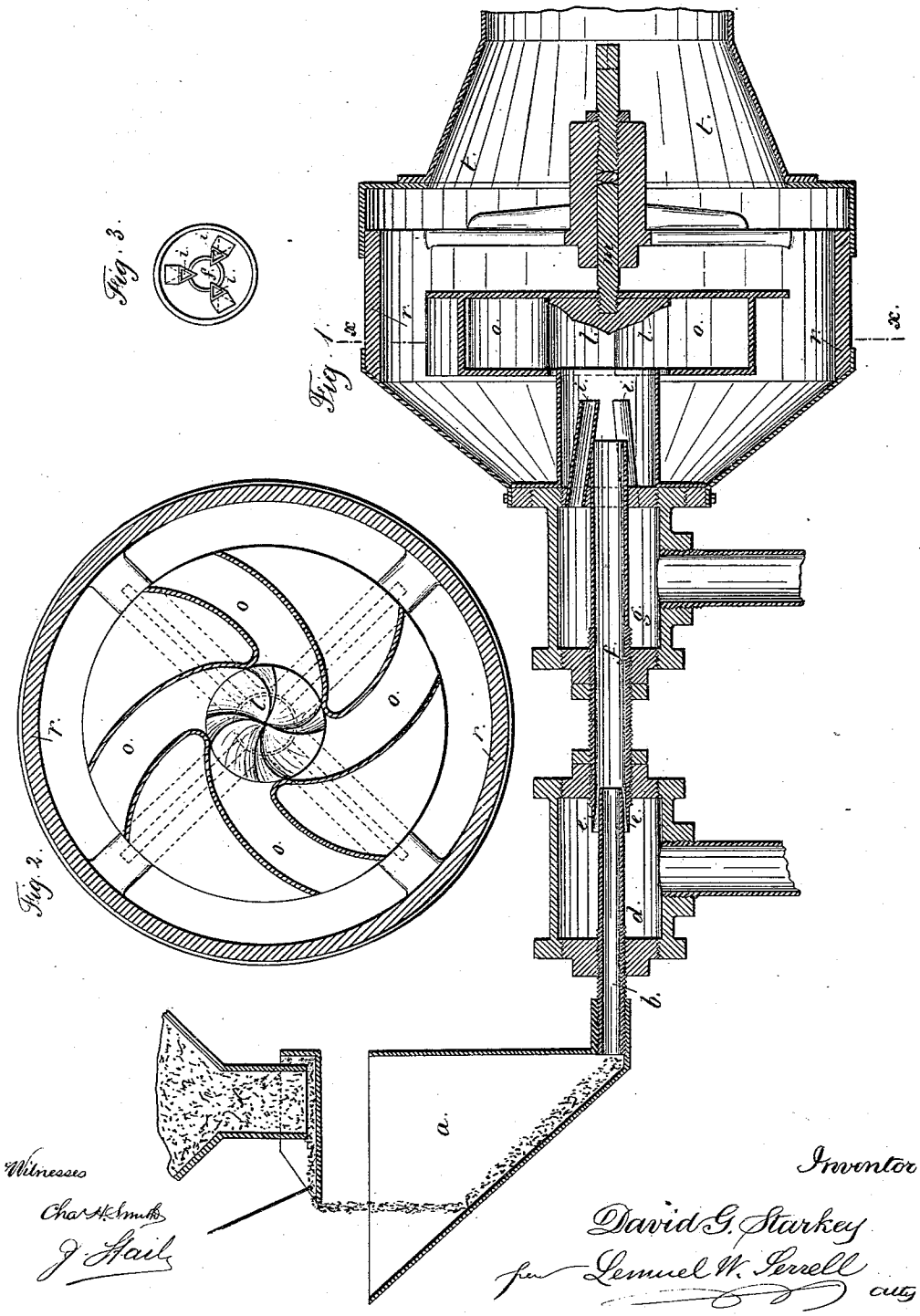
(No Model.)

D. G. STARKEY.

APPARATUS FOR PULVERIZING MINERAL AND OTHER SUBSTANCES.

No. 251,803. Patented Jan. 3, 1882.



N. PETERS Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

DAVID G. STARKEY, OF NEW YORK, N. Y.

APPARATUS FOR PULVERIZING MINERAL AND OTHER SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 251,803, dated January 3, 1882.

Application filed July 22, 1881. (No model.)

To all whom it may concern:

Be it known that I, DAVID G. STARKEY, of the city and State of New York, have invented an Improvement in Apparatus for Pulverizing Mineral and other Substances, of which the following is a specification.

A pulverizing apparatus has heretofore been made in which compressed air issuing in the form of a jet has given momentum to the material to hurl it with violence against a stationary surface.

The object of my present invention is to increase the momentum of the substance and to prevent the air intervening between the concussion-plate and the material to be shattered and forming a cushion that lessens the effectiveness of the impact. I also make use of centrifugal force to increase the velocity of the material that is being pulverized, and I bring steam into contact with such material, for a purpose hereinafter set forth.

In the drawings, Figure 1 is a longitudinal section of the apparatus complete. Fig. 2 is a section at the line *x x*, and Fig. 3 is an end view of the jet-nozzles.

The substance is supplied into a hopper, *a*, from which the same is drawn through a pipe, *b*.

Around the pipe *b* there is a chamber, *d*, with a nozzle, *e*, around the pipe *b*, and to this chamber air under a sufficient pressure is admitted, so that the issuing jet draws the material through the pipe *b* and gives to it a high momentum as it conveys it through the pipe *f*. The parts thus far described I do not claim.

