

(No Model.)

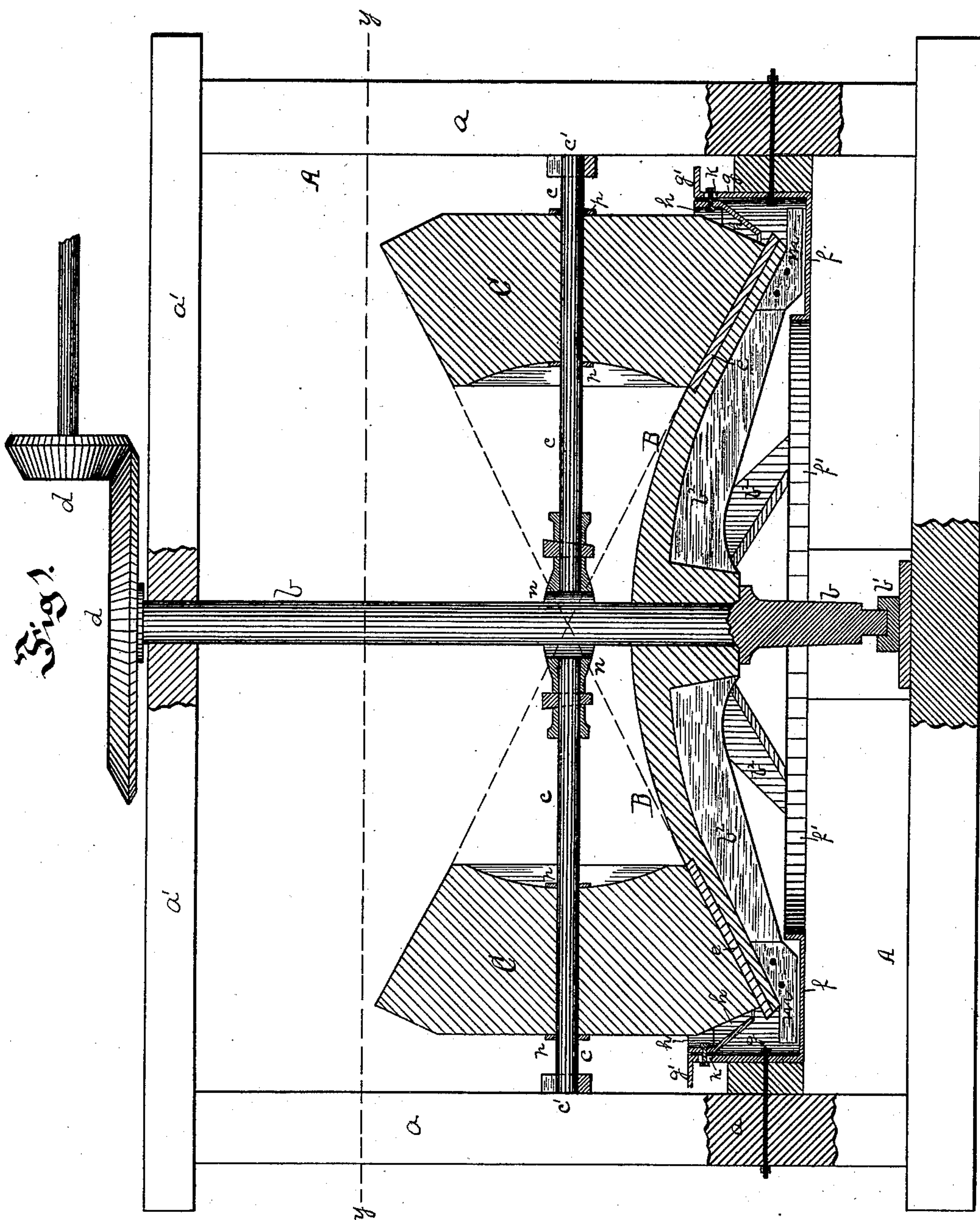
2 Sheets—Sheet 1.

G. W. MORROW.

CRUSHING MILL.

No. 297,083.

Patented Apr. 15. 1884.



Witnesses.

A. M. Imbrie,  
J. W. Cooke.

Inventor.

George W. Morrow  
by James S. Ray  
Attorney

(No Model.)

