

(No Model.)

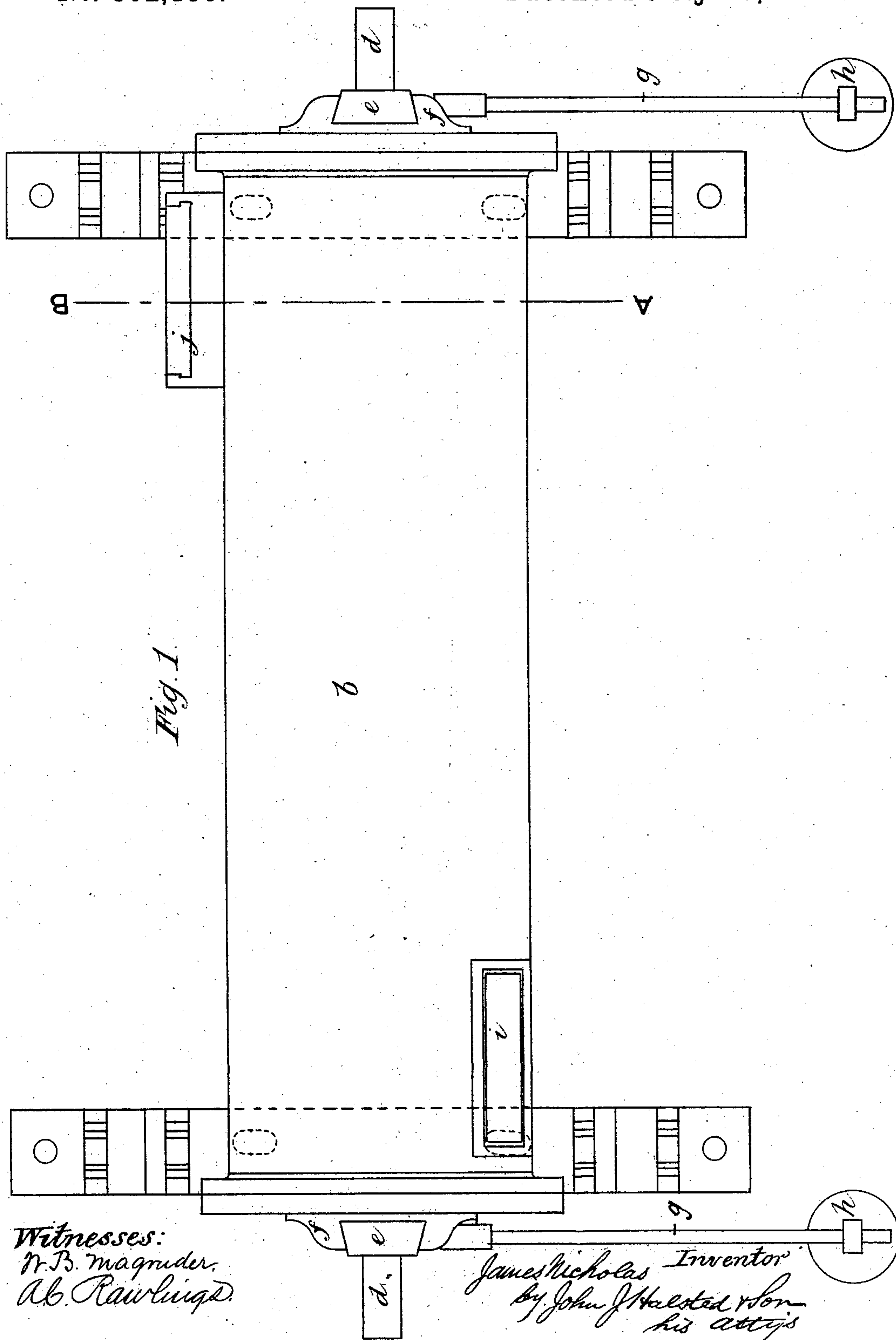
3 Sheets—Sheet 1.

J. NICHOLAS.

APPARATUS FOR PULVERIZING SAND, ORE, &c.

No. 302,156.

Patented July 15, 1884.



(No Model.)

