W. C. ARSEM.

PRODUCING CALCIUM.

APPLICATION FILED AUG. 18, 1909.

984,503.

Patented Feb. 14, 1911.

Fig. 1

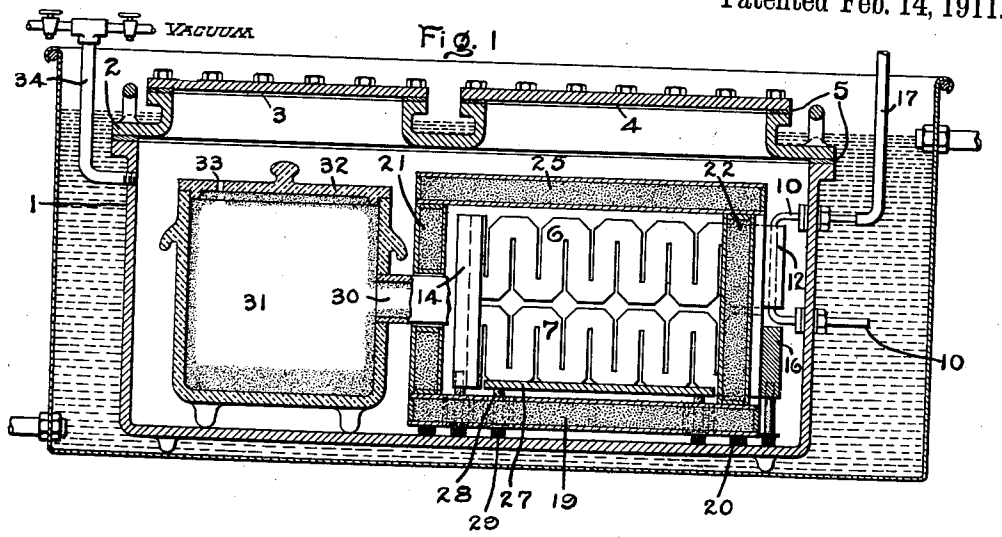


Fig. 2

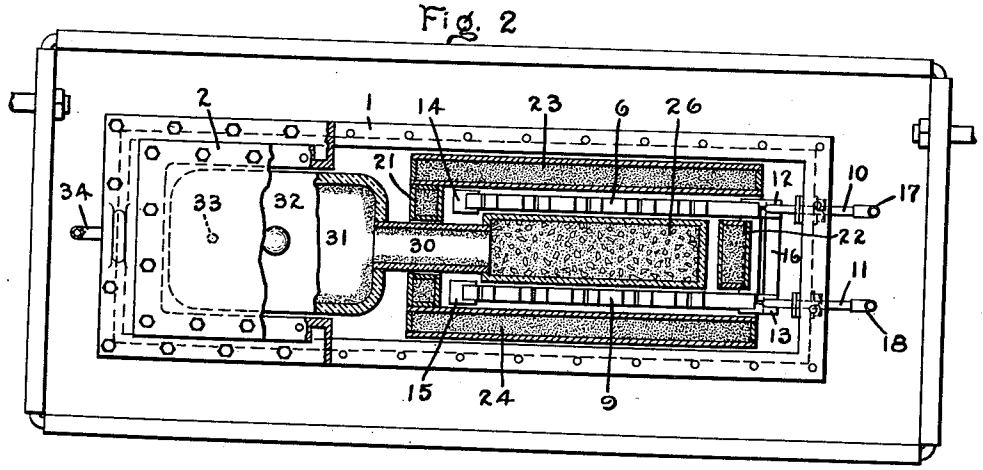
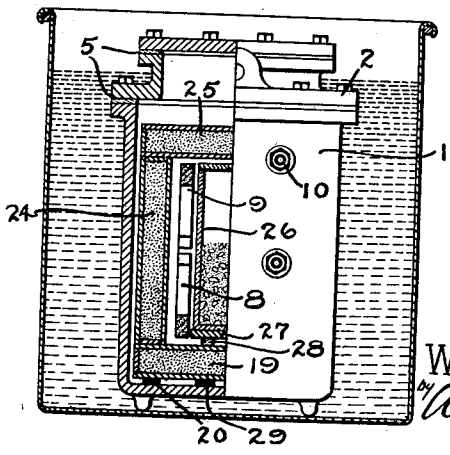


Fig. 3



WITNESSES:

Lloyd C. Bush

J. Ellis Glen

INVENTOR:

WILLIAM C. ARSEM

by Albert G. Davis,

ATT'Y.

UNITED STATES PATENT OFFICE.

WILLIAM C. ARSEM, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PRODUCING CALCIUM.

984,503. Specification of Letters Patent. Patented Feb. 14, 1911.

Application filed August 18, 1909. Serial No. 513,406.

To all whom it may concern:

Be it known that I, WILLIAM C. ARSEM, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Producing Calcium, of which the following is a specification.

My present invention comprises the production or recovery of metallic calcium by direct decomposition of calcium carbid in a suitable furnace in which the gaseous pressure is materially less than one atmosphere. The electric furnace devised by me and suitable for carrying out this operation, has an air-tight envelop in which a good vacuum can be produced and maintained and has a hot zone in which the calcium carbid can be heated and decomposed and from which the vaporized calcium can be conducted to a cooling zone for condensation and recovery as substantially pure metal.

