(No Model.)

E. M. CARHART.

ORE CRUSHING MACHINE.

No. 332,488. Patented Dec. 15, 1885.

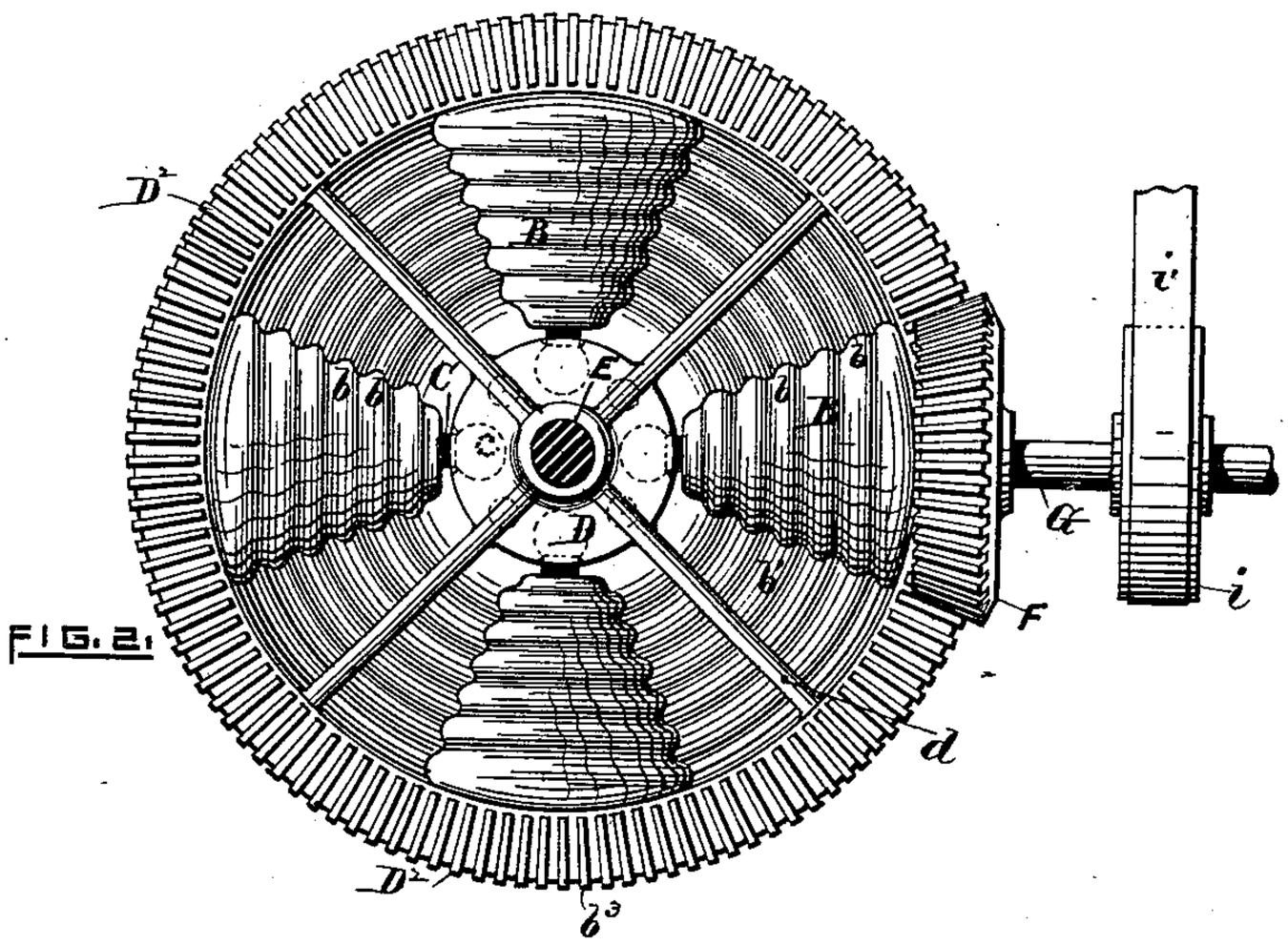

FIG. 2.

