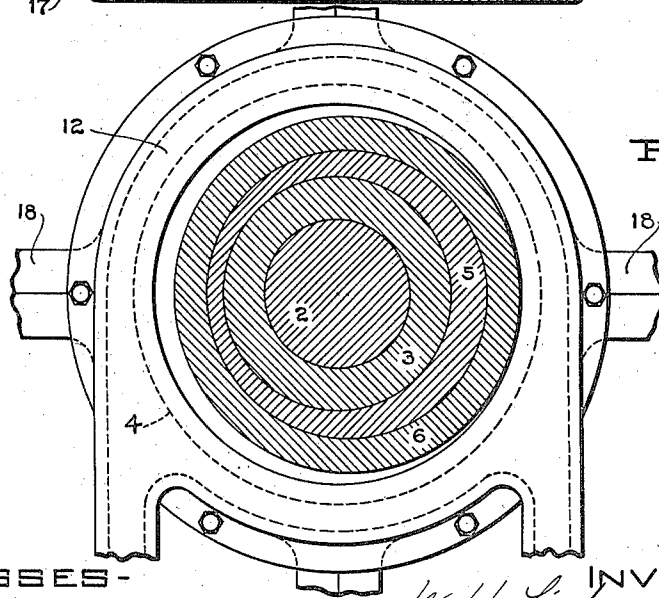
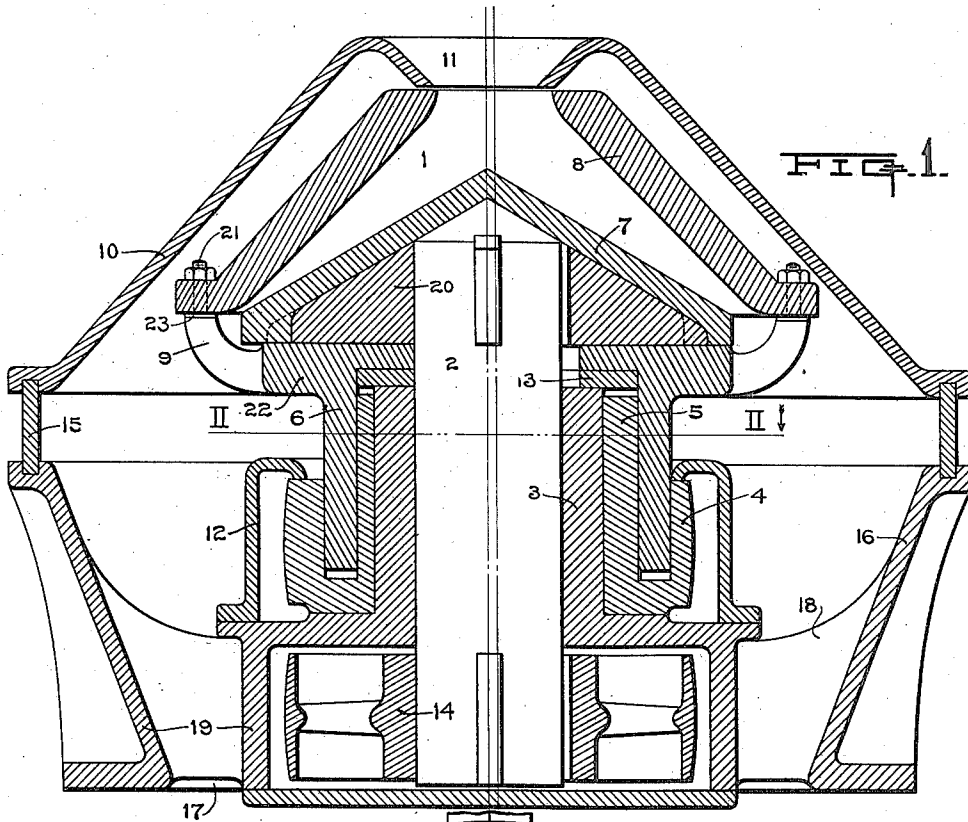


W. H. LIEBER.  
CRUSHER.  
APPLICATION FILED DEC. 29, 1911.

1,030,194.

Patented June 18, 1912

2 SHEETS-SHEET 1.



WITNESSES-

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2 SHEETS-SHEET 2.

