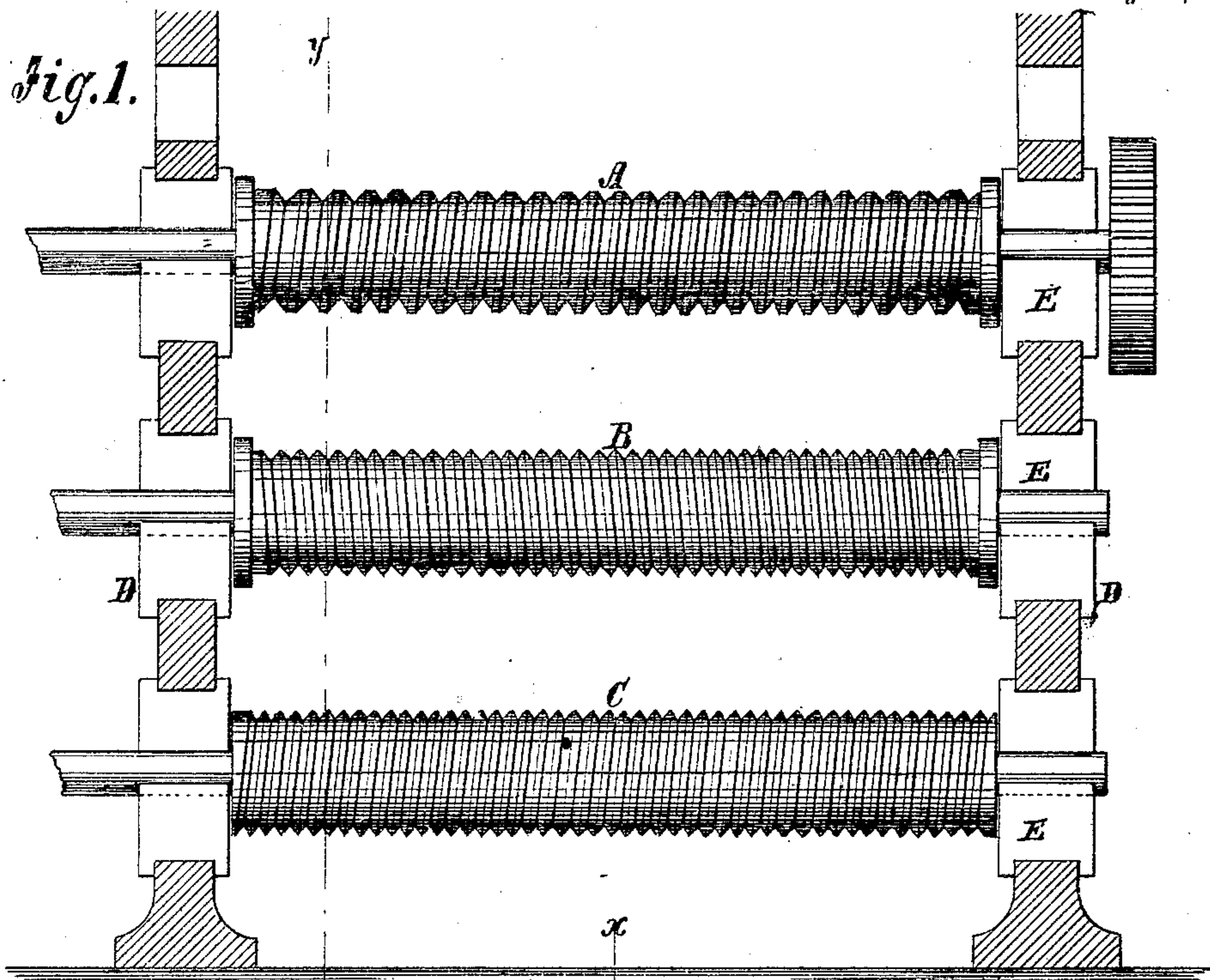


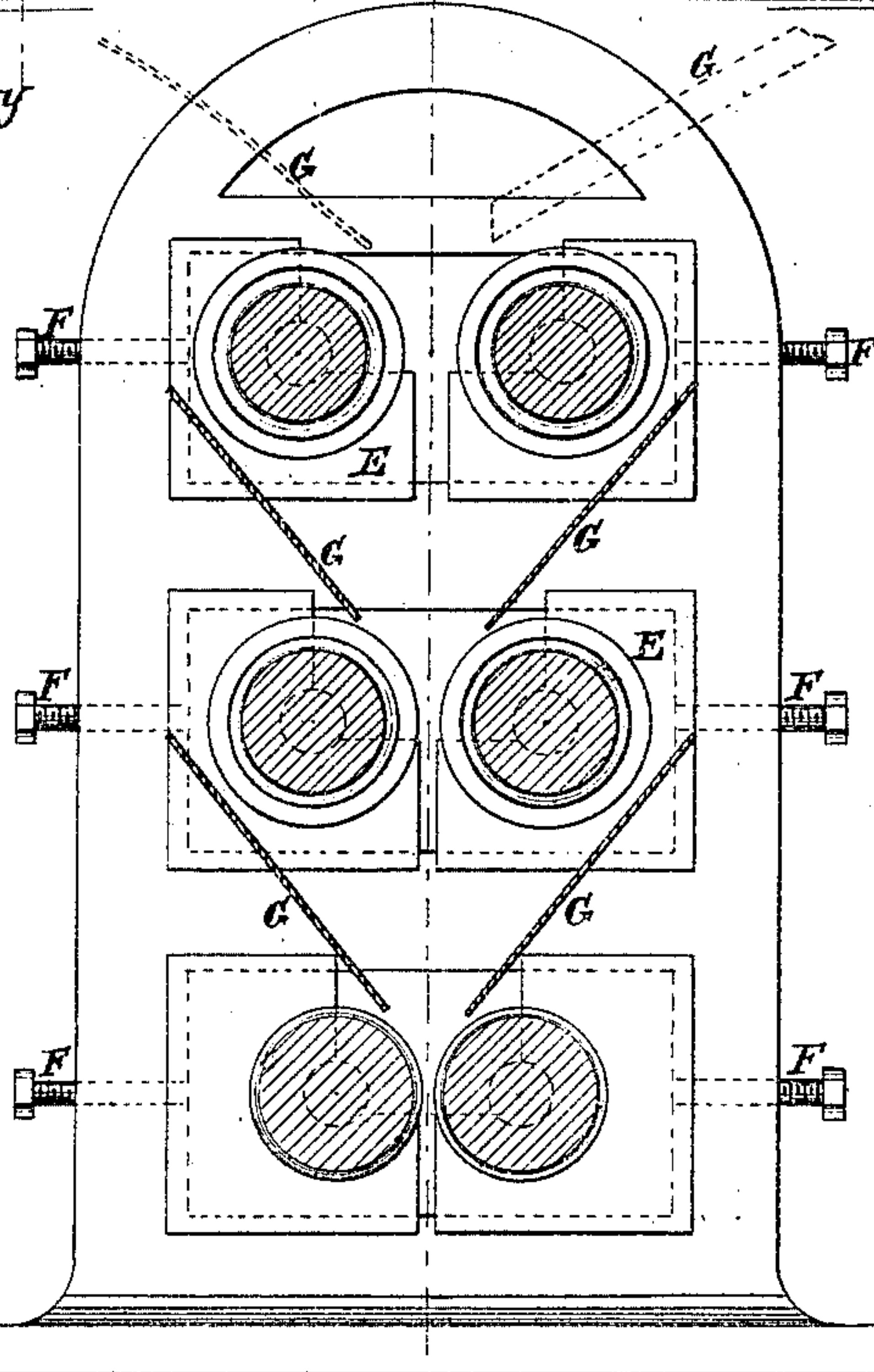
F. J. KIMBALL.  
Improvement in Machines for