Feb. 27, 1934. G. W. BORTON 1,948,504

CRUSHING MACHINERY

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Fig. 1.

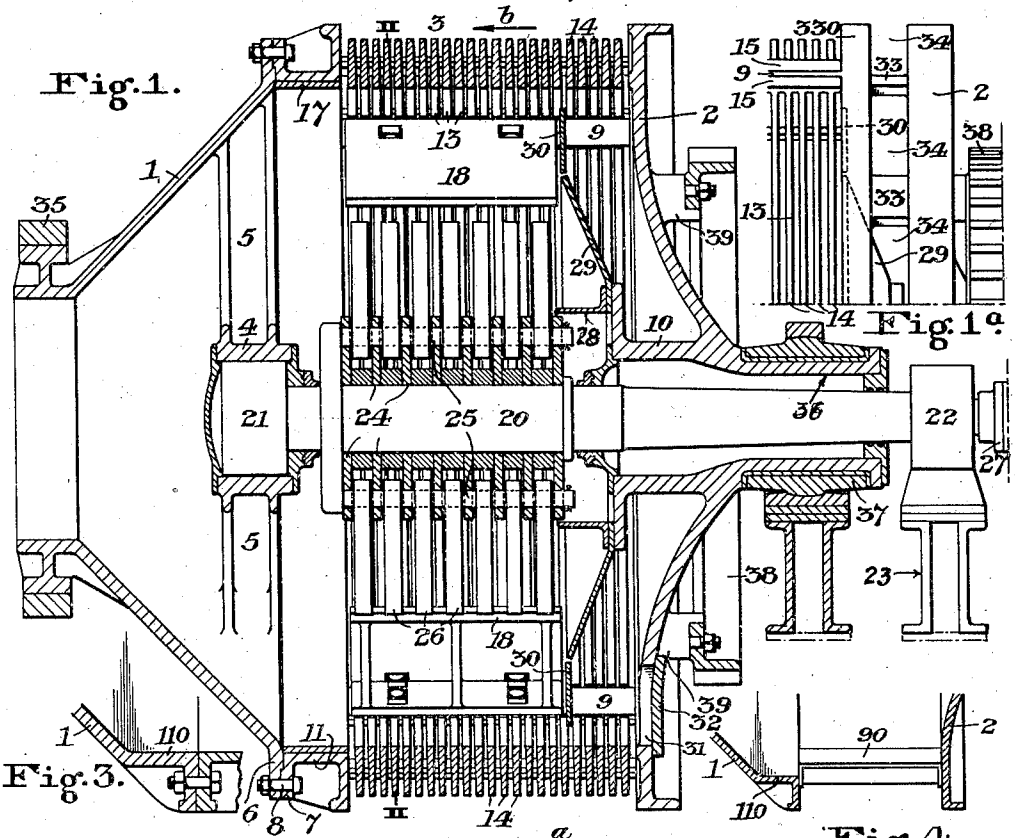
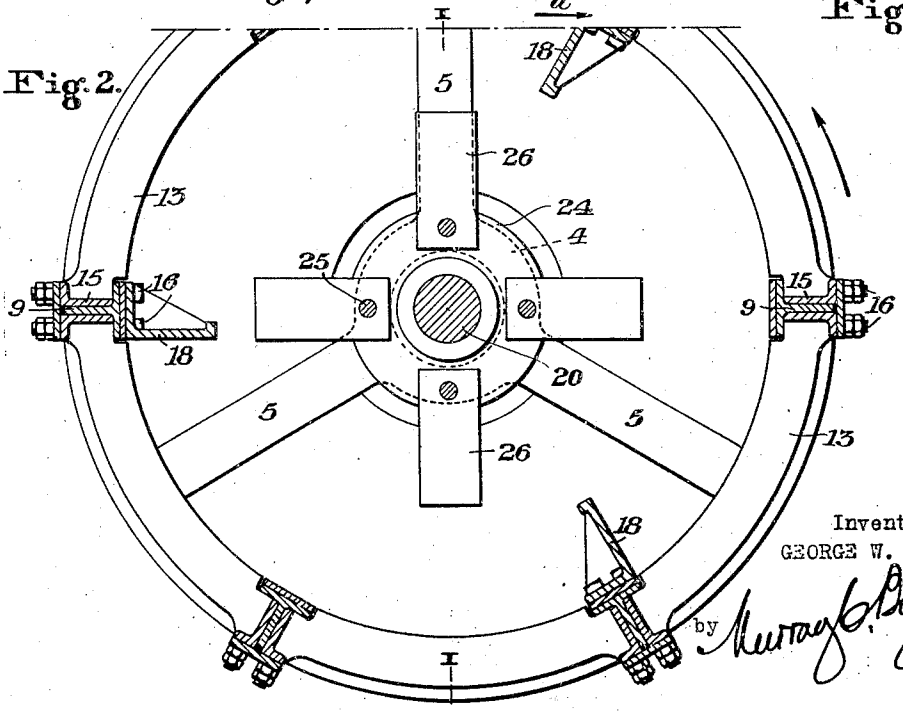


Fig. 1a.

