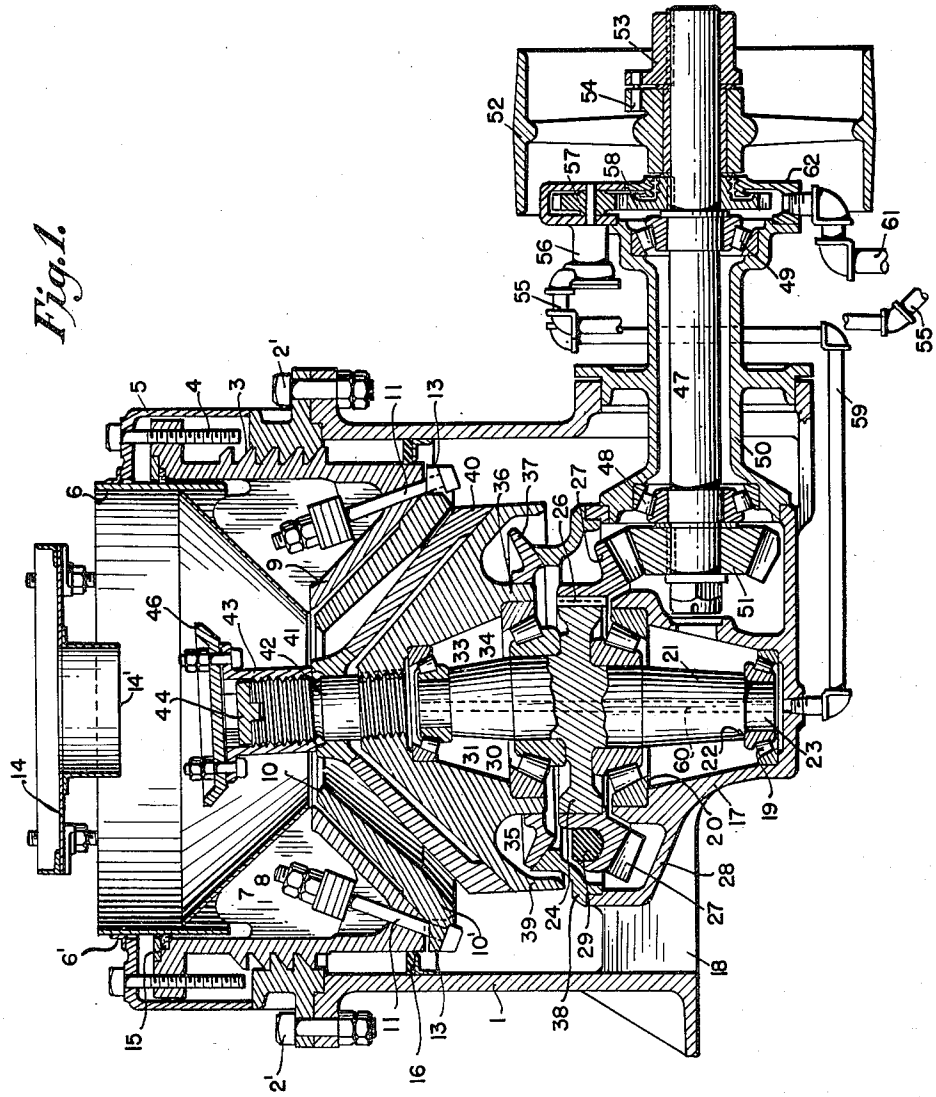
Jan. 2, 1940. J. W. STEVENS 2,185,528

CONE CRUSHER

Filed Aug. 26, 1938 2 Sheets-Sheet 1

Fig. 1.



Inventor

John W. Stevens

Herbert E. Smith

By

Attorney

Jan. 2, 1940. J. W. STEVENS 2,185,528

CONE CRUSHER

Filed Aug. 26, 1938 2 Sheets-Sheet 2

Fig. 3.

