A. W. WAERN.

EVAPORATOR.

APPLICATION FILED AUG. 11, 1916.

1,228,855.

Patented June 5, 1917.

4 SHEETS—SHEET 1.

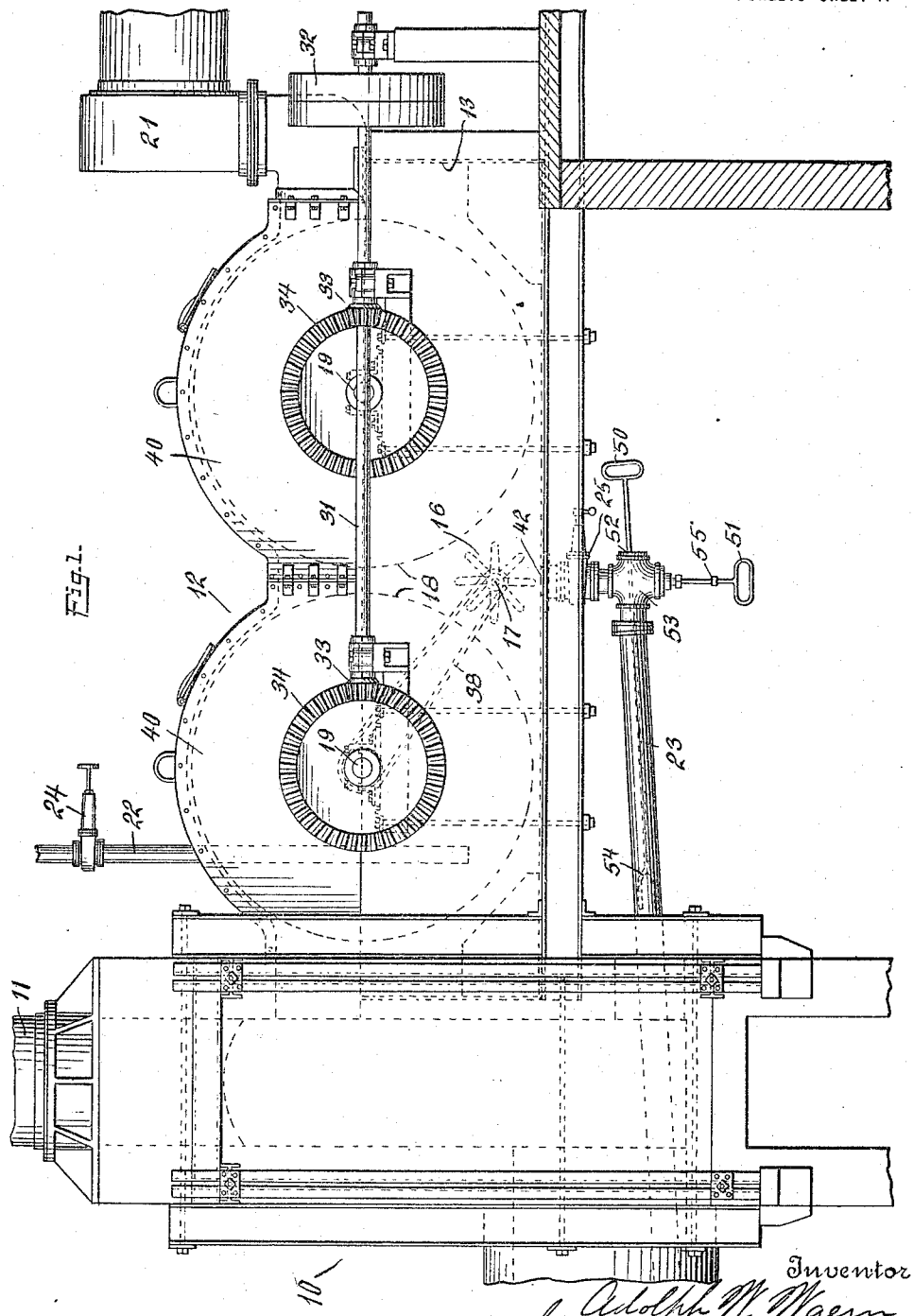


Fig. 1.

