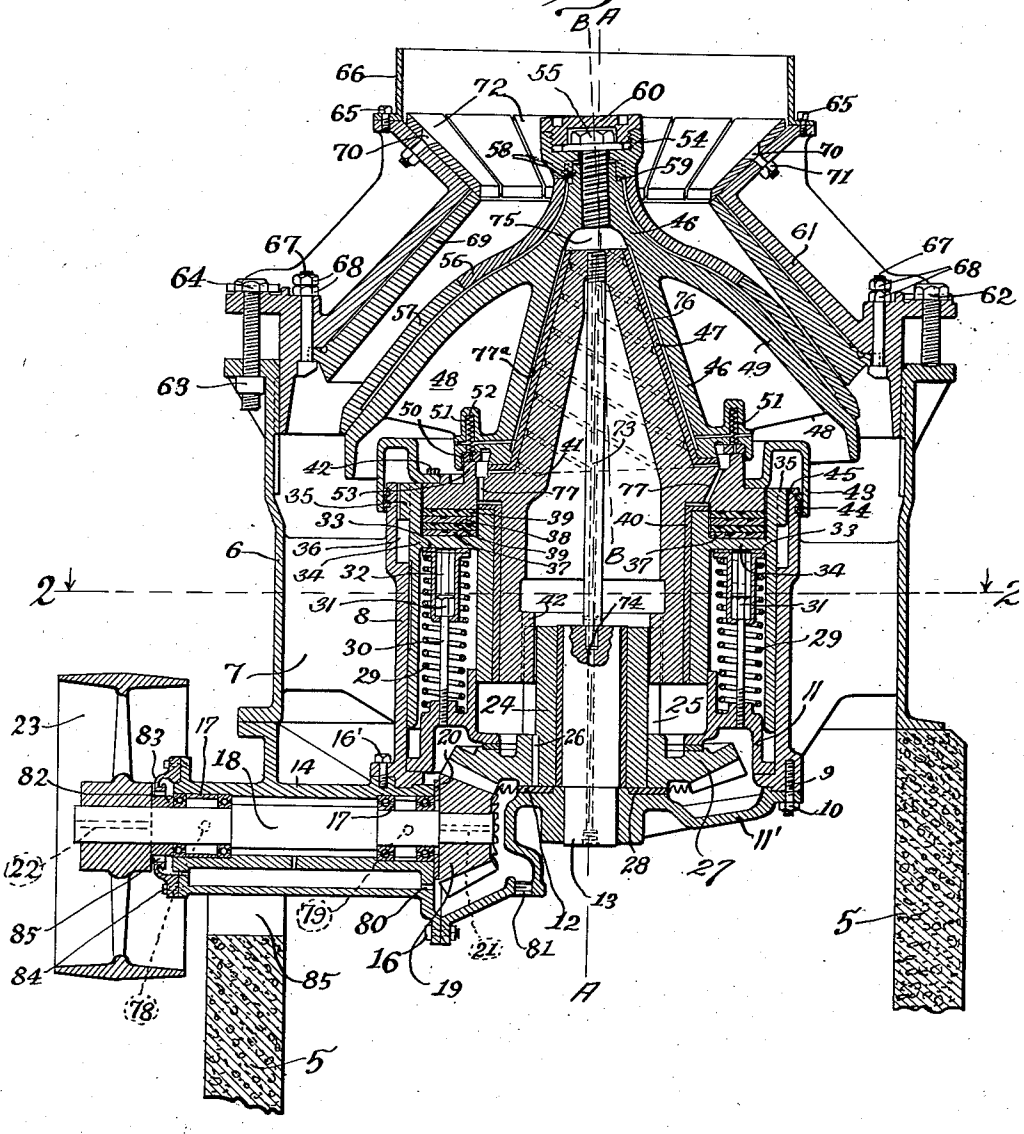
Sept. 1, 1936. W. W. GUEST 2,052,706

CRUSHING MACHINE

Filed Jan. 9, 1930 2 Sheets-Sheet 1

Fig. 1.



