(No Model.) 2 Sheets—Sheet 1.

H. COTTON.

CONSTRUCTION OF MILLS FOR GRINDING FLINT, STONE, BONE, GLAZE, &c.

No. 470,833. Patented Mar. 15, 1892.

FIG: 1.

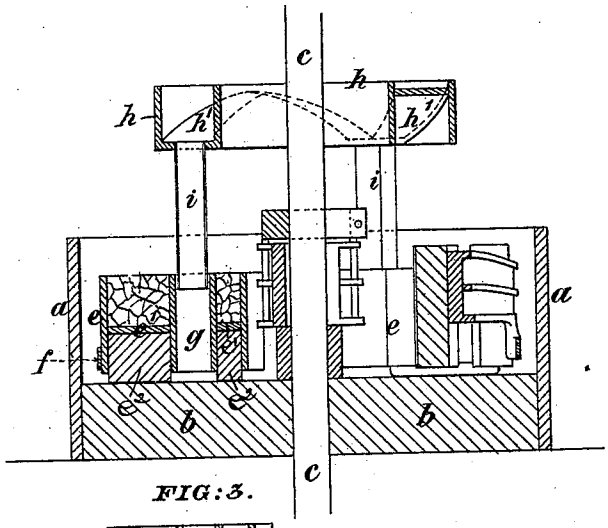


FIG: 3.

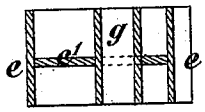
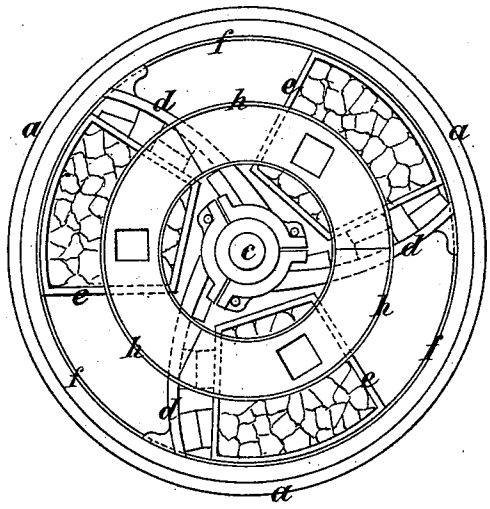


FIG: 2.



Witnesses.
John Revell
George Baumann

Inventor.
Henry Cotton
By his Attys.
Howson and Howson

(No Model.) 2 Sheets—Sheet 2.

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No. 470,833. Patented Mar. 15, 1892.

FIG: 4.

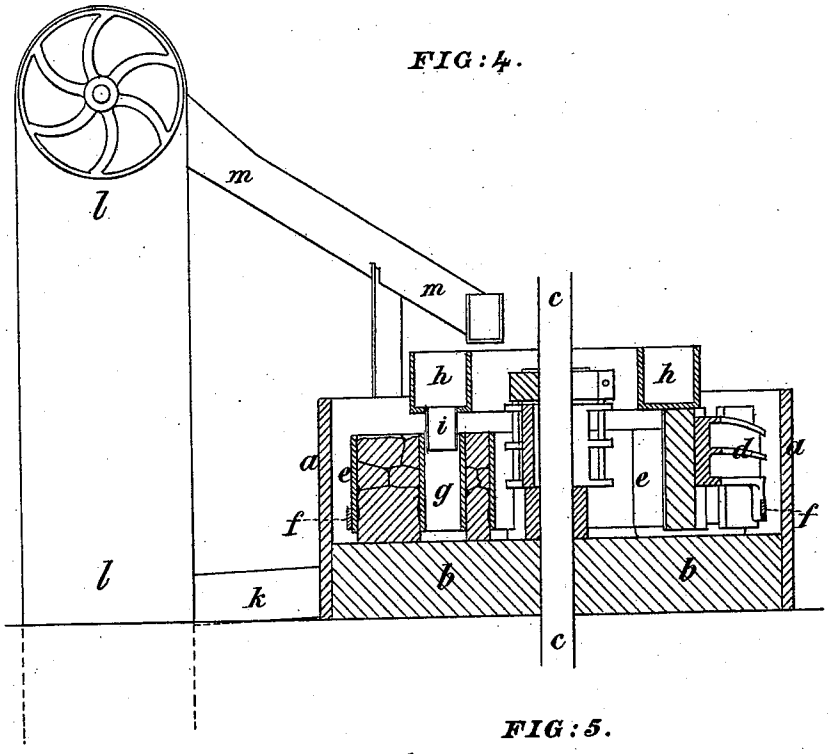

FIG: 5.