Inventor
Adolph W. Waern
By his Attorney
E. W. Marshall

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

A. W. WAERN.

EVAPORATOR.

APPLICATION FILED AUG. 11, 1916.

1,228,855.

Patented June 5, 1917.

4 SHEETS—SHEET 2.

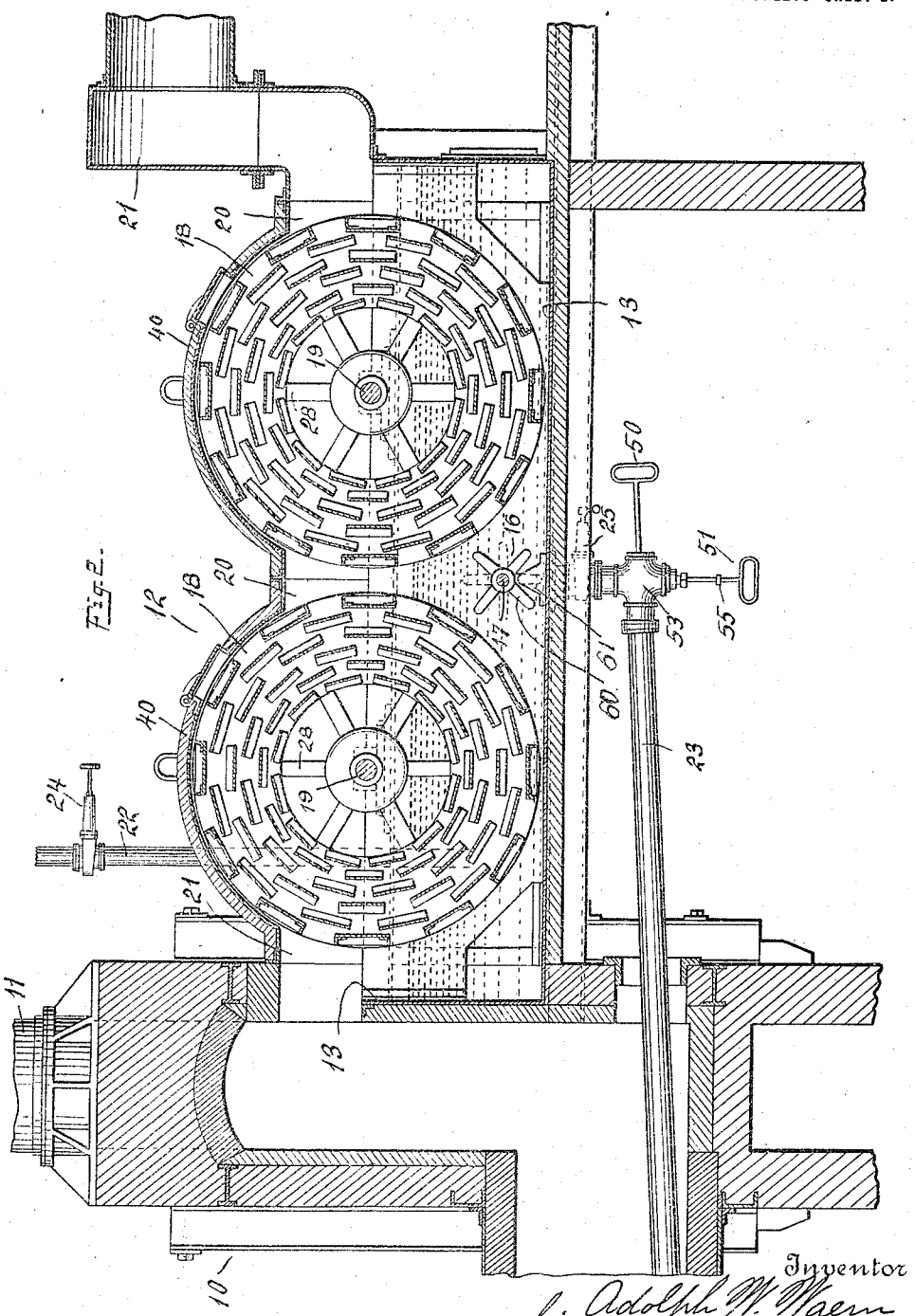


Fig. 2.

