

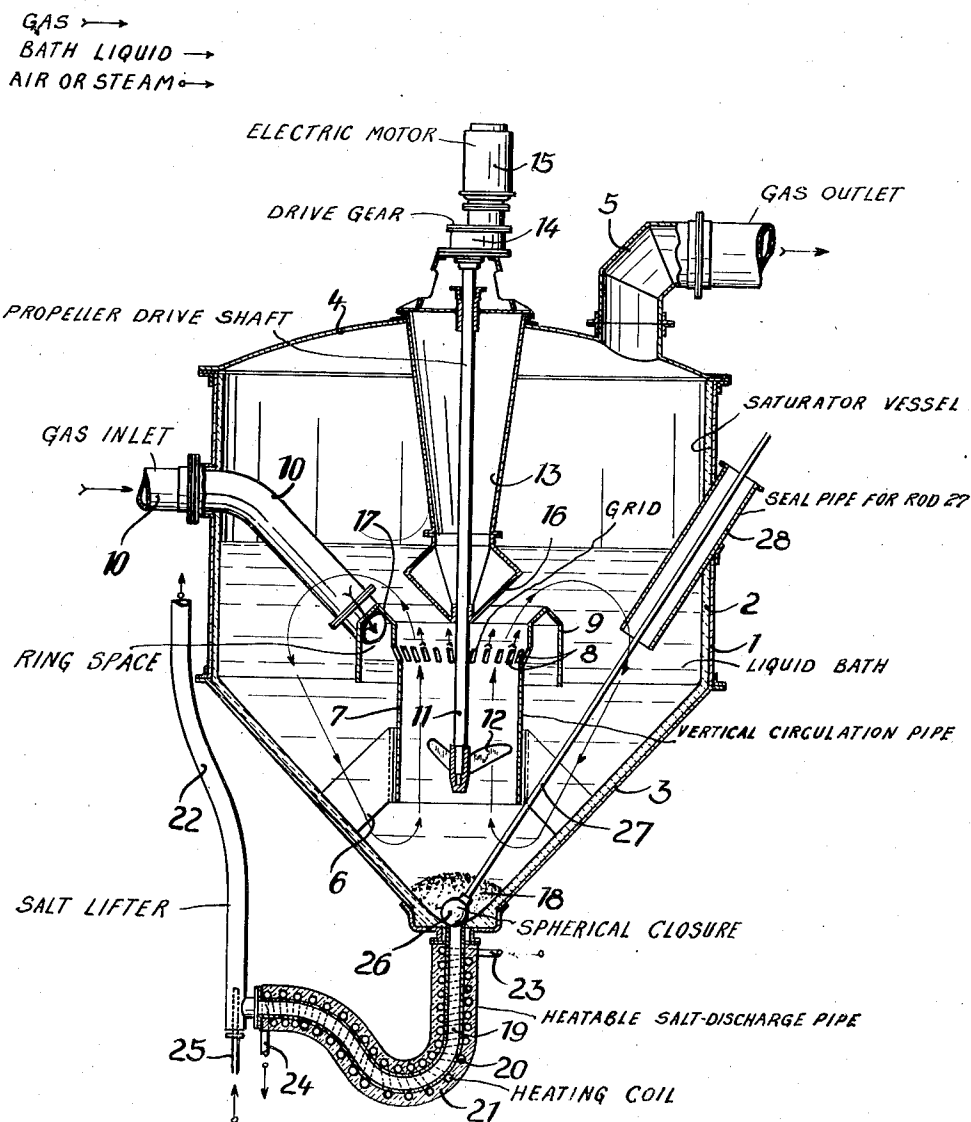
Feb. 18, 1941.

H. KOPPERS

2,232,115

SATURATOR FOR THE MANUFACTURE OF A COARSE CRYSTALLINE SULPHATE OF AMMONIA

Filed Sept. 12, 1938



Inventor:
Heinrich Koppers
By Henry L. Lohr
his atty

UNITED STATES PATENT OFFICE

2,232,115

SATURATOR FOR THE MANUFACTURE OF A
COARSE CRYSTALLINE SULPHATE OF
AMMONIAHeinrich Koppers, Essen, Germany, assignor, by
mesne assignments, to Koppers Company, Pitts-
burgh, Pa., a corporation of DelawareApplication September 12, 1938, Serial No. 229,441
In Germany September 13, 1937

4 Claims. (Cl. 23—273)

The invention relates to contrivances known as saturators for the production of sulphate of ammonia from sulphuric acid and ammoniacal gases or vapours such as are produced for instance in the coke oven industry or in gasworks, or to similar apparatus, and more particularly to those saturators or the like which are used for the manufacture of a coarse crystalline sulphate of ammonia or similar salts.

Various arrangements suitable for saturators or the like have been proposed which are intended to improve the growth of the crystals to such an extent that a coarse crystalline sulphate of ammonia is produced. It is already known that the coarse crystalline sulphate of ammonia is more advantageous than the usual fine crystalline sulphate of ammonia in that the salt does not cake together during storage so that it is possible to spread it out without any difficulty later-on when it is used for instance as a fertilizer.

