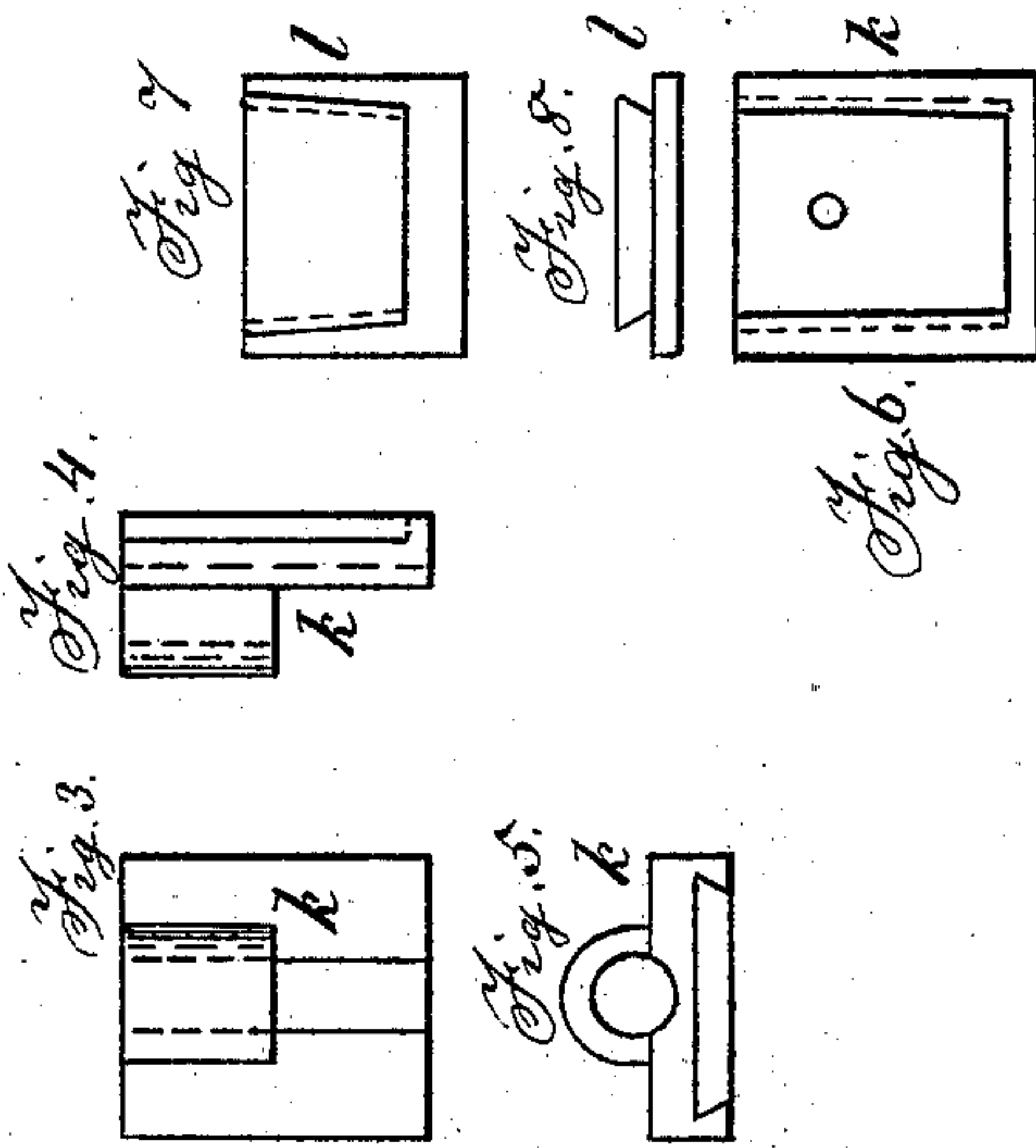
