

(No Model.)

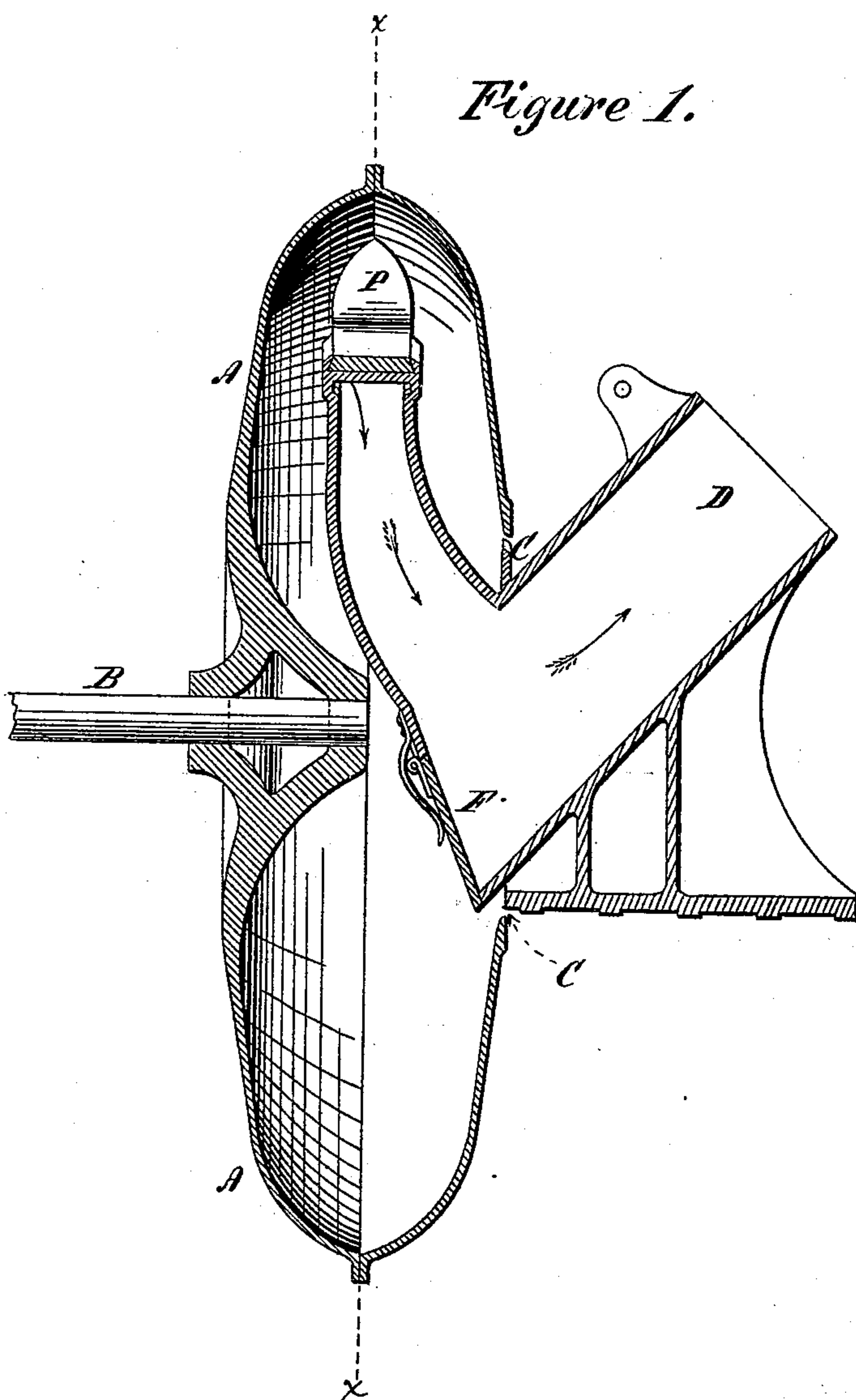
4 Sheets—Sheet 1.

H. A. DUC, Jr.  
ATTRITION MILL.

No. 251,535.

Patented Dec. 27, 1881.

*Figure 1.*



Witnesses:

Geo. W. Miatt  
*Alfred J.*

Inventor.

Henry A. Duc Jr.  
By his Attorney  
E. A. Dickerson

(No Model.)

