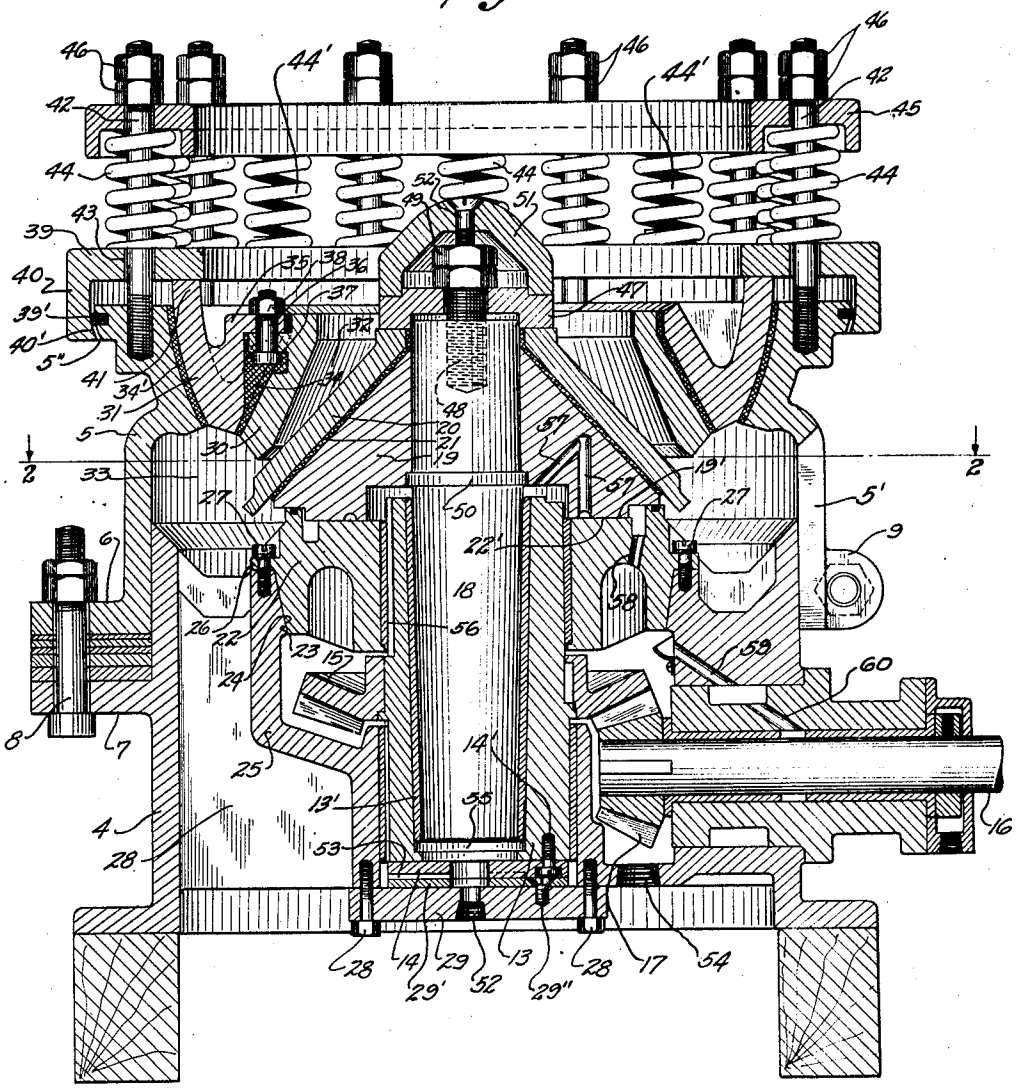
Nov. 13, 1928. 1,691,553

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CRUSHER

Filed Dec. 20, 1926 2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

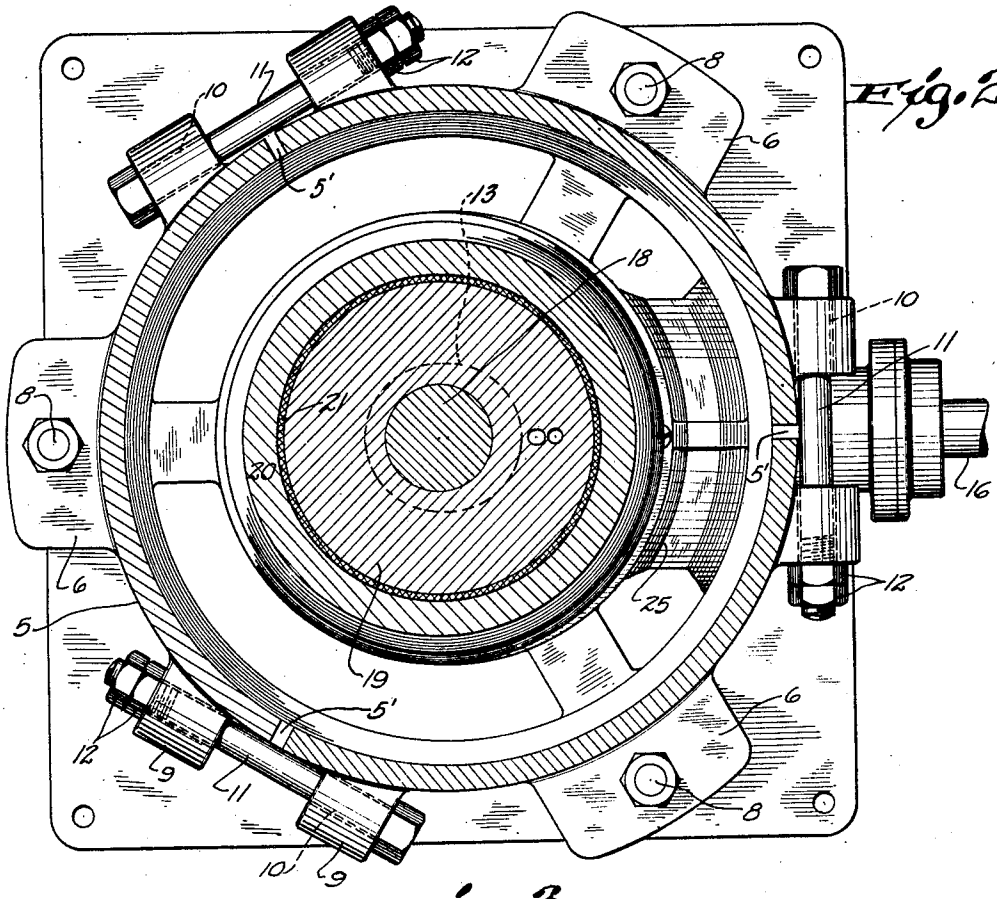
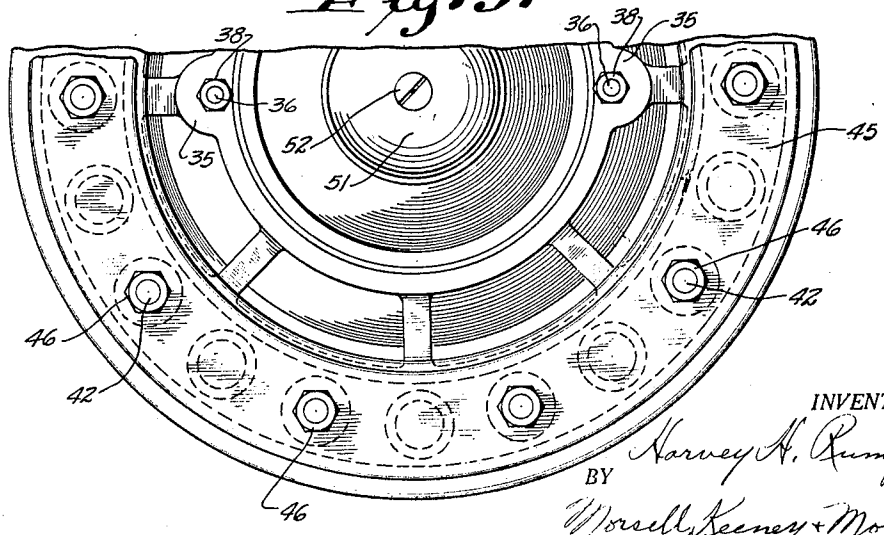


Fig. 3.



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CRUSHER.

Application filed December 20, 1926. Serial No. 155,934.

My invention has relation to improvements in crushers of the form wherein an eccentric parallel rolling motion is imparted to the crushing head.

One of the important objects of the present invention is to provide a crusher in which the crushing member or head is journaled in the eccentric bore of a revoluble sleeve to impart an eccentric parallel horizontal movement or throw uniform at all points of the bowl which is combined with a rolling movement of the crushing member.

A further object of the invention is to provide a crusher in which the crusher is formed with a flat under surface which is directly, slidably and rotatably supported on a flat portion of the frame to firmly reinforce the crushing impact of the head.

A further object of the invention is to provide a crusher in which the axis of the crusher head is at all times parallel to the axis of movement of the rotary sleeve in which the head is eccentrically mounted, and also to the axis of the outer crushing member or bowl.

A further object of the invention is to provide a crusher in which the outer non-rotatable crushing member is yieldingly maintained in position by springs and a ball and socket means.

A further important object of the invention is to provide for a movement of the outer crushing member upwardly when the resistance of the material passing through the passage between the two crushing members becomes too great. This undue resistance of the material may be due either to overloading, or by reason of the failure of the outer crushing member and the cooperating crushing head to crush particles passing therebetween, and which may be