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SATURATOR EJECTOR VENT PIPE

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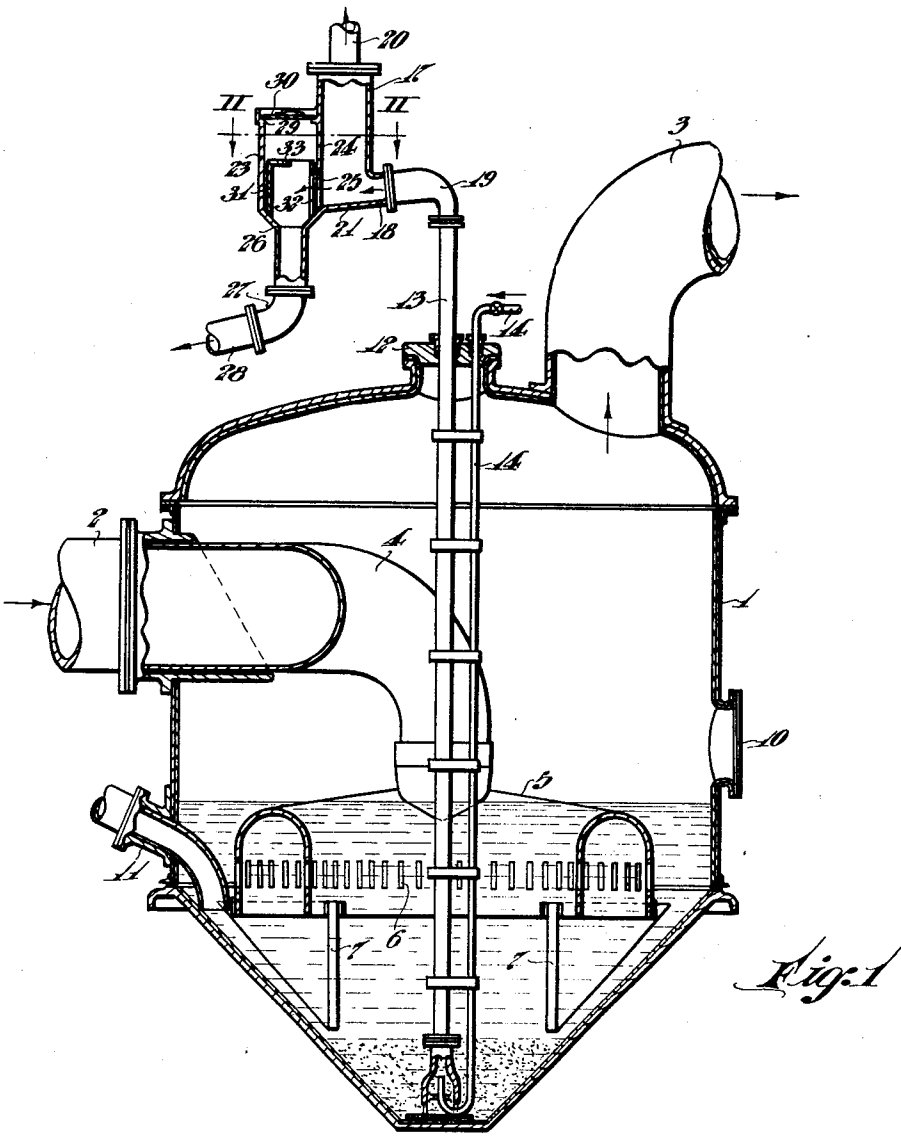


Fig. 1

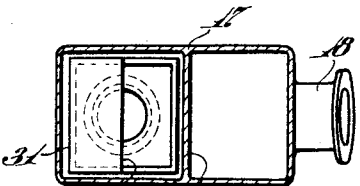


Fig. 2

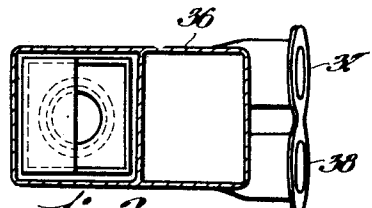


Fig. 3  
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## UNITED STATES PATENT OFFICE

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## SATURATOR EJECTOR VENT PIPE

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4 Claims. (Cl. 261—77)

This invention relates to saturator ejector vent pipes, and more particularly to devices of this character adapted for use in connection with an air lift type of sulphate ejector for an ammonia saturator, such as is used in a coal gas manufacturing plant.