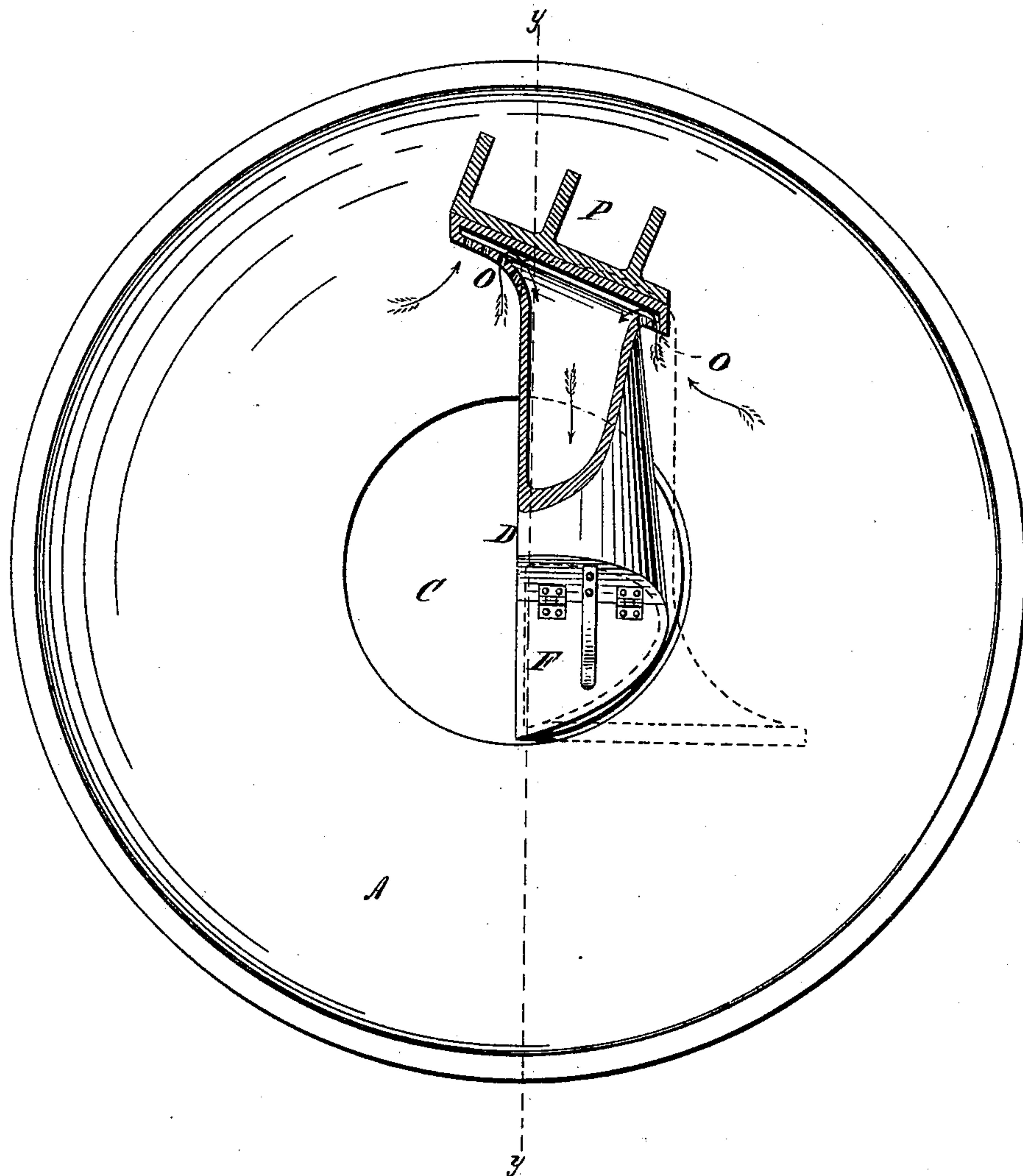
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H. A. DUC, Jr.  
ATTRITION MILL.

No. 251,535.

Patented Dec. 27, 1881.

*Figure 2.*



Witnesses:

Geo. H. Miatt  
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Henry A. Duc Jr.  
By his attorney,  
E. N. Dickerson

(No Model.)