Inventor

J. Adolph W. Waern

By his Attorney

E. W. Marshall

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

A. W. WAERN.

EVAPORATOR.

APPLICATION FILED AUG. 11, 1916.

1,228,855.

Patented June 5, 1917.

4 SHEETS—SHEET 3.

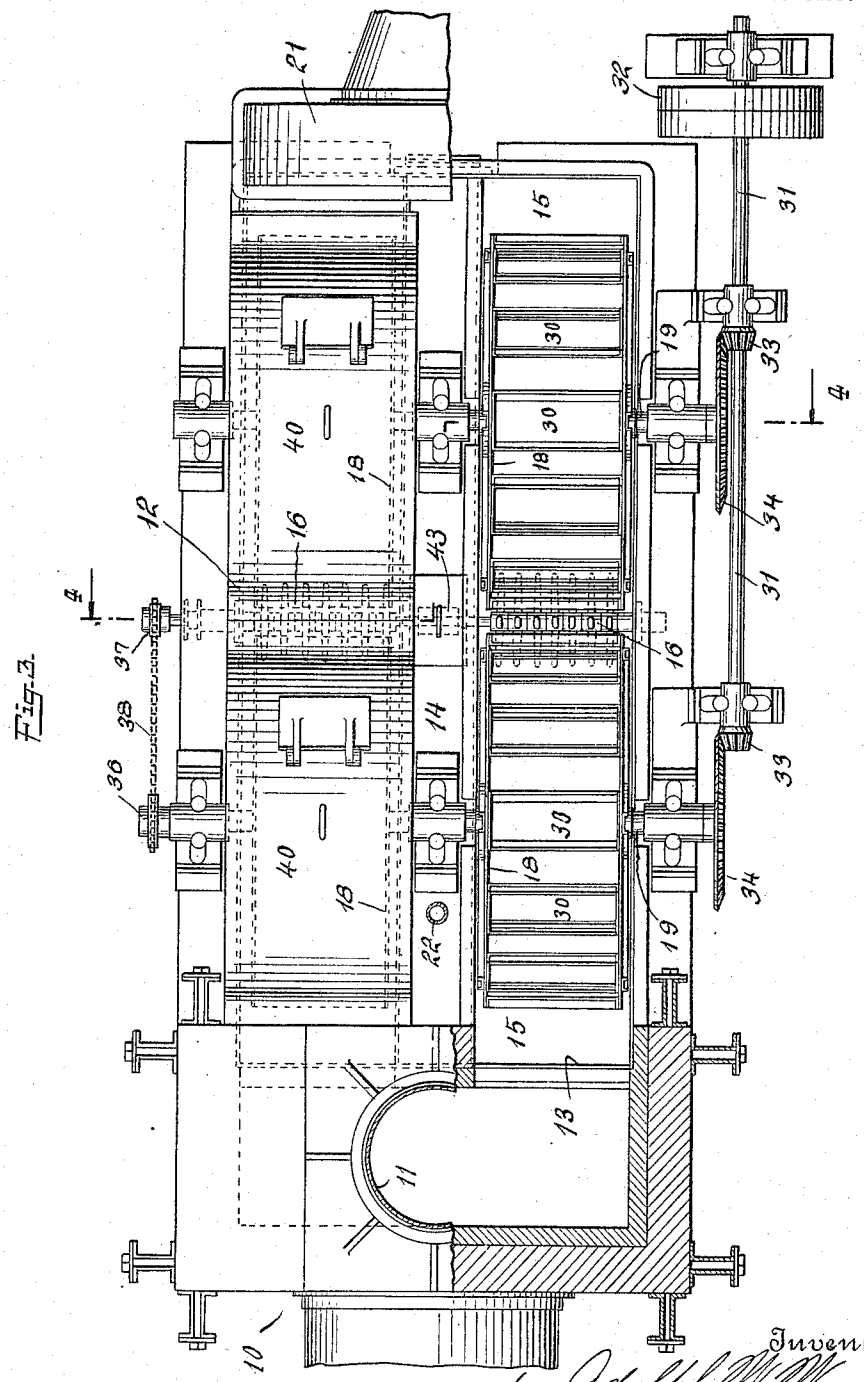


Fig. 3.

Inventor
Adolph W. Waern
By his Attorney