3 Sheets—Sheet 2.

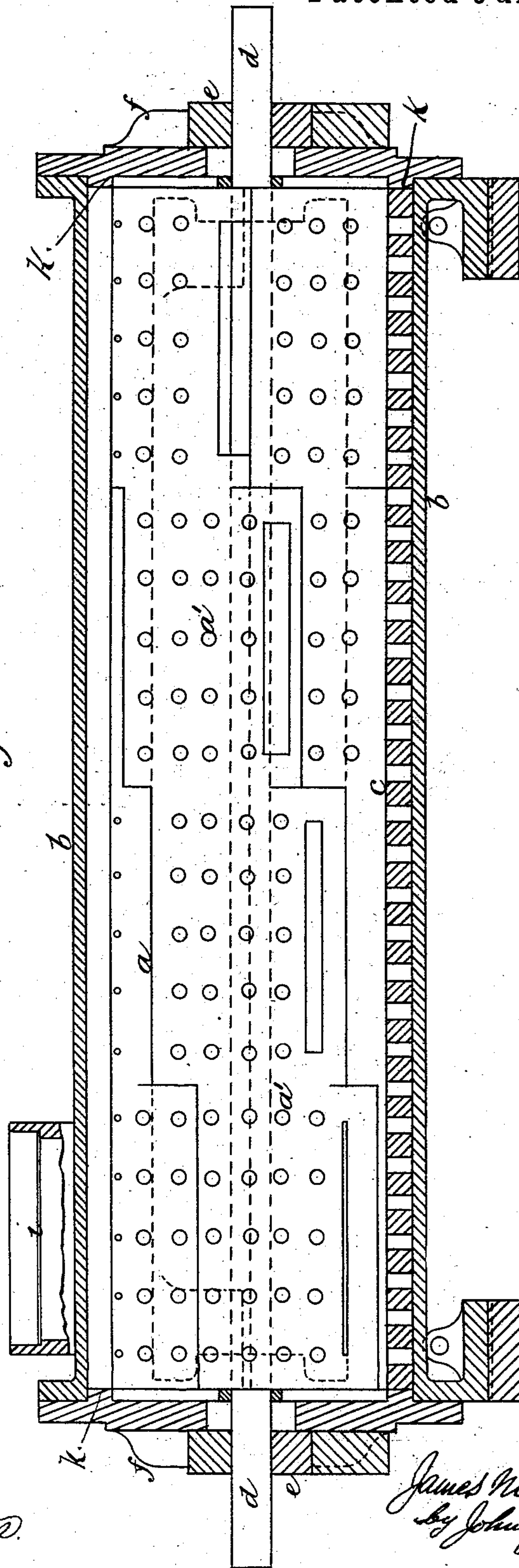
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Fig. 2.



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(No Model.)