4 Sheets—Sheet 3.

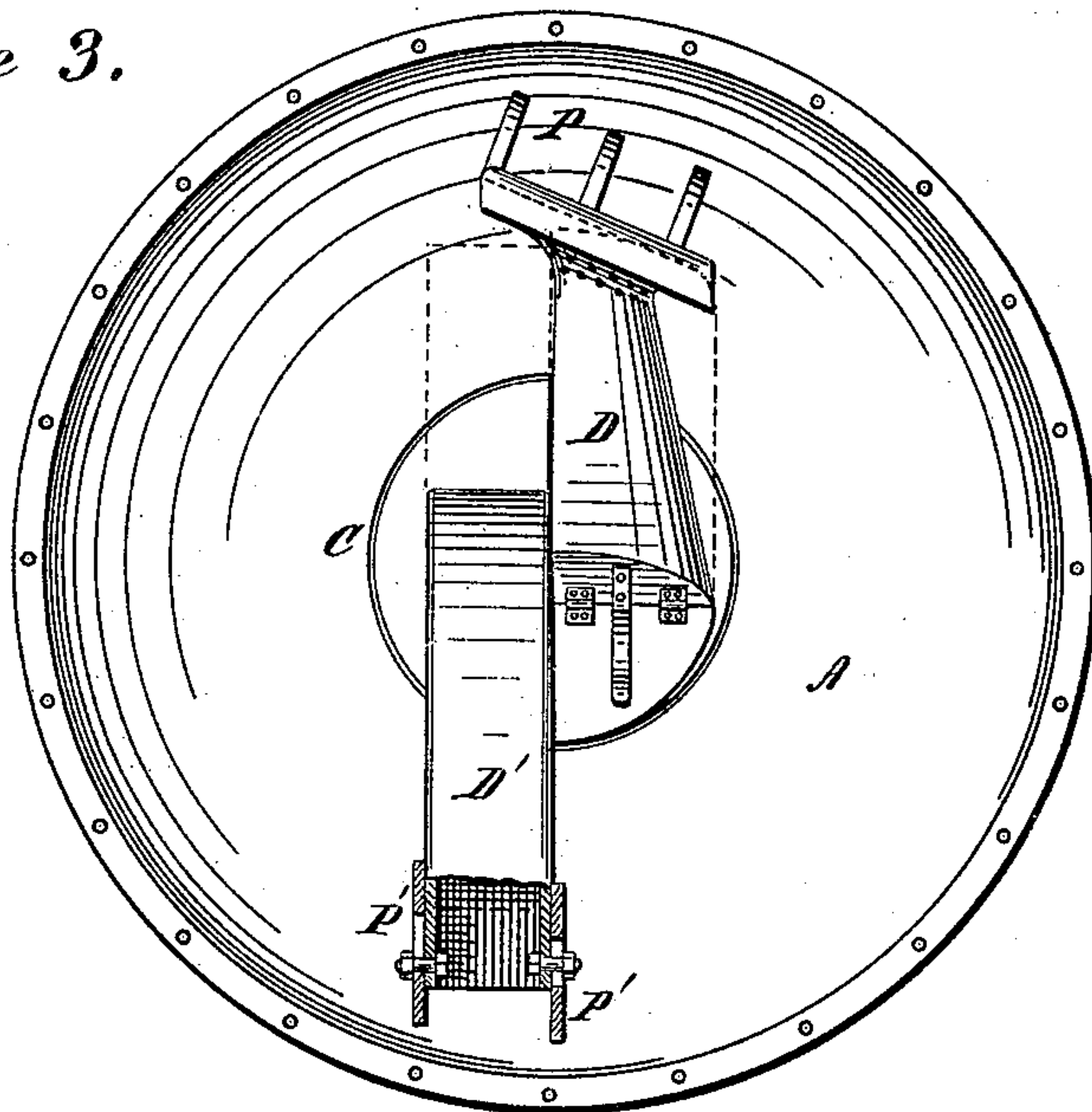
H. A. DUC, Jr.

ATTRITION MILL.

