

Jan. 2, 1923.

J. H. MACARTNEY ET AL.
GRINDING ART,
FILED SEPT. 3, 1918.

1,441,162.

2 SHEETS—SHEET 1.

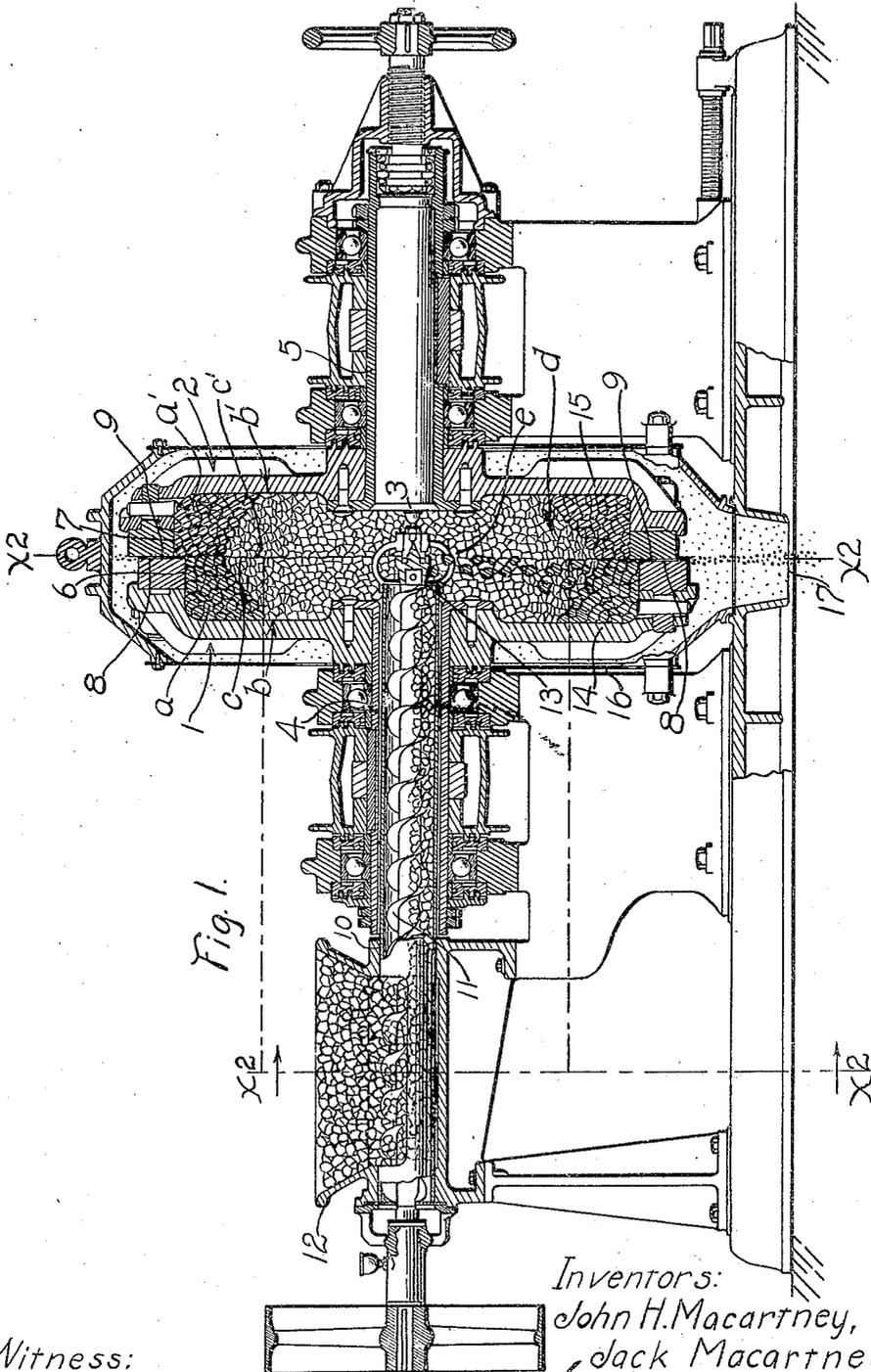


Fig. 1.