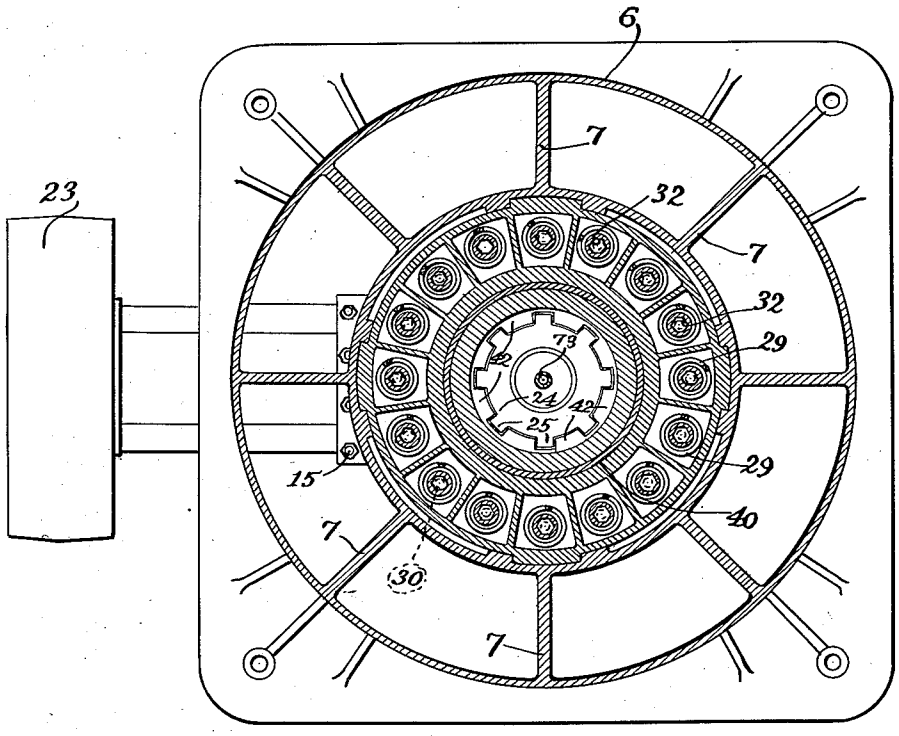
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CRUSHING MACHINE

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Fig. 2.



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Patented Sept. 1, 1936 2,052,706

UNITED STATES PATENT OFFICE

2,052,706

CRUSHING MACHINE

William W. Guest, Los Angeles, Calif.; Ignatius F. Parker, trustee of said Guest, bankrupt, assignor to Pascal Schilz, Los Angeles, Calif.

Application January 9, 1930, Serial No. 419,626

17 Claims. (Cl. 83—10)

My invention relates to a crushing machine and has for its principal object, the provision of a relatively simple, sturdy and efficient machine of wide eccentric range, free from the restrictions and impedimenta pertaining to gyrating shafts or like elements to accomplish the rolling motion of a crushing head operating on an axis oblique to an opposed crushing concave that is concentric with a vertical axis.

A further object of my invention is, to provide ample bearing surface for the distribution of the crushing load so as to relieve the excessive wear between the material engaging surfaces and consequently providing greater rigidity for the moving parts and materially increasing the life or period of service of said parts.

A further object of the invention is, to provide a yielding support that is arranged so as to move away from the fixed crushing element in a downward direction, the natural direction of least shock so as to permit the envelopment and passage of uncrushable material through the crushing cavity with the least shocks and strains and without causing breakage of operating parts.

A further object of the invention is, to provide simple and efficient means for flooding all bearing surfaces with necessary lubricant and at the same time effectively excluding the passage of dust or other injurious impurities that might contaminate the lubricant.

A further object of the invention is, to provide a crushing head having a nearly spherical crushing surface, the slope of which gradually decreases toward the apex of the crushing zone so as to retard the passage of large material and permitting the ready passage of crushed material over the crushing surface of the head and consequently minimizing the tendency of choke within the crushing cavity while the machine is in operation.

A further object of the invention is, to provide a bearing surface for the support of the crushing load, which surface is arranged so as to effectively confine the direction of the resultant of the crushing forces within the boundary of the bearing surface, thereby eliminating tendency of tipping action of the head and consequent heating of the bushings common to all forms of spherical or ball and socket bearings utilized in connection with gyrating shafts and the like.

With the foregoing and other objects in view, my invention consists in certain novel features of construction and arrangement of parts that will hereinafter be more fully described and claimed and illustrated in the accompanying drawings, in which:

Fig. 1 is a vertical section taken through the center of a crushing machine embodying the principles of my invention.