E. W. Marshall

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

A. W. WAERN.

EVAPORATOR.

APPLICATION FILED AUG. 11, 1916.

1,228,855.

Patented June 5, 1917.

4 SHEETS—SHEET 4.

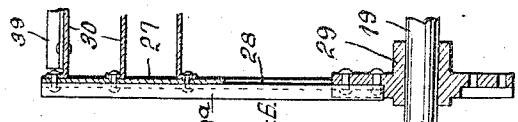


Fig. 6.

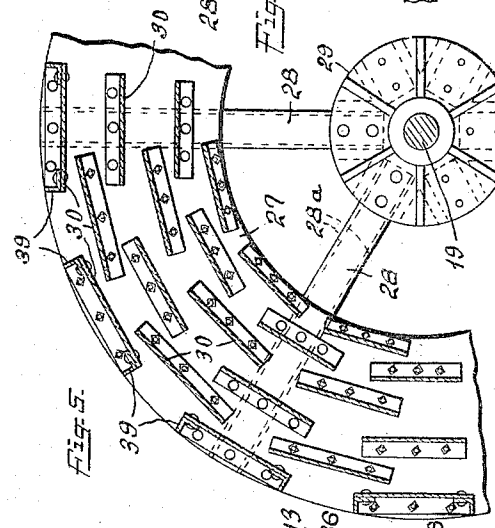


Fig. 5.

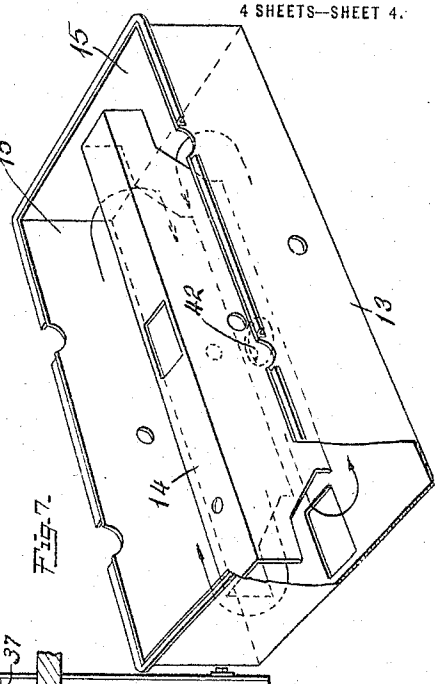


Fig. 7.