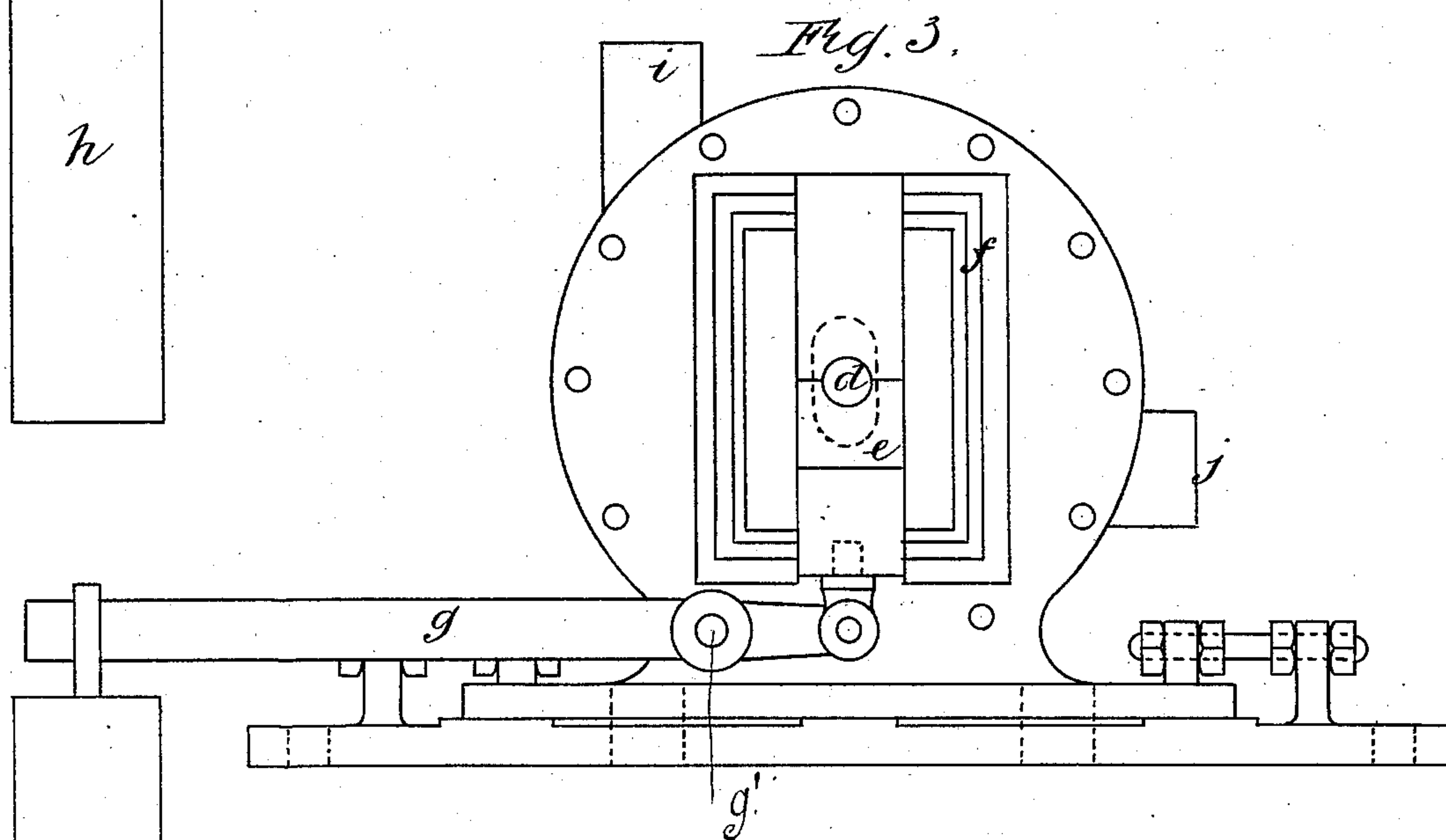
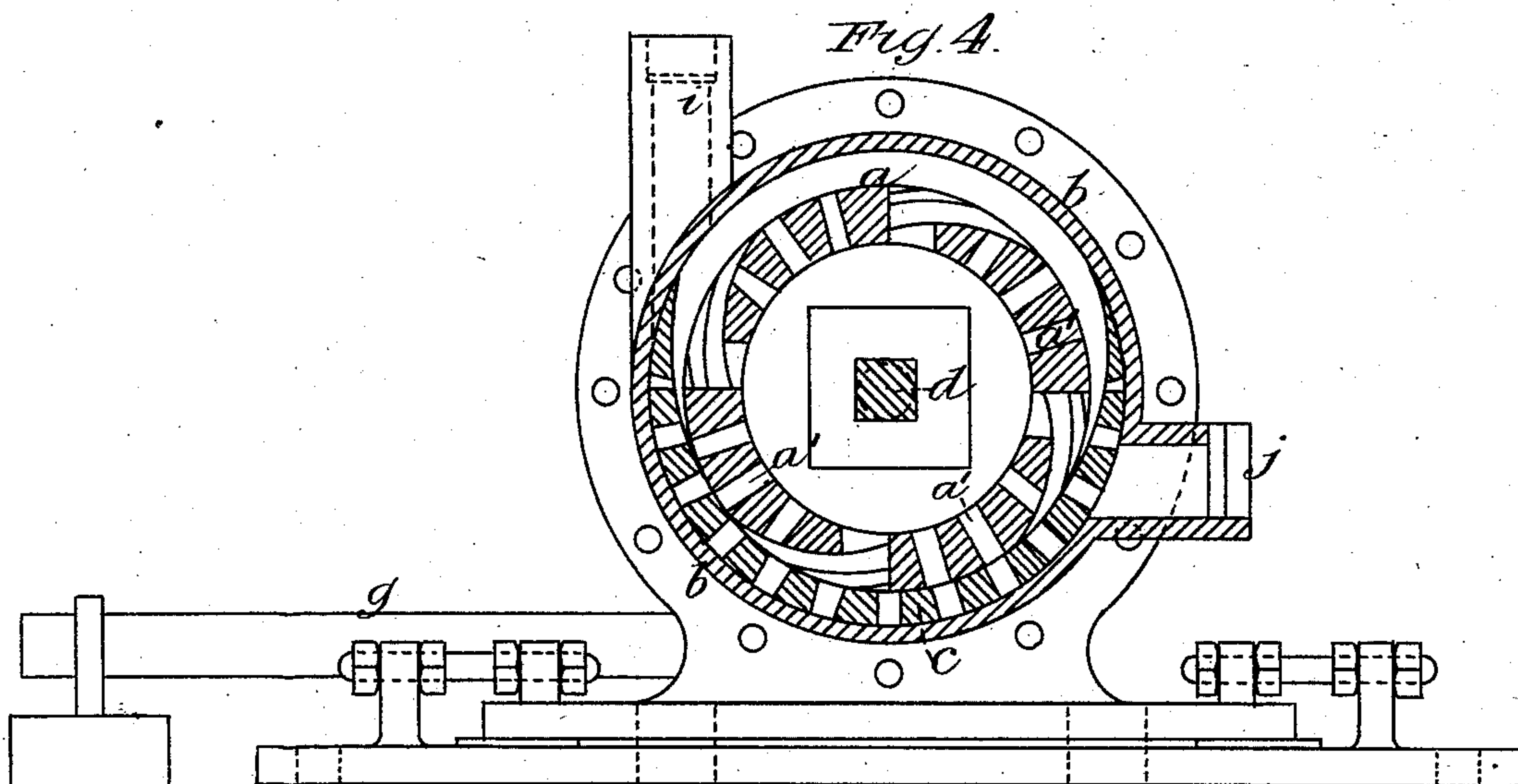
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UNITED STATES PATENT OFFICE.