1,030,194

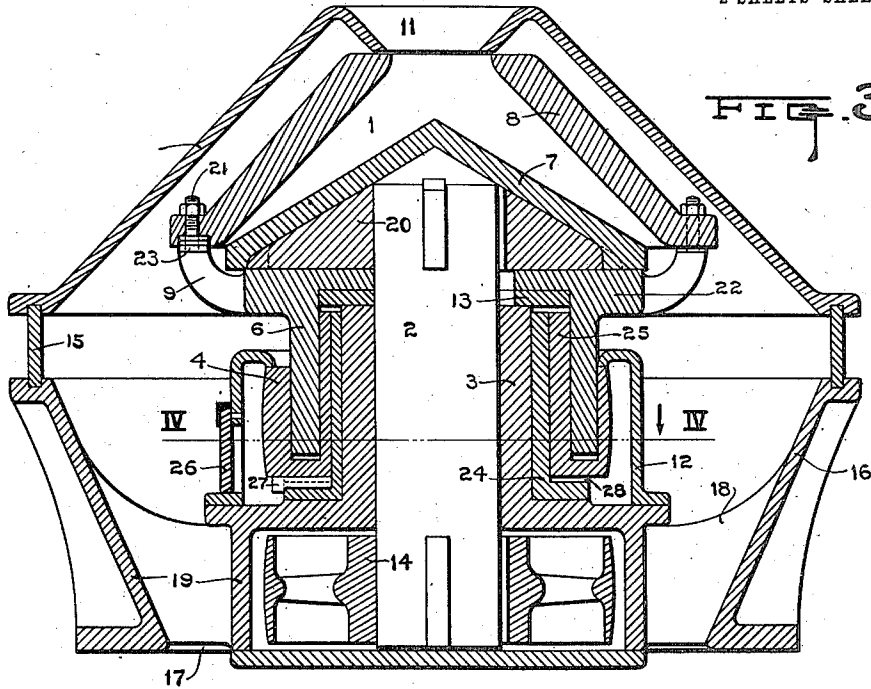


FIG. 3.

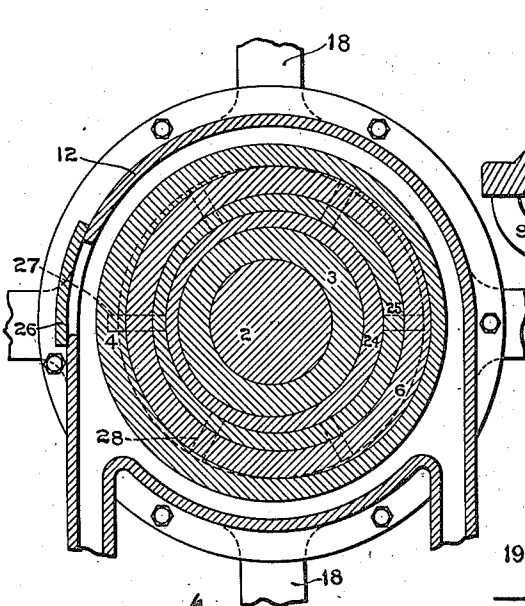


FIG. 4.

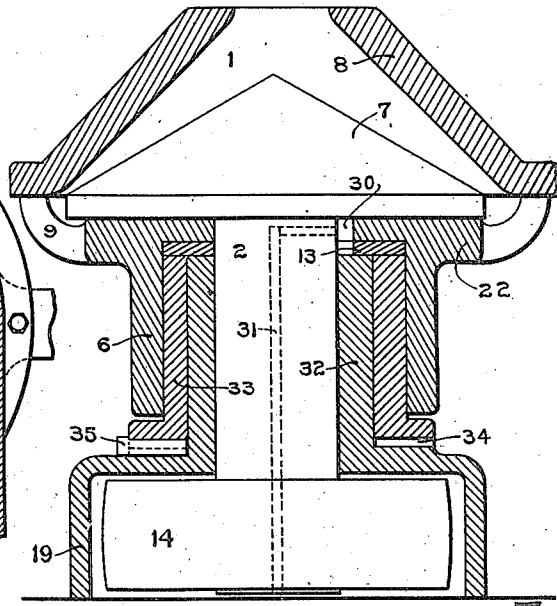


FIG. 5.

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# UNITED STATES PATENT OFFICE.

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## CRUSHER.

1,030,194.

Specification of Letters Patent.

Patented June 18, 1912.

Application filed December 29, 1911. Serial No. 668,407.

*To all whom it may concern:*

Be it known that I, WILLIAM H. LIEBER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Crushers, of which the following is a specification.