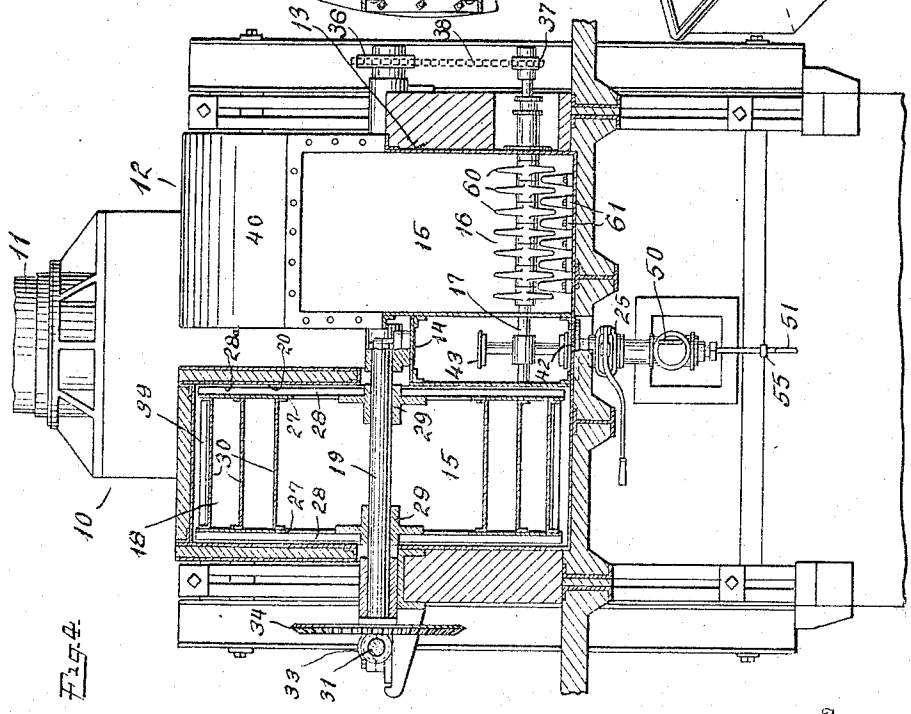


Fig. 4.

Inventor

Adolph W. Waern

By his Attorney

E. W. Marshall

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ADOLPH W. WAERN, OF NEW YORK, N. Y., ASSIGNOR TO INTERNATIONAL PROCESS COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

EVAPORATOR.

1,228,855. Specification of Letters Patent. Patented June 5, 1917.

Application filed August 11, 1916. Serial No. 114,323.

To all whom it may concern:

Be it known that I, ADOLPH W. WAERN, a citizen of the United States, and a resident of New York, county and State of New York, have invented certain new and useful Improvements in Evaporators, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to evaporators and particularly to apparatus for the recovery of soda ash by collecting it from the gases given off from soda ash furnaces and the like.

One object of my invention is to provide a relatively simple and particularly effective apparatus of the character above indicated that shall be arranged to contain the liquor to be evaporated, together with one or more revolving baffle wheels arranged to dip into the liquor and then to be exposed, when wet, to the hot gases from the furnace.

Another object is to provide such an apparatus having baffle wheels in which the baffle plates are particularly adapted to serve as dust catchers, for the purpose of removing the soda ash dust which is carried over by the gases.

Still another object is to provide means for circulating the liquor in the apparatus in a particularly desirable manner, dependent upon the baffle wheels.

In order that my invention may be thoroughly understood, I will now proceed to describe the same in the following specification, and then point out the novel features thereof in appended claims.

Referring to the drawings:

Figure 1 is a front elevation illustrating a soda recovery furnace, equipped with the apparatus of my invention.

Fig. 2 is a sectional elevation of the apparatus of Fig. 1, illustrating the interior mechanism. The same apparatus is shown in partially sectional plan in Fig. 3, and

Fig. 4 is a sectional elevation taken on the line 4—4 of Fig. 3.

Fig. 5 is a detail view showing a portion of one of the baffle wheels in end elevation.

A partially sectional elevation of the wheel is shown in Fig. 6.

Fig. 7 is a perspective view showing the tank which contains the liquor, and indicating the direction of circulation therethrough.

Like parts are designated by the same reference characters in all the figures.

10 designates furnace flues from which the soda ash is to be collected and 11 the bypass through which the gases may escape to the stack when it is desired to cut off the evaporator 12. This evaporator comprises a tank or receptacle 13 which is clearly shown, apart from the remainder of the apparatus in the perspective view of Fig. 7. It has a hollow longitudinal chamber or partition 14 which provides a passage communicating with the tank only at its respective ends. As hereinafter explained, the liquor in the tank is made to circulate in one direction through the inclosed passage and in the opposite direction in the chambers 15 of the tank which are spaced apart by the partition 14. The flow of liquor is clearly indicated by the arrows in Fig. 7.

