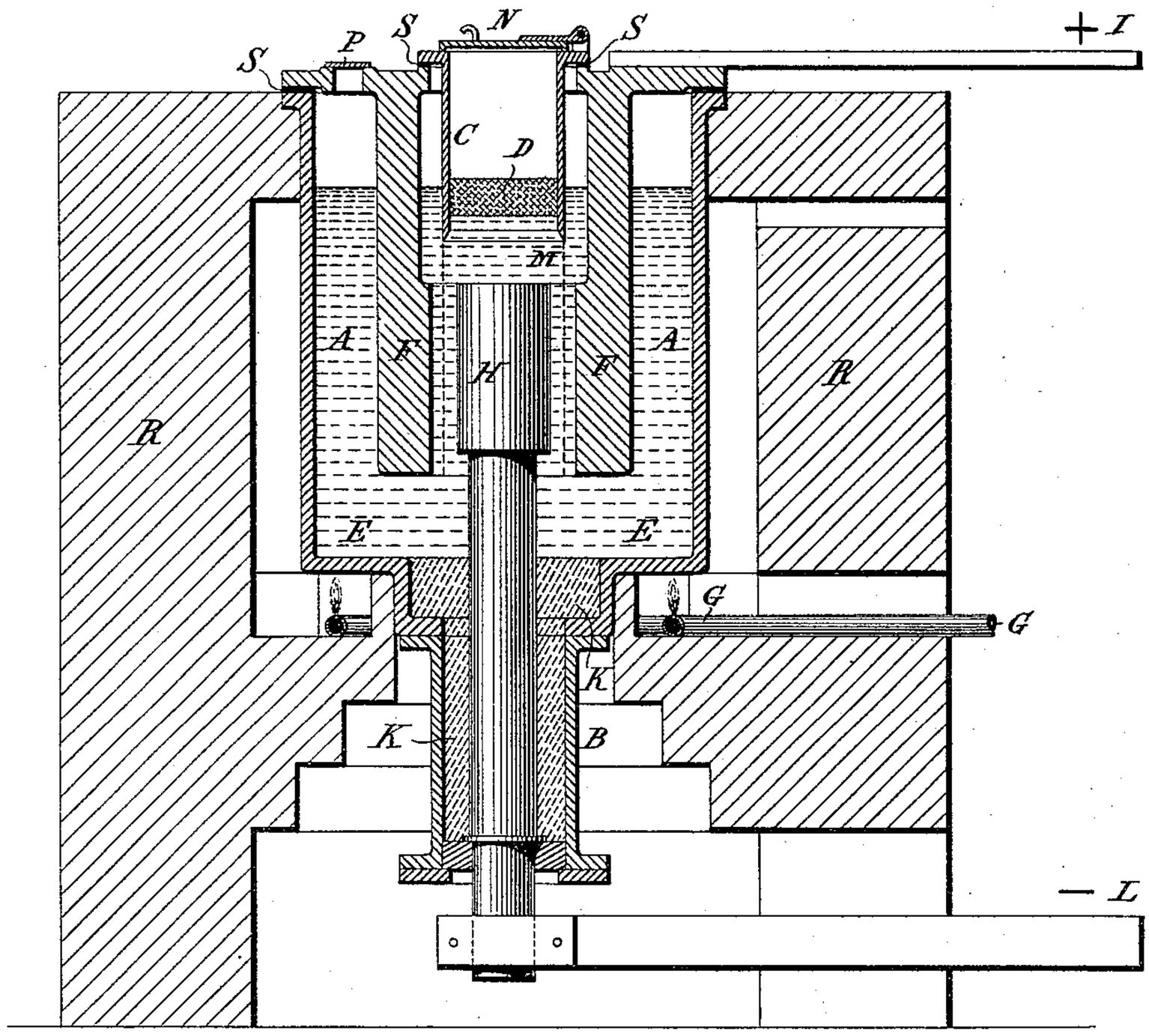
(No Model.)

H. Y. CASTNER.

PROCESS OF MANUFACTURING SODIUM AND POTASSIUM.

No. 452,030. Patented May 12, 1891.



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UNITED STATES PATENT OFFICE.

HAMILTON YOUNG CASTNER, OF LONDON, ENGLAND.

PROCESS OF MANUFACTURING SODIUM AND POTASSIUM.

SPECIFICATION forming part of Letters Patent No. 452,030, dated May 12, 1891.

Application filed September 3, 1890. Serial No. 363,856. (No specimens.)

To all whom it may concern:

Be it known that I, HAMILTON YOUNG CASTNER, a citizen of the United States of America, residing at No. 115 Cannon Street, in the city of London, England, have invented an Improved Process for the Manufacture of Sodium and Potassium; 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 make and use the same.

