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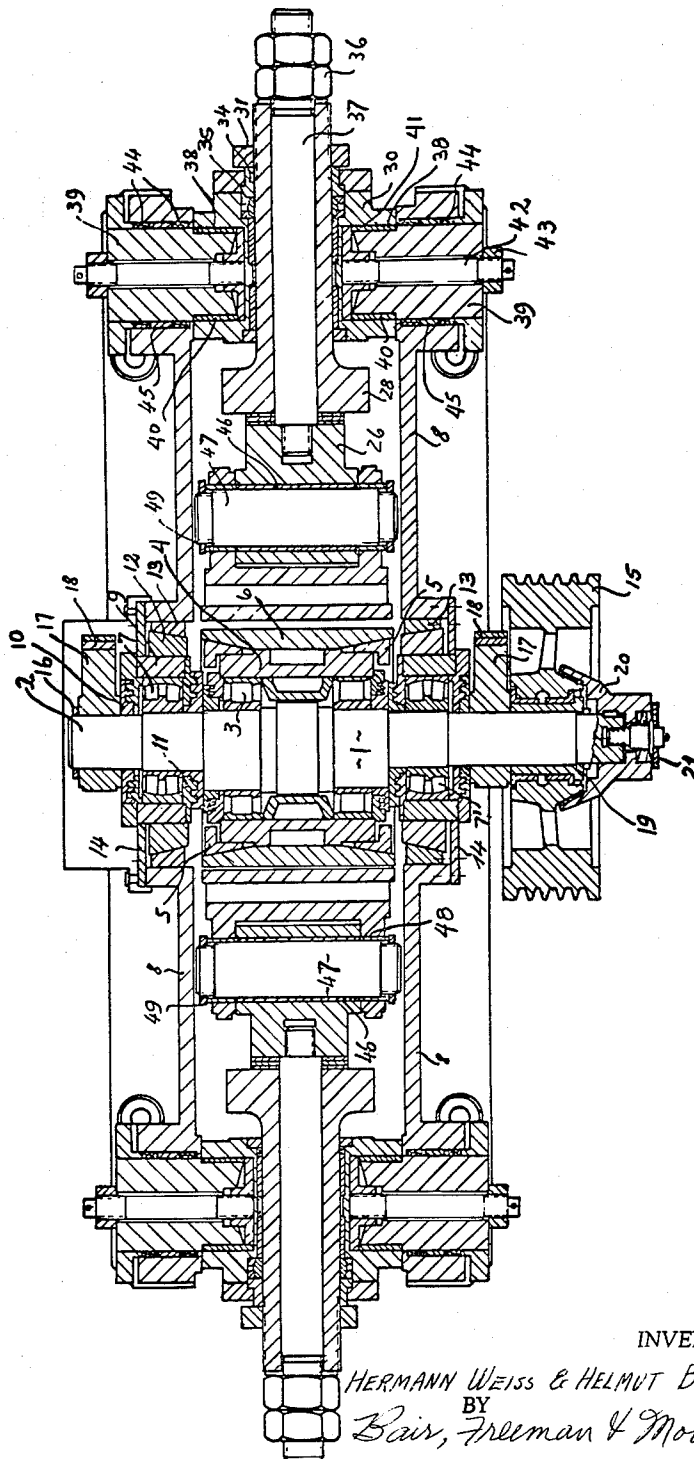
3,229,922

