No. 686,525. Patented Nov. 12, 1901.

J. H. MORLEY.

ELECTRIC FURNACE.

(Application filed June 18, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

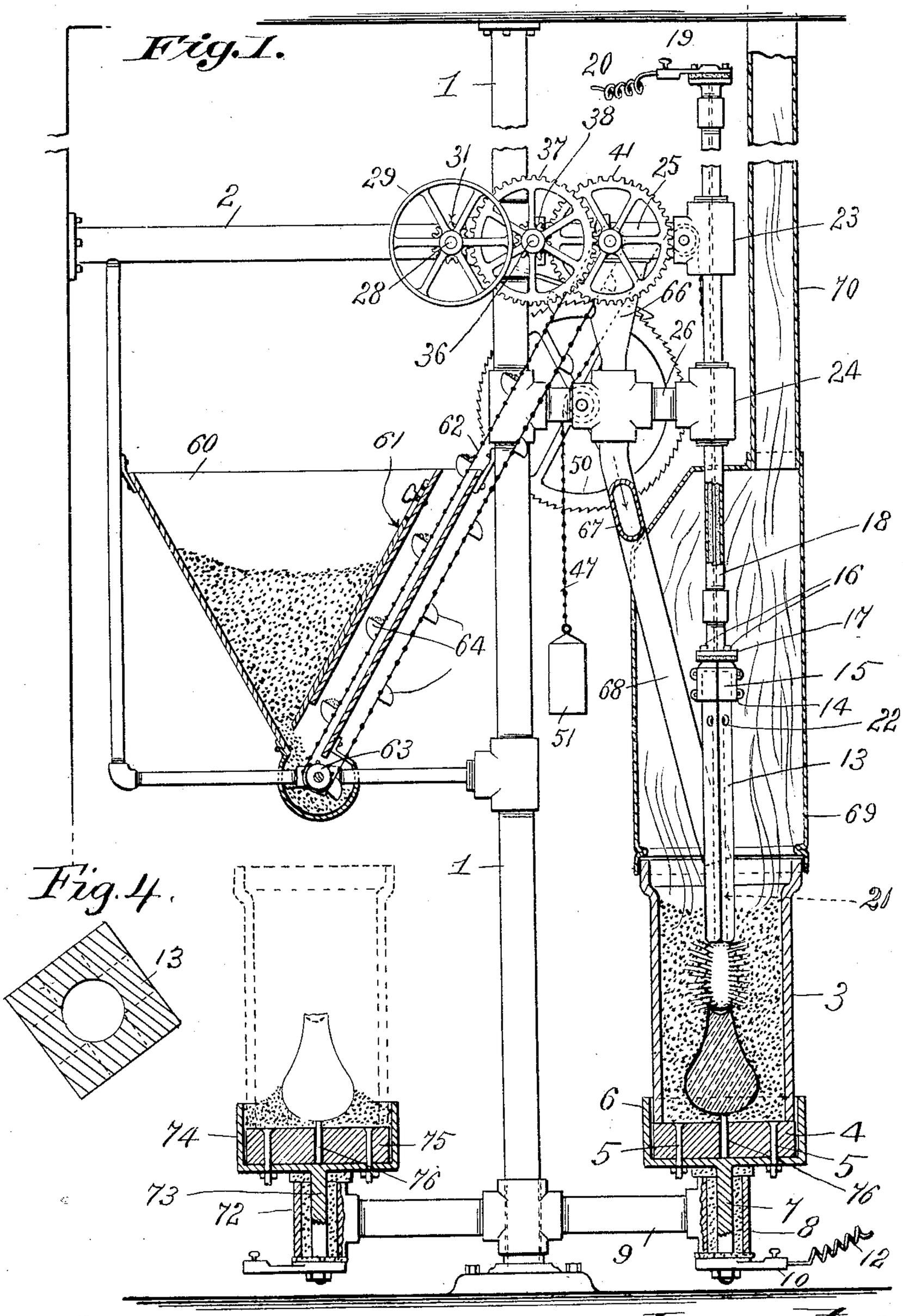

Fig. 4.