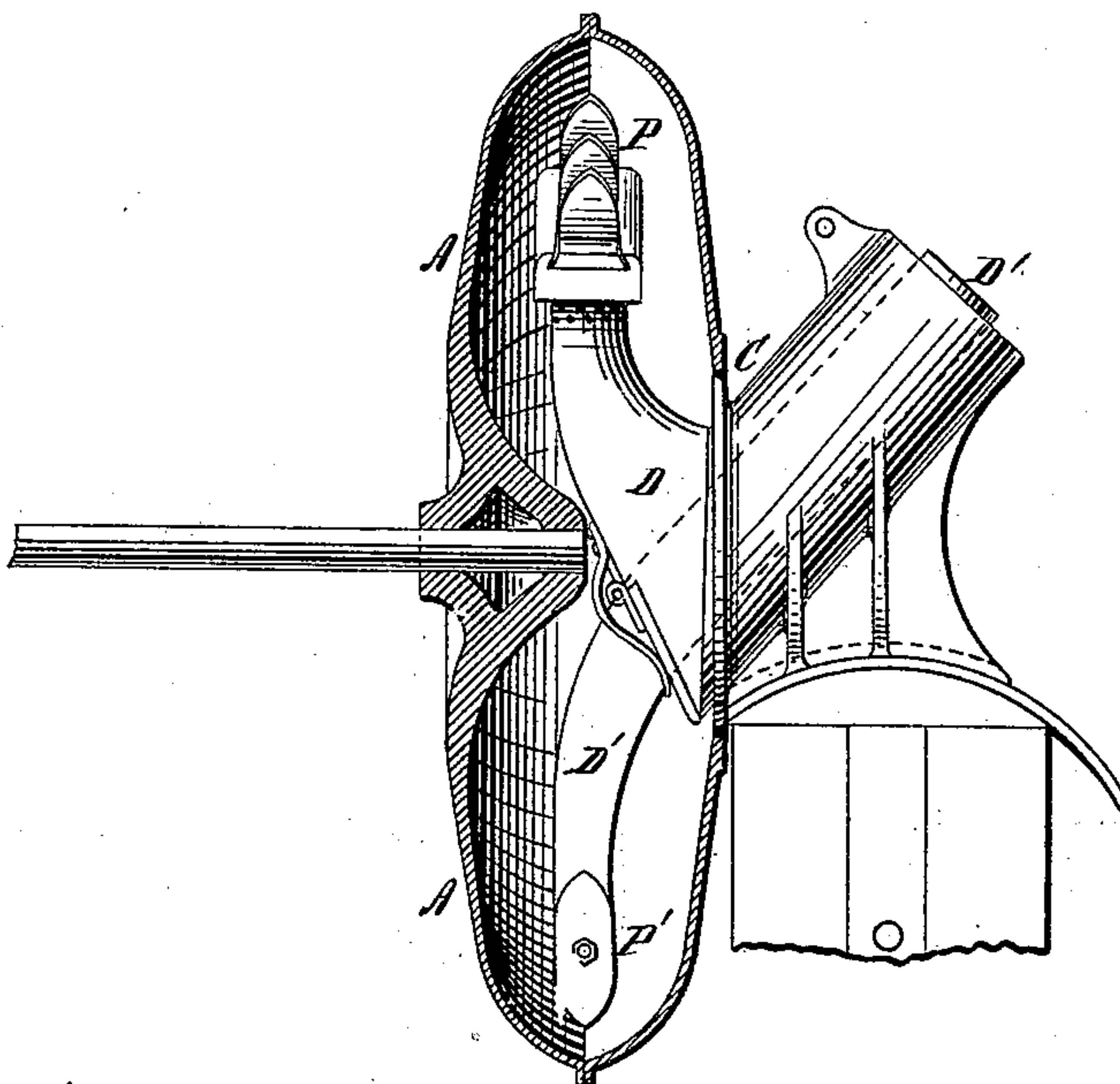
No. 251,535.

Patented Dec. 27, 1881.

*Figure 3.*



*Figure 4.*



Witnesses:

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A. G. J. K.

Inventor

Henry A. Duc Jr.  
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E. N. Dickerson



(No Model.)

