April 25, 1939. C. W. YOUNG 2,155,697

APPARATUS FOR PULVERIZING MINERALS AND OTHER MATERIALS

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Fig. 1.

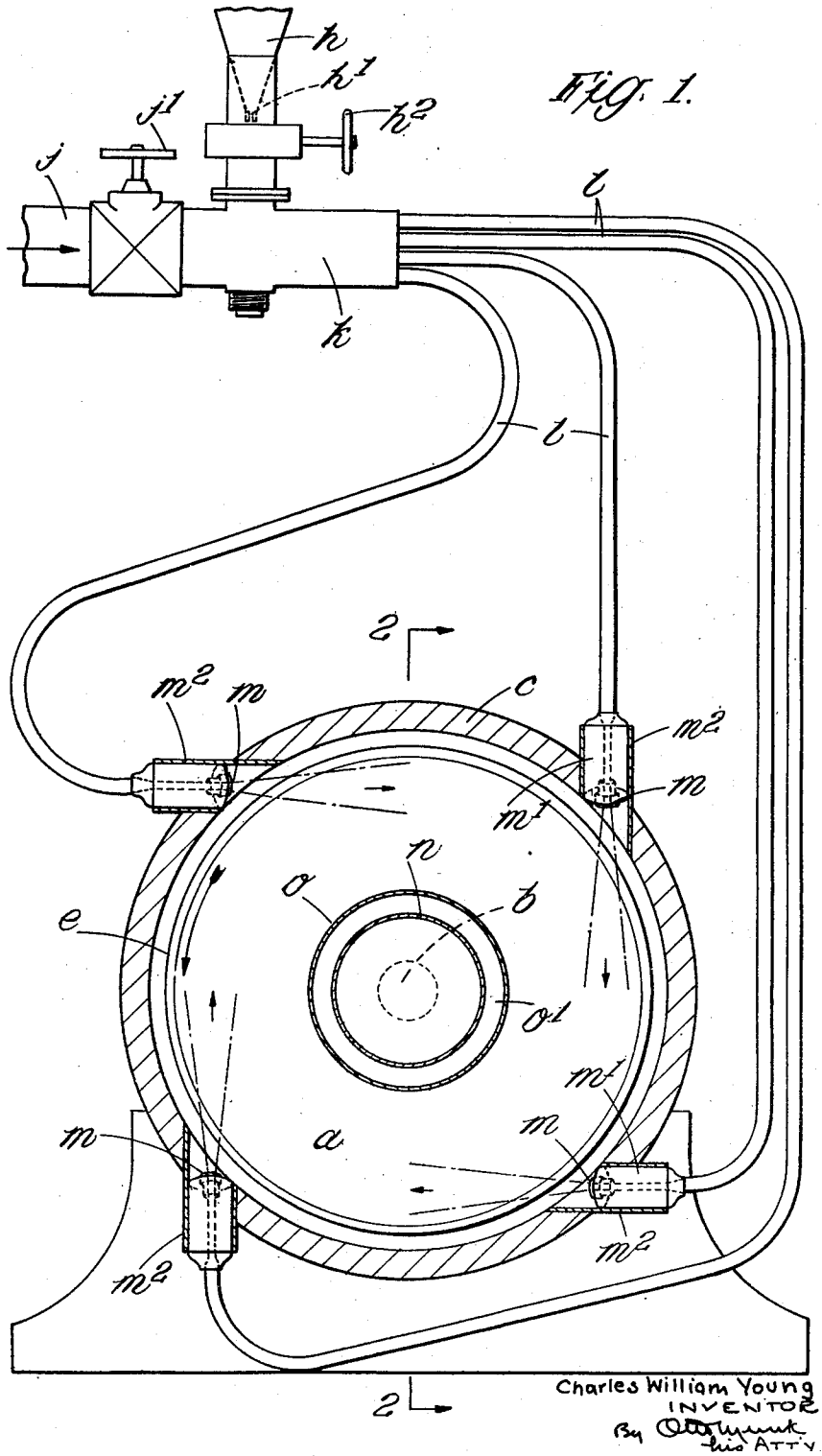

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Fig. 2.

