2 Sheets—Sheet 1.

J. SEANOR.

Method of and Machine for Reducing Ores.

No. 213,782. Patented April 1, 1879.

Fig. 1.

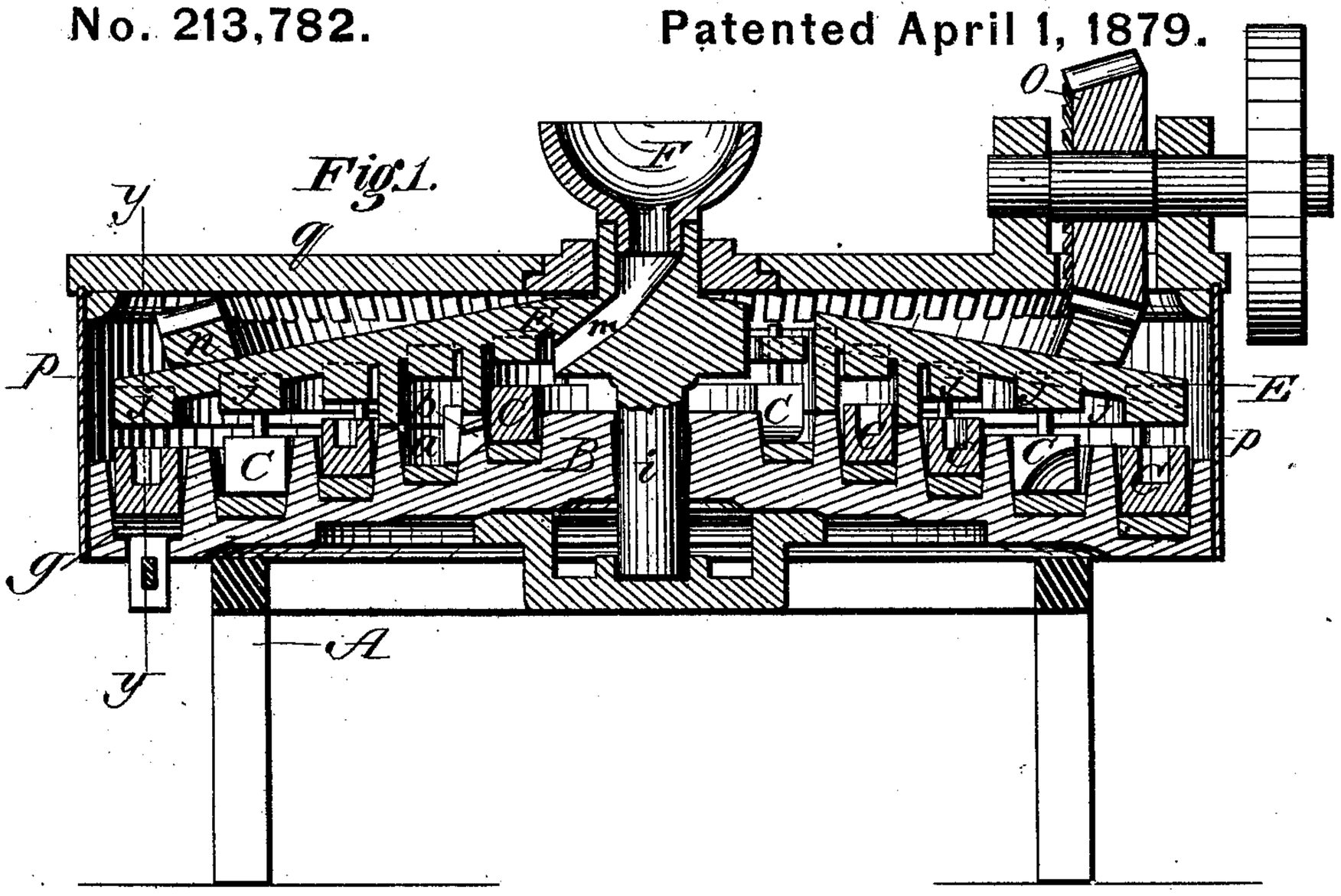
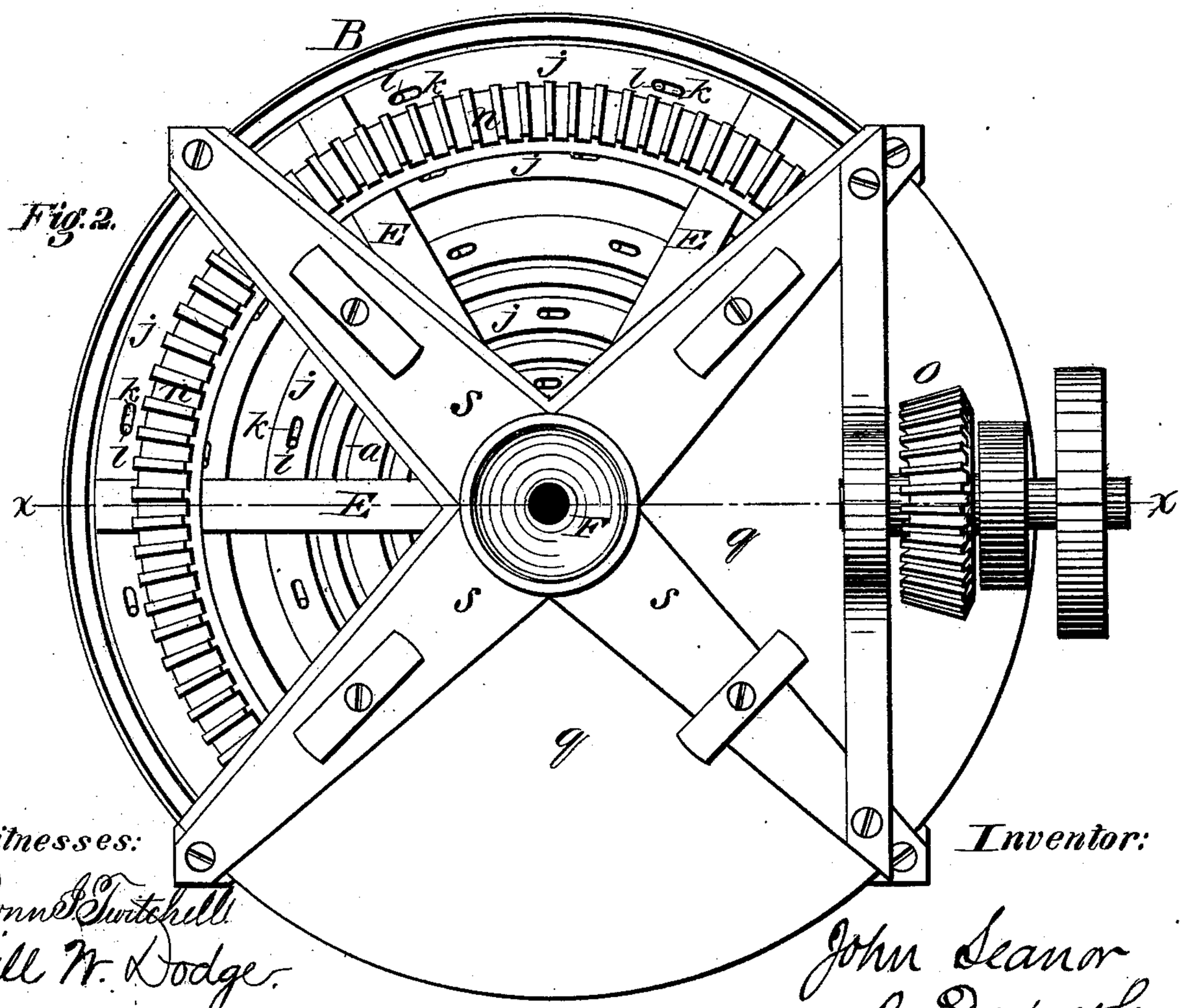