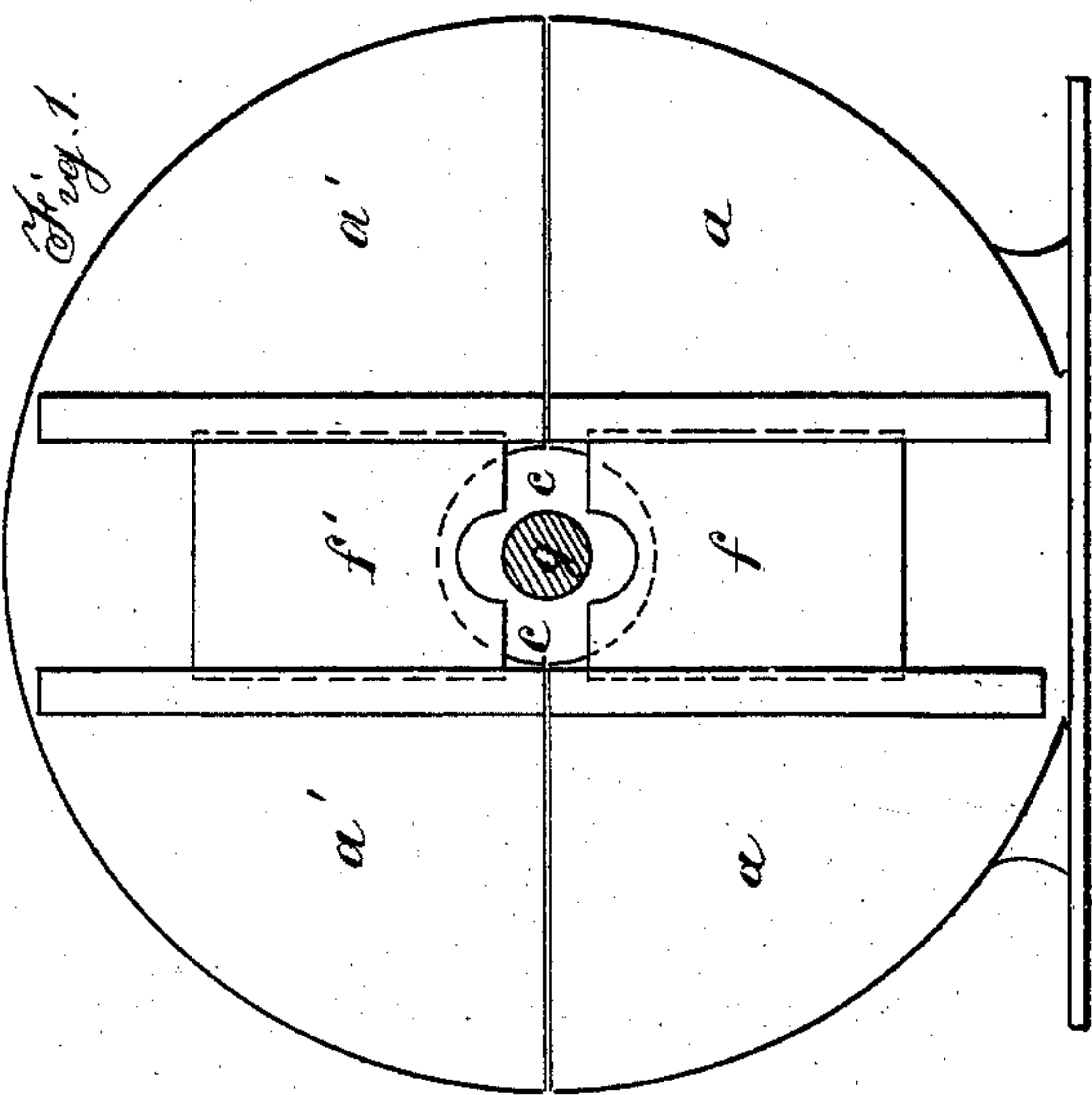