JAMES NICHOLAS, OF ILLOGAN, COUNTY OF CORNWALL, ENGLAND.

APPARATUS FOR PULVERIZING SAND, ORES, &c.

SPECIFICATION forming part of Letters Patent No. 302,156, dated July 15, 1884.

Application filed June 26, 1883. Renewed June 9, 1884. (No model.) Patented in England November 16, 1882, No. 5,454; in Germany May 27, 1883, No. 24,595, and in Victoria November 28, 1883, No. 3,608.

To all whom it may concern:

Be it known that I, JAMES NICHOLAS, a subject of the Queen of Great Britain, residing at Illogan, in the county of Cornwall, England, have invented new and useful Improvements in Apparatus for Pulverizing Sand, Ores, Metals, and other Substances, (for which I have obtained a patent in Great Britain No. 5,454, dated November 16, 1882,) of which the following is a specification.

This invention relates to improvements in machinery or apparatus for pulverizing sand, ores, metals, and all other substances which have been reduced to a small size, and reducing the same substances to very fine dust or powder.

In order to enable my invention to be fully understood and carried into effect, I will describe the same by reference to the accompanying drawings, in which Figure 1 is a plan of a pulverizer constructed according to my invention. Fig. 2 is a longitudinal section of the same, showing the barrel of the machine in elevation; Fig. 3, an end view of the machine, and Fig. 4 is a transverse section on line A B of Fig. 1.

Similar letters in all the figures represent similar parts.

The machine comprises among other things a barrel or rubber, *a*, which is made of inclined planes cast or bent into a cylindrical form, and so placed that the larger end of each plane is next to the lesser end of the plane following, as shown in Fig. 2, and in end view in Fig. 4. The barrel or rubber *a* is further pierced with a number of slots or holes, *a'* *a'*, the number and position of which are varied according to the material for which the machine is calculated to be used. In the treatment of substances which are of a softish nature, the barrel or rubber *a* may be used without the said slots or holes. The barrel or rubber *a* revolves within an outer case or cylinder, *b*, which may be, and generally will be, fitted at the lower part thereof with a plate called a "false bottom," *c*, so made as partially to surround the rubber *a*, and this false bottom *c* is, like the rubber, also pierced with a number of holes, or may, when necessary— as when substances of a hard gritty nature

have to be pulverized—be made without holes.

This plate or bottom *c* is made so as to be easily moved into or withdrawn from the outer case or cylinder, *b*. The purposes of the slots or holes in the barrel *a* and in the false bottom *c* are to allow room for the motion of the water to turn the substance being crushed, and which it is found by actual experiment it does. The slots or holes thus enable the substance under treatment to be turned, and to present another surface to the next pressure given, thus enabling the machine to break the said substance by way of a quick blow, and afterward to pulverize the same by the ordinary way of dragging it along the whole length on which the rubber bears upon the false bottom. The effect of this combination is that the substance in treatment is crushed both by effect of blows and by the grinding-motion, and thus the pulverizing powers are accelerated and increased, and the wear and tear on the fixed and revolving surfaces are reduced to a minimum and the friction diminished, thus lessening the weight to be moved, and consequently necessitating or requiring a much smaller motive power.

It must be borne in mind that one of the most important effects to be produced is the delivery of the pulverized substance by means of a regular flash or wave of water. With merely a smooth rubber—that is, one built in the ordinary way, and containing only holes, and without any grooves or channels, as shown in my present application—working on an ordinary bottom, the substance, after being pulverized, sinks into the bottom and rests there, because sufficient agitation is not caused to keep it intimately mixed with the water in the cylinder; but, by my construction, the slots or channels formed by the lesser and larger ends of the inclined planes of the barrel cause the water to be agitated regularly in flashes or wavelets, which has the effect of automatically delivering the pulverized substance without other aid or appliance. The false bottom *c* is run into its place and maintained there by lugs cast to the case or cylinder or to its heads, as shown at *k* in Fig. 2, the end or head of the cylinder being movable, for the purpose of taking out and replacing the false bottom and

other interior working parts as and when required.