Fig. 2.



Witnesses:
Donn B. Twitchell
Will N. Dodge.

Inventor:
John Seanor
By Dodgerson
Attys

2 Sheets—Sheet 2

J. SEANOR.

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Fig. 3.

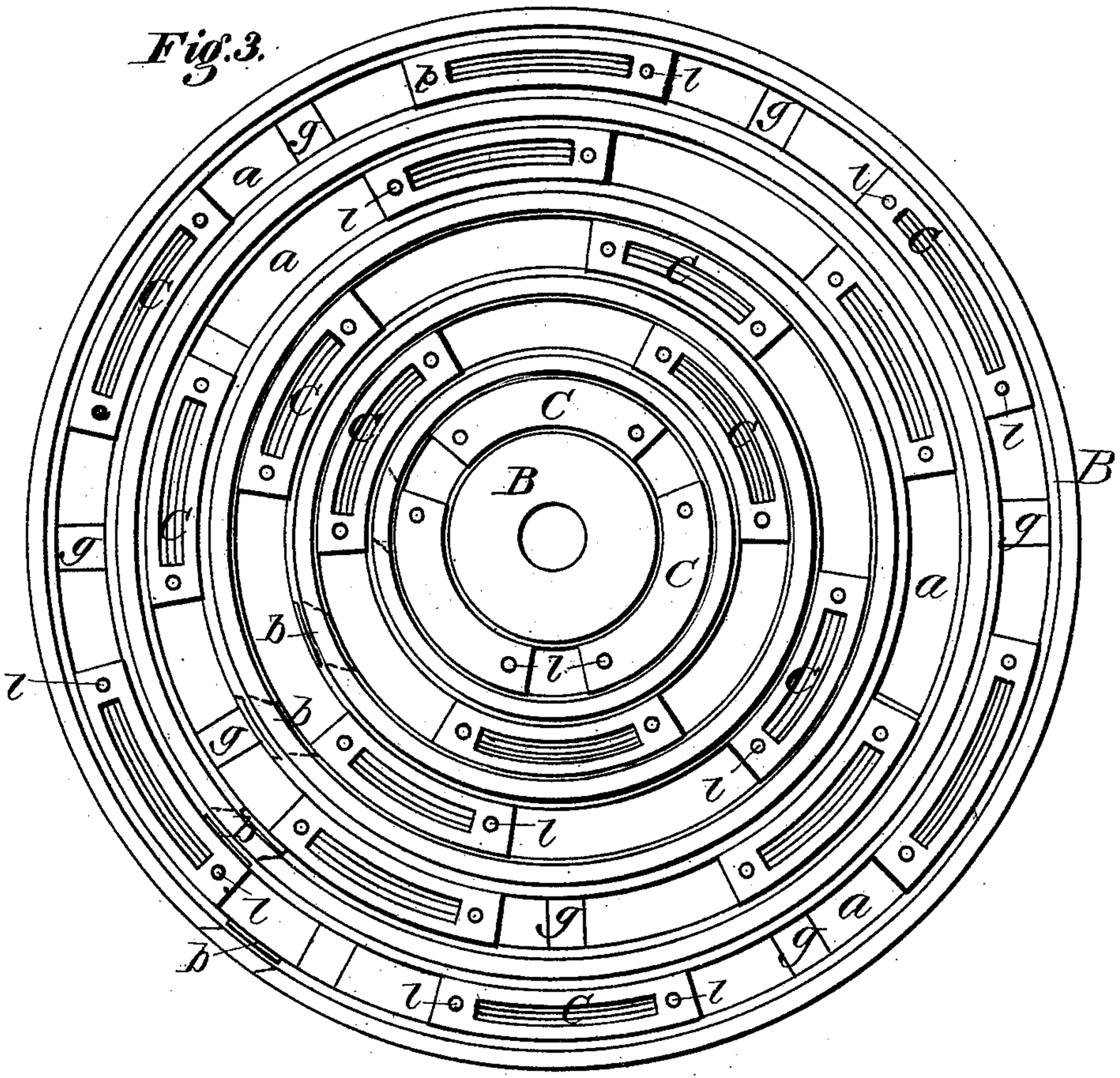


Fig. 4.