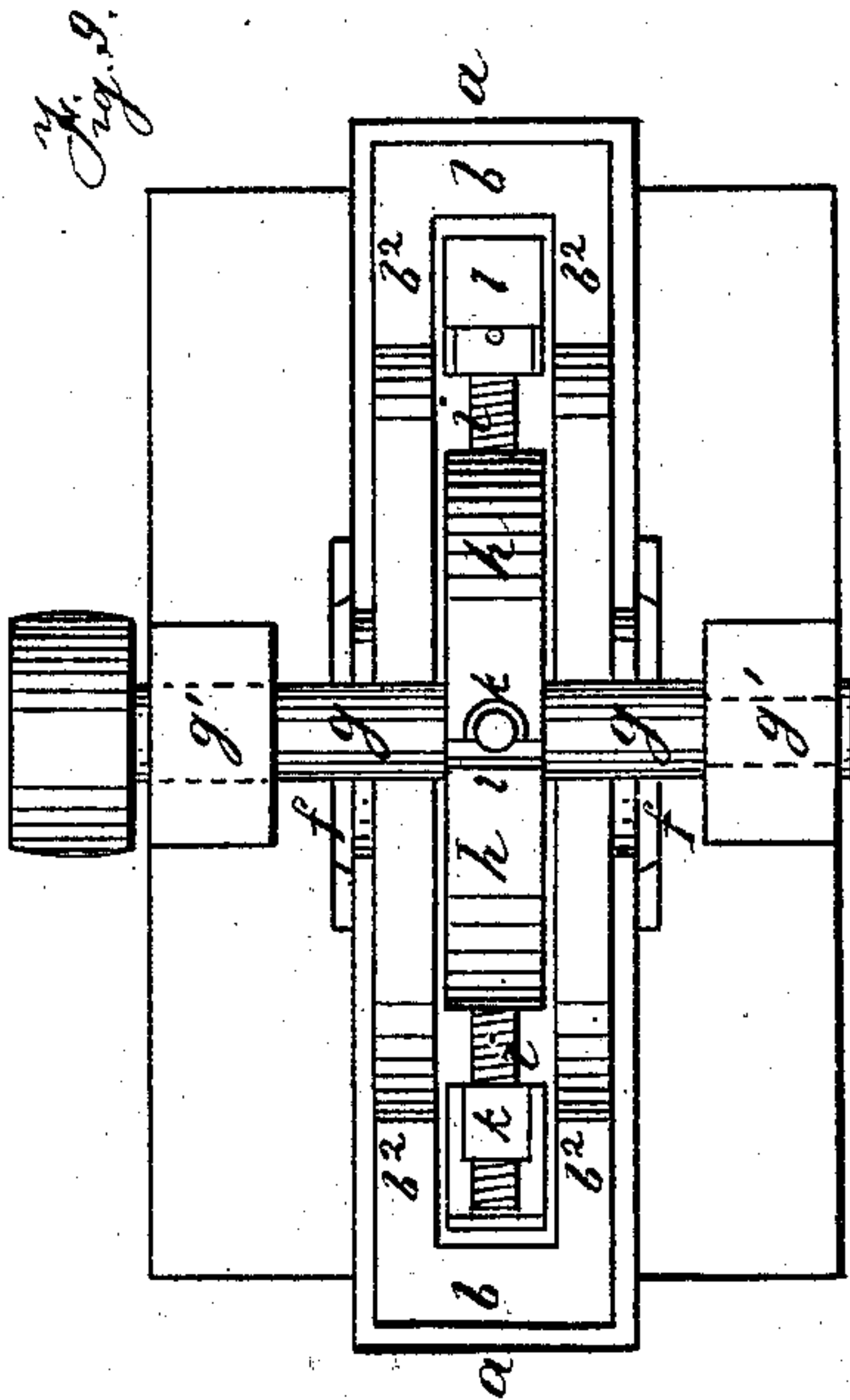