Witness:
C. C. Lux.

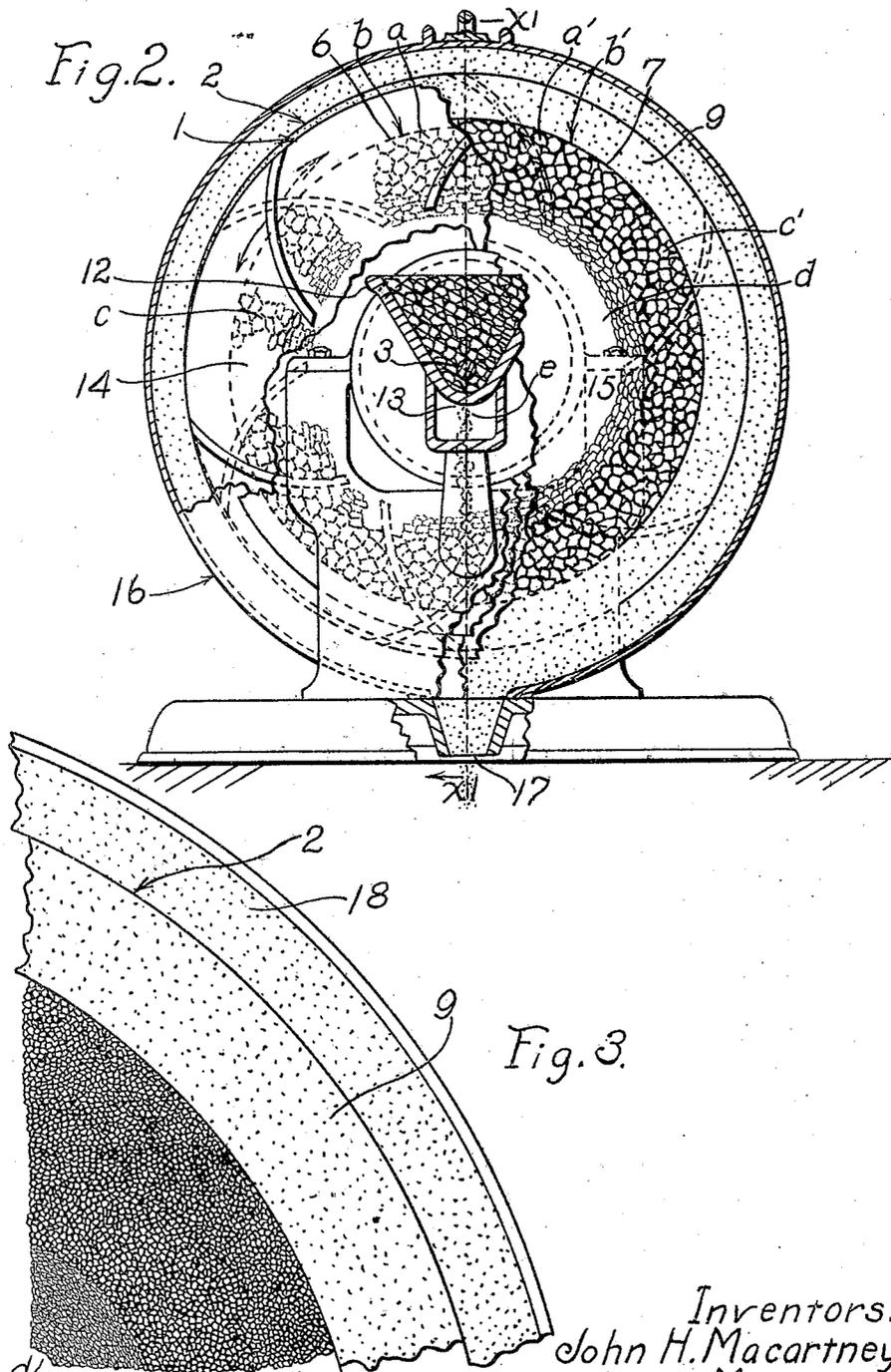
Inventors:
John H. Macartney,
Jack Macartney.
by James R. Townsend,
Their Atty.