The circulation of liquid in the chambers 15 and through the passage 14, is maintained by radial projections which act like propellers and form parts of the baffle wheels as hereinafter explained.

A pair of rotary crushers 16 are immersed in the liquid in the tank. They are substantially in the central transverse plane of the tank and hence do not interfere with the rotation of the baffle wheels 18 which are secured to transverse shafts 19 as clearly shown in Figs. 2 and 4. The baffle wheels dip into the liquor in the tank chambers 15, being arranged in pairs on opposite sides of the circulation passage or partition 14. They are large in diameter relative to the depth of the tank however, and extend materially above the tanks into sections 20 of a gas passage 21. Weak liquor is continuously supplied at a predetermined rate through a pipe 22 to hold the liquid in the tank at a predetermined level, the concentrated liquid being continuously discharged at a predetermined constant rate through a discharge pipe 23. A valve 24 controls the pipe 22, and a valve 25 the outlet pipe 23. The latter is adapted to be cleaned by scrapers 50 and 51 as shown in Fig. 2.

The scraper 50 comprises a rod having a handle at its outer end and arranged to slide through a suitable packing in a head 52, in coupling 53 of the outlet pipe. The inner end of the rod is forked as indicated at 54 in

broken lines, and is arranged to make contact with the inner walls of the pipe so that a pipe may readily be cleaned by moving the scraper 50 back and forth.

The short section of the outlet pipe from the outlet opening 42 to the connection 53, is cleaned by the scraper 51 which is similar in form to the scraper 50, but has a stop 55 to prevent the inner end of the scraper from extending through the opening 42 into the path of movement of a rotary scraper 43.

This rotary scraper is mounted in the hollow partition of the tank on the same shaft with the rotary crushers 16 and serves to clean the opening 42.

The baffle wheels 18 are similar to each other and as shown in Figs. 4, 5 and 6, each of them comprises a pair of end plates or disks 27 secured to radial spokes 28 which in turn are secured to hub members 29. The disks are spaced apart by baffle plates 30, having upturned ends and bolted or riveted to the end plates or disks 27. The plates are arranged in groups, those of each group being at right angles to a radial plane. Those plates which are in line with the spokes of the baffle wheel are preferably riveted to the end plates and to the spokes so that they constitute a permanent part of the structure while the remaining baffle plates are removably held in place by bolts.

The flue or passage sections 20 are formed to fit closely over the baffle wheels as clearly shown in Fig. 2, the arrangement being such that the gases as they traverse the passage from the furnace, must necessarily come in contact with the baffle plates 30. As already explained the wheels dip into the liquor in the tank chambers 15 and the liquid level therein is sufficiently high to immerse all of the baffle plates 30 as the wheel is rotating. In other words, the plates are first wet in the liquor in the tank and then travel upward into the path of the hot gases from the furnace. The hot gases, therefore, tend to rapidly evaporate the water and concentrate the liquor. The wet plates are also adapted to collect the soda ash dust which is carried over with the gas.

The baffle wheels are driven by any suitable means such as a driving shaft 31, to which a driving pulley 32 is secured, the driving connection being established by beveled pinions 33 on the shaft 31 and beveled gears 34 on the beveled wheel shaft 19.

The shaft 17 of the rotary crushers and the rotary scraper 43 is operatively connected to one of the shafts 19 by sprocket wheels 36 and 37 and a chain or belt 38.

The evaporators are generally operated continuously; that is, a flow of weak liquid is continuously fed to the evaporator and the concentrated liquor is continuously discharged from the evaporator into a recovery furnace (not shown). The valve 24 in the feed pipe regulates the flow so as to get a proper concentration in the liquor and the valve 25 regulates the rate at which the concentrated liquor is discharged.

