C. G. SIMONDS & A. E. SMITH.

ROCK CRUSHER.

APPLICATION FILED AUG. 18, 1910.

1,164,762.

Patented Dec. 21, 1915.

3 SHEETS—SHEET 1.

Fig. 1.

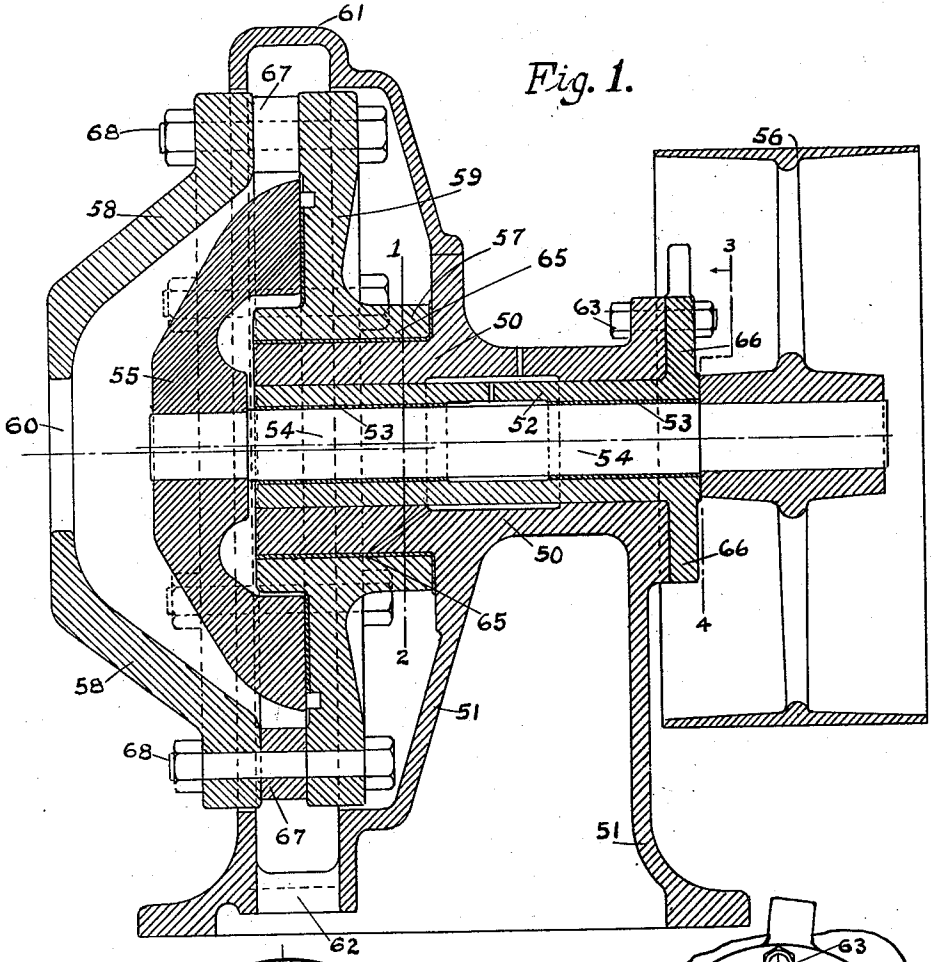


Fig. 2.

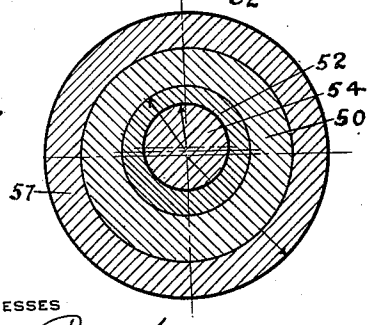
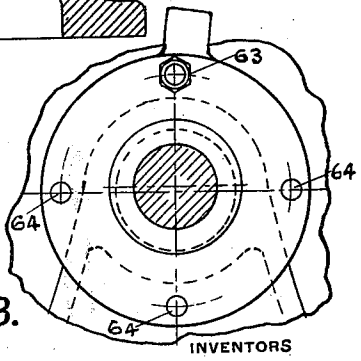


Fig. 3.



