(No Model.)

R. McCULLY.

STONE BREAKER.

No. 463,911. Patented Nov. 24, 1891.

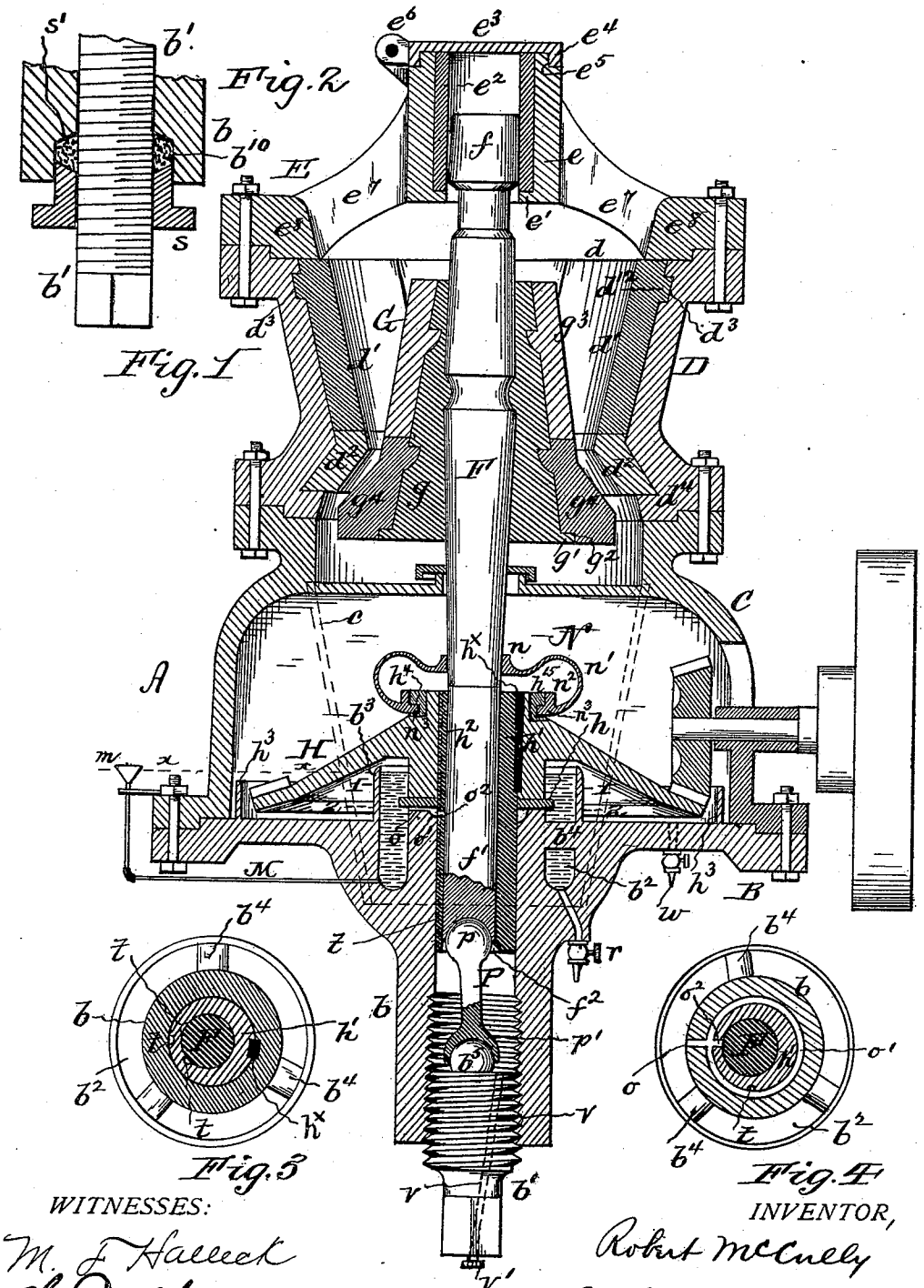

Fig. 2

Fig. 1

Fig. 3

Fig. 4

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STONE-BREAKER.

SPECIFICATION forming part of Letters Patent No. 463,911, dated November 24, 1891.

Application filed September 17, 1886. Serial No. 213,795. (No model.)

