J. MOHS.

CRUSHING AND GRINDING MILL.

APPLICATION FILED APR. 3, 1912.

1,063,463.

Patented June 3, 1913.

5 SHEETS—SHEET 1.

Fig. 1

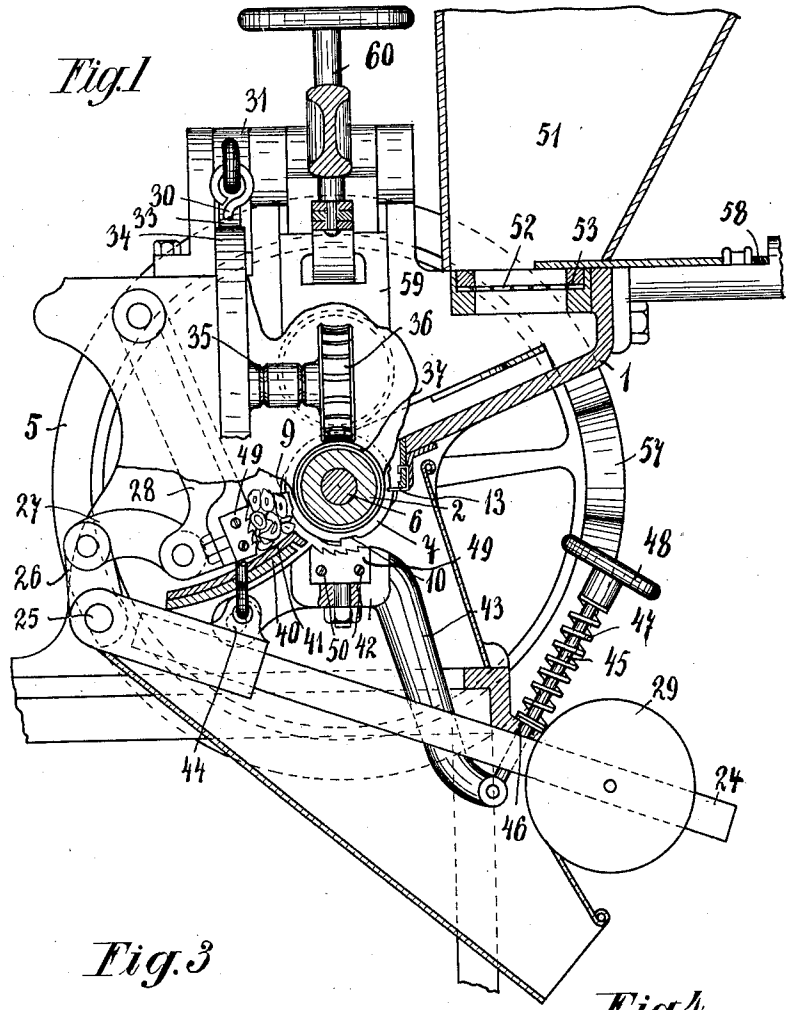


Fig. 3

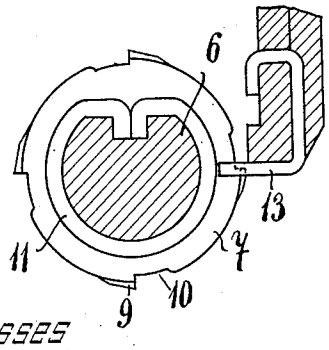
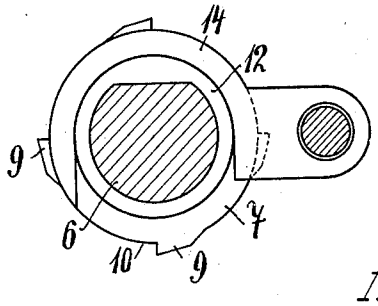


Fig. 4



Witnesses

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5 SHEETS—SHEET 2.