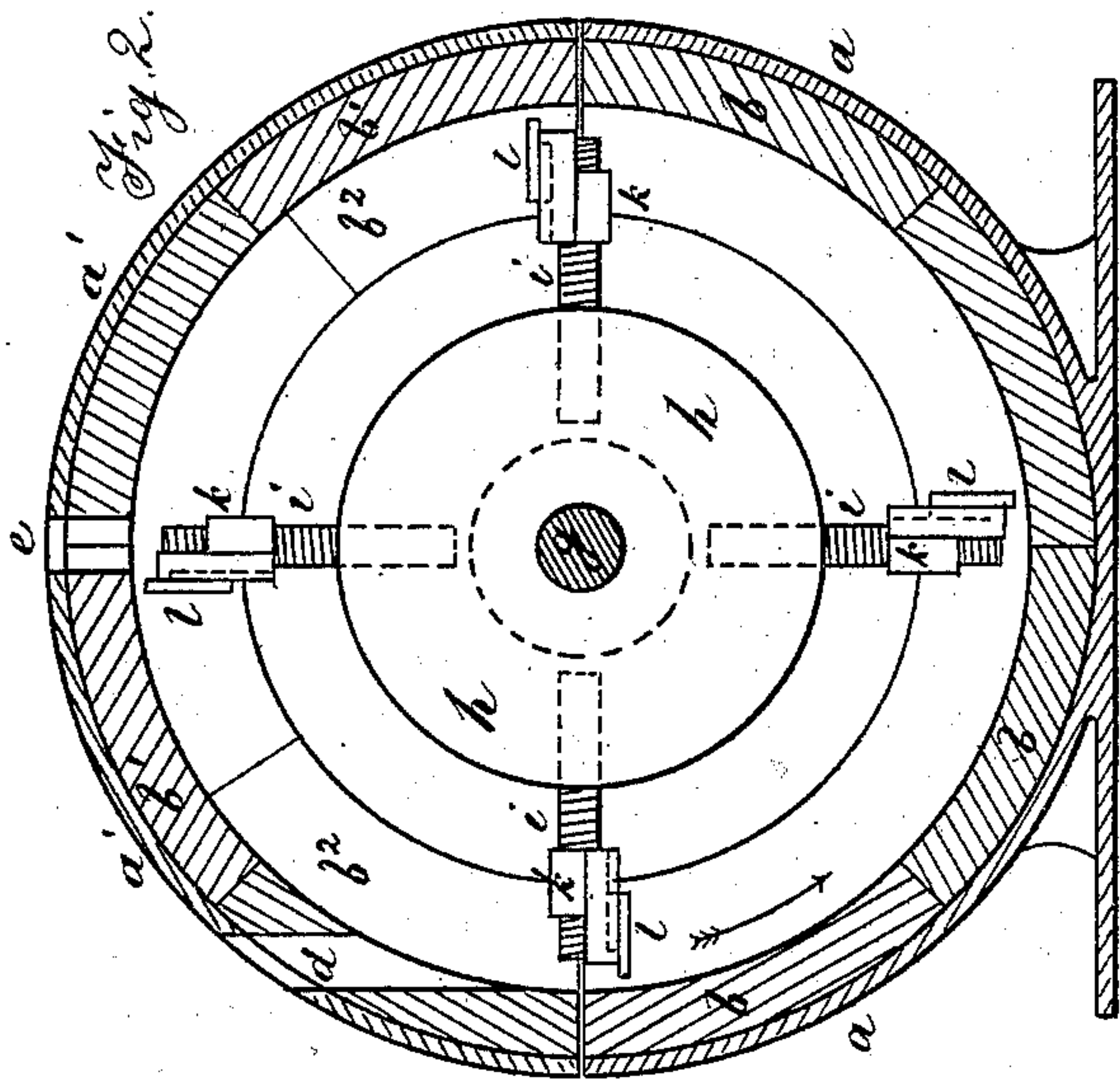