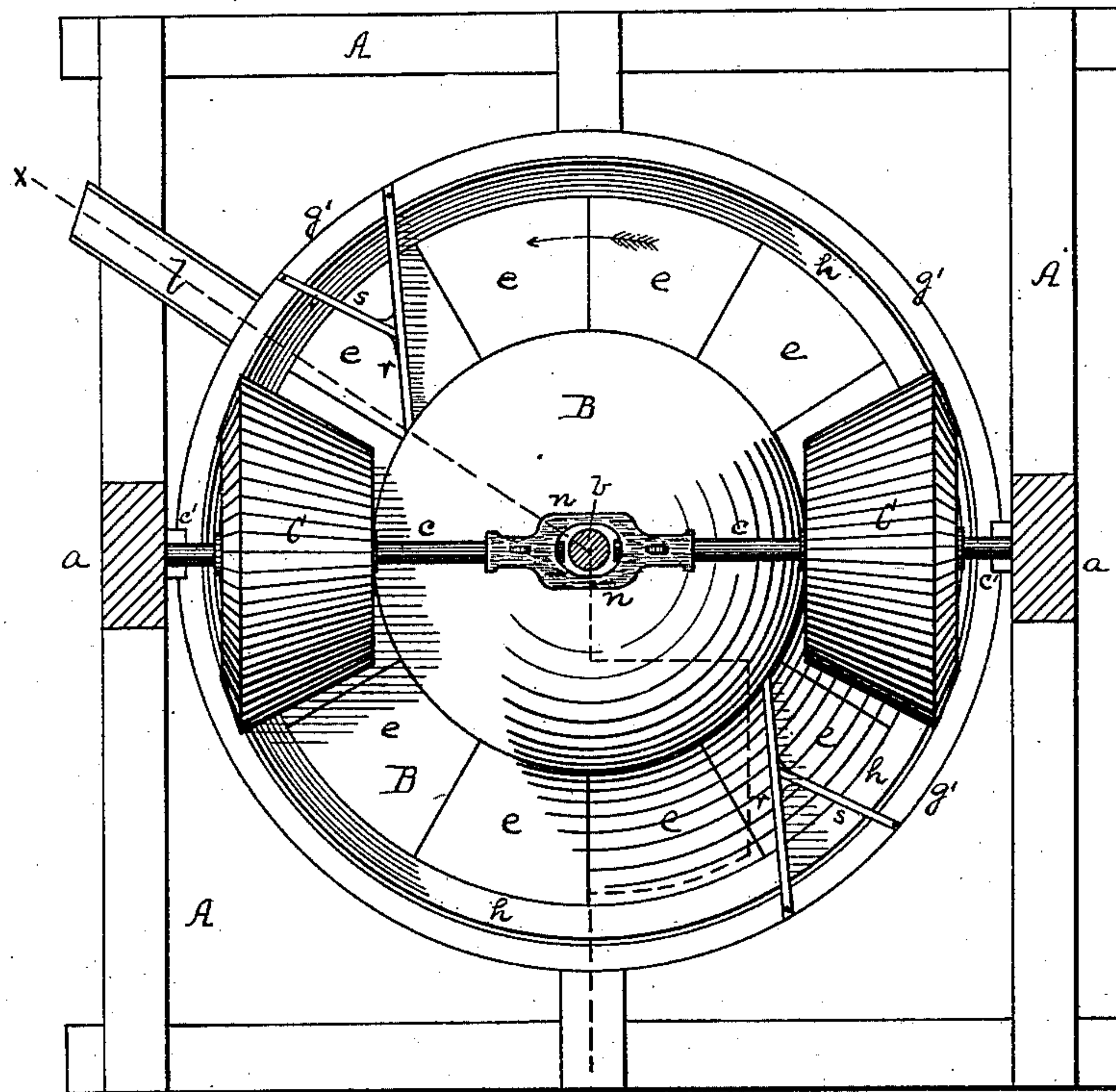
