Feb. 28, 1928.

1,660,652

A. MOLANDER

ROCK CRUSHER

Filed Oct. 15, 1926

2 Sheets-Sheet 1

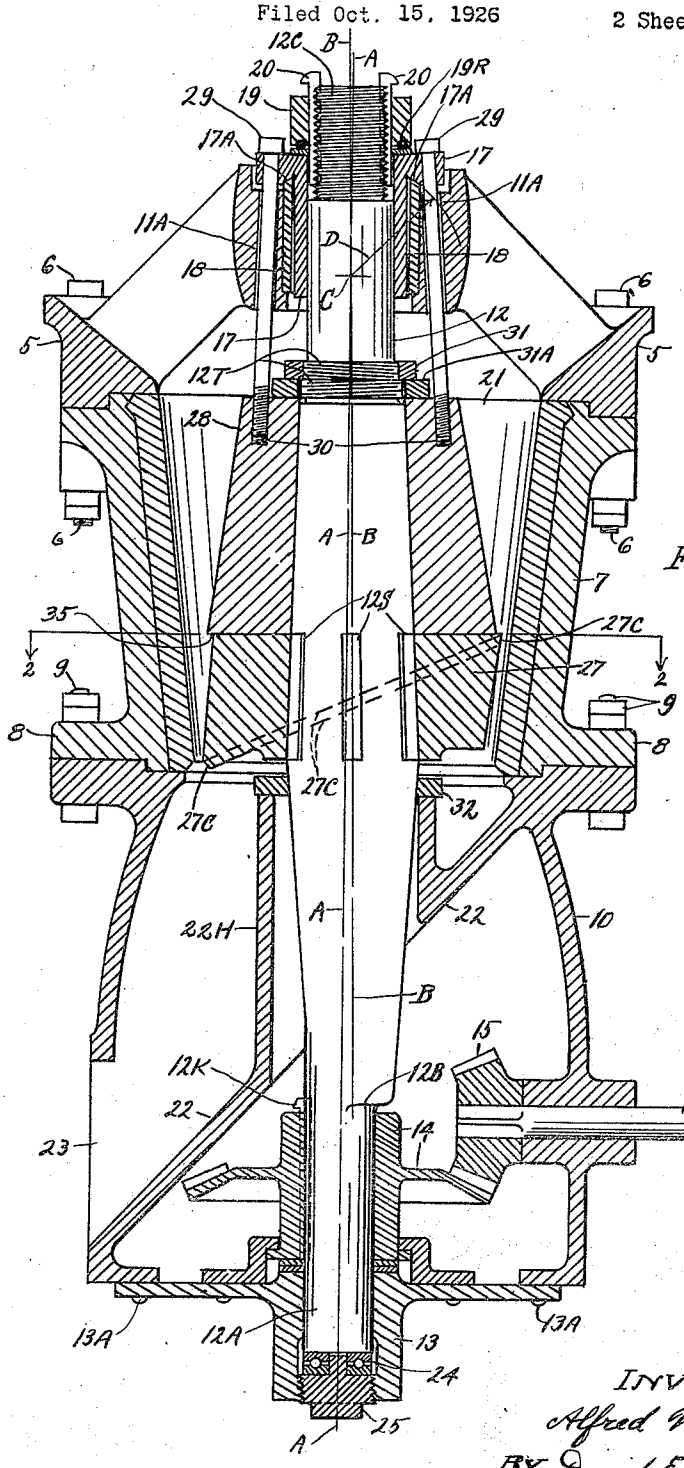


FIG. 1.