S. GARDNER.  
Ore-Pulverizers.

No. 144,330.

Patented Nov. 4, 1873.



Witnesses,  
Albert H. Hook,  
Thos. J. Clare

Inventor,  
Smith Gardner



# UNITED STATES PATENT OFFICE.

SMITH GARDNER, OF NEW YORK, N. Y.

## IMPROVEMENT IN ORE-PULVERIZERS.

Specification forming part of Letters Patent No. **144,330**, dated November 4, 1873; application filed October 30, 1873.

*To all whom it may concern:*

Be it known that I, SMITH GARDNER, of the city, county, and State of New York, have invented Improvements in a Mill or Apparatus adapted especially to the Pulverization of Mineral Substances, of which the following is a specification:

My invention consists in an improvement in an iron mill or apparatus, usually called the attrition-mill, which has been used more or less for pulverizing iron ore, siliceous, and other minerals; but in the pulverization of siliceous, feldspar, and sulphate of baryta the iron of which the mill is constructed fritters away and mingles with the pulverized minerals, and thus renders them impure and unfit for use in many of the arts in which they are required. My improvement consists, first, in lining all parts of the iron base or shell of the apparatus which are liable to abrasion with burr-stone, porcelain, glass, topaz, or any other material which will not be detrimental to the pulverized minerals should it fritter away and mingle with them; second, in facing the beaters *k k k k* with the same kind of material used in lining the shell; third, in the adjustable arms *i i i i* and beaters *k k k k*; fourth, in the manner of attaching the faces *l l l l* to the beaters.

The following specification and accompanying drawings clearly explain and illustrate my improvements.

Figure 1 represents a side elevation of the apparatus with the bearing *g'* removed; Fig. 2, a vertical section thereof, standing at right angles with the shaft *g*; Fig. 9, a plan view of the interior of the mill, the upper part or cap being removed. Fig. 3 represents a rear or back view of a beater; Fig. 4, a side view thereof; Fig. 5, an end view; and Fig. 6, a front view. Fig. 7 represents a rear or back view of a beater-face, *l*; and Fig. 8, an end view thereof.

The lower part of the case or shell of the mill is lettered *a a*, and the upper part *a' a'*. *b b b* designate the lining in front of the beaters in the lower part of the apparatus, and *b<sup>1</sup> b<sup>1</sup>* in the upper part thereof. The letters *b<sup>2</sup> b<sup>2</sup>* in the vertical section and in the plan view designate the side lining. *c c* designate openings around the shaft *g* for the admission of air into the mill. *f* and *f'* are marks on

slide-valves by means of which the admission of air into the apparatus through the openings can be regulated and controlled. The opening *d* in Fig. 2 is for passing the material to be pulverized into the mill, and the one lettered *e* at the top of the figure for discharging it therefrom when pulverized. A screw is cut on the arms *i i i i* at each end, or from end to end, and the arms screwed into the hub *h* a sufficient distance to allow of their being moved out several inches and still retain their hold on the hub. The beaters are attached to the outer ends of the arms in like manner, and can be moved out two inches or more without weakening their attachment to the arms. By means of this device the beaters can be extended out from time to time as the lining wears away, and the space between it and the beaters, which should be about half an inch, easily adjusted. The beaters taper a little from the rear to the front end, and are grooved out on the front side, as represented in Fig. 5. The rear or under parts of the facings *i*, Figs. 7 and 8, are tapered and beveled to fit the grooves in the beaters, and are snugly bedded in them. The upper part of the face projects out, and covers the part of the beater liable to abrasion. The pulverized material is removed from the mill as fast as the pulverization is accomplished, by means of a current of air, which the motion of the beaters causes to rush into the mill through the openings *c c*, and forces out through the aperture *e*. Should the rush of air into the mill be too strong it will force the material out before it is fully pulverized. I have therefore provided slide-valves *f* and *f'*, by means of which the current of air can be regulated to the required strength.

The material to be pulverized by this apparatus should not be coarser when fed into the mill than fine gravel.

The velocity at which it is desirable to revolve the beaters depends much on the nature of the material to be pulverized. An apparatus about three feet in diameter inside, with beater-faces four or four and a half inches square, revolved about twenty-five hundred times a minute in the direction of the arrow, will pulverize siliceous in a satisfactory manner.

I claim as my invention—

1. A case or shell lined with burr-stone or

other hard mineral substance, substantially such as described.

2. Beaters faced with burr-stone, glass, porcelain, or other like material.

3. The adjustable arms and beaters described.

4. The method described of facing the beaters, by means of dovetail and bevel, so as to hold the facings when the machine is moving.

5. The combination of the lined case or shell

*a* and *a'*, the adjustable arms and beaters *i i* and *k k*, the adjustable openings *c c*, and discharge-opening *e*, all combined and arranged substantially as described.

SMITH GARDNER.

Witnesses:

THOS. J. CLARE,

J. H. DISBROW.