July 6, 1926. 1,591,758

P. W. GRIFFIN

MACHINE FOR PULVERIZING OR GRINDING COAL AND OTHER MATERIALS

Filed July 20, 1923 3 Sheets-Sheet 1

Fig. 1.

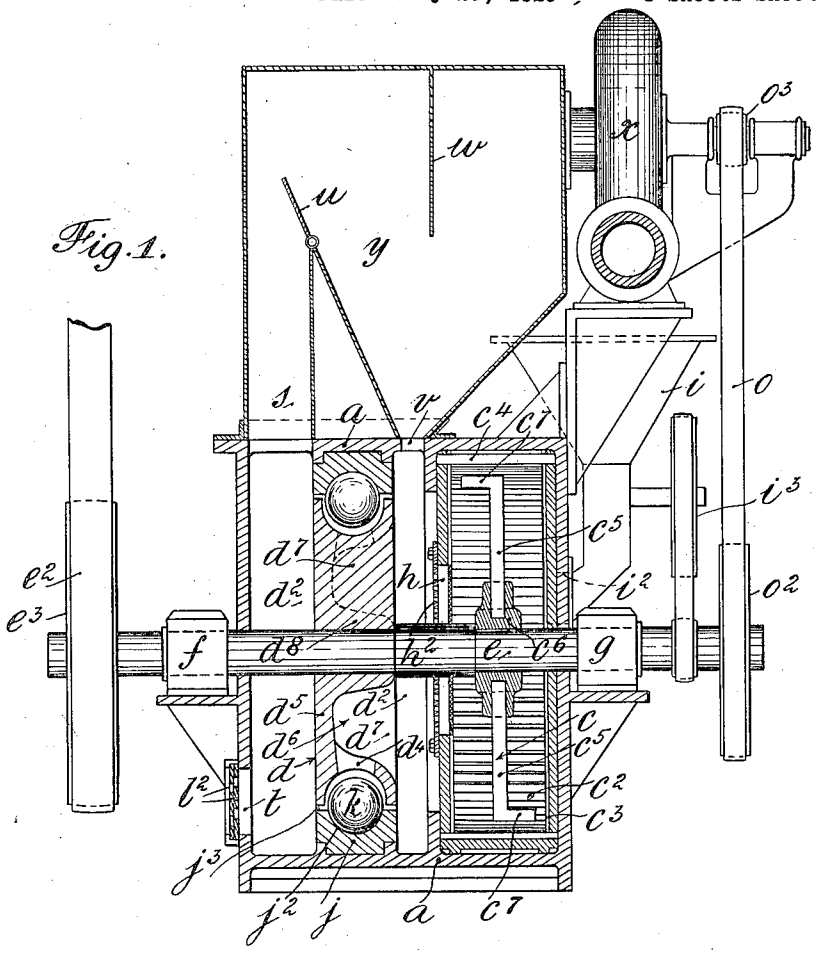

Fig. 2.