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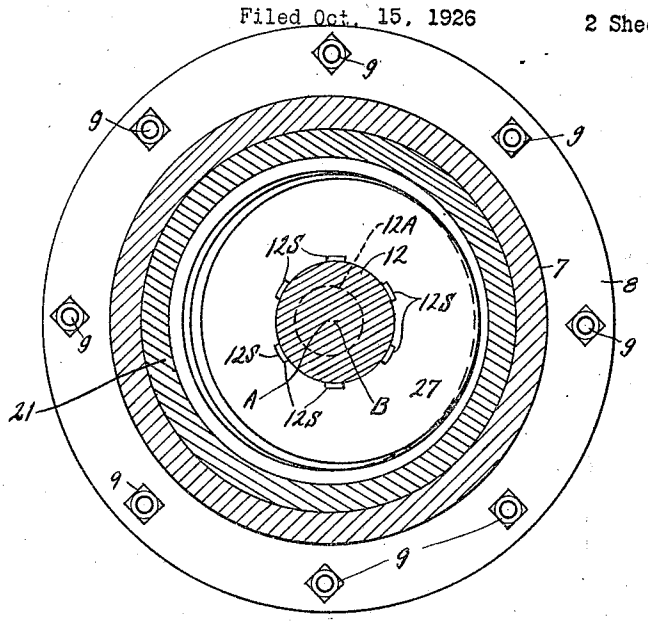


FIG. 2.

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Patented Feb. 28, 1928. 1,660,652

UNITED STATES PATENT OFFICE.

ALFRED MOLANDER, OF ST. PAUL, MINNESOTA.

ROCK CRUSHER.

Application filed October 15, 1926. Serial No. 141,726.

My invention relates to rock crushers and the main object is to provide a simple and highly efficient rock crusher for reducing various mixed sizes of rock to uniformly sized pieces in a comparatively short time. A further object is to further improve on my patented rock crusher issued August 24th, 1926, Patent Number 1,597,207.

In the accompanying drawing:

Fig. 1 is a vertical, central elevation of my improved rock crusher.

Fig. 2 is a horizontal section as on line 2—2 in Fig. 1 showing the crusher head of my device in operative position.

Referring to the drawings by reference numerals, 5 designates a feed hopper secured with bolts 6 to the top of the crusher body 7, the lower end of said body flanged externally as 8 for securing it with bolts 9 to the correspondingly flanged upper end of a bell shaped outlet chamber 10. All said parts, the feed hopper, the body 7 and the chamber 10, are of circular conformation horizontally and aligned concentrically on a vertical line designated as A. The feed hopper has an integral elevated bearing part 11 for housing the upper end of a vertical disposed breaker-head shaft 12, the lower end of the said shaft as at 12^A being rotatable in a vertical bearing 13 fixed as at 13^A to the bottom of chamber 10.

The lower end 12^A of shaft 12 is journaled concentrically of the center line A and on said part 12^A is fixed a bevel gear 14 driven by a bevel pinion 15 on a shaft 16 which is rotated by any suitable driving means (not shown). Shaft 12 is offset preferably just above gear 14, as 12^B in Fig. 1, shifting its center as to line B. From its eccentric the true center of the shaft (line B) is straight but inclined inwardly until line B converges with the vertical center line A, as at C, near or within the bearing 11. Thus the shaft 12, above the part 12^A, will gyrate about the true center line A the greatest gyration being at the offset and gradually diminishing to point C. That part of shaft 12 above point C will gyrate some and this part has a flanged bushing 17 the downwardly exposed flange-face 17^A of which is preferably rounded or concaved concentric with center C as indicated by radial line D in Fig. 1 and bears on a corresponding bearing surface on the upper end of a fixed bushing 18 in bearing 11.

The upper end of shaft 12 protrudes above bushing 17 and is threaded as 12^C for engagement by a nut 19 which is keyed to the shaft by removable keys 20 which serve to hold the nut in non-rotating relation to the shaft 12. 19^R is a ball or other suitable type bearing between the nut 19 and the adjacent top of bushing 17.

21 is a downwardly tapering crushing chamber suitably secured in the body member 7 and may also be held securely between the receiving hopper 5 and the chamber 10, and its downwardly tapering bore is concentric of the line A. The rock crushing takes place entirely within this hopper and the open end of the latter registers with the open upper end of chamber 10. Said chamber 10 has an angular discharge apron 22 on which the crushed rocks roll out of the machine through an opening 23 (see Fig. 1.)

The general construction of a rock crusher above described, is mostly old in the art but necessarily described herein for a thorough understanding of my improved rock crushing means.