This invention relates to improvements in the construction of crushers for rock or other materials, of the type in which a pair of crushing members are rotated about different axes, the material being fed along the members by the rotation thereof and one of the members being positively rotated while the other is driven by the material as it becomes lodged between the crushing surfaces of the two members. In crushers of this type as heretofore constructed with a stationary eccentric for causing the members to rotate about different axes, it has been found that in order to obtain the maximum capacity of the machine it was necessary to rotate the members at a high rate of speed thereby causing considerable wear on the various parts of the machine which were subjected to the material during its passage through the crusher at a high velocity.

The present invention is an improvement on the device disclosed herein and claimed in a co-pending application Serial Number 609,648, filed Feb. 20, 1911.

An object of the present invention is to provide a simple and efficient means whereby the speed of rotation of the crushing members can be reduced without decreasing the capacity of the machine, thus eliminating the objectionable excessive wear on the working parts of the crusher.

Another object of the present invention is to provide a means for varying the relative motion between the crushing members so that the size of the discharged material can be varied at will.

Still another object of the invention is to provide a construction in which the lubrication of the various elements of the machine can be accomplished from a central point of distribution.

A clear conception of several embodiments of the invention can be had by referring to the drawings accompanying and forming a part of this specification, in which

like reference characters designate the same or similar parts in the various views.

Figure 1 is a central vertical section through a crusher and its inclosing casing. Fig. 2 is a transverse fragmentary section of the crusher shown in Fig. 1, the section being taken along the line II—II looking in the direction of the arrow. Fig. 3 is a central vertical section through a crusher and its inclosing casing, having means for varying the eccentricity between the crushing members. Fig. 4 is a transverse fragmentary section through the crusher disclosed in Fig. 3, the section being taken on the line IV—IV looking in the direction of the arrow. Fig. 5 is a fragmentary transverse vertical section through a crusher having stationary bearings for both of the crushing members.

The main inner shaft 2 of the crusher, see Figs. 1 and 2, is mounted vertically and concentrically within a sleeve 3 formed in one with the stationary crusher frame 19. The convex crushing member or disk 20 is provided with the wearing liner 7 and is secured to the upper end of the shaft 2 in any suitable manner, as by keys. The liner 7 is locked against rotation relative to the convex disk 20. The driving pulley 14 is fixed to the lower end of the inner shaft 2 by any suitable fastening means, such as keys, and is housed in the lower portion of the crusher frame 19. The concave crushing member or disk 8 is connected by means of ribs 9 with an inwardly projecting flange 22 which is formed in one with the upper end of the outer shaft or sleeve 6, and extends toward its axis of rotation. The convex member or disk 20 projects into the concave member 8, the crushing chamber 1 being formed between the two members. Bolts 21 are secured to the ribs 9 and project upwardly through the flanged periphery of the concave disk 8. A series of liners or shims 23 embrace the bolts 21 and are clamped between the upper end surfaces of the ribs 9 and lower surfaces of the concave disk 8 by means of nuts which screw upon the outer ends of the bolts 21. The concave disk 8 is provided with a central inlet opening at its upper end which connects the feed hopper 11 with the crushing chamber 1 formed between the crushing

members. The crushing members are so positioned that a discharge opening exists between the members adjacent the ribs 9, the extent of this opening being adjustable by varying the number of shims 23.

5 An eccentric bearing or sleeve 5 has its interior surface bored so as to fit the external cylindrical surface of the fixed bearing or sleeve 3. The outer cylindrical surface of the eccentric sleeve 5 is turned to fit 10 the internal bore of the sleeve 6. As disclosed in Fig. 2, the outer and inner cylindrical surfaces of the eccentric sleeve 5 are generated about different parallel axes. 15 The pulley 4 is formed in one with the eccentric sleeve 5, the combined sleeve and pulley being supported upon an upper horizontal surface of the stationary frame 19. The pulley 4 is provided with a housing 12 20 which is secured to the stationary frame 19 and has passages for permitting belt connection to the exterior of the crusher casing. The bearing plate 13 has an upper surface which coacts with the lower surface 25 of the flange 22, and a lower surface which coacts with the upper surface of the fixed bearing or stationary sleeve 3. It should be noted that sufficient clearance has been allowed between the upper surfaces of the 30 eccentric sleeve 5 and the lower surfaces of the sleeve 6 and bearing plate 13 to permit the entire weight of the crushing members to rest upon the upper end of the stationary sleeve 3, rather than upon the eccentric sleeve 5. 35

The frame 19 is provided with funnel shaped walls 16 which are connected to the frame 19 by means of a series of ribs 18. Discharge openings 17 are formed at the 40 lower ends of the wall 16 and frame 19. Liners 15 are supported in a groove at the upper end of the wall 16 and in turn support the conical cap 10 through which the inlet hopper 11 is formed. The wall 16, 45 liners 15 and cap 10 combined form a stationary inclosing housing for the crusher.