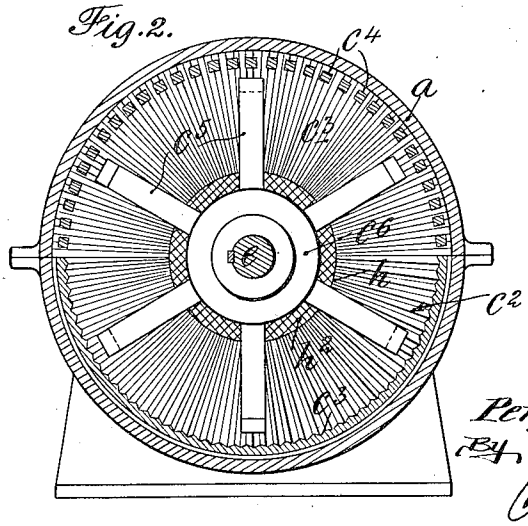

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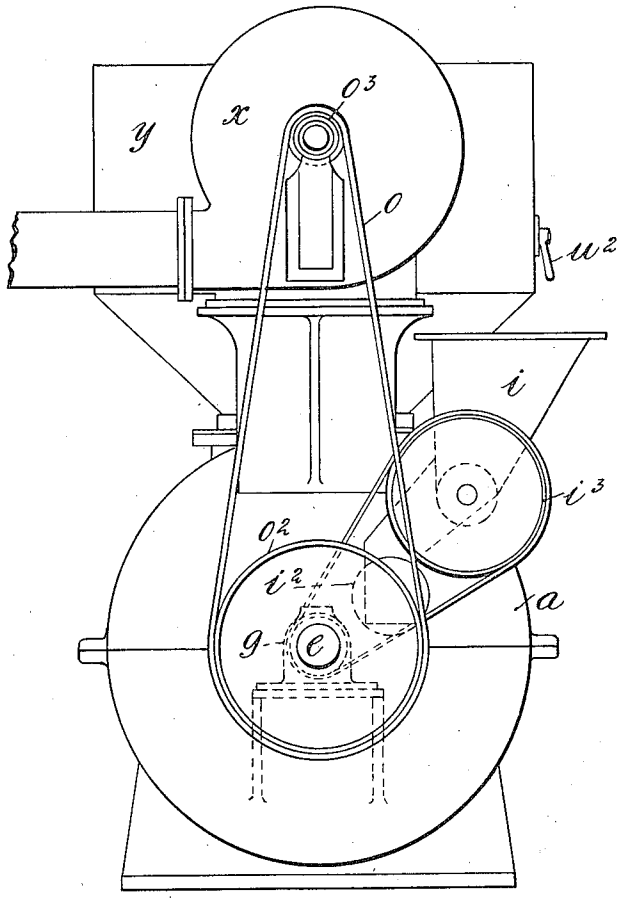
Fig. 3.



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MACHINE FOR PULVERIZING OR GRINDING COAL AND OTHER MATERIALS

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Fig.4.

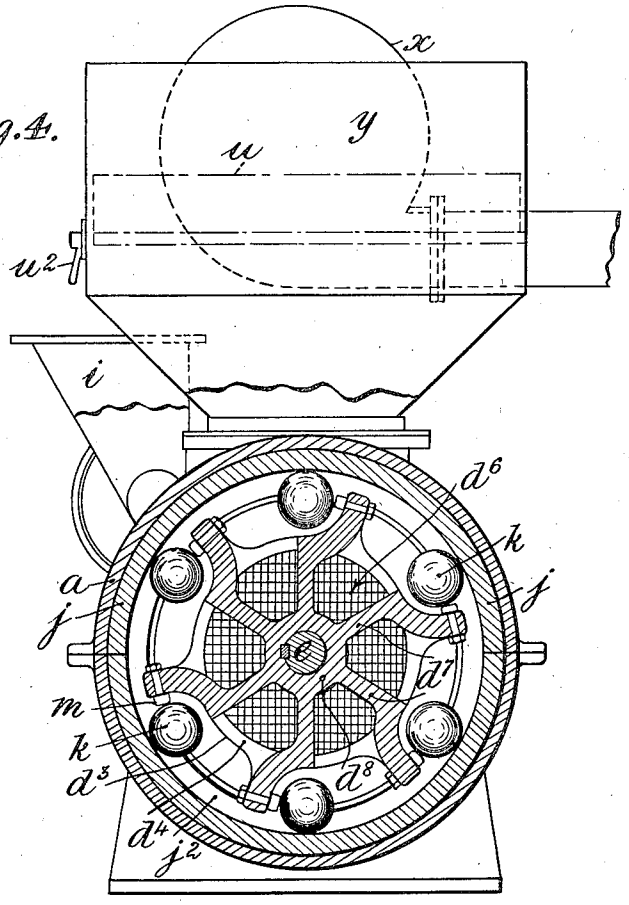


Fig.5.

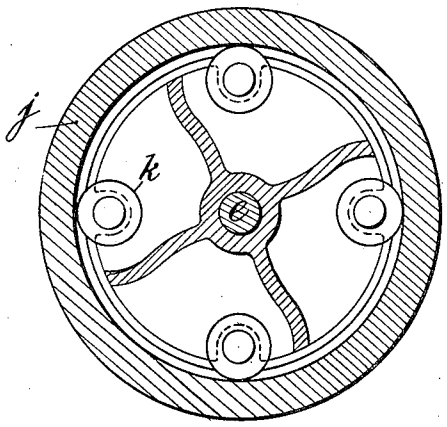
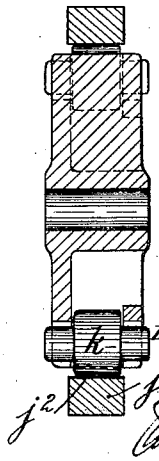


Fig.6.