To all whom it may concern:

Be it known that I, ROBERT McCULLY, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Stone-Breakers, of which the following is a specification, reference being had therein to the accompanying drawings, wherein—

Figure 1 is a vertical section, partly in elevation, of a stone-breaking and ore-crushing machine embodying my improvements. Fig. 2 is a sectional detail view, partly in elevation, of a modified form of step-bearing for the gyratory shaft. Fig. 3 is a section on line 1 1; and Fig. 4 is a like view on line 2 2, Fig. 1.

My invention has relation to stone-breaking and ore-crushing machines in general, and particularly to that form of the same for which Letters Patent of the United States were granted to me on the 7th day of September, 1886, Nos. 348,757 and 348,758; and it has for its object the construction of parts to reduce the cost of manufacture, to increase the durability and efficiency of the machine, and to diminish the power required for operating it.

My invention accordingly consists of the combination, construction, and arrangement of parts, as hereinafter described and claimed.

In the drawings, A represents the frame or casing of the mill, composed of the bottom plate B, chute or outlet-chamber C, crushing-chamber D, and top plate E, flanged and bolted together, as shown or as desired. The top plate E has a vertically-arranged central bearing *e*, open at both ends for the top or head *f* of the gyratory shaft F, which bearing has at its bottom an inwardly-projecting annular flange e', supporting a steel or other hard or chilled sleeve or bushing e^2, against which bears the head or top *f* of shaft F. The head of the shaft is cylindrical in form with a slight taper from below upward, and it rolls around upon bushing e^2 as the shaft F gyrates, without producing rubbing friction. The sleeve or bushing e^2 is loose in bearing *e*, and when worn out is readily replaced by a new one. The employment of the loose bushing e^2 avoids wear of bearing *e*, and consequently of top plate E, so that it never needs replacement. The top of bearing *e* is closed by a cap or cover e^3, having an edge flange e^4, which fits into a shoulder e^5 on the top of bearing *e*. This cap e^3 is preferably hinged at e^6 to bearing *e*, and is used for preventing dust or dirt gaining access to the bearing. The top plate E has the usual supply or feed openings e^7, and its rim or flange e^8 is constructed to partially overlap the top edge *d* of the crushing-faces in chamber D. These crushing-faces are composed of two parts d' and d^2, both of which are preferably made in sections, so as to be readily inserted into and withdrawn from the chamber D. The working faces of the two parts are reversely tapered, as shown, or they may be otherwise constructed, as desired. The sections of part d' have near their upper edges outside lugs or flanges d^{12}, which fit into recesses d^3 in the inner wall of chamber D, and their lower edges abut or rest upon the upper edges of the sections of part d^2, whose lower edges rest upon a bottom shoulder d^4, formed on chamber D immediately above the chute or outlet-chamber C. The chutes *c* for the latter may be constructed and arranged as desired; but I prefer to follow the construction shown and described in the above-named patents. The crusher-head G is composed of a truncated cone-shaped sleeve *g* cast upon the shaft F in any suitable manner, and has a bottom-edge flange g', which fits into a shoulder g^2 at the bottom of the bore of the working faces of the crusher-head. These working faces are composed of two separate rings g^3 g^4, which have different tapers or angular formations, as shown, and are fastened to sleeve *g*, as described and shown in the aforesaid patents, or as otherwise preferred.

The bottom plate B is formed with a central depending bearing or well *b*, having a removable screw bottom b'. Outside of and concentric with the top part of well *b* is a gutter b^2, which is preferably continued above the top surface of plate B by an upwardly-projecting annular flange b^3. To prevent weakening of plate B by gutter b^2, radially-arranged bars b^4 are cast across said gutter, as shown more plainly in Figs. 3 and 4.

Upon the top of well *b* is placed a steel ring or washer *h*, and upon this rests the driving-gear H, in the bore of which is a sleeve or bushing h', which is also inserted in well *b*,

