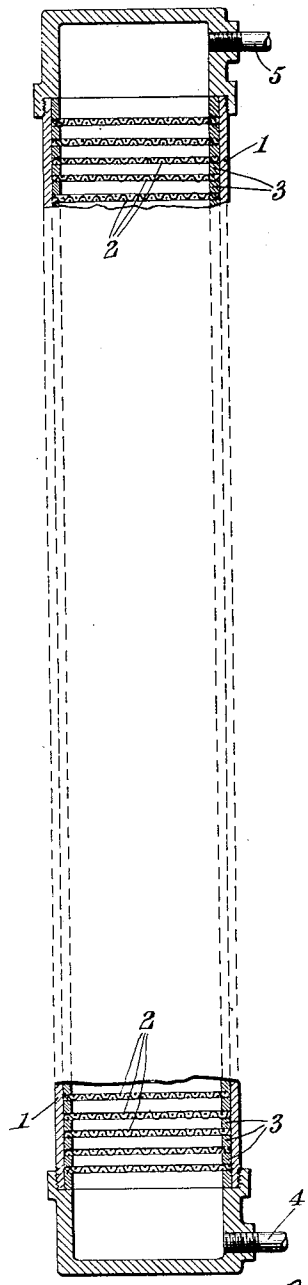
A. A. BACKHAUS AND F. B. ARENTZ.

PROCESS OF MAKING CATALYZERS.

APPLICATION FILED JUNE 15, 1918.

1,376,665. Patented May 3, 1921.



Inventor
Arthur A. Backhaus.
Fred B. Arentz,
By their Attorneys
Priddle, Wright & Small

UNITED STATES PATENT OFFICE.

ARTHUR A. BACKHAUS, OF BALTIMORE, AND FRED B. ARENTZ, OF CURTIS BAY, MARYLAND, ASSIGNORS TO U. S. INDUSTRIAL ALCOHOL CO., A CORPORATION OF WEST VIRGINIA.

PROCESS OF MAKING CATALYZERS.

1,376,665. Specification of Letters Patent. Patented May 3, 1921.

Application filed June 15, 1918. Serial No. 240,226.

To all whom it may concern:

Be it known that we, ARTHUR A. BACKHAUS, of Baltimore, in the State of Maryland, and FRED B. ARENTZ, of Curtis Bay, in the county of Anne Arundel, and in the State of Maryland, have invented certain new and useful Improvements in Processes of Making Catalyzers, and do hereby declare that the following is a full, clear, and exact description thereof.

Our invention relates particularly to a process of producing catalyzers which are used in the production of aldehydes.

The object of our invention is to provide a process by which catalyzers of the above type may be advantageously made and by which efficient catalyzers may be obtained to bring about the production of aldehydes, as for example, acetaldehyde, by passing alcohol over a catalyzer of this character while heated.

Another object of our invention is to provide a process of producing catalyzers containing a catalytic metal such, for example, as copper, nickel, chromium or iron, to be used for the production of aldehydes in this way.

Further objects of our invention will appear from the detailed description thereof contained hereinafter.

While our invention is capable of being carried out in may different ways, we shall describe hereinafter only one way of carrying out the same, and shall show only one form of apparatus used in connection with the same in the accompanying drawing, in which—

The figure is a vertical section of a catalyzer made in accordance with our invention.

In carrying out our process, we fill a copper tube 1 with a large number of substantially parallel disks 2 of permeable material, as for example copper gauze, which may be contiguous with one another or separated by rings 3, as desired.

The metal is a very good conductor of heat, and in this way the reaction temperature may be readily carried to all parts of the catalyzer tube 1, with which the disks are shown as contacting. In order to make the gauze disks 2 active, so as to bring about the change from alcohol to acetaldehyde, the surfaces of the disks 2 are, in the present embodiment of our invention, coated with a finely divided catalytic metal by pouring a solution of a catalytic metal nitrate, such for example as cupric nitrate or nickel nitrate ($Ni(NO_3)_2$ or both, into the catalyzer tube 1, and then passing ammonia gas through the tube to precipitate *in situ* the hydroxid upon the gauze disks 2. The hydroxid is then partially decomposed by heating to a temperature of 300° C. or higher, and is then reduced *in situ* by means such as a current of hydrogen heated to approximately 300° C.

Instead of proceeding as above, by pouring in a nitrate, we may introduce a dilute solution of nitric acid having a strength of 5 to 10%, and then proceeding as before to form the finely divided catalytic metal upon the disks 2.

In this way a very finely divided deposit of the metal is carried by the meshes of the disks 2, and thereafter, when a current of vapors of an alcohol, such for example as ethyl alcohol, is passed through the tube 1 while heated to a temperature of approximately 300° C., the finely divided catalytic metal causes the alcohol to be broken down into acetaldehyde and hydrogen, which may be conveyed away and separated in any suitable manner.

During the formation of the acetaldehyde, the heating of the catalyzer tube 1 may be very effectively carried out by the external application of heat, which is readily conveyed to all portions of the catalytic material by reason of the fact that the latter is carried upon the disks of gauze 2, which form very effective conductors of heat. In this way the acetaldehyde will be very uniformly formed from the alcohol vapors.

While we have described our invention above in detail, we wish it to be understood that many changes may be made therein without departing from the spirit of the invention.

We claim:

1. The process which comprises forming a salt of a catalytic metal upon a metal body by adding a salt to said body and then depositing a finely divided catalytic metal by precipitating and afterward reducing *in situ* by aeriform agents from said salt upon said body.

2. The process which comprises forming cupric nitrate upon a body of metal gauze and then depositing finely divided metallic copper by precipitating and afterward reducing *in situ* by aeriform agents from said salt upon said gauze.

3. The process which comprises forming a nitrate of a catalytic metal upon a metal body, the nitrate being formed thereon by applying a solution of a nitrate of the metal, and then depositing a finely divided catalytic metal by precipitating and afterward reducing *in situ* by aeriform agents from said salt upon said body.

4. The process which comprises forming cupric nitrate upon a disk of metal gauze, the nitrate being formed thereon by applying a solution of cupric nitrate, and then depositing finely divided metallic copper by precipitating and afterward reducing *in situ* by aeriform agents from said salt upon said gauze.

5. The process which comprises forming a nitrate of a catalytic metal upon a metal body, the nitrate being formed thereon by applying a solution of a nitrate of the metal, and then depositing a finely divided catalytic metal from said salt upon said body by treating with ammonia to form a hydroxid, igniting to form an oxid from said hydroxid, and reducing the oxid with a current of hydrogen.

6. The process which comprises forming cupric nitrate upon a disk of metal gauze, the nitrate being formed thereon by applying a solution of cupric nitrate, and then depositing finely divided metallic copper from said salt upon said gauze by treating with ammonia to form a hydroxid, igniting to form an oxid from said hydroxid, and reducing the oxid with a current of hydrogen.

7. The process which comprises (1) assembling, within a metallic tube, a large number of parallel permeable disks, made of heat-conductive material and in heat conductive relationship with said tube, (2) applying a dissolved salt of a catalytic metal thereto, (3) passing an aeriform precipitant into contact therewith, (4) partially decomposing the precipitate by heat, and then (5) reducing the metal *in situ* within said tube.

In testimony that we claim the foregoing we have hereunto set our hands.

ARTHUR A. BACKHAUS.
FRED B. ARENTZ.

Witnesses:
JOHN P. GISCHEL,
ARTHUR WRIGHT.