JAW CRUSHING ROLLER

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FIG. 1



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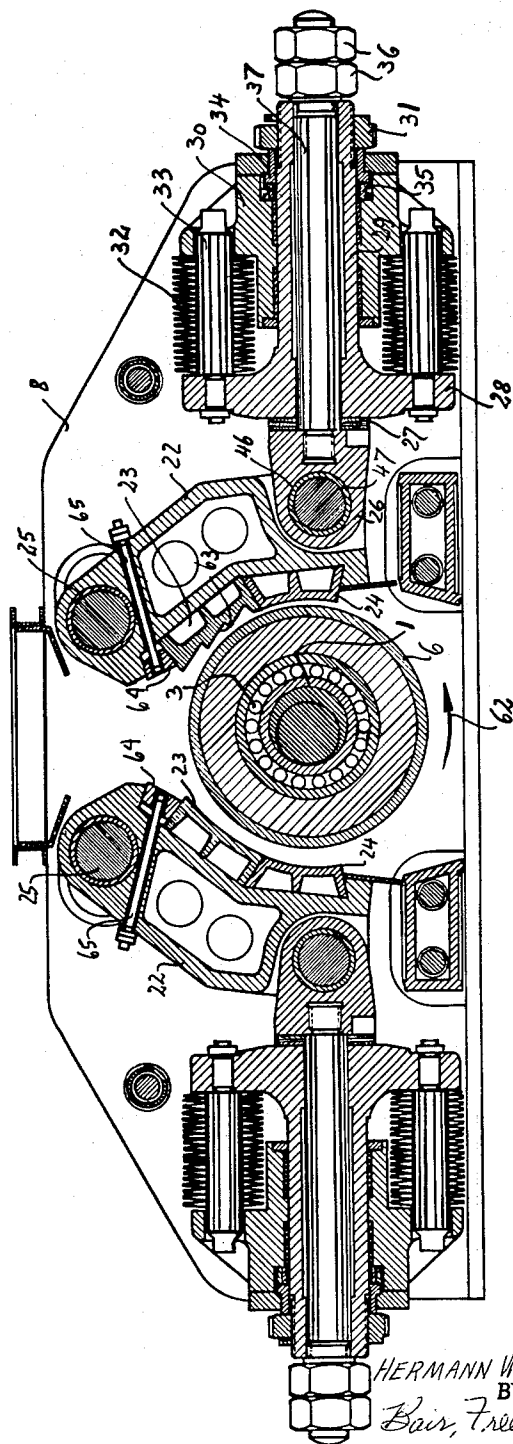


FIG. 2

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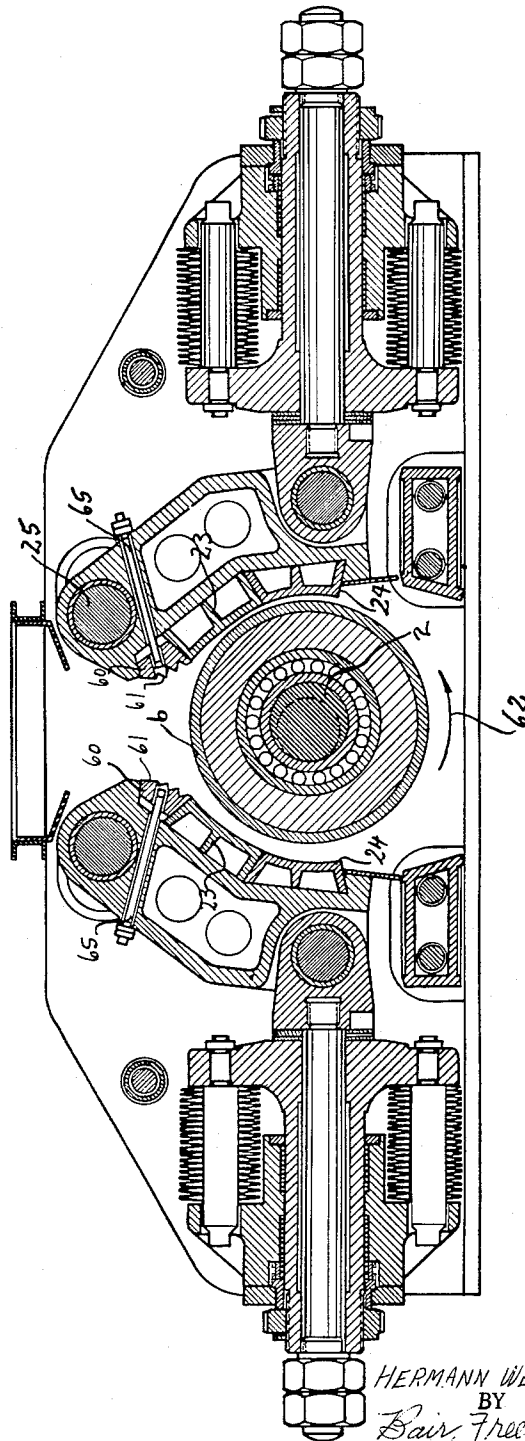