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James R. Townsend
Their Attorneys

regulated supplying of, and setting up centrifugal force within, the separate units *a* adapted to form an annular mass *b* of broken loose material of the character to be reduced to a greater fineness, and peripherally confining the mass in direct opposition to the operation of said centrifugal force upon such units so as to give a definite cylindrical form to the annular mass, we are able to produce a practically rigid and solid body having a flat continuous grinding surface *c* and also having a centrally located cavity *d*; and that by feeding broken material as at *e*, for further reduction, and for renewing and maintaining the grinding surface; a reduction is effected with sufficient speed and effectiveness; said flat face being brought into opposition to a corresponding face correspondingly formed for the purpose of effecting the grinding.

We have also discovered that upon opposing two of such flat grinding surfaces to each other, as at *c c'*, within two containers 1, 2, spaced apart a requisite slight distance, and supplying loose material of the same character to the cavity or chamber *d* formed within said containers at a distance internally, from the periphery of the mass, such supplied material will constantly renew both annular flat grinding surfaces thus constituted, as well as supply material to produce the requisite product; with maximized speed and minimized expenditure of power.

The size of the interior chamber into which the fresh broken material may be fed will enlarge or diminish according to the relative speeds of feeding and grinding. Increasing the feed, decreases the cavity, and vice versa if the speed of the grinders remain constant.

Our new method of grinding or crushing loose or broken material includes utilizing a regulated feed, centrifugal force and a force counter thereto to gather such material into, and hold such material in, a mass or masses flat faced and annular subjected to the rotative action by which the requisite centrifugal force is generated. This may be understood by reference to the drawings in which 1, 2, indicate hollow rotating heads containing masses *b, b'*, of broken material, the separate units *a*, of which are subject to the action of centrifugal force through the revolution of the masses *b, b'*, practically about a common locus 3, within the field or fields of revolution. The heads are shown as being revolved on axes 4, 5, that are eccentric to each other, so that the grinding faces will be relatively oscillated as well as relatively revolved. The regulated feed is indicated by the annular form of the masses.

The restraining or intercepting force which is opposed to the centrifugal force may be a component of any character effective to that end, and is indicated by the an-

nular rim walls 6, 7, by which it is understood the forms of the grinding surfaces will be determined. Each surface will vary in form and shape depending upon the speed of revolution of the mass or masses constituting such surface or surfaces, and said grinding surfaces at *c, c'*, of the two revolving bodies *b, b'*, of broken material will be extended approximately equidistant from a medial plane between the revolving bodies of material. The opposing faces 8, 9, of the rim walls 6, 7, are spaced apart according to the fineness of product desired.

The peripheral restraining means represented by the rim walls may be of any suitable character adapted to hold the material in opposition to the centrifugal forces set up in the two annular bodies respectively.

The two masses *b, b'*, are so placed that their grinding surfaces cooperate to grind the material supplied to the interposed cavity or chamber within them.

In the drawing, the masses are shown as revolving on or about a horizontal axis indicated at 3, and conveyor means comprising a tubular shaft 10, and a screw conveyor 11, which elements are means indicated for the purpose of supplying material from a hopper 12, to a central port 13, which is located at or about the medial plane of revolution so that the material that is fed into the chamber while said containers are being revolved in opposite directions, will take on motion immediately; whereby the broken material is put into a revolving state in two annular masses, the constituents of which are brought under control of centrifugal forces that operate at right angles to the axis of revolution, with the result that material being supplied to the interior of the chamber formed by the two containers forms the oppositely rotating annular contacting faces that become triturated and ground by the action of the rigid masses of material and the interposed loose units upon each other, and to form the central feed chamber.