Attention is particularly directed to the fact that in the baffle wheel structure of my invention there are no long bolts or rods, the baffle plates being directly bolted or riveted to the end rings and supported from the shaft by means of hubs and rugged spokes preferably formed of channel irons.

Each of the baffle plates at the periphery of the wheel is provided with angle irons 39 or other suitable means at its edges to stiffen the plate and act as propeller vanes to create circulation of liquor in the tank chambers. The circulation is assisted by the channel iron spokes 28 of the wheel which have outwardly extending flanges 28ª.

It has been found, especially in handling liquid from very resinous woods, that large lumps of resin develop in the evaporator on account of acid gases precipitating the resin which has been held in solution by the free sodium carbonate in the liquor. Such lumps are likely to close the outlet pipe through which the concentrated liquid escapes and clog the spaces between the plates; in fact, may even break the machine.

The rotary crushers 16 comprise a plurality of rows of radial projections or fingers 60, extending outwardly from a central hub or hubs, and a plurality of coöperating stationary fingers 61 which extend between the projections or fingers of the rotatable member as shown in Fig. 4.

These difficulties are overcome in the evaporator of my invention by the rotary crushers and by the cleaners 50 and 51 and the rotary scraper 43.

The circulation effected by the vanes or propellers, also tends to prevent the development or formation of lumps. Since the larger proportion of the baffle plates may be removed from the baffle wheel the evaporator is easy to clean. This is particularly so because the casings which complete the air flue sections 20, are provided with covers 40 which may readily be lifted off.

If an economizer is employed with the furnace, the evaporator is placed between the economizer and the stack.

By reason of the evaporation of the liquor the temperature of the gases is very materially reduced and consequently it may be necessary to employ a fan or other well known means for creating a forced draft.

The evaporator may be provided with only a single set of baffle wheels, or more than two sets may be employed, if desired; in fact, the structure illustrated may be modified in various ways within the spirit and scope of my invention, and I intend that only such limitations be employed as are indicated in appended claims.

What I claim is:

1. An evaporator for recovering soda ash comprising a tank having a hollow central longitudinal partition open at its ends, a pair of baffle wheels rotatable on a transverse axis and dipping into the tank on opposite sides of the partition, and means for directing furnace gases through the baffle wheels.

2. An evaporator for recovering soda ash comprising a tank having a hollow central longitudinal partition open at its ends, a pair of baffle wheels rotatable on a transverse axis and dipping into the tank on opposite sides of the partition, and means for directing furnace gases through the baffle wheels, each baffle wheel comprising a plurality of plates mounted in parallel groups at right angles to radial planes.

3. An evaporator for recovering soda ash comprising a tank having a hollow central longitudinal partition open at its ends, a pair of baffle wheels rotatable on a transverse axis and dipping into the tank on opposite sides of the partition, and means for directing furnace gases through the baffle wheels, each baffle wheel comprising annular end plates, and interposed baffle plates mounted in tangential planes.

4. An evaporator for recovering soda ash comprising a tank having a hollow central longitudinal partition opening into the body of the tank at its ends, a pair of baffle wheels rotatable on a transverse axis and dipping into the tank on opposite sides of the partition and having propellers for producing a circulation of liquor through the tank in one direction and back through the partition.

5. An evaporator comprising a liquid containing tank having a hollow central longitudinal partition providing an intermediate passage communicating with the tank at its respective ends and dividing the tank into a pair of spaced chambers, a plurality of pairs of baffle wheels, the wheels of each pair being mounted on a transverse axis on opposite sides of the partition in the respective chambers of the tank and dipping into the liquor in the tank, said baffle wheels comprising propeller vanes for producing a circulation of liquor through the chambers of the tank in one direction and back through the partition.

6. An evaporator comprising a liquid containing tank having a hollow central longitudinal partition providing an intermediate passage communicating with the tank at its respective ends and dividing the tank into a pair of spaced chambers, a plurality of pairs of baffle wheels, the wheels of each pair being mounted on a transverse axis on opposite sides of the partition in the respective chambers of the tank, and dipping into the liquor in the tank, said baffle wheels comprising annular end plates, interposed tangential baffle plates removably secured thereto having outwardly extending flanges constituting vanes or propellers for circulating liquid in the tank, the baffle plates being arranged to provide a tortuous path for hot gases above the liquid.

