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APPARATUS FOR SUBDIVIDING MATERIAL

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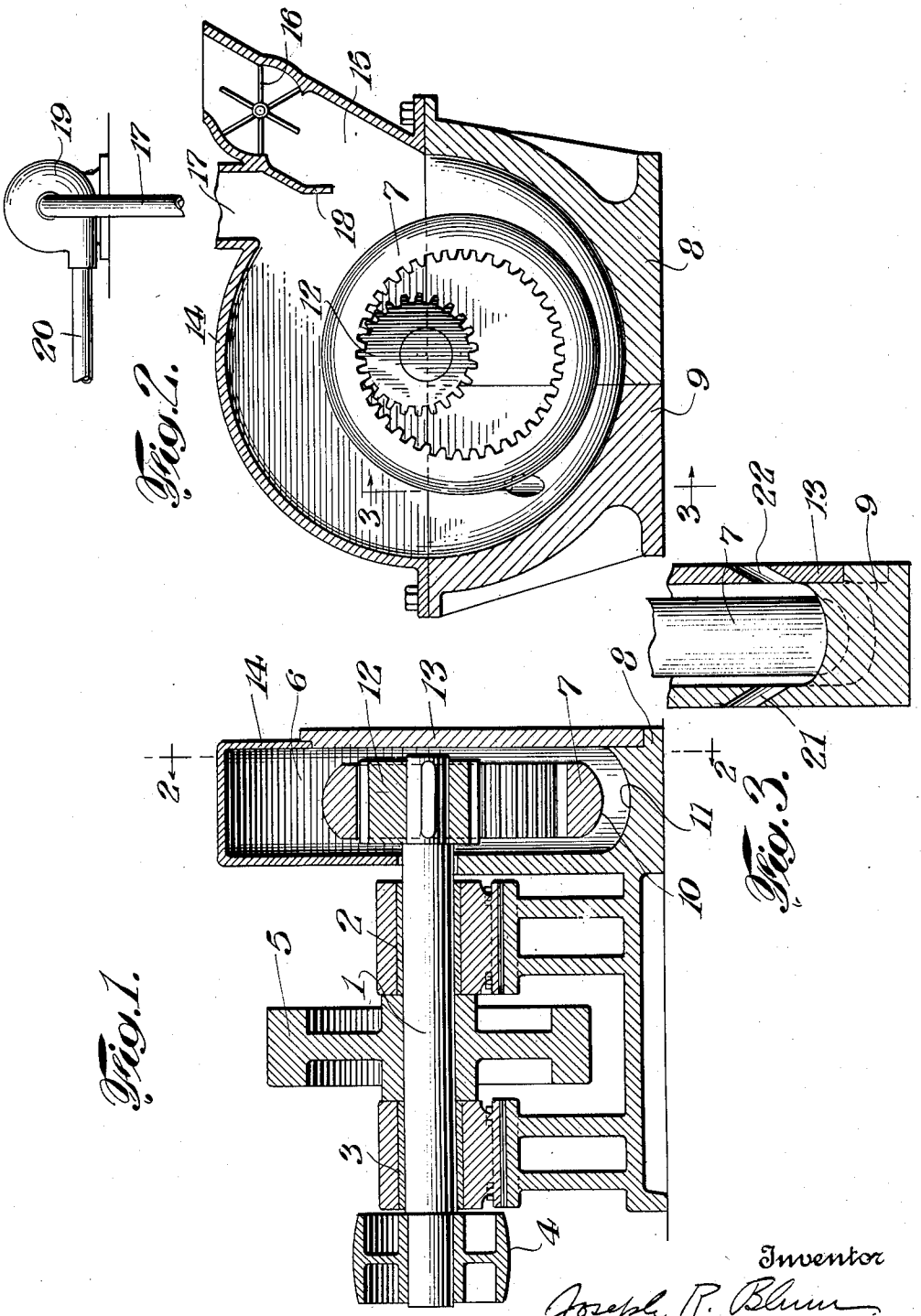


Fig. 2.

Fig. 3.

Fig. 1.

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APPARATUS FOR SUBDIVIDING MATERIAL

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10 Claims. (Cl. 83—9)

The present invention relates to apparatus, sometimes called a disintegrator, for subdividing frangible material for the purpose of reducing the same to particles of desired fineness; the principal object of the invention being to provide a simple, rugged apparatus which will have the capacity for subdividing such material by abrasive action as well as by impact. It is contemplated that the invention may find its greatest usefulness in connection with the pulverizing of coal or the like, and particular reference to such use of the apparatus will be made in connection with the following description, although other practicable uses of the described apparatus will be apparent to those skilled in the art.