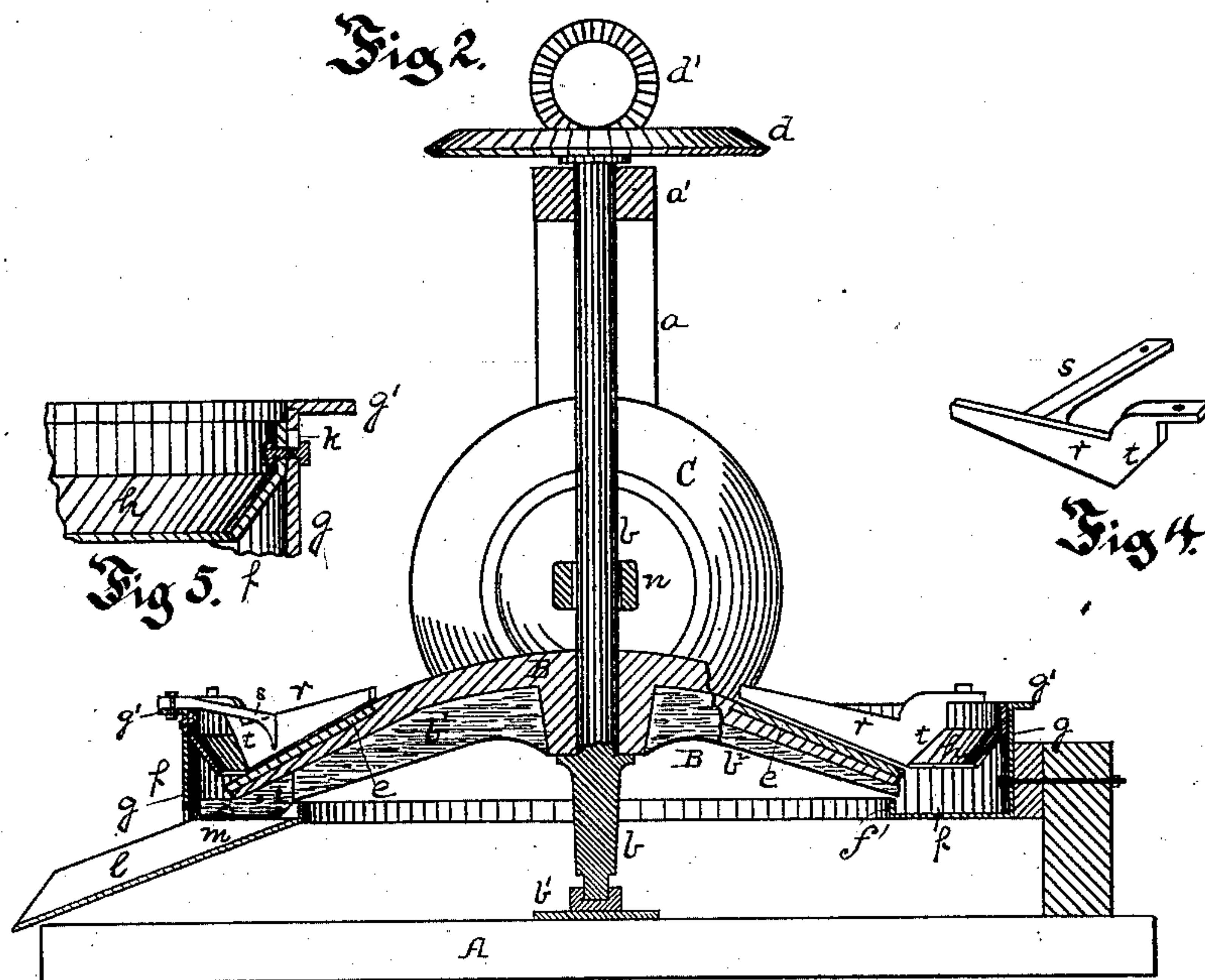
2 Sheets—Sheet 2.

