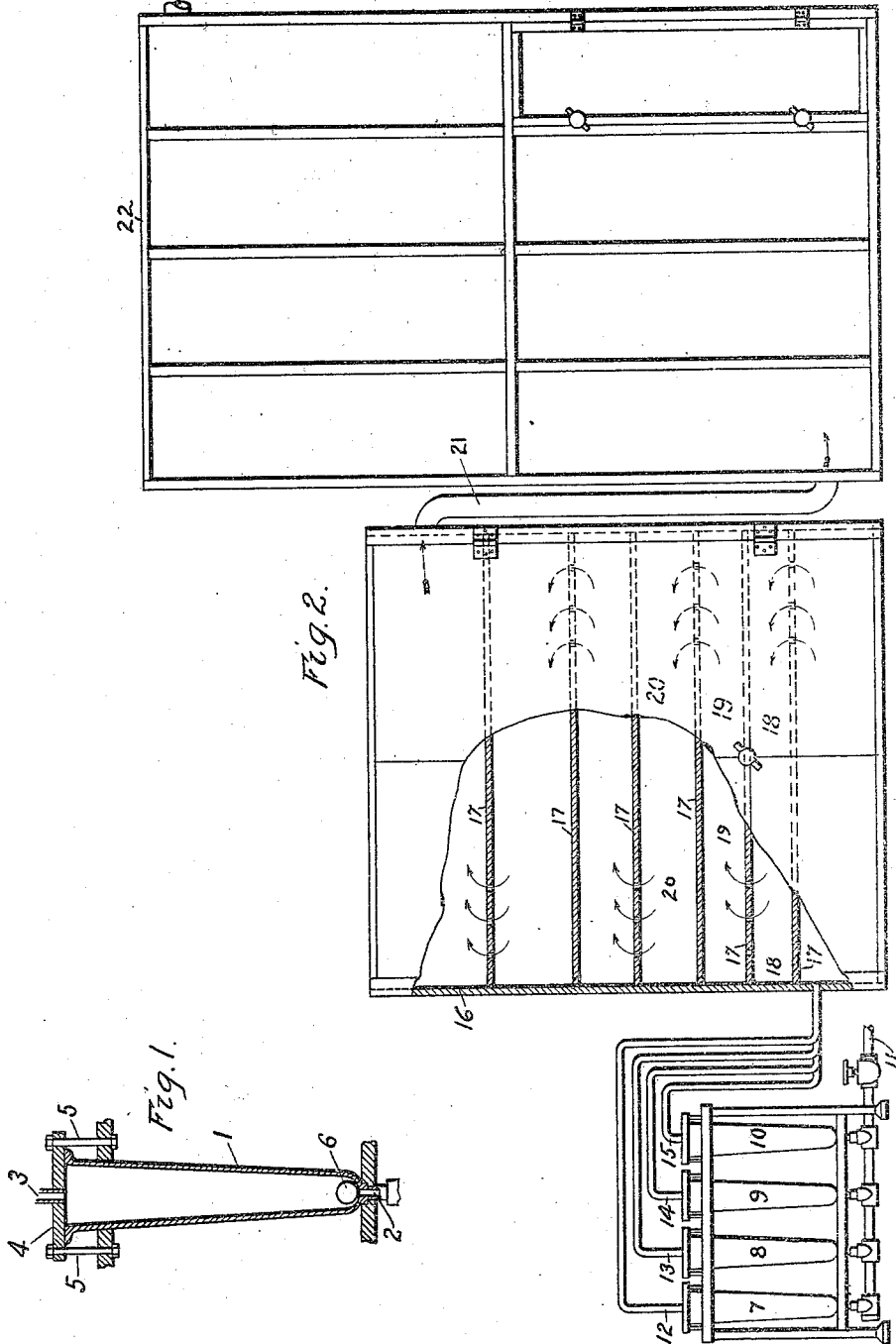


C. T. FULLER.
 APPARATUS FOR GRINDING AND SORTING POWDERS.
 APPLICATION FILED AUG. 19, 1907.

1,041,769.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR GRINDING AND SORTING POWDERS.

1,041,769.

Specification of Letters Patent.

Patented Oct. 22, 1912.

Application filed August 19, 1907. Serial No. 389,314.

To all whom it may concern:

Be it known that I, CARL T. FULLER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Apparatus for Grinding and Sorting Powders, of which the following is a specification.

According to my present invention, a powdered material is inclosed in a chamber and there subjected to a jet of gaseous fluid operating to grind the particles of the powder one on another and to float off and carry away the lighter particles, depositing them in settling chambers so arranged that the powder is sorted according to the size of the particles. The apparatus for effecting this result is suitable for use with a great variety of powdered materials, but I have applied it with particular success to the grinding and sorting of tungsten and its oxids. These materials are now used extensively in the manufacture of tungsten lamp filaments and other refractory conductors requiring a raw material very fine and uniform. I will explain my apparatus as used in the grinding of tungsten trioxid, and its use for other purposes will be obvious.

In the drawing accompanying this specification and forming a part thereof, Figure 1 is a sectional elevation of a grinding chamber, and Fig. 2 is an elevation, partly diagrammatic, of a battery of grinders connected to suitable settling chambers.

The grinder shown in Fig. 1 comprises a flaring glass jar 1, with an inlet 2 at the bottom through which a jet of air or other gaseous fluid may be projected, and with an outlet 3 at the top through which the finer particles of the material under treatment can be floated away to the settling chambers. The upper or larger end of the grinding chamber is closed by a board 4 secured in place in any suitable manner as by means of the bolts 5. I prefer to make this grinding chamber flaring in order that the velocity of the projected jet of air or other fluid may decrease progressively from the inlet 2 to the outlet 3.