In order that my improved process may be available to those skilled in the art, I deem it advisable to describe in detail the furnace in which it can be carried out.

In the accompanying drawing, Figure 1 is a sectional elevation of the furnace with the crucible removed from the heating chamber so that the heating elements may be clearly seen; Fig. 2 is a sectional plan of the same; and Fig. 3 is an end elevation with certain parts cut away.

The main envelop of the furnace consists of a rectangular box 1, preferably of gun metal with a coating of tin, provided with a cover 2 bolted securely in place. The cover 2 has man-holes 3 and 4 located respectively above the cold and hot zones of the furnace. Lead gaskets 5 can be used under the covers to make air-tight joints. The heating element of the furnace consists of four graphite grids 6, 7, 8 and 9 sawed transversely and with their corners rounded off, as shown in the drawing, so that when current is passed through them they will attain a uniform incandescence throughout substantially their entire length. Current is supplied to these graphite resistance elements by way of water cooled copper tubes 10 and 11 passing through insulating bushings in the end of envelop 1. The tubes are clamped, respectively, in copper blocks 12 and 13, which in turn are bolted to the graphite grids 6 and 9. The other ends of these grids may contact respectively with the graphite blocks 14 and 15 which make electrical connection with the lower pair of grids. A cross connection 16 of graphite at the extreme end of the furnace completes the electrical circuit. For the sake of avoiding confusion on the drawing, the current supply cables for the tubes 10 and 11 have been omitted but the rubber hose for conducting water to these terminals for cooling purposes is shown at 17 and 18.

The above described heating element consisting of the four grids 6, 7, 8 and 9 is inclosed in a rectangular heat insulating screen, the graphite walls of which are made double throughout with an intervening packing of graphite powder. The bottom member 19 of the screen rests on insulating buttons 20 of lava and supports the end walls 21 and 22 and also the side walls 23 and 24. The top member 25 rests on the tops of the four side walls. This heat insulating screen serves to limit the radiation of heat outward and serves to reflect and concentrate the heat on the rectangular space inclosed by the heater grids. Within this space may be introduced a rectangular crucible 26 of graphite containing the charge of calcium carbid to be decomposed to produce calcium.

The crucible may conveniently be supported on a rectangular platform 27 carried on graphite standards 28 which pass down through holes in the heat insulating screen and terminate in insulating bushings 29. The crucible is preferably provided with a cover to prevent free escape of vaporized material except through the tubular outlet 30 which leads to the condensing chamber 31 at the other end of the furnace.

The condensing chamber may advantageously consist of an earthenware pot of sufficient size to insure complete condensation of the calcium distilling over from the hot zone of the furnace. The condensing chamber may be provided with a cover 32 preferably having an outlet 33 for the ready removal of air when the entire furnace is pumped out by way of pipe 34 which leads to a vacuum pump.

Inasmuch as the direct decomposition of calcium carbid into calcium and carbon does not result in the liberation or production of any great quantity of gaseous material, the continuous maintenance of a substantial

vacuum in the furnace is easily possible even at the high temperature at which the operation must be carried out. By working in a vacuum, the temperature of decomposition is much reduced and the calcium comes off in pure and unoxidized condition. The operating temperature varies somewhat with the degree of vacuum and seems to be in the neighborhood of 1500°–2000°, the calcium distilling off at this temperature and leaving behind a pseudomorph of soft unctuous graphite. Alternating current may advantageously be used in the heater grids, and any temperature up to the vaporizing point of carbon can be obtained and constantly maintained for any length of time at a pressure of a fraction of a millimeter of mercury. The material under treatment does not come in contact with the heating elements and chemical action therebetween is avoided. The main envelop of the furnace is maintained cool by the circulation of water below and on all sides up to a level just below the man-hole covers 3 and 4. These are preferably left unsubmerged for the more ready introduction and removal of the calcium carbid and its decomposition products. In charging and discharging the furnace it is only necessary to remove the covers 3 and 4, whereupon after removal of the upper screen 25, the crucible 26 can be filled with a new charge and the condensing chamber 31 relieved of the condensed material and even lifted bodily out and replaced by another similar earthen pot.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of producing calcium, which consists in decomposing calcium carbid at less than atmospheric pressure, and condensing the resultant calcium vapors.

2. The method which consists in decomposing calcium carbid by heating in a vacuum, and collecting and condensing the resultant calcium vapor.

3. The method of producing calcium, which consists in thermally decomposing calcium carbid in an inert environment, and collecting the vaporized calcium.

4. The method which consists in heating calcium carbid to a temperature in the neighborhood of 1500° C. while under a pressure less than atmospheric, conducting away the resultant calcium vapor, and collecting and condensing said vapor.

5. The method which consists in heating calcium carbid in a substantial vacuum to a temperature at which it decomposes, conducting away the resultant calcium vapor, and collecting and cooling said vapor.

In witness whereof, I have hereunto set my hand this 17th day of August, 1909.

WILLIAM C. ARSEM.

Witnesses:

BENJAMIN B. HULL,

MARGARET E. WOOLLEY.