The material being thus delivered at the medial plane or the meeting plane between the two grinding faces thus formed, at once serves to augment the grinding faces, and the innermost material will apply force to the pieces or separate units of material nearer the periphery to drive them directly outward; and also, by the resolution of forces, to drive such pieces or units from one side of the medial plane towards the mass on the other side of such medial plane, and vice versa; so that the centrifugal force not only acts to provide a practically solid and rigid grinding surface, but it also acts to cause the surfaces to deviate from a direction at right angles to the axis, so that at the medial plane near the periphery there is grinding not only of the surfaces formed

by the peripherally restrained, centrifugally impelled, pieces; but there is also caused a grinding action of piece upon piece at the medial plane.

5 The peripheral restraining means shown, are in the form of annuli, fixed by webs 14, 15, to the shafts 4, 5, by which they are revolved.

10 Said webs form end walls to restrain the material from displacement in directions parallel to the axis of revolution and are spaced apart from the plane of the opposite faces of the rim walls sufficiently to provide the cavity necessary to accommodate the

15 requisite grinding body or mass.

In the drawings the operation is indicated as being performed in such manner that the centrifugal lines of force act in vertical planes thereby causing that distribution of the gravity fed material within the chamber or cavity inside the revolving bodies or masses, to occur without gravitational deflection from one to the other side of the meeting or medial plane where the pulverization is effected. Thus the chamber formed within the mass contained within the adjacent containers, and the distribution of the material to the field where it is given the rotary motion by which centrifugal force is generated and applied to bring the material

20 into a rigid and practically solid form and to impose upon the mass the character of solidity, is made symmetrical and the operation is conducted with all the elements in proper balance.

25 The discharge of the fine product thus also occurs in a vertical plane all around the rim walls and such product may be collected by a housing 16, and therefrom is gravitationally discharged through the bottom outlet 17, into any receiver, not shown.

30 By thus impelling under centrifugal force masses of broken material to be pulverized, and restraining such material at a distance from the center of impulsion to form relatively revolving rigid bodies having opposed grinding surfaces within containers the opposed rim walls of which are spaced apart to allow discharge of fine material only between the outer rims of such grinding surfaces and their containers, the grinding is effected without attrition upon the apparatus by the material to be ground; and by imposing upon the two bodies of material, fields of revolution that are eccentric to each other, a criss-cross rubbing effect is secured so as to avoid scoring effects.

35 As the separate units are thus acted upon by centrifugal force they are caused to revolve or rotate more or less upon their individual center or centers of gravity, thus to facilitate disintegration and pulverization.

40 By revolving the masses of broken material about a horizontal axis and feeding

fresh broken material that is to be pulverized or reduced, centrally into said chamber, the material is caused to pass by force of gravity along the radii of the chamber until it contacts with the inner periphery of the containers, the material will at once build up a lining inside the containers and such lining is constantly renewed, in a symmetrical manner by reason of the supplying of fresh loose units of the material centrally between the opposed linings.

45 The outlet between the two rim walls may be adjusted as desired to change the fineness.

In Figs. 1 and 2 the units a to be crushed are represented as consisting of broken rock of an average size as may be desired in reduction of ore, paint, clay or stone for any purpose requiring the material to be ground.

50 In Fig. 3 the units a'' have been reduced to a much greater fineness.

The product is indicated at 18 and may be in the nature of fine dust if the grinding is done dry or in the nature of suspensions if the grinding is done wet.

55 The speed of revolution must be such as to generate the requisite centrifugal force. Otherwise the work will not be effective.

A speed of from about 800 to 1200 revolutions more or less per minute is found to be effective, and the speed of the feed will be made to correspond thereto, due consideration being given to the character of the material so as to form the annular grinding surfaces according to the principles herebefore set forth.

We claim:—

1. The method of pulverizing material, which consists in impelling under centrifugal force masses of broken material to be pulverized, and restraining such material at a distance from the center of impulsion to form relatively revolving circular rigid bodies having continuously opposed grinding surfaces, and allowing the discharge of fine material only between the outer rims of such surfaces, and supplying fresh material to said grinding surfaces at the point of contact between such bodies.