Fig. 3.

Fig. 4.

Fig. 2.



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CRUSHING MACHINERY

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2 Claims. (Cl. 83—11)

My invention relates to apparatus for breaking, crushing, or comminuting various materials such as ore, rock, coal and/or the like.

My invention comprises improved apparatus well adapted for the free reception of material to be crushed or broken, which may be run-of-mine or other size initially, and it includes a rotatable drum which may be of relatively large diameter having circular or annular end members or frames which may be of special conformation, and a peripheral wall disposed between said end frames. The peripheral wall may be partially or wholly apertured for the discharge of the broken material, and for such purpose this wall may include screen sections of suitable character. These screen sections may be apertured plates of any usual type, and/or they may be in the form of integral frames with spaced bars, which bars may be arranged circumferentially of the wall of the drum or parallel with the longitudinal axis thereof, as may be necessary or desirable in connection with the particular material being crushed. The screen plates, or the grids, are supported by longitudinal members forming part of the drum structure, and these longitudinal members may be integral with one or both of the end members or frames making up the drum, or they may be in the form of structural members such as I- or T-beams, connecting said end frames or members and holding the same in spaced relation. One of the end frames or members may have the shape of the frustum of a cone in longitudinal section and serve as the chute or hopper for the delivery of material to the crushing chamber, and both end frames or members may be provided with trunnions or other suitable supports whereby the drum may be mounted for rotation. With this drum I employ a hammer-carrying rotor structure, and one of the end frames or members may be provided with a support receiving a bearing for the shaft carrying such rotor structure. The rotor structure may rotate in the same direction as the drum, but at a much greater speed.

In addition, the crushing chamber provided by the drum is equipped with lifting shelves, which may be adjustably mounted, whereby material delivered to such crushing chamber, preferably through the cone-shaped receiving end, may be continually lifted and dropped in the path of the hammers for impact thereby until broken to a size that will freely pass through the screen plates or the spaces between the bars of the grid section when the latter are employed. The lifting shelves may be mounted for angular adjustment longitudinally and radially of the drum.

A further object of my invention is to provide a structure of the general type referred to, with outboard shafts supporting the drum and the hammer-carrying rotor disposed within the same; one of said shafts being hollow and carrying bearings for the other shaft, and both drum and rotor being mounted for rotation in space at the ends of the respective shafts.

A further object of my invention is to provide means within the crushing chamber provided by the drum for trapping, collecting, and/or discharging foreign material, tramp iron and the like, accompanying the material undergoing crushing.

And a still further object of my invention is to provide means for moving such foreign material, tramp iron, and/or the like, into an annular space at the end of the drum opposite the receiving end thereof.

These and other features of my invention are more fully disclosed hereinafter; reference being had to the accompanying drawing, more or less diagrammatic in character, in which:

Figure 1 is a sectional elevation on the line I—I, Fig. 2, of one form of crushing chamber within the scope of my invention; such view looking in the direction of the arrow *a*.

Fig. 1*a* is a fragmentary view illustrating a detail of my invention.

Fig. 2 is a cross-sectional elevation on the line II—II, Fig. 1; looking in the direction of the arrow *b*, and

Figs. 3 and 4 are fragmentary views illustrating details and modifications of construction within the scope of my invention.

My improved crushing apparatus comprises a rotatable drum, with openings in the peripheral wall for discharge of the crushed material, and end frames or members connected thereto and provided with supporting means mounted in suitable bearings so that such drum may be freely rotated. In some instances, the screen supporting portions of the peripheral wall of the drum may be integral with one or both of the end frames, and in other instances the end frames may be connected by longitudinal beams which, in turn, support the screen plates or grids. In most instances, the longitudinal connections will provide spaces arranged circumferentially of the drum and adapted for the reception of screen plates, or grids made up of spaced bars, through which the material, when broken to the desired size, may be discharged.