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

Referring by numerals to the accompanying drawings which illustrate a practical embodiment of my invention, 5 designates a suitable foundation on which is mounted a substantially cylindrical frame 6 provided with inwardly projecting ribs 7 that support a vertically disposed cylindrical housing 8. Ribs 7 and housing 8 are preferably formed integral with frame 6. Supported by housing 8 and secured thereto by studs 9 and nuts 10 is a two-piece gear housing comprising an upper half 11 and a lower half 11'. Arranged on the lower half of the gear housing is a wear ring 12 and projecting upwardly from the center of said lower half of the gear housing is a journal pin 13.

Projecting laterally from the gear housing beneath frame 6 is a shaft housing 14 that is secured to frame 6 by screws 15, to the gear housing 11 by bolts 16 and to housing 8 by screws 16'.

Arranged within housing 14 and journaled in suitable anti-friction bearings 17 is a shaft 18 on the inner end of which is mounted a bevel pinion 19 that bears against a thrust washer 20 and said pinion being secured to shaft 18 by key 21.

Secured to shaft 18 by means of a gib key 22 is a fly wheel pulley 23 and a belt operating on this pulley may be driven by any convenient source of power.

Mounted for rotation on journal pin 13 is a bushed quill 24, the upper portion of which is provided with teeth 25 that are parallel with the vertical axis of pin 13, the purpose of which will hereinafter more fully appear.

Fixed on quill 24 and secured thereto by a feather key 26 is a bevel gear wheel 27 that meshes with and is driven by bevel pinion 19.

A thrust ring 28 is arranged between bevel gear 27 and the upper half 11 of the gear housing, thereby providing a thrust bearing for said bevel gear wheel.

Supported by the outer portion of the upper half 11 of the gear housing, are compression springs 29 that are stressed to their normal bearing tension by means of bolts 30 having heads 31 that occupy non-circular openings in quills 32 and which latter may be rotated by means of a suitable tool such as a socket wrench and which rotary movement rotates bolts 30 and screws the

same into or out of the gear housing 11 and consequently adjusting the tension of the springs 29. Washers 33 are arranged between the upper ends of the springs 29 and flanges that project outwardly from the upper ends of quills 32.

Supported on springs 29 and arranged to slide vertically in housing 8 is a bushed bearing table 34 having lugs 35 slidable in pockets 36, the latter being formed in housing 8 and the engagement of which lugs in said pockets prevents rotation of the bearing table and at the same time allowing sufficient vertical movement to permit depression of the active crushing element as occasion requires and as will be hereinafter more fully set forth.

Removably secured on the bearing table 34 is a wearing plate 37 that provides a bearing seat for said table and prevents wear upon the table.

Loosely arranged on the wearing plate 37 are bearing rings 38 and 39 that combine to form a laminated annular bearing to provide against excessive friction of the bearing surfaces while the machine is in operation. A bushing 40 is fixed in the bearing table 34 to form a replaceable vertical bearing surface and to receive the horizontal thrust developed by the active crushing loads.

Arranged to slide on bearing plates 38 and 39 and adapted to rotate on a vertical axis in bushing 40 of table 34 is a hollow spindle 41 having a depending cylindrical portion and projecting inwardly from the lower end of said depending portion are teeth 42 that engage the teeth 25 on quill 24.

The engagement of the teeth 24 and 42 provides a simple and efficient driving connection between quill 24 and hollow spindle 41 and at the same time permits the necessary vertical movement of said hollow spindle.

The upper extension of spindle 41 is conical in form and the axis of this conical portion is slightly inclined with respect to the vertical axis of the main body of said spindle.

The base of the conical upper extension is formed eccentric to the lower portion of the body of the spindle so as to cause the oblique axis of the conical upper portion to intersect the true vertical axis, at a predetermined point above the upper end of the upper conical extension.

The vertical axis of the spindle 41 is illustrated by the line A—A, Fig. 1, while the inclined or oblique axis for the conical upward extension of said spindle is illustrated by line B—B, Fig. 1. Secured to spindle 41 by screws 42 is a dust excluding ring 43, having a flange that overlies the upper portion of housing 8 and arranged in grooves 45 that are formed in the outer surface of the upper portion of housing 8 are packing rings 44 that engage the inner face of the depending flange of ring 43.