FIG. 3

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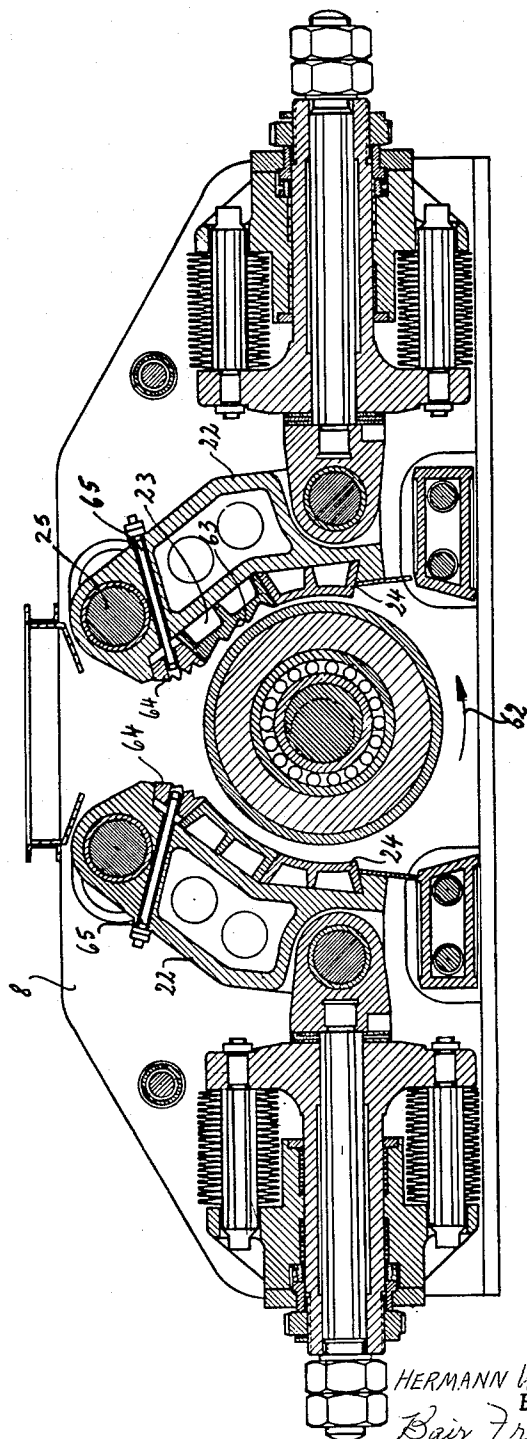
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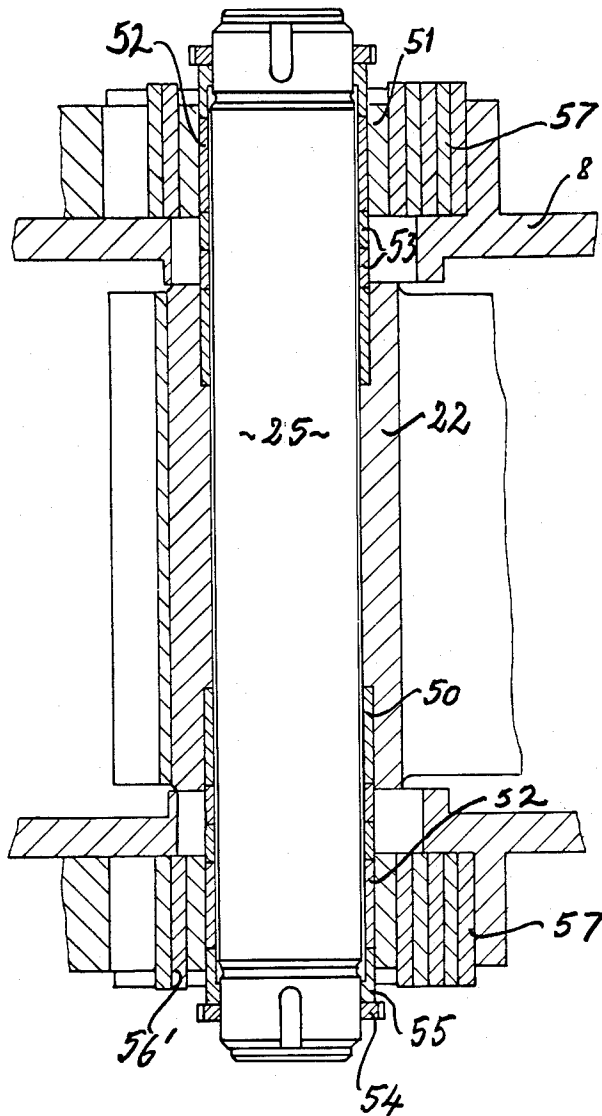