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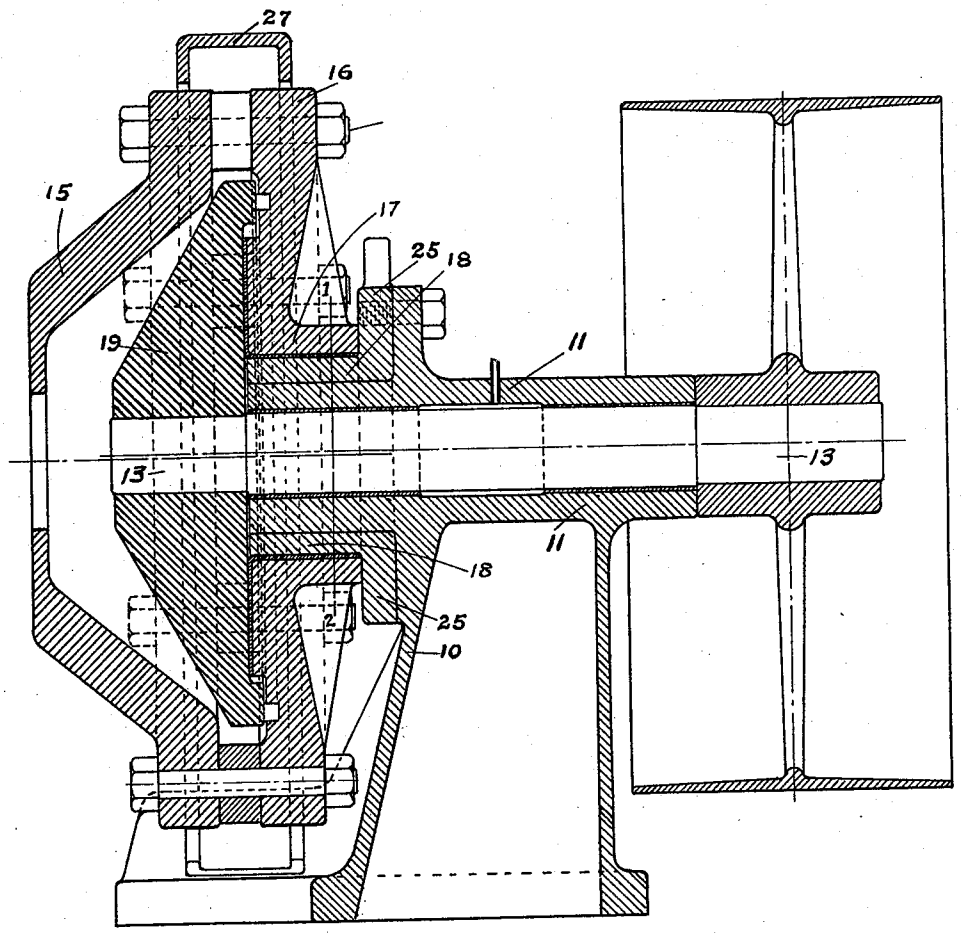


Fig. 4.

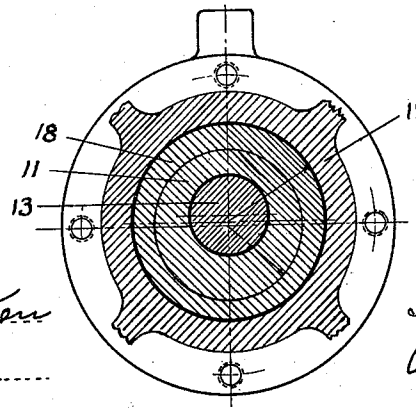


Fig. 5.

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3 SHEETS—SHEET 3.

