

RESERVED

# PATENT SPECIFICATION

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## PROVISIONAL SPECIFICATION

### Improved Apparatus for Reacting Sodium and Water

We, THE ASIATIC PETROLEUM COMPANY, LIMITED, a company organised under the laws of Great Britain, of St. Helen's Court, Great St. Helen's, London, E.C.3, JOHN AUGUSTUS ORIEL, British subject, of Norman House, Strand, London, W.C.2, and ISAAC LUBBOCK and ARTHUR HENRY GOODLIFFE, both British subjects, and both of St. Helen's Court, Great St. Helen's, London, E.C.3, do hereby declare the nature of this invention to be as follows:—

It is well-known that sodium and water when brought into contact generate hydrogen and a solution of caustic soda. This invention represents an improvement in apparatus used for this chemical reaction with the result that safe and smooth operation is obtainable.

In carrying out this chemical reaction a great deal of heat is evolved which if not carefully controlled can result in an intermittent operation of the reaction and also so affect the sodium fed into the apparatus as to cause the sodium to melt with consequent sporadic explosions or intermittent operation. This invention provides means whereby the sodium and water are brought progressively into conjunction and are held there until the reaction is complete.

According to the invention, apparatus for reacting sodium and water comprises a nozzle for their admission to the reaction

chamber which is formed so that the sodium is surrounded by the water. Thus the nozzle may be formed with a central opening through which the sodium is fed and with a surrounding annular passage connected to the supply of water.

The apparatus preferably comprises a primary reaction chamber from which the caustic soda solution and semi-reacted sodium are led to a secondary reaction chamber. In the latter, the fluid and the sodium particles are kept in a state of rotation which in the lower part is a forced vortex and in the upper part is a free vortex.

By means of baffles in the outer chamber part of the fluid may be recirculated and part allowed to escape, the generated gas being separated and taken off from another exit.

Where it is desirable that the gases should be led from the machine at a pressure above that of the atmosphere, the means of introducing the sodium and the water together with the exit of the fluid and the gas are so designed as to maintain a pressure above atmospheric within the reaction chambers.

Dated the 18th day of May, 1943.

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## COMPLETE SPECIFICATION

### Improved Apparatus for Reacting Sodium and Water

We, THE ASIATIC PETROLEUM COMPANY, LIMITED, a company organised under the laws of Great Britain, of St. Helen's Court, Great St. Helen's, London, E.C.3, JOHN AUGUSTUS ORIEL, British subject, of Norman House, Strand, London, W.C.2, and ISAAC LUBBOCK and ARTHUR HENRY GOODLIFFE, both British subjects, and both of St. Helen's Court, Great St. Helen's, London, E.C.3, 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:—

[P]

It is well-known that sodium and water when brought into contact generate hydrogen and a solution of caustic soda. This invention represents an improvement in apparatus used for this chemical reaction with the result that safe and smooth operation is obtainable.

In carrying out this chemical reaction a great deal of heat is evolved which if not carefully controlled can result in an intermittent operation of the reaction and also so affect the sodium fed into the apparatus as to cause the sodium to melt with consequent sporadic explosions or

intermittent operation. This invention provides means whereby the sodium and water are brought progressively into conjunction and are held there until the reaction is complete.

5 According to the invention, apparatus for reacting sodium and water comprises a nozzle for their admission to the reaction chamber, which nozzle is formed so that  
10 the feed of sodium is surrounded by the feed of water which comes into contact with the sodium as the latter emerges from the nozzle. Thus the nozzle may be formed with a central opening through  
15 which the sodium is adapted to be fed, and with a surrounding passage or passages connected to the supply of water. The said passage or passages are formed so that they direct the water towards the  
20 sodium, which may be fed in the form of a rod.

The water inlet to the nozzle may be formed so that the water is given a rotary motion.

25 The apparatus preferably comprises a primary reaction chamber in the vicinity of the nozzle and a secondary reaction chamber into which the caustic soda solution and semi-reacted sodium from the  
30 primary reaction chamber is led. The primary reaction chamber may be bounded by a shield surrounding the space in front of the nozzle and thus confining the spray of the reacting water and sodium.

35 In the secondary reaction chamber means are preferably provided for rotating the fluid and the sodium particles.

40 One exit may be provided for the generated gas and another for the fluid, and the passage for fluid to the exit may be formed so as to provide a seal of fluid against the exit of gas. This seal may be obtained by means of a partitioned extension providing a downward passage for the fluid on one  
45 side of the partition and an upward passage on the other side of the partition leading from the downward passage to the fluid exit. This extension is preferably made long enough to provide for a head of  
50 fluid to balance a substantial superatmospheric pressure within the apparatus.

If it is desired to work under superatmospheric pressure within the apparatus, the means for introducing the  
55 sodium and water will of course be adapted to overcome this superatmospheric pressure, the latter being produced by suitably controlling the exit or withdrawal of the generated gas, e.g. by a  
60 restriction or control valve.

