

(No Model.)

H. Y. CASTNER.

PROCESS OF AND APPARATUS FOR MAKING ALKALI CYANIDS.

No. 543,643.

Patented July 30, 1895.

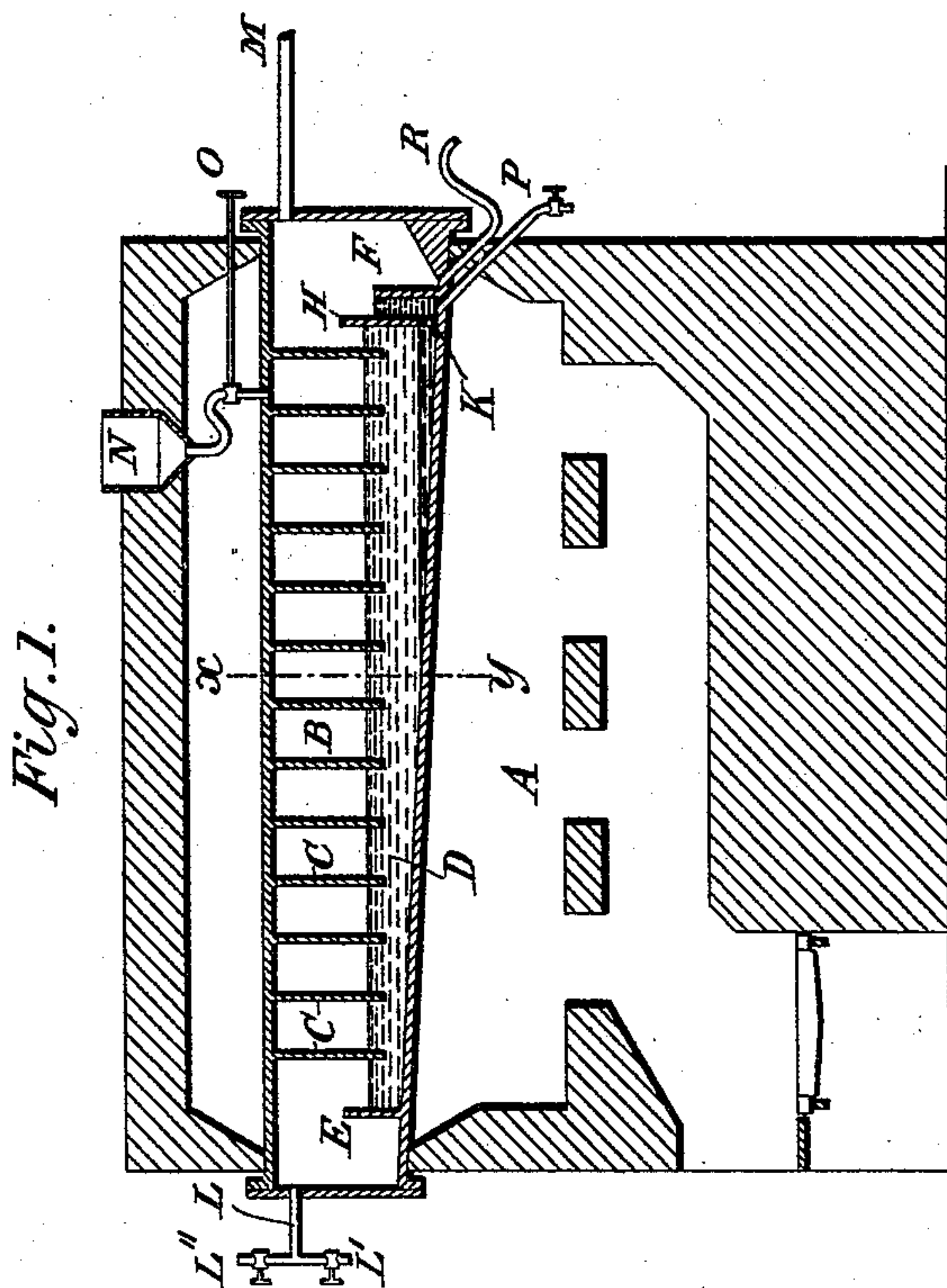
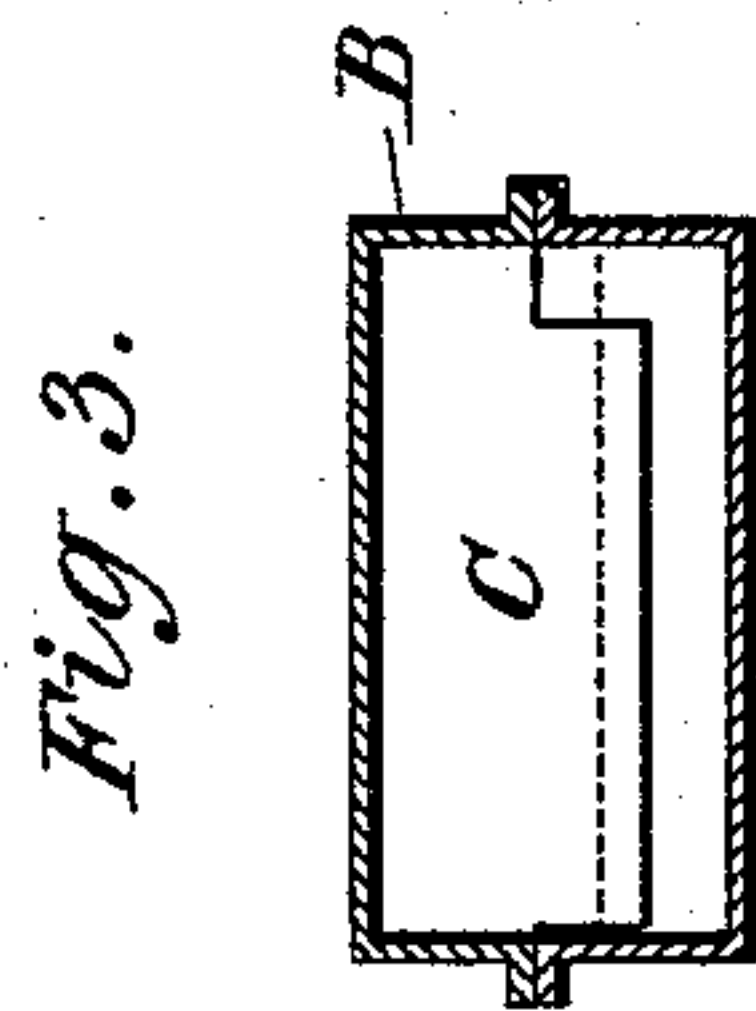