Arranged for rotation on the conical upper extension of spindle 41 is a hollow substantially hyperbolic brushing head 46 within which is secured a bushing 47 and projecting radially outward from this head 46 are webs 48 with which are formed integral a substantially hyperbolical crushing shell 49.

Arranged to slide vertically in crushing head 46 is an oil ring 50 that is normally urged downwardly by compression springs 51 located in pockets 52 in head 46 and said oil seal ring slideably engages an upwardly projecting flange 53 that is formed on spindle 41 around the base of the conical upper extension thereof. This ring 50 provides a simple and efficient seal to prevent the passage of oil and at the same time excluding dust or other impurities that would otherwise affect the operating parts of the active crushing element.

Mounted on the crushing head and secured thereto by means of a follower ring 54 and screw 55, are replaceable wear plates 56 and 57 that are aligned with the nearly hyperbolic contour of the crushing shell 49 and these wear plates are designed to protect the crushing shell from abrasion during operation of the machine.

Follower ring 54 is provided with lugs 58 that engage in pockets 59, formed in head 46, thereby preventing the loosening of screw 55 as a result of rotation of the following ring 54 relative to the head 46.

A cover 60 is screw seated in the upper end of follower ring 54, thus protecting the head of screw 55 against mutilation and battering by material fed into the machine.

Arranged to slide vertically within the upper portion of frame 6 is a crushing concave 61, provided with adjusting screws 62 and retained in position by bolts 64 that pass through flanges on said frame 6 and concave 61 and which bolts receive nuts 63. The adjusting screws 62 are arranged alternately with the bolts 64 and provide means for adjusting the vertical position of concave 61.

Secured to crushing concave 61 by screws 65 is a hopper 66 which confines the stream of material that is fed to the crushing machine.

Mounted in the crushing cavity of the concave 61 and secured by bolts 67 and nuts 68 is a replaceable wearing plate 69 that protects the concave 61 from abrasion during crushing operations.

Mounted in the upper bowl of the concave 61 and secured by bolts 70 and nuts 71 are wearing plates 72 that protect the upper bowl surface of the concave, from abrasion by the stream of material passing into the crushing cavity between said concave 61 and crushing head 46.

Mounted for rotation in the upper end of journal pin 13 is a vertically disposed tube 73, the upper open end of which is seated in the upper end of the conical upper extension of spindle 41 and this tube is adapted to convey liquid lubricant from an axial duct 74 in pin 13, to the cavity 75 that is formed between head 46 and the upper end of the conical extension of spindle 41. Oil grooves 76 and ducts 77 are provided on spindle 41 to permit the free flow of lubricant to all of the bearing surfaces and moving parts that require lubrication. Lubrication for the oil seal ring 50 is provided for by ducts 77a that are formed in head 46.

A liquid lubricant supply pipe is suitably connected to the lower end of duct 74 and oil is forced by pressure through this pipe.

The pinion shaft bearings 17 are lubricated independently by the introduction of lubricant directly into the pinion shaft housing 14 through ducts 78 that are formed in said housing and the surplus lubricant passes out through duct 79 and thence through drain opening 80 into a sump directly below pinion 19 and excess oil from this sump overflows through outlet duct 81 to a suitable receptacle. As pinion 19 rotates it dips into the oil that accumulates in the sump.

An oil collar 82 is secured on shaft 18 so as to deflect oil into an oil cap 83 that is secured to the outer end of housing 14 by screws 84 and this lubricant thus deflected into said cap drains

through port 85 and thence through port 80 to the oil sump.

In the operation of my improved machine, a belt operating on pulley 23 effects rotation thereof and shaft 18 and pinion 19 and the latter meshing with gear wheel 27 causes rotation thereof, together with the quill 24 so that the latter rotates on journal pin 13.

As a result of the engagement of teeth 25 with teeth 42, spindle 41 is rotated on the vertical axis A—A and carrying crushing head 46 through a horizontal path concentric with the vertical axis A—A and the crushing concave 61.