G. W. MORROW.

CRUSHING MILL.

No. 297,083.

Patented Apr. 15, 1884.



Witnesses.  
A. M. Imbrie  
J. Cooke

Inventor.  
George W. Morrow  
by James I. Ray  
Attorney



# UNITED STATES PATENT OFFICE.

GEORGE W. MORROW, OF TORONTO, OHIO,

## CRUSHING-MILL.

SPECIFICATION forming part of Letters Patent No. 297,083, dated April 15, 1884.

Application filed August 23, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE W. MORROW, of Toronto, in the county of Jefferson and State of Ohio, have invented a new and useful Improvement in Crushing-Mills; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to machines for grinding or crushing fire-clay, quartz, grain, cotton-seed, and other materials, and has reference to that class of crushing-mills in which the material is fed upon a pan and crushed by means of heavy rolls working over the surface of said pan, either the rolls traveling around over a stationary pan or the pan being movable and traveling under the rolls, which are mounted on one or more shafts fitting in stationary bearings. It has special reference to mills of this class in which an annular tapering pan and conical crushing-rolls are employed, the rolls and pan being constructed in this manner to overcome the friction, as the outer ends of the rolls travel over more space than the inner ends, and when made conical they do not drag over the face of the table, and for this reason they are not so liable to wear unevenly as where the rolls are not conical.

The special objects of my invention are to improve the discharge from these crushing-mills, to lessen the force necessary to work them, and to cause them to wear longer.

To enable others skilled in the art to make and use my invention, I will describe its construction and operation, referring to the accompanying drawings, in which—

Figure 1 is a vertical section of a crushing-mill, partly in full lines, embodying said invention. Fig. 2 is a section on the line  $xx$ , Fig. 3. Fig. 3 is a plan view, the upper part of the frame being removed, on the line  $yy$ , Fig. 1. Fig. 4 is a perspective view of the scraper; and Fig. 5 is a detached view of part of the skirt, to illustrate the means of adjustment.

Like letters of reference indicate like parts in each.

In the drawings, A represents the framework of the crushing-mill;  $a$ , the upright stanchions, and  $a'$  the cross-beam.

The apparatus is illustrated where the table B is mounted so as to be rotated under the

rolls C, and the shafts  $c$  of the rolls are mounted in stationary bearings  $c'$ . The table is rigidly secured to the upright shaft  $b$ , which is journaled at the base in the ink-pot  $b'$ , and passes through the cross-beam  $a'$ , and above the cross-beam is provided with the bevel cog-wheel  $d$ , in which the bevel-pinion  $d'$  meshes, and the table is rotated by any suitable power applied through the bevel-gear. The table is formed of cast metal, and slopes gradually downward from the central shaft to the outer edge, being thus formed annularly tapering, to conform to the shape of the rolls, as hereinafter referred to, as well as to feed the material down under the crushing-rolls, and discharge the crushed material more easily from the table. The table is provided with suitable braces  $b^2$ , extending out from the central hub, to give it the necessary strength, and is preferably provided with the interchangeable segmental wearing-plates  $e$ , fitting in seats in the outer part of the table under the course of the crushing-rolls, these plates being formed on the same curve or taper as the face of the table. The wearing-plates  $e$  may be formed of very hard cast-steel or other metal, while the body of the table may be formed of tougher and stronger metal than where it has to take the wear; and for this reason a more durable table is obtained, both against heavy strains and the wear in crushing.

Around the table, secured to the stanchions  $a$  and other suitable part of the frame, is the annular box  $f$ , into which the material is discharged from the table, the box having an inner rim,  $f'$ , which fits up close to the braces  $b^2$  of the table, and an outer rim,  $g$ , which extends up above the discharge-opening of the table, and at top of which is the flange  $g'$ . To this outer rim,  $g$ , is secured the annular skirt  $h$ , which extends inwardly from the rim, so that its lower edge approaches the table and thus forms the annular discharge-opening for the crushed material at the edge of the table. The skirt  $h$  is vertically adjustable on the rim  $g$  of the box  $f$ , so that by raising or lowering the skirt the discharge-opening may be increased or diminished, according to the quantity of the material to be crushed or in case the skirt or table should wear. In the drawings, the skirt is bolted to the rim  $g$ , through slots  $k$  in the rim, and may be adjusted by loosening