7. An evaporator for recovering soda ash comprising a tank, a baffle wheel rotatable on a transverse axis and dipping into the tank, and a rotatable crusher in the tank near the lower part of said baffle wheel.

8. An evaporator for recovering soda ash comprising a tank, a baffle wheel rotatable on a transverse axis and dipping into the tank, and a crusher in the tank near the lower part of said baffle wheel, said crusher comprising a plurality of stationary fingers and a plurality of radially disposed fingers rotatable between said stationary fingers.

9. An evaporator for recovering soda ash comprising a tank, an outlet therefor, a baffle wheel rotatable on a transverse axis and dipping into the tank, and a rotary scraper over said outlet.

10. An evaporator for recovering soda ash comprising a tank having a hollow central longitudinal partition open at its ends, a pair of baffle wheels rotatable on a transverse axis and dipping into the tank on opposite sides of the partition, means for directing furnace gases through the baffle wheels, and a pair of rotatable crushers in the tank near the lower part of said baffle wheels.

11. An evaporator for recovering soda ash comprising a tank having a hollow longitudinal partition open at its ends, an outlet for said tank within said partition, a pair of baffle wheels rotatable on a transverse axis and dipping into the tank on opposite sides of the partition, means for directing furnace gases through the baffle wheels, a transverse shaft extending through said partition, a pair of rotary crushers on said shaft, one near the lower part of each baffle wheel, and a rotary scraper on said shaft within the partition and over said outlet.

12. An evaporator for recovering soda ash comprising a tank having a hollow central longitudinal partition open at its ends, an outlet for said tank within said partition, a pair of baffle wheels rotatable on a transverse axis and dipping into the tank on opposite sides of the partition, means for directing furnace gases through the baffle wheels, a transverse shaft extending through said partition, a pair of transverse rows of stationary fingers in the tank under said shaft, a pair of rotary crushers comprising radially disposed fingers on said shaft, and a rotary scraper on said shaft within the partition and over said outlet.

13. An evaporator comprising a liquid

containing tank having a hollow central longitudinal partition providing an intermediate passage communicating with the tank at its respective ends and dividing the tank into a pair of spaced chambers, a plurality of pairs of baffle wheels, the wheels of each pair being mounted on a transverse axis on opposite sides of the partition in the respective chambers of the tank and dipping into the liquor in the tank, an outlet for said tank within said partition and between the pairs of baffle wheels, a pair of rows of transverse fingers in the tank in the side chambers of said tank under said transverse shaft, a pair of rotary crushers comprising radially disposed fingers on said shaft, and a rotary scraper on said shaft within the partition and over said outlet.

14. An evaporator for recovering soda ash comprising a tank, an outlet therefor, a baffle wheel rotatable on a transverse axis and dipping into the tank, a rotary scraper over said outlet, a discharge pipe connected with said outlet, and a manually operable scraper within said discharge pipe.

15. An evaporator comprising a liquid containing tank having a hollow central longitudinal partition providing an intermediate passage communicating with the tank at its respective ends and dividing the tank into a pair of spaced chambers, a plurality of pairs of baffle wheels, the wheels of each pair being mounted on a transverse axis on opposite sides of the partition in the respective chambers of the tank and dipping into the liquor in the tank, an outlet for said tank within said partition and between the pairs of baffle wheels, a pair of rows of transverse fingers in the tank in the side chambers of said tank under said transverse shaft, a pair of rotary crushers comprising radially disposed fingers on said shaft, a rotary scraper on said shaft within the partition and over said shaft, a discharge pipe connected with said outlet, and a manually operable scraper within said discharge pipe.

In witness whereof, I have hereunto set my hand this 10 day of August, 1916.

ADOLPH W. WAERN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."