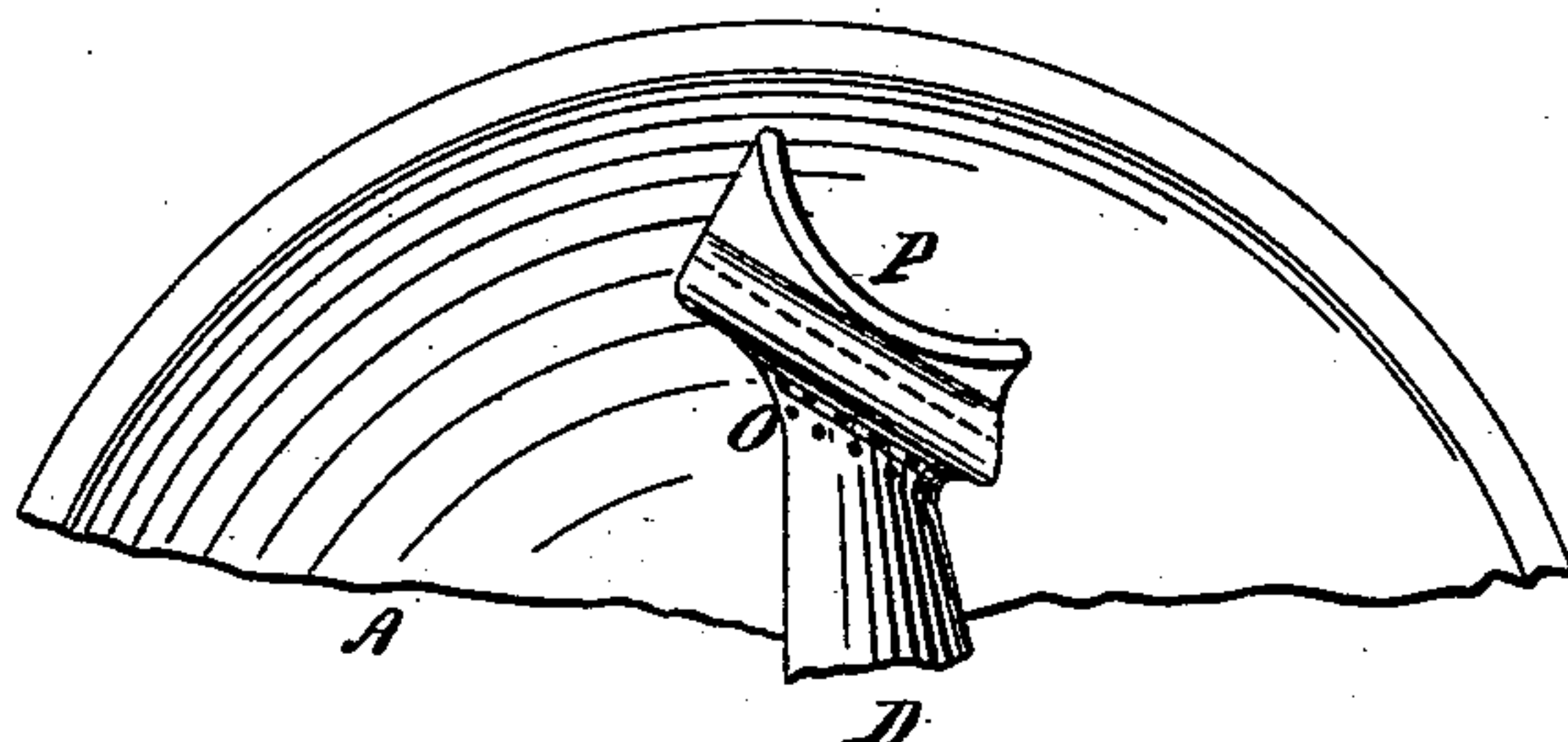
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H. A. DUC, Jr.  
ATTRITION MILL.