One of the more efficient methods of burning coal includes the introduction of the coal into the fire box of a suitably designed furnace in a finely divided condition and, in effect, suspended in a stream of air which provides a part if not all of the oxygen required for the complete combustion of the coal. Various types of apparatus for reducing coal to the necessary degree of fineness are used but many types of such apparatus are objectionable because of the relatively high speed at which they must be operated, because of the number of moving parts or because of the power required for operation. Moreover certain types of such apparatus are relatively inflexible and incapable of efficient operation at varying speeds or capacities necessitated by the variation in steam consumption from the boilers or varying demands upon furnaces in connection with which they are used. It will appear from the following description of a preferred illustrative embodiment of the present invention that these disadvantages have been largely overcome by means of the present apparatus.

In the accompanying drawing

Figure 1 is a longitudinal section of apparatus embodying the present invention,

Figure 2 is a cross section on the line 2—2 of Figure 1, and

Figure 3 is a section on the line 3—3 of Figure 2.

Referring to the drawing, a shaft 1 of ample dimensions is journaled in heavy bearings 2 and 3 which are arranged for vertical adjustment relative to the main frame of the apparatus. Fastened to this shaft is a drive pulley 4 and a fly wheel 5. One end of the shaft 1 projects into a chamber 6 wherein the frangible material is subjected to treatment.

Within the chamber 6 the active elements of the apparatus are mounted for movement relatively to each other to effect the desired action upon the material to be treated. Means are provided to impart to the two active elements of the apparatus a relative linear movement with respect to each other as well as movement toward and from each other, thus enabling the material to be subjected to an abrasive action as well as a crushing action and thus securing the advantageous results of abrasion and impact upon the materials.

In the present embodiment of the invention the movable or "hammer" element of the pulverizer takes the form of an annular member 7 while the stationary element or "anvil" comprises two rugged castings 8 and 9. The cooperating surfaces of the hammer and anvil are preferably so formed as to provide a space between them of dimensions increasing in all directions from a single point where the two elements most closely approach each other. Herein the surface of the anvil is formed upon two intersecting arcs of greater radius than the two corresponding arcs of the face of the hammer element. This is clearly observable in Figure 1 where it will be seen that the face 10 of the hammer element is formed in cross section upon the arc of the circle having a less radius than the surface 11 of the anvil, and in Figure 2 it will be observed that the radius of the hammer element 7 is less than the radius of the anvil element. Such a design of the cooperating faces of the hammer and anvil insures the displacement of material fed between the two and overcomes any tendency of the material to become compacted between the two elements.

In order to impart to the annular hammer element the desired reciprocating and linear movement with respect to the anvil, it may be mounted upon an eccentric 12 fast to one end of the shaft 1 as shown in the accompanying drawing. The periphery of the eccentric contacting with the inner face of the annular hammer will impart rotary motion to the hammer while the variation in distance from the axis of the shaft to the periphery of the eccentric will impart a reciprocatory motion to the hammer in a vertical direction. Due to the fact that the line of contact between the eccentric and the annular hammer will move from one side to the other of a vertical plane through the axis of the shaft 1, a rocking or swinging motion will also be imparted to the hammer element. If desired, the inner face of the hammer and the periphery of the eccentric may be provided with gear teeth as shown but frictional contact between smooth surfaces may be entirely sufficient to insure the continued rota-

tion of the hammer 7. The minimum clearance between hammer and anvil may be varied by raising or lowering the main shaft 1.

The chamber 6 previously referred to is formed by the anvil castings, a heavy face plate 13 and a housing 14. At one side of the housing 14 a passage 15 is formed for the introduction of material to be treated and this passage is preferably provided with a multiple flap valve 16 mounted for rotation to govern the rate of feed of the material to the apparatus and also to prevent, except as hereinafter described, the ingress of air to the apparatus when it is used as a pulverizer. The feeder 16 may be rotated at any desired speed to govern the rate of feed. A discharge opening 17 is formed at any appropriate point in the housing 14 herein shown, adjacent the feed opening 15 and separated therefrom by a baffle plate 18. When used as a coal pulverizer this discharge opening may be suitably connected with the inlet side of a suction fan or blower 19 the outlet of which is suitably connected through a conduit 20 with the fire box of a furnace.

Air ports 21 and 22 are formed respectively in the anvil casting 9 and face plate 13 so that the action of the blower 19 will induce a strong current of air therethrough directing it through the material which has been subjected to the action of the hammer 7 and anvil 8, 9.

