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H. MAXIM.

METHOD OF MAKING CALCIUM CARBID.

(Application filed June 25, 1895.)

(No Model.)

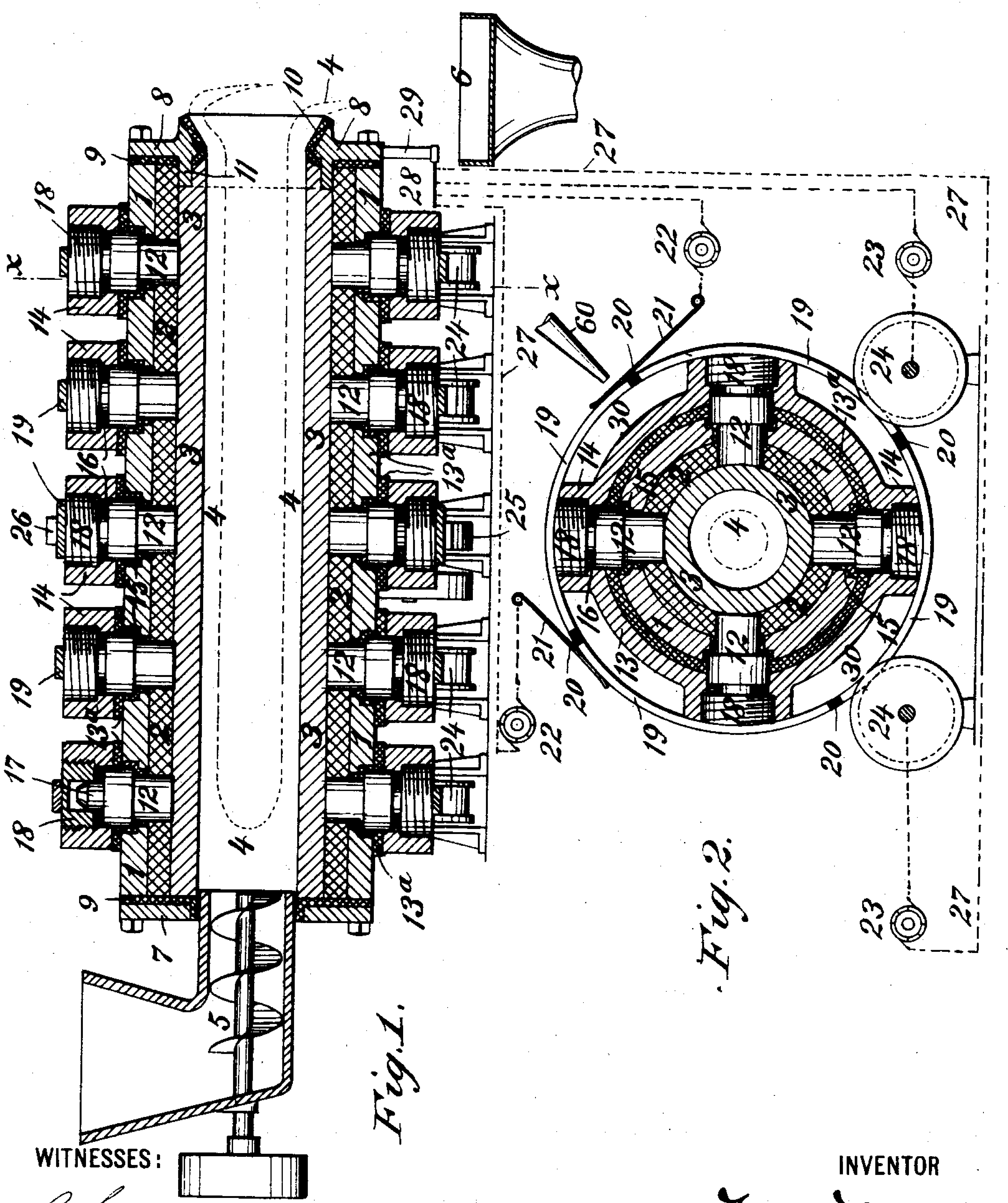

Fig.1.

Fig.2.

WITNESSES:

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METHOD OF MAKING CALCIUM CARBID.

SPECIFICATION forming part of Letters Patent No. 683,962, dated October 8, 1901.

Application filed June 25, 1895. Serial No. 553,952. (No specimens.)

To all whom it may concern:

Be it known that I, HUDSON MAXIM, a citizen of the United States, residing at the city of New York, county and State of New York, have invented certain new and useful Improvements in Methods of Making Calcium Carbid, of which the following is a specification.