It is an object of the present invention to provide improved means for separating the air from the slurry in the mixture discharged by the sulphate ejector.

Another object is to provide a wide surface over which the mixture of air and slurry may flow from the ejector in order to permit the air to escape therefrom.

Another object is to provide a combined surge box and vent with an inclined bottom over which the slurry may flow, so as to prevent the sulphate from banking.

Other objects and features of novelty will be apparent as the following description proceeds, reference being had to the accompanying drawing, in which

Figure 1 is a vertical section through a saturator provided with an air lift, to which the combined surge box and vent according to the present invention is applied;

Fig. 2 is a section taken along the line II—II of Fig. 1; and

Fig. 3 is a similar section showing a modified construction.

Referring more particularly to the drawing, the invention is illustrated in connection with an ammonia saturator, such as is used in a coal gas manufacturing plant for removing ammonia from the gas. This saturator comprises a shell 1 provided with a gas inlet 2 and a gas outlet 3.

A pipe 4 connected to the inlet 2 receives the gas from a gas main, preferably leading from an exhaustor, with or without a reheater therein.

The pipe 4 terminates in a cracker pipe 5, which comprises an annular ring having an inverted U-shaped cross section, the inner and outer walls of the cracker pipe being provided with a plurality of slots 6.

The cracker pipe 5 is mounted upon a plurality of supports 7 which are carried by the shell 1. The shell is also provided with a cleaning or inspection manhole 10, and an inlet 11 which receives a drain pipe from the drip pot for the return of acid or liquor to the saturator.

The top of the casing 1 is provided with a fitting 12, through which passes the sulphate ejector pipe 13, and the air pipe 14. These two pipes cooperate to form an air lift for ejecting the sulphate from the saturator.

The gas from which the ammonia is to be removed is passed in at the inlet 2 through the pipe 4 and the cracker pipe 5, and passing out through the slots 6, bubbles up through the liquid contained within the shell 1. This liquid is initially a solution of sulphuric acid, preferably containing about 5%  $H_2SO_4$ , and the liquid level is preferably maintained near the upper part of the cracker pipe.

The ammonia combines with the water in this dilute solution to form ammonium hydroxide, which immediately combines with the acid to form ammonium sulphate, as is well known in this type of reaction.

The gas from which the ammonia has been removed rises above the liquid in the shell 1 and passes out through the outlet 3 to the acid separator (not shown). The ammonium sulphate remains in solution, until sufficient gas and consequent ammonia has passed through the solution to cause a concentration which will result in crystallization of the ammonium sulphate.

The crystals and the concentrated salt gravitate to the bottom of the casing 1 and thus form a slurry. The upward passage of the bubbles of air from the air pipe 14, passing upward through the ejector pipe 13 will lift the slurry therein according to the well known air lift principle, and so discharge the accumulated ammonium sulphate from the saturator.

The ejected sulphate is drained and dried, the liquid drained off returning through the pipe 11 to the saturator, and the dried sulphate otherwise disposed of. The construction and operation described above is well known in the art, and therefore forms no part of the present invention other than in combination with the structure now to be described.

As shown in Figs. 1, 2 and 3, a casing 17 is provided, which has an inlet 18 connected to the ejector pipe 13 by means of an elbow 19. The casing 17 is also provided with an air outlet 20 which is located in the upper part of the casing.

The bottom 21 of the casing 17 is wide and substantially flat, being inclined downwardly from the inlet 18, so that the mixture of air and slurry received at the inlet 18 from the sulphate ejector may flow over the wide surface 21, which will permit the air to be readily separated therefrom and pass out through the air vent 20.

The novel structure also includes a surge box 23, which may be a separate chamber connected to the air chamber 17, but in the preferred embodiment disclosed herein the surge box and air vent are portions of a single casing. Accordingly

there is provided a partition 24, the lower portion of which is cut away to form an aperture 25. The bottom of the surge box is constricted to form an outlet 26 which is connected by an elbow 27 to a discharge pipe 28.

The upper rim of the surge box is flanged as at 29 so as to receive a removable cover 30. A surge box baffle 31 is preferably inserted in the surge box, and it comprises a shell conforming to the walls of the surge box and having an aperture 32 registering with the partition aperture 25. The top of the surge box baffle is provided with a flange 33, upon which this element depends for its baffling action.