In the crusher as disclosed in Fig. 3 the general construction of the frame 19, the inclosing casings and the crushing members, 50 is identical with that above described. The eccentric bearing or sleeve 25 which has the pulley 4 formed integral therewith, is provided with an outer cylindrical surface which coacts with the inner bore of the sleeve 6. 55 The inner bore of the eccentric 25 coacts with the outer cylindrical surface of a second eccentric sleeve 24, the lower surface of the eccentric sleeve 25 resting upon a plane surface formed on the base of the eccentric sleeve 24. The inner bore of the 60 eccentric sleeve 24 coacts with the outer cylindrical surface of the stationary sleeve 3. The eccentric sleeve 24 has a lower plane surface which rests upon an upper 65 surface of the frame 19. With this con-

struction the combined eccentric sleeves 24, 25 and pulley 4 are supported directly upon the stationary frame 19. The lower portion of the eccentric sleeve 25 is provided with a series of radial grooves or slots 28, 70 see Figs. 3 and 4. The portion of the eccentric sleeve 24 upon which the combined sleeve 25 and pulley 4 are supported, is provided with a single radial slot in which a key 27 is adapted to be inserted. By removing the key 27 and rotating the outer 75 eccentric sleeve 25 upon the inner eccentric sleeve 24, the eccentricity of the outer cylindrical surface of the sleeve 25 can be varied. With the key 27 inserted in a pair of adjacent slots as shown in Figs. 3 and 4, the 80 inner and outer sleeves 24 and 25 are locked together so that rotation of the pulley 4 will cause the inner sleeve 24 to rotate about the sleeve 3. The inclosing housing 12 of 85 the pulley 4 is provided with an opening, normally closed by a cover plate 26, through which the key 27 may be removed and inserted so that any desirable variation of the eccentricity of the outer cylindrical surface 90 of the sleeve 25 can be conveniently made.

In the form of crusher disclosed in Fig. 5, the stationary bearing or sleeve 32 which is formed in one with the frame 19, has its 95 outer cylindrical surface generated on an axis which is eccentric to the axis of the inner bore thereof. The inner bore of the eccentric bearing or sleeve 33 coacts with the outer cylindrical surface of the stationary sleeve 32 and has an outer cylindrical 100 surface which is formed eccentric to its inner bore. The outer cylindrical surface of the sleeve 33 coacts with the inner bore of the outer shaft or sleeve 6 which sleeve carries the concave crushing member 8. The 105 sleeve 33 has a lower plane surface which coacts with an upper plane surface of the frame 19. The bearing plate 13 rests directly upon an upper plane surface which is common to the upper ends of both sleeves 110 32, 33. The lower portion of the sleeve 33 is provided with a series of radial slots 34. The key 35 is adapted to coact in a radial slot formed in the frame 19 and serves as a means for locking the eccentric sleeve 33 115 to the stationary sleeve 32. The series of slots 34 and key 35 serve as means for varying the eccentricity of the outer cylindrical surface of the sleeve 33. As disclosed in Fig. 5, the main crusher shaft 2, which 120 carries the convex disk 20, is provided with conduits or passages 31 through which oil or other lubricant can be forced to the chamber 30.

During the operation of the crusher, the 125 material to be pulverized is passed into the crushing chamber 1 through the inlet hopper 11. The main inner crusher shaft 2 is rotated by means of belt power applied to the pulley 14 at the lower end of the shaft. 130