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Patented July 6, 1926. 1,591,758

UNITED STATES PATENT OFFICE.

PERCY WALTER GRIFFIN, OF ENFIELD, ENGLAND, ASSIGNOR OF ONE-HALF TO VICKERS LIMITED, OF WESTMINSTER, LONDON, ENGLAND, A REGISTERED BRITISH COMPANY.

MACHINE FOR PULVERIZING OR GRINDING COAL AND OTHER MATERIALS.

Application filed July 20, 1923, Serial No. 652,803, and in Great Britain July 25, 1922.

The invention provides the hereinafter described and claimed improved machine of the horizontal type for pulverizing or grinding coal and other materials. By horizontal type is meant a kind built about a horizontal shaft and employing a grinding rotor comprising a fixed grinding annulus, and a wheel revolving within the annulus and carrying around in pockets of its periphery balls or rollers adapted to work against the bore of the annulus by centrifugal action, the material to be treated being fed by suction into the centre of the wheel and centrifugally thrown into the grinding annulus.

The invention has the primary distinctive features that the grinding wheel, revolving about a horizontal shaft, is constructed to operate as a suction fan for the purpose of creating suction upon an opening at its side to draw the material to be treated into said wheel by said suction, and to subsequently centrifugally throw it into the grinding annulus or ring. The present invention also combines in one machine, upon the same axial shaft, a grinding rotor aforesaid and a beater rotor, each working in a separate chamber of a casing, but communicating by an opening between the two chambers, which opening forms the exit for the material from the chamber of the beater rotor and the entrance of said material into the chamber of the grinding rotor, the grinding wheel having its fan-like action on said opening to create a suction. To this opening is applied a renewable screen determining the size of the material allowed to pass. On the closed side of the grinding wheel a chamber is provided into which the ground material from the grinding rotor is discharged. Through this chamber a suction is created by a fan from an adjustable air inlet of said chamber, through a separating box of large capacity, to an outlet.

As the amount of air drawn through this chamber can be regulated from the air inlet, different gradings of ground material can be lifted with the air into the separating box, where provision is made for automatically returning to the grinding rotor material insufficiently ground.

The construction and operation of the beater rotor creates air currents tending to dry the material being treated, so that said material passes into the grinding rotor in a dry condition.

The drawings show a convenient and desirable adaptation of the invention.

Fig. 1 is a vertical section.

Fig. 2 is a transverse section through the beater chamber.

Fig. 3 is a right-hand end elevation of Fig. 1.

Fig. 4 is a transverse section through the grinding chamber.

Figs. 5 and 6 show a modified form of a grinding rotor and annulus in which rollers are used instead of balls.

Within a stationary enclosing casing a are provided two rotors c and d revoluble with a common horizontally arranged shaft, e, having bearings at f and g outside said casing. The latter is divided into two chambers c^2, d^2 and the rotor c, which is a beater one, revolves within the chamber c^2, and the rotor d, which has a grinding or finishing operation, revolves within the chamber d^2. The two chambers are separate except for the large central opening h, to which is fitted a grid-like screen h^2 through which the material must pass from the beater chamber into the grinding chamber.

The beater chamber is lined with hard wearing renewable serrated linings c^3, and the upper part of it is furnished with a circumferential series of metal bars c^4 to form an impact surface.

The beater rotor is formed by a number of radial arms c^5 projecting from a hub c^6 and reversely bent at right-angles at their outer ends c^7. Instead of right-angled ends said arms may be furnished with impact blades or paddles. This rotor is a beating or impact one and operates within the chamber to break down material to a size sufficient

for it to pass through the grid h^2, the action of this rotor also displacing air to have a drying effect upon the material.

Material to be treated enters the beater chamber at i^2, falling from the hopper i, or being suitably conveyed therefrom into said chamber, as, for example, by a screw conveyor driven by the wheel i^3.