The lower end of shaft 12 is rotatably supported by a suitable ball bearing 24 resting on the inner end of an adjusting nut 25 threaded in the lower end of bearing housing 13. The upper end of the shaft is supported by bearing 19^R previously described.

A portion of shaft 12 just above the lower opening of chamber 21 is splined as 12^S for retaining a correspondingly splined lower crusher head section 27 of special form and presently to be described said crusher head comprising also an upper stationary section 28. The latter is suspended with its lower end closed to the upper end of section 27 and tapers upwardly therefrom to approximately a level with the top of chamber 21. The suspending means therefor (28) consists of a number of circularly spaced upright bolts 29 passed downwardly thru the outer part of the flanged bushing 17 thence thru corresponding apertures 11^A in the bearing 11 and the threaded lower ends of said bolts engaging in corresponding threaded holes 30 in the upper end of crusher head section 28. Said section 28 is bored to be concentric of the shaft 12 above its splines 12^S, that is concentric of center line B. Thus it will be seen that section 28 does not rotate with shaft 12 but when the latter is rotated the head has a gyratory movement and its outer surface may be said to have a horizontal weaving movement which breaks

the rocks between it and the adjacent chamber 21. As the breaking of rocks continues the pieces are of course gradually reduced in size and drop further down in the hopper and toward the lower circular edge of head 28 and just below said edge the said rocks are reduced to a certain predetermined size by the lower crusher head section 27 which will presently be described.

The upper crusher head 28 is prevented from moving upwardly preferably by two collars 31—31A one with left hand thread and the other with right hand thread adapted to engage corresponding threads 12T on shaft 12 just above the upper level of chamber 21, the lower one of said collars, as 31A, adapted to engage the upper end of head 28. Thus it is readily seen that head 28 is suspended between the upper surface of crusher head section 27 and the adjusting collar 31A.

For convenience I will hereinafter designate the upper crusher head section as the breaker head and the lower section as the cutter head, the latter being comparatively short and having an angular approximately circular cutting edge 27C extending from its lowest point on about a level with the lowest edge of chamber 21 to a high point at its upper level, as shown clearly in Fig. 1. It will be fully understood that the cutter head bore is concentric of center line B (on shaft 12) and it is important that the curvature of the cutting edge is such that any point on its perimeter is equi-distant from the adjacent wall of chamber 21 horizontally. In other words the cutting edge 27C is one inch from the chamber wall, for example if one inch size of crushed rock is desired. That part of the cutter head above its cutting edge is also tapered upwardly and below said edge suitably tapered downwardly to permit the crushed rock to fall freely down to the discharge chamber. It will be understood that rotating of shaft 12 will rotate the cutter head and all parts of the cutting edge of the latter will always be a uniform distance from the adjacent walls but the upwardly tapering exterior causes the rocks to roll and get wedged and broken smaller as they gravitate downwardly and are reduced to a uniform size before they can drop past the cutting edge and onto the delivery apron. From apron 22 is extended upwardly a tubular shaft housing 22H extending approximately to the top of housing 10 and on its upper end I provide a loose collar 32 about shaft 12 to prevent falling stones from dropping onto the gears in the lower part of the housing.

The use of my device has been fairly disclosed. An important improvement in it is the flanged riding bushing 17 with the inserted hanger bolts 29 extending through the large bores 11A in the bearing 11, said bores being large enough so the bolts can sway therein enough to compensate for the gyratory movement of the upper end of the crusher head 28. This manner of suspending the crusher head is substantial and has proven highly satisfactory.

The gyratory movement of the breaker head, which may also be aptly termed a cam action, breaks up the large stones in the downwardly tapering space between said head and the wall of the chamber, literally imparting a rotary smashing blow to the rocks and breaking them into smaller and smaller pieces. The same breaking action is caused by the upper area of the cutter head which reduces the stones to smaller sizes and the cutting edge 27C breaks and cuts the stone to a uniform size before it can pass through to the apron.

It will be noted that as shown in Fig. 1, at 35, the upper edge of the cutter head is inward of the lower edge of the crusher head providing an enlarged space for the broken rock to fall into and providing for wear and tear on the crusher head which may be used until worn even with said upper edge of the cutter head.

