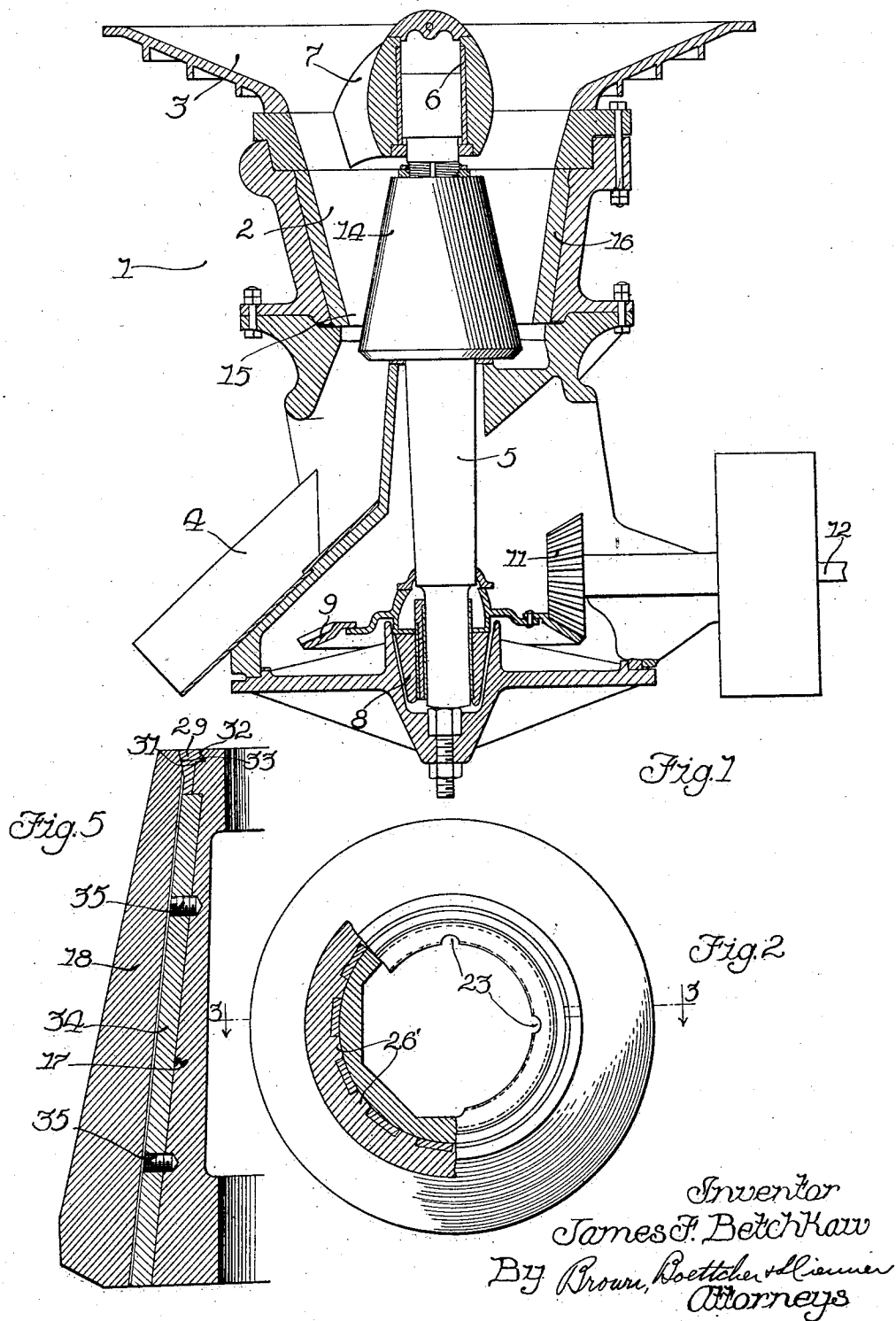


1,396,016.

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ROCK CRUSHER.
APPLICATION FILED MAY 22, 1919.

Patented Nov. 8, 1921.
2 SHEETS—SHEET 1.



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APPLICATION FILED MAY 22, 1919.

Patented Nov. 8, 1921.

2 SHEETS—SHEET 2.



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ROCK-CRUSHER.

1,396,016.

Specification of Letters Patent.

Patented Nov. 8, 1921.

Application filed May 22, 1919. Serial No. 298,880.

To all whom it may concern:

Be it known that I, JAMES F. BETCHKAW, a citizen of the United States, residing at Berlin, in the county of Green Lake and State of Wisconsin, have invented a certain new and useful Improvement in Rock-Crushers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates generally to rock crushers, and more specifically to improved means for locking the mantle to the gyratory head of the crusher, as will be more apparent from the following description.

In the class of rock crushers or breakers to which my invention has particular reference, there is employed a gyrating conical head disposed in a cooperating conical crushing chamber, into which the unbroken rock is fed. The gyrating conical head is mounted on a power shaft which is actuated by an eccentric or similar mechanical device to gyrate the head through a circular path in the crusher chamber and break the rocks between the conical surfaces of the head and chamber. This operation is, naturally, productive of severe erosion of the crushing surfaces, particularly the surface of the gyratory head when crushing hard rock and consequently this head must be frequently renewed.