true, especially, in the case of foreign matter entering between the two crushing members. This excess resistance may also be occasioned by reason of the packing action which frequently takes place at the point of the discharge of the material from the passage in which it is crushed, and when this packing occurs the outer crushing member automatically moves upwardly, and therefore takes care of, or compensates for, this packing condition.

A further important object of the invention is the provision for a spring-pressed downward yielding pressure against the outer crushing member, by which the outer crushing member, when too great resistance is offered by the material passing therethrough, will move uwardly against the opposing force exerted by the spring pressure and thus counter-act the effect of overloading or packing, by permitting the particles which cannot be crushed to pass freely through the passage between the two crushing elements, or where packing occurs, to permit the packed material to freely discharge from the passage.

A further object resides in the provision of means for tensioning the downward yielding spring pressure against the outer crushing member, to thereby reduce the amount of horse-power required for running the machine.

A further object of the invention resides in the provision of means whereby the upper frame may be adjusted upwardly, carrying with it the outer crushing member, to thereby increase or decrease the space at the exit end of the passage for the crushed material.

A further object of the invention is the provision of a movable support for the inner crushing head.

A further object of the invention is the provision of bearings arranged above and below the gear member, whereby tilting of the eccentric sleeve is prevented.

A further object of the invention is the provision of a construction of such character that the material to be crushed is reduced to a very fine state or condition.

And a still further object of the invention resides in the provision of an improved oiling system.