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Fig. 2.

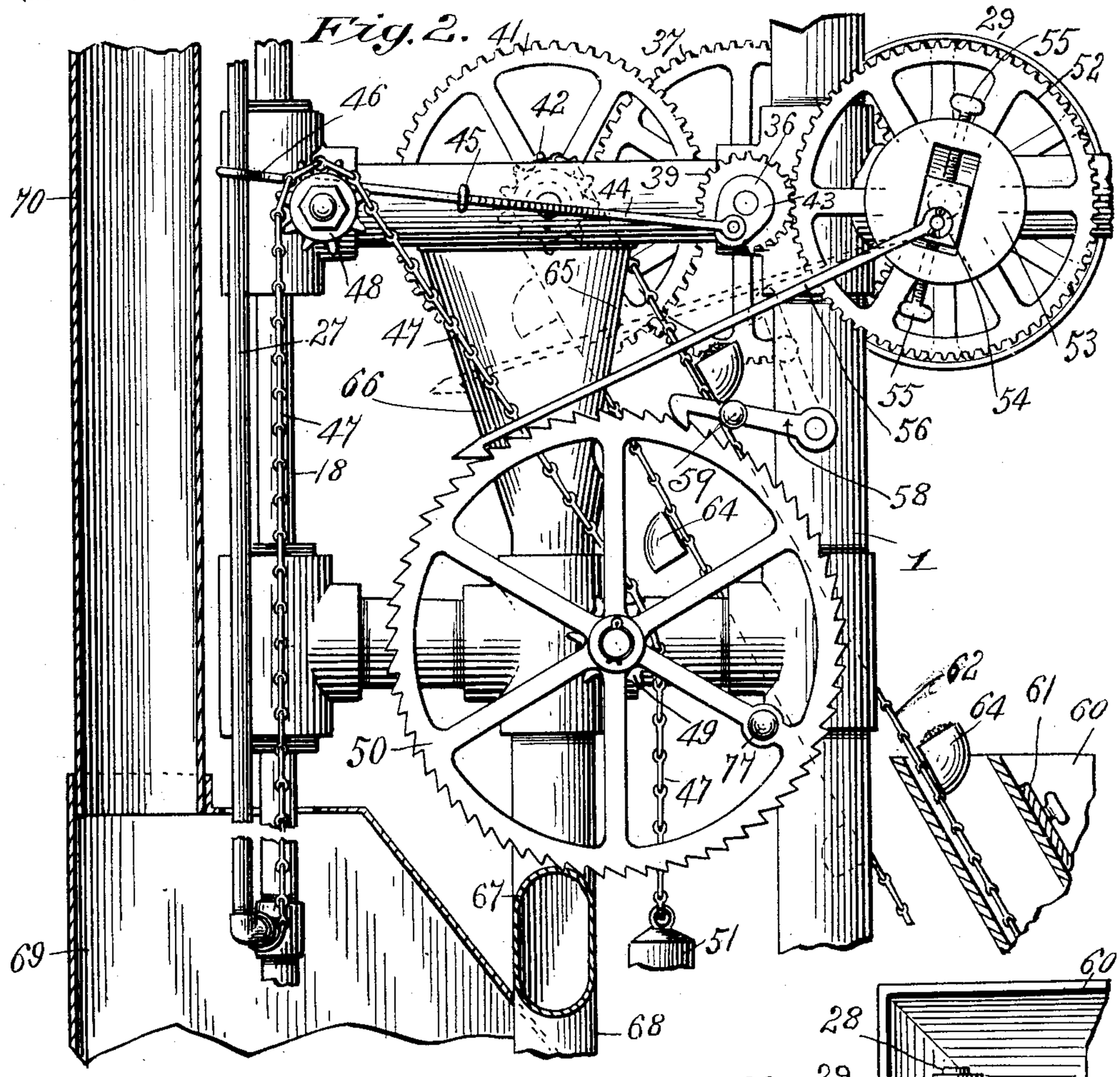