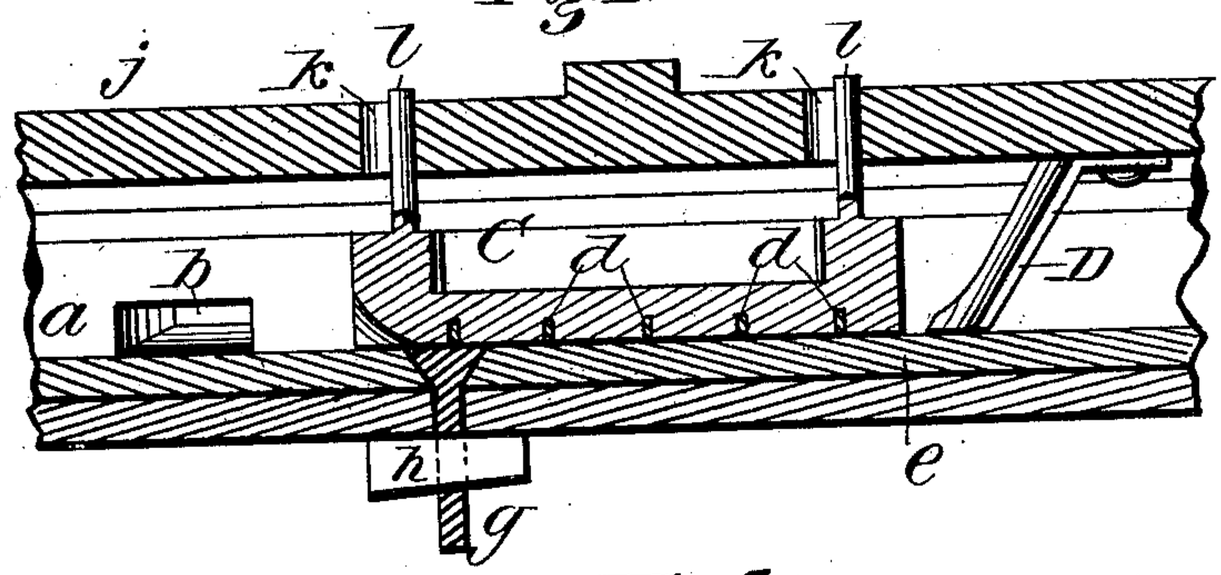
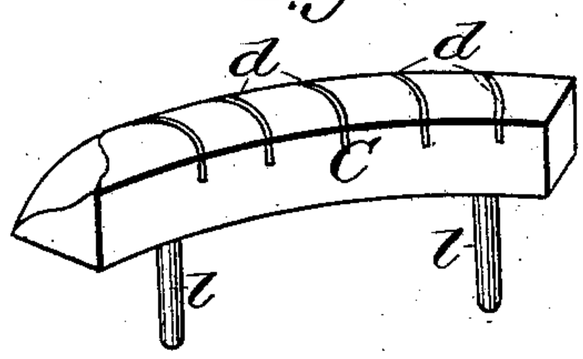


Fig. 5.



Witnesses:

Donn S. Twitchell.

Will N. Dodge.

Inventor:

John Seanor

By Dodgerson

Attys

UNITED STATES PATENT OFFICE.

JOHN SEANOR, OF CEDAR RAPIDS, IOWA.

IMPROVEMENT IN METHODS OF AND MACHINES FOR REDUCING ORES.

Specification forming part of Letters Patent No. **213,782**, dated April 1, 1879; application filed October 25, 1878.

To all whom it may concern:

Be it known that I, JOHN SEANOR, of Cedar Rapids, in the county of Linn and State of Iowa, have invented certain Improvements in Methods of and Machines for Pulverizing Ore, of which the following is a specification:

The first part of my invention relates to an improved method of dry pulverization for ores and other hard substances; and consists in effecting the reduction by causing an attrition of the particles one upon another under very light pressure, as contradistinguished from the ordinary methods, in which the material is subjected to a grinding or crushing action under heavy pressure.

In carrying out my method or process of reduction any apparatus may be used which will give the particles a rolling motion and cause them to grind and wear upon each other under a light pressure, so that they will be reduced in fineness by such wear or attrition upon each other; but I find the best plan to be to employ a circular trough or troughs, with light metal drags or runners arranged to travel therein.