With the above and other objects in view the invention consists of the improved crusher and its parts and combinations as set forth in the claims, and all equivalents thereof.

In the accompanying drawings in which the same reference characters indicate the same parts in all of the views:

Fig. 1 is a vertical sectional view through the machine;

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary plan view of the machine.

The frame of the machine is shown as composed of two sections, i. e., a lower section 4 and an upper section 5, the lower section extending into the upper section for a desired

distance. The two sections are provided, respectively, with a series of outstanding, registering, horizontal flanges 6 and 7, with removable vertical shims, or in other words plates of steel of varying thicknesses interposed therebetween to permit adjusting the distance apart of the upper fixed crushing member and the lower rotary crusher member. Vertical bolts 8 pass through the flanges 6 and 7 and the interposed plates of steel, the head of each bolt being beneath the lower flange 7, and the threaded end of each bolt carrying nuts 8, whereby the parts may be securely clamped together.

The upper section 5 of the frame is preferably split at a plurality of points as indicated by the numeral 5'. Lugs 9—9 project outwardly from the upper section 5 in such position that each split portion 5' lies between these lugs. Through apertures or openings 10 of each pair of these lugs passes horizontally a headed bolt 11, one end of each bolt being threaded to receive nuts 12—12. These nuts, when turned, act to clamp the split portions, to thereby tighten the upper frame around the upper portion of the lower frame 4. When the nuts 12—12 are loosened, and also the nuts on the upper end of the vertical bolts 8 likewise loosened, the upper frame member 5 may be raised or lowered for a purpose hereinafter referred to.

Within the lower section 4 of the frame is a sleeve 13, the upper end of which extends a slight distance into the upper section 5 of the frame. The lower end of the sleeve is attached to a bearing wear plate 14, preferably of cast iron.

Surrounding the sleeve, about mid-way thereof, and fast thereto, is a beveled gear 15. In view of the location of the beveled gear about mid-way of the sleeve, this provides for said sleeve having bearings on both sides of the gear, or in other words, above and below the gear, and thereby preventing any tendency of the sleeve to tilt under strain of crushing load or transmission of power to the gear.

A horizontal driving shaft 16 has its bearing in the lower portion of the frame member 4, and carries on its inner end a beveled pinion 17 which meshes with the beveled gear 15. In this manner rotation is imparted to the sleeve 13.

The bore 13' of the sleeve 13 is arranged eccentrically with relation to the axis of the sleeve and tapers downwardly, and within this bore is a vertical shaft 18, which is also of a corresponding tapered formation, the tapered surfaces providing for maintaining a close fit while compensating for wear of the parts and also facilitating the pouring of the metal lining for the sleeve. The shaft 18 extends upwardly into the frame member 5, and carries a conical crushing head. As is usual, this crushing head is composed of two portions, the inner main portion 19, and the outer mantle or lining 20, of manganese steel, or other suitable material, there being a lining 21, preferably of zinc, between the mantle and the head proper. When the outer mantle 20, which is the acting surface of the crushing head, becomes unduly worn, it can be removed and a new mantle, or lining, substituted.

It will be observed that the crushing head is formed with a lower flat face 19' which slidably and revolubly rests on the upper flat face 22' of a removable circular support 22 forming part of the inner lower frame portion later described. The outer peripheral surface of this support, from a medial point downwardly, is tapered or beveled, as indicated by the numeral 23. This tapered or beveled surface fits a tapered or beveled surface 24 formed at the upper end of an inner lower frame portion 25. It will be understood that it is very important to maintain a firm, close fit between these two castings, as the joints encounter considerable crushing pressure from the work done, and unless the parts have a permanently tight fit they will both wear rapidly. The mating beveled surfaces referred to afford such tight fit.

It will be noticed that the head support 22 constitutes the upper half of the bearing for the eccentric sleeve 13, and is lined with Babbitt, or similar bearing material. It will also be noticed that the lower portion of the inner lower frame member 25 forms the bearing for the lower end of the eccentric sleeve, or that portion of the eccentric sleeve which is below the gear. This bearing is likewise lined with Babbitt or similar material. When the Babbitt, or other bearing linings, become unduly worn it is, of course, desirable that provision be made for ready dismantling or removal of the support, so that the worn Babbitt linings may be replaced with new linings. With this end in view the support is provided with an outwardly extending flange 26, which is seated on the upper end of the inner frame portion 25, and is fastened thereto by screws 27. When, therefore, it becomes necessary to remove the head support for the purpose of substituting a new bearing lining, the upper portion of the machine is disconnected and removed from the lower portion thereof, and when this is done the screws 27 are turned out of engagement, when, of course, the support 22 is freed to be withdrawn upwardly from engagement with the inner frame member and a new bearing lining can then, of course, be applied to the support 22.

Also, the inner frame member 25 can be removed by turning out the bolts 28, and a new lining applied to the lower bearing portion of this frame.

It will be noted that the bolts 28 pass through a supporting base plate 29, and are

turned into the frame member 25. Interposed between the base plate 29 and the cast iron plate 14 hereinafter referred to, is another plate 29′, preferably of brass. It will be understood that the plate 14 is connected to the lower end of the sleeve 13 by a screw 14′, and this plate 14 thereby revolves with the eccentric sleeve and on the brass plate 29′. The latter plate 29′ is connected to the base plate 29 by means of a screw 29″. The base plate 29, therefore, carries the weight of the sleeve and gear.