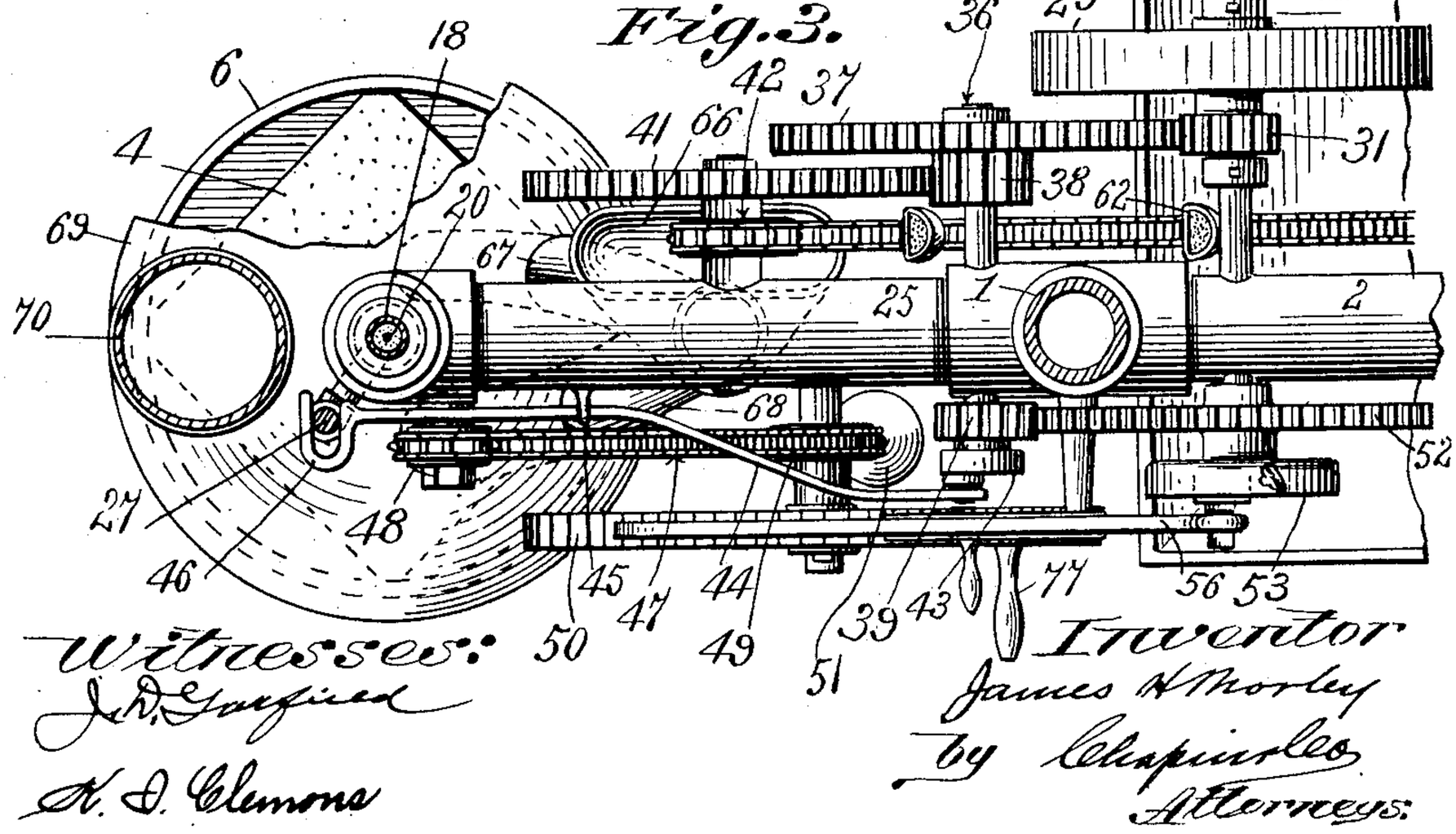


Fig. 3.



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UNITED STATES PATENT OFFICE.