Assuming that the apparatus is used for the purpose of pulverizing coal its operation may be explained as follows: The rotation of the main shaft 1 will, as before described, impart to the annular hammer 7 a combined rotary and reciprocating motion, the fly wheel 5 assisting in maintaining a constant speed for the apparatus irrespective of the varying power consumption thereof. If desired, the fly wheel may be counterbalanced relatively to the position of the eccentric 12. The annular hammer 7 is so designed that its weight will be sufficient to crush the hardest lump of material which may be introduced between it and the anvil. With the hammer in operation the rotary feeder 16 may be operated to feed coal at the desired rate into the chamber 6. The coal will fall to the right of the hammer in Figure 2 toward the point of minimum clearance between hammer and anvil and as the larger lumps approach this point, they will be subjected to the impact of the hammer as well as to constant abrasion, thus producing from the mass of coal fine particles which will be caught up by the stream of air entering through ports 21 and 22 and carried upward toward the top of the housing. Due to the combined effect of abrasion and impact the apparatus may be operated at a comparatively low speed. The particles which are sufficiently fine will be entrained with this stream of air and carried through the discharge opening 17 to blower 19 and the conduit 20 to the fire box. Particles which are not sufficiently fine to be entrained by the air current will return to the zone of action between hammer and anvil. The continued rotation of the hammer 7 in addition to abrading the coal acts to feed the same to the left in Figure 2 past the air ports 21 and 22.

In the event that it is not desired to reduce the material to such fineness that it may be removed by a current of air, the anvil casting 9 may be dispensed with and the material allowed to feed out from between the hammer and anvil 8 by gravity.

It is to be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention:

1. In apparatus for subdividing material, the combination of two relatively movable members having surfaces diverging from each other in all directions from a common point, and means to rotate and reciprocate one of said members with respect to the other.

2. In apparatus for subdividing material, the combination of two relatively movable members having surfaces diverging from each other in all directions from a common point, and means to impart relative reciprocatory and rotary movement to said members.

3. In apparatus for subdividing material, the combination of material feeding means, means including a driven member and providing two relatively movable cooperating surfaces between which the material is fed, and a driving member with a portion of its surface normally spaced from the driven member and operatively related thereto to impart continuous relative rotary and reciprocatory motion to said surfaces simultaneously.

4. In apparatus for subdividing material, the combination of material feeding means, means including a driven member and providing two relatively movable cooperating surfaces between which the material is fed, a housing enclosing said means, a driving member with a portion of its surface normally spaced from the driven member and operatively related thereto to impart continuous relative rotary motion and curvilinear motion toward and away from each other to said surfaces simultaneously, and means to induce a current of a fluid medium through said housing to remove finely divided material therefrom.

5. In apparatus for subdividing material, the combination of an annular movable member, a cooperating stationary member, means to introduce material therebetween, and means to rotate the annular member and move the same bodily in a curvilinear path toward and away from the stationary member.

6. In apparatus for subdividing material, the combination of an annular movable member, a cooperating stationary member, an eccentric engaging the inner surface of said annular member with a portion of its surface normally out of engagement with said inner surface, and means for rotating said eccentric to impart a rotary and curvilinear motion to the annular member relatively to the stationary member.

7. In apparatus for subdividing material the combination of a casing providing a fixed grinding surface, an eccentric arranged within said casing for rotation in a vertical plane, and a grinding ring carried by and adapted to roll on said eccentric, said ring having a grinding surface spaced at all points from said fixed grinding surface, the arrangement being such that rotation of the eccentric causes said ring to rotate about its axis.

8. In apparatus for subdividing material, the combination of an annular grinding member, a co-operating grinding member, means to introduce material between the grinding members, means to rotate the annular member substantially continuously about its axis and to revolve said annular member about another axis, causing movement toward and away from said co-operating grinding member.

9. In apparatus for subdividing material, the combination of an annular grinding member, a co-operating grinding member, means to intro-

duce material between the grinding members, and a rotatable eccentric engaging and having substantially continuously moving contact relative to the inner surface of said annular grinding member to cause said annular member to rotate about its own axis and to revolve in the same direction about another axis.

10. In apparatus for subdividing material, the combination of a casing providing a fixed grinding surface, an eccentric arranged within the casing for rotation therein, an annular grinding ring having an inner diameter greater than the external diameter of the eccentric and surrounding and engaging the eccentric to provide a flexible driving connection, a grinding surface on said ring which is spaced at all points from said fixed grinding surface, and means for rotating the eccentric to impart movement to the grinding ring relative to the fixed grinding surface.

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