ing the nuts and sliding the bolts in these slots; but other suitable means for adjusting the skirt may be employed. The box *f* is provided with a discharge-spout, *l*, and blades *m*, 5 secured to the braces of the table, travel in the annular box, and carry the crushed material around in the box to the discharge-spout. The rolls *C* are conical in shape, their faces being preferably turned to correspond with a line 10 drawn from the center of the upright shaft *b* and the axis of the rolls, and the lower part of the table has a slope corresponding to that of the rolls, so that as the rolls work over the face of the table, the parts in contact travel at the 15 same speed, and all unnecessary friction is overcome. The ends of the shafts *c* are secured to the yoke *n*, fitting around the shaft *b*, and the outer ends of the shafts rest in the bearings or seats *e*, and as the rolls are raised by 20 the material passing under them, the shafts rise in these bearings, thus preventing injury to any part of the mill in case any material is fed to the pan which is too hard to be crushed when first passing under the rolls. The rolls 25 are journaled loosely on the shafts *c*, and are held in position thereon by the collars *p*. In order to carry the material which is not sufficiently crushed back toward the upper part of the table, scrapers *r* are employed, these 30 scrapers corresponding in shape to the slope of the table, and being supported at such height above the table as to allow all material sufficiently crushed to pass under them, but carry all larger pieces up into the course of 35 the rolls. The rear portions of the scrapers are of such form as to fit close to the inwardly-extending portion of the annular skirt *h*, as at *t*, and thus prevent the passage of any insufficiently-crushed material along the skirt. 40 They are bolted to the flange *g'* of the outer rim and are braced by the arms *s*, extending from the rear of the scrapers to the said flange.

The operation of my improved crushing-mill is as follows: Power is applied through 45 the bevel-gear *d d'* and vertical shaft *b* to the annular tapering table *B*, causing it to travel under the conical rolls *C* and scrapers *r*, and as the rolls bear on the table they are rotated thereby, less power being required for this 50 purpose than where the rolls are flat faced, for the reasons before given. The ore, clay, grain, or other materials to be crushed or ground, is fed upon the table at any desired point, and is carried by the rotating table under 55 the rolls or against the scrapers, up which it travels, so as to be delivered under the rolls and be crushed thereby. As the material passes under the rolls the roll-shafts *c* rise in their bearings *e'*, allowing any material not 60 crushed sufficiently fine at the first crushing to pass under, and these lumps or large particles are carried by the table against the scrapers, and by them thrown again to the upper part of the table into the course of the 65 rolls. As the table is rapidly rotated the centrifugal force throws all the material toward the outer edge, and as the table slopes gradu-

ally downward toward its outer edge this slope of the table aids in carrying the material toward the outer edge, so that any material 70 which is crushed fine enough will pass down the table and be thrown by the centrifugal motion through the annular discharge-opening at the base of the cones of the rolls. It is then carried, by means of the blades *m*, 75 through the box *f*, to the spout *l*. The crushed material is not caused to pass up over a rim or annular ridge before being discharged, but is discharged at the lowest part of the table, being thrown against the skirt and 80 through the annular opening after passing under the rolls, and at the base of the cones of the rolls. After the material has passed under the rolls, it is carried round by the table against the scrapers, and any part not crushed 85 sufficiently fine travels up the scrapers and is thrown by centrifugal force under the rolls and again crushed, while the part crushed sufficiently passes under the scrapers, and is thrown 90 by the centrifugal force through the annular discharge-opening, as above described. The wear on the table comes on the interchangeable wearing-plates *e* under the course of the rolls, and when they become worn they can be replaced. 95

To arrange the mill to crush to another gage, the annular skirt is adjusted vertically, as above described, to change the width of the discharge-opening, and if the lower edge of the skirt becomes worn it can be adjusted in 100 the same manner.

The mill may be employed for crushing, breaking, or grinding any desired materials, whether wet or dry, and the table may be arranged to rotate under the rolls, as above described, or the table be stationary and the 105 rolls work over its surface; and in the latter case, on account of the slope of the table and annular discharge-opening around its edge, an efficient discharge for the crushed material is 110 obtained. I prefer, however, to have the table travel under the rolls.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In crushing-mills, the combination, with 115 crushing-rolls, of a table or pan, and an annular skirt forming, in connection with the edge of the table, an annular discharge opening for the crushed material, substantially as and for the purposes set forth. 120

2. In crushing-mills, the combination, with crushing-rolls, of a table or pan, an annular skirt forming, in connection with the edge of said table, an annular discharge-opening, and means for adjusting the skirt vertically to and 125 from said table, to vary the size of the discharge-opening, substantially as set forth.

In testimony whereof I, the said GEORGE W. MORROW, have hereunto set my hand.

GEORGE W. MORROW.

Witnesses:

THOMAS DONAHUE,  
THOMAS HOOD.