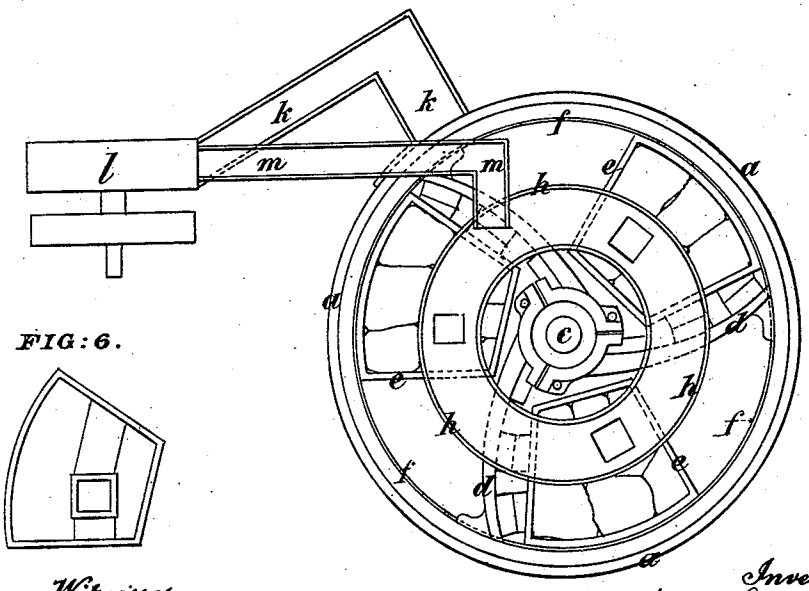

FIG: 6.

Witnesses.
John Revell
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By his Attys.
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UNITED STATES PATENT OFFICE.

HENRY COTTON, OF HANLEY, ENGLAND.

CONSTRUCTION OF MILLS FOR GRINDING FLINT, STONE, BONE, GLAZE, &c.

SPECIFICATION forming part of Letters Patent No. 470,833, dated March 15, 1892.

Application filed September 15, 1891. Serial No. 405,766. (No model.)

To all whom it may concern:

Be it known that I, HENRY COTTON, a subject of the Queen of Great Britain and Ireland, residing at Hanley, in the county of Stafford, England, have invented Improvements in the Construction of Mills for Grinding Flint, Stone, Bone, Glaze, and other Like Substances, of which the following is a specification.

This invention relates to improvements in the construction of mills, such as are employed principally for grinding flint, stone, and other materials used in the manufacture of pottery, one of the special objects of the invention being to cause the material or materials under treatment to be brought with greater certainty and frequency between the stones or runners and the bottom of the pan, and consequently to be ground or pulverized in a shorter time and with less expenditure of power than hitherto.

Another object is to diminish the cost of the runners or stones employed for grinding.

The class of grinding-mills to which my improvements are particularly applicable are constructed with a circular pan or bed of suitable diameter and material and having the bottom lined or paved with hard stones. Through the center of this pan passes a vertical shaft which is caused to revolve by suitable gearing and is provided with either curved or straight arms extending laterally or radially therefrom, by means of which large heavy stones or runners are carried or driven round in a circular track over the paved bed before described, so that the material to be operated upon is ground or pulverized between the lower faces of the moving stones and the upper surface of the paved bed. The stones or runners are kept in position by a ring of wrought-iron called the "slug-iron," which is fastened to the arms and is placed within the pan, so as to leave an annular space of about three or four inches between it and the inside of the rim or wall of the pan, into which the centrifugal force evolved by the circular motion of the stones causes the material to pass, and, as before stated, it is one of the special objects of my invention to provide means for causing the material being operated upon to be removed from this space and repeatedly placed directly between the stones or runners and the paved bed.