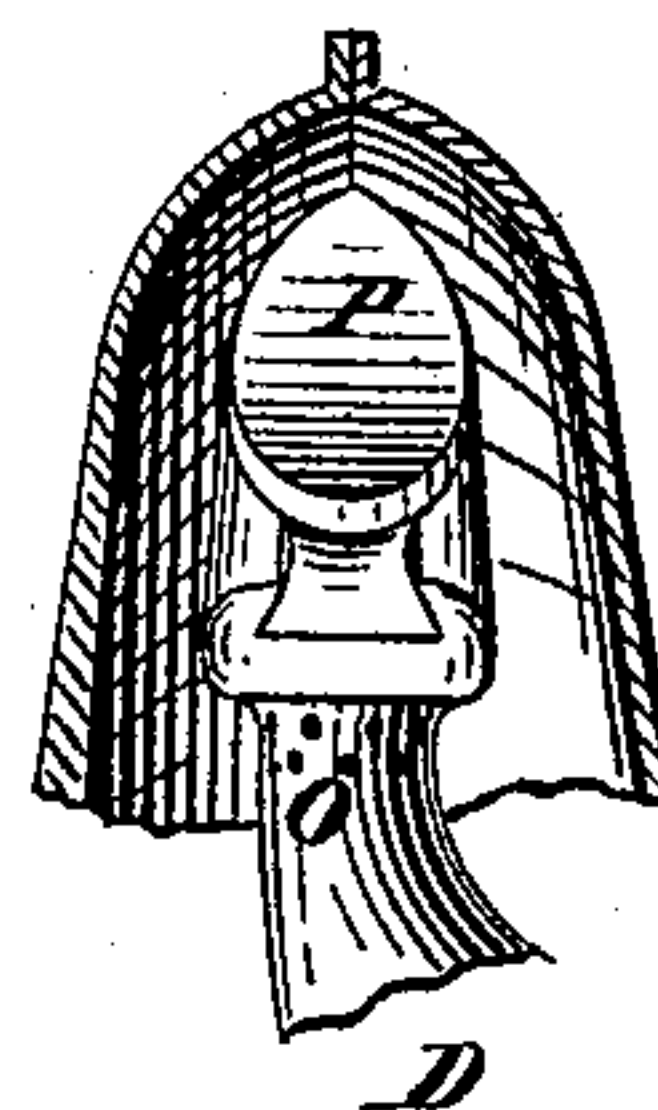
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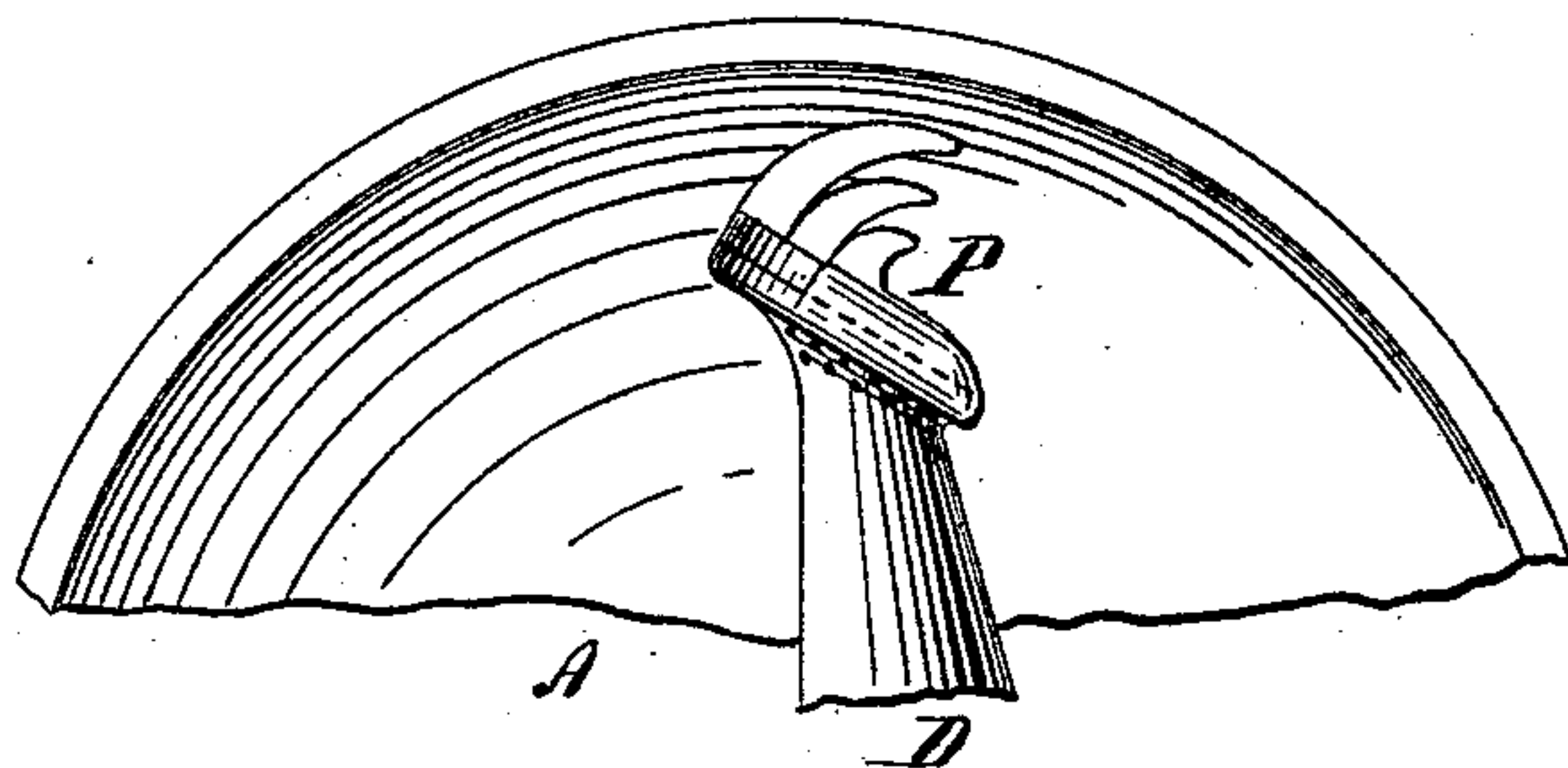
*Figure 5.*



