a size as to be carried upwardly and discharged from the tank. By preference, each of the tanks is constructed as follows:

Disposed axially of the tank 10 is an upright agitator shaft 18 which is journaled at its lower end in a suitable bearing 19 and connected at its upper end to a motorized speed reducer unit 20 mounted on a transverse support 21 applied to the upper end of the tank. Secured to this shaft for operation in the tank is a vertical agitator including a plurality of upright blades 22 which extend substantially from the bottom to the top of the tank and rotate at a high velocity to continuously and thoroughly circulate the liquor around the cooling coils in the tank. At its lower end and operating adjacent the bottom of the tank, the shaft has a substantially radially-disposed agitator arm or flight 23 having its lower edge curved, as indicated at 24, and functioning to keep all suspended matter in suspension during the cooling process. The curved edge of this agitator arm acts to scoop up any salt in the bottom of the tank to prevent its accumulating on such bottom and to keep it in continuous circulation with the liquor to build up the crystals.

The means for cooling the liquor in the treating tank consists of a circulating coil 25 for water or like cooling medium disposed concentrically of the tank in spaced relation thereto and immediately about the agitator 22, and suspended from the top of the tank by suitable straps 26 and rigidly held in place at its lower end by stay bolts 27. The upper end of this coil has its inlet branch 28 connected to the water inlet 15 while the opposite end thereof has its outlet branch 29 connected to the water outlet 17.

The liquor is introduced into the tank 10 and discharged into the lower end thereof by a pipe 30 which is preferably located outwardly of the cooling coil 25. The cold liquor outlet 14 is disposed at the upper end of the tank and is arranged so as to discharge in the direction that the agitator 22 is turning.

During the continuous circulation of the liquor in the tank by the agitator about and in intimate contact with the cooling coil to effect a maximum heat transfer and a relatively rapid cooling of the liquor, crystals are formed and

with the cooling of the liquor the crystals increase in size, and an effective means is provided for separating and carrying the coarser or large size crystals upward to a point where they are discharged through the cold liquor outlet 14. This means for effecting the separation and upward travel of the larger crystals consists of a spiral or helix vane or flight 31 extending about the inner wall of the tank and from the bottom thereof to a point adjacent the liquor outlet. At this point the spiral flight is provided with an upright portion or deflector wall 32 projecting from the inner edge thereof and extending part way around the tank, resulting in the formation of an entraining channel or chamber into which the larger crystals are finally guided and from which they are discharged through the liquor outlet 14 into the pipe 13 connected to the adjoining tank of the series. By this construction the larger crystals are carried by centrifugal force to the outer side of the tank where they are carried upward by the spiral flight 31 to the cool liquor outlet 14, whereas the smaller crystals remain in the circulating liquor and continue their growth.

While manifestly simple, compact and inexpensive in construction, this apparatus is efficient and reliable in the continuous process or operation of cooling liquors containing salts or other suspended matter, such as caustic soda and caustic potash, and other crystallizing solutions, and at the same time building up the crystals to a large size and thereupon separating and directing them upwardly to a point of discharge while recirculating the smaller crystals and keeping them in suspension until built up to a size when separation takes place.

I claim as my invention:

1. An apparatus of the character described, comprising a liquor-receiving tank having an inlet and an outlet for the liquor, a coil in the tank for cooling the liquor to build up crystals therein, means in said tank for circulating the liquor therein, and a helix flight in said tank and disposed concentrically about the coil for separating and directing the larger-size crystals upwardly through the body of the liquor to said tank-outlet.

2. An apparatus of the character described, comprising a liquor-receiving tank having an inlet and an outlet for the liquor, means in the tank and spaced from the inner wall thereof for cooling the liquor to build up crystals therein, agitating means in said tank for circulating the liquor around the cooling means, and means extending about the tank and in the space between the same and said cooling means for separating and directing the larger-size crystals upwardly through the body of the liquor to said tank-outlet.

3. An apparatus of the character described, comprising a liquor-receiving tank having an inlet and an outlet for the liquor, means in the tank and spaced from the inner wall thereof for cooling the liquor to build up crystals therein, agitating means in said tank for circulating the liquor around the cooling means, and means extending spirally about the inner wall of the tank in the space between it and said cooling means and from substantially the bottom thereof to a point adjacent said tank-outlet for conducting the larger-size crystals upwardly through the body of the liquor and toward said outlet.

4. An apparatus of the character described, comprising a liquor-receiving tank having an inlet and an outlet for the liquor, a cooling coil in the tank and spaced from the inner wall thereof for cooling the liquor to build up crystals therein, a rotatable agitator disposed axially of the tank and within said cooling coil for circulating the liquor about the same, and means extending spirally about the inner wall of the tank in the space between it and the cooling coil and from substantially the bottom thereof to a point adjacent said tank-outlet for conducting the larger-size crystals upwardly through the body of the liquor and toward said outlet.

5. An apparatus of the character described, comprising a liquor-receiving tank having an inlet and an outlet for the liquor, means in the tank and spaced from the inner wall thereof for cooling the liquor to build up crystals therein, agitating means in said tank for circulating the liquor around the cooling means, and means extending spirally about the inner wall of the tank in the space between it and said cooling means and from substantially the bottom thereof to a point adjacent said tank-outlet for conducting the larger-size crystals upwardly through the body of the liquor and toward said outlet, said crystal-conducting means terminating at its upper end adjacent the tank-outlet in an entraining wall for directing the crystal through said outlet.

6. An apparatus of the character described, comprising a liquor receiving tank having an inlet and an outlet for the liquor, means in the tank for cooling the liquor to build up crystals therein, means in said tank for circulating the liquor around the cooling means, and a spiral flight extending around the inner wall of the tank from the bottom thereof to a point adjacent the tank-outlet for directing the crystals to the latter.

7. An apparatus of the character described, comprising a liquor-receiving tank having an inlet and an outlet for the liquor, means in the tank for cooling the liquor to build up crystals therein, means in said tank for circulating the liquor around the cooling means, and a spiral flight extending around the inner wall of the tank from the bottom thereof to a point adjacent the tank-outlet for directing the crystals to the latter, the upper end of said flight having a flange at its inner edge forming with the adjoining tank-wall an entraining channel for receiving the crystals and conducting them to said tank-outlet.

8. An apparatus of the character described, comprising a liquor-receiving tank having an inlet and an outlet for the liquor, means in the tank and spaced from the inner wall thereof for cooling the liquor to build up crystals therein, agitating means in said tank for circulating the liquor around the cooling means, said agitating means including a substantially radial arm at its lower end having its lower edge curved in scoop-like fashion to keep any suspended matter in the bottom of the tank in continuous circulation, and means extending about the tank and in the space between the same and said cooling means for separating and directing the larger-size crystals upwardly through the body of the liquor to said tank-outlet.

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