FIG. 5

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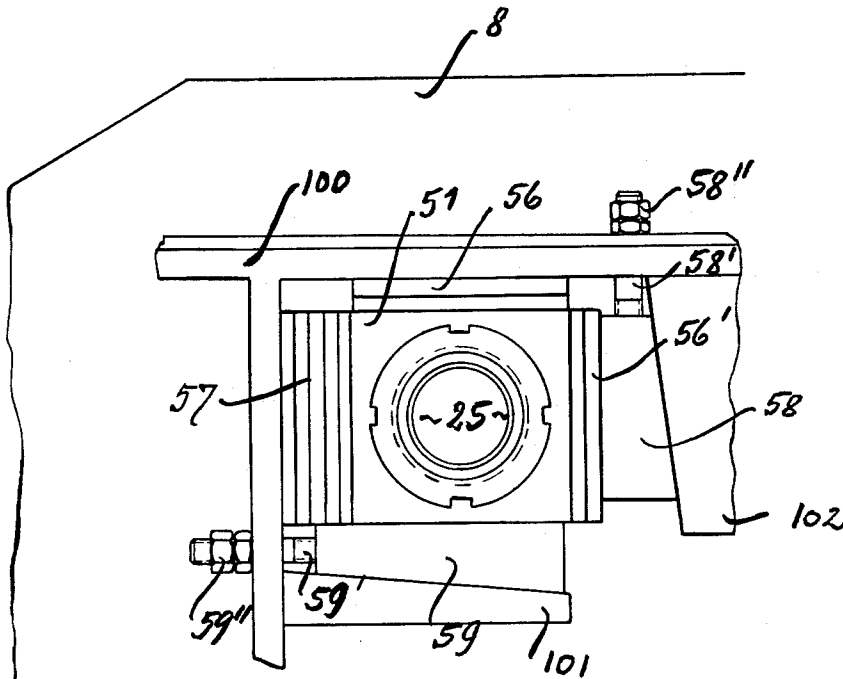


FIG. 6

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JAW CRUSHING ROLLER

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E 23,701

12 Claims. (Cl. 241—204)

This invention relates to a double jaw rolling crusher, which contains an eccentric drive shaft on which a roller body is pivotably carried and executes back-and-forth movements with reference to the crusher jaws mounted laterally from it, and the invention particularly relates to the construction of the crushing chamber of rolling crushers.

In the crushing chamber of such rolling crushers, with a uniform direction of rotation of the roller body, the break-up process of the material entering the crushing chamber takes place on one side of the roller body, starting at the upper end of the gap between the roller and the crusher jaw and narrowing gradually downward. This side, the direction of rotation of the roller taking place in the direction of throughput of the material to be crushed, is designated as the downflow side, while the opposite side, the rotational direction of the roller being directed upwardly with reference to the throughput direction of the material to be crushed, is designated as the upflow side of the machine.

It has been shown that, in known symmetrical types of construction for crushing chambers, on the upflow side, considerably higher pressures occur than on the downflow side, which is due to the fact that on the upflow side the passage of the broken-up material is delayed by the opposite rotational direction of the roller and becomes choked on the later falling material, so that a more severe packing occurs. This leads to an uneven loading of the whole crusher, whereby breakdowns in operation often result.

It is therefore an important object of the present invention to eliminate such problems associated with known rolling crushers.

According to the present invention, therefore, the crushing chamber cross-section lying between the oppositely positioned crusher jaws is sub-divided asymmetrically by a vertical plane running through the center of the drive shaft, whereby the broken-up material no longer becomes undesirably packed on the upflow side of the crushing roller. This is achieved by providing that the two crushing chamber wings, arising between the roller body and the lateral crushing jaws, have different size opening angles, or by providing that the surface of the crushing jaws facing the crushing chamber on the upflow side is equipped with ribs or teeth, preferably running in the longitudinal direction of the roller body.

The invention also relates to the drive of the crushing drum of such rolling crushers, wherein the revolving inertia forces arising in the eccentric movement of the crusher drum are balanced.

It is known practice to mount flywheels or balance wheels on the drive shaft of the crusher drum, whereon adjustable balance weights are positioned for the compensation of the inertia forces. However these known arrangements have the disadvantage that, for example, in the case of overload, if uncrushable foreign bodies enter the crushing chamber, they produce particularly great inertia forces, because these known devices operate with a certain lag, so that the torque initiated from the drive, in case of blocking, is further increased by the inertia lag moments of the balancing plates.

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It is therefore another object of this invention to provide devices wherein these inertia forces are considerably reduced by an arrangement whereby the balancing and drive plates or pulleys or flywheels are coupled over an overload coupling, which may be of known construction, and over the eccentric shaft having the crusher drum device.