Fig. 2

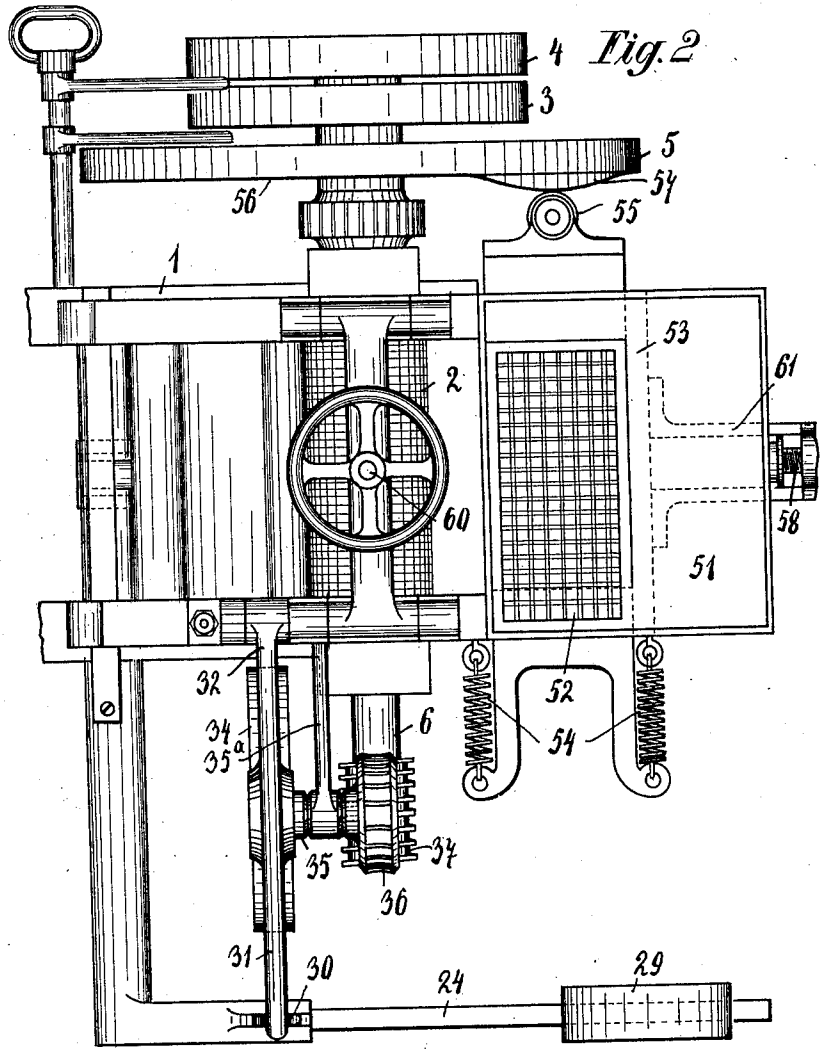
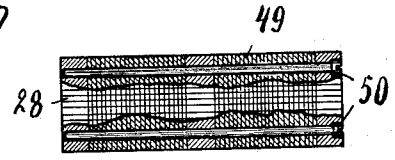


Fig. 19



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5 SHEETS—SHEET 3.