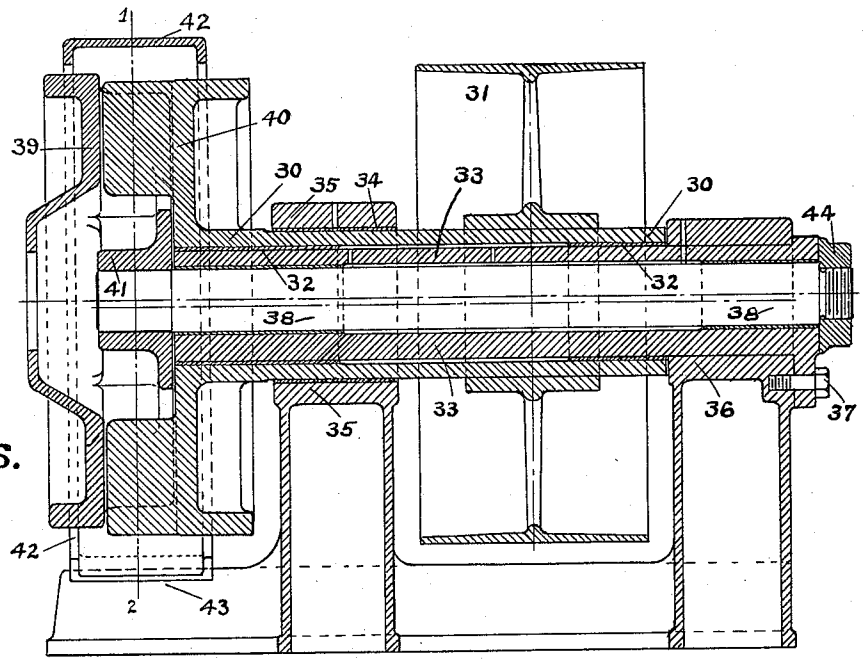


Fig. 6.

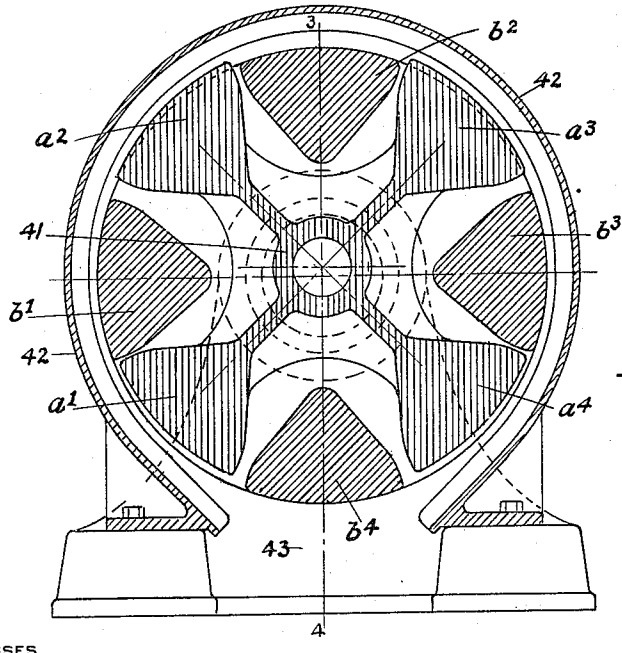


Fig. 7.

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UNITED STATES PATENT OFFICE.

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ROCK-CRUSHER.

1,164,762. Specification of Letters Patent. Patented Dec. 21, 1915.

Application filed August 18, 1910. Serial No. 577,841.

To all whom it may concern:

Be it known that we, CHARLES G. SIMONDS and ALBERT E. SMITH, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and useful Rock-Crusher, of which the following is a specification.

The object of our invention is to provide a crusher in which the product is rapidly discharged being assisted in its exit by centrifugal force; to provide an extremely simple and compact machine, and one in which means is provided for readily adjusting the crusher heads to and from each other to compensate for wear and to vary the size of the product.

We attain these objects by the mechanism illustrated in the accompanying drawings, in which three embodiments of the invention are shown, which drawings form a part of this specification.

Figure 1 is a vertical longitudinal section of the machine taken along the center line of the crusher shaft; Fig. 2 is a transverse section taken on the line 1—2 Fig. 1; Fig. 3 shows a transverse section taken on the line 3—4 Fig. 1 and looking in the direction of the arrow. Fig. 4 shows a vertical longitudinal section taken along the center line of the crusher shaft of a modified form of the device; Fig. 5 is a transverse section on the line 1—2 of Fig. 4. Fig. 6 is a central longitudinal and vertical section of a second modification of the device; and Fig. 7 is a transverse section taken on the line 1—2 of Fig. 6.

