[Second Edition].

PATENT SPECIFICATION

261,787

Convention Date (Germany): Nov. 21, 1925.

Application Date (in United Kingdom): Nov. 20, 1926. No. 29,403 / 26.

Complete Accepted: Feb. 20, 1928.

COMPLETE SPECIFICATION.

Improvements in Methods for Carrying Out Catalytic Chemical Processes.

I, JOSEPH TRAUTMANN, of 33, Halskestrasse, Berlin-Südende, Germany, of German nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

In carrying out catalytic processes it is of great importance to secure as fine a division of the materials to be treated as possible and then to mix the particles intimately so as to secure their very close contact. These preliminary conditions are a necessary part of the chemical conversion processes involved in improving the quality of fuel, that is to say, in producing valuable liquid fuels, such as, for example, benzine, from less valuable liquid or solid fuels, such as, for example, residues that are difficult to evaporate, or coal. According to the present invention they are created by the use of threshing or centrifugal apparatus.

It is known to accelerate the hydrogenation of carbon or oil or the synthetic production of oils, for instance, from carbonic oxide and hydrogen by catalysers. As such may be considered metals such as tin. To assist the action of the catalyser it has before been proposed to introduce the catalyser in a liquid condition into the reaction chamber or to force the raw material through a liquid metal bath. This last-mentioned method has the particular disadvantage that the surface action is comparatively small.

The fine division, intimate admixture, and increased surface action secured by the centrifugal or threshing movement according to the invention are combined with an increase in the action of the catalyser, the threshing or centrifugal apparatus working in a bath of catalytic substance. If desired, the threshing or centrifugal apparatus may also be coated with the catalyser.

The process according to the present invention may, for example, be carried out as follows:

The metallic catalysers and other reaction substances may be introduced into the reaction chamber in liquid condition, or they may be liquefied by heating the reaction chamber and are maintained in this condition. Rotating members are disposed in the reaction chamber; these thresh the liquid bath and thus atomize the liquid, the reaction substances intimately mixing with the resulting mist.

Furthermore, the rotating parts can be so arranged that they drag the reaction substances through the bath and produce intimate contact between the reaction substances and the bath. This method has the advantage that by the threshing action of the rotating parts—that is, by the dragging of the reaction substances through the metal bath, local compressions are produced which assist the reaction process.

The liquid metal may, for instance, be circulated through the reaction chamber and heating apparatus, or the whole reaction chamber may be heated, the operation being advantageously so carried out that the atomized metal impinges upon the hot walls and is there permanently maintained heated. In this way the transmission of heat from the walls to the reaction substances is appreciably assisted.

The reaction chamber or the metal therein may be advantageously heated electrically, resistance heating elements, properly insulated, being provided outside the reaction chamber or in the metal bath itself. If metal salts are used as catalysers instead of metals themselves, electrical heat can be applied by directing the current directly through the bath of salts. Furthermore, the reaction chamber may be immersed in an electrically heated bath of salts.

A large surface action may be secured, moreover, by providing the threshing members, and if necessary, also the walls of the reaction chamber, with a catalytically acting coating. This process applies to a further action by catalysers having a high melting point.

The catalytic coating may be applied electrolytically (galvanically) or by spraying those faces of the reaction chamber or threshing apparatus which come into

[Price 1/-]

contact with the reaction substances during the operation.

The reaction chambers may be provided similarly to the blowers of known form used for other purposes, in which a plurality of blowers can be arranged in series. In thus arranging the blowers the pressure rises in stages in the several blowers.

Apparatus for carrying out the method of the invention are illustrated by way of example in the accompanying drawings, in which:

Figures 1 and 2 show an apparatus which operates chiefly by threshing action;

Figure 3 shows an apparatus with centrifugal action; and

Figure 4 shows a blower.

In the construction according to Figures 1 and 2, threshers *d* are mounted on a shaft *c* in a vessel *a*, which is provided with a heating jacket and a removable cover *b* that is likewise heated; the shaft rotates in the bearing blocks *k* and *l* and is driven by means of the belt pulley *f*. At the ends of the threshers *d* beaters *e* are pivotally mounted. The substance to be treated is fed under pressure through the pipe *g* in such manner that it comes into position under the beaters, and is thence forced into the liquid in the vessel, which is molten metal *m*, and drawn right through it. As already indicated, this ensures particularly intimate contact between the liquid *m* and the reaction substance. Those of the products that are gaseous are carried off through the pipe *j*, and those which are solid or liquid are drawn off through the pipes *h*.

Figure 3 shows a different construction. The upper part *b* of the heated vessel *a* has a number of recesses or cavities *i*, which has the effect of increasng the heating action. The shaft *c*, which runs in the bearings *k* and *l*, is provided with a number of discs *d* which are connected together at their peripheries by bars *e*. The bars *e* pass through the metal in the vessel *a* taking up particles and carrying them along, so that a mist is formed from the molten metal or metal salts in the lower part. The reaction substances, which enter at *g* and leave at *h*, are obliged to pass through the mist so that very intimate contact is secured. The projections *i* prevent the reaction substance from passing directly from *g* to *h*, but cause it to be deflected towards the centre of the vessel. The device shown in Figure 4 comprises a wheel *d* with two inlet (suction) openings and common outlet openings on the periphery. It is disposed within the outer heated jacket, the upper part *b* of which can be lifted from the lower part *a*. The jacket is heated so strongly that the molten metal passing through the apparatus does not change its condition. Through the pipe *z* and the annular space to which it leads the molten metal is fed to the suction opening d^1 while through the pipe *g* and the annular space to which it leads reaction substances are fed to the suction opening d^2 of the wheel *d*, the openings d^1 and d^2 being oppositely disposed. The surfaces h^1, h^2 form the blades of the blower wheel. On leaving the blade space the metal and the reaction substances are brought together. The centrifugal force produces centrifugal action which causes an intimate mixture of the metal acting as the catalyser and the reaction substances. The whole mixture is discharged through the outlet *y*, to a separating plant (not illustrated) by which the metal is separated from the products of the treatment, and the metal can be re-introduced into the circuit as a catalyser after it has been again heated up.