As the material deposited in the chamber 1 drops upon the rotating liner 7 of the disk 20, it is fed or passed outwardly by the action of centrifugal force and becomes wedged between the conical surfaces of the liner 7 and the concave crushing disk 8. This wedging of the material between the crushing members causes the rotation of the convex crushing head to be transmitted to the concave crushing disk 8, causing the two crushing members to rotate in the same direction and at substantially equal speeds. Since the concave crushing disk 8 is mounted upon the outer cylindrical eccentric surface of the sleeve 5, the disk 8 will have a different axis of rotation than that of the convex crushing member. The rotation of the crushing disk 8 upon a different axis than that upon which the convex crushing member rotates, will cause each portion of the crushing surface of one of the members to approach and recede from an adjacent portion of the other member, once in each revolution providing the axes of the members are held stationary. The eccentric outer shaft or sleeve 5 is rotated however by means of a belt coacting with the pulley 14 in a direction opposite to the direction of rotation of the crushing members. This rotation of the eccentric sleeve 5 causes the adjacent crushing surfaces of the convex and concave members to be at least distance apart along radial lines which lie in an imaginary plane passed vertically through the narrowest portion of the eccentric sleeve 5. The adjacent surfaces of the crushing members are at greatest distance apart along lines which lie in a vertical imaginary plane passing through the thickest portion of the eccentric sleeve 5. As the eccentric sleeve rotates in a direction opposite to the direction of rotation of the crushing members, the axis of the vertical bearing surface of the concave disk 8 moves in a circular path about the axis of the convex crushing member, thus gyrating the disk 8 and causing the vertical planes marking the positions of least and greater distances between the members to move in circular paths. The rate of travel of these imaginary planes is dependent upon the rate of rotation of the eccentric sleeve 5. This shifting of these planes causes each portion of one of the members to approach an adjacent portion of the other member more than once in each revolution. By thus causing each portion of the crushing surfaces of one member to approach and recede from corresponding portions of the other member more than once in each revolution of the members, it will be seen that the speed at which the crushing members must be rotated can be greatly reduced while the same crushing effect and capacity of machine that is produced by holding the eccentric sleeve 5 stationary is ob-

tained. This reduction in the necessary speed of rotation will greatly reduce the velocity at which the material is discharged between the ribs 9 onto the liners 15, thereby reducing the wear on the machine elements. It should be noted that it is not necessary to rotate the sleeve 5 in a direction opposite to the direction of rotation of the crushing members. The objection to rotating the sleeve 5 in the same direction as that of the crushing members is that a very high rate of rotation of the sleeve 5 is necessary in order to produce the same effect that is obtained by rotating the sleeve in the opposite direction. As the material becomes crushed by the approach of the crushing surfaces, which however are at no time in contact with each other, it is gradually fed toward the peripheries of the disks by centrifugal force. The formation of the crushing surfaces is such as to aid in feeding the material along the crushing members by the rotation of same. Upon being discharged from the crushing chamber 1, the crushed material is discharged from the crusher through the passages 17.

With the use of a double eccentric sleeve as disclosed in Figs. 3, 4 and 5, the extent of eccentricity or the radius of gyration between the crushing members can be easily and effectively varied by shifting one of the eccentric sleeves upon the other. In the construction disclosed in Fig. 3, the combined eccentric sleeves 24, 25, are adapted to be rotated as in the construction disclosed in Fig. 1, the locking together of the two sleeves being accomplished by means of the key 27. In the construction disclosed in Fig. 5, the eccentric sleeve 33 is rotatable upon the sleeve 32 for the purpose of varying the extent of eccentricity between the crushing members, but the combined eccentric mounting for the concave crushing disk 8 is stationary relative to the frame 19.

The lubrication of the bearing surfaces of the crusher can be easily accomplished by passing lubricant through the passage 31 to the chamber 30, from which chamber the lubricant is fed downwardly automatically along the bearing surfaces of the sleeve 6 and shaft 2 by the action of gravity thereon, and outwardly along the horizontal bearing surfaces of the various elements by the action of centrifugal force thereon. As the crushing members are forced in contact with each other along their plane surface of co-action, only sufficient lubricant will be permitted to pass between the members to efficiently lubricate the bearing surfaces, and the discharged product will not be flooded with oil.

The present disclosures show crushers in which the elements are vertically disposed, the terms upper and lower being used in describing various parts thereof. It should

not be inferred however, from this descriptive matter that the device cannot be used in a horizontal or any other than a vertical position, as the terms have merely been used to avoid complicated description. An advantage of having the crusher vertically disposed, is that the material discharged from the machine as well as the wear on the parts are more evenly distributed. Another advantage resulting from the vertical disposition of the machine is that the entering raw material can be deposited directly upon the positively driven rotating member.