Crushing and Grinding  
Rock Phosphates, &c.

No. 114,303.

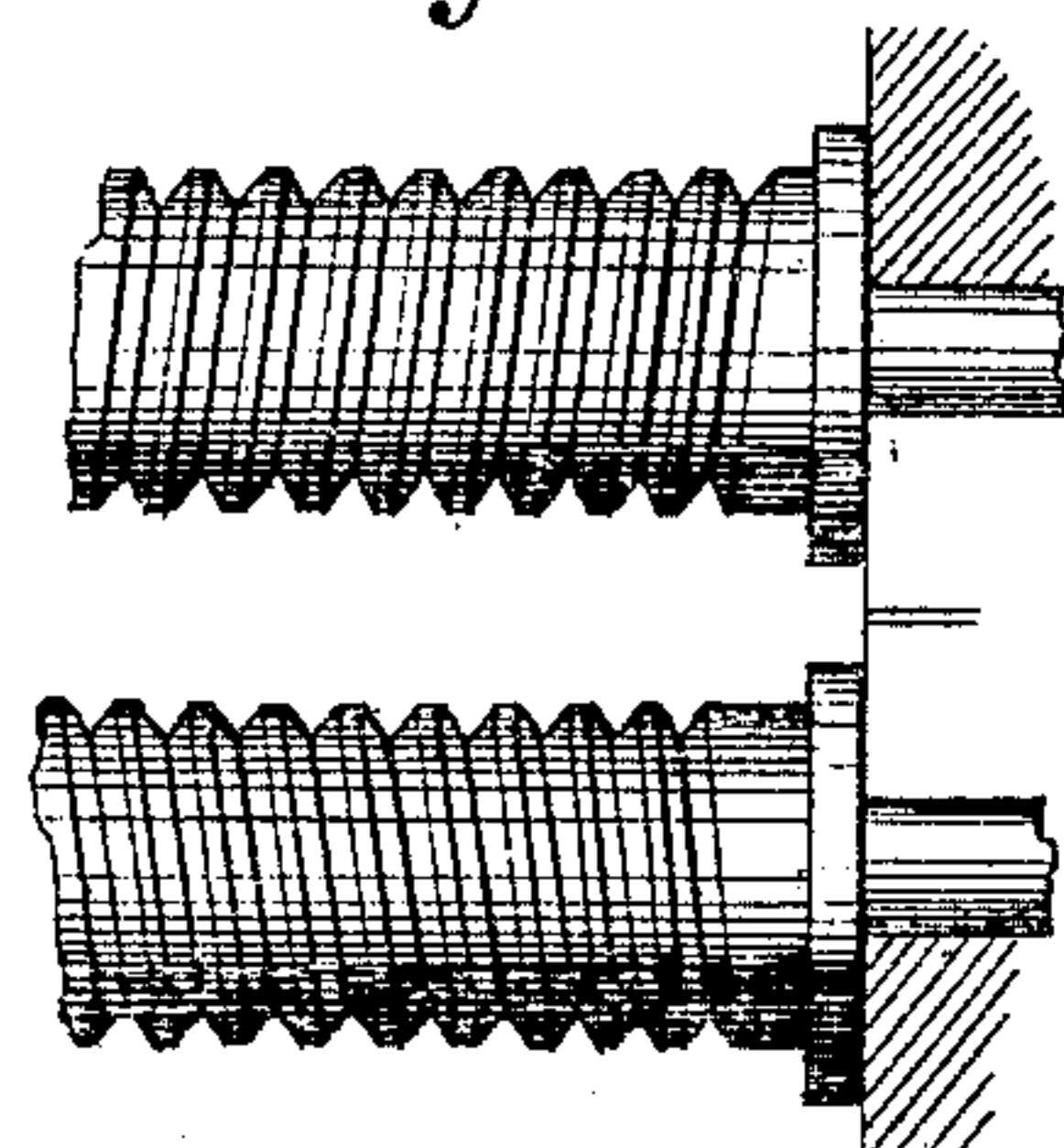
Patented May 2, 1871.



