A. A. DAY.

REDUCING MECHANISM.

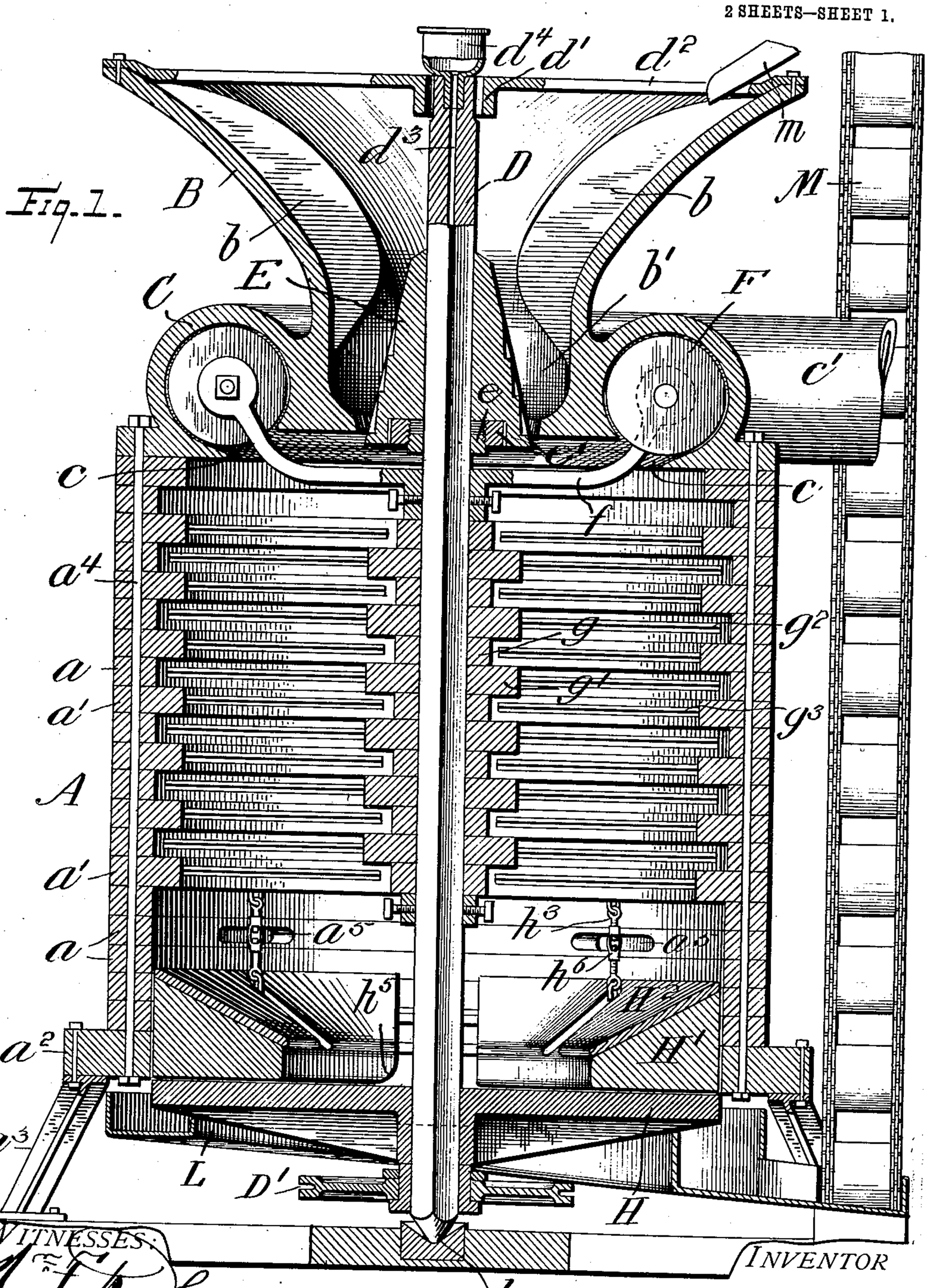
APPLICATION FILED JUNE 19, 1907.

919,327.