The same parts are given the same reference numerals throughout the different views of the drawings.

The machine frame as shown in Fig. 1 consists of two essential parts, a tube-like part 50 and a pedestal 51. These parts may be made separate and rigidly secured together or they may be made integral as shown. The tube or barrel 50 carries interiorly an eccentric sleeve 52 which is virtually a part of the frame during operation of the device. This sleeve 52 affords two internal bearings 53 for the shaft 54 which shaft carries at one end the interior crusher head 55 and at the other end the driving pulley 56. The left hand end of the frame barrel 50 is turned eccentrically of its bore, and affords a bearing 65 for the sleeve 57 which carries the external crusher head 58 through the flange 59.

The material to be crushed is fed through the opening 60 to the space between the crusher heads 55 and 58. In this tapering annular space between the heads the material acts as a wedge and causes the exterior head 58 to take up the rotative motion of the head 55 which is positively driven. As the heads 55 and 58 rotate respectively about different centers, opposing points on the crushing surfaces will alternately recede and approach thereby pinching and crushing during the approach whatever material has lodged therebetween during the recession. As both heads and the material between them are revolving, centrifugal force will move the material away from the center, and when crushed fine enough to pass through the outlet between the crusher heads, the material will be thrown out and gathered by the trough or hood 61, which covers the opening between the flange 59 and the head 58 and leads to the spout 62, through which the material is finally discharged.

The eccentric sleeve 52 may be adjusted in the barrel 50 so that its eccentricity will augment or decrease the resultant eccentricity of the crushing heads. This adjustment is for the purpose of giving the heads a greater relative movement when crushing spongy tough material, or a smaller relative movement with attending greater force when crushing very hard material. The sleeve 52 is secured in its adjusted position by the bolt 63 which may be engaged in any one of the holes 64 in the flange 66 of the sleeve.

The head 58 is adjusted to or from the head 55 to compensate for wear or to materially change the size of the product, by placing washers of different thickness on the bolts 68. These washers 67 may be U-shaped in order that they may be removed or replaced without entirely removing the head 58 or the bolts 68. In order to make the washers 67 more accessible the top half of the hood 61 is made removable.

It will be noted that the horizontal component of the crushing strain which, in the machine shown in Fig. 1 is between one half and two thirds of the total amount, is taken on the vertical bearing between 55 and 59, the reacting surfaces of which have only the small relative movement due to the eccentricity of the heads. The vertical component of the crushing strain acts upward on the bearing 65 and is partly counter balanced by the weight of 58 and 59.

The machine as shown in Figs. 4 and 5 does not differ in principle or mode of operation from the preceding form, nor does it differ very materially in construction. The adjustable eccentric sleeve 18 is placed outside of the frame barrel or tube 11. This arrangement has the trifling disadvantage that as the sleeve 18 is adjusted, the peripheries of the crusher member 15 and flange 16 will be varied relatively to the hood 27. Also the crusher heads 15 and 19 must overhang the pedestal 10 more than in Fig. 1 by the thickness of the flange 25 on the eccentric sleeve 18. Also the bearing of the sleeve 18 is not so readily lubricated as in the form shown in Fig. 1. Otherwise the two forms are about the same.

In Figs. 6 and 7 we show a modified form of frame and mounting with a radically different form of crushing heads. The mounting shown in Fig. 6 may however be employed with the form of crusher heads shown in Fig. 1. In this form the outer hollow shaft 30 carries the driving pulley and if the form of heads shown in Fig. 1 were used the outer head would be directly driven.

The hollow shaft 30 has two internal bearings 32 running on a stationary quill 33, and one external bearing 34 journaled in the frame bearing 35. The rear end of the stationary quill 33 is supported in the frame bearing 36 and is prevented from turning in the frame by the bolt 37. The crusher shaft 38 has its bearing in the stationary quill, said bearings being parallel with but eccentric to the others. This form of frame, shafting and quill is in some respects preferable to the form shown in Fig. 1 from the fact that the outer sleeve has a much larger bearing on the eccentric stationary quill, and with the form of heads of Fig. 1 the outer and heavier head would be directly driven leaving the smaller head to follow.