I am aware that annular troughs or channels have been used in combination with heavy drags or blocks arranged to travel therein, and reduce the material by a heavy grinding or crushing action, dependence being placed upon the heavy weight or pressure; and I wish it to be distinctly understood that I lay no broad claim to the combination of an annular trough and a metal runner therein, nor to the crushing and grinding of ore under heavy pressure by such apparatus.

It is to be clearly understood that in my process the pressure of the drags or runners is not relied upon to crush the ore, and that I employ only sufficient pressure to cause a rolling motion of the particles.

Instead of introducing the ore, as usual, in a thick body or layer within the trough, I introduce it in a thin sheet or layer, so that each particle may bear against both the trough and the runner, and consequently be certain to rotate and to grind against the surrounding particles.

In practice, I find that the best results are secured by subjecting the material to a pressure of about one-quarter of a pound to the square inch, and by making the shoe or runner and the trough of soft cast-iron, in order that they may take hold upon the particles with certainty and give them the required rolling motion.

The second part of my invention relates to a machine particularly adapted for carrying out my process; and consists in various details hereinafter described.

Figure 1 represents a vertical transverse section through the center of the machine; Fig. 2, a top-plan view of the machine with two of the lids or covers removed; Fig. 3, a plan view, showing the channels or troughs and runners therein with the upper parts removed; Fig. 4, a section on the line *y y*, Fig. 1; Fig. 5, a perspective view of one of the runners or drags, looking against the under side.

A represents a rigid frame, supporting a circular bed, B, in which there are a series of concentric annular grooves or channels, *a a*, having flat bottom faces.

As shown in Figs. 1, 3, and 4, the channels are connected with each other by openings or passages *b*, so that the material may pass from one to another as it is reduced to different degrees of fineness.

As will be seen on reference to Fig. 3, the channels are arranged, in passing from the center of the machine outward, one below another, so that the material introduced at the center of the machine will naturally flow through the intermediate channels in succession to the one at the outside.

It will also be noticed that the channels increase in width as the outside of the machine is approached, each channel being wider than the one next adjoining it on the inside.

The object of thus increasing the width of the channels is to secure a single and even layer of the particles or grains on the bottom of each channel, a given amount of material serving to cover an increased area in proportion to the fineness to which it is reduced, so that the coarse particles which covered the bottom of a small channel will, after having been reduced therein, cover the bottom of the next and larger channel.

By thus increasing the size of the channels and providing for the passage of the material

from one to another as its reduction progresses, I am able to work the machine to its full capacity, and to secure a full, but thin, layer of the material in each channel—a result which is quite important to the success of my improved method of reduction.

Within each channel I mount a series of light iron runners or drags, C, of the full width of the channels. The under faces of these runners or drags are made flat, and at the forward ends they are slightly rounded on the under side, in order that they may readily pass over and upon the particles of ore, instead of forcing them out of the way in advance, as they might otherwise do.

In order to give the runners the necessary height at the sides, and at the same time secure the required lightness, they are cast hollow in the top or back, as shown.

The runners are also made, by preference, with an oblique forward end, resembling in general appearance an ordinary plow, for the purpose of securing a better and more even distribution of the material as it enters the channel, and keeping the material, to a great extent, in the middle of the channel, so as to avoid the tendency to wear grooves or holes in the surfaces, and secure a uniform action on all the particles.

In the arrangement of the openings *b*, through which the material passes from channel to channel, each one should be placed in rear of the one extending to the next channel above, in order that the material may be caused to travel as far as possible before having a chance to escape. There may be as many passages from each channel to the next as desired. As a substitute for, or in addition to, the plow-shaped ends of the runners, there may be one or more small shovels or plows, D, arranged to travel in each channel, to assist in the distribution of the material, these plows being attached to the runners or to their driving devices, as desired.

Brushes of steel, wire, or other material may also be arranged in the same manner as the plows, to assist in the distribution of the materials in the channel, especially galena and other greasy or soapy minerals, paints, &c., and sugar.

In constructing the machine the operating-surfaces of the channels and runners should be made wholly or mainly of soft cast-iron, by which is meant iron softer than that usually employed for the construction of machinery, and without the hard scale or surface commonly found on cast-iron.