The exit for generated gas may be positioned in the wall of a funnel surrounding a space intermediate the primary reaction chamber and the secondary reaction chamber, the funnel being provided with aper-

tures for the passage from the outside of the funnel to the exit of gas generated from the secondary reaction chamber.

The funnel may accordingly be arranged in relation to the secondary reaction chamber so that fluid will overflow therefrom on the outside of the funnel, and gas separating from this fluid will pass up outside the funnel to the apertures therein and thence to the gas exit.  
75

The invention is illustrated by way of example in the accompanying drawing, in which fig. 1 is a vertical section of the apparatus provided according to the invention and fig. 2 is a part plan view taken  
80 on the line 2-2 of fig. 1.

Referring to the drawing, the nozzle comprises an inner member 1 having a central opening 2 through which is continuously fed a sodium rod 3, the feed  
85 being effected mechanically by the power-driven spiked wheels 3<sup>1</sup>. The reference numeral 4 indicates a packing to seal the place of admission of the sodium rod into the nozzle member 1. The nozzle also  
90 comprises the annular passage 5 for the admission of water to surround the sodium rod as it is fed through the central opening. This annular passage 5 is of conical form so as to direct the water upon the  
95 sodium rod. Instead of being a single passage, the water inlet may be a number of jets spaced around the central opening. Water is fed in through an inlet 6 leading to a chamber 7 behind the annular passage  
100 5. A deflector 7<sup>1</sup> is provided so that the incoming water may be given a rotary motion.

A tubular shield 8 surrounds the space in front of the nozzle so as to confine the  
105 spray of reacting water and sodium. The space within the shield 8 constitutes a primary reaction chamber.

Surrounding the shield 8 is a funnel 9 the lower end of which leads into a secondary reaction chamber 10.

At the bottom of the secondary reaction chamber 10 is a spinner 11 serving to impart rotation to the fluid in the lower part of the reaction chamber, whereby the fluid  
115 rising in the upper part of this reaction chamber has mainly a rotary motion. The rotation of the fluid in the secondary reaction chamber promotes complete reaction and the separation of gas from liquid.  
120 The secondary reaction chamber is partly covered by an annular baffle 12 which serves to prevent a too ready escape of liquid out of the secondary reaction chamber. A gauze disc may be mounted across  
125 the interior of the funnel.

The secondary wall of the secondary reaction chamber extends upwardly as indicated at 13 and downwardly as indicated at 14. The main wall 15 of the apparatus  
130

coaxially surrounds the secondary chamber wall and its extensions 13 and 14, thus providing a downwards passage 16 for fluid overflow out of the secondary reaction chamber after passing above the top of the extension 13. Surrounding the main wall 15 is an outer wall 17 providing an annular space 18 for the upward passage of fluid which has reached the extremity of the downward passage 16 whence it passes into the upward passage 18 underneath the main wall 15 which thus serves as a partition between the downward passage 16 and the upward passage 18.

The fluid exit is indicated at 19. It will be appreciated that the fluid in the downward passage 16 and the upward passage 18 leading to the exit 19 provides a seal of fluid against the exit of gas. Moreover, by providing the walls 14, 15 and 17 of sufficient differential head of fluid in the passages 16 and 18 to balance a substantial superatmospheric pressure within the apparatus.

The exit 20 for generated gas is formed in the upper part of the wall of the funnel 9, the latter being provided with apertures 21 for the passage from the outside of the funnel to the exit 20 of gas generated from the fluid in the secondary reaction chamber 10 and which passes up on the outside of the funnel 9.

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

1. Apparatus for reacting sodium and water comprising a nozzle for their admission to the reaction chamber, which nozzle is formed so that the feed of sodium is surrounded by the feed of water which comes into contact with the sodium as the latter emerges from the nozzle.

2. Apparatus as claimed in claim 1 in which the nozzle is formed with a central opening through which the sodium is adapted to be mechanically fed and with a surrounding passage or passages connected to the supply of water.

3. Apparatus as claimed in claim 1 or 2, in which the nozzle is adapted for the feed of sodium in the form of a rod.

4. Apparatus as claimed in claim 1, 2, or 3, in which means are provided for feeding the water to the nozzle with a rotary motion.

5. Apparatus for reacting sodium and water comprising a nozzle for their admission to the reaction chamber, which nozzle is constructed substantially as described and as shown in the accompanying drawing.

6. Apparatus as claimed in any of the

preceding claims comprising a primary reaction chamber in the vicinity of the nozzle and a secondary reaction chamber into which the caustic soda solution and semi-reacted sodium from the primary reaction chamber is led.

7. Apparatus as claimed in claim 6 in which the primary reaction chamber is bounded by a shield surrounding the space in front of the nozzle and thus confining the spray of reaction water and sodium.

8. Apparatus as claimed in claim 6 or 7, in which means are provided for rotating the fluid and sodium particles in the secondary reaction chamber.

9. Apparatus as claimed in claim 8 in which said means is a mechanically rotated spinner in the lower part of the secondary reaction chamber.

10. Apparatus as claimed in any of the preceding claims in which one exit is provided for the generated gas and another exit for the fluid.