The material has more or less inertia, and cannot acquire a maximum velocity by the mere contact with the issuing air, and the material tends to retard the movement of the air. I therefore provide for still further accelerating the movement of the material by bringing into contact with it a second issuing jet of fluid to impart the utmost initial velocity possible. This I accomplish by placing a second chamber, *g*, around the pipe *f*, with one or more jet-pipes, *i*, that act upon the mineral or other substances just as they are issuing from such pipe *f*.

I prefer and use three jet-nozzles of a V shape, passing partly into the pipe *f* and set at a forward inclination, and thus the jets of issuing fluid intersect the column of grain or other material and air as it passes out of the said pipe *f*, and every particle receives an additional momentum, so that when it strikes against the surface of impact the velocity will be as great as it is practicable to attain.

The issuing fluid may be air; but I prefer and use steam, either ordinary steam as it issues from a boiler or steam superheated to any desired temperature, for the reason that the steam expands as it issues, and it comes intimately into contact with both the air and the material to be shattered, it expands the air and augments its speed, and it suddenly heats the substances, and at the same time the moisture from the steam serves to promote the subsiding of the fine particles after the shattering operation takes place, and thus to lessen the waste that might otherwise take place from very fine particles floating off through the screens that are used to arrest the solid materials and allow the air and fluids to pass off. These screens are to be applied at a distance from the pulverizing apparatus. They are not shown in the drawings.

Another feature of my invention relates to a centrifugal concussion-plate, *l*, against which the material to be shattered is hurled. This plate *l* is at the end of the shaft *m*. Its surface is ribbed or channeled radially, and hence as it is revolved at a high rate of speed the corrugations or offsets are moved across the path of the issuing air or fluid and materials to be shattered, and there is a grinding action resulting from changing direction, and the particles are rolled over, and the air cannot form a cushion by its reaction; neither can the portion of the solid substance that first strikes form a cushion for the other portions of the particles; neither can one particle form a cushion for another, because it is thrown off instantly by the centrifugal force, and the centrifugalaction augments the percussive and attrition action of the material. The result is that the force expended in revolving the concussion-plate is expended in a grinding or attrition action upon the substance to be pulverized. I furthermore augment the aforesaid action by extending the centrifugal concussion-plate in the form of cycloidal trunks *o o*, that receive the air, fluid, and shattered solid material and throw off the same against the impact-ring *r*,

that surrounds the centrifugal concussion-plate. Said ring is stationary, and its interior surface may be either plain or corrugated. I prefer to use hardened steel or chilled cast-iron for both the centrifugal concussion-plate and the impact-ring, so that they will be durable.

It will be evident that the centrifugal action augments the speed of the fluids as they pass off the concussion-plate and carry with them the solid particles, because the cycloidal trunks *o o* act as blowers and draw the said substances from the center, and the action is compound of preventing accumulation of air against the concussion-plate and of augmenting the velocity of the material passing off from the concussion-plate, so that it may be shattered by contact with the impact-ring *r*, thus effecting in one apparatus the pulverization of the mineral or other substances.

It is to be understood that such material may be passed through the apparatus a second time; but usually this will be unnecessary.

It is to be understood that the centrifugal concussion-plate might be revolved by a pulley and belt; but usually that will not be necessary, as the issuing currents of air, striking against the curved inclined surfaces of the target, set the same in rotation, and the speed will be very great, because the air acts near the center of the centrifugal concussion-plate, and but little power is required to maintain the revolution. Hence the periphery of the cycloidal trunks will attain a greater velocity than the expanded air within the trunks, and the centrifugal action will be more potent than the air to hurl the particles against the stationary percussion-ring, because a greater speed will be given to the materials to be pulverized by the centrifugal action than by the air alone.

The case *t*, that conveys away the air and pulverized material, may be of any desired shape. I have shown it as conical, leading to a discharge-pipe.

I do not claim a target within a chamber detachably supported at its center, as the same had been made by others before my present invention.

I claim as my invention—

1. The combination, in an apparatus for pulverizing mineral and other substances, of a supply-pipe for such material, a nozzle for an issuing jet of air under pressure to impart an initial velocity, a straight tube leading from the first nozzle to the second nozzle, a second nozzle for fluid under pressure to issue in the same direction and augment the velocity of the material, and a concussion-plate for the material to strike against, the second nozzle being employed between the first nozzle and the concussion-plate, substantially as set forth.

2. The method herein specified of shattering mineral and other substances, consisting in imparting an initial velocity to the material by an issuing jet of fluid, then augmenting that velocity by one or more jets of fluid, and then causing the material to strike upon a concussion-plate, substantially as set forth.

3. In a pulverizing-machine, in combination with apparatus for imparting to material to be pulverized a rapid movement by an issuing current of air or fluid, a revolving centrifugal concussion-plate, substantially as set forth.

4. In a pulverizing-machine, the centrifugal concussion-plate and cycloidal trunks, in combination with the stationary percussion-ring, substantially as set forth.

5. The method herein specified of shattering mineral or other substances by imparting to the same an initial velocity by air under pressure, and then bringing steam at a high temperature and velocity into contact with such material and the air to increase the velocity and heat the air, and then arresting such material against a target for its disintegration, substantially as specified.

Signed by me this 6th day of July, A. D. 1881.

D. G. STARKEY.

Witnesses:
GEO. T. PINCKNEY,
WILLIAM G. MOTT.