The inertia forces of the eccentrically moving crusher drum are largely compensated for, according to the invention, by balancing weights, arranged within the drum bearing. Outside the crusher drum bearing there are arranged, in easily accessible places on each side of the machine, adjustable balancing weights securely connected with the eccentric shaft; these allow a fine regulation of the inertia compensation and also an adaptation to the changed inertia conditions, resulting from wear of the drum surface. These balancing weights are not joined with the balancing plates.

It is a further object of the invention to increase the throughput performance of a double jaw rolling crusher, so that pieces of relatively large dimensions, contained in the input material, can be broken-up, although the size thereof exceeds the size of the material that is suited for the opening angle of the main crushing chamber.

As is known, the size of the input material for breaker machines is dependent on the crushing chamber angle, as determined by the surface of the crushing jaw and the diameter of the roller body, together with the size of the discharge gap of the crushing chamber. If, therefore, the piece size adapted to this crushing chamber angle is exceeded by certain material, then the material to be broken-up is, in practice, pushed out, in an upward direction and is not broken-up. Thus, if, in the material to be crushed, there are pieces larger than the crushing chamber angle, then congestions occur at the entry openings to the crushing gap. This invention, therefore, also provides a structure for crushing jaws, preferably of the upper ends of the crushing jaws, wherein larger pieces in the material to be crushed, can be crushed without the occurrence of congestions. Thus, not only is clogging of the crushing chamber eliminated, but also there is an increase in the throughput performance of the machine.

This is accomplished by the present invention by providing that the angle formed by the surface of the crushing members be constructed considerably larger in the region of a preliminary crushing chamber, which is encountered ahead of the main crushing chamber. For this purpose, the surfaces of the crushing jaws in the region of the preliminary crushing chamber are provided with teeth or ribs which run in the longitudinal direction of the roller body and which have a progressive ratio, in the direction toward the roller center, equal to or less than the total stroke of the roller body. These surfaces of the crushing jaws, provided with ribs or teeth in the preliminary crushing chamber, prevent a squeezing out of the excessively large material, so that such material is broken-up.

Other features of the present invention relate to the bearing of its upper crusher jaw ends, situated in the crushing chamber near the inflow of material, on their independent axles, passing through the casing wall, and also to devices for shifting the bearings of the independent axles so that the crushing gap between the crusher jaw and the crushing roller surface changes can be adapted to the material to be crushed.

Further purposes and objects of this invention will appear as the specification proceeds.

Particular embodiments of the present invention are illustrated in the accompanying drawings wherein:

FIGURE 1 is a horizontal, longitudinal sectional view through a double jaw rolling crusher;

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FIGURE 2 is a vertical, longitudinal sectional view through a double jaw rolling crusher with a toothed upper crushing jaw on the upflow side, without a preliminary crushing chamber;

FIGURE 3 is a vertical, longitudinal sectional view through a double jaw rolling crusher having preliminary crushing chamber;

FIGURE 4 is a vertical longitudinal sectional view through a double jaw rolling crusher with a preliminary crushing chamber and a toothed upper crushing jaw on the upflow side;

FIGURE 5 is a sectional view showing the bearing of the upper independent axle; and

FIGURE 6 is a side view of the bearing of the upper independent axle on the casing.

Referring to the drawings, on the eccentric offset 1 of an eccentric shaft 2, there is rotatably carried by roller bearings 3, a roller body 4; the body 4 carries a roller shell 6 of highly abrasion-proof material, secured by conical rings 5. Bearings 7 and 7' are surrounded by a sleeve 9 and, in the usual manner, are protected against access of dust by labyrinth rings 10 and 11. The space between the sleeve 9 and the cylindrical recess of the side walls 8 is filled by multiple-part sleeve 12 and an axially slidable conical ring 13. Through axial sliding of the conical ring 13 against the cone pitch, a close seating of all the bearing casing parts is achieved. Axially, the bearings 7 and 7' are held by the discs 14. After disassembling the discs 14 and after releasing the conical rings 13, the whole roller 4 with bearing, roller shell etc. can be taken out in the direction of the drive pulley 15. If there is removed on the side opposite the drive pulley 15 on the eccentric shaft 2, the ring nut 16 and the balance weight 17, then after disassembling the multi-part conical ring 13, the multi-part casing ring 12, and also the conical ring 5 on the side of the pulley 15, the roller shell 6 can be disassembled without it being necessary to open the casing and packings of bearings 3 and 7. This is an important advantage since the changing of the crushing shell 6 frequently has to be carried out in an atmosphere which is not free of dust.