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ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 686,525, dated November 12, 1901.

Application filed June 18, 1900. Serial No. 20,713. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. MORLEY, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Electric Furnaces, of which the following is a specification.

This invention relates to electric furnaces for making calcium carbid by fusing a mixture of lime and carbon.

The objects of the invention are to provide a furnace of this character which is portable, which will be automatic in its action of feeding the mixed lime and carbon to the furnace, which will automatically produce an intermittent separating movement of the electrodes, in which the proper stoking of the furnace and the proper separation of the fused materials from the end of the upper electrode are facilitated by an automatic movement of the upper electrode about its axis, in which provision is made for using a plurality of lower electrodes in connection with a single upper electrode and feeding mechanism for the latter, said lower electrodes being used interchangeably to expedite the operation of the furnace, and to provide a form of upper electrode which will dispose of the gases generated in such manner as to greatly prolong the effective life of said electrode and secure an even and regular fusing action.

To these ends my invention consists in the furnace constructed and operating as hereinafter fully described, and particularly pointed out in the claims.

Referring to the drawings, in which like numerals designate like parts in the several views, Figure 1 is a side elevation, partly in section, of a furnace for making calcium carbid embodying my invention. Fig. 2 is an elevation of the opposite side of the furnace to that shown in Fig. 1, certain frame parts being shown broken off and illustrating the relative positions of operative parts more clearly than they are shown in said last-named figure. Fig. 3 is a top plan view of the furnace, showing certain parts in section and other parts broken away.

The furnace hereinafter described can be supported by a frame of any desired description; but with a view to rendering it conveniently portable and to economize in the amount of floor-space consumed I prefer to utilize as such frame a tubular standard 1, secured at its opposite ends to the floor and ceiling, respectively, and a brace 2 for connecting said standard with a side wall, as shown in Fig. 1.

The furnace proper is composed of a chamber 3, which is preferably composed of clay or other hardened plastic material, with an open slightly-flaring upper end, said chamber resting at its lower end upon a block of carbon 4, constituting the lower electrode, which block is secured by bolts 5 within a cup-shaped holder 6. Said holder is provided with a stem 7, which passes through a socket 8 at the end of an arm 9, projecting from the standard 1, and has connected to its lower end a binding-post 10, which receives one of the wires 12 leading from the electrical generator, the said socket 8 having its central bore and ends provided with suitable insulating material, as shown in Fig. 1, whereby said lower electrode is entirely insulated from the frame of the furnace. The upper electrode 13, composed of a block of carbon which is preferably rectangular in cross-section, has its rounded upper end inserted within a holder 14, which holder has a removable side section 15 (see Fig. 1) and is connected by insulated bolts 16 to a circular head 17 at the lower end of a pipe 18, the upper end of said pipe having connected therewith a binding-post 19 to receive the wire 20 leading from the generator. Said upper electrode 13 is provided with a centrally-disposed passage 21 (see Fig. 1) leading from its lower end nearly to its upper end, where it joins a passage 22, extending transversely through the electrode. The combined action of said passages is to withdraw from the electrode in a great degree the gases generated by the fusing process, as will be presently described. Said pipe 18, which supports the upper electrode 13, passes through sockets 23 24 at the ends of two arms 25 26, projecting from standard 1, it being free to both revolve and move longitudinally within said sockets, and is provided with an offset arm 27, which is connected to it at its upper and lower ends, as shown in Figs. 2 and 3. In the practice of my invention I provide means for imparting to said