The crusher heads shown in Figs. 6 and 7 consist of flanges or webs 39 and 40, each carrying four inter-engaging lugs. These flanges are carried respectively by the internal shaft 38 and external hollow shaft 30. The lugs a^1, a^2, a^3, and a^4 are carried by the internal shaft 38, the web 39, and the hub 41. The lugs b^1, b^2, b^3 and b^4 are carried by the outer shaft 30 and the web 40. As these shafts are parallel and eccentric the space between two adjacent lugs, as a^1 and b^1, will be at its minimum while the diametrically opposite space, between a^3 and b^3, will be at its maximum, and all the spaces around the arcs between these two will vary between these limits. The spaces between the lugs taper decreasing outwardly, and centrifugal force will move the material until it is caught and crushed between the lugs to finally escape to the collecting trough or chute 42 and be delivered thereby through the opening 43 in the base of the frame.

It is quite obvious that the form of crusher heads of Figs. 6 and 7 could be used in a machine otherwise the same as in Fig. 1.

What we claim as our invention and desire to secure by Letters Patent of the United States, is—

1. A rock crusher comprising a frame member; internal and external parallel and eccentric bearing surfaces on said frame member; and coacting crushing heads rotatably supported by said bearing surfaces.

2. A rock crusher comprising a frame; two parallel rotatable shafts one internal of the other eccentrically carried by said frame; and coacting crusher heads carried by said rotatable shafts.

3. A rock crusher comprising a frame; two parallel rotatable members eccentrically carried by said frame; coacting crusher heads one external of the other carried by said rotatable members; means for continuously feeding material between the crusher heads through a hole at the center of the external crusher head; and openings for the escape of the crushed material at the periphery thereof.

4. A rock crusher comprising a concave crushing member, a convex crushing member internal of the concave member, means supporting both members to rotate on their own axes, means for rotating both crushing members together in the same direction, and means causing the opposing parts of the crushing surfaces to approach and recede during their rotation.

5. A rock crusher comprising a revoluble concave receptacle, a revoluble crusher head in said receptacle, a feed opening to the receptacle through the center of the concaved wall of the receptacle, crushing surfaces on said receptacle and head inclined to each other and to their axes of revolution, shafts eccentric but parallel to each other supporting said receptacle and head, and means for driving one of said shafts.

6. A rock crusher comprising two rotatable crushing members, two shafts, one internal of the other, each supporting one of said crushing members, a stationary eccentric sleeve between said shafts and supporting them both adjacent to the crushing members, and means for driving one of said shafts.

7. A rock crusher comprising a rotatable external crushing member and a rotatable internal crushing member, the opposing surfaces of which are nearer together at their peripheries than at their centers; means for feeding material into the space between the members through the external member substantially at its axis; and means for rotating one of said members eccentrically of the other.

8. A crusher comprising two revoluble crushing members having an antifriction

bearing against each other, means causing the crushing surfaces of said members to approach radially during one part of each revolution and to recede radially during the other part thereof, and means for feeding the material to be crushed to the space between the crushing members at the center thereof.

9. A crusher comprising two rotatable crushing members having an antifriction bearing against each other, parallel shafts supporting said members with the crushing surfaces of said members nearer together on one side of the axes than on the other, and means for driving one of said members.

10. A rock crusher comprising two rotatable crushing members, one internal of the other; parallel shafts one internal of the other supporting said members with the crushing surfaces of said members nearer together on one side of the axes than on the other; a flange connecting the external shaft to the external crushing member and bearing against the end of the internal crushing member, and means for driving one of said members.

11. A rock crusher comprising two rotatable crushing members, one interior of the other, the crushing surfaces of which are wider apart near the center than at their peripheries; a feed opening at substantially the centers of said members; an annular discharge opening between the peripheries of said members; means for rotating one of the said members, and means eccentrically supporting said members.

12. A rock crusher comprising two rotatable crushing members adapted and arranged forming an annular tapering chamber therebetween having an inlet at the small diameter and an outlet at the large diameter; and shafts having different but parallel center lines supporting said members.