As a saving expedient to avoid the expense and difficulty of renewing the entire head, it has been proposed to apply a mantle of extremely hard metal to the head, such as one of manganese steel, which could be renewed with relatively small expense and little difficulty. At this point a problem was encountered in the method of locking or securing the mantle to the head. One widely adopted practice of effecting this locking has been to provide cooperating lugs and slots on the two parts coacting similarly to a bayonet or gun lock, but it has been proven that this mode of locking does not possess the required rigidity and strength to take care of the severity of the work, and furthermore it requires careful machining of the mantle and

of which is to afford the desired rigidity and strength to the crushing unit. A secondary object of my invention is to provide an improved construction of mantle and head embodying features having particular relation with the above locking means.

In the appended drawings I have illustrated a preferred embodiment of my invention applied to a gyratory rock crusher, but from the utility of my invention, which will be more apparent as the description proceeds, it will be obvious that my invention is not limited solely to this particular use, but includes in its scope other classes of machinery and also tool mechanism in general.

Figure 1 is a vertical sectional view of a gyratory crusher embodying a head constructed in accordance with my invention;

Fig. 2 is a plan view of the head in its entirety, part of the same being broken away in section;

Fig. 3 is an enlarged section of the same taken on the line 3—3 of Fig. 2;

Fig. 4 is a bottom plan view of the head in its entirety, part of the same being broken away in section; and

Fig. 5 is a fragmentary sectional view taken on the plane of the line 5—5 of Fig. 4.

The crusher 1, which I shall describe but briefly, includes a conical crushing chamber 2, a feeding hopper 3, which opens into the top of the crushing chamber, and a discharge spout 4 which discharges the crushed rock from the bottom of the chamber 2. Supported vertically in the machine is a shaft 5, the upper end of which is loosely guided in a play bearing 6 in the hub of the spider 7, and the lower end of which is mounted in an eccentric 8. The eccentric 8 forms part of the hub of a bevel gear 9 which is driven by a bevel pinion 11 mounted on the end of the power shaft 12. On the shaft 5 is mounted the conical crushing head 14, the inclined taper of which, in cooperation with the oppositely inclined walls of the chamber 2, forms a tapering restricted throat 15 in the bottom of the chamber 2, where the actual rock breaking is accomplished.

It will be apparent that rotation of the eccentric 8 will impart a gyratory motion to the lower end of the shaft 5 which will produce a circular gyratory motion of the

head 14 about the interior of the throat 15, with a reversely rotating motion of the head 14 about its gyrating axis. This action results in breaking the material in the crushing chamber, which then drops through by a continuous action at the successive places around the throat from which the head is most distant.

Obviously, this breaking action causes severe erosion of the breaking surfaces which, particularly when breaking exceptionally hard rock, necessitates their periodic renewal. In the case of the crushing chamber 2, this is accomplished by inserting new liners or "concaves" 16, which form a sectional lining for the chamber 2. The crushing surface of the head 14 is renewed by substituting a new mantle on the head center, which will be more apparent from the sectional illustration of the head shown in Fig. 3.

Referring to this figure, the head 14 comprises in its entirety, a head center 17, preferably of cast iron or steel, and a conical mantle 18 of manganese steel or some other extremity hard metal. The head center 17 is formed with the two interior end bearing surfaces 19 and 21, which are machined off with a slight taper to fit the taper of the shaft 5. The interior portion of the casting intermediate the bearing surfaces, is spaced away from the shaft 5 and is of polygonal formation, as indicated at 22. After mounting the head center on the shaft, the intervening central space between the two is filled with a filler of zinc, babbitt, or any preferred material, which is poured into the space 22 through the semi-circular grooves 23 in the top of the head center. The zinc or Babbitt filler constitutes a backing for that part of the head center which is spaced away from the shaft, and hence forms a solid unit of the shaft and center. The head center may also be keyed to the shaft if desired.

The outer tapering surface of the head center 17 is machined adjacent the top and bottom to provide the tapering centering surfaces 24 and 25. The outer mantle 18 is centered on the head center 17 by shoulders 26 and 27 which project inwardly from the body of the mantle and bear on the surfaces 24 and 25. The shoulders 26 and 27 are machined on a common taper and are made segmental; that is, they are fashioned with alternate slots and segments, the segments being indicated at 26' and 27' in Figs. 2 and 4. The shoulders 26 and 27 form an intervening space 28 between the mantle and head center, which is adapted to be filled by a filler 29 of zinc, babbitt, cement or any other suitable material which may be inserted between the mantle and head center in a molten or plastic condition. Of these, however, I preferably employ

zinc. When the head has been assembled, the molten filler 29 is poured into the space 28 from the top of the head, between the segments 26' and the level of the filler is brought up flush with the top of the head. The filler permeates into the slots between the upper and lower segments 26' and 27', and upon solidifying, the mantle 18 and filler 29 are rigidly locked together.

