

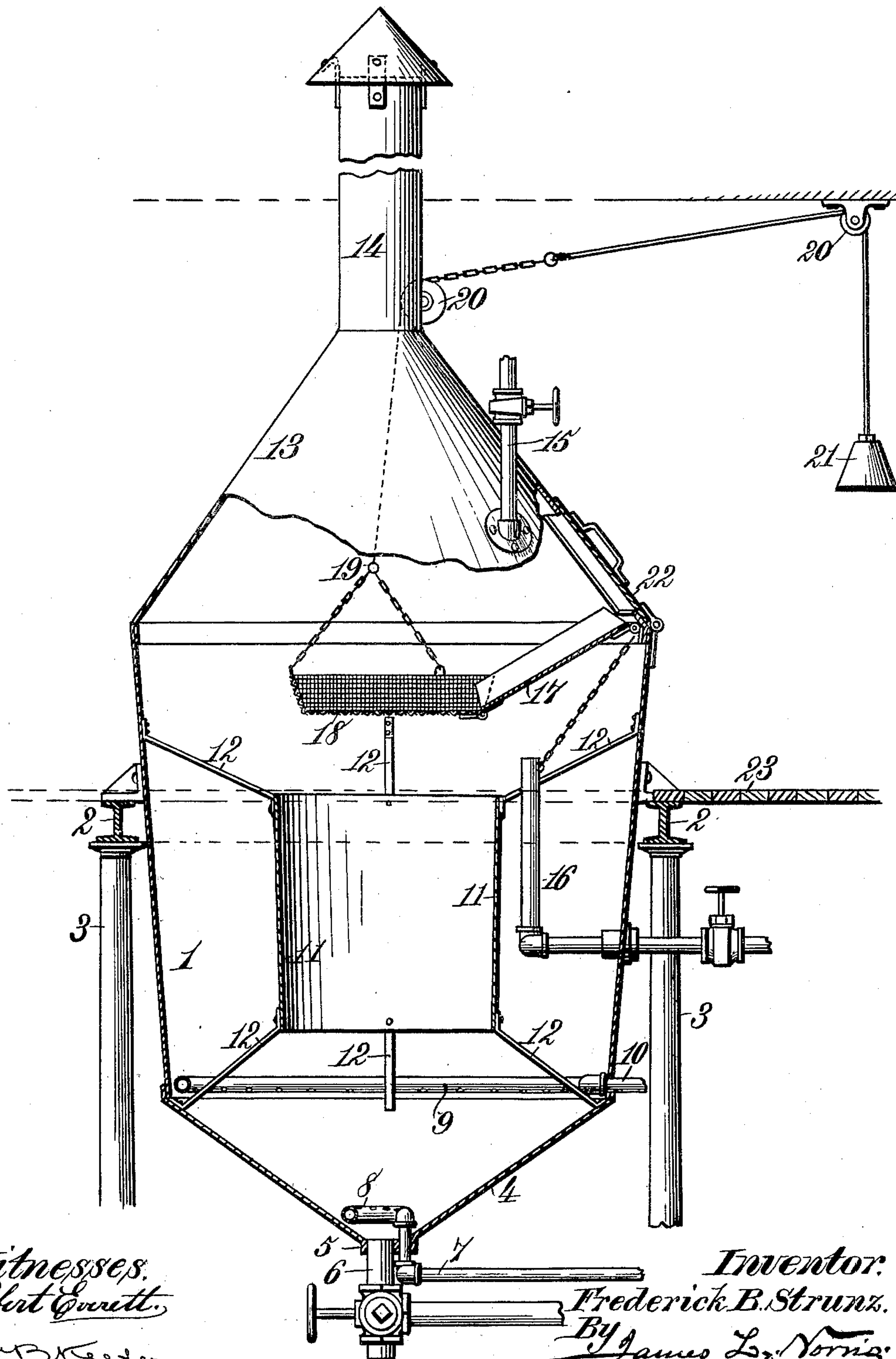
(No Model.)

F. B. STRUNZ.

APPARATUS FOR MAKING CAUSTIC SODA.

No. 604,670.

Patented May 24, 1898.



Witnesses.
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UNITED STATES PATENT OFFICE.

FREDERICK B. STRUNZ, OF PITTSBURG, PENNSYLVANIA.

APPARATUS FOR MAKING CAUSTIC SODA.

SPECIFICATION forming part of Letters Patent No. 604,670, dated May 24, 1898.

Application filed August 2, 1897. Serial No. 646,817. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK B. STRUNZ, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Apparatus for Making Caustic Soda, of which the following is a specification.

This invention relates to apparatus for making caustic soda; and it consists in features of construction and novel combinations of parts in a caustic-lye plant, as hereinafter described and claimed.

The annexed drawing is a sectional elevation of a portion of a caustic-lye plant illustrating my improvements.