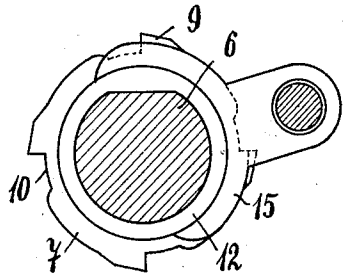

Fig. 5

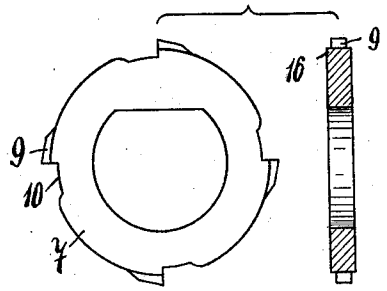

Fig. 6

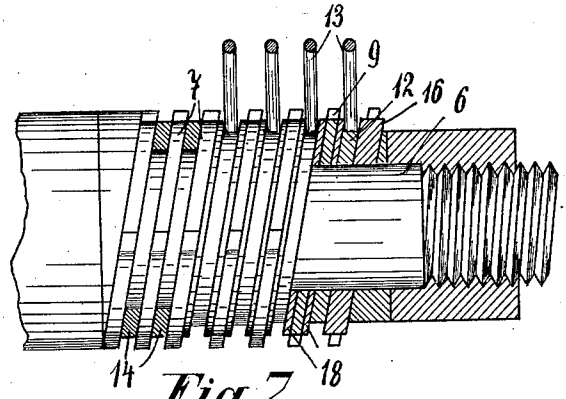

Fig. 7

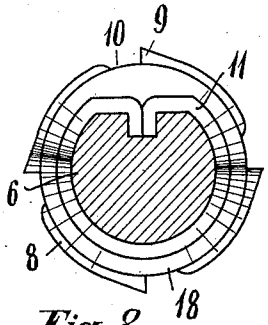

Fig. 8

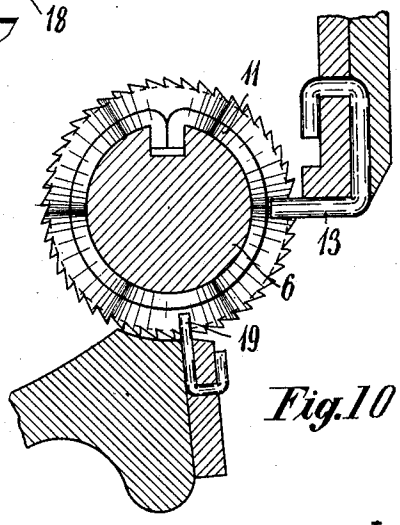

Fig. 10

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5 SHEETS—SHEET 4.

Fig. 9

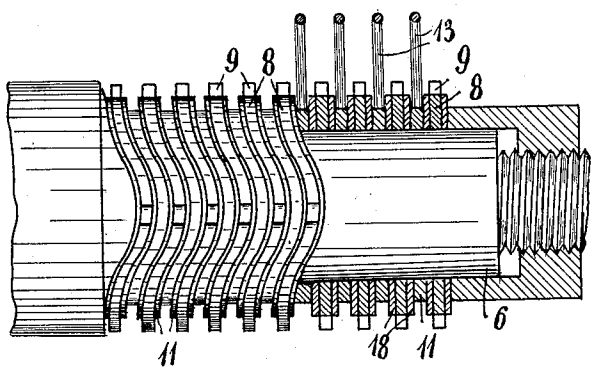


Fig. 11

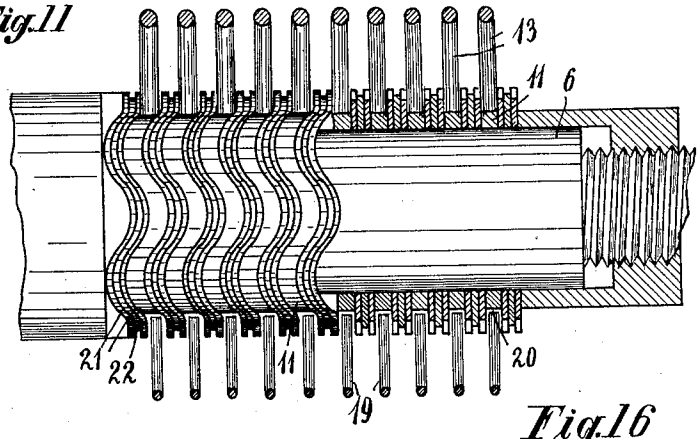


Fig. 16

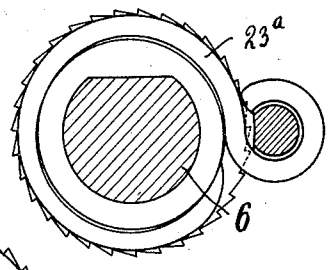


Fig. 12

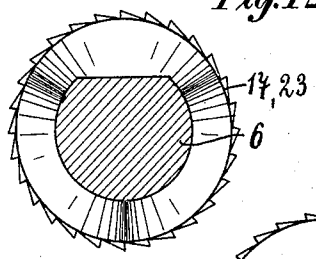
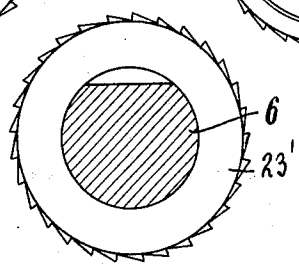


Fig. 14



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5 SHEETS—SHEET 5.