In the forms of structures illustrated in Figs. 1 and 2, et seq., the end walls or members are indicated at 1 and 2, and the peripheral wall is indicated generally at 3. The end wall 1 may be in the form of a frustum of a cone in longitudinal section, provided with a central feed opening, and it may have a spider at its point of greatest diameter; such spider comprising a hub 4, having a series of arms 5, of which there may be three, and in some instances this hub may provide a bearing support. The end frame 1 has an annular flange 6, to which a complemental flange 7 on the peripheral portion of the drum may be secured, as by bolts 8. The frame or wall 2 at the opposite end of the drum is illustrated in Fig. 1 as being integral with longitudinal members 9 forming part of the peripheral wall, and such end wall may be provided with a central hub 10. The peripheral wall 3 may include a substantially imperforate portion 11, to the left of Fig. 1; the longitudinal ribs or bridging members 9 connecting such portion 11 to the end wall 2. When independent longitudinal members are employed to connect the frames 1 and 2, the cone-shaped end 1 may include a peripheral wall portion 110, to which said longitudinal members are secured, as indicated in Figs. 3 and 4.

The longitudinal ribs or bridging members 9 (or 90) are spaced apart circumferentially of the drum and provide openings for the reception of screen plates of usual type, or grids 13; the latter being in the form of interchangeable cast steel segments, which may have deep V-shaped bars 14 disposed in spaced relation and providing slots which, in the structure illustrated in Figs. 1 and 2, are arranged circumferentially of the peripheral wall of the drum. These grid segments may have flanged ends 15 which fit against the webs of the longitudinal ribs or members 9 and may be secured thereto by suitable bolts 16. When separate longitudinal members or beams are employed to connect the end frames or members, as shown at 90 in Fig. 4, the screen plates, or the grids, through which the broken material is discharged, may be secured thereto in a similar manner. The portion 11 of the peripheral wall of the drum shown in Fig. 1 may be imperforate and it is preferably provided with wear plates or liners 17, and the portion 110 of the cone-shaped end member 1 of the type illustrated in Fig. 4 may also be provided with wear liners, secured in place in the same manner as those indicated at 17.

While I have referred to the portion 11 (and the portion 110) of the peripheral wall of the drum as being substantially imperforate, it will be understood that such portion of the wall, as well as the wear liners or plates mounted thereon may be apertured for the discharge of material broken within the drum, or the fines accompanying such material and delivered thereto through the cone-shaped feed end. In like manner, the wall of this cone-shaped feed may be apertured so that the finer portions of the material not requiring crushing may pass therethrough before entering the crushing chamber of the drum.

The drum carries a series of lifting shelves 18, which may be radially disposed, or they may be inclined at a suitable angle with respect to radial planes passing through the axis of rotation. These shelves may be arranged opposite certain or all of the longitudinal ribs 9 (or the beams 90) of the drum, to which they may be secured by the bolts 16 which hold the screen plates or the grids in position. While in general practice the lifting shelves will be fixed with respect to the peripheral wall of the drum when the desired angle is developed, I may arrange them for adjustment with respect to said wall. The speed at which the drum rotates is a factor in its successful operation, and this factor also determines the height to which the shelves will carry the material. It may be desirable to carry certain material to a different height than other materials in order to secure the desired reduction effected by the impact of the rotating hammers; the essential point being to carry the material to a height whereby it will fall from the shelves into the hammer zone at the proper point to insure the desired reduction; such hammers hurling the material tangentially against the inner wall of the drum at one point of engagement and such material rebounding from the wall of the drum at another angle and dropping into the hammer zone for further reduction, which cycle of operation will be repeated until the desired comminution has been effected.

While only three shelves are shown in the structure illustrated in Figs. 1 and 2, it will be understood that I may employ the number necessary to effect such lifting of the material as will insure proper delivery to the hammers for economic reduction; a condition closely related to the volume of feed and the length of the crushing chamber, as well as the speed of the drum carrying the shelves and the speed of the hammers which act upon the falling material. It is desirable that the discharge of broken material from the drum should be such that substantially no unbroken material backs up against the wall 2.

