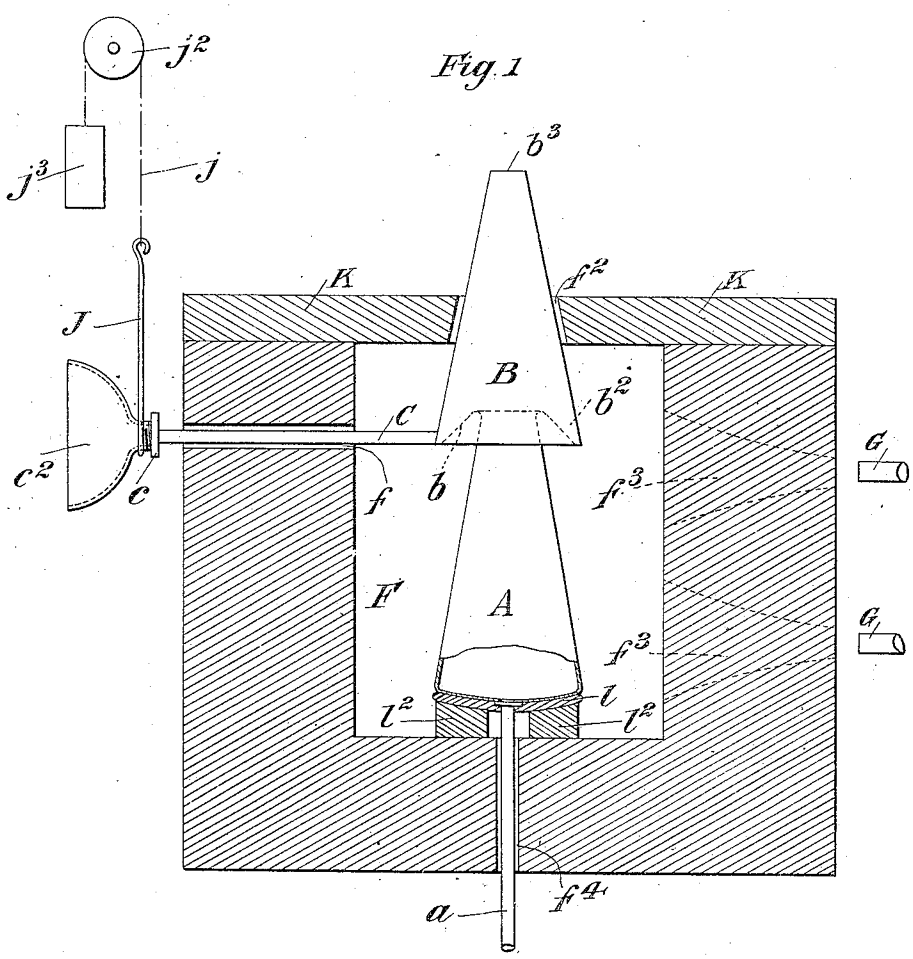
J. A. KENDALL.
PROCESS OF MANUFACTURING ALKALI METAL CYANIDS.
APPLICATION FILED NOV. 5, 1910.

1,037,019

Patented Aug. 27, 1912.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2.

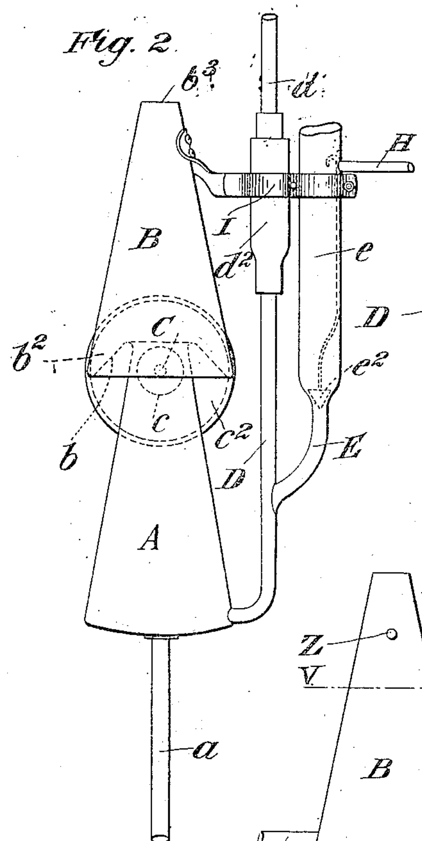


Fig. 3.