and has an eccentric bore h^2, into which the end f' of shaft F passes, and by means of which the shaft and crusher-head G are gyrated. The sleeve h' is keyed to the wheel H, as is usual, and as indicated at $h^\times$, so as to rotate therewith, and its exterior diameter snugly fits the bearing b. Outside of gear-wheel H and formed upon the top of plate B is an annular flange or ring h^3 to hold and retain any overflow of oil from gutter b^2 and any waste of oil from the periphery of the driving-wheel. Between the top of gear-wheel H and shaft F is a dust shield or protector N, which consists, essentially, of a central thick hub n, having an opening for the shaft to pass through, so that the hub will loosely hug the shaft, an annular curved part n', terminating in a second thick rim or hub n^2, having a shoulder n^3, which enters an annular recess h^4 in a ring h^{15}, loosely mounted in position upon and near the top of driving-wheel H. The dust-shield is made of rubber, leather, or other flexible material, and rotates with the shaft F. It prevents dust or débris falling upon the top of the driving-wheel hub and gaining access to its bore or the shaft-bearing therein. The shield N, being elastic and having the thin curved part n', admits of it stretching or accommodating itself to the vertical movement of the shaft when adjusted to regulate the fineness of the output or for other purposes. Between the lower end of shaft F and bottom b' is a knuckle or toggle step-bearing P, which preferably has a ball-shaped upper end p fitting into a semi-spherical recess or cavity f^2 in the lower end of shaft F, and a lower or semi-spherical or cup-shaped end p' impinging upon a ball b^5, formed on or resting upon the top of screw bottom b'. The ball b^5 is preferably in line with the center line of the machine or of the well b and the sleeve e^2 e, while the knuckle or toggle P inclines with the center of the shaft F, but in an opposite direction to that of the inclination of the shaft in the eccentric bore in sleeve h'. This step-bearing or toggle P supports the shaft in its inclined position opposite to the driving side of the eccentric or cam of the driving-wheel H, and it has the same gyratory movement as that of the shaft; or, in other words, the toggle P engages the lower end of the shaft F, and is so situated that it always points away from the eccentric portion of the wheel H, thereby causing it to incline constantly toward that part of the crusher-head which is in action. The toggle or knuckle P, so supporting shaft F, assists the cam or eccentric on the gear H to throw the head G to the grinding side of the mill, relieves the shaft of undue pressure between it and the driving side of the eccentric or cam of wheel H, avoids undue friction between said parts, and also the rubbing friction and consequent heating at the bottom of the shaft, and therefore less power is required to operate the machine than is required for the same class of machines as heretofore made, or wherein the end of the shaft rests and gyrates upon a flat step-plate or set-screw, which produces a violent rubbing friction and resultant heating between the screw and shaft. By adjusting bottom b' in the proper direction the toggle or knuckle P and shaft F are raised or lowered to elevate or depress crusher-head G for varying the degree of fineness of the output, and this is accomplished without altering the relative positions of said toggle, shaft, and screw.

The oil-supply pipe M for gutter b^2 has its supply end or nozzle m located outside of frame A at a height approximating a line drawn just below the top of gutter b^2, as indicated by dotted line x, Fig. 1—that is to say, the nozzle m and top of gutter b^2 are nearly level, the latter being slightly above the former, so that a quantity of oil poured into pipe M will first fill the channels and cavities in bearing b and then rise in gutter b^2 without overflowing from it. If, however, there is any overflow, the annular flange or ring h^3 prevents its escape from the machine. The oil in gutter b^2 finds its way through lateral and annular ducts o and o', respectively, in the top of well b to sleeve or bushing h', thence down the same, filling the space between the bottom b' and bottom of the shaft, thence by capillary attraction to the bearing for the shaft in sleeve h', so as to oil all parts of the shaft F, sleeve h', and wheel H that need oiling. If desired, lateral openings o^2 may be formed in sleeve h' in line with ducts o and o' to more readily supply oil to the shaft-bearing in said sleeve. The gutter b^2 may, if desired, be provided with a drain-cock r to draw off the sediment accumulating in said gutter. The adjustable bottom b' is in the form of a set-screw, and is made large enough to provide a suitable bottom opening in well b for inserting the knuckle or toggle P into and withdrawing it from the bearing without displacing any other parts of the machine.

I prefer the form of toggle or knuckle P and end bearings therefor shown in Fig. 1, as grit or dirt do not readily collect on the bearings; but, if desired, the knuckle or toggle may have a ball at each end, as shown in Fig. 2, in which case the bearing b^5 is in the form of a cup or recess in the top of screw b' to receive the ball on the lower end of the knuckle or toggle P.

The step-bearing P may be used without an adjustable and detachable bottom b', or any other suitable adjusting mechanism may be substituted for the screw form of said bottom; or, as shown in applications filed by me of an even date herewith, Serial Nos. 213,796 and 213,797, so too, if desired, vertical channels t may be formed on the outside and inside of sleeve h' to facilitate the flow of oil down the same from recess or duct o', as more plainly shown in Fig. 3. The bottom b' is provided with a suitable outlet-channel v, having a plug or cock v' for draining off or removing the oil in bearing b. For the same

reason the plate B is provided with a drip-cock *w* between flange h^3 and well *b*.