This invention relates to a process for the production of sodium or potassium from caustic soda or potassa without distillation, whereby the cost of production is considerably reduced. Briefly stated, the process may be said to consist in submitting fused caustic alkali maintained at a low temperature to the decomposing action of the electric current, suitable apparatus being provided for collecting the separated metal. I am aware that so long ago as 1808 Sir Humphrey Davy electrolyzed caustic soda and produced the alkaline metal in a minute quantity; but the method adopted in such experiment did not enable the metal to be commercially produced, and I believe that prior to my present invention it was not known that only under certain conditions of temperature could the electrolysis be effected, as I have failed to find that any process has heretofore been suggested for commercially manufacturing the alkaline metals, either by chemical or electrical means, that did not involve the use of a temperature sufficient to insure the distillation of the metal. All such processes are more or less wasteful, owing to the loss of material and to the wear and tear of the apparatus consequent upon the high temperatures necessarily employed. My experiments have proved that to secure any practical result from the electrolysis of either caustic soda or potash it is absolutely necessary that the temperature be kept as low as possible while insuring the liquidity of the electrolyte. At their melting-points both caustic soda and caustic potassa while being electrolyzed recombine in a degree both with the alkaline metal and oxygen, and at even slight elevations of temperature this recombining power rapidly increases and finally becomes so great at higher temperature that the products from the electrolysis are recombined as rapidly as they are formed and practically no decomposition is obtained. Thus I have found that in order to attain any practical result such means must be employed as will insure a constant and low temperature, while at the same time the elements produced from the decomposition should be given an opportunity of escaping or being removed from the absorbing power of the electrolyte as quickly as possible. In carrying out my present invention there is practically no waste or loss of material, while the wear and tear upon the apparatus are small.

In order that others skilled in the art may fully comprehend my invention, reference is made to the accompanying drawing, which represents a sectional elevation of a convenient form of apparatus for carrying my invention into effect.

Said apparatus consists of an iron vessel or receptacle A, suitably mounted in brick-work R, so that the heat applied by the gas-burners G may be well distributed. The vessel A is provided with one or more base pipes or extensions B, adapted to receive the negative electrodes H, which are preferably of metal and pass up into the vessel. Suspended directly above the said cathode is a tubular iron receptacle or vessel C, which is provided on its upper end with a lid N, and to its lower edges is secured an iron-wire-gauze cylinder M, the said gauze, when the receptacle N is placed in position, completely surrounding the cathode. The positive electrodes F are preferably made of such metal as will withstand the oxidizing action of the evolved gases and either form part of the cover of the vessel A or may be bolted thereon, being so placed that when the cover is adjusted the electrodes are a suitable distance from and directly surround the gauze M. Electrical connection is made between the cover by the connection I with the positive pole of the dynamo and by the connection L with the negative pole. The cover is provided with an opening P for the escape of gases resulting from the electrical action, this opening also serving for the introduction of a thermometer or other heat-registering device. Insulation is made at the points S S by means of asbestus or other insulating medium. The size and dis-

tance apart of the electrodes are both proportioned to the quantity of current to be supplied. Should the electrodes have a larger surface than is actually required, the elements set free at each electrode are exposed to the absorbing-alkali to a greater extent than necessary and a quantity of the electrical action is wasted, owing to the elements being absorbed and recombining. Should the electrodes be too small, the resistance will be increased to such an extent that the bath will be unduly heated and that at the very points where an excess of temperature is most objectionable. As an example, the drawing filed herewith is made to scale and illustrates an apparatus which I have found practicable, and in which the negative electrode H is four inches in diameter, and the vessel is adapted to contain a bath of two hundred and fifty pounds of molten caustic alkali. This apparatus is adapted for use with a current of about twelve hundred ampères in strength. If a suitable electric current be passed through the molten caustic soda or potash E, the alkali being kept at a very low temperature—say within 20° centigrade of its melting-point—any water contained in the caustic will be decomposed first and resolved into its elements of hydrogen and oxygen, which will be given off at the negative and positive electrodes, respectively. When this action has ceased, the current will act upon the caustic alkali, oxygen or a mixture of oxygen and water being given off at the positive pole, while the alkaline metal and hydrogen or the alkaline metal alone are given off at the negative pole.

In the apparatus as described the alkaline metal, (being much lighter than the caustic,) together with the hydrogen, will rise from the negative electrode and pass into the receiver C, the hydrogen escaping around the edges of the cover N, while the molten metal continues to collect in quantity. From time to time this collected metal D is removed by means of a large finely-perforated spoon, the perforations enabling the molten caustic to flow out, while the metal remains in the spoon. Caustic is added to the bath from time to time to replace the metal removed, and in this manner a continuous process may be carried on without the aid of an expensive plant and in an economical manner. As before mentioned, any increase of temperature is followed by a proportionate loss of product and waste of electrical energy; but it is possible to so adjust the electrical current and the quantity of caustic alkali forming the electrolyte that the proper temperature will be maintained in a previously-melted bath without external heat or even by an increase of current to melt the bath, subsequently reducing the quantity of current until the working temperature is attained.

The cathode may be conveniently sealed in the extension B by means of molten caustic K, which is allowed to harden before beginning the process.

In order to secure a fair yield of alkaline metal for the current applied, it is necessary that the temperature of the electrolyte should not be allowed to go above 20° centigrade of the respective melting-points of the caustic used, viz: In using caustic soda having a melting-point of about 310° centigrade for the electrolyte the temperature should be maintained below 330° centigrade. The same rule is to be observed in respect to the caustic potash or to a mixture of the two hydrates, the same having a lower melting-point than either the potash or soda compound alone.

I do not of course confine myself to the particular form of apparatus shown, but simply describe it as one of the forms which may be employed.

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. The hereinbefore-described process of manufacturing the alkaline metals, which consists in treating the caustic alkali while constantly maintained at a temperature of not more than 20° centigrade above its melting-point to the action of the electric current, substantially as described.

2. In an apparatus for the manufacture of alkaline metals, the combination, with positive and negative electrodes, of the gauze or screen interposed between said electrodes and a superposed vessel or dome for collecting the separated metal, substantially as set forth.

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

HAMILTON YOUNG CASTNER.

Witnesses:
PHILIP M. JUSTICE,
WILLIAM TRIMMER.