Surrounding the crushing head and spaced a desired distance therefrom, is an outer coacting crushing member, composed preferably of two sections, i. e., an inner wear section 30, and an outer section 31. The inner surface of the inner section is inclined in a direction to form, in conjunction with the inclined surface of the crushing head, an upwardly flaring and downwardly converging passage 32, the passage leading into a discharge chamber 33.

Between the opposed surfaces of the two sections of the outer crushing member is a packing of zinc, or other suitable material 34.

The outer section of the outer crushing member is provided with a series of lugs 35, through which the threaded ends of vertical bolts 36 pass, the heads of said bolts being seated beneath shoulders 37 formed on the inner section of said crushing member. Nuts 38 are turned onto the threaded ends of the bolts against the lugs 35, whereby the two outer crushing sections, assisted by the zinc packing, are held together. The zinc packing is usually introduced by inverting the two sections of the outer crushing member and pouring the molten zinc in the spaces between said sections. The bolts 36 are therefore useful in holding the parts together. Upon the subsequent hardening of the metal the heads of the bolts are, of course, surrounded and held by the hardened metal. When the inner wear section of the outer crushing member becomes worn, the two sections of said member are removed from the machine, and the nuts 38 are then removed when, of course, the crushing section 30 can be driven out, carrying with it the bolts and the zinc lining. A new inner wear section can then be substituted for the worn out section 30.

The machine is surmounted by a plate 39, preferably in the form of a ring. This plate is provided with a depending flange or rim 40 which surrounds the outer edge of the upper end of the upper frame member 5. The under surface of this plate is in contact with an upward extension 41 of the outer section of the outer crushing member. Bolts 42 pass freely through openings 43 in the plate, and have their opposite ends threaded, the lower threaded ends entering threaded recesses in the upper frame member.

A coiled spring 44 surrounds each of these bolts, and the lower end of each coiled spring bears against the upper side of the plate 39, and the upper end of each spring bears against a plate 45 loosely mounted on the bolts, and preferably in the form of a channeled ring. The upper threaded end of each bolt passes loosely through an opening therefor in the plate 45, and receives nuts 46 which bear against the plate 45, and by turning these nuts the tension of the springs may be either increased or diminished to properly adjust the yield of the outer crushing member to the character of the material being crushed in the machine. Besides the springs 44 which surround the bolts 42, there are other springs 44′ whose upper ends are seated in the channel of the plate 45, and their lower ends bear against the lower ring or plate 39. These springs 44′ form an additional means, co-operating with the springs 44, for yieldingly holding the upper crushing member in crushing position.

Normally, the tension of the springs is such as to exert downward pressure on the plate 39, and the crushing member 31 and hold said member yieldingly in engagement with the frame 5 as shown in Fig. 1 of the drawings.

It will be noticed that the outer surface of the outer crushing member 31 is of rounded or convex form and the opposed surface of the upper section of the main frame 5 and its lining 34′ are also of rounded or concave form. This provides substantially a ball and socket bearing. This ball and socket construction is for the purpose of the outer crushing member to yieldingly tilt upwardly to enlarge the opening between the two crushing members and permit the discharge of any accumulation of large particles being crushed at any point or of any foreign matter which might otherwise block the passageway.

Under such circumstances the outer crushing member, of course, may tilt upwardly on one side against the spring pressure, or may move bodily upwardly permitting the discharge of the material above mentioned, and when discharged the ball and socket connection will realine the rotary crusher in position. Another point of advantage is that the ball and socket formation will automatically take up wear between the parts and prevent undue lateral play, the wall being extended as at 41 so as to provide for this wear and permitting the dropping downwardly of the outer section of the outer crushing member in its socket seat. The upper edge of the flanged part 41 bears against the under surface of the ring plate 39 and freely slides thereon to permit independent movement thereof and the ball member to seat in its socket. It will also be noted that the inner surface of the rim 40 is of concave form, indicated by the numeral 40′, and co-operates with a convex surface 5″ formed at the upper end of the upper frame member 5 to permit

tilting of the rotary crusher member. A packing ring 39′ is interposed between the parts 40 and 5 to prevent the entrance of dust to the ball and socket joint.

Over the upper end of the crusher shaft, but not in bearing contact therewith, is a plate 47. The outer edge of the underside of this plate bears against the upper truncated end of the crusher head. The plate 47 is provided with a central opening, through which passes freely a screw stud 48, said stud entering and engaging the upper end of the crusher shaft. The screw stud is provided with nuts 49 threaded on its upper end, which are turned against the upper side of the plate 47. By this arrangement, when the mantle 20 becomes loosened on its tapered lining, the nuts can be tightened, forcing the mantle to a tight bearing on its tapered head.

The crusher shaft 18 is provided medially with an annular shoulder 50. It will be understood that the crushing head 19 is shrunk onto the shaft 18. The shoulder 50 forms a means for maintaining the tapered shrunk-on head in its proper relation to the shaft.

Seated on the plate 47 is a cap 51 which acts as a guard or cover for the bolt 48 and the nuts 49, and being of a substantial conical form also acts to perform the function of the usual deflector distributing the material to be crushed into the passage 32. This cap is held in place by means of a screw 52 which passes through the top of the cap and is threaded into the screw stud 48.