Patented Apr. 27, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

H. F. Hoyle.

J. K. Moore

INVENTOR

BY Albert A. Day

Whitaker & Prevost

Attorneys

A. A. DAY.

REDUCING MECHANISM.

APPLICATION FILED JUNE 19, 1907.

919,327.

Patented Apr. 27, 1909.

2 SHEETS—SHEET 2.

Fig. 2.

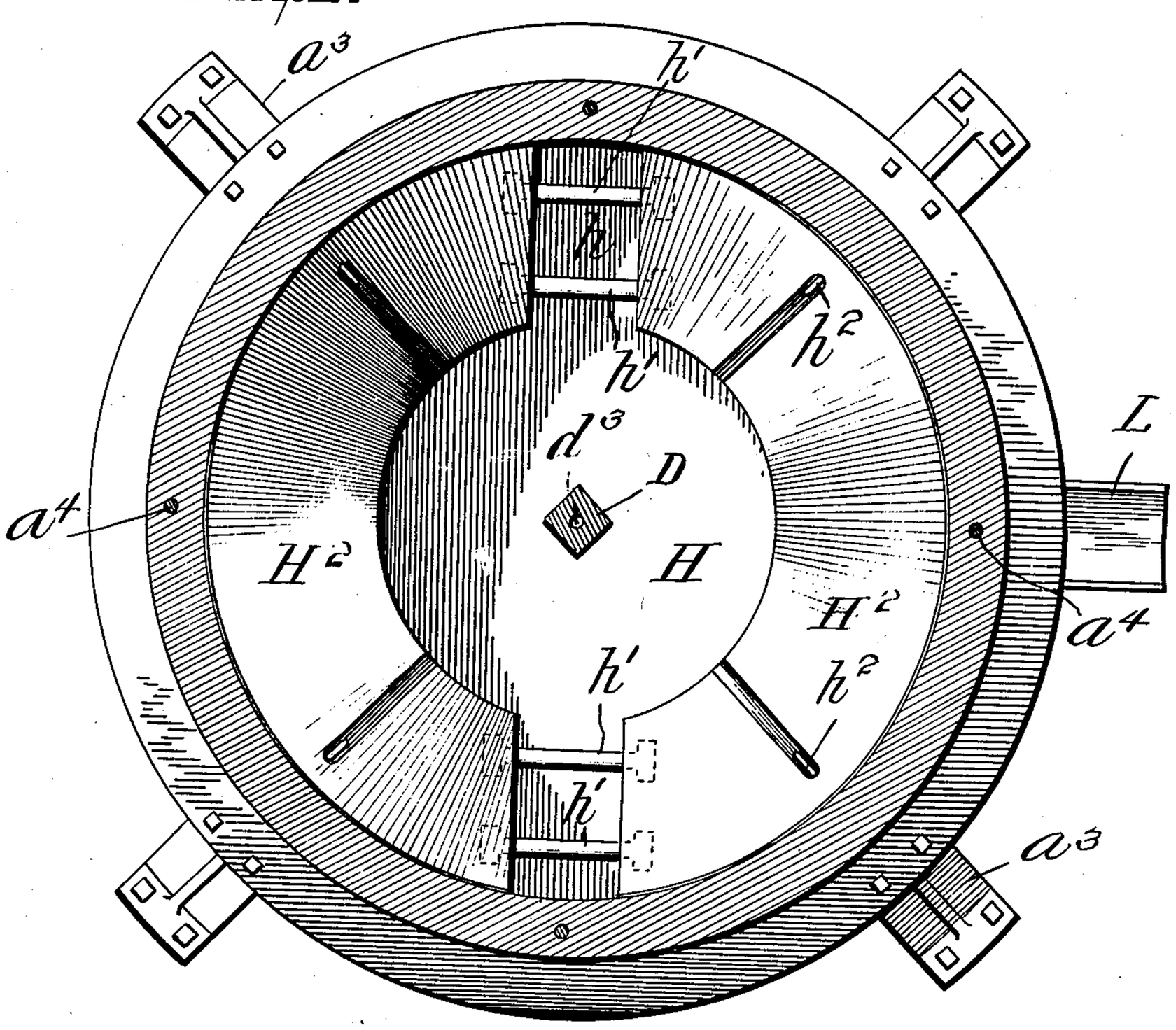
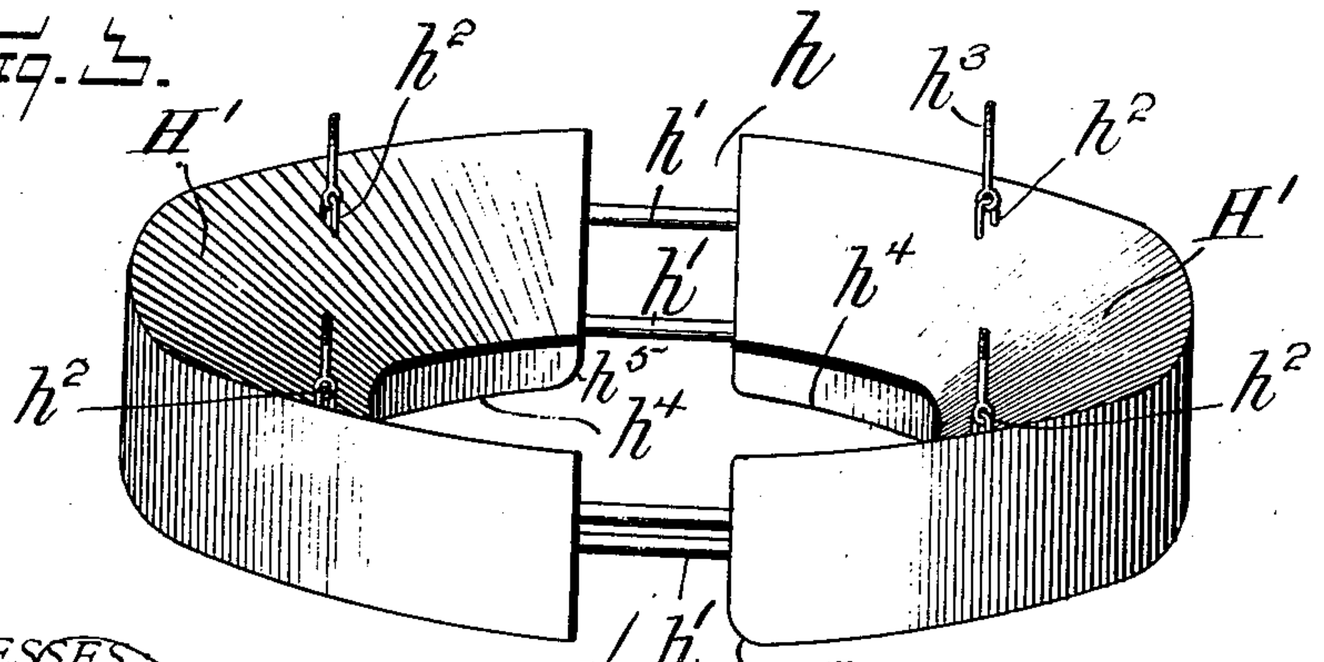