Centrally of the drum a shaft 20 is mounted; such shaft passing through the hub 10 of the end wall 2, and being preferably journaled in roller bearings 21 and 22. The bearing 21 is mounted in the hub 4 carrying the spider arms 5, while the bearing 22 is arranged externally of the apparatus and may be carried by a suitable support 23. The bearings 21 and 22, should be in axial alignment with the drum so that while the latter is rotating, the bearing 21 may function properly. The shaft 20 supports a rotor structure of usual hammermill type, which may comprise spaced disks 24, supporting rods 25, and hammers 26 hung from such supporting rods. The shaft 20 may be driven by suitable means (not shown), which may be connected at 27 to the end of said shaft beyond the bearing 22. It will be understood, of course, that I may employ a rotor structure having rigidly mounted hammers without departing from my invention.

An annular guard 28 surrounds the shaft 20 at the end of the rotor structure, and a convex shield 29 may extend beyond this guard. Such convex shield, with an annular wall 30 aligned therewith, provides an annular space for the reception of foreign material, tramp iron, and the like; such wall being properly spaced from the peripheral wall of the drum for the passage of such foreign material.

To assist movement of foreign material, tramp iron and the like, to this annular space, I may employ plows of suitable type, mounted on the inner face of the screen plates or otherwise arranged to function properly. Any portion of the burden being crushed that may entrain with this tramp iron will, if sufficiently small, be discharged through the screen plates or grids which underlie this annular space; otherwise it will return to the main crushing chamber through the annular

space between said wall 30 and the screen plates or grids. It will be understood that foreign material, tramp iron, and/or the like, entering this annular space will be held therein and will not return to the main portion of the crushing chamber, except as above noted, and that it may be removed periodically. Any crushable material reaching the tramp iron space that does not escape as described will either be broken therein until small enough to escape through the wall of the drum or will have to be periodically removed. The entrained tramp iron will hasten the reduction of such crushable material. For the purpose of removing foreign material, tramp iron and the like, from the space between the annular wall 30 and the end wall 2, the latter may be provided with an opening 31, normally closed by a door 32.

In lieu of this arrangement I may provide openings in the peripheral wall of the drum beyond the convex shield 29 and annular wall 30. Such construction is illustrated in Fig. 1a; showing a fragmentary view of a portion of the drum adjacent the end wall 2 thereof in which longitudinally disposed wall portions 33, substantially in the plane of the inner surface of the drum as defined by the grids 13, are arranged in spaced relation and connect said end wall 2 with an annular wall portion 330 to which the beams 9 (or members 90) are attached. Between said wall portions 33, openings 34 are provided and foreign material, tramp iron and the like, passing beneath the annular wall 30 may discharge through these openings.

The cone-shaped end frame or member 1 may be provided with a bearing ring 35, which may be suitably supported, and the end wall or frame 2 may have its hub 10 extended in the form of a trunnion 36, which may be mounted in a bearing 37. The drum may be rotatably driven by suitable gearing and a gear wheel 38 may be mounted on lugs or bosses 39 formed on or carried by the end wall 2. Such gear wheel may be driven by a pinion (not shown) operatively connected to a prime mover of suitable character. The driving means for the drum may be independent of the means driving the hammer rotor, or a single motor, properly geared, may be employed to drive the drum as well as the hammer rotor. The hammer rotor is preferably rotated in the same direction as the drum, but at a much greater speed. It will be understood, of course, that the hammer rotor may be driven in a direction opposite to that of the drum if such arrangement is desirable, without departing from my invention.

From the foregoing description it will be apparent that simple and efficient means are provided for accomplishing the objects of the invention, and while the elements shown and described are well adapted to serve the purposes for which they are intended, it is to be understood that the invention is not limited to the precise constructions set forth, but includes within its scope such changes and modifications as may be made within the terms of the appended claims.

I claim:

1. In a crushing structure, the combination of a rotatable drum comprising an end wall, a ring section spaced from said end wall and having a smooth inner surface, longitudinal ribs at the periphery of said drum connecting said ring section and end wall, screen plates comprising circumferentially arranged grids carried by said ribs and forming a foraminous wall for said drum, a conical end for receiving material to be crushed connected to said ring section, lifting means extending longitudinally of said drum internally of the same and disposed opposite the screen plates only whereby material introduced therein may be lifted for gravitational discharge, hammer mechanism within the drum adapted to act upon the material delivered by said lifting means, a shaft carrying said hammer mechanism, supports for said shaft; one of said supports being formed integral with the conical delivery end; means for rotating said drum, and independent means for driving the shaft supporting the hammer mechanism.

2. In a structure such as set forth in claim 1, an inwardly projecting hub carried by the end wall, and a shield disposed between the hammer mechanism and said end wall and carried by said hub; said shield defining a space for the reception of foreign material, tramp iron and the like.

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