By so arranging the supporting bearings that the weight of the crushing members is carried by the stationary frame rather than by the rotating eccentric sleeves, the power necessary for driving the sleeves is reduced to a minimum. The compactness of the machine is also augmented by positioning the eccentric sleeves as near to the crushing members as possible.

It should be understood that it is not desired to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

It is claimed and desired to secure by Letters Patent,—

1. In a crusher, a pair of rotatable crushing disks, inner and outer shafts by which said disks are carried, an eccentric for gyrating said outer shaft, and means for rotating said eccentric.

2. In a crusher, a pair of rotatable crushing disks, inner and outer shafts by which said disks are carried, an eccentric for gyrating said outer shaft, and means for rotating said eccentric independently of said disks and shafts.

3. In a crusher, a pair of rotatable crushing disks, shafts by which said disks are carried, a rotatable eccentric for gyrating one of said shafts, and a fixed bearing on which said eccentric is rotatable, said eccentric being located near said disks.

4. In a crusher, a pair of rotatable crushing members one internal of the other, a flange connected to one of said members and extending toward its axis of rotation, a plane engagement between said flange and the other of said members, and rotary means positioning said members eccentrically of each other.

5. In a crusher, a rotatable concave member, a rotatable convex member internal of the concave member, rotary means eccentrically positioning said members with the crushing surfaces nowhere in contact with each other, and means for causing rotation of said members to positively feed material from end to end of the members by centrifugal force.

6. In a crusher, a pair of rotatable crushing members one internal of the other,

means for causing rotation of said members to positively feed material along the members by centrifugal force, and rotary means for causing opposing surfaces of said members to approach and recede transversely to their axes.

7. In a crusher, a concave crushing member, a convex crushing member internal of said concave member, a frame supporting said members, means for causing rotation of said members to positively feed material from end to end of the members by centrifugal force, and means for gyrating one of said members relative to said frame.

8. In a crusher, a frame, two parallel rotatable shafts one internal of the other carried by said frame, coacting crusher heads carried by said shafts, and means for gyrating one of said shafts relative to said frame.

9. In a crusher, two crushing members having their respective axes parallel to each other, one of said members extending around to and coacting in plane contact with the rear of the other, means for positively rotating one of said members, and means for moving the other of said members so that its axis revolves about the axis of said positively rotated member.

10. In a crusher, a pair of crushing disks, inner and outer shafts by which said disks are carried, an eccentric for gyrating said outer shaft, means for varying the eccentricity of said eccentric, and means for rotating said eccentric.

11. In a crusher, a pair of rotatable crushing disks, inner and outer shafts by which said disks are carried, an eccentric for gyrating said outer shaft, means for varying the eccentricity of said eccentric, and means for rotating said eccentric independently of said disks and shafts.

12. In a crusher, a pair of rotatable crushing disks, shafts by which said disks are carried, a rotatable eccentric for gyrating one of said shafts, means for varying the eccentricity of said eccentric, and a fixed bearing on which said eccentric is rotatable.

13. In a crusher, a frame, two parallel rotatable shafts one internal of the other carried by said frame, coacting crusher heads carried by said shafts, means for gyrating one of said shafts, and means for varying the radius of gyration.

14. In a crusher, a pair of crushing members, inner and outer shafts by which said members are carried, a frame for supporting said shafts, an eccentric for gyrating one of said shafts relative to said frame, and means for varying the eccentricity of said eccentric.

15. In a crusher, a pair of rotatable crushing disks, inner and outer shafts by which said disks are carried, an eccentric for gyrating said outer shaft, and means for varying the eccentricity of said eccentric.

16. In a crusher, a pair of rotatable crush-

ing members, shafts by which said members are carried, a frame for supporting said shafts, an eccentric for gyrating one of said shafts relative to said frame, and means for varying the eccentricity of said eccentric.

17. In a crusher, a pair of rotatable crushing members, shafts by which said members are carried, an eccentric for gyrating one of said shafts, means for varying the eccentricity of said eccentric, and means adapted to rotate said eccentric in a direction opposite to the direction of rotation of said members.

18. In a crusher, a pair of rotatable crushing members, means for permitting adjust-

ment of said members toward and away from each other, shafts by which said members are carried, a frame for supporting said shafts, an eccentric for gyrating one of said shafts relative to said frame, and means for varying the eccentricity of said eccentric.

In testimony whereof, the signature of the inventor is affixed hereto in the presence of two witnesses.

WILLIAM H. LIEBER.

Witnesses:

G. F. DE WEIN,  
H. C. CASE.