Fig. 3.



WITNESSES:

W. F. Noble.

D. K. Moore

INVENTOR

Albert A. Day

BY

Whittemore Wood

Attorneys.

UNITED STATES PATENT OFFICE.

ALBERT A. DAY, OF NEW YORK, N. Y.

REDUCING MECHANISM.

No. 919,327. Specification of Letters Patent. Patented April 27, 1909.

Application filed June 19, 1907. Serial No. 379,786.

To all whom it may concern:

Be it known that I, ALBERT A. DAY, citizen of the United States, residing in the borough of Brooklyn, in the county of Kings and city and State of New York, have invented certain new and useful Improvements in Reducing Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention consists in the novel features hereinafter described, reference being had to the accompanying drawings which illustrate one form in which I have contemplated embodying the invention and said invention is fully disclosed in the following description and claims.

The object of my invention is to provide a satisfactory reducing mechanism for the purpose especially of reducing and feeding fuel, such as lignite and soft or bituminous coal in a finely divided condition to a boiler furnace, although the apparatus hereinafter described may be used in treatment of other materials.

I have found by practical experiment that it is very difficult to insure the uniformity of fineness of the powdered fuel, or other material, which is delivered from a reducing mechanism owing to the fact that the larger and heavier particles find their way by gravity or otherwise into the discharge of the apparatus.

It is one of the objects of my invention to arrange in a vertical relation a preliminary reducing mechanism, a pulverizing mechanism below and in communication therewith and a grinding mechanism below the pulverizing mechanism, and to provide an ejector fan connected with the apparatus above the pulverizing mechanism.

I also provide means for admitting air to the apparatus at the bottom and thus create by means of the fan an upward suction, which tends to draw into the fan all the lighter particles from the reducing mechanism, the pulverizing mechanism and the grinding mechanism, so that only the heavier particles of the material will pass downward through the machine. Thus the material when it leaves the preliminary reducing mechanism and drops into the pulverizing mechanism contains some fine dust particles, and these are sucked at once into the fan, and do not go to the pulverizer; the heavier particles pass to the pulverizing mechanism and so much of this portion of the material as is converted by the pulverizing mechanism into dust of such fineness as to be carried by the suction of air will be caught up and taken to the fan, leaving only the heavier particles to pass onto the grinding mechanism which therefore has to treat only a small part of the material. The grinder reduces the larger particles to powder which is caught up in the air currents and carried to the fan. Any material escaping from the grinder is conveyed to the preliminary reducing mechanism and again passed through the machine. It will, therefore, be seen that instead of passing all the material through all the mechanisms of the apparatus, I separate after each reduction, all the lighter particles, removing them from the apparatus and only the heavier particles are passed through more than one reducing mechanism. This effects an immense saving of power and greatly increases the effectiveness of the apparatus. By regulating the speed of the fan I can regulate the power of the air draft or suction and to a large extent control the maximum size of the particles which will be carried to the ejector fan.

I also provide a grinding mechanism of novel construction, comprising a horizontal revoluble lower grinding member, above which is a horizontally disposed upper grinding member, supported by vertically disposed pendulous connections or links, which permit a slight rotary movement of the upper member. The upper member is suspended by its connections so that it just clears the lower member, and when the material to be treated is between the two members, the rotation of the lower member will cause the attrition or grinding thereof between the grinding members. The frictional resistance on the lower face of the upper grinding member, will cause it to revolve slightly with the lower member, and such slight revolving movement will cause it to be lifted slightly, by reason of the inclination of the suspending connections. This construction will, therefore, produce a compensating action by means of which the pressure and friction on the material between the faces of the upper

and lower members will be maintained practically constant as will be readily understood.

I also provide an auxiliary weight or weights for the upper grinding member which can be attached thereto as the member itself wears to add weight to compensate for the loss by wear, and I also provide means for adjusting the members with respect to each other, preferably by making the suspending connections adjustable to secure the proper relation between said members at all times.

In order that the finely ground material may rise from the grinding members and pass off to the fan with the currents of air, I provide the upper grinding member, which is preferably annular in its general form, with spaces arranged at intervals through which the fine particles may rise.

My invention also includes certain details which are fully described hereinafter.

Referring to the accompanying drawings, Figure 1 represents a vertical sectional view of a reducing apparatus embodying my invention and adapted for use to reduce fuel such as lignite and soft coal to a powder and feed the same to a furnace. Fig. 2 represents a horizontal sectional view of the same. Fig. 3 is a detail perspective view of the upper grinding member of my improved grinding mechanism.

In the drawings A represents a vertically disposed casing, open at the bottom, and formed preferably of a plurality of built-up sections or rings a a' supported upon an annular base a' provided with suitable legs a^3. The rings a^1 are wider than rings a and project inwardly beyond the same, and the upper portion of the casing is preferably formed by alternating the rings a and a', as shown, while the lower part is formed of rings a only.