13. A rock crusher comprising two parallel shafts; a stationary sleeve between said shafts having its exterior surface eccentric to its bore; a crusher receptacle and crusher head supported respectively from said shafts, the crushing surfaces being inclined to the shafts, said surfaces being comparatively wide apart at the center and gradually approaching each other toward the periphery; means for feeding the material to the receptacle at its center; openings in the outer periphery thereof through which the crushed material may be discharged; and means for revolving one of said shafts.

14. A rock crusher comprising two rotatable crushing members; two shafts, each supporting one of said members; a stationary eccentric around one of said shafts, and inside of the other, the said eccentric being composed of two eccentric parts one being circularly adjustable relative to the other.

15. A rock crusher comprising a concave and a convex crushing member; a hollow and an internal shaft supporting said members respectively; a flange on said hollow shaft extending beyond the periphery of said convex member; a flange of equal diameter on said concave member; a series of bolts or studs connecting said flanges; and removable distance pieces on said bolts or studs between said flanges, said convex crushing member bearing against a plane surface on said hollow shaft.

16. A rock crusher comprising two rotatable crushing members each having a conical crushing surface; means supporting said members in such manner that any point on the crushing surface of one member will radially approach the opposing surface of the other member during one half revolution and will radially recede therefrom during the other half revolution.

17. A rock crusher comprising two rotatable crushing members; a hollow and an internal shaft each supporting one of said members; a stationary eccentric sleeve around said internal shaft and inside of said hollow shaft; means for driving one of said members; and means for adjusting the eccentricity of the sleeve.

18. A rock crusher comprising two rotatable crushing members; a hollow and an internal shaft, each supporting one of said members in such manner that any point of the crushing surface of one member will radially approach the other member during one half of a revolution and radially recede therefrom during the other half revolution; a flange on said hollow shaft extending beyond the crushing surfaces; a flange on one of said crushing members of substantially equal diameter to the other flange; and a series of studs or bolts connecting said flanges.

19. A rock crusher comprising a shaft; a convex crusher head on said shaft; a flanged hollow shaft exterior of said first mentioned shaft; a concave crusher member exterior of said convex head; means attaching said flange and concave member; and a stationary eccentric sleeve between said shaft and said flanged hollow shaft.

20. A rock crusher comprising two rotatable crushing members; two shafts, each supporting one of said crushing members, said shafts being parallel and eccentric; means adapted to feed material to the space between the crushing surfaces of the members at their axes; and adjustable means spacing the crusher members longitudinally of the shafts.

21. A rock crusher comprising two rotatable crushing members; two shafts each supporting one of said members, said shafts being so positioned that the crushing surfaces are nearer together on one side of the axes than on the other; means for adjusting

one of said members in the direction of its axis; and means for adjusting the axis of one of said shafts parallelly toward or from the axis of the other.

22. A rock crusher comprising a frame member, two rotatable crushing members, and two shafts, one of which is internal of the other, each of said shafts supporting one of said crushing members, the internal shaft rotating in and entirely supported by said frame member, and the external shaft rotating on and supported by said frame member.

23. A rock crusher comprising external and internal crusher members, rotatably mounted, a flange rigidly connected to said external member outside of said internal member and extending toward its axis of rotation, a plane engagement between said flange and internal member, and means supporting said members eccentrically of each other.

24. A rock crusher, comprising a rotatable concave crushing member, a rotatable convex crushing member internal of the concave member, means eccentrically supporting said members with the crushing surfaces nowhere in contact with each other, and means for feeding material from end to end of the members by the rotation thereof.

25. A rock crusher comprising a rotatable concave crushing member, a rotatable convex crushing member internal of the concave member, said members having an antifriction bearing against each other, means eccentrically supporting said members, means for feeding material through one end of the concave member and for discharging it through the other end thereof, the crushing surfaces of said members forming an annular tapering chamber.

26. A rock crusher comprising a rotatable tapering concave crushing member having a feed opening at its smaller end, an internal flange connected to said member at its larger end with discharge openings between said connections, a rotatable crushing member interior of said concave member bearing on said flange, the crushing surface of both members forming an annular chamber tapering in width and wider at the feed end than at the discharge end.