Through both ends of the outer case or cylinder, *b*, projects the axle *d*, by which the barrel or rubber *a* is driven, and at both ends of the cylinder *b* are brackets *f*, for the purpose of receiving and keeping in their places the slides, hereinafter mentioned.

On each end of the axle *d* is fitted a slide, *e*, in and on which the axle *d* rests. These slides *e* work in the brackets *f*, before mentioned. The slides *e* are connected with levers *g*, and weights *h*, (or with springs,) placed so as to raise or depress the slides *e*, as required, and consequently the rubber *a* also. The object of this arrangement of slides *e* and levers *g* and weights *h* (or springs) is to bring the rubber *a* and the false bottom *c* to such a distance from one another as may be desired, and also to take the surplus weight of the barrel *a* from the driving-power and to reduce the friction between the rubber *a* and the bottom *c*. The levers *g* are severally fulcrumed on a projection or pin, *g'*, which are cast on the ends of the cylinder, or which may be screwed to the said ends, and the operation of the levers is to raise the slides *e* on which the axle *d* of the rubber rests. As these slides are raised or depressed, by virtue of the weight *h* on the ends thereof being brought nearer to or carried farther from the fulcrum, so the axle of the rubber resting on the slides is raised or lowered; and the surface of the barrel may be removed from the surface of the false bottom, or brought nearer thereto, as it may be required to crush rough or fine. The levers also reduce the friction between the rubbing parts by keeping the same always at a distance, and thus serve two effects: first, to allow the material to be always falling to the bottom in the course of the revolution of the rubbers for crushing; second, to regulate the crushing distance, and allow the barrel to bear only its own weight on its axis without being impeded in its revolution by the resistance it would encounter if allowed to lie on the false bottom.

The cylinder *b* before mentioned incloses the whole apparatus, and is pierced at one side with an opening, *i*, to receive the substance which it is wished to pulverize, and at the opposite side with another aperture, *j*, for the discharge of the material when reduced to the required size. These openings may be varied both in size and position, as required.

The material to be pulverized is put into a hopper conveniently fixed on the cylinder *b*, and by means of water will be conducted through the aperture *i*, and will fall on the barrel or rubber *a*, which in its revolution will rub or crush the same on and against the bottom, or the false bottom *C*, whichever may be in use. The action of this barrel or

rubber *a*, constructed of a series of inclined planes, as hereinbefore described, will be that of a series of grindings or pressures, and as each inclined plane comes into contact with the bottom the material will be ground or pulverized. The groove formed by the junction of the greater and lesser ends of the inclined planes will allow a space for the material to change position, and on the next contact it will receive consequent pressure on another surface. The material, when ground of sufficient fineness, will be carried out of the apparatus by the escape of water through the opening *j*, provided for that purpose.

The machine is fixed on any convenient stand, and may be driven by any ordinary power, such as steam, water, or horse power.

The size of rubber or barrel which I have found to give good results is one varying from about seventeen inches to forty-eight inches in diameter, and that of the cylinder from about twenty inches to fifty-one inches. The number of revolutions per minute at which the machine is driven will vary considerably; but in a machine of seventeen inches diameter a speed of about thirty revolutions per minute gives good results.

Having thus described the nature of my invention and the manner of carrying the same into effect, what I claim is—

1. In a pulverizing-machine, a barrel formed of a series of connected or continuous inclined planes, each cast or bent into a cylindrical form, and placed with the larger end of each plane directly next to the lesser end of the plane following it, substantially as described, and for the purposes set forth.

2. The combination of a revolving barrel or rubber, *a*, having the series of inclines arranged as set forth, and a series of holes with an outer cylinder provided with a removable false bottom, *c*, substantially as described.

3. In combination with the revolving barrel *a*, constructed as shown and described, and the false bottom *c*, the movable slides *e e*, serving to support the axle, and means for permitting said slide to be raised or lowered to adjust the barrel relatively to said false bottom, all as and for the purposes set forth.

4. In combination, the outer cylinder, having a removable head, and a removable false bottom held to place as set forth, the revolving barrel constructed with the inclines, as shown and described, and the adjustable slides serving as bearings for the axle of the barrel.

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