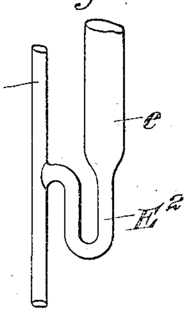
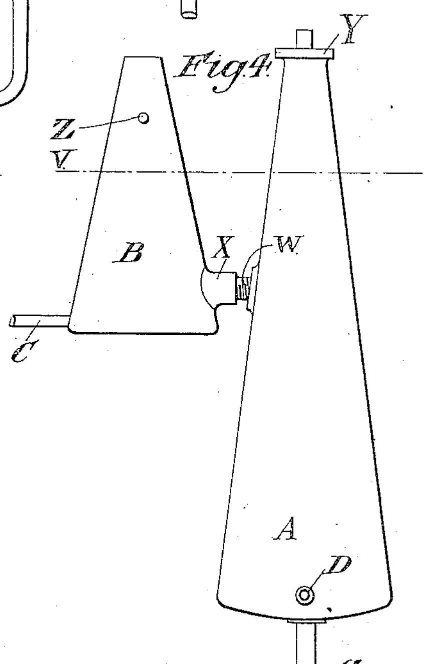


Fig 4.



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UNITED STATES PATENT OFFICE.

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PROCESS OF MANUFACTURING ALKALI-METAL CYANIDS.

1,037,019. Specification of Letters Patent. Patented Aug. 27, 1912.

Application filed November 5, 1910. Serial No. 590,873.

To all whom it may concern:

Be it known that I, JAMES ALFRED KENDALL, a subject of the King of Great Britain and Ireland, of 44 Fairmile avenue, Streatham, in the county of London, England, have invented a new and useful Process of Manufacturing Alkali-Metal Cyanids, of which the following is a specification.

This invention relates to the manufacture of alkali metal cyanids by reaction between carbon, nitrogen, and alkali, at a high temperature, and the said invention has for its object to provide means whereby the required cyanid can be conveniently, efficiently, and continuously, produced in a condition of great purity.

According to this invention the nitrogen and the required alkali metal containing matter, such as carbonate, or hydrate, of potassium, or of sodium, are fed in a carefully regulated manner into the lower part of a reaction chamber, or vessel, containing carbon, and the vapor of alkali metal cyanid, due to the reaction, passes into a condensing chamber, or vessel, which is provided at its lower part with means by which the liquefied alkali metal cyanid condensed passes out. The aforesaid apparatus is made of nickel, or cobalt, or other suitable metal, or alloy, but preferably nickel plate, either cast, or rolled, and containing one half of one per cent. of manganese, or plate cast from melted nickel to which a small quantity of carbon has been added. The plate should be autogenously welded in forming the apparatus. The apparatus is heated in a furnace flooded with the flame got by the combustion of hydrocarbon gas, or oil fuel, the flame being driven into the furnace by jets of air so as to completely fill it and allow a small surplus of flame to issue at openings provided for the purpose.

The apparatus, and the furnace by which it is heated, are preferably constructed as hereinafter described with reference to the accompanying drawing, but I do not limit myself to the precise details which I shall describe.

Figures 1 and 2 show the apparatus in elevations at right angles to each other. The furnace is shown in section in Fig. 1, but is omitted from Fig. 2. Fig. 3 shows a modified detail as hereinafter described. Fig. 4 is a side elevation of a modified form of reaction vessel and condenser.

The chamber, or vessel, A in which the reaction takes place is conical and its smaller upper end enters, for a short distance, a superposed condensing chamber, or vessel, B (also of conical formation), the said upper end being shaped, or provided with a turned down flange b so as to form a channel, or trough, b^2 surrounding the upper part of the reaction chamber, or vessel, A, and, from this channel or trough, b^2 leads an outlet tube C for the liquefied cyanid, the said tube being provided with a flange c near its end (to prevent any creeping back of cyanid) and having a cup-like termination c^2 screwed onto its end, onto which cup-like termination the cyanid trickles, and from which it will fall into a receiver.