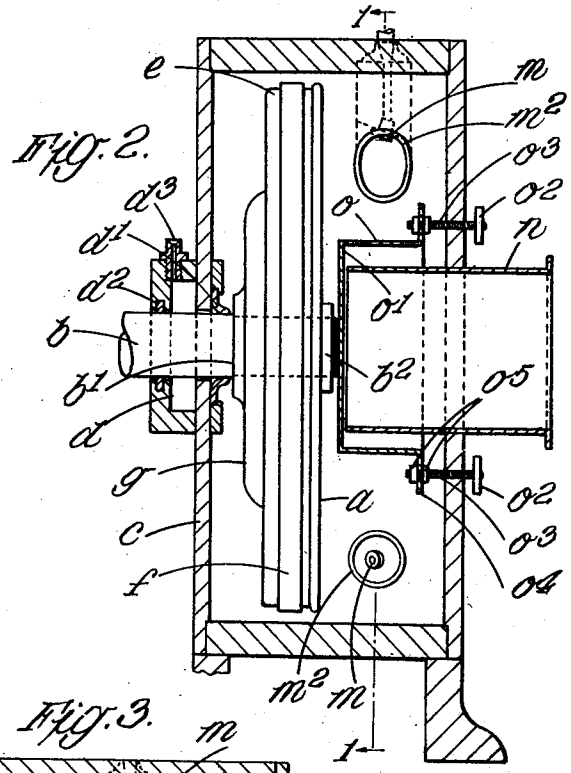
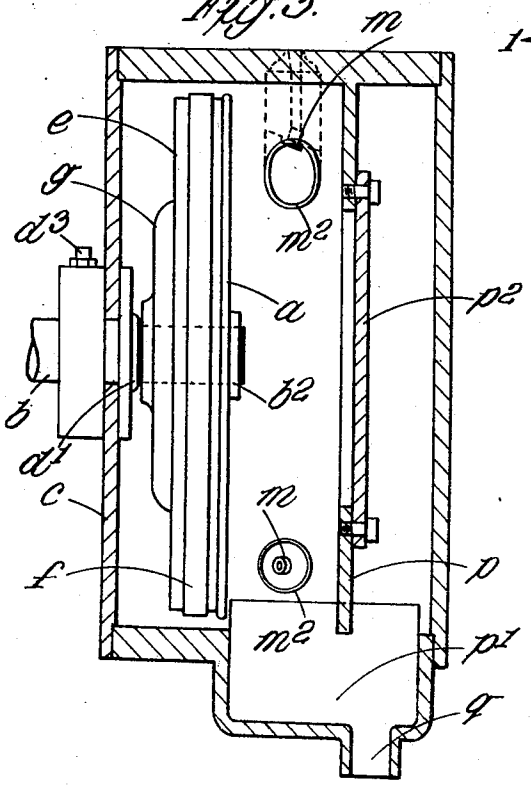


Fig. 3.



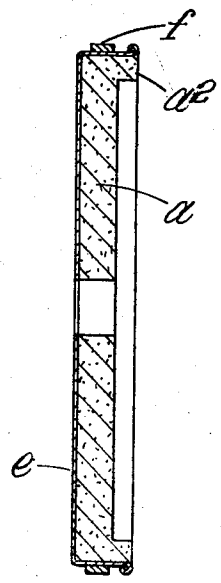


Fig. 4

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2,155,697

UNITED STATES PATENT OFFICE

2,155,697

APPARATUS FOR PULVERIZING MINERALS AND OTHER MATERIALS

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Application November 26, 1937, Serial No. 176,471
In Great Britain October 2, 1936

1 Claim. (Cl. 83—46)

This invention relates to an apparatus for reducing minerals and other such material from a granular or relatively coarse condition to a state of impalpability or extremely fine division and has reference to that general method and type of apparatus wherein the material is projected on to an abrasive surface.

The underlying principle of the invention is the projection of the granular material on to an abrading surface which is moving at a high speed relatively to the impinging granular material and, in general, in a direction different from and preferably opposed to that from which the granular material proceeds. The vehicle by which the granular material is projected on to the relatively moving surface will be some form of fluid under pressure and in the case of dry pulverization compressed air, or other gas suitable to the material being treated, will be employed, but in some cases liquid carrying the granular material in suspension may be used as will hereafter appear.

The invention relates broadly to an apparatus for pulverizing granular material to a state of impalpability or fine division in which the granular material is projected on to an abrading surface moving at high speed relatively to the impinging granular material. Such apparatus comprises essentially an abrading surface, a nozzle or nozzles or equivalent means for projecting the granular material on to the abrading surface, and means for establishing and maintaining relative movement between the nozzles and the abrading surface.

It is preferred that the abrading surface be in the form of an abrasive wheel which rotates at high speed, and in order to prevent disruption thereof and/or to give balance thereto, the wheel may be, according to a further feature of the invention, enclosed in a metallic shroud, except at its working face. The abrasive wheel may also be provided with a lateral flange extending around its working face. The wheel may also be surrounded by a stator of similar or other material to the wheel and the enclosing casing may be lined in a similar manner which still further tends to reduce the material.

The abrasive wheel may be made of any suitable material, for example, metal, porcelain or stone, but preferably carborundum or analogous material.

Examples of machines suitable for carrying out the improved method and constructed in accordance with the invention are illustrated in the accompanying drawings, wherein,

Figure 1 is a section of a machine for dry grinding or disintegrating taken on line 1—1 of Figure 2;

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is a central vertical section of a machine for wet grinding or disintegrating; and

Figure 4 is a central section through a modified form of abrasive wheel.