pipe 18 an intermittent upward movement through said sockets and also a reciprocating rotary movement about its axis, which means in their preferred form are as follows: Upon a fixed shaft 28 on the frame is mounted a band-pulley 29, carrying at its inner side a pinion 31. A shaft 36, journaled on the frame, carries at one end a gear 37, which meshes with said pinion 31 and also carries a pinion 38 and at its opposite end a pinion 39. A gear 41 is mounted upon a fixed shaft, which gear meshes with the pinion 38 and carries at its inner side the sprocket-wheel 42. The shaft 36 carries at the outer side of the pinion 39 a crank-disk 43, the crank-pin of which engages one end of a connecting-rod 44, which rod passes through a guide 45 and is provided at its front end with a lateral bend 46, which embraces the arm 27 on the rod 18. A sprocket-chain 47, connected at one end to the pipe 18, near the lower end of the latter, as shown in Fig. 2, passes over an idler sprocket-wheel 48 on the frame and thence over a sprocket-wheel 49, mounted upon a stud on the frame and carrying the ratchet-wheel 50, said chain supporting at its free end a weight 51. Upon the fixed shaft 28 is mounted a gear 52, which meshes with the pinion 39 on the shaft 36, said gear carrying at its outer side a crank-disk 53, which disk is provided with a groove or slot extending diametrically across its face and with a block 54, located within said groove or slot, which is held in any desired position of adjustment therein by two screws 55, bearing against its opposite ends. To a crank-pin on said block is connected one end of a pawl-arm 56, which arm normally rests upon the ratchet-wheel 50, it having a tooth to engage the teeth of said wheel. A stop-pawl 58, hung to the frame, normally engages the teeth of said ratchet-wheel to prevent any retrograde movement thereof. On said stop-pawl is a handle 59, whereby the pawl may be raised out of engagement with the teeth of the ratchet. The free end of the stop-pawl is broadened out sufficiently to engage the pawl-arm 56, when the stop-pawl is raised, and force said arm 56 up and out of engagement with the ratchet, as shown in dotted lines in Fig. 2.

A hopper 60 on the frame is adapted to receive the mixed lime and carbon from which the carbid is made, said hopper being provided with a gate 61, which can be operated to open and close a passage at the bottom thereof, and a sprocket-chain 62, passing about a sprocket-wheel 63 adjacent to the outlet-opening of said hopper and about the sprocket-wheel 42 and carrying a series of elevator-buckets 64, elevates said material and dumps it into the flaring mouth 65 of a feed-conduit 66, which conduit is divided into the two branches 67 68, terminating at their lower ends within the mouth of the chamber 3 at opposite sides of the upper electrode 13.

A hood 69, suspended above the chamber 3 and having a pipe 70 leading therefrom to a chimney-flue or to the open air, serves to conduct the gases and dust arising from said chamber away from the furnace, said hood having an aperture through which the pipe 18 passes.

In order to expedite the operation of forming nuggets of carbid, I continue the arm 9 upon the opposite side of the standard 1 and adapt it for a revolving movement about the standard, said arm carrying at its opposite end a socket 72, which supports a holder 73 for a chamber 74 and a lower electrode and binding-post 75, similar to those first described.

The ratchet-wheel 50 is provided with a projecting handle 77 to enable said wheel to be readily revolved by hand.

In practice I provide the lower electrode 4 with a central orifice and locate within said orifice a small auxiliary electrode 76, of carbon or other suitable material, which projects above the face of the electrode 4, the office of said auxiliary electrode being to facilitate the forming of the initial arc, when the upper electrode is lowered to a point adjacent thereto.

The operation of the furnace thus constructed is as follows: The properly-mixed lime and carbon being placed in the hopper 60, the pulley 29 being connected by belt with a source of power, and the wires 12 and 20 leading from a generator being connected to the binding-posts 10 and 19 by suitable belt-shipping devices, the moving parts of the mechanism are set in motion. The gate 61 is then raised, permitting a portion of the material to be carried from the hopper by the elevator mechanism and dumped into the conduit 66, down the arms 67 68 of which it passes to the chamber 3. The operator then grasps the handle of the stop-pawl 58 with one hand, raising it and the pawl-arm 56 out of engagement with the ratchet-wheel 50, and with the other hand grasps the handle 77 of said wheel, and by revolving the latter lowers the upper electrode to a point where it is but slightly separated from the auxiliary electrode 76. The switch governing the electric current is then operated to throw the current through the furnace, and the normal operation of the furnace begins. The arc formed between the upper electrode and the auxiliary electrode fuses the intermediate mixed material and begins the formation of a nugget of carbid, which gradually increases in size as the upper electrode is moved upwardly by the pawl-and-ratchet mechanism described, the said auxiliary electrode 76 soon becoming fused into a part of the nugget and the arc then extending between the upper electrode and the nugget thus formed. The reciprocating rotary motion of the upper electrode, in connection with its rising movement, serves to constantly bring a new supply of the material within the range of the arc, thus stoking the furnace in a manner to secure the best results. An excess of the material is fed into the chamber 3, which surplus material forms a lining be-