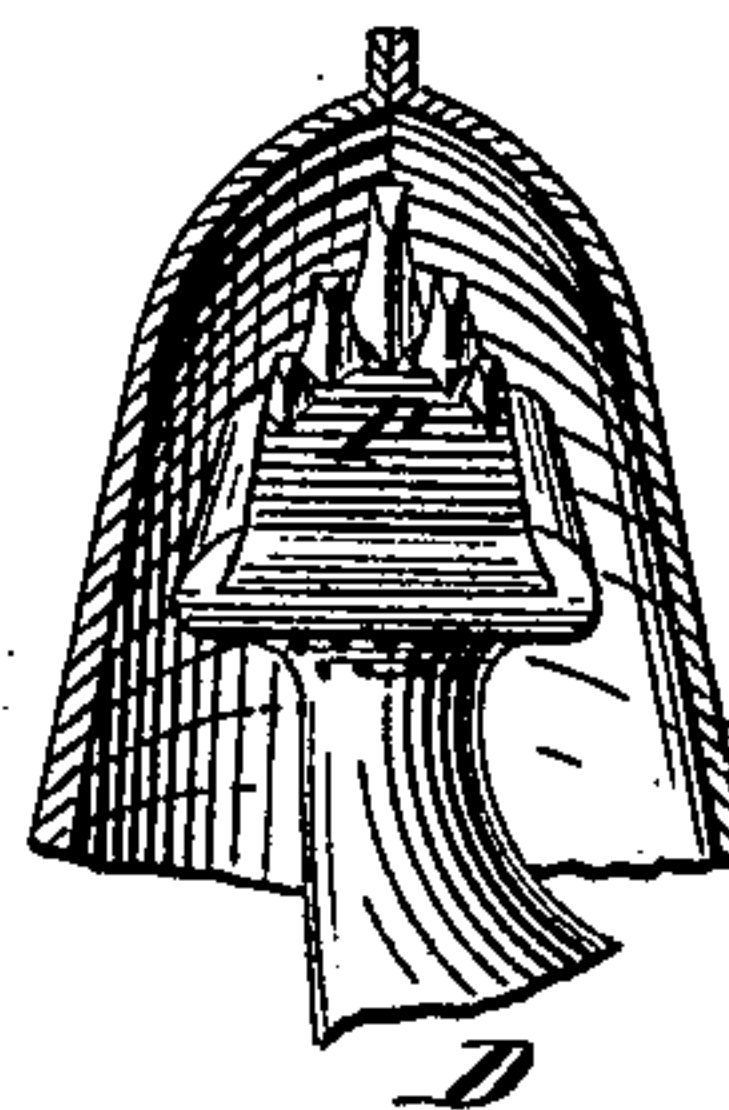
*Figure 6.*



*Figure 7.*



*Figure 8.*



Witnesses:

Geo. W. Miatt  
A. Gref. Jr.

Inventor

Henry A. Duc Jr.  
By his Attorney  
E. W. Dickerson

# UNITED STATES PATENT OFFICE.

HENRY A. DUC, JR., OF CHARLESTON, SOUTH CAROLINA.

## ATTRITION-MILL.

SPECIFICATION forming part of Letters Patent No. 251,535, dated December 27, 1881.

Application filed August 26, 1880. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY A. DUC, Jr., of the city of Charleston, State of South Carolina, have invented a new and useful Improvement in Attrition-Mills, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

My invention relates to that class of mills for one of which a patent was granted to me on the 5th day of April, 1879, No. 214,243. In these mills the attrition or grinding is done by the movement of the particles over and past each other. In my present mill I dispense with two rotating disks or carriers and cause the grinding to be done by the movement of a single rotating vessel having substantially an elliptical section.

My invention will be readily understood from the accompanying drawings, of which Figure 1 represents a cross-section of my mill; Fig. 2, a section at right angles through Fig. 1 on the line  $xx$ ; Figs. 5 and 6, views at right angles to each other of different forms of plows; Figs. 7 and 8, views at right angles to each other of different forms of plows; Figs. 3 and 4, views at right angles to each other of a modification of my apparatus in which the grinding parts are duplicated.