Attention is now directed to the improved oiling system employed by me. The numeral 52 indicates an inlet oil passage into which the oil is pumped. Part of the oil so forced through said inlet passage passes into radial passages 53 (preferably three of these passages being employed) formed in the plate 14. These passages lead to and communicate with the space between the outer surface of the lower portion of the eccentric sleeve, and the inner surface of the lower bearing formed by the inner frame 25, and the space in question leads to and communicates with the gear and pinion casings. Thus lubrication is provided for not only the lower bearing for the eccentric sleeve, but also for the gear and pinion. The oil in excess of that used for lubrication is free to flow from the pinion casing through an outlet opening 54, with which a pipe (not shown) is connected, said pipe serving to return the oil to the oil tank. It will be understood that not all of the oil which is forced through the inlet opening 52 passes directly into the bearing at the lower end of the eccentric shaft and thence into the gear and pinion casings. A quantity of this oil passes into the space 55 below the crusher shaft. This oil passes from the said space 55 into the space between the crusher shaft and the inner surface of the eccentric sleeve to thus lubricate these parts. It will overflow at the upper end of the eccentric sleeve, and will pass downwardly in the passage 56 and into the gear and pinion casings, the excess to be finally discharged through the opening 54.

Also, some of the oil which overflows the upper end of the eccentric sleeve will pass through passages, such as 57, which lead to the space between the under side of the inner crushing head 19 and the upper side of the support 22, and lubricate the flat bearing portions 19′ and 22′ of the frame part 22 and the crusher head 19, and the excess of this oil also passes to the gear and pinion casings through a passage 58, finally passing out of the exit opening 54.

It will be further noted that diagonal passages 59 and 60 lead from the gear casing, and these passages afford means for also lubricating other parts, particularly the bearing for the shaft 16, any excess of this oil passing back along the shaft to the pinion casing.

With reference to the advantages possessed by my invention, attention is again directed to the feature of the spring-pressed downward yielding pressure exerted against the outer crushing member, and by which the outer crushing member, when too great resistance is offered by the material passing therethrough, will tilt or move upwardly against the opposing force exerted by the spring pressure, and thus counteract the effect of overloading or packing.

Also, this feature possesses further advantage by reason of the provision for tensioning the downward yielding spring pressure against the outer crushing member to thereby adjust the tension of the yield to the character of the material being crushed.

Furthermore, by reason of the provision for the adjustment of the upper frame vertically, a decided advantage arises, inasmuch as with this vertical adjustment of said frame the outer crushing member is carried with the frame, whereby the space at the exit end of the passage is either increased or decreased.

It will, furthermore, be noted that the ball and socket bearing is approximately in horizontal alinement with the upper half portions of the crusher members so that when any comparatively large pieces of rock are crushingly engaged by the said upper half portions of the crusher members the strain of the crushing effort will be more in a laterial direction and will be directly resisted sidewise by the ball and socket portions of the machine and thus relieve the springs, bolts and plate 39 from undue lateral strain. As the material moves downwardly and radially outwardly between the crushing members and below the horizontal plane of the ball and socket joint the strain is more upwardly and will be taken by the springs, thus relieving the bolts and springs of undue lateral strains as before mentioned.

Furthermore, not only has the removable support 22 the advantage heretofore pointed out, but, furthermore, as the crushing head 19 is slidably and revolubly supported on the flat upper side of said support which receives the direct strain from the rotary crusher member of the work performed, a further advantage arises, inasmuch as the flat surface affords provision for even wear of the parts.

It is to be furthermore noted that my improved machine provides for a parallel crushing stroke which I believe to be far superior to the ordinary gyratory lever stroke, which latter diminishes toward the top of the crushing movement. The advantage arising from this feature of the machine is the greatest in the case of smooth gravel boulders, but quite marked even in crushing quarried rock.

Attention has heretofore been directed to the advantage arising from the location of the gear 15 in my improved construction. As this gear is located halfway up the eccentric sleeve, this provides a bearing on both sides of the gear, or in other words, above and below the gear, thus equalizing the wear on the bearing and preventing any tilting tendency.

In the operation of the machine, when the driving shaft 16 is rotated, rotation is imparted to the eccentric sleeve 13 by reason of the inter-meshing gearing hereinbefore described. As the sleeve 13 is rotated, a parallel eccentric motion is imparted to the vertical shaft 18, due to the fact that said shaft is mounted in the eccentric bore of the sleeve. Of course, the parallel eccentric motion of the vertical shaft is communicated to the crushing head mounted on the upper end of said shaft which travels in an eccentric path within the confines of the outer crushing member. As the crushing head and its shaft moves eccentrically, it is also free to rotate in the bore of the sleeve, it acts upon the particles passing through the passageway, and forces said particles against the outer crushing member, resulting in the crushing of the material. If, however, the passageway is overloaded with material, or becomes clogged or packed so that escape of the material from the passageway is interfered with, the increasing accumulation of clogged material will force the outer crushing member upwardly and enlarge the discharge opening at the point clogged and permit the more free discharge of said material. The eccentric parallel movement of the head will constantly change the size of portions of the discharge opening as the head moves in an eccentric path with relation to said discharge opening with the result that when the head moves closer to any point of the outer crusher member it will crush the material therebetween and when it recedes therefrom the crushed material will drop through the enlarged space part of said discharge opening. When the clogging effect is removed, of course, the coiled springs 44 and 44′ expand and have the effect of returning, and the ball and socket joint guiding, the outer crushing member to normal position. The material to be crushed, of course, is fed to the passage 32 by suitable hopper mechanism (not shown).