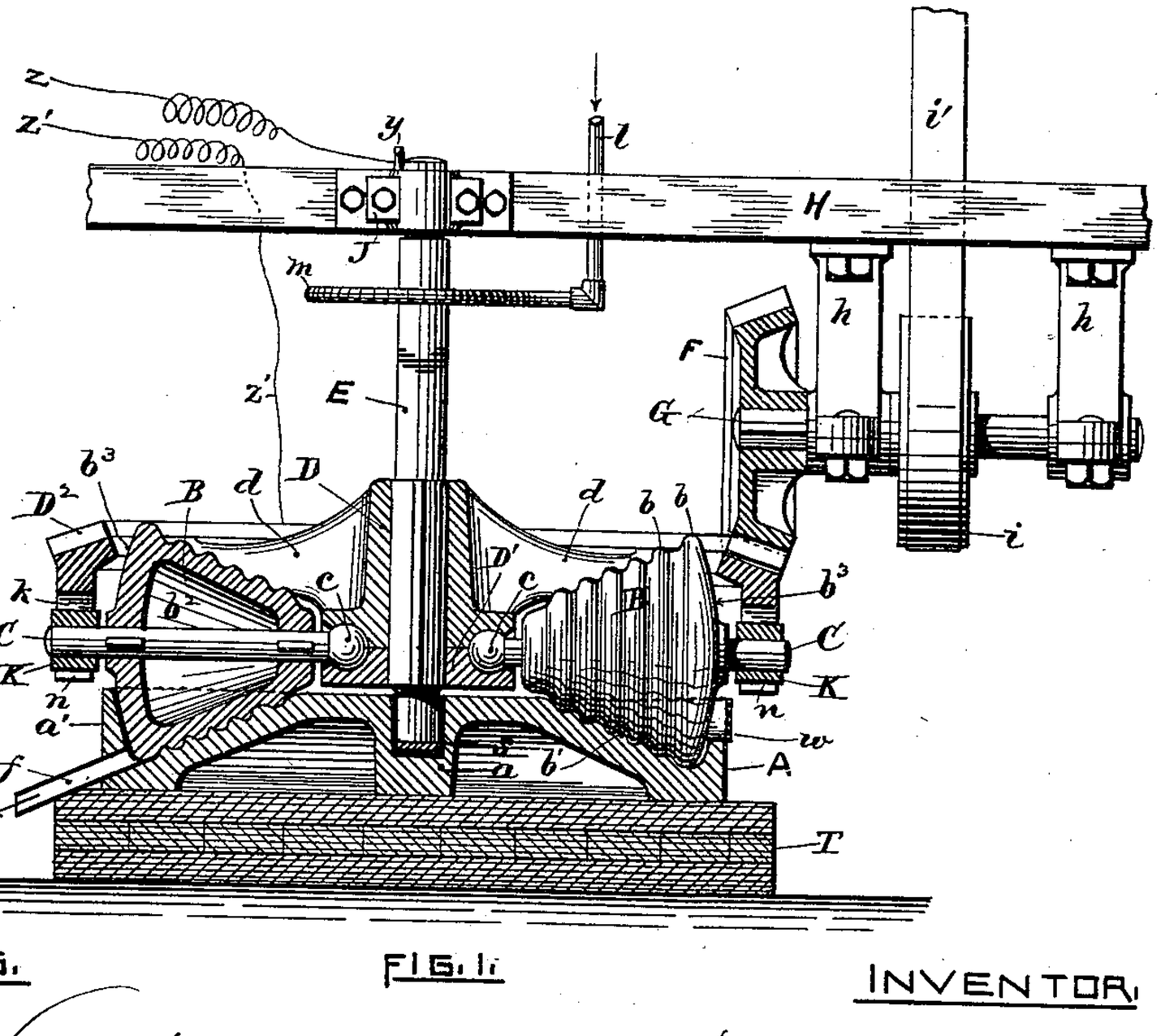

FIG. 3.