11. Apparatus as claimed in claim 10 in which the passage for fluid to the exit is formed so as to provide a seal of fluid against the exit of gas.

12. Apparatus as claimed in claim 11 comprising a partitioned extension providing a downward passage for the fluid on one side of the partition and an upward passage on the other side of the partition leading to the fluid exit.

13. Apparatus as claimed in claim 12, in which the extension is long enough to provide for a head of fluid to balance a substantial superatmospheric pressure within the apparatus.

14. Apparatus as claimed in claim 13 in which the means for introducing the sodium and the water are adapted to overcome superatmospheric pressure within the apparatus and the exit of the generated gas is controlled so as to cause superatmospheric pressure to arise within the apparatus.

15. Apparatus as claimed in any of claims 6 to 14 in which an exit for generated gas is positioned in the wall of a funnel surrounding a space intermediate between the primary reaction chamber and the secondary reaction chamber, the funnel being provided with apertures for the passage from the outside of the funnel to the exit of gas generated from the secondary reaction chamber.

16. Apparatus as claimed in claim 15 in which the funnel is arranged in relation to the secondary reaction chamber so that fluid will overflow from the said reaction chamber outside the funnel and gas separating from this fluid will pass up outside the funnel to the aperture therein.

17. Apparatus as claimed in any of claims 6 to 16 in which an annular baffle

partially covers the secondary chamber for the purpose described.

18. Apparatus as claimed in any of claims 15 to 17 in which a gauze disc is mounted across the interior of the said funnels.

19. Apparatus as claimed in any of the preceding claims having reaction cham-

bers and exit arrangements for fluid and gas all substantially as described and as shown in the accompanying drawings.

Dated the 19th day of May, 1944.

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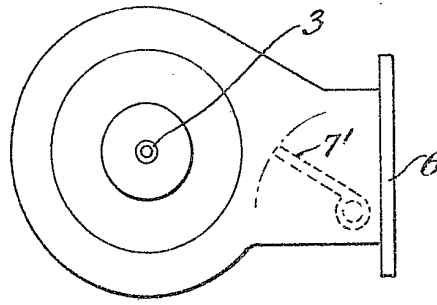


Fig. 2.

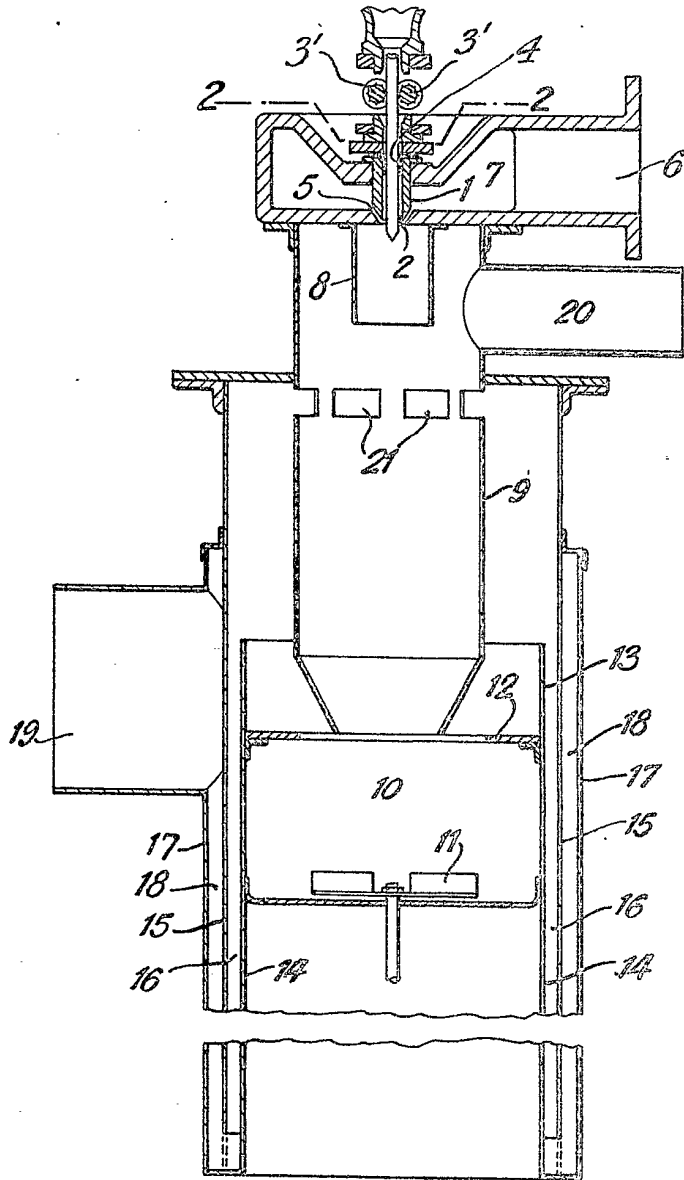


Fig. 1.

[This Drawing is a reproduction of the Original on a reduced scale.]