In causticizing soda-ash solution it is boiled in a kettle with lime. Upon the proper shape of this kettle, the arrangement of the steam pipes or coils therein, and suitable means for supplying the lime will depend the efficiency and completeness of the result desired—namely, to get all the carbonate of soda converted into caustic soda.

Referring to the drawing, the numeral 1 designates a kettle of large capacity suspended in a frame 2, that may be supported by columns 3 or otherwise. The sides of the kettle should be slanting, about as shown—that is to say, the diameter of the kettle-body is to be greater at the top than at the lower end. The object of this construction is to avoid any violent jumping of the contents of the kettle at such times as when there is a sudden change of pressure in the pipe supplying the steam. It is obvious that when this occurs in a kettle of the form described the effect will be less violent at the top on account of the ability afforded for the force to disperse as the force is gradually transmitted to the surface of the kettle contents. For this purpose also it is important that the kettle-bottom 4 should be conical, with a slant of less than forty-five degrees preferably.

At the lower end of the conical bottom 4 there is attached a flanged cap 5, which is large enough for connection of the outlet-pipe 6 for drawing off the contents of the kettle, and also for attachment of a pipe 7 for introducing steam. This steam-pipe 7 connects with a steam-coil 8 in the lower part of the conical bottom 4. I also prefer to provide an

upper steam-coil 9, located in the lower part of the kettle just above the upper part of said conical bottom and about where it connects with the kettle-body. An independent steam-supply pipe 10 is provided for this upper steam-coil. Each steam-coil 8 and 9 is a single circle, and each is provided with perforations for escape of steam into the kettle. The combined area of the perforations in the lower steam-coil 8 is less than the cross-sectional area of the steam-supply pipe and the perforations are arranged in such direction as to effect a motion of the kettle contents up through the center and down along the slanting sides, the perforations in the upper steam-coil 9 being preferably directed downward. Since it is desirable to limit the amount of heat supplied with the steam for agitating the kettle contents, I regulate this by the size of perforations in the coils, according to the dimensions of the kettle.

The steam-supply pipes for the coils 8 and 9 should be independent of each other, as it is not necessary or desirable to inject steam through the upper coil 9 continuously during the entire operation of causticizing. The coil 9 may be placed a little above the upper end of the cone-bottom, so that the steam can be supplied to this coil through a flange at the side of the kettle, as near as possible to the upper end of the cone-bottom.

The effect of the slanting kettle sides and its conical bottom with the steam-coils arranged in the lower part of the kettle and perforated, as described, is as follows: Let it be assumed that the lime has been added to the soda solution in the kettle and that the kettle contents are in a boiling state. By my provision for introducing steam through the steam-coils at the bottom of the solution the lime is forced up either through the center of the kettle contents and down the sides or up along the sides and down at the center, according to the relative arrangement of the perforations in the upper and lower steam-coils, and in both cases the kettle contents will take on an even rolling motion. The direction of this motion will be determined by the upward or downward position of the perforations in the respective steam-coils at the lower part of the kettle. It is preferable to direct the lime upward at the center and

downward at the sides of the kettle, as where the perforations in the lower steam-coil 8 have an upward position, while in the upper steam-coil 9 they are placed downward. If the cone-shaped kettle-bottom 4 is too steep, the lime will move to the center so suddenly that the gradual and continuous injection of steam will be interfered with, and thus as the force of the steam would no longer be sufficient to keep the contents of the kettle in motion the lime would begin to settle very fast and will remain at the bottom until sufficient steam-pressure has accumulated to suddenly remove the obstructing lime. In case there is not sufficient slant to the kettle-bottom the motion of the liquid alone will not have enough power to move the lime along the bottom to the center of the kettle-bottom. The result will be similar to the other case and a considerable portion of the lime will remain inactive at the bottom.

As shown in the drawing, I prefer to provide within the kettle a cylindrical or annular shield 11, open at top and bottom for the purpose of guiding the upward current produced by the small lower steam-coil. Braces 12 are arranged to support the shield.

It has been customary to force atmospheric air through the contents of the kettle to keep the lime from settling; but in this case all the carbonic-acid gas contained in the air is taken up by the caustic soda, converting it back into carbonate. In some instances a mechanical agitator has been employed in addition to injecting steam. An objection to the employment of a mechanical agitator is the difficulty of getting power, which is rarely convenient to the lye plant. By injecting steam in the manner described from the bottom of the kettle it will not be necessary to employ either an air-pump or a mechanical agitator.

The usual practice of entering the steam-pipe at the top of the kettle is objectionable for the reason that it is the force of the steam more than the heat that is desired. In passing down through the contents of the kettle considerable steam force or pressure is spent without proper effect. It is therefore of considerable advantage to introduce the steam into the kettle through a steam-coil at the bottom and as close as possible to the flanged cap 5, with which the steam-supply pipe is connected.