In practicing my invention I employ a revoluble furnace utilizing electricity as a heating agent and so constructed and so operating under electrical and centrifugal influences that great heat energy may be developed and maintained for any desired length of time or continuously without distorting the structure or causing its interior walls to collapse or run down when subjected to the great heat within. Substances charged into the furnace may thus be subjected to a very high temperature for any required time, most advantageously facilitating reactions of their fused or volatilized elements. There is embodied in the furnace a peculiar arrangement of electrodes whereby a progressively-increasing temperature is produced within the furnace—that is to say, temperature that increases in direction of the general flow of electric current through the apparatus. For this purpose I use an interior common electric conductor adapted to receive independent electric currents from a series of outer electrodes disposed at successively-advancing points along the furnace, each successive and additional electric current adding quantity to the current already flowing through the interior common electric conductor, whereby is generated an intense heat, which increases toward the place of discharge of the treated material. The furnace is provided with an auxiliary interior lining which protects its fire-clay or other refractory lining, and also the furnace body or shell, from injury by heat. This auxiliary protecting-lining may consist of loose materials thrown into the furnace and distributed and held by centrifugal force against the fire-clay lining as a protective interior tubular layer of unfused material, or said auxiliary lining may be built up from and be constantly renewed by a portion of the fused material under treatment, which thus forms a practically frictionless fluid-bed, upon and along which the surplus treated material is caused to move or float or drift forward in tubular form by centrifugal action developed by rotation of the furnace. The material treated may be a substance or compound having sufficient conductivity to serve as a conductor of the electric current employed in the furnace. Means for exteriorly cooling the furnaces are also provided.

In the accompanying drawings I have illustrated one form of apparatus made in accordance with the invention; but it is to be understood that the same are designed merely to enable the invention to be better understood and not as defining the limits thereof.

Figure 1 is a longitudinal sectional view of one style of horizontal furnace apparatus. Fig. 2 is a transverse section thereof, taken on the line $x\,x$ in Fig. 1.

The numeral 1 indicates the furnace body or shell, which is preferably made of steel, and may have a fire-clay or other refractory electrically non-conductive lining 2, within which is the centrifugally-maintained auxiliary protective lining or bed 3, hereinafter more fully described. The material 4 under treatment may be fed from a hopper by a screw conveyer 5 and flows through or along on the bed 3 and discharges at the opposite end into a chute 6, which may convey the treated material to any suitable receiver. Opposite heads 7 8, with interposed insulation 9, of asbestos or other suitable material, are bolted to the ends of the furnace-body. The head 7 has an opening receiving the material feed-spout, and the head 8 has a central opening for discharge of the treated material and is preferably flared outward and faced by insulation 10, preferably magnesite. The head 8 also has a flange 11, which projects inward inside of the fire-clay lining 2 and into the auxiliary protective bed 3 to allow the electric current to be taken off from the bed through the head.

The electric appliances furnishing the progressively-increasing temperature in this apparatus comprise, in connection with the interior protective bed 3, a series of outer circumferential electrodes 12, preferably arranged in two opposing radial pairs or in series of four in the same transverse plane and projecting inward to the protective bed 3 to transmit thereto electric current which usually fuses the bed material to a fluid state, while it is maintained in tubular form by centrifugal force. For each transverse or circumferential series of electrodes 12, and preferably over an interposed encircling asbestos packing 13[a], there is shrunk around the steel furnace-body a metal ring or band 13, which for each electrode has a cup-shaped radial projection 14. Inside of each cup 14 a shouldered insulation 15 is fitted to the furnace-body 1 and its lining 2. The electrode is passed into the cup 14 and rests by its shoulder on a shoulder of the insulation 15. A suitably-insulated annular packing 16 is placed on the outer end of the electrode around its outwardly-projecting stem 17, which preferably enters an opening in a conductive plug 18, screwed into the cup 14 to retain the electrode. Centrifugal force developed by rotation of the furnace throws the electrode 12 outward and compresses the packing 16 between it and the plug to prevent leakage past the electrode of the fluid-bed 3 or the fused materials under treatment in the furnace. The electrode-retaining plugs 18 of each circumferential series are each in contact with an independent conductive segment 19 of a ring having as many segments as there are electrodes in the series, the segments being preferably separated by end insulation 20, thus directing the current toward the electrodes in contact with the respective segments. The ring may be removed to allow the plugs to be taken out to give access to the electrodes and their packings. Each of the uppermost segments 19 in Fig. 2 is in circuit by a brush 21 with one pole of a dynamo 22, while the two lower segments receive current from separate dynamos 23 through wires leading to the axis of the antifriction-rollers 24, on which the furnace rests for rotation at any required speed by one or more pinions 25, meshing with a toothed gear 26 on the furnace-body. Wires 27 connect a conductive rod 28 with each of the dynamos 22 23 to receive the return-current by means of a brush 29 on the rod bearing on the head 8 of the rotating furnace-body. There being four currents transmitted to each circumferential series of electrodes 12, the furnace shown in Figs. 1 and 2 and having five such series will have twenty independent electric currents supplied to it, and it may be by as many separate dynamos to give their joint powerful heating effect on the material under treatment. It will be noticed that by providing the ring 13 with projecting cups 14 and fitting the conductive segments 19 outside of these cups or the plugs 18 in them considerable space is provided at 30 for circulation of air inside and quite around the parts 19 to prevent overheating of the exterior contacts by either the electric currents which they distribute to the furnace or the heat generated by said currents within the furnace and radiating through its body-wall.