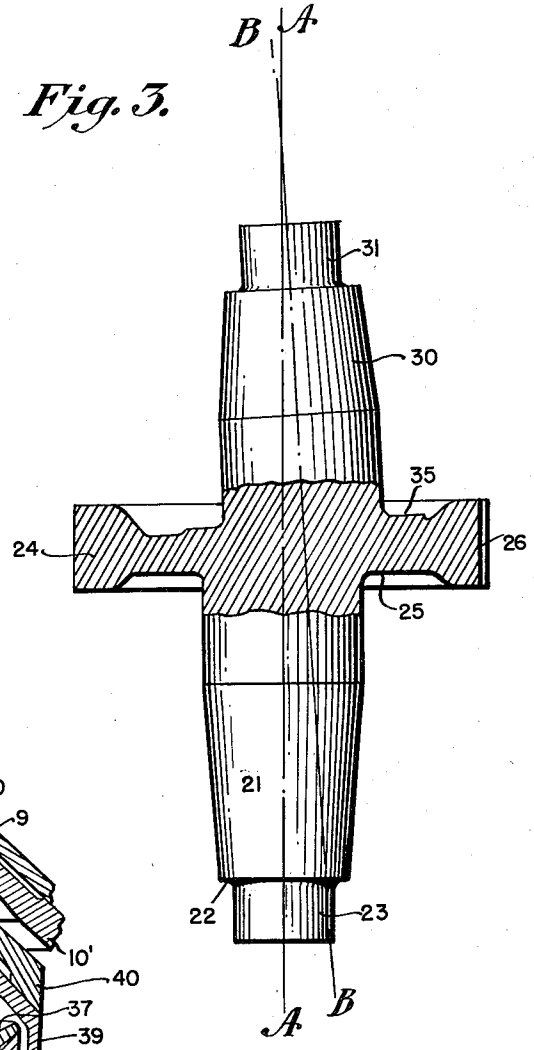
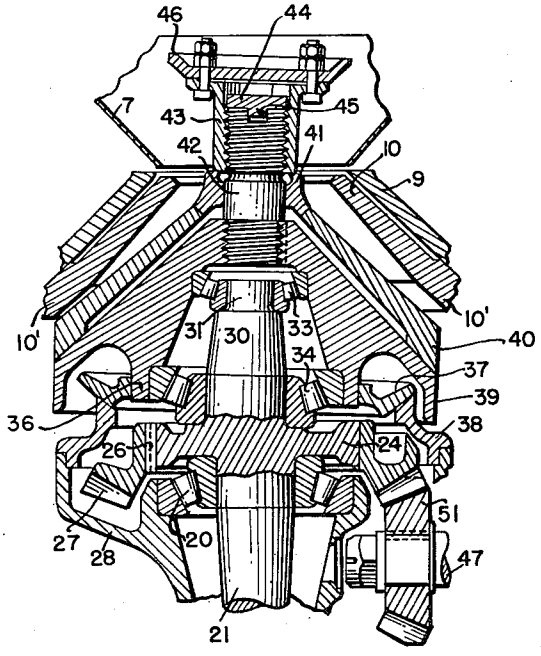


Fig. 2.



Inventor

John W. Stevens

Herbert E. Smith

By

Attorney

Patented Jan. 2, 1940

2,185,528

UNITED STATES PATENT OFFICE

2,185,528

CONE CRUSHER

John W. Stevens, Salt Lake City, Utah, assignor to The Eimco Corporation, Salt Lake City, Utah

Application August 26, 1938, Serial No. 226,913

2 Claims. (Cl. 83—10)

My present invention relates to improvements in cone crushers or crushing mills of the compound movement type in which is embodied a floating gyratory crusher head operating within an overhead concave for crushing ores, rock, and other similar material. In carrying out my invention I employ a compound rotary spindle having a lower journal that is supported in bearings, an upper offset eccentric axle here illustrated as obliquely disposed with relation to the lower perpendicular journal of the spindle, and an intermediate hub and driving member through which power is transmitted to the gyratory head that is journaled on the upper axle portion of the spindle.

The gyratory head is thus suspended or mounted directly upon the axle or actuating portion of the spindle, and through the combined rotary and oscillating movement of the axle a compound movement is transmitted to the head to cause its gyrations.