27. A crusher comprising a pair of rolls one internal of the other, means for feeding material along the rolls by the rotation thereof, and means causing the opposing surfaces of the rolls to approach and recede transversely to their axes.

28. A crusher comprising a pair of rolls one internal of the other, a feed opening at one end of the rolls and a discharge opening at the other end, both rolls continually increasing in diameter from the feed end to the discharge end thereof, and means causing the opposing surfaces of the rolls to approach and recede transversely to their axes.

29. A crusher comprising a pair of rolls one internal of the other, a feed opening at one end of the rolls and a discharge opening at the other end thereof, both rolls continually increasing in diameter from the feed end to the discharge end thereof and at different rates rendering the space between them tapering said space being larger at the feed end than at the discharge end, and means causing the opposing surfaces of the rolls to approach and recede transversely to their axes.

30. In a crusher, a cone shaped crusher head, a crusher member having a conical interior crushing surface surrounding and overlying said head and having an inwardly extending base at its larger diameter, a bearing between said base and said head, means causing the crushing surfaces of said head and said hollow member to relatively approach and recede, and means for adjusting said hollow member to and from said inwardly extending base.

31. A crusher comprising a pair of rolls one internal of the other, means for feeding material from end to end of the rolls by the rotation thereof, and means supporting said rolls to rotate on different and definite center lines.

32. A crusher comprising a pair of rolls one internal of the other, means for feeding material from end to end of the rolls by the rotation thereof, and means supporting said rolls to rotate on different and parallel center lines.

33. A crusher comprising a pair of rolls one internal of the other, means for feeding material from end to end of the rolls by the rotation thereof, means supporting said rolls to rotate on different center lines, and an antifriction bearing between the rolls transverse to their axes.

34. A crusher comprising a pair of rolls one internal of the other, means for feeding material from end to end of the rolls by the rotation thereof, means supporting said rolls to rotate on different and definite center lines, and an antifriction bearing between the rolls transverse to their axes.

35. A crusher comprising a pair of rolls one internal of the other, means for feeding material from end to end of the rolls by the rotation thereof, means supporting said rolls to rotate on different and parallel center lines, and an antifriction bearing between the rolls transverse to their axes.

36. A crusher comprising two rotatable crusher members one internal of the other, and means causing the opposing parts of the crushing surfaces of said members to alternately approach and recede, said members having an antifriction bearing against each other.

37. A crusher comprising a frame, two rotatable journal members one internal of the other and eccentric thereto each bearing against a common frame member therebetween, and opposed crusher members attached to said journal members.

38. A crusher comprising two tapering rotatable crusher members one internal of the other and disposed with a tapering annular chamber therebetween, cylindrical bearings supporting said members disposed to cause approach and recession of opposing parts of the crushing surfaces of the members.

39. In a crusher, a shaft, a substantially conical crusher head on the end of the shaft with its apex pointing outward, an annular crusher member having a conical interior crushing surface likewise pointing outward and encircling said head, a supporting member encircling said shaft and having axially adjustable rigid connection to said annular crusher member, an antifriction bearing between said supporting member and the base of said head, an eccentric sleeve between said shaft and said supporting member and close to said head, and means for feeding material between the head and the annular crusher member at their smaller diameters and for discharging it at their largest diameters.

40. In a crusher, a crusher head having a substantially conical crushing surface, a bearing on the reverse side of the head and a shaft projecting from the bearing side of the head, in combination with a hollow conical crushing member surrounding the crushing surface of the head, supporting means connected to said hollow member affording a bearing surface for said reverse side bearing of the head, and an eccentric sleeve between said shaft and said supporting means close to said head.

41. A crusher comprising a substantially conical crusher head having a bearing on its reverse side within the outer edge of which substantially all perpendiculars to the crushing surface pass, and a shaft projecting from the bearing side of the head, in combination with a hollow conical crushing member surrounding the crushing surface of the head, supporting means connected to said hollow crushing member affording a bearing for the conical head and an eccentric sleeve between said shaft and said supporting means.