In my co-pending application for Letters Patent entitled: "Improvements in saturators for the manufacture of a coarse crystalline sulphate of ammonia" and executed on the 23rd March, 1937, now Patent No. 2,141,186, issued December 27, 1938, I have described an improved saturator for the manufacture of a coarse crystalline sulphate of ammonia. According to my said former invention there is arranged in the interior of the space filled with the saturator liquid, an essentially vertical circulating pipe which is open at the top and at the bottom. Through said circulating pipe the saturator liquid is circulated by means of an agitator or the like preferably arranged within said circulating pipe in such a manner that the liquid may flow along the points where the ammonia or ammoniacal gas enters the saturator liquid. This circulating pipe is suitably arranged just above the lowest point of the saturator so that the crystals accumulating on the bottom of the saturator are partly whirled-up and lifted into the so-called saturating zone of the bath where the crystals are able to grow to the desired size of grain.

For the removal of the large crystals of sulphate of ammonia accumulating at the lowest point of the saturator bottom and which are no longer whirled-up through the stream of liquid due to the size and gravity of the crystals, a salt lifting device comprising an ejector is preferably used. Such salt lifting devices comprise a tube open at the bottom, the lower opening of which lies above the point of the saturator bottom

where the large crystals will accumulate. The salt lifting pipe projects through the roof of the saturator and is connected for instance to a centrifuge. At the lower end of the salt lifting pipe there is provided an ejector-like arrangement by means of which steam or another suitable medium may enter the salt lifting pipe in such a manner that a strong upward flow is produced inside the salt lifting pipe. In this manner the crystals lying underneath the lower opening of the salt lifting pipe are drawn into the pipe and together with a certain quantity of the saturator liquid they are moved upwards. The crystals are then separated from the withdrawn liquid in the above mentioned centrifuge.

In operating the saturators carried out according to my aforesaid co-pending Letters Patent I found certain difficulties obtain which prevent providing in the center of the saturator a salt removing device which corresponds to the above details, because the circulating pipe and its agitator are arranged in the center of the saturator.

Now, the main object of my present invention is to provide such improvements which enable me to employ an effective salt removing device of an approved ejector even in those cases where the space immediately above that point of the saturator bottom on which the crystals to be removed are accumulating is occupied by a contrivance serving to recirculate the saturator liquid, for instance by means of a circulating pipe open at top and bottom and by means therein of an agitator or another suitable means.

My present invention principally consists in connecting a heated salt discharge pipe with the lowest point of the saturator and with a salt lifter situated beside the saturator and outside its bathroom and arranging a removable closure means consisting of rubber or another suitable material within the saturator above the mouth of the heated salt discharge pipe.

The carrying out of the saturator according to the present invention now offers the advantage that the bathroom of the saturator practically is at free disposal for the circulation of the saturator liquid. The circulation of the liquid can therefore be effected uniformly and the even concentration within the bath thus obtained prevents the salt from depositing on certain parts of the saturator in the form of crusts which circumstance was unavoidable hitherto.

With the above and other objects and features of my present invention in view, I will now describe a preferred embodiment of my invention on

the lines of the accompanying drawing showing a vertical section through the saturator built in accordance with my present invention.

The saturator comprises a casing 1 consisting of lead-coated sheet iron or the like. The inside of said casing 1 is provided with an acid-resisting brick-lining 2. The bottom of the saturator is conical, as indicated at 3. The top of the saturator is closed by the roof 4 in which is arranged the gas outlet pipe 5.

A vertical circulation pipe 7 which is open above and below is arranged in the middle of the saturator on supports 6. On the slightly enlarged upper end of the pipe 7 there is provided a grid comprising a multitude of slot-like openings 8 leading to a ring space which is formed within the bent-over upper end 9 of the pipe 7 and which is open to the bath towards the bottom.

The gas inlet pipe 10 for ammoniacal gas terminates in this ring space. The gas flows through the slots 8 and enters in this way the chamber of the vertical circulation pipe 7.

In the middle of the circulation pipe, there is fitted an impeller or agitating propeller 12 on a shaft 11. The shaft 11 extends in a gas-tight manner through a casing 13, carrying the rotary bearings and through the roof 4 to a driving gear 14 which is connected with an electric motor 15 or another suitable power device.

The lower end of the casing 13— as marked at 16— is built conically in such a manner that the lower conical faces run essentially parallel with the ring face of the circulating pipe 7 as indicated at 17. Between the upper end of the circulating pipe 7 and the lower conical faces 16 of the casing 13, a ring nozzle like space is thereby formed through which the liquid moved by the impeller 12 is uniformly distributed over the whole cross section of the saturator.

For simplicity, the delivery means for sulphuric acid and other auxiliary contrivances of the saturator are not shown on the drawing and are essentially carried out in the usual way.