The grinding chamber may be two or three feet in height and will then take a charge of say 3000 grams of tungsten trioxid. The charge is placed loosely in the

flaring glass tube 1 and then subjected to the action of a jet of air forced in through an inlet 2 at a pressure of say 15 pounds to the square inch.

In order to vary the direction of the incoming air and to insure the best distribution thereof through the charge, I place a weighted ball 6 immediately over the inlet 2 in such a way that it tends to float about or move around on the inlet and thus serve as a baffle to shift the direction of the incoming jet from one side to another. This shifting jet of air keeps the entire charge in rapid movement.

The continuous and violent movement of the powder serves to grind the particles against one another, thereby breaking up the larger particles into bodies which can float away easily through the outlet 3.

A battery of grinders may be operated simultaneously, as shown in Fig. 2, in which 7, 8, 9 and 10 are similar grinding chambers supplied from the air pipe 11, and discharging respectively through the tubes 12, 13, 14 and 15 into a series of settling chambers arranged in a cupboard shaped box 16. This cupboard 16 may conveniently have a height of six or eight feet and be divided by horizontal partitions 17 into a plurality of chambers 18, 19, 20, etc., of progressively increasing volume. When the air blast enters the cupboard at the bottom, as shown in Fig. 2, it passes across the bottom and then up through holes in the lower partition 17 and thereafter follows a zig-zag path upward through the several chambers 18, 19, 20, etc. Inasmuch as these chambers progressively increase in volume the velocity of air blast will progressively decrease and the fine particles of dust or powder carried in suspension will gradually settle out on the shelf 17. The coarser powder will be near the bottom of the cupboard and the finer powder near the top.

Inasmuch as the air blast passing through the upper compartment of the cupboard may carry very considerable quantities of the oxid, and this of the finest and therefore most valuable quality, I provide the upper compartment with an outlet or discharge pipe 21 leading downward and discharging into a closed room 22. I prefer to make this room relatively large, say twenty feet on a side, and to line it with a smooth material

from which the finely divided powder can readily be collected. The room may be provided with an outlet 23 discharging into the open air.

5 When the grinders 7, 8, 9 and 10 are charged with tungsten trioxid and operated by air jets under a pressure of say 15 pounds to the square inch, the oxid powder seems to boil and swirl about in the grinding cham-
10 bers and gradually passes over into the cupboard where a considerable part is deposited on the shelves 17. The finest particles pass over into the room 22 and there settle on the walls and floor. These finer particles are so
15 light and fluffy as to float about for a long time in the air. They therefore require a relatively large settling chamber, such as the room 22 shown in the drawing. This finest product has proved very satisfactory for use
20 in the manufacture of incandescent lamp filaments.

The coarser material deposited on the lower shelves of the cupboard can be used for various purposes or can be returned to
25 the grinders and again subjected to the grinding action, and thus broken up into fine particles which will pass over into the final settling chamber. By repeatedly charging the grinders from material taken
30 from the lower shelves of the cupboard, I can gradually convert the powder into very fine form and pass it over in the final settling chamber.

As previously stated, the use of this im-
35 proved apparatus is not limited to the treatment of tungsten trioxid, but is of use in connection with many other materials. Inasmuch, however, as tungsten trioxid is, according to ordinary methods, one of the most
40 difficult materials to grind, it serves well to illustrate the application of my invention. If the grinding of tungsten trioxid is attempted in a ball mill or other similar grinder it presses together into compact nod-
45 ules, and also cakes on the balls and on the walls of the chamber, but it undergoes no apparent grinding. In fact, material so treated packs together and becomes utterly useless for lamp filament manufacture. The
50 material produced by the use of the apparatus disclosed herein is very light and fluffy and when reduced with hydrogen or other suitable reducing agent yields an extremely fine tungsten powder, well adapted for the
55 production of lamp filaments according to any one of several methods.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. The combination of a grinding chamber in which powdered material may be
60 placed, means for discharging a jet of gaseous fluid into said powder within the chamber and movable means for automatically and progressively shifting the position and
65 direction of the jet.

2. The combination of a grinding chamber in which a charge of powdered material may be placed, inlet means for introducing
70 gaseous fluid thereinto to produce a grinding action between the several particles of said powdered material in the chamber, and an automatically shifting baffle between said inlet means and the material to be ground, said chamber having an outlet.

3. The combination of a grinding cham-
75 ber for powdered material, inlet means through which a gaseous medium may be introduced into said chamber in a jet of high velocity to exert a grinding action on the powdered material, and movable means by
80 which the direction in said chamber of the incoming jet is constantly varied.

4. As a means for grinding powder, a flaring chamber in which the powder may be introduced from the top, means for dis-
85 charging a jet of gaseous fluid into the bottom of said chamber to produce a grinding action of the several particles of said powder one on another, and a ball in the path of the incoming jet and movable thereby.
90

5. The combination of a grinding chamber into which powdered material may be introduced, means for subjecting said mate-
95 rial to the grinding action of a jet of pure air and a moving object between the incoming jet of pure air and the powdered material for varying the direction of play of said jet in said chamber.

6. The combination with a closed up-
100 wardly flaring grinding chamber of means for introducing an upwardly jetting blast of gaseous fluid at the bottom thereof and means in the path of said blast and brought into effective activity by the blast itself for shifting and varying the direction of the
105 blast in said chamber.

In witness whereof I have hereunto set my hand this 17th day of August, 1907.

CARL T. FULLER.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.