May 2, 1939. O. BAADER 2,156,422

APPARATUS FOR CARRYING OUT REACTIONS WITH WIRE GAUZE CATALYSTS

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Fig. 1

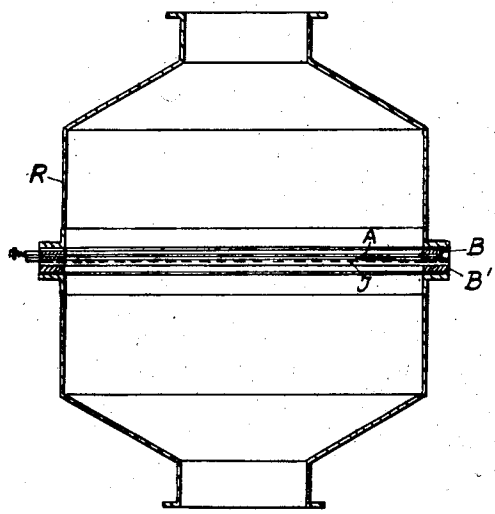


Fig. 1a

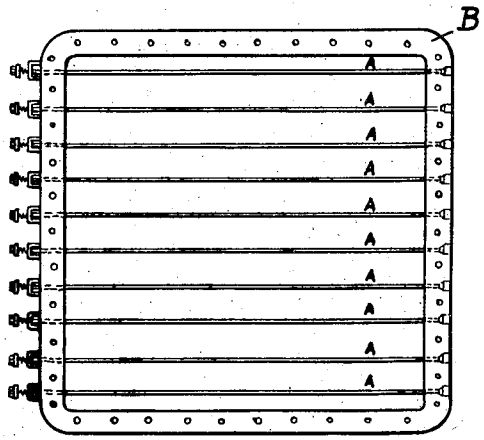
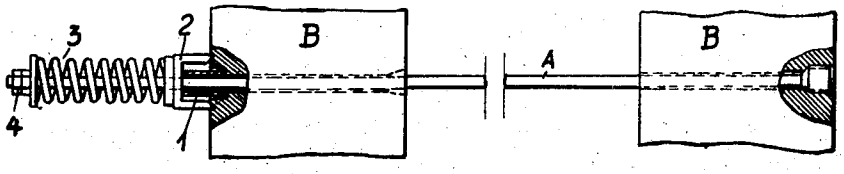


Fig 1b



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Fig. 1c

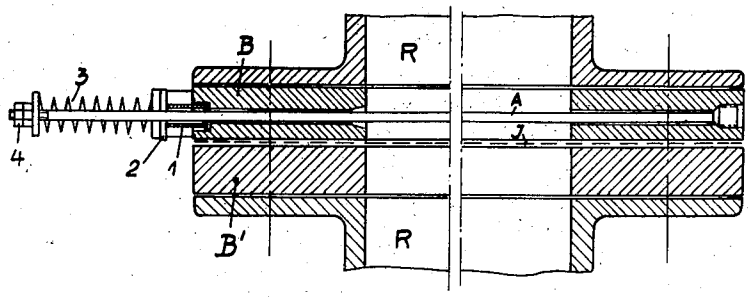


Fig. 1d

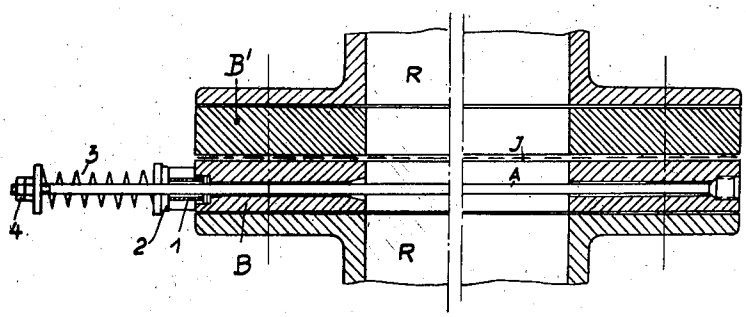
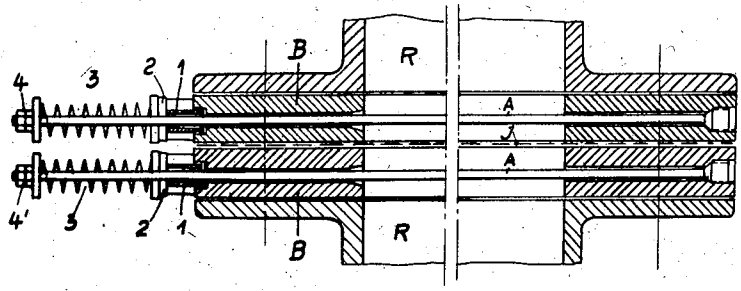