Because of this construction and arrangement of parts involving the compound spindle, the construction and operation of the crushing mill is materially simplified; a minimum number of parts may be utilized to secure a compact mill that occupies comparatively small space, and all parts of the mill are readily accessible so that the mill may be erected starting at the bottom thereof, and with equal facility the mill may be dismantled when necessary starting at the top of the mill and working downwardly.

By the combination and arrangement of parts dependent upon the operation of the compound spindle a very small power is required for the operation of the mill; a wider range of gyration in the crusher head is attained, and due to the smooth operation of the gyratory head the capacity of the mill is increased, over similar cone crushers with which I am familiar.

The invention consists in certain novel combinations and arrangements of parts involving the compound spindle and parts dependent upon its operation, as will hereinafter be more fully set forth. In the accompanying drawings I have illustrated one complete example of the physical embodiment of my invention wherein the parts are combined and arranged about a compound spindle having a lower perpendicular journal and an upper offset and obliquely disposed axle, but it will be understood that changes and alterations may be made in these exemplifying structures, within the scope of my appended claims, without departing from the prinicples of my invention.

Figure 1 is a vertical transverse sectional view through a crushing mill embodying my invention, showing also the driving mechanism.

Figure 2 is a similar view of a fragment of the mill, showing the relation of parts when the spindle and the gyratory head have revolved or rotated through an angle of one hundred eighty degrees from the position of Figure 1.

Figure 3 is a detail view of the compound spindle showing its perpendicular journal, the obliquely disposed offset or eccentric axle for the crusher head, and the intermediate driving-hub of the spindle, the operating gear being omitted from the hub.

In the assembly view of Figure 1 I employ a main cylindrical frame 1 upon which is mounted an internally threaded adjusting ring 2 that is fastened in place by bolts 2'.

Within the threaded adjusting ring is mounted the cylindrical flanged bowl 3 that is exteriorly threaded for vertical adjustment in the adjusting ring, and a series of set bolts or locking bolts 4 are employed to lock the bowl in adjusted position. These bolts are threaded through holes in an upper exterior flange of the bowl and they pass through clearance holes in the top of an enclosing open center cap 5, which encircles the bowl and rests upon the top of the adjusting flanged ring 2.

Before adjusting the bowl the screws or bolts 4 are backed out of the flanged bowl to remove their heads from contact with the cap, then the bowl is turned in its threads to desired vertical adjustment, after which the set bolts are turned home with their heads resting against the top flange of the cap 5, to draw or jam the cap down tight on the top of the flanged ring and thereby retain the bowl against accidental turning movement.

Within the open center of the flanged cap and also within the bowl is mounted a cylinder 6, preferably of rolled plate, which forms a fixed feed-sleeve that is suspended within the top of the bowl by an exterior angle-ring 6' secured on the top of the flanged cap 5, and this sleeve projects downwardly a considerable distance within the bowl as indicated in Figure 1. An inverted frusto-conical hopper 7 is mounted with its upper portion within the feed sleeve, and this hopper rests upon a series of spaced interior radial webs 8 integral with the bowl and projecting toward the center of the bowl. These webs are also integral with an interior frusto-conical open center bearing flange 9 that projects upwardly and inwardly from the bottom rim of the bowl, and the frusto-conical liner or concave 10 having an

outwardly flared bottom area 10' is mounted within the bearing flange 9 and fastened up against the flange by bolts 11 which unite the webs 8 and lugs 13 of the concave through laminated saddles resting on the webs.

Material is fed to the feed-sleeve from an elevated feed-table 14 adjustably supported on a suitable frame above the mill, and the feed-table is fashioned with a central feed-spout 14' which delivers the material centrally of the top of the mill.

Dust seals are indicated at 15 between the top of the bowl and the feed-sleeve, and at 16 between the bottom edge of the bowl and the cylindrical main frame to prevent access of dust to the interior parts of the mill.

From this description in connection with the drawings it will be understood that the bowl with its concave or liner, and also its feed hopper 7 may be vertically adjusted with relation to the feed-sleeve and the main frame, and also with relation to the adjustable feed-table and its feed-spout 14'.