The grinding or finishing chamber d^2 is furnished with a fixed annulus, j, of durable material and preferably made in halves as shown. The bore of this annulus is grooved at j^2 for balls k to work in, or said bore may be flat, as shown in Figs. 5 and 6, for flat rollers k to contact.

The grinding rotor d is in the form of a wheel revolving within the annulus and having a series of spaced pockets or recesses, d^3, on its periphery in each of which is a ball k free to revolve. As the grinding rotor revolves the balls are carried round in contact with the groove of the annulus by centrifugal force. The driving end of each pocket is fitted with an easily renewable stud m against which the ball abuts.

The bottom of each pocket is radially slotted at d^4 to communicate with the hollow interior of the wheel, which interior communicates with the opening h of the beater chamber c^2. The back side of this wheel is closed as shown at d^5.

The hollow centre of said wheel is formed by spaces d^6 and intervening blades acting as spoke-like arms d^7, extending from a hub d^8 so that the construction of this centre creates air currents by operating fan-like, and centrifugally acts upon the material entering the chamber to throw same in a stream into the groove of the annulus in front of the grinding balls k.

The material to be ground is automatically drawn or sucked through the screen h^2 into the hollow centre of the wheel through which it cannot pass axially, but is thrown radially through the slots d^4, through the pockets d^3, and into the groove of the annulus to be ground between the balls and the surface of said annulus, ultimately leaving said annulus by the space j^3.

A feature in the operation of this grinding wheel or rotor is that its fan-like construction induces air currents through the grid h^2 from the beater chamber, and therefcre sucks the material broken down through said grid into its own centre, to be centrifugally whirled into the grinding annulus and in a stream entering the annulus in front of the grinding balls or rollers.

The grinding chamber d^2 on the back and closed side of the grinding wheel is put into communication with a suction fan x by which the ground material is drawn out of the machine suspended in the air.

Between said fan and the back side of the chamber aforesaid is a separating box y and a passage s. The box admits of expansion of the dust-laden air. Air is admitted low down in the grinding chamber through an adjustable opening t controlled by a hit-and-miss regulating shutter t^2. The upper end of the passage s can also be either fully open or partially closed by the hinged shutter u operated from the handle u^2.

The control of the air inlet t, and the control of the passage s by the shutter u, combined with the operation of the suction fan x, enables the grading of the ground material to be adjusted in relation to the constant operation of the fan x, whereas the expansion of the dust-laden air in the separating box, y, insures material insufficiently ground, or pulverized, to fall down the separating box and through the opening v into the grinding chamber again for regrinding by the grinding wheel.

w is a baffle provided within the separating box to give a circuitous flow of the dust-laden air through the box and assist the separation of the heavier particles for regrinding.

The shaft e is driven by the belt e^2 over the pulley e^3, and the spindle of the suction fan x by the belt o travelling over the pulleys o^2, o^3.

It will be clear from the foregoing that the fan-like construction of the grinding wheel exerts a suction on the opening h to which the grid h^2 is applied, so that as soon as the material in the beater chamber is sufficiently small it is sucked through the grid into the grinding wheel, and whirled centrifugally into the grinding annulus in front of the balls k.

It is to be understood that the walls of the beater chamber may be in any way conveniently provided for co-operation with the beaters to break up the material to the size suitable for passing axially through the grid into the grinding wheel.

It will be clear that the balls k are free to revolve within the grooved bore of the annulus and within the pockets or recesses, and that by centrifugal action they are kept in working contact with the grooved bore of the annulus.

Apart from the current of air produced by the fan x, which air serves as the carrying medium for ground material, a current of air is continually passing through the machine by virtue of the operation of the beater rotor, and more particularly by the fan-like grinding wheel, this air keeping the machine cool and driving off any moisture contained in the material.

Having now described my invention what I claim and desire to secure by Letters Patent is:—

1. A machine for pulverizing or grinding coal and other material, comprising a stationary casing forming a grinding chamber

having an entrance opening at one side, a driven shaft passing horizontally through said chamber and opening, a grinding annulus fixed within said chamber coaxially of said shaft, a grinding wheel upon said shaft revoluble within said annulus and having openings therein at the side adjacent to the entrance opening of the grinding chamber, and grinding elements carried by said wheel and coacting with the inner face of said annulus, said wheel being also formed with blades adjacent to said central opening to provide a fan for drawing material into the grinding wheel through the said entrance opening solely by suction.