It is obvious that stones precipitating into the space around the cutter head will gravitate toward the bottom of the latter but will be broken into the desired size at any elevation where the angular cutting edge crushes it. The main shaft and its cutting head may be rotated either way thus prolonging the usefulness thereof for if it is rotated one way only the cutting edge would be worn out sooner at one side only.

I claim:

1. In a rock crusher having a feed hopper, a rock crushing chamber and an outlet chamber in vertical alinement, a rotatable shaft arranged centrally of the crusher, a crusher head removably arranged on said shaft and comprising a non-rotatable suspended upper section and a lower cutting section keyed to the shaft, and a bearing for the shaft in the lower part of the crusher, and a bearing in the upper central part of the hopper alined vertically with the said lower bearing, said shaft having a single offset adjacent its lower bearing, the shaft center inclined from said offset to a point of convergence with the vertical center of the upper bearing at or near said upper bearing to provide a gyratory movement of the shaft and crusher head within the rock crushing chamber, vertically adjustable means supporting the lower end of said shaft and means at the upper end of said shaft adapted to support the upper end thereof according to the position of said lower supporting means, and simultaneously support the non-rotatable section of the crusher head continuously concentric of the shaft.

2. The structure specified in claim 1, in which said upper section of the crusher head

comprises an upwardly tapering member, suspending means therefor comprising a vertically arranged bushing about the upper part of the shaft and having a flange at its upper end, circularly arranged apertures provided near the perimeter of said flange, bolts passed downwardly one through each aperture and the lower end of each bolt threaded into the upper end of the crusher head, said bearing over the receiving hopper having an aperture for each said bolt to pass through and each bolt head adapted to engage the upper face of said bushing flange to carry a portion of the weight of the crusher head and means on said shaft engaging the upper end of said crusher head to prevent vertical movement thereof.

3. The structure specified in claim 1, in which said upper section of the crusher head comprises an upwardly tapering member, suspending means therefor comprising a vertically arranged bushing about the upper part of the shaft and having a flange at its upper end, circularly arranged apertures provided near the perimeter of said flange, bolts passed downwardly one through each aperture and the lower end of each bolt threaded into the upper end of the crusher head, said bearing over the receiving hopper having an aperture for each said bolt to pass through and each bolt head adapted to engage the upper face of said bushing flange to carry a portion of the weight of the crusher head and means on said shaft engaging the upper end of said crusher head to prevent vertical movement thereof, said latter means comprising a pair of threaded spacing nuts on the shaft, one adjacent the upper end of the crusher head and the other to serve as a jamb nut.

4. The structure specified in claim 1, in which said upper section of the crusher head comprises an upwardly tapering member, suspending means therefor comprising a vertically arranged bushing about the upper part of the shaft and having a flange at its upper end, circularly arranged apertures provided near the perimeter of said flange, bolts passed downwardly one through each aperture and the lower end of each bolt threaded into the upper end of the crusher head, said bearing over the receiving hopper having an aperture for each said bolt to pass through loosely and each bolt adapted to engage the upper face of said bushing flange to carry a portion of the weight of the crusher head and means on said shaft engaging the upper end of said crusher head to prevent vertical movement thereof, and a fixed bushing in the upper bearing with its upper end exposed and having its exposed end rounded on a radius from the point of convergence of the vertical center line and the angular center line of the shaft described, said flange of the shaft bushing having a correspondingly curved downwardly exposed circular face engaging said upper end of the fixed bushing.

5. The structure specified in claim 1, in which the lower section of each crusher head comprises a rock cutting and breaking element rotatable with the shaft and splined thereto, said lower member having a cutting edge arranged in an angular plane extending from a low point in horizontal spaced relation to the lower end of said crushing chamber thence upwardly to a level just below the lower face of the upper crusher head, the entire edge of said cutting element being uniformly spaced from the adjacent wall of the crushing chamber to provide a uniform size of opening for crushed rock to pass through.

In testimony whereof I affix my signature.

ALFRED MOLANDER.