For supporting the operating mechanism of the mill the main frame, at its lower portion is fashioned with a central interior cup-shaped bearing-box or housing 17 that is united with the main frame by means of radial webs 18 spaced across the annular discharge space through which the crushed or fine material falls by gravity from the crushing elements, and preferably the upper edges of these webs or ribs are sharpened to prevent accumulation of material and to facilitate falling of the crushed material into a receptacle located below the mill.

The upright compound spindle for the gyrating head is supported in bearings 19 and 20 of the bearing-housing, and as best seen in Figure 3 the lower journal end 21 of the spindle is fashioned with a lower shoulder 22 for the lower bearing 19, and an intermediate circular disk or hub 24 having an under seat 25 for the inner race of bearing 20 also aids in supporting the spindle through its lower journal end 21. The hub 24, journal 21, and its reduced bearing end 23 below the shoulder 22, it will be noted, are circular and concentric with a perpendicular axial line or center line A—A in Figure 3, and a keyway is provided in the annular periphery of the hub for a key-point 26 between the hub and a flanged gear ring 27, which forms an operating gear that is rigidly united to and concentric with the perpendicular journal 21 of the spindle. This operating gear is rigidly mounted on the spindle with its teeth projecting face downwardly within a gear-housing 28 integral with and flaring upwardly and outwardly from the bearing-housing 17. As indicated in Figure 1 a counter-weight 29 is fixed on the upper face of the operating gear for counterbalancing the compound spindle.

The upper portion of the spindle, above the hub and operating gear is fashioned with an axle 30 which terminates in a reduced bearing pin 31, and these parts, as indicated in Figure 3 by the axial line B—B, are disposed obliquely of and at a substantial angle to the perpendicular axial line A—A of the spindle, to form an eccentric arrangement which provides for the gyratory or compound rotary movement of the crusher head, which cooperates with the stationary concave to crush the ore, rock, or other material fed to the mill.

The hollow gyratory crusher head, of frusto-conical shape, is supported on the spindle by means of spaced internal bearings 33 and 34, the upper bearings 33 being interposed between journal end 31 of the spindle and the upper interior part of the hollow head; and the lower bearing 34 is supported between the upper face of seat 35 of the hub and a lower flange 36 of the head.

The four bearings of the spindle are thus compactly arranged in pairs above and below the operating gear to provide a stable and substantial support for the spindle and to provide a similar support for the gyratory crusher head; and further the mounting of the gyratory head directly on the actuating axle permits transmission of power and motion to the gyratory head without reduction in the degree of movement. In addition, it will be obvious that any reasonable degree of eccentricity and angular or oblique inclination of the axle may be employed to cause variations in the range of gyration of the crusher head, and such a change in spindles may be accomplished with facility, due to the ready accessibility of parts of the mill.

On the outer periphery of the inner annular flange 36 of the hollow crusher head an effective floating dust seal is provided through the use of loosely mounted bearing ring or seal 37 that gyrates with the crusher head, and this floating bearing ring or seal ring is fashioned with a lower bearing face that is spherical in shape. The spherical face of the bearing ring rests or floats upon a complementary upper face of a fixed base-ring 38 that is rigidly mounted on the top of the gear housing 27.

An outer downwardly projecting annular bottom flange or skirt 39 of the head extends over and encircles this floating sealed seat to deflect falling crushed material and protect the seat from dust and debris.

Upon the exterior face of the hollow frusto-conical head is mounted a mantle 40, the face of which has an angularity differing in degree from the working face of the concave with which it cooperates, but, as indicated in Figures 1 and 2, the lower annular face 10' of the concave which flares outwardly from the main working face of the concave is substantially parallel with that portion of the crusher head or the mantle at the point of closest proximity of the parts when the head is gyrating. This arrangement of the crushing faces of the concave and the mantle provide for a continuous passage, by gravity, of the material to be crushed between the crushing elements of the mill, first, through a gradually decreasing upper coarse-crushing zone, and then through a lower dressing zone, and the finely crushed material then falls through the annular discharge space within the cylindrical frame of the mill.