Fig.13

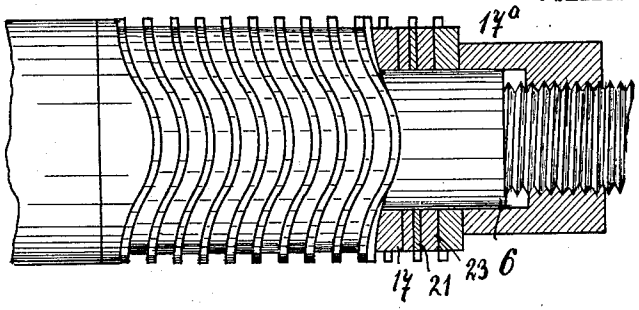


Fig.15

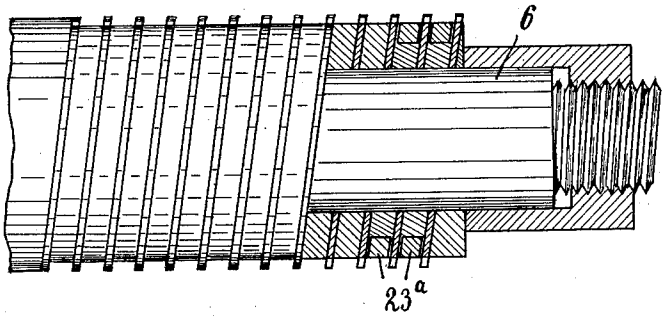


Fig.17

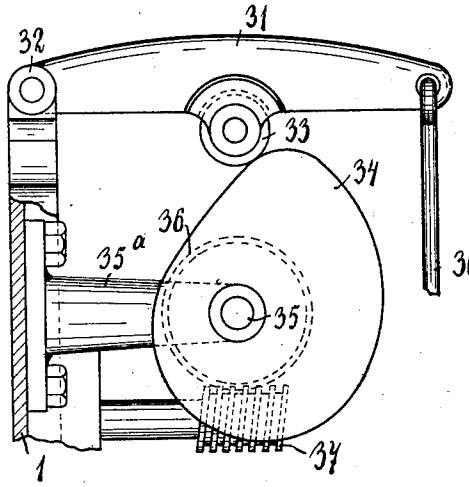
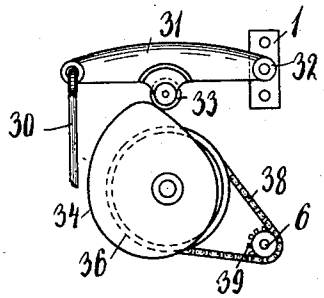


Fig.18



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UNITED STATES PATENT OFFICE.

JULIUS MOHS, OF DESSAU, GERMANY.

CRUSHING AND GRINDING MILL.

1,063,463. Specification of Letters Patent. Patented June 3, 1913.

Application filed April 3, 1912. Serial No. 688,316.

To all whom it may concern:

Be it known that I, JULIUS MOHS, a subject of the Emperor of Germany, residing at Dessau, Germany, have invented certain Improvements in Crushing and Grinding Mills, of which the following is a specification.

The present invention relates to a machine such as employed for reducing bones, oil-cakes and the like into a coarse-grained product and also for a finer reduction of horn, oyster-shells, resin, grain, roots and fruit.

The machine belongs to the type having grinding rollers composed of ring-shaped saw-blades which are clamped together on a core, and the invention consists essentially in the construction and combination of such blades and their spacing elements, as hereinafter described.

It has been found that when a coarse-grained product is desired, the ordinary saw-blades, in which one tooth follows closely upon another, are unsuitable, since one tooth simply runs in the groove cut by the previous one, the effect being that the materials, instead of being reduced by the roller, are simply scored by the same. This occurs whether the blades are made straight and arranged at an angle to the roller-axis or made sinuous, the materials being in either case guided by the closely set teeth and adjusted to the varying positions of the latter.

According to the invention this defect is remedied by spacing the teeth on the blades.