Like reference letters refer to like parts throughout the drawings.

Referring firstly to Figures 1 and 2 of the drawings, *a* is a plain-surfaced carborundum abrasive wheel which is fixed on a driving shaft *b* and rotates in a casing *c* with a clearance all around it. The opening in the casing through which the shaft passes is fitted with a gland having a closed chamber *d* provided with sealing washers d^1 and d^2. d^3 is a union to which a source of pressure is applied so as to prevent leakage due to pressure within the casing *c*. A valve (not shown) may be provided to regulate the pressure within the chamber *d*. The wheel is embedded within a steel shrouding *e* reinforced by a steel band *f* which prevents its disruption when rotating at high speed. A steel hub *g* is attached to or formed integrally with the shroud and the whole assembly is secured with a key against a shoulder b^1 on the shaft by means of a nut or nuts b^2. The material of the shroud assembly is preferably made relatively thick in order that, by suitably boring out, the wheel may be balanced for perfect rotation. *h* is a closed chamber into which the material, e. g., graphite, to be ground or disintegrated, is fed, and *j* is a conduit for the energizing fluid, e. g., compressed air, steam or other gas. *k* is a mixing chamber into which the material is forced from the hopper by pressure through the jet h^1 and from which it is forced by the energizing fluid along pipes *l* to jets *m* which latter pass through the casing *c* at equidistantly spaced points and may be fitted in holders m^2 so that they may be adjusted as to angle or direction. h^2 is a valve for cutting off the feed of material and j^1 is a valve for regulating the flow of the fluid in the chamber *k*. The jets are arranged so that they cause the material to be projected against the adjacent face of the oppositely rotating wheel *a* at an angle of 15° or thereabouts and substantially in the direction indicated by the broken lines shown issuing from the jets in Figure 1. *n* is an exhaust pipe for the fines. Its inner end is open and it is mounted in a suitable gland in the casing to prevent leakage and so that it can be moved to and from the rotor to control the degree of fineness of the

finished product. *o* is a baffle which is closed at its inner end o^1 and is made adjustable to and from the inner end of the exhaust pipe by means of hand-wheels o^2 mounted on spindles o^3 which are screwed through the casing and the inner ends of which pass through the flange o^4 and are provided with collars o^5. The exhaust pipe *n* and the baffle *o* are preferably arranged concentrically with the shaft *b*. The baffle *o* is not essential, but its use is advantageous inasmuch as it increases the sensitiveness of the control of the finished product. Alternatively, the shaft *b* may be hollow and the finished product may be exhausted through it.

In operation, the wheel is rotated in a direction opposed in general to that in which the material issues from the jets. The wheel is rotated at a high speed, and the material is also delivered to it at a high speed. For example, it has been found that when dealing with dry graphite using an 11-inch wheel a speed of 1800 revolutions per minute with the material issuing from the jets at the rate of 1,000 feet per second and at a pressure of 70 lbs. to 80 lbs. per square inch using compressed air gives satisfactory results. When the particles have become reduced they will pass out through the exhaust pipe. This pipe may, if desired, also be lined with abrasive or other material which will utilise any energy left in the exhaust fluid so as still further to reduce the material. Upon leaving the exhaust the fines are separated if necessary and subsequently collected. As the chamber will constantly be filled with air or gas or the like in dry grinding.

Referring now to the machine shown in Figure 3, for wet grinding, its construction is similar to that shown in Figures 1 and 2, excepting that a slightly larger clearance is left between the periphery of the wheel *a* and the casing, and a dam ring *p* and sump p^1 are provided. The dam ring has a plate p^2 attached to it. The dam ring and plate p^2 serve to prevent excessive splashing of the liquid and to keep the material reasonably close up to the wheel. In some cases, the plate p^2 may even be dispensed with. The material is forced through the jets by liquid such as water or other convenient medium under pressure and the jets are placed relatively to the wheel in substantially the same way as they are in Figures 1 and 2. The liquid containing the fines passes into the sump and out at the conduit *q* and, after separation, the oversize particles are returned to the machine for further treatment.

The reducing action on the particles of the material takes place, in the examples illustrated, only on the face of the wheel adjacent to the jets.

In a modification, according to this invention, jets may be arranged so that they deliver the material on to the opposite faces of the wheel in which case the fines may be exhausted or removed on both sides of the wheel.

One modification is shown in Figure 4 in which the abrasive wheel is provided with a lateral flange a^2, the wheel being preferably provided also with a shroud *e* and reinforcing ring *f* as above described.

I claim:

Pulverising apparatus comprising a casing, an abrasive wheel having at least one flat end and being arranged in said casing, means for projecting the material to be pulverized on to the flat end surface of said wheel at an angle of about 15° at the point of impingement, means for rotating the wheel in a direction substantially opposed to that in which the said material is projected, and exhausting means for the treated material.

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