The mantle is firmly fastened on the top face of the crusher head by means readily accessible from the top of the mill, and for this purpose the mantle 40 in the shape of an open center truncated cone, is provided with a retaining cap 41 that is slipped down over an adapted pin 42 which, as shown, is threaded at both its upper and lower ends, and the cap rests on the top of the truncated mantle. The lower threaded end of the central adapted pin is threaded into an opening in the crown of the crusher head, and a flanged clamp-sleeve or nut 43 is screwed on the upper threaded end of the adapted pin, and this nut or sleeve bears upon the cap 41 to clamp the cap and mantle down upon the crusher head.

For locking this clamp fastener in place the upper inner portion of the nut or sleeve 43 is fashioned hexagonal in shape, and a flat hex-

agonal key 44, having a bottom rib 45 seated in a complementary diametrically extending kerf in the top of the adapted pin is dropped into the sleeve after the parts are clamped together. The ribbed hexagonal key, in co-action with the hexagonal inner portion of the nut, thus securely locks the clamp device against turning. The key is, of course, removed in the event the mantle is to be removed and replaced.

To protect the clamp device, and also form a central feed-plate or distributing plate for the material that falls from the elevated feed spout 14', a flanged plate 46 is bolted to an annular exterior flange at the top of the clamp sleeve or nut 43, and as indicated by the relation of parts in Figure 1, the distributing plate, which gyrates with the crusher head uniformly spills or distributes the material to the walls of the tapered hopper from whence the material falls into the adit zone of the crusher.

For rotating the compound spindle and thereby gyrating the crusher head through the use of the operating gear ring 27, I employ the horizontally extending drive shaft 47, journaled in spaced bearings 48 and 49 within the shaft housing 50, which housing is rigid with the lower part of the main frame or cylindrical casing 1, and a driving pinion 51 on the shaft meshes with the operating gear for transmission of power.

A driving pulley 52 is mounted loosely on the shaft, but made rigid therewith through the use of a safety-hub 53 that is keyed on the shaft and united with the pulley by means of a shear pin 54. As is well known, the shear pin will break under excessive pressure, as in the presence of an uncrushable object that might otherwise jam the mill, and in the use of the safety device serious damage to the mill is avoided.

The operating parts of the mill are lubricated through the use of an oiling system indicated in Figure 1, which includes a supply or feed pipe 55 from a suitable source extended to the oil pump 56, which pump is operated from the drive shaft by means of gears 57 and 58. Oil passes from the pump 56 through its discharge pipe 59 and supplies oil under pressure to the interior of the bearing housing 17 for lubricating various operating parts. As indicated by dotted lines in Figure 1 the spindle is fashioned with a longitudinally extending oil duct or passage 60, through which oil flows to the upper part of the spindle and thence down through the hollow crusher head for lubrication of the floating seal, and other bearings, and an outlet or drain pipe 61 connected to the gear casing 62 at the end of the shaft housing 50 disposes of the used oil in suitable manner.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a gyratory crushing mill, the combination with a frame, a perpendicular spindle having an obliquely extending axle, a hollow crusher-head mounted in bearings at the upper end of the axle, and bearings in said frame for the lower end of the spindle, of an intermediate hub integral with said spindle and axle and a gear ring rigid with the hub, a bearing between the frame and spindle and located beneath the hub, a bearing between the hollow head and axle and located directly over the hub, and a driving pinion journaled in the frame and located below and engaging with the gear ring.

2. In a gyratory crushing mill, the combination with a frame, a perpendicular spindle having an obliquely extending axle, a hollow crusher head mounted in bearings at the upper end of the axle, bearings in the frame for the lower end of the spindle, and an inner annular flange on the hollow crusher head, of an intermediate hub integral with the axle and spindle and a gear ring rigid with the hub, a bearing between the frame and spindle located beneath the hub, a bearing between the inner face of said flange and the axle and located directly over the hub, a fixed base ring mounted on the frame exterior of and above the gear ring, a gyratory friction ring mounted on the exterior face of the flange and bearing on the base ring, and a driving pinion journaled in the frame beneath the gear ring.

JOHN W. STEVENS.