The nature of my said invention and the manner in which the same is to be performed or carried into practical effect will be readily understood on reference to the sheet of drawings hereunto annexed and the following explanation thereof.

Figure 1 on the drawings is a vertical section, and Fig. 2 a plan view, of a flint-grinding mill of the class above referred to, with my improvements shown as applied thereto; and Fig. 3 is a vertical section through one of the runners. Figs. 4 and 5 are similar views of a mill, showing a modification of my invention, and Fig. 6 is a plan view of one of the runners.

a is the pan; *b*, the paved bed; *c* the vertical shaft; *d*, the curved radial arms fixed thereto and propelling the runners *e*.

f is the slug-iron.

For the purposes of my invention I make the runners *e* principally of cast-iron or other suitable material, preferably with a mid-feather *e'*, as shown at Fig. 3, leaving recesses underneath, so that they may be faced or fitted with stones e^2 or other similar grinding-surface suitable to the substances to be operated upon. In the recesses above the mid-feather *e'* is placed rubber, pig-iron, or other inexpensive material, as ballast. By this means I obtain the necessary weight in the cast-iron or other material of which the runner is made, and the grinding-surface only is required to be of stone or other suitable grinding material, whereby a considerable economy is effected; or, if preferred, I sometimes make the runner in the form of an open box, (without the mid-feather,) as shown at Fig. 4, into which I drop the grinding-stones from above, and back them up with rubble, pig-iron, or other inexpensive kind of ballast or weighting material.

Through each runner *e* I form one or more conduits or pipes *g* in a vertical or nearly vertical position and as near as practicable to the inner edge thereof, the said conduits being open at the top and bottom.

About the top of the pan *a*, or at a suitable height above the same, I mount an annular trough *h*, connected to the arms *d* or to the ver-

tical shaft *c*, so that it revolves therewith. A hole is made in the bottom of this trough *h*, and a pipe *i* (preferably made of flexible material) is fitted between them (see Fig. 4) to conduct the material from the trough *h* into the conduit *g*, the bottom of the trough being preferably made with inclines *h'*, (see Fig. 1,) which cause the material to gravitate toward the holes; or, if preferred, the annular trough may be attached to and carried round with the runners *e*.

The material to be ground is introduced into the annular trough *h* with a proper proportion of water and passes by gravitation down the pipes or conduits *g* in the runners *e*, and as the latter are carried round or propelled by the arms *d* over the bed *b* the material passes out at the bottom and becomes pulverized between the face of the runners *e* and the bottom *b* of the pan *a* as it passes from the inner edge of the runners *e* to the outer edge, and thence into the annular space outside the slug-iron *f*, whence it flows along the trough K (see Figs. 4 and 5) into a cistern, from whence it is pumped or raised by an elevator *l*, or otherwise conveyed by a chute *m* back again into the before-mentioned annular trough *h* and again passes through the conduits *g* and through and under the runners *e*, and so on until it has been sufficiently ground.

By my improved means I can with advantage propel the runners at a greater speed and can use sufficient runners to cover the whole area (or nearly so) of the bottom of the pan and can use more arms than are at present employed to propel the runners, and with such facilities I can grind the material in considerably less time and with less expenditure of power than by the apparatus at present in use.

I claim as my invention—

1. A grinding-mill having a number of boxes or runners each faced with grinding-stones and weighted, each of said boxes being provided with a vertical conduit, substantially as and for the purposes set forth.

2. In a grinding-mill, the combination of boxes or runners provided with grinding-stones and having vertical conduits therethrough with a revolving annular feed-trough, and tubes leading to the said conduits from the feed-trough, substantially as and for the purposes set forth.

3. In a grinding-mill, the combination of boxes or runners provided with grinding-stones and having vertical conduits therethrough, with a revolving annular feed-trough having openings in the bottom thereof, tubes connecting the said conduits with the said openings in the feed-trough, and means for raising the partially-ground material from the bed and redelivering it into the said feed-trough, as and for the purposes set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY COTTON.

Witnesses:
ARTHUR BLAKEMAN,
ARTHUR EATON.