The top of the kettle-shell 1 may be provided with a conical or dome-shaped cover 13, to which a vapor-escape pipe 14 is connected. The cover 13 may have connected therewith a valved pipe 15 for introducing water into the kettle.

At any suitable point the kettle 1 may be provided with a double-jointed drop-pipe 16, through which the clear lye may be drawn off. After the lime precipitate has settled this drop-pipe 16 is to be carefully and gradually lowered into the kettle contents until the dividing-line is reached between the clear

lye and the lime precipitate, so that the lye may be drawn off without disturbing the lime at the bottom of the kettle.

For the purpose of introducing lime into the kettle there is preferably provided a lime-chute 17, having one end hinged to the kettle immediately below the cover. The other end of the chute 17 is hinged to a lime-basket 18, suspended in the kettle by means of a chain 19, passed over pulleys 20, and having a counterweight 21 attached to the outer end of the chain. In the kettle-cover 13 there is provided a hinged lid 22 immediately above the lime-chute. A floor 23 may be arranged to afford ready access to the lid 22 for introducing lime into the chute. The lime-basket 18 may be made of heavy wire screen or perforated sheet metal, and is preferably provided with half-inch holes in bottom and sides as close together as possible.

The construction of the kettle, with its conical bottom and the steam-coils 8 and 9 for introducing steam at the bottom of the kettle in such manner as to cause a movement of the kettle contents upward at the center and downward at the sides, not only obviates any need of a mechanical agitator, but provides also for the accomplishment of a more perfect result in the production of caustic lye with less residue of carbonate or unconverted alkali.

What I claim as my invention is—

1. In apparatus for causticizing soda-ash solution, the herein-described kettle having downward and inward slanting sides and a conical bottom, in combination with a perforated steam-coil located in said kettle close to the lowest part of the conical kettle-bottom, to cause agitation of the kettle contents and a motion of the same upward and downward in the kettle, and mechanism suspended in the kettle for introducing lime therein, the slanting sides of the kettle-body being adapted to permit a gradual distribution of the force of steam-pressure toward the top of the kettle and thereby prevent a sudden accumulation of lime precipitate at the bottom, substantially as described.

2. In apparatus for causticizing soda-ash solution, the herein-described kettle having downward and inward slanting sides and a conical bottom, in combination with mechanism suspended in said kettle for introducing lime therein, a lower perforated steam-coil located close to the lowest part of the conical kettle-bottom, and an upper perforated steam-coil located in the kettle at about the junction of the kettle-body and its said conical bottom, one of said steam-coils having its perforations directed upward and the other downward to cause agitation and circulation of the kettle contents, and whereby the slanting sides of the kettle-body will permit a gradual distribution of the force of steam-pressure toward the top of the kettle and thereby prevent a sudden accumulation of lime precipitate at the bottom, substantially as described.

3. In apparatus for causticizing soda-ash solution, the herein-described kettle having a conical bottom and provided with the lower perforated steam-coil 8 located close to the bottom and the upper perforated steam-coil 9 located at or near the junction of the kettle-body and its said conical bottom, the perforations of the lower steam-coil being directed upward and the perforations of the upper steam-coil being directed downward, whereby there is caused a movement of the kettle contents upward at the center and downward along the slanting sides of the conical kettle-bottom, in combination with mechanism for introducing and suspending a body of lime within the said kettle, substantially as specified.

4. In apparatus for causticizing soda-ash solution, the herein-described kettle having its sides slanting downward and inward and provided with a conical bottom and a conical cover having a vapor-escape pipe attached, in combination with a perforated steam-coil located in the conical kettle-bottom, and a perforated lime-basket suspended in the kettle substantially as specified.

5. In apparatus for causticizing soda-ash solution, the herein-described kettle having slanting sides and a conical bottom and provided with a cover having an attached vapor-escape pipe, in combination with a flanged

cap secured to the lower part of the conical kettle-bottom, a drawing-off pipe and a steam-inlet pipe connected with said cap, a perforated steam-coil located in the conical kettle-bottom, a lime-basket suspended in the kettle and a lime-chute having hinged connection with said basket and kettle, substantially as specified.

6. In apparatus for causticizing soda-ash solution, the combination with the herein-described kettle provided with downward and inward slanting sides and a conical bottom, of a perforated steam-coil located in and close to the lowest part of the conical kettle-bottom, an upper perforated steam-coil located in said kettle at about the junction of the kettle-body and its said conical bottom, an annular shield supported above said steam-coils to serve as a guide for upward and downward currents of the kettle contents caused by injection of steam into the kettle through said coils, and a lime-receptacle suspended in the kettle above said shield or guide, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FREDERICK B. STRUNZ.

Witnesses:

A. BATCHELDER,
E. C. RICE.