tween the nugget and the wall of the chamber and is afterward returned to the hopper to be again used. The passages 21 and 22 in the upper electrode secure a current of air downwardly through said electrode to the fusing-point, thereby supplying a sufficient amount of oxygen at that point to secure a steady and even fusing operation.

In the ordinary process of fusing materials to make carbids explosions of gas occur with more or less frequency within the furnace, which are made to cease entirely by the introduction of air at the point of fusion. This is accomplished by the provision of an air-duct in the upper electrode, as shown in the drawings, and the current of air is downward through those ducts, being thus induced by the superior upward current from the fusing mass which escapes around the top of the furnace. This downdraft is plainly observable during the operation of the machine. The same result would be accomplished if the passage 22 were omitted and the passage 21 were extended throughout the entire length of said electrode and connection thus made with an air-inlet passage at some point in the tubular rod 18. The speed of the rising movement of the upper electrode can be accurately governed by adjustment of the block 54 on the disk 53 by means of the screws 55, and this speed is made to depend upon the strength and character of the current employed. I find, for example, that with a current of about sixty volts and four hundred amperes and an upper electrode about four inches square in cross-section a speed of about eight inches per hour gives good results. When the nugget has reached the desired size, the current is shut off. The ratchet-wheel is manipulated to raise the upper electrode above the level of the chamber 3, and by the usual belt-shipping devices the machine is stopped. The arm 9 is then swung about the standard 1 to move the fresh chamber 74 beneath the upper electrode, the wire is connected to its binding-post 75, and the operation just described is repeated. While the second nugget is being formed, the first one cools sufficiently to enable it to be removed from the chamber 3, and the latter is emptied and made ready to be again used when the second nugget is completed. By reason of such alternate use of the chambers I greatly expedite the operation of forming nuggets from a single upper electrode and am enabled to keep the electric current in practically continuous operation.

By causing the supply-stream of material to descend through the two branches of the conduit 66 and to be delivered in the chamber 3 at opposite sides of the upper electrode I overcome any tendency of the material to accumulate in said chamber at one side of the center thereof and cause a nugget to be formed which is of a uniform consistency from end to end thereof.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In an electric furnace adapted to fuse a mixture of lime and carbon to form a carbid, a source of supply for said material, a fusing-chamber, two electrodes operating therein, automatic means for supplying said material to said chamber consisting of a conveyer between said source and said chamber, adjustable means for separating said electrodes and for imparting to one of them a reciprocating rotative movement, whereby said electrode may be freed from the fused material, substantially as described.

2. In an electric furnace, the combination with one upper electrode, of a plurality of fusing-chambers, each carrying a lower electrode, means for locating said chambers interchangeably beneath said upper electrode, means for delivering a variable quantity of material at the base of said upper electrode, and means for reciprocatingly rotating the latter for effecting the separation of fused material from said base, substantially as described.

3. In an electric furnace, the combination with a fusing-chamber, of two electrodes operating within said chamber, a vertically-movable support for one of said electrodes, and a pawl-and-ratchet mechanism operatively connected with said support for automatically imparting a step-by-step movement thereto, and means for reciprocatingly rotating said electrode in said support during said step-by-step movement, substantially as described.

4. In an electric furnace, the combination with a fusing-chamber having an electrode at the bottom thereof, of an upper electrode adapted to be raised and lowered within said chamber, said upper electrode being provided with a passage extending transversely therethrough at or near its upper end, and with a centrally-disposed passage leading from said transverse passage to its lower end, substantially as described.

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