In this manner the guiding effect of the teeth is eliminated, and each succeeding tooth of a blade, as it rotates in a different plane to the previous one, is caused to attack a particular lump in a different place. Instead of a scoring of the lump, therefore, a reduction of the same into coarse grains is effected.

When a finely reduced product, particularly of beetroots and the like, is desired, the saw-blades must not enter too deeply into the roots but simply scrape on the surface thereof. In order to produce such an effect in a satisfactory manner the teeth are, according to the invention, made very fine and thinner than the actual blade so that only the teeth themselves can enter the materials. The same results may be obtained by making blade and teeth of the same thickness and placing the blade between two blank rings extending to the base of the teeth. This thickening of the actual blade also serves as a means for protecting the clearing fingers against the abrasive action of the teeth, such fingers being adapted to work between the thick portions of the blades which are suitably spaced for the purpose.

The improved machine is fitted in known manner with a breast plate which presses the materials against the grinding roller, a stationary plate being arranged underneath said breast plate with one edge directed toward the roller so as to prevent the admission of unreduced particles. According to the invention an additional breast plate is arranged at the opposite sides of said stationary plate for the purpose of subjecting the reduced materials to a final grinding, this being advisable when a very fine reduction of maize or the like is required.

The milled grinding surfaces of the breast plates are according to the invention produced in a similar manner to the grinding surface of the roller, *i. e.*, by means of toothed plates clamped together in juxtaposition. This arrangement enables the grinding surfaces to be made of the material which is wasted in the manufacture of the saw-blades for the rollers. It moreover enables them to be made particularly hard and to be readily exchanged when worn out without the necessity of exchanging the whole breast plate.

A particular system of levers, operated by a cam, is provided for actuating the ordinary breast plate and feeding the materials to the roller with as little expenditure of power as possible.

The breast plate is held by a pivoted arm and actuated by a weighted double-armed angle lever which is linked to the free end of the arm. The weighted lever is so arranged as to intersect the vertical plane of the grinding roller. The lever does not, therefore, extend beyond the body of the machine so as to increase its bulk, and yet it enables a leverage of great magnitude to be obtained.

In the accompanying drawings the invention is illustrated, Figure 1 representing a side view of the machine, partly in section, Fig. 2, a plan of the same, Fig. 3, a cross-section of the grinding roller with clearing finger, on an enlarged scale, Fig. 4, a cross-section of the roller with a different kind of clearing element, Fig. 5, another cross-

section of the roller fitted with yet another kind of clearing element, Fig. 6, a side view and a cross-section of one of the saw-blades, Fig. 7, a front view, partly in section, of the roller shown in Fig. 3, Fig. 8, a cross-sectional view of a roller the grinding surface of which is formed of sinuous saw-blades, Fig. 9, a front view of the latter roller, partly in section, Fig. 10, a cross-sectional view of a grinding roller fitted with two sets of clearing fingers of different dimensions, Fig. 11, a front view of the roller according to Fig. 10, partly in section, Fig. 12, a cross-section of a roller in which the spacing elements or the sinuous blades are made such as to fill up the whole space and only leave a piece projecting, Fig. 13, a front view, partly in section, of the latter roller, Fig. 14, a cross-section of a roller constructed in the same manner as that of Fig. 13 but with straight blades arranged at an angle to the roller axis, Fig. 15, a front view, partly in section, of said roller, Fig. 16, a view showing a modified arrangement of Fig. 14, Fig. 17, a side view of the operating element for the breast plate, Fig. 18, another side view of the same element, fitted with a different kind of gearing, and Fig. 19, a longitudinal section of the improved breast plate.

The grinding roller 2 is mounted in the machine frame 1 and carries on its shaft a fly-wheel 5 as well as belt-pulleys 3 and 4 of which one is loose. If the machine is to be driven by hand, the pulleys 3 and 4 are replaced by a suitable crank-handle. The grinding roller is composed of a core 6 on which ring-shaped saw-blades 7 are arranged and clamped together so as to form a grinding surface with their teeth. The blades may either be made sinuous, as shown in Fig. 13, or straight as shown in Fig. 15, in which latter case they are arranged at an angle to the roller axis.

