

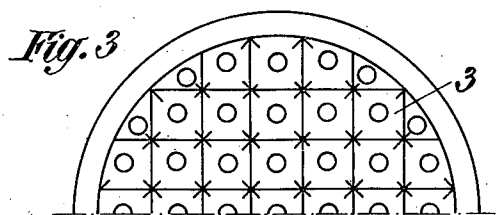
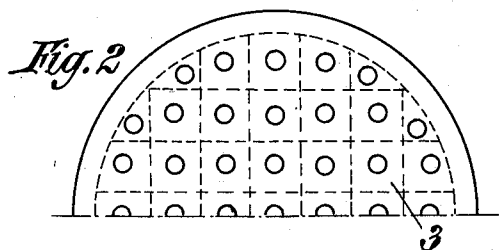
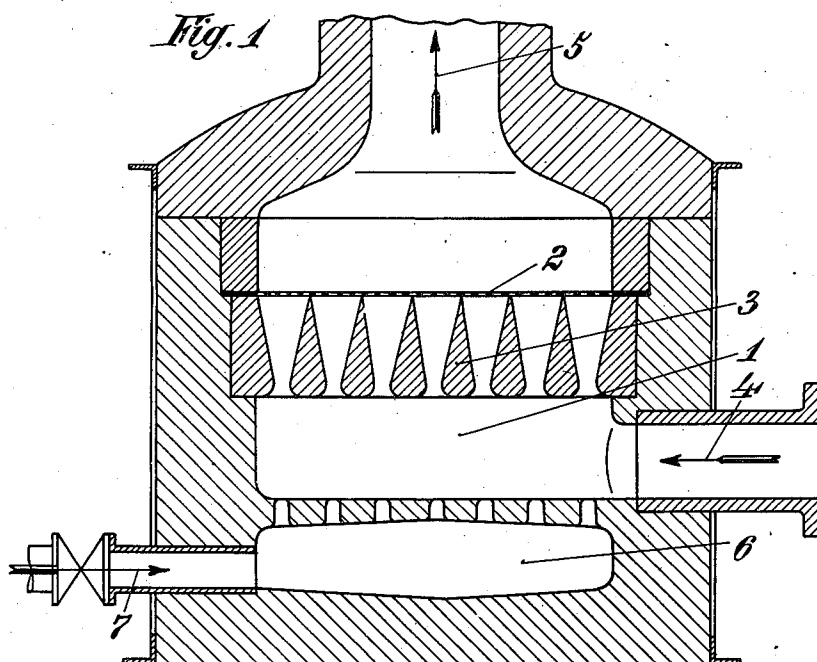
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COMBUSTION OF AMMONIA

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COMBUSTION OF AMMONIA.

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This invention relates to improvements in or relating to the catalytic combustion of ammonia.

In the catalytic combustion of gaseous ammonia with air or oxygen to form nitrous (nitrose) gases there exists, as is known, particular difficulty relative to the distribution of the gas mixture uniformly over the whole surface contact and this difficulty becomes greater with the tendency towards unifying the contact to a greater extent, that is also, towards larger combustion element units. Since the disadvantage of irregular loading on the various parts of the contact surface makes itself felt not only in a decreased yield but also in more or less rapid destruction of the overloaded parts of the contact, attempts have been made to take special precautions or to provide special arrangements intended to ensure the maximum uniformity of distribution. Thus, for example, in order to obtain uniform gas distribution it has been proposed to enclose the contact layer between two sieve plates which are covered with granular material of a suitable layer-depth. However, even with this arrangement the uniformity depends naturally, very much on the uniformity of the granular layer and it is obvious that complete success cannot be achieved. Other proposals make use of the fact that a gas-current moving at high speed distributes itself comparatively uniformly over a considerably increased cross-section if the increase of cross-section in the direction of flow is gradual, that is the so-called diffuser principle is utilized. At the same time the advantage is thereby attained that, in spite of the large cross-section which is entailed by the maximum allowable velocity of flow of the gas through the contact, small cross-sections only are nevertheless, necessary for the gas inlet and outlet. With large contact cross-sections, however, even this method fails to a certain extent because it is not possible to construct a diffuser which gives a really uniform gas current with large cross-sections. On the contrary it would appear that the flow is always materially stronger in the neighbourhood of the axis than at the periphery, this difference being the larger, the greater the actual diffuser diameter. If this disadvantage is to be counteracted it is ab-

solutely necessary to increase the length of the diffuser to a disproportionate extent.

To obviate this drawback the gases are, according to the present invention, supplied to a large contact cross-section not by means of a single large diffuser but by means of a large number of comparatively small diffusers which may be disposed in the wide contact chamber below the contact in a very simple manner. In practice the plurality of small diffusers may be constructed in an extremely simple manner by combining them to form a single element, such as a plate of suitable thickness traversed by the diffuser orifices. The diffuser inlet openings may be of a circular cross-section and the outlet openings, on the other hand, of a square cross-section, knife-edge ribs being thus formed on the outlet side which themselves constitute a network of squares on which the contact body, for example a fine mesh suitable metal gauze, may be directly mounted. This at the same time presents the advantage that use may be made of very large contact surfaces in a single piece since with the arrangement described sagging cannot occur. As the diffuser body in such an arrangement naturally becomes very hot, even reaching red heat, clearly no material can be used for its construction which may be attacked and destroyed by the oxygen in the air. For this reason the diffuser body will be made of a refractory material.