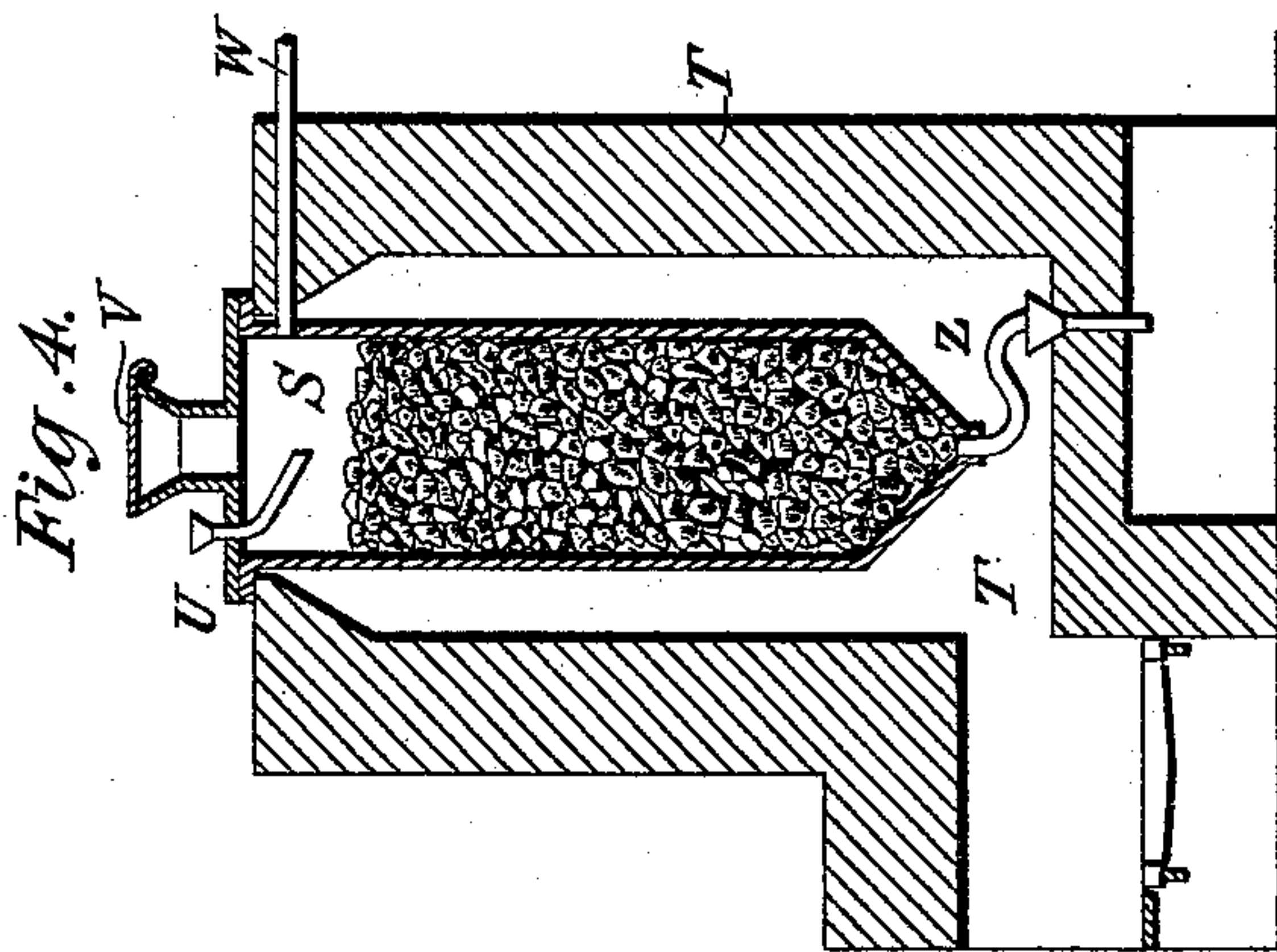
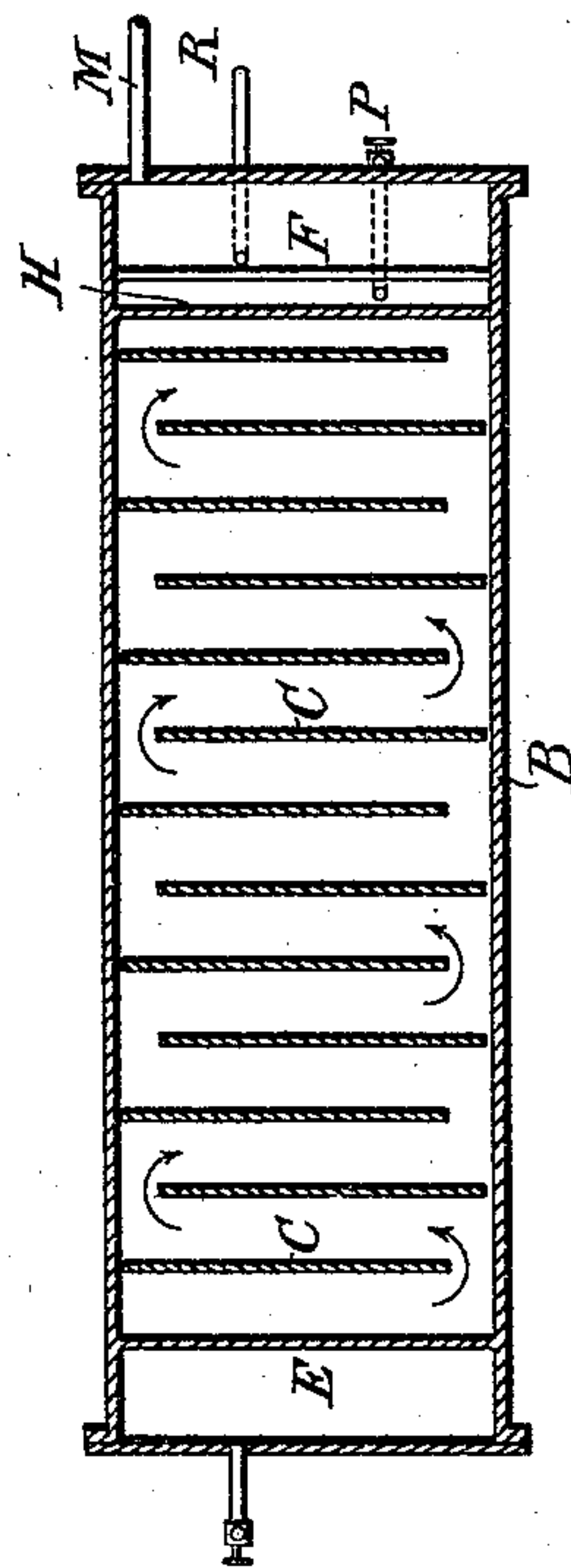