42. A crusher comprising a substantially conical crusher head having a bearing on its reverse side, a shaft projecting from said bearing, a hollow conical crushing member surrounding the crusher head, a supporting member adjustably connected to said hollow member and having a bearing for said head, and an eccentric sleeve between said shaft and said supporting member.

43. In a crusher, a crushing head having a substantially conical crushing surface, a bearing on the reverse side of said head extending transverse to the axis within the outer edge of which substantially all perpendiculars to the crushing surface pass, and a shaft projecting from said reverse side, in combination with a crushing member surrounding said head. and means causing the crushing surfaces to relatively approach and recede from each other.

44. In a crusher, a conical crusher head having a bearing on its reverse side and a shaft projecting from said bearing, a hollow conical crusher member surrounding said head, a supporting member connected to said hollow member and having a bearing for said head, and an eccentric sleeve between said shaft and said supporting member close to the crushing head.

45. In a crusher, a crushing head having an exterior conical crushing surface on one side, a bearing surface on its opposite side transverse to its axis, and another bearing surface on said head extending along and around the axis, the relation of the crushing surface and the transverse bearing being such that the perpendicular to the crushing surface at its medial diameter will pass within said bearing.

46. In a crusher, a crushing head having an exterior conical crushing surface on one side, a bearing surface on its opposite side transverse to its axis and of greater diameter than the axial length of the cone of which the head forms a part, and a shaft secured to and projecting from the bearing side of the head, affording a longitudinal bearing surface for said head.

47. In a crusher, a hollow crusher member having an interior crushing surface of conical form, said member being open at its smaller diameter and having an inwardly extending base rigidly attached to said crusher member at its larger diameter, a bearing surface transverse to the axis and on the side of said base facing said crushing surface, and another bearing surface on said base extending along and around the axis adjacent to said transverse bearing.

48. In a crusher, a hollow crusher member having an interior crushing surface of conical form, said member being open at its smaller diameter, an inwardly extending base rigidly and adjustably attached to said crusher member at its larger diameter, a bearing surface transverse to the axis and on the side of said base facing said crushing surface, and another bearing surface on said base extending along and around the axis adjacent to said transverse bearing.

49. In a crusher, a crusher head having an exterior conical crushing surface, a crusher member having an interior conical crushing surface surrounding said head, said member

being open at its smaller diameter and having an inwardly extending base at its larger diameter, a bearing between said base and said head transverse to their axes, and means for causing the opposing portions of said crushing surfaces to successively approach and recede relatively to each other.

50. In a crusher, a conical crusher head having a shaft projecting from its reverse side, a hollow conical crusher member surrounding said head, said member being open at its smaller diameter and having an inwardly extending base at its larger diameter, a bearing between said head and said base transverse to their axes and an eccentric sleeve between said shaft and said base.

51. In a crusher, a cone shaped crusher head, a crusher member having a conical interior crushing surface surrounding said head, said head and member each having a bearing surface along and around its axis and having a mutual bearing transverse to their axes at the larger diameter of both cones.

52. In a crusher, a cone shaped crusher head, a crusher member having a conical interior crushing surface surrounding and overlying said head and having an inwardly extending base at its larger diameter, a bearing between said base and said head and means causing the crushing surfaces of said head and said member to relatively approach and recede.

53. A rock crusher comprising a pair of rolls one internal of the other, journals connected to each roll positively supporting said rolls rotatable on different fixed center lines, means for rotating said rolls in the same direction and means adapted to allow centrifugal force developed by the rotation of said rolls on their own axes to feed material from end to end thereof.

54. A rock crusher comprising a pair of rolls one internal of the other, journals connected to each roll positively supporting said rolls to rotate on different fixed and adjustable center lines, means for rotating said rolls in the same direction and means adapted to allow centrifugal force developed by the rotation of said rolls on their own axes to feed material from end to end thereof.

55. A rock crusher comprising a pair of rolls one internal of the other, journals connected to each roll positively supporting said rolls to rotate on different center lines and spacing their crushing surfaces apart with a continuously tapering opening between them, means for rotating said rolls in the same direction and means adapted to allow centrifugal force developed by the rotation of said rolls on their own axes to feed material from end to end thereof.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."