2. A machine for pulverizing or grinding coal and other material comprising a stationary casing forming a grinding chamber having an entrance opening at one side, a driving shaft passing horizontally through said chamber and opening, a grinding annulus fixed within said chamber coaxially of the shaft, a grinding wheel upon said shaft revoluble within the annulus and having blades disposed to operate as a suction fan with relation to said entrance opening to draw the material into the grinding wheel through the said entrance opening solely by suction, and grinding elements carried by the peripheral portion of said wheel and coacting with the inner face of the annulus.

3. A machine for grinding or pulverizing coal or other material, comprising a stationary casing forming a chamber, having an entrance opening at one side, a driving shaft passing horizontally through said chamber and opening, a grinding annulus fixed within said chamber co-axially of said shaft, a grinding wheel on said shaft revoluble within said annulus, grinding elements carried peripherally of said wheel, the latter being formed with blades constituting a suction fan for drawing material into said grinding wheel through said entrance opening, a separating box communicating with said chamber on the side of said grinding wheel opposite said entrance opening, said casing being formed with a passageway leading from the discharge side of said chamber to the side adjacent said entrance opening for returning insufficiently ground material to the grinding wheel.

4. A machine for pulverizing or grinding coal or other material, comprising a stationary casing having a partition separating the space within said casing into grinding and beater chambers, said partition having a screened entrance opening to establish communication between the two chambers, a driving shaft passing horizontally through the said chambers and opening, a beater mounted upon said shaft within the beater chamber, a grinding annulus fixed within the grinding chamber at an intermediate portion thereof and coaxially of said shaft, a grinding wheel on the shaft freely revoluble within the annulus and having blades to constitute the same as a suction fan which operates through the said opening between the two chambers and creates a suction to set up a feed of the material operated upon to the grinding wheel, and grinding elements peripherally carried by said grinding wheel and cooperating with the inner face of the annulus.

5. A machine for pulverizing or grinding coal or other materials comprising a stationary casing having a partition, separating the space within said casing into grinding and beater chambers, said partition having an entrance opening placing said beater chamber and grinding chamber into communication, a driving shaft passing horizontally through said chambers and opening, a beater mounted upon said shaft within the beater chamber, a grinding annulus fixed within the grinding chamber at an intermediate portion thereof, and co-axially of said shaft, a grinding wheel on said shaft revoluble within the annulus, grinding elements carried peripherally of said grinding wheel and cooperable with the inner face of said annulus, said grinding wheel being formed with blades constituting a suction fan for drawing material from said beater chamber through said entrance opening into said grinding wheel, that part of said grinding chamber to the rear of said grinding wheel having a discharge passage for material and an adjustable air inlet, and a separating box associated with said casing communicating with said discharge passage having an outlet for the discharge of ground material and suction means associated with said outlet.

6. In a machine for grinding coal and other material, a grinding chamber having an opening in one side thereof, a grinding annulus within said chamber, a grinding wheel cooperating with said annulus provided with vanes formed on the side thereof adjacent to said opening and also with pockets between the said vanes and passageways leading from the pockets to the periphery of the grinding wheel, the grinding wheel through the operation of the vanes setting up a suction relatively to the opening of the grinding chamber to constitute the said grinding wheel as a self-feeding device, and grinding means between the annulus and the grinding wheel and exposed to the pockets by means of said passageways.

7. In a machine for grinding coal and other material, a grinding chamber having an opening at one side thereof, a grinding annulus within said chamber, a grinding wheel mounted within said annulus and having vanes formed on the side thereof adjacent to the opening of the grinding chamber with pockets between the said vanes and passageways leading from the pockets to the

periphery of the grinding wheel, the opposite side of the grinding wheel being closed, the vanes of the grinding wheel constituting suction-creating means by which the material to be ground is drawn into the grinding wheel and passes out through the periphery of the latter by way of the pockets and passageways, and balls loosely mounted in the annulus and engaging the periphery of the grinding wheel and exposed through the passageways to the said pockets.

In testimony whereof I have hereunto set my hand.

PERCY WALTER GRIFFIN.