The balance weights 17 have interchangeable additional weights 18. These balance weights 17, in conjunction with the additional weights 18, make it possible to completely balance all the forces of unbalance generated on the parts mounted on the eccentric offset 1 of the eccentric shaft 2. The interchangeable additional weights 18 also make possible an attuning of the balance of inertia when there is progressive wear of the crushing shell 6. The inertia balancing weights 17 are connected in a known manner, as, for example, by means of fitting springs or a key with the eccentric shaft 2.

The drive pulley 15 is adapted to turn freely on a sleeve or bushing 19. The torque closure of the drive pulley 15 with the eccentric shaft 2 is accomplished by means of a cone clutch coupling sleeve 20, which is longitudinally slidable but not turnable on the eccentric shaft 2, the spring 21 providing the desired pressure against the sleeve 20.

If, for example, through the entry of uncrushable foreign bodies, the crushing roller 6 is blocked, then the drive pulley 15, after overcoming the coupling frictional moment, can turn freely. Thus, the motor drive moment, and the inertia lag moments of the drive pulley, and of the motor rotor or other known drive means, no longer act on the eccentric shaft 2. So, in conjunction with the rocker arm cushioning to be hereinafter described, there are provided twofold means for insuring against overloading of the machine.

On one or on both sides of the crushing roller 6, there are arranged crushing rockers 22 which, on the side facing the crushing chamber, are equipped with interchangeable crushing jaws 23 and 24. The crushing rocker arms are swingably carried at their upper ends on independent rocker-arm axles 25. At their lower ends, they are sup-

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ported on a jointing piece 26 and spacing plates 27 against a spring carrier 28. The spring carrier 28 is carried, with its cylindrical sleeve 29, in a corresponding recess of a counter holder 30. By means of a ring nut 31, plate springs 32 are arranged between the spring carrier 28 and the counter holder 30. The bolts 33 hold the plate spring sets together.

The ring nut 31 is mounted against a sleeve 34 and a 3-part ring spring 31 is mounted against a corresponding opening of the counter holder 30. When the spring carrier 28, after a yielding operation, resumes its original position, the shock of this recoil movement is absorbed by the ring spring 35. If the ring spring 35 was not used, there would be a danger of damage occurring at the spring carrier 28 or at the ring nut 31, because of the high lag force. The ring springs 32 are ordinarily biased to such an extent that they do not yield on normal crushing strains; only on entry of foreign bodies into the crushing chamber does the crushing rocker arm 22 tend to swing out about the pivot point of the rocker arm axle 25 and the ring spring sets are compressed at this time.

The discharge gap of the crushing chamber formed between the outer contact circle of the crushing roller 6 and the lower edge of the lower crushing jaw 24 can easily be altered by changing the spacing plates 27. The nuts 36 and the spindle 37 hold the jointing piece 26, the spacing plates 27 and the spring carrier 28 together.

The counter holder 30 has cylindrical recesses 38 on both sides. In each cylindrical recess 38, there are bolts 39; in this arrangement, rubber sleeve 40 is placed between the bolts 39 and the cylindrical recesses 38. The rubber sleeve 40 is axially biased by means of the plate 41, the spindle 42 and the nut 43 in such a way that a close fit is provided between the counter holder bore 38, the rubber sleeve 40, and the bolt 39. Up to a certain degree, by reason of the low thrust modulus of the rubber sleeve, a twisting in the bearing seat is possible. The bolt 39 is connected by means of known ring spring tightening elements 44 with a corresponding recess 45 in the casing side wall 8.

The jointing piece 26 is, by means of an axially biased rubber sleeve 46 connected with the bolt 47 and this, in turn, is connected by means of a rubber sleeve 48 with a corresponding recess in the lower end of the rocker arm 22. The axial bias of this rubber sleeve 46 is accomplished through ring nuts 49.

The crushing rocker arm 22 has, at its upper end, a bore with recesses for the rubber sleeve 50, as shown in FIGURE 5. In the side walls 8 of the bearing casing 51, there are arranged recesses for the rubber sleeves 52; spacing sleeves 53 of steel are positioned between the rubber sleeves 50 and 52. The axial tension of the rubber sleeves 50 and 52 is provided by means of a ring nut 54 and sleeves 55.