When the machine is desired to produce a coarse-grained article, spaces 10 are left between the teeth 9 of the individual blades so as to insure the reducing effect previously explained. The blades are spaced by rings 11 (Figs. 3, 8, 9, 10, 11) or disks 12 (Figs. 4, 5, 7), and clearing fingers 13 are arranged in known manner so as to work on said rings or disks and clear the roller of materials. In the case of straight blades arranged at an angle to the roller axis, the fingers may be replaced by ring-segments such as 14 of Fig. 4 or 15 of Fig. 5. These segments bear against the disks 12, and the elements are adjusted in size so that the upper edge of the segment registers with the base of the teeth 9. When fingers are employed it is preferable to make the teeth thinner than the actual blades, as shown at 16 in Figs. 6 and 7, or to arrange a thin ring 18, as shown in Figs. 7, 8 and 9, extending to the base of the teeth, at each side of the blade, the fingers being arranged in the groove formed between the blades or between the rings 18 so as to be out of direct contact with the teeth and thus guarded against abrasion.

When reducing beetroots, potatoes, fruit or the like it is advisable to employ, in addition to the ordinary clearing fingers 13, a set of fingers 19 (Figs. 10 and 11) of smaller dimension, said additional finger being arranged underneath the roller 2 so as to work in the grooves 20 and form a kind of sieve retaining all particles which are unable to pass between the fingers and the blades. The degree of reduction can thus be determined by the fingers 19. After the fine pulp has passed the fingers 19 it is cleared off the grooves 20 by the fingers 13 which fill up such grooves entirely. It is also desirable, in connection with this construction, to arrange the blades in pairs, as shown in Fig. 11, and to arrange a blank disk 22, extending to the base of the teeth, between the blades 21 of each pair. The different pairs are separated by rings 11 as previously described. By this arrangement the blades are prevented from penetrating too far into the roots or the like, the latter being simply scraped by the teeth so that a very fine product is obtained. The same effect is achieved by the provision of the rings 18 or the corresponding thickening 16 of the blades.

When grinding dry greaseless materials the clearing elements may be dispensed with, since the centrifugal force is in that case sufficient for keeping the roller clear of ground particles. For that purpose, therefore, the roller is constructed as shown in Figs. 12 to 16, plain surfaces, coinciding with the base of the teeth, being provided between the latter. This may either be effected by means of spacing disks 23 or 23′ arranged between the blades, or by making the teeth thinner than the actual blade, as shown at 17 and 17^a in Fig. 13. According to Figs. 15 and 16 a ring 23^a is arranged, similarly to the clearing elements 14 and 15, in a groove in the spacing disk so as to remain stationary while the roller rotates, the upper surface of such ring being flush with the base of the teeth.

The materials are pressed against the grinding roller by a breast plate 28 which is held by a pivoted arm, the latter being rocked intermittently for admitting the materials to the roller. For operating said arm with a minimum expenditure of power without diminishing the force with which the breast plate is applied to the roller, the following arrangement is resorted to: The arm of the breast plate is connected by a link 27 to an arm 26 which is mounted on a rock-shaft 25. Another arm 24 on said rock-

shaft carries a weight 29 which has a tendency to turn the shaft 25 so as to apply the breast plate to the roller 2. A lever 31, pivoted at 32 to the upper part of the machine-frame, has its free end connected by means of a rod 30 to the arm 24. Underneath said lever a cam 34 is arranged which is mounted on a shaft 35 held in a bracket 35a. While the shaft 35 is rotated, the cam 34 engages and rocks the lever 31, the latter being fitted with a roller 33 to take the thrust. The rocking movement of the lever 31 is communicated by the rod 30 to the arm 24 and thence to the arm of the breast plate, the latter being thus, when the weight 29 is lifted, retracted from the roller 2 so as to admit materials for grinding as shown in Fig. 1.