Superposed upon the casing A is a casting provided with a hopper B, and an annular fan casing C, having an annular slit or aperture c communicating with the casing A, and having a tangential discharge c' which is connected by a pipe with an aperture in a furnace door (not shown) when the apparatus is used as a fuel feeder. The top casting, the rings a a' and base a^2 are united by suitable bolts a^4 making a strong and convenient structure as shown. I may, however, construct the apparatus in a different manner if desired.

D represents a vertical revoluble shaft which extends through the casing and hopper and is provided at its lower end with a step bearing d permitting a certain amount of inclination of the shaft, and the shaft is provided at the top with a steadying bearing d' carried by a spider or frame d^2, secured to the hopper B, and fitting the shaft loosely, a sufficient amount of play being provided in said steadying bearing, to permit the shaft to rotate gyroscopically upon a free axis, together with the parts carried thereby so that it will come into a state of stable equilibrium when rotated at high speed, after the manner of a top, and will rotate then only upon the step bearing, and without touching the upper or steadying bearing. Any form of step bearing which will permit of the gyroscopic rotation of the shaft and its connected parts, may be substituted for the simple form of step herein shown.

The hopper B forms part of the preliminary reducing mechanism and is provided with radially disposed webs b to hold the material from rotation and below said webs, the hopper is provided with an annular pocket or recess b'. This pocket will naturally fill up with comparatively fine particles of the material and will form a cushion into which any refractory substance, as a piece of rock or metal, may be forced and thus prevent the breaking or stalling of the machine.

E represents a cone shaped device provided with angular cutting edges which I term the "abrading device" and which is mounted on the shaft D to rotate therewith and is adjustable vertically therein. The cone E with the hopper B forms the preliminary reducing mechanism. The shaft D is preferably square (or of other polygonal shape) in cross section and the cone E fits upon said shaft and projects into the hopper B. In this instance the shaft is shown provided with a rigidly secured collar externally threaded and engaging an internally threaded ring e', which supports the cone, and by adjusting the ring e' with respect to collar e, the cone may be raised and lowered in the hopper and thereby the space between the cone and the delivery aperture of the hopper may be regulated or adjusted. This will regulate the fineness of the larger particles delivered by the preliminary reducing mechanism into the casing below. The shaft D also carries arms f, below the cone E, which extend into the fan casing C and are provided with fan blades F. Below the fan arms f, the shaft D is provided with a series of smaller disks g, alternating with larger disks g', the latter of which carry pulverizing or impact rods g^2 extending thereform into the recesses formed between the inwardly projecting wings a' of the casing and said casing rings a' are provided with inwardly extending stationary impact rods g^3 which extend into the spaces between the projecting disks g', as shown. In this instance the rotary impact rods and stationary impact rods form the pulverizing mechanism, below which is located the grinding mechanism, which is preferably of the form herein shown and described.

H represents the lower grinding member which consists of a disk having a horizontal upper face, mounted on shaft D, to rotate therewith and forming the bottom of the cas-

ing A. Above the disk H is the upper grinding member H′ which is annular in general form, and is preferably formed in two parts each of less extent than half of the annulus, the said parts being rigidly connected, and leaving openings h between their adjacent ends to permit the finely ground material or dust to rise. I conveniently form the upper grinding member by casting the same and at the same time uniting the sections thereof, by placing the headed connecting bolts or bars h' h' in the mold, before the metal is poured, thus rigidly uniting the parts as shown in Figs. 2 and 3. The lower face of the upper grinding member is flat, and the upper face is inclined downward toward its inner edge, so as to direct material falling thereon into the center. The upper member H′ is provided with means for attaching it to suitable supporting connections, in this instance ears or perforated lugs h^2, and I prefer to provide four or more of such ears, although a smaller number may in some cases be sufficient. The member H′ is supported by means of pendulous vertically disposed connections h^3, from a stationary part of the casing A, as shown, so as to nearly touch the lower grinding member H. It will be seen that when material is between the members H and H′ and the lower member H is rotating the friction on the lower face of the upper member will tend to cause it to slightly move in a rotary direction with the lower member and such movement will more or less raise the upper member, according to the greater or less inclination of the connections h^3, which connections will also resist the torsional movement. This will cause the upper grinding member to bear upon the material under treatment with a substantially constant pressure and friction, and the construction provides a compensating means for maintaining the pressure and friction practically constant. Thus if the friction is momentarily increased for any reason, the upper member will instantly be swung farther around torsionally, thus reducing the friction correspondingly. If the friction is momentarily reduced the upper member will swing back slightly and increase the friction, as will be readily understood. It will be understood that whenever the apparatus is in operation and there is material between the upper and lower grinding members, there will be a certain amount of torsional drag on the upper members, which distorts the connections h^3 out of their normal positions. In order to facilitate the introduction of the material between the upper and lower members H and H′, I prefer to curve or bevel the lower and inner edge of the upper member H′ all the way around as shown at h^4 and also to bevel or curve the forward edge h^5 of each section, of said upper member, as shown in Fig. 3.