What I claim is:

1. In a crushing machine, the combination of a frame, an eccentric member mounted therein and movable in a parallel plane, an inner crusher head mounted on the member and also movable therewith in a plane parallel to the plane of movement of the eccentric member, a fixed support upon which the inner crusher head bears, an outer crushing member spaced from the crusher head, the space between the two crushing members forming a passage for the material to be crushed, and yielding means acting to hold the outer crushing member in its normal crushing position, but permitting said crushing member to move in a direction to widen the passage between it and the crusher head, when undue pressure is exerted against the outer crushing member by the material traveling through said passage.

2. In a crushing machine, the combination of a frame, an eccentric member mounted therein and movable in a parallel plane, an inner crusher head mounted on the member and also movable therewith in a plane parallel to the plane of movement of the eccentric member, a fixed support upon which the inner crusher head bears, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, the opposing faces of the two crushing members being beveled to gradually converge the passage toward and to the discharge end of said passage, and yielding means acting to hold the outer crushing member in its normal crushing position, but permitting the said crushing member to move in a direction to widen the passage between it and the crusher head, when undue pressure is exerted against the outer crushing member by the material traveling through said passage.

3. In a crushing machine, the combination of a frame, a sleeve journaled therein and having an eccentric bore, an inner crusher head having a shaft which is journaled in the bore and also moving therewith in a plane parallel to the plane of movement of the eccentric member, a fixed support upon which the inner crusher head bears, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, and a spring-pressed member in contact with the outer crushing member and acting to hold said outer crushing member in its normal crushing position, but permitting the said crushing member to move in a direction to widen the passage be-

tween it and the crusher head when an undue pressure is exerted against the outer crushing member by material traveling through said passage.

4. In a crushing machine, the combination of a frame, a sleeve journaled therein and having an eccentric bore, an inner crusher head having a shaft which is journaled in the bore and also moving with the sleeve in a plane parallel to the plane of movement of the eccentric member, a fixed support upon which the inner crusher head bears, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, a spring-pressed member in contact with the outer crushing member and acting to hold said outer crushing member in its normal crushing position, but permitting the said crushing member to move in a direction to widen the passage between it and the crusher head, when undue pressure is exerted against the outer crushing member by material traveling through said passage, and means for regulating the tension of the spring-pressure.

5. In a crushing machine, the combination of a frame, a sleeve journaled therein and having an eccentric bore, an inner crusher head having a shaft which is journaled in the bore and also moving with the sleeve in a plane parallel to the plane of movement of the eccentric member, a fixed support upon which the inner crusher head bears, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, a plate in contact with the outer crushing member, coiled springs bearing at their inner ends against the plate, and means against which the outer ends of the springs bear, the plate under the spring pressure acting to hold the outer crushing member in its normal crushing position, but permitting the said crushing member to move in a direction to widen the passage between it and the crusher head, when undue pressure is exerted against the outer crushing member by the material traveling through said passage.

6. In a crushing machine, the combination of a frame, a rotatable sleeve mounted therein and having an eccentric bore, an inner crusher head having a shaft which is journaled in the bore and moves with the sleeve in a parallel plane, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, a plate positioned above and in contact with the outer crushing member, said plate provided with a series of openings, bolts extending freely through said openings, and having their opposite ends threaded, the lower threads engaging the frame work, springs surrounding the bolts and bearing at their lower ends against the plate, means against which the upper ends of the springs bear, and a nut engaging the upper threaded end of each bolt and adapted to be turned against the bearing means for the upper end of each spring, the spring pressure exerted against the plate holding the outer crushing member normally in its crushing position, but permitting an upward movement of said outer crushing member, when undue pressure is exerted against said outer crushing member by the material traveling through the passage between the two crushing members.

7. In a crushing machine, the combination of a frame, a rotatable sleeve mounted therein and having an eccentric bore, an inner crusher head having a shaft journaled in the bore and moving with the sleeve in a parallel plane, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, a plate in the form of a ring positioned above and in contact with the outer crushing member, said ring provided in its outer portion with a series of openings, another plate in the form of a ring above the first mentioned plate, said other plate also provided with a series of openings through its outer portion, bolts extending freely through the openings of the two places, and having their opposite ends threaded, the lower threads engaging the frame work, springs surrounding the bolts between the two plates, and nuts on the upper threaded ends of the bolts, adapted to be turned downwardly against the outer plate, the spring pressure exerted against the innermost plate holding the outer crushing member normally in its crushing position, but permitting an upward movement of said outer crushing member when undue pressure is exerted against said crushing member by the material passing through the passage between the two crushing members.

8. In a crushing machine, the combination of a frame, having in the upper portion thereof a rounded concave surface, a rotatable sleeve mounted in the frame and having an eccentric bore, an inner crusher head having a shaft journaled in the bore and moving with the sleeve in a parallel plane, an outer crushing member spaced from the crusher head to form a passage for the material to be crushed, the outer surface of said outer crushing member being of rounded convex form and fitting the rounded concave surface of frame, whereby a ball and socket bearing is formed, and yielding means acting to hold the outer crushing member in its normal crushing position, but permitting said crushing member to move in its bearing in a direction to widen the passage between it and the crusher head, when undue pressure is exerted against the outer crushing member by the material traveling through said passage.

9. In a crushing machine, the combination of a frame, having in the upper portion thereof a rounded concave surface, a rotatable sleeve journaled in the frame and having an eccentric bore, an inner crusher head having a

shaft journaled in the bore, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, the outer surface of said outer crushing member being of rounded convex form and fitting the rounded concave surface of the frame, whereby a ball and socket bearing is formed, a plate in contact with the outer crushing member, coiled springs bearing at their inner ends against the plate, and means against which the outer ends of the springs bear, the plate under the spring pressure acting to hold the outer crushing member in its normal crushing position, but permitting said crushing member to move in its bearing in a direction to widen the passage between it and the crusher head, when undue pressure is exerted against the outer crushing member by the material traveling through said passage.