It will be apparent from the foregoing that the machining operations necessary to provide for properly centering the mantle 18 on the head center 17 are very much simplified by machining only the surfaces 24 and 25 and the shoulders 26 and 27. The span between the shoulders 26 and 27 is backed up by the filler 29, which thus affords the desired solidity and strength to the crushing head. The filler furthermore prevents the entrance of pulverulent rock between the mantle and head center and thus avoids the abrasion between these two which characterizes the gun lock type of joint.

The filler 29 is securely locked to the head center 17 by the following construction. Referring to Figs. 3 and 5, it will be noted that the upper end of the head center 17 is provided with an annular recess or groove 31 which has an inwardly and downwardly inclined face or surface 32. It will be apparent that the face 32, being inclined at an angle to the line of separation of the filler 29 and head center 17, will function as a wedge to lock the filler 29 against upward displacement under the stress of axial forces, tending to raise the head or mantle. When it is desired to remove the mantle 18 for the purpose of substituting a new one, the entire head 14 is first removed from the crusher in a manner well known to those skilled in the art. The filler 29 is then merely chipped out around the groove 31 by a chisel or the like, whereupon the mantle and filler are free and can be slipped off over the top of the head center. There is very little, if any, molecular cohesion between filler material 29 and the head center 17 and therefore this can be easily accomplished. After substituting the new mantle a new charge of molten filler 29 is of course poured between the mantle and head center to lock the two together. It will be noted that the face of the mantle 18 is fired back, opposite the groove 31, as indicated at 33, to permit access to the groove 31 for chipping or cutting out the filler.

To prevent any relative rotation between the mantle 18 and head center 17, I provide two diametrically opposite flat keys 34—34, as indicated in Fig. 5. These keys engage between segments 26' and 27' on the mantle 18 and are recessed in the head center 17 where they are held in place by set screws 35. The mantle 18 is also provided with two diametrically opposite holes 36—36

(Fig. 3), which are adapted to be engaged by grappling pins when the head is to be lifted from the interior of the crusher.

The locking feature of my invention is not to be limited to the particular form of groove shown, as it will be obvious that I may employ recesses or projections of any formation, so long as they present a face or surface disposed at an angle to the line of separation of the mangle 18 and core member 17. This angular surface, whether it be a recess or a projection, may be disposed at either the top or bottom of the core member 17, or in any position where it will be accessible to permit of removal of the filler.

I claim:

1. In combination, a central member of conical formation, a conical mantle engaging over said central member, said conical mantle being adapted to be withdrawn endwise off the end of said central member, a locking surface on said central member disposed at an angle to the line of separation of said mantle and said central member, a cooperating locking surface on said conical mantle also disposed at an angle to the line of separation of said mantle and said central member, a locking filler between said central member and said mantle and engaging with both of said surfaces, said surfaces being arranged whereby the engagement of the filler therewith positively locks the conical mantle against endwise withdrawal, one of said surfaces being accessibly disposed to permit the releasing of said locking filler therefrom.

2. In combination, an inner member, an outer member engaging over said inner member, said outer member being adapted for removal over the end of said inner member, releasable locking means for said members comprising a filler between said members, locking surfaces on each of said members cooperating with said filler, said locking surfaces being arranged whereby the filler is positively locked against endwise removal from said inner member, and whereby said outer member is positively locked against endwise removal from said filler, one of said locking surfaces being accessibly disposed to permit the releasing of the filler therefrom for removing said outer member, said inner and outer members be-

ing locked together solely by the cooperation of said filler and said locking surfaces.

3. In a gyratory crusher, the combination of a gyratory shaft, a conical head center mounted on said shaft, said head center having machined surfaces adjacent the top and bottom thereof, a removable conical mantle on said center having inwardly projecting shoulders bearing on said machined surfaces, a metallic filler between said head center and said mantle, an annular locking groove formed in the upper end of said head center, said filler being molded in said groove and thereby rigidly locking said filler against endwise removal over the reduced end of said head center, said conical mantle being rigidly locked to said filler to prevent endwise removal over the reduced end of said filler, said locking groove being accessibly disposed to permit said filler to be chipped out around said groove, and a key between said head center and said mantle for preventing relative rotation therebetween.

4. In a crusher head, a conical head center, a removably conical mantle on said head center, an annular groove formed in said head center, said groove having a surface inclined inwardly at an angle to the line of separation of said mantle and head center, and a metallic filler molded in said groove, said filler having rigid engagement with said mantle, said groove being accessibly disposed to permit removal of said filler.

5. In a gyratory crusher, a crusher head comprising a conical head center having annularly machined surfaces adjacent the top and bottom of said head center, a removable conical mantle on said head center having inwardly projecting shoulders bearing on said machined surfaces, a groove formed in said head center adjacent the top thereof, said groove having an inwardly inclined wedging surface, and a metallic filler between said head center and said mantle and molded in said groove, one of said shoulders being segmental to permit access of said filler to the space between said shoulders.

In witness whereof I hereunto subscribe my name this first day of May, 1919.

JAMES F. BETCHKAW.