For the supply of nitrogen, a tube D, soldered into the lower part of the reaction chamber, or vessel, extends upward outside the reaction and condensing chambers and is connected at top with the supply of nitrogen entering by the pipe d. Into the said tube D opens another tube E which also extends upward. This tube E is for the admission of the fused alkali metal containing material which can be supplied to, and be fused in, a funnel e (preferably cylindrical) at the top of the tube, for example when using a carbonate; or the fused alkali metal containing material can be allowed to drip into the funnel e, for example when using a hydrate, or it can be supplied in the form of compressed pellets.

The apparatus is placed in a furnace F so that the reaction chamber, or vessel, A, and the lower part of the condensing chamber, or vessel, B, and the tubes D and E and the lower part of the funnel e which receives the alkali metal containing material, are in the furnace, the upper part of the condensing chamber, or vessel, B extending to outside the furnace, so that gases produced in the cyanid reaction will escape by its contracted upper opening b^3 and so that fresh supplies of carbon can be introduced by the said opening, which can, if desired, be provided with a plate by which it can be closed to any required extent. The upper part of the funnel e to which the alkali metal containing material is supplied also projects from the furnace. The cyanid outlet tube C extends through an opening f in the wall of the furnace, there being a space between the wall and the said tube, and there being also a space between the condensing chamber, or vessel, and the opening f^2 in the roof of the furnace through which it passes to allow of the passage of the surplus flame around the said outlet tube C, and around the condensing chamber, or vessel, B. Besides these openings for the escape of flame, I provide an outlet which can be opened and closed by a movable brick, especially in the case of a furnace of large size. The furnace is provided with openings f^3 in its wall, opposite which openings are burners G and means for forcing air, with the flames of the burners, into the interior of the furnace.

For preventing the escape of nitrogen gas through the funnel e by which the alkali metal containing material is supplied, the opening leading from the said funnel into the tube E below it can be closed by a plug e^2, or the said tube can be made of siphon form, as illustrated at E^2 in Fig. 3. The said funnel e can be provided with means for passing coal-gas, or the like, into it to prevent access of air. The pipe at H is for this purpose. The tube D, by which nitrogen is supplied, is preferably made with an enlargement d^2 at the part where it emerges from the furnace, so as to prevent any alkali, which may penetrate into the said tube, causing obstruction to the flow of nitrogen.

The funnel e for the alkali metal containing material, and the pipe D for the nitrogen, can be supported by a clamp I fastened to the upper part of the condensing chamber, or vessel, B, as illustrated. The outlet tube C, and its cup-like termination C^2, should be so supported as to relieve strain and compensate for expansion and contraction. This may be done by means of a hook J on a chain j passing over a pulley j^2 and provided with a counterweight j^3, the hook being applied to the boss of the cup c^2, or to the end part of the cup-like termination c^2 of the outlet tube.

The entire apparatus within the furnace is made of metal which will withstand the action of the materials, and the high temperature employed, preferably nickel with a small percentage of manganese, or carbon, as aforesaid, the parts being autogenously welded together. The furnace may be made of refractory earthenware and the top may be made of removable bricks K. It is preferred to mount the reaction chamber, or vessel, A on a disk l of nickel, or the like, supported from the floor of the furnace by bricks l^2 and to put a little refractory earth on the said disk to prevent the reaction vessel adhering to it at the high temperature employed. The flame which passes out by the channel f around the cyanid outlet tube C will keep the cyanid in the said tube in a sufficiently liquid condition to cause it to flow out. The said channel f can be made as a slot from the top of the furnace and the upper part of this slot be filled in by a removable brick (or removable bricks) when the apparatus is in place in the furnace.