Fig. 1e



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Fig. 2

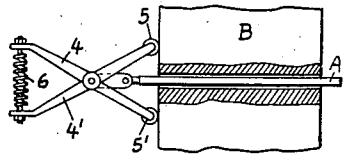


Fig. 2a

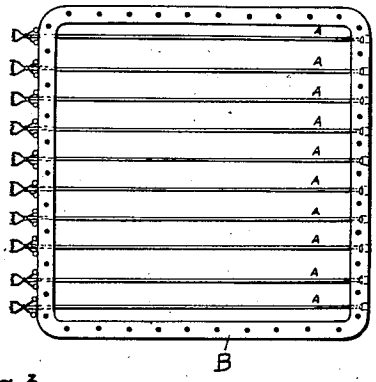


Fig. 3

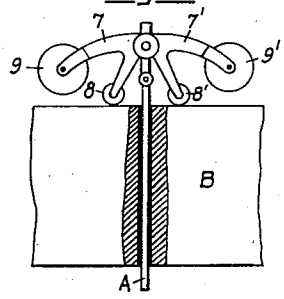
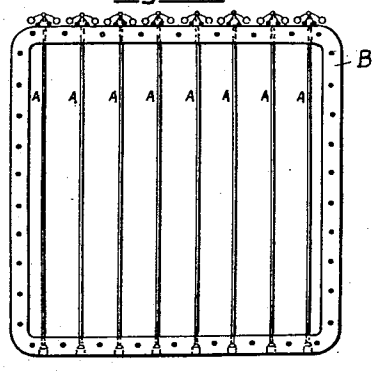


Fig. 3a



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UNITED STATES PATENT OFFICE

2,156,422

APPARATUS FOR CARRYING OUT REACTIONS WITH WIRE GAUZE CATALYSTS

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Application September 8, 1937, Serial No. 162,953
In Germany January 30, 1936

3 Claims. (Cl. 23—288)

The present invention relates to improvements in apparatus for carrying out reactions with wire gauze of catalytically active metals.

The wire gauze constructed of catalytically active metals, such as platinum or its alloys, which are arranged transverse to the direction of flow of the reactants in catalytic reactions, in particular in the oxidation of ammonia, are subjected to quite considerable strain by the working temperatures which are frequently very high. The wire gauze expand when heated and tend to bulge by reason of their own weight and/or the pressure of the reactants flowing therethrough. This strain on the wire gauze leads to a shortening of its working life. It has therefore already been proposed to subject the wire gauze to a strong tensile stress by loading with weights or by spring action. It is not advisable, however, to expose the sensitive wire gauze to such strong tension, especially since the latter is increased by the pressure of the flowing reactants. According to another proposal, the wire gauze is provided with supports, especially supports of heat-resistant metals. However, such devices fulfil the desired purpose for long only incompletely, in particular because they themselves are subjected to the expansion phenomena caused by the heat.

I have now found that bulges in the wire gauze can be effectively prevented even in continuous operation by taking care that the supports, advantageously used in the form of wires, are kept in a tightly stretched state during the operation by a device which acts automatically. In this way mechanical strain on the wire gauze is appreciably reduced; this not only results in a considerable increase in its working life but also renders it possible to pass through a considerably larger amount of reaction gases per unit of surface of the catalyst net than without the said device.

The supporting wires may be arranged parallel to each other or at an angle to each other and on one or both sides of the wire gauze which is arranged in the reaction chamber in a horizontal, vertical or inclined position.

Devices for constantly keeping wires under tension are already known, for example in apparatus for electrical gas purification, but the employment of such devices in combination with wire net catalysts is new.

The invention will now be further described with reference to the accompanying drawings which show arrangements of apparatus according to this invention but the invention is not restricted to the particular arrangements shown.

Figure 1 is a vertical section through a reaction chamber.

Figure 1*a* is a plan view of the mid-section of the chamber shown in Figure 1.

Figure 1*b* is a detailed view illustrating a manner in which the supporting wire may be fastened to the walls of the apparatus.

Figures 1*c*, 1*d* and 1*e* are detailed views showing various modifications of applicant's invention.

Figure 2 illustrates another means for keeping the supporting wire taut.

Figure 2*a* is a plan view similar to that of Figure 1*a* in which the means of keeping the supporting wire taut is that shown in Figure 2.

Figures 3 and 3*a* correspond to Figures 2 and 2*a* respectively and illustrate a further modification of applicant's invention.