*Fig. 2.*



*Fig. 3.*



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# United States Patent Office.

FREDERICK J. KIMBALL, OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 114,303, dated May 2, 1871.

## IMPROVEMENT IN MACHINES FOR CRUSHING AND GRINDING ROCK PHOSPHATES, &c.

The Schedule referred to in these Letters Patent and making part of the same.

*To all whom it may concern :*

Be it known that I, FREDERICK J. KIMBALL, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Machine for Crushing and Grinding Rock Phosphate, &c.; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawing forming part of this specification.

This invention relates to a new and useful machine for crushing and grinding phosphate rock or nodules and other material, and consists in one or more pairs of horizontal rollers having spiral grooves, the spirals in each pair running in opposite or reverse directions, and arranged to operate as hereinafter more fully described.

In the accompanying drawing--

Figure 1 represents a sectional side elevation of the machine, the section being on the line *x x* of fig. 2.

Figure 2 is a vertical cross-section taken on the line *y y* of fig. 1.

Figure 3 is a detailed view, showing the position of the spirals of a pair of rollers.

Similar letters of reference indicate corresponding parts.

In this example of my invention I show a machine with three pairs of rollers, but I do not confine myself to any particular numbers.

Each roller is provided with a spiral groove resembling a screw-thread, with the spirals for each pair running in opposite or reverse directions, as seen in fig. 3.

The roller may be cast with the grooves thereon, or the groove may be cut, or the roller may be cased in a grooved tube, as may be found most convenient.

A, B, and C represent the three pairs of rollers.

These pairs are placed one above the other, as seen in fig. 3, and revolved, by means of gear-wheels or otherwise, by the application of steam or other motive power. The rock or material is fed between the rollers of the upper pair A, from which it descends to the pair B, and from B to the pair C. The distance be-

tween the rollers of each pair diminishes from A down, so that the rock, when delivered from the lower pair, will be reduced to the required degree of fineness; but the operation need not necessarily end with the third pair of rollers, as other rollers or cylinders may be employed to still further reduce the phosphate or material, if desired.

D D are the head-blocks which support the rollers.

H represents the boxes in which the journals of the rollers revolve.

These boxes are made adjustable by means of the set-screws F, so that the rollers may be set nearer together or further apart to crush and reduce the phosphate or material more or less.

G represents hopper-plates (two for each pair of rollers) placed, as seen in fig. 2, in an inclined position so as to conduct the phosphate or material between the rollers.

The pitch of the spiral grooves may diminish from the upper to the lower pair of rollers, according to the distance the rollers are set from each other.

The phosphatic material, or nodules which are thus reduced, is not hard, like granite or marble, but is quite easily crushed and reduced to a powdered state, thus preparing it for heating or purifying, drying, and fitting it for market.

My reversely-grooved or threaded crushing and grinding-rollers adapt the machine for other purposes, or for crushing and reducing other material than phosphate. I do not, therefore, confine myself in the use of the machine to that particular purpose, but design it for all the purposes for which it may be adapted.

Having thus described my invention,

I claim as new and desire to secure by Letters Patent--

One or more pairs of reversely-grooved or threaded rollers, arranged, substantially as shown and described, for the purpose of crushing, reducing, or grinding rock-phosphate or other material.

FREDERICK J. KIMBALL.

Witnesses:

WM. E. SIMPSON,  
GEO. NICHOLS.