Should the carbon, or the alkali metal containing material, contain any appreciable quantity of ash, or non-volatile matter, means should be provided for removing such ash, or non-volatile matter, without it being necessary to remove the apparatus from the furnace for the purpose. This may be done by leading a tube a from the bottom of the reaction chamber, or vessel, A, this tube a passing out through a hole f^4 in the floor of the furnace, and the furnace being supported on columns, or the like, which will allow of access to the said tube a and a separate burner can be used at this hole so that the said tube a can be strongly heated when required. When ash, or non-volatile matter, is to be removed, the temperature of the furnace is reduced considerably below the working heat and a quantity of fused alkali metal containing matter is passed down the tube E which feeds in the said matter, and, if necessary, some alkaline borate can be added to it. The fused alkali containing matter will carry the ash, or non-volatile matter, out through the tube which is heated to the necessary temperature. The said tube may be closed by a plug of nickel, or other suitable material, during normal work, or the said tube may have a siphon bend in it.

The reaction vessel A, when in use, is completely filled with carbon which should extend up into the condensing chamber, or vessel, B, so as to partially fill it also.

The temperature required for the reaction I find is 1300° centigrade.

The condensing vessel B, instead of being superposed on the reaction vessel A, may, if desired, be situated at the required elevation at the side thereof, as illustrated for example in Fig. 4. The vessel A is made of such length that its upper part project above the furnace, the top of which is indicated by the dotted line V. The vessels A and B are in communication with each other for allowing the gaseous and vaporous products to pass from the vessel A to the condensing vessel B, which can be conveniently effected by two tubes W and X screwed together. The top of the vessel A is provided with a stopper Y which is removed when it is necessary to introduce fresh carbon. The clamp for supporting the nitrogen tube and the potash funnel can be carried by the upper part of the vessel A. The weight of the condensing vessel B can be counterpoised in order to prevent undue strain on the tubes W and X. This can be done by inserting two metal pegs (Z) into the upper part of the vessel B and connecting to these pegs the chain attached to a counterpoise like that shown in the first arrangement. The parts which correspond with those shown in the other figures are marked with the same reference letters.

I claim as my invention:

1. The method of manufacturing alkali metal cyanids which consists in feeding nitrogen and alkali metal containing matter to the lower portion of a quantity of carbon in a reaction chamber, highly heating the latter, leading the cyanid vapors upward through the carbon to a heated condenser and leading off therefrom in liquid form the cyanid condensed therein, substantially as described.

2. The method of manufacturing alkali metal cyanids which consists in feeding nitrogen and alkali metal containing matter to the lower portion of a quantity of carbon in a reaction chamber, highly heating the latter, leading the cyanid vapors upward through the carbon to a heated condenser containing carbon and leading off therefrom in liquid form, the cyanid condensed therein, substantially as described.

3. The method of manufacturing alkali metal cyanids which consists in feeding nitrogen and alkali metal containing matter to the lower portion of a quantity of carbon in a reaction chamber, highly heating the latter, leading the cyanid vapors upward through the carbon to a heated condenser and leading off therefrom in liquid form through a heated outlet the cyanid condensed therein, substantially as described.

4. The method of manufacturing alkali metal cyanids which consists in feeding nitrogen and alkali metal containing matter to the lower portion of a quantity of carbon in a reaction chamber, highly heating the latter, leading the cyanid vapors upward through the carbon to a heated condenser and leading off therefrom in liquid form the cyanid condensed therein and flowing off the ash from the reaction through a heated bottom discharge outlet, substantially as described.

5. The method of manufacturing alkali metal cyanids which consists in feeding carbon to a reaction chamber from above, and feeding nitrogen and alkali metal containing matter to the bottom thereof, highly heating the reaction chamber, leading the cyanid vapors upward through the carbon to a heated condenser and leading off from the latter, in liquid form, the cyanid condensed therein, substantially as described.

6. The method of manufacturing alkali metal cyanid which consists in filling a reaction chamber and at least partially filling a superposed condensing chamber with carbon, feeding to the lower portion of the reaction chamber a controlled quantity of nitrogen and alkali metal containing matter, heating the reaction chamber, leading the cyanid vapors upward through the carbon to the condenser, and leading off therefrom, in liquid form, the cyanid condensed therein, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES ALFRED KENDALL.

Witnesses:

EDWARD GEORGE DAVIES,

GILBERT FLETCHER TYSON.