The bearing casing 51 is mounted, as shown in FIGURE 6, in a framelike structure 100 which is attached to the side wall 8 of the machine. Between the sides of the frame 100 and the bearing casing 51 there are spacing plates 56 and 56', which are held by the wall parts of the frame against adjustable wedges 58 and 59. The wedges 58 and 59 are connected with screw bolts 58' and 59', which protrude through the side parts of the frame 100, and can be slid on the corresponding surfaces of the wedge shaped projections 101 and 102 of the frame 100. The nuts 58'' and 59'' secure the wedges 58 and 59.

By changing the spacing plates 56 and 57, the mid-point of the upper rocker arm axle 25 can be changed with respect to the machine center. Thus, it is possible to provide a different setting for the entry gap of the crushing chambers on the two sides of the crushing roller. Also, the crushing chamber angle formed between the tangent of the outer contact circle of the crushing roller 6 and the tangent of the curved crushing jaw 23 or 24 can be differently adjusted on the two sides.

As is seen from FIGURES 2 to 4, the upper crushing

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jaws 23 and the lower crushing jaws 24 are held together by wedges 60 which are secured by screw bolts 65, interchangeably on the crusher rocker arms 22.

In the structure shown in FIGURE 3, the surface 61 of the wedges 60 cooperates with the crushing roller 6 to form a preliminary crushing chamber. Here, individual larger pieces contained in the crushing material, which normally are not engaged by the crushing members, are reduced in size to such an extent that further breaking up thereof in the normal crushing chamber is possible. The crushing chamber angle formed by the surface of the wedges 60 and the tangent at the oppositely situated point of the contact circle of the crushing roller 6 is made sufficiently large that, with smooth crushing members, the crushing material would no longer be gripped. Through a particular shaping of the surface 61 of the wedges, as for example by indentations extending in the axial longitudinal direction of the eccentric shaft 2, individual larger pieces may be gripped with certainty and subjected to preliminary breaking-up. Thus, through the enlarged crushing chamber angle of the preliminary crushing zone, there is achieved, in conjunction with the indentations a high degree of material size reduction. By the particular configuration of the securing wedges 60, the forces in the preliminary crushing zone contribute to an increase in the gripping action of the wedges 60.

In FIGURE 4, on one side of the crushing chamber, the surface of the upper crushing jaw 23, facing the crushing chamber is provided with grooves or indentations 63. Upon the circular movement of the eccentric shaft, the crushing process begins on one side of the crushing chamber at the upper end of the crushing jaw 23 and ends at the lower end of the crushing jaw 24. On the other side it begins at the lower end of the crushing jaw 24 and ends at the upper end of the crushing jaw 23. The latter side is designated as the upflow side and the former as the downflow side. At the upflow side, as can be demonstrated with the aid of known equations for the throughput performance, the material being crushed has less time, between the individual crushing thrusts, for falling downward in the direction of the crushing chamber discharge than on the downflow side. Because of this fact there occurs early on the upflow side, clogging of the material and, through the high compression forces created, overloads result. By a particular shaping of the surface 63 of the upper crushing jaw 23 on the upflow side, assuming the eccentric shaft 2 turns in the direction of arrow 62, there is provided a certain lag in the crushing material feed in the upper crushing chamber part. Thereby, congestion dangers are substantially reduced. The same effect can also be achieved, for example, by an asymmetrical setting of the crushing space.

In FIGURE 2, there is shown a double jaw rolling crusher without the preliminary crushing chamber, but with a toothed surface 63 on the upper crushing jaw 23 on the upflow side. In this embodiment, the crushing jaws 23 and 24 are securely held in place by wedges 64 and screws 65. The crushing chamber begins at the upper edge of the inside surface of the upper crushing jaw 23. This design is advantageously used when the material to be crushed already has a homogeneous particle size adjusted to the crushing chamber angle.

While in the foregoing there have been provided particular embodiments of the present invention, it is to be understood that all equivalents obvious to those having skill in the art are to be included within the scope of the invention, as claimed.

What is claimed is:

1. A jaw rolling crusher having a roller body rotatably carried on an eccentric drive shaft and also having crushing jaws spaced from said drive shaft, said jaw rolling crusher comprising a crushing chamber formed between said roller body and said crushing jaws to provide both downflow and upflow movement for material being crushed, said chamber being sub-divided asymmetrically

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by a substantially vertical plane extending longitudinally of said drive shaft and through the center thereof, whereby the material passing through the upflow side of said roller body moves upwardly without compacting.

