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PROCESSES FOR THE MANUFACTURE OF AMMONIUM NITRATE

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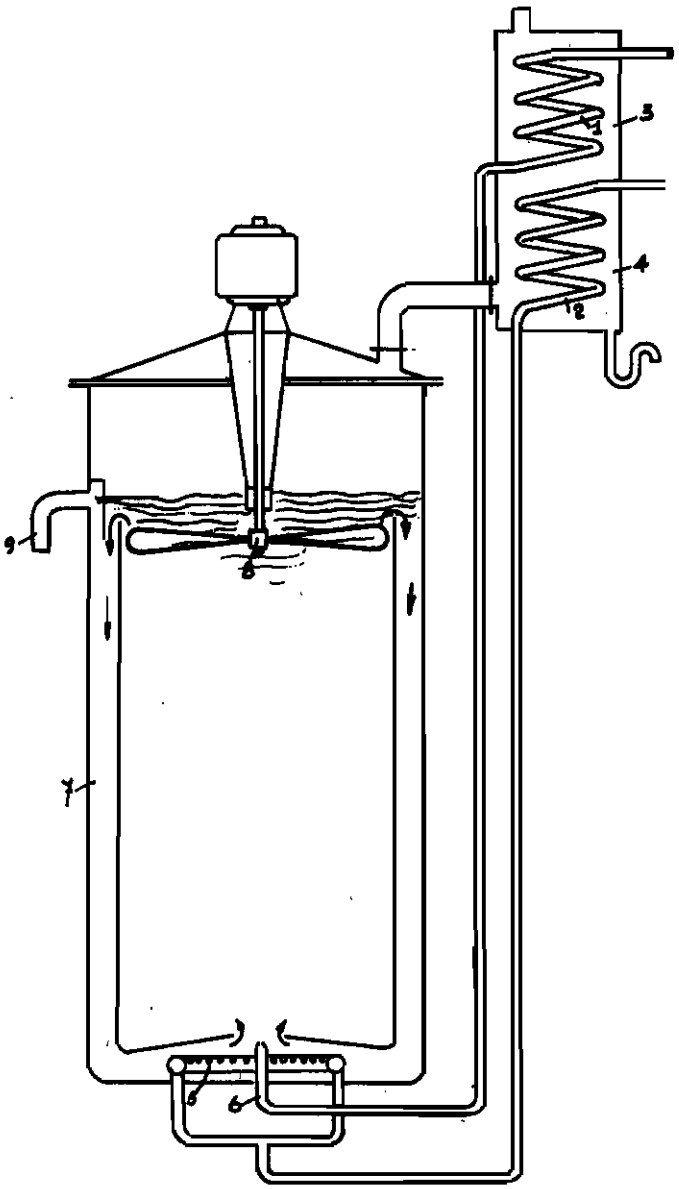

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ALIEN PROPERTY CUSTODIAN

PROCESSES FOR THE MANUFACTURE OF AMMONIUM NITRATE

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It is known that the utilisation of the reaction heat in the manufacture of ammonium nitrate encounters considerable difficulties owing to the tendency of nitric acid to volatilization, so that considerable nitrogen losses occur, as soon as the boiling temperature is reached, if ammonia is introduced into nitric acid without special precautions.

In order to avoid similar losses it has already been proposed to operate the reaction between acid and ammonia at a higher pressure than that corresponding to the boiling temperature of the ammonium nitrate solution produced. This solution is then discharged into another vessel, outside and under atmospheric pressure, where it is evaporated by means of the heat developed by the reaction itself. This working scheme is however connected with the disadvantage to require the compression of nitric acid and of ammonia. It has also been proposed to operate the neutralisation of acid and of ammonia under atmospheric pressure and to use the reaction heat to concentrate the solution in a vacuum evaporator, but this process causes a considerable complication because of the necessity to provide for the vacuum and to condense the whole amount of vapour produced from the solution, that which means a large consumption of cooling water.

My invention, on the contrary, allows to utilise the heat produced by the reaction of ammonia with nitric acid to concentrate the ammonium nitrate solution without being compelled to use a saturator under pressure and without condensing the vapour under a vacuum.

The principle of my new invention is still that to cause the neutralisation of nitric acid with ammonia to take place under a higher pressure than that of the vapour tension of the solution formed, while evaporation is carried out under atmospheric pressure, but the difference in pressure is given by the height of the liquid column contained in the saturator.

The annexed drawing shows a scheme of the apparatus. Nitric acid and ammonia are sent in the proportions required by the reaction through coils 1 and 2 into the heat exchangers 3 and 4 where they are preheated at the expense of the vapour coming from the concentration of the nitrate solution obtained. Then ammonia is introduced into the lower part of the saturator by means of distributor 5, while nitric acid is injected into the central pipe 6. The heat developed by the reaction causes the temperature of the solution to rise up to the boiling temperature; for instance, if a concentration of 90% is required, the solution at the surface of the bath boils at 148° C. If the height of the liquid in the saturator is 4 m., the pressure at the bottom is 0.55 atmospheres correspondent to a boiling temperature of about 157° C. In order to avoid any loss of ammonia and nitric acid, it is necessary that the evaporation of the solution be started only when neutralisation is complete ultimated and therefore the temperature in the lower part of the saturator where nitric acid and ammonia is injected must be maintained below 157° C. This condition is obtained by an intensive circulation of the liquid in the direction shown by the fleshes, so that the solution of the upper part of the saturator, where temperature is maintained at 148° C. owing to the evaporation of water is sent back through the annular space 7 into the lower part, securing thus the temperature to be kept within the limit desired.

The circulation of the liquid is operated by a helix on vertical shaft 8, which takes therefore the place of a circulating pump. When the solution reaches the higher part of the saturator and begins to boil owing to the lower pressure, it is already completely neutralised, so that no loss of nitrogen takes place. The concentrated solution issues from the saturator by means of pipe 9.

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