With reference to Figure 1, R denotes a reaction chamber provided with flange rings B and B', supporting wire A, and catalytic screen J. Catalytic screen J is not attached rigidly to any portion of the apparatus and is, therefore, free to expand and contract without being subjected to tensile stress or bending. Since the supporting wire A is positioned above screen J, in this instance it is obvious that the reaction chamber shown in Figure 1 is one through which the reaction gases pass in an upward direction.

A plurality of supporting wires A may be and preferably are employed throughout the cross-section of the apparatus. Said supporting wires A, which pass through the reaction chamber, may be fastened to the walls thereof in the following manner. At one end the wires are thickened and the thickened portions thereof are positioned in cavities in the flange ring in order to provide a firm hold at said end. At the other end each wire A projects beyond the chamber wall and is not fixed. It is kept under tension by means of compression spring 3 acting upon nut 4 threaded upon the end of supporting wire A. Stuffing box 1 serves to prevent any of the reaction gases from leaking out of the chamber by passing along supporting wire A, and collar bearing 2, which is not rigidly attached to supporting wire A, serves the double purpose of keeping packing box 1 in its proper position and as an abutment for compression spring 3. Nut 4 is tightened so as to give supporting wire A the proper amount of tension when the apparatus is cold. As said apparatus becomes heated, wire A will tend to expand and is allowed to do so by means of the described device without any decrease in its tension. Thus

it may be seen that the supporting wires A require no further adjustment even though they are rapidly heated and cooled. Instead of the tension device being arranged at only one end of each wire A, it may also be arranged at both ends of each supporting wire. The number of supporting wires A used depends upon special requirements such as the active area and thickness of the metal wire screen J.

The relative position of supporting wires A, with respect to metal wire screen or screens J, may be varied in several ways, depending upon the direction of the flow of the reacting gases. Thus Figure 1c illustrates, as does Figure 1, a modification wherein supporting wires A are positioned above catalytic screen J so that the latter may be given support when reacting gases are passed through chamber R in an upward direction. It is evident that supporting wires A may also be positioned below catalytic screen J, as illustrated in Figure 1*d*, so that the latter will receive support from the former when reacting gases are passed through chamber R in a downward direction. A further modification, illustrated in Figure 1*e*, is that of positioning supporting wires both above and below catalytic screen J. This latter modification is particularly suitable when the reacting gases are passed through chamber R in alternating directions. It is obvious, of course, if two or more catalytic screens are required, that supporting wires A may be positioned between and on either or both sides of said catalytic screens.

In the arrangement shown in Figure 2, a helical spring 6 acts upon scissor-like levers 4 and 4' which are freely movable by means of rollers 5 and 5' over the surfaces of flange ring B. Supporting wire A passes through flange ring B and is attached to the fulcrum of scissor-like levers 4 and 4'. As the supporting wire A expands, levers 4 and 4' will tend to close. Spring 6, by tending to draw together the ends of levers 4 and 4', continually maintains tension in supporting wire A. Thus it may be seen that this modification also allows supporting wire A to expand and contract while automatically being under tension. Figure 2*a* illustrates an application of this modification.

Another means for continually keeping supporting wires A in a state of tension, which is particularly suitable when said supporting wires are placed in a vertical position, is illustrated in Figures 3 and 3*a*. It consists of a scissor-like device, similar to that of Figure 2, comprising levers 7 and 7', rollers 8 and 8' and weights 9 and 9'. The free end of supporting wire A is attached to the fulcrum of the scissor-like device and is continually kept in tension while being allowed to expand and contract due to the action of weights 9 and 9' which tend to force rollers 8 and 8' towards one another and to thus raise the fulcrum.

What I claim is:

1. Apparatus for carrying out catalytic reactions comprising catalytically active metal wire gauze arranged transverse to the direction of flow of the reactants, supports for said catalytically active metal wire gauze and an automatically acting tension device to maintain said supports in a tightly stretched condition during operation, the catalytically active metal wire gauze resting loosely against the supports and being subjected to none of the tension imparted to said supports.

2. Apparatus for carrying out catalytic reactions comprising catalytically active metal wire gauze arranged transverse to the direction of flow of the reactants, supports for said catalytically active metal wire gauze and a tension device acting automatically by spring action to maintain said supports in a tightly stretched condition during operation, the catalytically active metal wire gauze resting loosely against the supports and being subjected to none of the tension imparted to said supports.

3. Apparatus for carrying out catalytic reactions comprising catalytically active metal wire gauze arranged transverse to the direction of flow of the reactants, supports for said catalytically active metal wire gauze and a tension device acting automatically by loading with weights to maintain said supports in a tightly stretched condition during operation, the catalytically active metal wire gauze resting loosely against the supports and being subjected to none of the tension imparted to said supports.

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