The removable and adjustable bottom *b'* is shown in the form of a solid screw having the toggle-bearing b^5 formed thereon. In this application I only claim such specific form of removable and adjustable bottom. The broad idea of such removable and adjustable bottom for supporting toggle P and shaft F, whether such bottom be a screw or other constructed form, is claimed in another pending application of even date herewith, Serial No. 213,797, and, further, the broad idea of a removable and adjustable screw bottom with stuffing-box for toggle P and shaft F is claimed in still another pending application filed the 1st day of December, 1886, Serial No. 220,330.

What I claim is—

1. In a stone-breaker, the combination of top plate E, having cylindrical bearing *e*, provided at its bottom with an inwardly-projecting flange *e'*, removable bushing e^2 in and snugly fitting said bearing and supported upon flange *e'* and said bushing having a cylindrical bore, gyratory shaft F, having slightly-tapered cylindrically-shaped head *f*, adapted to said bushing, and operating devices for gyrating said shaft, substantially as set forth.

2. In a stone-breaker, the combination of a vertically-adjustable gyratory shaft having at its upper end an outside bearing and a crusher-head below said bearing, a driving-wheel having an eccentric bore for the lower end of the shaft, and a knuckle or toggle step-bearing engaging the lower end of said shaft, said toggle being so situated that it always points away from the most eccentric portion of the wheel, thereby causing it to incline constantly toward that part of the crusher-head which is in action, substantially as set forth.

3. In a stone-breaker, the combination of a gyratory shaft, a crusher-head on said shaft, a driving-wheel having a depending sleeve or hub provided with an eccentric bore for the lower end of said shaft, and a knuckle or toggle step-bearing engaging with the lower end of said shaft, said toggle being so situated that it always points away from the most eccentric portion of the wheel, thereby causing it to incline constantly toward that part of the crusher-head which is in action, substantially as set forth.

4. In a stone-breaker, the combination of a gyratory shaft F, bottom plate B, having well *b*, a washer *h* on the top of well *b*, an annular oil chamber or duct b^3 outside of and concentric with well *b* and extending above said washer, lateral duct or ducts *o*, leading from chamber b^2 into well *b*, driving-wheel H, resting on washer *h* and having a bushing or sleeve *h'* depending into well *b*, a duct or ducts o^2 in sleeve *h'*, communicating with well *b*, and an oil-supply leading into chamber b^2, substantially as set forth.

5. In a stone-breaker, the combination, with a gyrating shaft, a top plate E, having central bearing *e*, an inwardly-projecting flange *e'* at the bottom of bearing *e*, a loose sleeve or bushing in bearing *e* snugly fitting said bearing and resting on flange *e'* for the upper end of said shaft, and a driving-wheel having a hub with an eccentric bore for the lower end of said shaft, substantially as set forth.

6. In a stone-breaker, the combination of a frame A, having bottom plate B, provided with bearing *b*, and a gutter b^2 outside of and concentric with the top of said bearing, and an oil-supply pipe M, leading to gutter b^2 and having a nozzle *m* located below the top of the gutter b^2, substantially as set forth.

7. In a stone-breaker, the combination of the gyratory shaft F, having wheel H, bottom plate B, having well *b* and gutter b^2 exterior to and concentric with said well, washer *h* between the wheel H and top of said bearing, ducts *o* and *o'* between the washers and bearing, and an oil-supply pipe having an inlet or supply end located below the line of the top of gutter b^2, substantially as set forth.

8. In a stone-breaker, the bottom plate B, having well *b*, gutter b^2 outside of and concentric with well *b* and extending above said plate and provided with radial arms or bars b^4, substantially as set forth.

9. In a stone-breaker, the combination of gyratory shaft F, driving-wheel H, provided with a central bore and an eccentric sleeve, plate B, having a central bearing *b*, a washer *h* at the top of said bearing, a gutter b^2, surrounding and extending above and below said washer, ducts *o* and *o'*, and an oil-supply pipe M, substantially as set forth.

10. In a stone-breaker, the combination of the bottom plate, well *b* in said plate, adjustable solid screw bottom *b'*, having oil-channel *v* and fixed toggle-bearing b^5, gyratory shaft F, and toggle P between said bearing b^5 and said shaft, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT McCULLY.

Witnesses:
S. J. VAN STAVOREN,
CHAS. F. VAN HORN.