The slurry, from which the air has been removed in the casing 17, passes through the apertures 25 and 32 and into the surge box, and through the outlet 26 and elbow 27 to the discharge pipe 28. Any irregularities in flow will be impeded by the baffle 33, so as to prevent splashing or foaming of the slurry. The removable cover 30 permits the operator to inspect the conditions of flow within the surge box, and also permits him to remove samples for testing as desired.

The device has been described above as a single unit associated with a single saturator, but the invention permits of gang or battery operation, in that the ejector pipes from several saturators may be respectively connected to inlets of a common air vent. This arrangement has been illustrated in Fig. 3, in which the air chamber 36 corresponding to the air chamber 17, is provided with separate inlets 37 and 38 each adapted to be respectively connected to the ejector pipes of separate saturators. Otherwise the construction of this embodiment is identical with that hereinbefore disclosed.

While two embodiments of the invention have been illustrated and described in such detail as to enable anyone skilled in the art to practice the invention, it is to be understood that the invention is not to be limited to any of the details disclosed other than as necessitated by the development of the prior art. Instead it will be appreciated that the invention embraces such embodiments of the broad idea as fall within the scope of the appended claims, it being obvious that various changes may be resorted to with respect to the disclosed embodiments without departing from the spirit of the invention.

I claim as my invention:

1. In combination with an ammonium sulphate saturator having a shell, an air lift comprising a vertical pipe extending outside of the saturator shell, a casing connected to the top of said vertical pipe, said casing having a partition with an underflow aperture and dividing said casing into an air vent compartment adjacent said pipe and a surge box, said air vent compartment having a wide bottom inclined toward said underflow aperture, an air vent pipe connected to said air vent compartment, and a slurry discharge pipe connected to said surge box.

2. In combination with a saturator having an air lift and a slurry outlet for said air lift, of

a compound surge box and vent connecting the air lift with the slurry outlet therefor and comprising a vent pot and surge pot connecting therewith, the vent pot being connected with the air lift to receive slurry therefrom and being of larger area than the air lift and the slurry outlet to lower the velocity and thereby separate the air from the slurry passing from the air lift to the outlet therefor, and the surge pot being connected with the slurry outlet for delivery of slurry thereto so as to maintain a steady volume of vented liquid therein for preventing surging of slurry through the slurry outlet, the connection between the surge pot and the vent pot comprising a partition shutting off the vent pot from the surge pot and having an underflow connecting passage for the passage of slurry from the vent pot to the surge pot as underflow, and a vent from the vent pot for venting the same.

3. In combination with a saturator having an air lift and a slurry outlet for said air lift, of a compound surge box and vent connecting the air lift with the slurry outlet therefor and comprising a vent pot and surge pot connecting therewith, the vent pot being connected with the air lift to receive slurry therefrom and having a large flat surface providing a larger area than the air lift and the slurry outlet to lower the velocity and thereby separate the air from the slurry passing from the air lift to the outlet therefor, and the surge pot being connected with the slurry outlet for delivery of slurry thereto so as to maintain a steady volume of vented liquid therein for preventing surging of slurry through the slurry outlet, the connection between the surge pot and the vent pot comprising a partition shutting off the vent pot from the surge pot and having an underflow connecting passage for the passage of slurry from the vent pot to the surge pot as underflow, and a vent from the vent pot for venting the same.

4. In combination with a saturator having an air lift and a slurry outlet for said air lift, of a compound surge box and vent connecting the air lift with the slurry outlet therefor and comprising a vent pot and surge pot connecting therewith, the vent pot being connected with the air lift to receive slurry therefrom and having a large flat surface inclined to the horizontal toward the surge pot providing a larger area than the air lift and the slurry outlet to lower the velocity and thereby separate the air from the slurry passing from the air lift to the outlet therefor, and the surge pot being connected with the slurry outlet for delivery of slurry thereto so as to maintain a steady volume of vented liquid therein for preventing surging of slurry through the slurry outlet, the connection between the surge pot and the vent pot comprising a partition shutting off the vent pot from the surge pot and having an underflow connecting passage for the passage of slurry from the vent pot to the surge pot as underflow, and a vent from the vent pot for venting the same.

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