I also provide means for securing an accurate adjustment of the grinding members with respect to each other. In this instance I have shown the connections h^3 provided with turn buckles h^6 to enable them to be adjusted at any time, and the casing A is provided with hand holes a^5 to enable the adjustment to be made from time to time to compensate for wear. As the upper member H′ wears away it will also lose its weight and in order to compensate for this loss, I provide auxiliary weights H^2, as shown in Figs. 1 and 2, preferably having slots therein to slip over the ears h^2 which weights may be added as required to make up for the loss of weight.

L is a trough located beneath the lower part of the casing and adapted to catch any material which may fall from the grinding mechanism and convey it to an elevator M (see Fig. 1) which carries it upward and discharges it by means of a trough m (partly broken away in Fig. 1) to the hopper B. At the same time it may be noted that when the fan is in operation, there will be a suction of air all around the grinding mechanism between it and the casing A, so that no fine material will be likely to fall out of the casing.

The shaft D is driven in any suitable manner, as by a pulley D′ at its lower end, secured thereto frictionally so as to slip in case of any stoppage of the rotary parts, and the shaft is preferably bored throughout its length to provide an oil passage d^3 communicating with an oil cup d^4 at its upper end for lubricating the step bearing.

In the operation of the apparatus, the material is fed into the hopper B, and acted on by the preliminary reducing mechanism, to abrade or chip off particles which fall into the casing A, the fine dust particles will be be drawn by the suction of the fan, into the fan casing and the coarser particles will descend and be acted on by the pulverizing mechanism, the finer particles so formed being continually carried upward by the air to the fan and the coarser particles falling into the grinding mechanism, in which they are finely reduced to an impalpable dust or powder, which is carried upward therefrom to the fan. The fine particles or dust are discharged by the fan, with air into the furnace, and will burn with the production of intense heat.

What I claim and desire to secure by Letters Patent is:—

1. In a reducing mechanism, the combination of horizontally disposed upper and lower grinding members, means for continuously rotating the lower grinding member, a stationary support for the upper grinding member, above the same, pendulous connections secured to said support, and connected to said upper grinding member at a distance from its center, and constructed to permit

relative movement in a rotary direction between said upper grinding member and its support, to change the vertical relation of the upper and lower grinding members, substantially as described.

2. In a reducing mechanism, the combination of horizontally disposed upper and lower grinding members, means for rotating the lower grinding member, a stationary support for the upper grinding member located above the same, links connected to said support, and connected to the upper grinding member at separated points at a distance from its center, forming the only connections with said upper grinding member, and permitting said upper grinding member to turn on its own axis with respect to its support to alter its vertical relation with respect to the lower grinding member, and means for positively adjusting said upper and lower grinding members, one with respect to the other, substantially as described.

3. In a reducing mechanism, the combination of horizontally disposed upper and lower grinding members, means for rotating the lower grinding member, a stationary support for the upper grinding member located above the same, links connected to said support, and connected to the upper grinding member at separated points at a distance from its center, forming the only connections with said upper grinding member, and permitting said upper grinding member to turn on its own axis with respect to its support to alter its vertical relation with respect to the lower grinding member, means connected with said links for positively adjusting said upper and lower grinding members, one with respect to the other, an auxiliary weight and means for securing said weight to the upper grinding member to compensate for wear, substantially as described.