The sulphate of ammonia produced in the saturator from sulphuric acid and ammonia crystallizes out in the well known manner. The crystals thus formed accumulate on the lowest point of the saturator bottom 3 as indicated at 18. The small crystals are whirled up from the salt storage 18 through the movement of the bath and returned again to the neutralizing zone so that only the valuable large crystals remain on the salt storage 18. From the lowest point of the saturator 3 there leads a salt discharge pipe 19 which is fitted with a heating coil 20 and a heat insulating jacket 21. The pipe 19 extends by means of a suitable bend to a salt lifting pipe 22 which is carried out similar to an ejector. The heating medium for the pipe 19 is for example led through the pipe line 23 to the heating tubes 20. The cooled-down heating medium or the condensation liquor is withdrawn at point 24.

The salt lifter 22 is operated in the usual manner by introducing for instance air or steam through the pipe line 25 into the ejector nozzle. The salt paste moving upwards in the pipe 22 enters as usual the contrivances of the plant which are necessary for the recovery of a dry and neutral salt of the desired quality.

To eliminate a continuous emptying of the saturator, a spherical closure 26 which can be removed is arranged in the saturator bottom above the mouth of the salt discharge pipe 19, said closure means consisting of rubber or another

suitable resilient and acid-proof material. For

the removal of the closure means 26 it is of advantage to provide a thin carrying rod 27 which is introduced slantingly into the bath of the saturator through a lateral seal pipe 28. The diameter of this rod 27 is so small that practically the movement of the circulating liquor is not hindered. It is, however, also possible to lead the carrying rod 27 of the closure means 26 into the interior of the circulating pipe or for instance through the shaft 11 of the impeller if it is intended to keep the bathroom of the saturator entirely clear of the parts of the apparatus.

I have now described my present invention on the lines of a preferred embodiment thereof, but my invention is not limited in all its aspects to the mode of carrying it out as described and shown since the invention may be variously embodied within the scope of the following claims.

I claim:

1. In a saturator for the manufacture of coarse crystalline sulphate of ammonia comprising, an upper central gas inlet, a lower salt outlet opening arranged in the lowermost part of the saturator bottom at the point over which the crystals accumulate, and means disposed below the gas inlet but above the point of the saturator bottom where the crystals accumulate for elevating liquid from below into the plane of the gas inlet, the combination of a salt outlet pipe connected to and leading downwardly from said lower salt outlet opening but disposed outside the saturator, an air-lift means arranged outside the saturator and leading from the salt outlet pipe for lifting the final salt product for removal of the same from the saturator, and closure means for closing off the lower salt outlet opening from its salt outlet pipe, said closure means comprising a spherical closure seatable on the saturator bottom inside the same but above the mouth of the salt outlet pipe.

2. In a saturator for the manufacture of coarse crystalline sulphate of ammonia comprising, an upper central gas inlet, a lower salt outlet opening arranged in the lowermost part of the saturator bottom at the point over which the crystals accumulate, and means disposed below the gas inlet but above the point of the saturator bottom where the crystals accumulate for elevating liquid from below into the plane of the gas inlet, the combination of a salt outlet pipe connected to and leading downwardly from said lower salt outlet opening but disposed outside the saturator, an air-lift means arranged outside the saturator and leading from the salt outlet pipe for lifting the final salt product for removal of the same from the saturator, and closure means for closing off the lower salt outlet opening from its salt outlet pipe, said closure means comprising a sealing element acting to seal at the mouth of the salt outlet pipe.

3. In a saturator for the manufacture of coarse crystalline sulphate of ammonia comprising: an upper central gas inlet comprising grid ports, a substantially vertical circulation pipe disclosed below the gas inlet but above the point of the saturator bottom where the crystals accumulate, agitation means within the circulation pipe for elevating liquid from below into the plane of the grid ports, and an agitator propeller shaft extending downwardly from the top of the saturator centrally of the latter and through the inlet and terminating at the agitation means inside the vertical circulation pipe, the combination of a salt outlet opening arranged in the lowermost part of the saturator bottom at the point over

which the crystals accumulate, a salt outlet pipe connected to and leading downwardly from said opening but disposed outside the saturator, an air-lift means arranged outside the saturator and leading from the salt outlet pipe for lifting the final salt product for removal of the same from the saturator, and closure means for closing off the salt outlet opening from its salt outlet pipe, said closure means comprising a spherical closure seatable on the saturator bottom inside the same but above the mouth of the salt outlet pipe.

4. In a saturator for the manufacture of coarse crystalline sulphate of ammonia comprising: an upper central gas inlet comprising grid ports, a substantially vertical circulation pipe disposed below the gas inlet but above the point of the saturator bottom where the crystals accumulate, agitation means within the circulation pipe for elevating liquid from below into the plane of the grid ports, and an agitator propeller shaft ex-

tending downwardly from the top of the saturator centrally of the latter and through the inlet and terminating at the agitation means inside the vertical circulation pipe, the combination of a salt outlet opening arranged in the lowermost part of the saturator bottom at the point over which the crystals accumulate, a salt outlet pipe connected to and leading downwardly from said opening but disposed outside the saturator, an air-lift means arranged outside the saturator and leading from the salt outlet pipe for lifting the final salt product for removal of the same from the saturator, means for heating the outlet pipe, and closure means for closing off the salt outlet opening from its salt outlet pipe, said closure means comprising a spherical closure seatable on the saturator bottom inside the same but above the mouth of the salt outlet pipe.

HEINRICH KOPPERS. 20