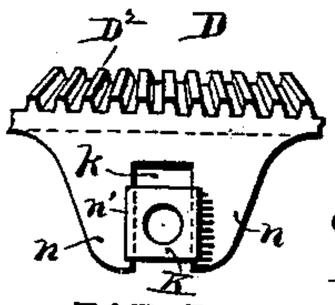

FIG. 4.

WITNESSES.

Charles Hannigan.

Fred A. Gay.

INVENTOR.

Edwin M. Carhart.

by Geo. H. Remington

Atty.

UNITED STATES PATENT OFFICE.

EDWIN M. CARHART, OF PROVIDENCE, RHODE ISLAND.

ORE-CRUSHING MACHINE.

SPECIFICATION forming part of Letters Patent No. 332,488, dated December 15, 1885.

Application filed January 10, 1885. Serial No. 152,465. (No model.)

To all whom it may concern:

Be it known that I, EDWIN M. CARHART, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Ore-Crushing Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This my present invention relates to ore-crushing machines; and it consists in certain essential features which combined produce new and useful results, all as will be more fully hereinafter described and claimed.

The object of my improvement is to increase the crushing-surfaces of the rolls and the circular track, the same being effected by means of a series of ogee-like concentric corrugations formed upon the conical faces of said rolls, the latter revolving upon and around the inclined track provided with concentric corrugations forming the counterpart of the rolls.

In the accompanying sheet of drawings, Figure 1 represents in partial vertical central section an ore-crushing mill embodying my invention. Fig. 2 is a top view of the same, and Fig. 3 is a partial side view of the driving-gear, showing the method of mounting the outer ends of the roll-shafts.

The following is a description of the invention and its manner of operation.

A, again referring to the drawings, designates the bed, having a circular form, its top or crushing surface approximating the form of a flattened conic frustum, and provided with the series of concentric ogee-shaped corrugations b', which form the circular path or track upon and around which the crushing-rolls B revolve.

a' is an outer flange projecting upward from the bed for the purpose of forming the circular cavity or trough within which the material is retained during the crushing operation.

f designates a conductor which connects with an opening formed in the lowest portion of said trough for the purpose of drawing off the amalgam, or for other necessary operations as common. One or more of said conductors, each provided with a suitable gate or valve, may be used, if desired. The flange a' is also provided with one or more screen-covered openings, w, which permit of the escape and collection of the fine overflowing material, also as usual.

B is the crushing-roll—the drawings showing a series of four—having a conical form. Its peripheral surface is provided with the series of concentric grooves or ogee-shaped corrugations b, adapted to conform to the base-grooves b', before described. The outer end, b^3, of said roll is made convex, the center of its describing radius being at the intersection of the axes of the horizontal and vertical shafts. By means of this convexity and the corresponding concave inner surface of the flange a', I am enabled to reduce the friction between said surfaces. The roll B is provided with an internal chamber, b^2, Fig. 1, for the purpose of reducing its weight, thereby adapting it to be more readily handled and transported over rough and mountainous roads. Said chamber, however, may be subsequently filled with plaster, or other suitable material, if desired, to increase the weight of the roll.

D designates the main driving or carrying wheel, provided with cogs D^2 upon its outer edge, said gear-wheel being firmly secured to the upright shaft E.

n n represent a series of downwardly-projecting guides, adapted to receive bearings K, which in turn support the outer ends of the shafts C. These bearings are arranged to slide freely in a vertical direction, but are retained laterally by means of the lips or flanges n', Fig. 3.

The lower end of the gear-hub is adapted to receive and retain the inner spherical ends, c, of the roll-shafts, thus forming a pivot by means of the ball-and-socket joint. A removable flange, D', being a continuation of said hub, is provided with cup-shaped depressions corresponding to those formed in the upper part of the hub. By means of said joints the roll-shafts are secured in position both longitudinally and laterally, but are adapted to vibrate in a vertical direction, all as fully shown.