4. In a reducing mechanism, the combination with horizontally disposed upper and lower grinding members, said upper member being apertured to permit the finely ground material to rise therethrough, means for driving the lower grinding member, a support for said upper member located above the same, pendulous devices extending from said support, connected to the upper grinding member at a distance from its center, and permitting relative movement in a rotary direction of the upper grinding member with respect to its support, to change the vertical relation of the upper and lower grinding members, a casing inclosing said grinding members, and provided with an outlet at its upper end, and means for creating a current of air from the bottom of the casing to said outlet, to remove the finely divided material, substantially as described.

5. In a reducing mechanism, the combination with a vertical revoluble shaft, a supporting bearing for the lower end of said shaft, a steadying bearing for the upper end of said shaft, provided with sufficient play to permit the shaft to rotate upon a free axis, a horizontally disposed lower grinding member carried by and rotating with said shaft, a horizontally disposed upper grinding member independent of said shaft, and surrounding the same, a support for the upper grinding member above the same, and vertically disposed connections from said support secured to the upper grinding member at a distance from its center, and constructed to permit a relative movement in a rotary direction between said upper grinding member and its support to change its vertical position with respect to the lower grinding member, substantially as described.

6. In a reducing mechanism, the combination with a preliminary reducing mechanism, of a vertically disposed casing located below and communicating therewith, pulverizing mechanism located in the upper part of said casing, a horizontally disposed revoluble lower grinding member located in the lower part of said casing, a horizontally disposed upper grinding member located above the lower grinding member, pendulous supports, connecting said upper member with parts connected with said casing and constructed to permit movement of the upper grinding member in a rotary direction, to change its vertical relation with respect to the lower grinding member, an ejector fan casing located above the pulverizing mechanism, and having an annular aperture communicating with said chamber, and a fan in said fan casing, substantially as described.

7. In a reducing mechanism, the combination with a rotatable grinding member and an opposed non-rotatable grinding member, supporting connections between said non-rotatable member and a stationary part permitting a slight movement of the non-rotatable member in a rotary direction, said connections being so constructed that the said permitted movement will cause the separation of the grinding members, to relieve the pressure between the same.

8. In a reducing mechanism, the combination with two grinding members having their axes in alinement, and provided with opposed grinding surfaces, means for continuously rotating one of said members, links connected to the other member, at separated points around its axis, and having their opposite ends pivotally connected to a stationary part, said links preventing the rotation of their connected member with the rotating member, but permitting a slight movement of the connected member in a rotary direction, to relieve the pressure between the opposed grinding surfaces, substantially as described.

9. In a reducing mechanism, the combination with horizontally disposed upper and

lower grinding members, means for rotating the lower grinding member, connections extending from the upper grinding member to a stationary part, holding the upper member from rotating with the lower member but constructed to permit the upper member to move slightly in a rotary direction to relieve the pressure between the grinding surfaces of the members, the upper grinding member having its grinding surface recessed to afford space for the discharge of ground material, substantially as described.

10. In a reducing mechanism, the combination with horizontally disposed upper and lower grinding members, means for rotating the lower grinding member, connections extending from the upper grinding member to a stationary part, holding the upper member from rotating with the lower member but constructed to permit the upper member to move slightly in a rotary direction to relieve the pressure between the grinding surfaces of the members, the upper grinding member being provided with apertures extending therethrough above the grinding surface of the lower grinding member to permit the escape of ground material, substantially as described.

11. In a reducing mechanism, the combination with horizontally disposed upper and lower grinding members, means for rotating the lower grinding member, connections extending from the upper grinding member to a stationary part, holding the upper member from rotating with the lower member but constructed to permit the upper member to move slightly in a rotary direction to relieve the pressure between the grinding surfaces of the members, the upper grinding member consisting of separate horizontally curved parts, spaced a distance apart, and rigid connections between said parts, whereby apertures are formed through the upper member for the escape of ground material, substantially as described.

In testimony whereof I affix my signature, in the presence of two witnesses.

ALBERT A. DAY.

Witnesses:
L. P. WHITAKER,
J. K. MOORE,