For rotating the shaft 35 either of the arrangements shown in Figs. 17 and 18 may be employed. In the first instance the shaft is fitted with a worm-wheel 36 which gears with a worm 37 connected to the shaft of the roller 2. In the second instance rotation is imparted to the cam-shaft by means of a chain 38 and a sprocket wheel 39 for driving the latter. By adjusting the weight 29 on the arm 24 the pressure of the breast plate on the grinding roller can be regulated in accordance with the density of the materials under treatment. Underneath the breast plate 28 a stationary plate 41 is arranged in known manner with its edge directed toward the roller. This plate is carried by another plate 40 on which it can be adjusted for varying its distance from the roller so as to admit more or less coarse particles. In the treatment of certain materials such as sugar-beets, maize and the like, it is essential to have a second breast plate 42 arranged underneath the plate 41 so as to subject the previously reduced materials to a final crushing or grinding. This breast plate is connected to a lever 43 which is pivoted at 44 and which has its free end hinged to a rod 45. The rod 45 is slidably held in a guide-way 46 against which and against an adjustable nut 48 screwed on the upper end of the rod, a helical spring 47 abuts. This spring holds the breast plate 42 against the roller with a force dependent upon the position of the nut 48 on the rod. A very finely reduced material can thus be obtained.

The breast plates are generally provided with milled grinding surfaces the better to retain the materials in contact with the roller. According to the invention the grinding surfaces of the breast plates are produced by the teeth of a plurality of saw-blades 49 which are clamped together by screw-bolts 50 as shown in Fig. 19. It is evident that by this arrangement the grinding surface can be made far more hard and effective than by the milling of the breast plate itself. It can moreover be conveniently renewed when worn out. The blades 49 can be made out of the waste-material produced in the manufacture of the blades for the grinding roller and may, like the latter blades, be either straight or sinuous. An additional grinding roller may be provided which in that case is arranged above the roller 2, as shown dotted in Fig. 1, so as to coöperate with this roller. The top-roller is mounted in slidable bearings 59 so as to allow of being adjusted relative to the roller 2. The bearings 59 are controlled by a spring which is held by an adjustable screw-spindle 60.

The materials are fed to the roller or rollers through a hopper 51 which, when the machine is used for the treatment of grain, is provided with a bottom in the form of a shaking-sieve 52. The frame of this sieve is slidably held in guide-ways 53 and carries at one end a roller 55 adapted to contact with the rim 56 of the fly-wheel 5. A projection 57 on said rim reciprocates the sieve in coöperation with springs 54 which tend to hold the roller 55 in contact with the rim. Above the sieve 52 a sliding shutter 61 may be arranged for varying the feed aperture of the hopper. The shutter is preferably connected to a screw-spindle 58 by means of which it can be adjusted for such purpose.

I claim:—

1. In a crushing and grinding mill, a grinding roller composed of ring-shaped saw-blades clamped together on a core and arranged at an angle to the roller axis, the teeth of said blades being arranged some distance apart, spacing elements arranged between said blades so as to form grooves of less width than the distance between the teeth of adjacent blades, and clearing fingers adapted to work in said grooves so as to be out of contact with the teeth, substantially as and for the purpose set forth.

2. In a crushing and grinding mill, a grinding roller composed of ring-shaped saw-blades clamped together on a core, a breast plate held by a pivoted arm against said roller, a rock-shaft, an arm mounted on said shaft, a link connecting said arm with the breast plate, a weighted arm mounted on said shaft and tending to press the breast plate against the roller, a pivoted lever arranged above said weighted arm, a rod connecting the free end of said arm with the weighted arm, a cam-shaft arranged underneath said lever, a cam arranged on said shaft so as to rock the lever and withdraw the breast plate temporarily from the roller, and connections between the roller-shaft and the cam-shaft for rotating the latter, substantially as and for the purpose set forth.

3. In a crushing and grinding mill, a grinding roller composed of ring-shaped

saw-blades clamped together on a core and arranged at an angle to the roller axis, said blades having spaced teeth, a breast plate held by a pivoted arm against said roller, and a weighted double-armed lever arranged in the mill so as to intersect the vertical plane of the grinding roller, said lever having a short arm which is set at an angle and linked to the free end of the breast plate arm for pressing the breast plate against the roller, substantially as and for the purpose set forth.

JULIUS MOHS.

Witnesses:
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WOLDEMAR HAUPT.