My apparatus consists, essentially, of a rotating vessel of substantially elliptical section, A, mounted on and revolved by shaft B. One side of the chamber A is open around its axis, as at C. Through this enters an exhaust air-tube, D, one branch of which extends upward and close to the revolving periphery of the chamber or vessel. At this point it is provided with a plow or wearing-surface, P. Openings are likewise provided into the tube at points below the plow P, as at O. This air-tube carrying the plow should be very firmly made and strongly mounted, as considerable pressure will be exerted against it in the operation of my apparatus.

The operation of my mill is readily understood. The vessel A being rapidly revolved, the substances to be ground are fed into such vessel through the opening C. This opening C is shown more clearly in Fig. 2, in which it is located by the side of the vacuum or exhaust pipe. By the centrifugal force imparted to them they immediately form a layer around the out-

side of the casing or vessel. The rotation of this vessel brings this compact bed against the plow P and forms over the end of said plow a wearing-surface of material to be abraded. It is found in practice that the material banks, as it were, against the obstruction P, and thereby protects the same against any considerable wear. When necessary, large portions or lumps of the material to be abraded can be fed into the apparatus, which will permanently remain between the plow P and the material which is being abraded, thereby forming an additional wearing-surface between the plow and such material. A powerful exhaust is connected with the pipe D, which pipe connects with the interior of the chamber through holes O, and the location of these openings will serve as a separator to determine the fineness of the particles drawn through such tube.

It is obvious that should any large pieces of the material to be ground be carried by the rotating vessel against the plow P, their motion being there stopped, they would fall by gravity to the bottom of the vessel, to be again carried up and caused to impinge against the mass of material in the vicinity of said plow. As shown in the figures, this plow consists of several pointed wearing-surfaces. In Figs. 5 and 6 a single wearing-surface of a concave shape is shown. In Figs. 7 and 8 hooks or claws are substituted. Different shapes may be used, depending upon the material to be treated. A door, F, kept closed by a light spring, is placed in the tube D, so that any material which might enter said tube in large portions could be relieved through said door and caused once more to enter the mill.

In Figs. 3 and 4 an upper and lower plow is shown, the material to be abraded being fed through the lower channel, D', between the wearing-surfaces P' of the plow. Two independent tubes, D and D', are used in this case. The material to be ground is in this modification fed through the lower pipe, from whence it passes into the rotating mill, while it is withdrawn through the openings in the upper pipe, which are exhausted in the same way as in the other form. By removing the material which has been reduced to a powder by an exhaust-tube provided with openings suitably located in the chamber, I am enabled by means of the



power of the exhaust to select material of any given degree of fineness, the strength of the exhaust determining the size of the particles which will be withdrawn by it out of the reach of the centrifugal forces of the machine. I consider also that it is a very important feature in my machine that the exhaust-openings for withdrawing the material from within the chamber are located in close proximity to the grinding-surfaces, so that the material, when sufficiently reduced, is immediately withdrawn through such exhaust-openings, instead of being carried around in the mill and allowed to be compacted into the revolving mass or surface. The arrangement shown by which the plow is supported upon the tube, enabling the ready withdrawal of the products of attrition, is also very convenient, as it simplifies the construction and enables me to obtain the beneficial effect of the tube in supporting the plow.

I do not claim, broadly, the idea of the revolving chamber for compacting the material with a plow adapted to act against the same.

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

1. The combination, in an attrition-mill, of a vertical revolving vessel or chamber and a plow or wearing-surface extending into the upper portion of the same, for the purpose of abrading or grinding the body of the material held by centrifugal force against the revolving chamber and causing the larger portions of said material to fall to the bottom of the re-

volving vessel, to be again carried against the plow-surface, and an exhaust-tube adapted to withdraw from the said chamber the abraded material when sufficiently reduced, substantially as described.

2. The combination of a rapidly-revolving vessel, A, supported and revolved by shaft B, and the stationary plow D, entering through the central opening, C, and supporting a plow, P, adapted to engage with and abrade the revolving surface of compacted material, said plow being supported on an exhaust-tube for withdrawing the abraded material, substantially as described.

3. In an attrition-mill, the combination of a rapidly-revolving chamber in which a body of the material to be abraded is formed by centrifugal force, and a stationary plow supported near the periphery of said chamber and adapted to enter and abrade the compacted material, and an exhaust-tube through which the air is drawn by suitable mechanism, having its orifice located in immediate vicinity to the abrading-plow, so as to withdraw the abraded material as soon as it is reduced to a sufficiently-comminuted condition without retaining the same unnecessarily within the apparatus, substantially as described.

HENRY A. DUC, JR.

Witnesses:

ANTHONY GREF, Jr.,  
GEO. H. EVANS.