The operation of this apparatus is as follows: Before feeding the material 4 to be treated into the furnace any suitable substance or compound having proper electrical resistance and a specific gravity higher than that of the material to be treated may be charged into the rotating furnace upon its lining 2 and be melted to form the auxiliary protective fluid bath or bed 3 by dynamos 22 23. The fused material of the bed 3 forms a common interior electrode along which returns the constantly-increasing electric current derived from the successive circumferential series of electrodes 12, and whereby a very high temperature is obtained in the furnace, due mainly to the rapidly increasing supply of electric current entering the fluid-bed toward the discharge end of the furnace and the resultant heating of the bed incidental to the resistance offered by the bed to the passage of the common return-current. The fluid-bed is maintained in tubular form against the furnace-lining 2 by centrifugal force, which also will maintain the lining 2 in tubular form against the furnace body or shell should this lining become softened or partly fused by the intense heat attained within the furnace. As the material 4 is fed into the furnace by the screw 5 or otherwise, the centrifugal force causes the material to assume a tubular form and to float or drift forward easily along the tubular fluid-bed 3 while subjected to the intense heat of the electric current derived from the circumferential electrodes 12 and returning through the fluid-bed. The electrothermal treatment may continue for a longer or shorter time, as determined by the rapidity of feed of the material, or the speed of rotation of the furnace, or the nature of the material. The treated material discharges from the furnace into the receiver 6. In treating certain classes of materials the fluid-bed 3 serves a very important function by constituting a practically frictionless tubular bearing-surface, along and within which the treated materials are carried, floated, or drifted forward through the furnace by the developed centrifugal force aided by the natural tendency of the materials to seek their own level. It will be understood that the fluid-bed 3 may be formed or built up from and be constantly renewed by a portion of the materials under treatment, or from one of the products of the reaction effected in the furnace. One such material is calcium carbid, to produce which calcium oxid and carbon are fed into the furnace and subjected to its heat energy. As the reaction takes place and the carbid is formed, it is carried by centrifugal force against the lining 2 of the furnace-body to form an auxiliary protective lining therefor, and the surplus carbid will discharge from the furnace into the receiver 6, the fluid-bed or protective lining being constantly renewed by freshly-formed carbid on its way to the outlet. At various stages of the operation water or other cooling fluid will be thrown over the exterior walls of the furnace from a series of nozzles 60 or equivalent cooling apparatus to prevent overheating of the furnace. These nozzles are shown in Fig. 2 of the drawings.

The apparatus herein described, while of my invention, is not herein claimed, as the same will form the subject-matter of another application.

I claim as my invention—

1. The method of making calcium carbid, consisting in maintaining a carbid-conductor incandescent by means of an electric current, subjecting carbid-forming materials to the heat thereby engendered, thus converting said materials into calcium carbid, maintaining the cross-sectional area of the carbid-conductor approximately constant by removing the calcium carbid from the furnace as formed, and supplying fresh materials to the heating field.

2. The method of making calcium carbid, consisting in maintaining a carbid-conductor incandescent by means of an electric current, subjecting carbid-forming materials to the heat engendered thereby, thus converting said materials into calcium carbid, continuously removing the excess of carbid from the furnace as formed, thereby maintaining the resistance of the conductor to the current, and supplying fresh materials to the heating field.

In witness whereof I have hereunto signed my name in the presence of two witnesses.

HUDSON MAXIM.

Witnesses:
E. L. TODD,
JAMES HUBER.