2. In the art of pulverizing material method of forming a disc grinder which consists in impelling under centrifugal force masses of broken material to be pulverized, and restraining such material at a distance from the center of impulsion to form a revolving circular rigid body having its grinding surface continuously in a plane perpendicular to its axis of rotation, and supplying fresh material at the axial center of the medial plane of said grinding surface.

3. The method of grinding or crushing loose or broken material by utilizing centrifugal force and a force normal thereto to gather such material into and to hold it

into annular mass and causing the material of one annular mass to continuously grind against the material of another similar mass, and supplying fresh material at the axial center of the medial plane of said annular masses. 65

4. The method of forming broken or loose material into a grinder which consists in subjecting such material to the action of centrifugal force within a revolving peripheral restrainer, and bringing a plurality of such grinders into contact with each other while revolving so as to form a continuous grinding surface, and supplying fresh material at the axial center of the medial plane of said grinding surface. 70

5. The method of forming grinding apparatus out of loose or broken rock or other material by subjecting such material to the action of centrifugal force and a force normal thereto, forming a plurality of rigid masses, and bringing a plurality of such masses into contact with each while each is revolving on its own axis; so that such rock or other material will be ground or crushed by action of component units of one of such masses upon component units of another of such masses and thereby form a continuous grinding surface between said masses, and supplying fresh material at the axial center of the medial plane of said rotating masses. 75

6. The method of grinding material substantially set forth which comprises subjecting two masses of said material to the action of centrifugal force, restraining said material in such a manner that each of said masses forms a separate, continuous grinding surface, said two masses being so placed that their grinding surfaces cooperate to grind the material therebetween and supplying fresh material to such masses at their grinding surfaces. 80

7. The method set forth of grinding material which consists in revolving two peripherally restrained masses of broken material about a common axis, the axis of revolution of each mass being horizontal, and thereby generating sufficient centrifugal force to form said bodies respectively into annular grinders; spacing the adjacent faces of the grinders apart to allow fine material to pass out at the rim; and causing fresh broken material to pass to the bodies at the medial plane between such bodies. 85

8. The method set forth of grinding loose or broken material which consists in holding such loose or broken material by means of centrifugal force within two opposite revolving containers in such a manner that for all practical purposes a continual grind- 90

ing action takes place between the two masses of such material itself and not between such masses of material and their respective containers, and supplying fresh broken material to said masses at the axial center of the medial plane of the rotating masses. 65

9. The method substantially set forth of holding loose or broken peripherally restrained material in place by centrifugal force so that such loose or broken material may be continuously ground against a similar mass of said material held in like manner so that neither mass has any grinding action upon its respective container and supplying fresh material to said masses at the axial center of the medial plane of said revolving masses. 70

10. The method set forth of grinding loose or broken material within opposed containers in which the material to be ground is held in place within such containers by centrifugal force in such manner that such material forms a protective lining for such containers and by the action of such centrifugal force such material is gathered and formed into crushing or grinding masses having annular faces which continuously act upon each other to crush or grind such material and supplying fresh material to said masses at the axial center of the medial plane of said grinding masses. 75

11. The method of pulverizing material, which consists in impelling under centrifugal force broken material to be pulverized, restraining said material at a distance from the center of impulsion into annular masses to form said masses respectively into continuous annular grinders; supplying fresh broken material at the axial center of the medial plane between said masses and allowing the discharge of the pulverized material only between the outer rims of the restraining means. 85

12. The method of grinding material which consists of forming by centrifugal force two oppositely revolving masses of the material to be ground, which serve as continuous grinders; supplying fresh material to said grinders at the axial center of the medial plane of said masses, and allowing ground material only to peripherally pass out between said masses. 90

In witness whereof, we have hereunto set our hands at Los Angeles, California, this 10th day of August, 1918. 115

JOHN H. MACARTNEY.
JACK MACARTNEY.

Witness:

JAMES R. TOWNSEND.