By the employment of the soft metal the surfaces are caused to engage or bite readily upon the particles of the ore, and to impart thereto the constant rolling motion which constitutes the basis of my process.

In order to secure a uniform wear of the surfaces, and prevent the grooving and channeling which is liable to occur on account of the porous and honey-combed character of the cast metal, I introduce into the surfaces of the channels and runners transverse pieces of sheet-iron or other thin vertical strips or pieces of hard material, *d*, as represented in the drawings. These pieces are best secured by placing them in the molds and running the cast metal in place upon them.

In order that the surfaces of the channels may be replaced or renewed to compensate for wear, they may be provided with removable surface plates or sections *e*, as represented in the drawings. These plates will be provided with the transverse strips of hard metal as before explained, and will be secured in any suitable manner within the channels—as, for example, by means of cast-metal wedges *g* passed down between their ends, flush with their upper faces, and secured by keys *h* on the under side, as represented in Fig. 4. When reduced by wear the plates are readily removed and replaced by new ones, and thus the body of the bed is adapted to be used for an indefinite length of time.

As a means of driving the entire series of runners, I employ a rotary frame or spider, E, sustained by a central shaft, *i*, and provided with a series of rings, *j*, which latter are provided with vertical holes or slots *k*, to receive two studs or pins, *l*, on each runner. The slots *k*, which permit the runners to rise and fall and adjust themselves readily to the channels and the material beneath them, are curved concentrically with spider, and serve to prevent the runners from being carried outward by the centrifugal force so as to bind against the outer sides of the channels. By thus limiting the runners so as to prevent the outward movement, the power required to drive the machine is greatly reduced, and the lateral wear of the channels and runners prevented.

As a means of feeding the machine, the spider or driving-frame is provided with a central hopper, F, and a passage, *m*, leading downward and outward through one side, so as to deliver into the innermost channel.

The driving-frame or spider may receive motion in any suitable manner; but ordinarily it will be provided on the top with a geared ring, *n*, and driven by means of a pinion, *o*, sustained by bearings on the frame, and engaging in the ring, as shown.

In order to confine the dust within the machine, a rim or casing, *p*, is secured around the bed, and provided with a top or cover, consisting of removable panels *q*, mounted in sustaining-arms *s*, as shown in Figs. 1 and 2.

Having described my invention, what I claim is—

1. The herein-described method for the dry pulverization of ores, consisting in causing a constant rolling motion of the particles in a thin layer subject to a very light pressure, substantially as set forth, whereby the particles are reduced by attrition upon each other, instead of being crushed and ground by heavy pressure, as usual.

2. The herein-described method of treating

dry ores, consisting in passing the same between two flat horizontal surfaces of soft metal, one of which moves upon the other, subject to a pressure of about one-quarter of a pound to the square inch.

3. In a machine for pulverizing ores, the combination of a series of annular channels and corresponding runners, both having flat faces, the channels being arranged one below another, and of increasing size from the highest to the lowest.

4. In a machine for pulverizing ores, two annular channels having flat soft cast-iron faces, one channel being arranged below and made of greater capacity than the other, in combination with flat-faced runners mounted in said channels, as shown.

5. In combination with an annular channel, and an elongated runner mounted therein and provided with one or more upright studs or pins, the rotary frame or spider, provided with slots concentric therewith, holding the studs loosely, as described and shown, whereby the runner is advanced, prevented from moving radially, but permitted to rise and fall freely and independently at its two ends.

6. In an ore-reducing mill, a soft cast-metal runner having hard-metal strips set into and flush with its face, as and for the purpose shown and described.

7. In an ore-pulverizing mill, an annular channel having a flat soft-metal face, with sheet-metal or other hard strips or pieces seated firmly therein flush with its surface.

8. In an ore-pulverizing machine, the combination of an annular channel or groove with a metal runner having an opening or recess in its back, as shown, whereby the necessary height and lightness of weight are secured.

JOHN SEANOR.

Witnesses:
THOS. J. DUDLEY,
U. C. BLAKE.

2,250 words