The use of such a diffuser body results first in an extraordinarily uniform distribution of the gas flow over the whole contact surface; moreover it has the material advantage over arrangements employing a granular layer that it offers no resistance to the gases which might cause pressure losses and since, as is known, the action of the diffuser results, during the change to a larger cross-section, not only in rendering the flow uniform but also in a conversion of velocity into pressure, no energy loss is entailed by the arrangement according to the present invention and the pressure increase thus obtained may be converted back, beyond the contact, into velocity apart, naturally, from small losses resulting from the friction on the diffuser walls.

One embodiment by way of example of the arrangement of the contact element accord-

ing to the present invention is illustrated in the accompanying drawing in which:

Fig. 1 is a vertical longitudinal section through a combustion element.

Fig. 2 a view of the diffuser from below, and

Fig. 3 a view of the diffuser from above.

The contact vessel 1 has a cylindrical, oval or other cross-section and contains the contact body 2, for example a platinum gauze, 3 being the diffuser body, 4 the gas inlet and 5 the gas outlet. From the foregoing, the modus operandi will be evident and it may merely be remarked that, as is known, a diffuser operates more efficiently when the angle between its surface and the axis does not exceed 10° . Consequently there is a certain relationship, for the diffuser, between the depth and the smaller and larger diameters. Since it is already necessary for mechanical reasons to make this diffuser plate of a certain thickness depending upon the size of the combustion element, it is not possible to give definite dimensions for said thickness and the diameters of the entry and outlet openings of the diffusers dependent upon the same. The only determining factor is that these dimensions shall have such a relationship between themselves that the diffuser action is not impaired, a guide being that the mentioned angle may be the larger, that is the length of the diffuser may be the shorter, the smaller the actual size of the individual diffusers.

In the example illustrated provision is also made of a chamber 6 which has openings in its cover located co-axially with the diffuser openings in the plate disposed thereabove. This arrangement is employed merely for setting the element in operation, this being effected by supplying an appropriate gas, for example illuminating gas or hydrogen at the necessary pressure, to the chamber 6 by way of the inlet orifice 7 whereupon the individual gas currents emerging from the cover of this chamber are ignited, a corresponding amount of air only being blown at the same time into the upper chamber through the inlet 4. Thus in each diffuser passage a burning gas flame is produced which develops its heat mainly towards the top, that is, heats the contact body and the upper part of the diffuser chambers and soon brings the same to red heat. When the necessary temperature is obtained the supply of combustible gas is gradually throttled and in place of the air the ammonia air mixture enters into the upper chamber at an appropriate temperature. After a short time the combustible gas may be cut off completely because the combustion of the ammonia now provides for the maintenance of the necessary temperature. Naturally in place of the lower chamber 6 a tube system, with suitably arranged orifices or jets for the supply of the combustible gas, may also be employed, provided that the arrangement of the

passages of the tube system for blowing the gas currents axially into the diffuser chambers be considered. Furthermore the novel ignition method described above may naturally be applied also to elements which do not employ diffusers but so-called sieve-plates. With cylindrical passages, however, the heating up operation does not take place so rapidly as with the diffuser chambers.

If after the heating up air only is, as before, conducted into the upper chamber then, in place of the combustible gas, the ammonia gas to be subjected to combustion may be introduced through the lower chamber or the corresponding tube system. It will then flow, suitably distributed, through the individual diffuser chambers, thereby attaining practically complete mixture of the two gases before reaching the contact.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An arrangement for the catalytic combustion of ammonia with air or oxygen comprising a contact body adapted to be used as a catalyzer; and a plurality of diffuser conduits of comparatively slight depth and correspondingly small cross-section arranged before the contact body, the conduits being variable in cross-section and having their larger ends at the contact body.

2. An arrangement for the catalytic combustion of ammonia with air or oxygen comprising a platinum gauze adapted to be used as a catalyzer; and a plurality of diffuser conduits of comparatively slight depth and correspondingly small cross-section arranged before the platinum gauze, the conduits being variable in cross-section and having their larger ends at the platinum gauze.

3. An arrangement for the catalytic combustion of ammonia with air or oxygen comprising a contact body adapted to be used as a catalyzer; and a plurality of diffuser conduits of comparatively slight depth and correspondingly small cross-section arranged before the contact body, the conduits being variable in cross-section and having their larger ends at the contact body and the diffuser conduits supporting the contact body.

4. An arrangement for the catalytic combustion of ammonia with air or oxygen comprising a contact body adapted to be used as a catalyzer; a plurality of diffuser conduits of comparatively slight depth and correspondingly small cross-section arranged before the contact body, the conduits being variable in cross-section and having their larger ends at the contact body; means for supplying a combustible gas; and means for causing a jet of combustible gas to flow axially into each diffuser conduit.

5. An arrangement for the catalytic combustion of ammonia with air or oxygen com-

prising a contact body adapted to be used as a catalyzer; a plurality of diffuser conduits of comparatively slight depth and correspondingly small cross-section arranged before the contact body, the conduits being variable in cross-section and having their larger ends at the contact body; means for supplying a combustible gas; means for causing a jet of combustible gas to flow axially into each diffuser conduit; and means for supplying ammonia which is subjected to combustion after the combustible gas has heated the diffuser conduits and contact body.

In testimony whereof I have affixed my signature.

HARRY PAULING.