2. A jaw rolling crusher having a roller body rotatably carried on an eccentric drive shaft and also having a pair of crushing jaws oppositely spaced from said drive shaft, said crusher comprising downflow and upflow crushing chamber wings formed between said roller body and each of said crushing jaws, said wings having different size opening angles for permitting the free passage of material during the upflow movement thereof.

3. The jaw rolling crusher of claim 2 wherein the crushing jaw on the upflow side of said roller body includes teeth, extending longitudinally of said roller body.

4. A jaw rolling crusher having a roller body rotatably carried on an eccentric drive shaft and also having a pair of crushing jaws spaced from said drive shaft, said crusher comprising downflow and upflow crushing chamber wings formed between said roller body and said crushing jaws, said wings having different size opening angles for permitting the free passage of the material during the up-flow movement thereof, first balancing weights mounted on said eccentric shaft, and adjustable balancing weights mounted on said first balancing weight in order to compensate for inertia variations.

5. A jaw rolling crusher having a roller body rotatably carried on an eccentric drive shaft and also having a pair of crushing jaws spaced from said drive shaft, said crusher comprising a drive pulley for driving said shaft, overload coupling means for connecting said pulley to said shaft, downflow and upflow crushing chamber wings formed between said roller body and said crushing jaws, said wings having different size opening angles for permitting the free passage of the material during the up-flow movement thereof, first balancing weights mounted on said first balancing weight in order to compensate for inertia variations.

6. A jaw rolling crusher having a roller body rotatably carried on an eccentric drive shaft and also having a pair of oppositely positioned crushing jaws spaced from said drive shaft, said crusher comprising a main crushing chamber positioned between said crusher jaws and being sub-divided asymmetrically by a substantially vertical plane extending longitudinally of said drive shaft and through the center thereof, whereby the material passing by the upflow side of said roller body moves upwardly without compacting, and a preliminary crushing chamber positioned ahead of said main crushing chamber, whereby oversized material is broken-up prior to entering said main crushing chamber.

7. A jaw rolling crusher having a roller body rotatably carried on an eccentric drive shaft and also having a pair of oppositely positioned crushing jaws spaced from said drive shaft, said crusher comprising a main crushing chamber positioned between said crusher jaws and being sub-divided asymmetrically by a substantially vertical plane extending longitudinally of said drive shaft and through the center thereof, whereby the material passing by the upflow side of said roller body moves upwardly without compacting, a preliminary crushing chamber positioned ahead of said main crushing chamber, the angle formed between said crushing jaws and said crushing roller being greater in the region of said preliminary crushing chamber than in the region of said main crushing chamber, whereby oversized material is broken up prior to entering said main crushing chamber.

8. The crusher of claim 7 wherein the surfaces of said crushing jaws in the region of said preliminary crushing chamber include teeth which extend longitudinally of the roller body.

9. A jaw rolling crusher having a roller body rotatably carried on an eccentric drive shaft also having a pair of oppositely positioned crushing jaws spaced from said drive shaft, said crusher comprising downflow and up-

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flow crushing chamber wings formed between said roller body and each of said crushing jaws, said wings having different size opening angles, a preliminary crushing chamber for breaking up oversized pieces prior to reaching said downflow and upflow crushing chamber wings, and said crushing jaws in the region of said preliminary crushing chamber including wedge pieces for maintaining said crushing jaws in place.

10. A jaw roller crusher comprising a roller body, an eccentric drive shaft for rotatably carrying said roller body, a pair of crushing jaws laterally spaced from said drive shaft, arms for carrying said crushing jaws, axles for independently carrying said arms, downflow and upflow crushing chamber wings positioned between said roller body and each of said crushing jaws, each of said wings having different size opening angles for permitting the free passage of material therethrough during the upflow movement of said material.

11. A jaw roller crusher comprising a roller body, an eccentric drive shaft for a rotatably carrying said roller body, a pair of crushing jaws laterally spaced from said drive shaft, arms for carrying said crushing jaws, bolt for carrying the lower end of said arms, a jointing piece for supporting said bolt, a rubber sleeve positioned between said bolt and said jointing piece, axles for inde-

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pendently carrying said arms, downflow and upflow crushing wings positioned between said roller body and each of said crushing jaws, each of said wings having different size opening angles for permitting the free passage of material therethrough during the upflow movement of the said material.

12. The jaw rolling crusher of claim 11 wherein means are provided for adjusting the position of said axles so that the gap between said crushing jaws and said roller body according to the size of material to be crushed.

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