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. A method of carrying out catalytic reactions with molten metals or alloys or metal salts as catalysers, characterised in that the molten metal or the alloy or metal salts is atomised in the reaction chamber by threshing or centrifugal apparatus, for the purposes and substantially as hereinbefore described.

2. A method as specified in Claim 1, in which the threshing or centrifugal action is produced by rotating members, which pass through a bath of metal, for example, liquid tin, or of a metal alloy or a metal salt, and spray the liquid, substantially as hereinbefore described.

3. A method as specified in Claim 1 or in Claim 2, in which the rotating members drag the raw material through the bath and thus produce intimate contact, substantially as hereinbefore described.

4. A method as specified in any of the preceding claims, in which the bath of metal or metal salts, and in certain circumstances also the reaction chamber, are heated electrically, substantially as hereinbefore described.

5. A method as specified in any of the preceding claims, in which the liquid, which acts as a catalyser, circulates through the reaction chamber and a heating apparatus provided in series therewith, substantially as hereinbefore described.

6. A method of carrying out catalytic

processes with molten metals or alloys as catalysts, according to Claims 1 to 5, characterised in that the threshing or centrifugal members provided for atomising the molten metal or the metal alloy, and/or the walls of the reaction chamber are provided with a coating of a difficultly fusible catalytically acting metal for the purpose of securing an additional catalytic action, substantially as hereinbefore described.

7. A method of carrying out catalytic processes with molten metals or alloys as catalysers, as specified in any of the preceding claims, in which the reaction is carried out in a centrifugal blower into which the material to be treated and the molten catalyser are fed or drawn in by suction and the inner surfaces of which can be completely or in part provided with a catalytic coating, substantially as hereinbefore described.

8. A method as specified in any of the preceding claims, in which the material to be treated and the molten catalyser are treated in a number of blowers arranged in series in differing pressure stages.

Dated this 20th day of November, 1926.
EDWARD EVANS & Co.,
27, Chancery Lane, London, W.C. 2,
Agents for the Applicant.

Abingdon: Printed for His Majesty's Stationery Office, by Burgess & Son.
[Wt. 51A.—50/12/1929]

261,787 COMPLETE SPECIFICATION

2 SHEETS
SHEET 1

2nd Edition

Fig. 1.

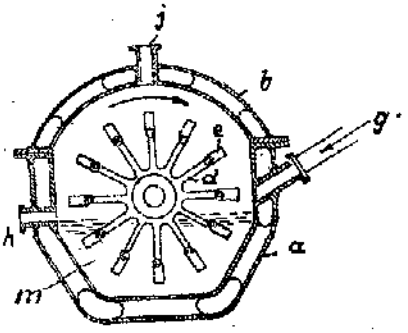


Fig. 2.

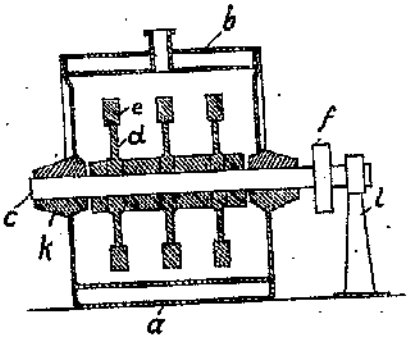
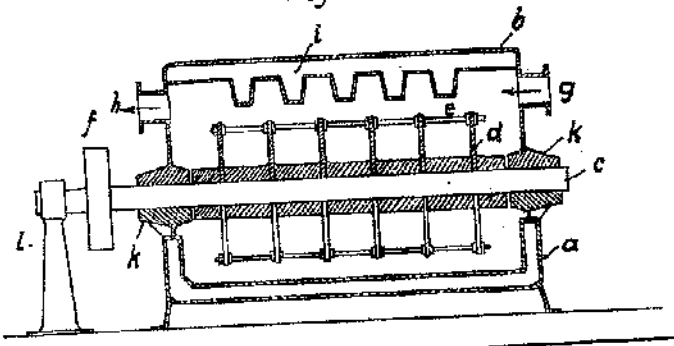
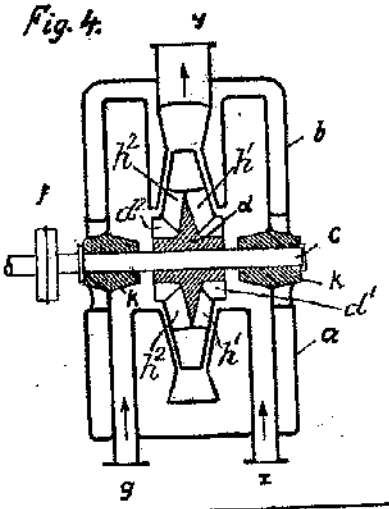


Fig. 3.



SHEET 2

Fig. 4.



Charles & Read Ltd. Photo Litho.