Fig. 2.



WITNESSES.

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# UNITED STATES PATENT OFFICE.

HAMILTON YOUNG CASTNER, OF LONDON, ENGLAND.

## PROCESS OF AND APPARATUS FOR MAKING ALKALI CYANIDS.

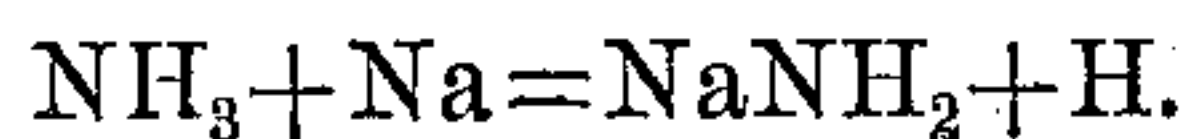
SPECIFICATION forming part of Letters Patent No. 543,643, dated July 30, 1895.

Application filed November 20, 1894. Serial No. 529,387. (No model.)

*To all whom it may concern:*

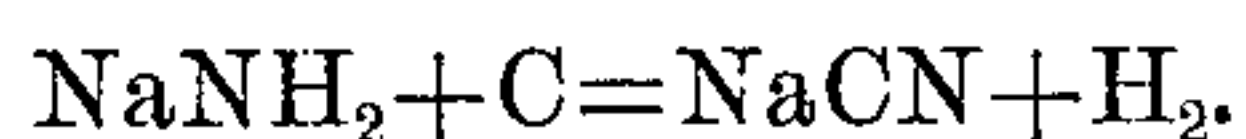
Be it known that I, HAMILTON YOUNG CASTNER, a citizen of the United States, residing at London, England, have invented a certain new and useful Improvement in the Manufacture of Alkali Cyanids; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to use the same.

In two patent applications filed on July 5, 1894, I have described and shown a method for the production of alkali cyanid by employing the alkali metal as a starting point and combining same with either nascent or combined nitrogen and carbon, (either in the nascent state or in one of its ordinary forms,) the nitrogen being either in the nascent state or nitrogen combined with a certain quantity of hydrogen being produced by the decomposition of anhydrous ammonia. In carrying on the said processes while the ultimate product is alkali cyanid several intermediate reactions take place and these at times render it difficult to carry on the manufacture without considerable care to avoid loss of nitrogen. I have found by experiment that such loss can be avoided if I carry on the process in two separate steps or reactions. Thus a product closely approaching the theoretical yield from the amount of alkali metal and ammonia employed can be obtained and the general character of the process will be much simplified. In this manner the process may either be carried on continuously or intermittently. Briefly stated, therefore, the present invention while depending upon the same principle as to the employment of the alkali in the metallic form particularly relates to carrying on the process in two steps, whereby an intermediate product is actually obtained and which is then directly and separately converted into alkali cyanid. The first step of the process consists in passing anhydrous ammonia over metallic sodium heated to a temperature of between 300° and 400° centigrade and thereby producing amid of the alkali metal, the reaction being



The second step is the fusing of the pro-

duct in contact with carbon and so forming the alkali cyanid, the reaction being



In the accompanying drawings I show a form of apparatus well adapted for carrying out the manufacture.

Figure 1 is a sectional elevation of the furnace A, in which is set the rectangular iron retort B, having an inclined bottom. Fig. 2 is a horizontal section of the upper half of the iron retort; Fig. 3, a section of the retort through the line *xy* in Fig. 1, and Fig. 4 is a vertical iron retort in which the second step of the process is carried on.

The upper half of the retort B is provided with partitions C, which reach down so as to project into the bath of molten alkali metal D. Opposite ends of these partitions are cut away, as shown in Fig. 2, so as to compel the passage of any vapor or gas to take the direction shown by the arrows. The upper half is furthermore provided with a branched inlet-pipe L, an outlet-pipe M, and a swan-neck inlet-pipe and hopper N, which is also provided with a valve O. The bottom half of the retort is provided with partitions E and F, the former rising above the level of the latter and the partition H, which rises above the level of F and which partition has several openings at the bottom. (Shown at K.) The bottom is furthermore provided with an outlet-pipe P and a swan-neck outlet-pipe R.