The roll-shafts, as before stated, are mounted in the gear D, the inner ends, *c*, being retained in the hub of the gear, while the outer ends are supported in the bearings K, mounted upon the under side of the gear-rim, as hereinbefore described. The corrugated crushing-rolls are secured to said shafts intermediate of the gear-hub and its rim, and alternating with the spokes or arms *d*. The upright shaft E rests in a step, *s*, at the center of the base A, the upper end of said shaft being journaled in a box, J, secured to the frame or beam H, as usual.

F designates a small bevel-gear secured to the jack-shaft G, the latter being mounted in bearings *h*. A pulley, *i*, secured to this shaft, is adapted to receive transmitted power by means of the belt *i'*, also as common. The gear F meshes into and drives the large overhanging gear, D, as shown. By means of this arrangement I am enabled to reduce the torsional pressure upon the upright shaft, as well as to operate the machine with less power, or a lighter class of motors for a given output, as compared with other mills employing this system of reducing ores.

l indicates a tube adapted to conduct water into the perforated circular pipe *m*, the water falling therefrom to the circular track *b'* for the purpose of mingling with the quartz and ores to assist in allaying the dust, as well as to assist in disintegrating the material under the crushers.

Z designates a conducting-wire leading from the dynamo or other electric source, adapted to electrically connect the crushing mechanism, and Z' is the return-wire leading therefrom to the dynamo, thus completing the electric circuit. The step *s* may be lined with insulating or non-conducting material, if desired.

The several parts having been assembled and arranged to form the complete machine, substantially as shown in the drawings, its operation would be as follows: The material or ore is first delivered into the trough of the bed, within which also has been placed a quantity of mercury, when, upon revolving the gear D, the rollers B commence to perform the work of crushing the ores lying upon the circular path, the corrugations *b'* of said path serving not only to increase the area of its crushing-surface, but also serving as a series of riffles or slight barriers to prevent, in a greater degree than heretofore, the mass of the ore from falling or sliding into the lower portion of the trough until sufficiently pulverized by the combined action of the water and rolls. The bearings K readily permit the rolls to pass over the irregular pieces of ore, &c., the gear D at the same time remaining practically invariable in its vertical direction. As the crushing operation progresses, the finer particles will gradually accumulate at the lowest portion of the track, the larger ends of the rolls corresponding therewith, owing to their greater peripheral velocities and weight, also assisting in producing this result. As before stated, the screen-covered openings *w* permit the "float" to escape, the same being collected and concentrated as usual. After the ores have been sufficiently reduced, the amalgam is withdrawn and then treated by any suitable mercurial process as commonly employed in this method of crushing.

I contemplate, when convenient or desirable, to drive the gear D by means of an additional pinion, F, located upon the opposite side of the machine, thereby balancing the pressure upon the gear and its shaft.

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

1. In an ore-crushing machine, a bed having a circular inclined track provided with a series of concentric corrugations, forming the crushing-surface, in combination with crushing-rolls, each secured to a supporting-shaft mounted in bearings, forming a part of the driving-gear, the surface of each roll being substantially a cone-frustum, and provided with a series of concentric grooves or corrugations, forming the counterpart of the circular track of said bed, substantially as shown and described.

2. The ore-crushing machine herein described, consisting of the stationary bed A, having the beveled and corrugated circular crushing-track *b'*, and the vertical circular retaining-flange *a'*, provided with the concave inner surface, the crushing-rolls B, each having a series of concentric corrugations, *b*, and the convex shaped outer end, b^3, adapted to conform to said track and flange, shafts C, carrying the rolls, the driving-gear D, having said shafts mounted therein, the vertical shaft E, carrying the gear, and means, substantially as shown, for imparting rotary motion to the gear, as set forth.

3. In an ore-crushing machine, the conical crushing-rolls B, each having a series of concentric ogee-like corrugations, *b*, and means, substantially as described, for mounting and driving said rolls, in combination with the stationary bed A, having an inclined circular track provided with a series of concentric corrugations, *b'*, forming the counterpart of the roll's crushing-surface, as and for the purpose specified.

In testimony whereof I have affixed my signature in presence of two witnesses.

EDWIN M. CARHART.

Witnesses:
GEO. H. REMINGTON,
CHARLES HANNIGAN.