10. In a crushing machine, the combination of a frame, a sleeve mounted in the frame and having an eccentric bore, an inner crusher head journaled in the bore and movable in a plane parallel to the plane of movement of the eccentric member, a fixed support upon which the inner crusher head bears, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, said eccentric bore causing said sleeve and the crusher head to impart a parallel eccentric crushing stroke against the material confined in the passage between the inner crusher head and the outer crushing member.

11. In a crushing machine, the combination of a frame, a movable sleeve mounted in the frame and having an eccentric bore, an inner crusher head mounted in the bore and movable in a plane parallel to the plane of movement of the eccentric member, a fixed support upon which the inner crusher head bears, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, and a support for the crusher head, the upper surface of said support being flat, and having the lower surface of the crusher head bearing thereon.

12. In a crushing machine, the combination of a frame, a movable sleeve mounted in the frame and having an eccentric bore, an inner crusher head mounted in the bore and movable in a parallel plane, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, and a removable support for the crusher head having an upper flat surface to form a bearing for the lower flat surface of the said crusher head.

13. In a crushing machine, the combination of a main frame, an inner frame member having an upper beveled or tapered portion, a movable sleeve mounted in the frame member and having an eccentric bore, an inner crusher head journaled in the bore and movable in a parallel plane, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, and a removable support for the crusher head, said support having a beveled or tapered surface fitting the beveled or tapered surface of the inner frame.

14. In a crushing machine, the combination of a main frame, an inner frame member, a movable sleeve mounted in a bearing part of the frame and having an eccentric bore, an inner crusher head journaled in the bore and movable in a parallel plane, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, a support removably connected to the inner frame member and above the bearing part for supporting the crusher head, and a gear means between the bearing part and the removable support for rotating the sleeve.

15. In a crushing machine, the combination of a main frame, a movable sleeve mounted in a bearing part of the frame and having an eccentric bore, an inner crusher head journaled in the bore and movable in a parallel plane, an outer crushing member spaced from the inner crusher head to form a passage for the material to be crushed, a removably connected inner frame member having an upper beveled or tapered portion, and a support for the crusher head removably connected to the inner frame and positioned above the bearing part, said support having a beveled or tapered surface fitting the beveled or tapered surface of the inner frame member and also having a flat upper end against which the flat lower end of the crusher head bears, and a gear means between the bearing part and the removable support for rotating the sleeve.

16. In a crushing machine, the combination of a main frame, a sleeve mounted in said main frame and having an eccentric bore and provided medially with a gear, a pinion meshing with the said gear to rotate the sleeve, a shaft mounted in the eccentric bore of the sleeve, a crusher head mounted on the upper end of said shaft, a crushing member co-operating with the crusher head, the space between the two crushing members forming a passage for the material to be crushed, an inner frame member, the lower portion thereof forming a bearing for the lower portion of the sleeve below the gear, and a support having a flat surface against which the lower flat end of the crusher head bears, said support also forming a bearing for the upper portion of the sleeve above the gear.

17. In a crushing machine, the combination of a main frame, a sleeve mounted in said main frame and having an eccentric bore and provided medially with a gear, a pinion meshing with the said gear to rotate the sleeve, a shaft mounted in the eccentric bore of the sleeve, a crusher head mounted on the upper end of said shaft, a crushing member

co-operating with the crusher head, the space between the two crushing members forming a passage for the material to be crushed, an inner frame member, the lower portion thereof forming a bearing for the lower portion of the sleeve below the gear, and a removable support having a flat surface against which the lower flat end of the crusher head bears, said support also forming a bearing for the upper portion of the sleeve above the gear.

18. In a crushing machine, the combination of a frame, a sleeve journaled therein and having an eccentric bore, a movable shaft journaled in the sleeve and movable in a plane parallel to the plane of movement of the sleeve, said shaft provided at a medial point with an annular shoulder, a two part crusher head mounted on the shaft and bearing against the annular shoulder, and having a lower flat end, a support against which the lower flat end of the crusher head also bears, a plate extending over the upper end of the shaft, and bearing against the upper end of the crusher head, said plate provided with an opening, a screw stud passing through the opening of the plate and entering the shaft, a nut turnable on said screw stud and against the plate, whereby the upper part of the crusher head is clamped between said plate at one end and against the lower part of the head at the other end thereof, and an outer crushing member co-operating with the crusher head and spaced therefrom, whereby a passage is formed for the material to be crushed.

19. In a crushing machine, the combination of a frame, a sleeve journaled therein and having an eccentric bore, a vertical shaft journaled in the sleeve and movable in a plane parallel to the plane of movement of the sleeve, a two part crushing head mounted on the shaft and having a lower flat end, a support having an upper flat surface against which the lower flat end of the crushing head bears, a plate extending over the upper end of the shaft and bearing against the upper end of the crushing head, means for clamping said plate to the upper end of the crushing head, a conical deflector cap above the plate and resting thereon, means for holding the cap in engagement with the plate, and an outer crushing member co-acting with the crushing head and spaced therefrom, whereby a passage is formed for the material to be crushed.