Fig. 4 shows a vertical iron retort S set in furnace T. This retort is provided with a funnel entrance-pipe U, a hopper V, a gas-outlet pipe W, and a swan-neck outlet-pipe Z.

In carrying on the process the retort, Fig. 1, is raised to a temperature of between 300° and 400° centigrade. Perfectly-dry ammonia-gas is then allowed to enter through the pipes L' and L in order to expel the air. Metallic sodium, which is melted in N, is then allowed to flow in until it rises to the level of the dotted line between E and H and, overflowing at F, it passes out through R, when the supply is temporarily stopped. The flow of ammonia-gas is now regulated to the ascertained capacity of the retort and the proportionate quantity of sodium introduced through N at intervals—that is, for every seventeen pounds



of ammonia-gas introduced twenty-three pounds of sodium must be added. The amid forming on the surface of the molten sodium melts, sinks to the bottom, flowing along the same, and gradually fills the space between H and F, expelling the sodium through the pipe R. The overflow of amid then becomes regular and may be collected in closed vessels for future treatment with carbon, or it may be allowed to flow direct into the retort S through the opening U. This retort having been heated to dull redness and filled with charcoal through the hopper V, the reaction here taking place produces hydrogen and cyanid, the former escaping through the opening W, while the latter fuses, filters through the bed of charcoal, and escapes through the opening Z into receptacles placed for its reception. Fresh carbon is introduced from time to time to replace that used in the formation of the cyanid. The gas escaping from the pipe M will consist of hydrogen, together with a small quantity of ammonia, and is led through acid, when the latter is absorbed for re-use.

In stopping the apparatus some care is necessary owing to the presence of hydrogen. The inlet-pipe N, Fig. 1, is closed by the tap O, and while the ammonia is still passing the charge of molten sodium and amid is drawn off through the pipe P. This is then closed and either nitrogen or carbonic-acid gas admitted through L'' L, while L' L is closed in order to sweep out all the ammonia and hydrogen. It is thus possible to obtain pure alkali cyanid practically in one continuous operation, although by two separate and distinct reactions.

I am quite aware that it is not new to form an amid by passing ammonia over an alkali metal, although such an operation had no commercial application and was merely of scientific interest.

I am aware that the description in Fehling's *Neues Handwörterbuch der Chemie*, vol. 4, page 695, states that sodium amid has been formed by heating metallic sodium with dry ammonia with exclusion of air, and also that sodium amid has been heated with charcoal with the formation of cyanid and hydrogen; but so far as I am aware it has not heretofore been proposed to commercially manu-

facture alkali cyanid by first making an amid and then decomposing the same in the presence of preheated carbon.

It is evident that in place of carbon it is quite possible to heat the amid in an atmosphere of hydrocarbon to form the cyanid, and in place of an alkali metal being used an alkali alloy may be substituted.

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

1. The improvements in the manufacture of alkali cyanids consisting in first producing an amid by decomposing anhydrous ammonia in the presence of an alkali metal maintained at a temperature as set forth and then converting the amid into cyanid by decomposing it in the presence of carbon heated previously to the admission of the amid, as described.

2. The improvements in the manufacture of alkali cyanids consisting in introducing molten alkali metal at a temperature of about 300° to 400° centigrade into an atmosphere of anhydrous ammonia in the proportions of about twenty-three pounds of alkali metal for each seventeen pounds of ammonia gas, withdrawing the amid produced and decomposing it by passing it through carbon heated to redness previously to the admission of the amid and collecting the resulting cyanid.

3. In apparatus for the manufacture of alkali cyanids an externally heated retort provided with gas inlet and discharge pipes and inlet pipes for the molten alkali metal, means for causing the gas to come into intimate contact with the metal and means for drawing off the amid produced.

4. In apparatus for the manufacture of alkali cyanids an externally heated retort provided with baffle plates dipping into the molten metal an end plate with bottom openings through which the produced amid passes and an overflow plate and discharge pipe for same.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HAMILTON YOUNG CASTNER.

Witnesses:

G. H. CLARKSON,  
E. MASON.