20. In a crushing machine, the combination of a frame, consisting of upper and lower members, a sleeve journaled therein and having an eccentric bore, a movable shaft journaled in the sleeve, a crushing head mounted on the shaft and having an outer acting surface of substantially conical form, an outer crushing member carried by the upper frame member and spaced from the inner crushing head, and having its inner acting surface inclined in the opposite direction to the inclination of the crushing head to form a converging passage between the two crushing members, an adjustable connection between the upper and lower frame members, whereby said upper frame member may be raised or lowered and the outer crushing member raised or lowered therewith, to regulate the width of the exit opening of the passage, and means for retaining the upper frame member in adjusted position.

21. In a crushing machine, the combination of a frame, consisting of upper and lower members provided, respectively, with outstanding horizontal flanges, and the upper frame member being slitted downwardly and having flanges extending outwardly therefrom, the slitted portion lying between the said flanges, removable shim plates of variable thickness disposed between the horizontal flanges, bolts passing through the horizontal flanges and through the interposed plates, bolts extending through the flanges which are adjacent to the slitted portion of the upper frame member, a sleeve journaled in the frame and having an eccentric bore, a movable shaft journaled in the sleeve, a crushing head mounted on the shaft and having an outer acting surface of conical form, and an outer crushing member carried by the upper frame member and spaced from the inner crushing head, and having its inner acting surface inclined in the opposite direction to the inclination of the crushing head, to form a converging passage between the two crushing members.

22. In a crushing machine, the combination of a frame, a sleeve journaled in the frame and having an eccentric bore, a shaft journaled in the sleeve, an inner crushing head mounted on the shaft, an outer crushing member spaced from the inner crushing head to form a passage for the material to be crushed, said outer crushing member being mounted in a ball and socket bearing, and also provided with an upward extension, and a spring-pressed member in contact with the upward extension of the outer crushing member and acting to hold said outer crushing member in its normal central crushing position, but permitting said crushing member to move in a direction to widen the passage between it and the crushing head when an undue pressure is exerted against the outer crushing member by the material traveling through said passage.

23. In a crushing machine, the combination of a frame, provided with inlet and outlet oil openings, a sleeve journaled therein and having an eccentric bore, a gear fast on the sleeve and confined in a casing provided therefor in the frame, a rotatable shaft, a pinion on the inner end thereof meshing with the gear, said pinion being also confined

within a casing provided therefor, and from which casing the outlet oil opening extends, a shaft journaled in the sleeve, and extending thereabove and movable in a plane parallel to the plane of movement of the sleeve, a crushing head mounted on the shaft which is journaled in the sleeve, a support for the crushing head spaced from the outer wall of the sleeve, and forming a passage between the head and the support which communicates with a passage extending over the upper end of the sleeve and leading to the gear and pinion casings, and also affording means for the flow of the oil between the crushing head and the upper side of said support, a plate beneath the lower portion of the sleeve and provided with radial passages, the oil inlet opening leading to said radial passages, an inner frame member spaced from the inner portion of the sleeve to form a passage which, at its lower end, is in communication with the radial passages and at its upper end is in communication with the gear and pinion casings, and an outer crushing member with which the crushing head co-operates.

24. A crushing machine, comprising a frame, upper and lower bearings forming part thereof, the upper bearing having an upper flat face, a sleeve journaled in the bearings and having an eccentric bore, a shaft journaled in the bore and moving with the sleeve in an eccentric parallel plane and having a crushing head formed with a flat surface which slidably engages the flat face of the upper bearing, an outer crushing member surrounding the head and co-acting therewith in crushing material and supported by the frame, and means for rotating the sleeve.

25. A crushing machine, comprising a frame, upper and lower bearings forming part thereof, the upper bearing having an upper flat face, a sleeve journaled in the bearings and having an eccentric bore, a shaft journaled in the bore and movable with the sleeve in an eccentric parallel plane and having a crushing head formed with a flat surface which slidingly engages the flat face of the upper bearing, and an outer crushing member surrounding the head and co-acting therewith in crushing material, said outer crushing member yieldingly supported by the frame to give upwardly and laterally under crushing strains.

26. A crushing machine, comprising a frame having an upper curved bearing, an outer crushing member extending into said bearing and movable yieldingly upwardly therefrom, a sleeve journaled in the frame and having an eccentric bore, a shaft journaled in the bore and movable with the sleeve in an eccentric parallel plane, said shaft having a crushing head which co-acts with the outer crushing member for crushing material passing therebetween, and means for rotating the sleeve.

27. A crushing machine, comprising a frame having an upper curved bearing, an outer crushing member extending into said bearing and movable yieldingly upwardly therefrom, a sleeve journaled in the frame and having an eccentric bore, a shaft journaled in the bore and extending upwardly into the outer crushing member and movable with the sleeve in an eccentric parallel plane, said shaft having a crushing head which co-acts with the outer crushing member for crushing material passing therebetween, said crushing head and the outer crushing member extending below the horizontal plane of the lower portion of the curved bearing, and means for rotating the sleeve.

28. A crushing machine, comprising a frame having an upper curved bearing, an outer circular crushing member having an outer curved portion which engages the curved bearing, spring means for yieldingly holding the outer crushing member in engagement with the curved bearing, but permitting it to tilt or move vertically or laterally, a sleeve journaled in the frame in concentric relation to the outer crushing member and having an eccentric bore, a shaft journaled in the bore and having a crushing head which co-acts with the outer crushing member, said head having a lower flat face which rests upon a flat portion of and is supported by the frame, and a geared means for rotating the sleeve and thereby the shaft and crushing head in an eccentric parallel plane.

In testimony whereof, I affix my signature.

HARVEY H. RUMPEL.