As a stream of material, introduced into the hopper 66, passes over the wear plates 72 into the crushing cavity between the wear plates 56 and 57 on the crushing head 46 and the wear plates 69 in the crushing concave 61, said ore produces contact between the head 46 and concave 61 so as to cause rotation of the head 46 about the inclined axis B—B of the upper extension of spindle 41. This conditions produces an alternate crushing and release of the material within the crushing cavity during each revolution of the spindle 41 and when said material is released after being crushed, it is permitted to fall away from the crushing head between the frame 6 and housing 8 and such crushed material discharges unto a conveyor or a suitable receptacle.

The spindle 41 that carries the crushing head 46 is yieldingly supported between springs 29 and under normal conditions these springs are compressed sufficiently to resist yielding under ordinary material crushing conditions or while crushable material is passing through the machine.

Should, however, an uncrushable object, for instance, a nut, bolt or metal tool, pass into the crushing cavity, the springs will yield to permit the bearing table to move downwardly into the housing 8 a sufficient distance to permit the passage of the uncrushable material or object without undue strains or breakage of parts of the machine and the shock developed as the crushing head is engaged by an uncrushable object is entirely absorbed by the springs 29 that support the bearing table and parts carried thereby.

Thus it will be seen that I have provided a crushing machine that is relatively simple in construction, having a wide range of adjustability and which machine may be conveniently and economically employed for crushing ore rock and like material.

It will be understood that minor changes in the size, form and construction of the various parts of my improved crushing machine may be made and substituted for those herein shown and described without departing from the spirit of my invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. In a crushing machine, a spindle mounted to rotate on a vertical axis, a bearing for said spindle, a table mounted to move vertically for a limited distance and supporting said bearing, springs supporting said table, means for regulating the tension and limiting the extension of said springs, means for mounting said springs, a frame for supporting said mounting, a crushing concave mounted to move vertically in said frame, means for vertically adjusting said crushing concave, a crushing head mounted to rotate on an inclined axis on the upper portion of said spindle, within the concavity of said crushing concave, means for driving said spindle and means for lubricating the bearings of said spindle, said crushing head, said table and said spindle driving means.

2. In a crushing machine, a fixed crushing concave, a spindle mounted for rotation on a vertical axis below said concave, said spindle comprising a lower part and an upper part, springs arranged between a fixed part of the machine and the upper part of said spindle for yieldingly supporting the upper part, the upper portion of the upper part of said spindle being inclined with respect to the axis of said spindle and a substantially conical crushing head loosely mounted on the inclined upper portion of the upper part of said spindle and positioned within said concave.

3. In a crushing machine, a fixed crushing concave, a spindle mounted for rotation on a vertical axis below said concave, said spindle comprising a lower part and an upper part, springs arranged between a fixed part of the machine and the upper part of said spindle for yieldingly supporting the upper part, the upper portion of the upper part of said spindle being inclined with respect to the axis of said spindle, a substantially conical crushing head loosely mounted on the inclined upper portion of the upper part of said spindle and positioned within said concave and means for imparting rotary motion to the lower part of said spindle.

4. In a crushing machine, a fixed crushing concave, a spindle mounted to rotate on a vertical axis below said concave, said spindle comprising a lower part and an upper part, said upper part being mounted for vertical movement on the lower part, springs arranged between a fixed part of the machine and the upper part of said spindle for yieldingly resisting the downward movement of the upper part, a conical head projecting upwardly from the upper part of the spindle into said crushing concave, which conical head is inclined with respect to the axis of the spindle and a crushing head loosely mounted on said conical head and disposed within said concave.

5. In a crushing machine, the combination with a spindle and a crushing concave, the axes of which are coincident and the upper portion of the spindle being inclined with respect to the coincident axes of said spindle and said crushing concave, which spindle comprises upper and lower parts, the upper part being mounted to rotate with and move vertically upon the lower part of a crushing head mounted for rotation on the inclined upper portion of said spindle and disposed within said crushing concave and springs arranged between the upper part of said spindle and a fixed part of the machine frame for yieldingly resisting downward movement of the upper part of said spindle and the crushing head carried thereby.

6. In a crushing machine, the combination with a spindle and a crushing concave, the axes of which are coincident, said spindle comprising separately formed upper and lower parts, the upper portion of the upper part of the spindle being inclined with respect to the coincident axes of the spindle and crushing concave, and said upper part being mounted to rotate with and move vertically upon the lower part of a crushing head mounted to rotate on the inclined upper part of the spindle within said crushing concave and springs arranged between the upper portion of the upper part of the spindle and a fixed part

of the crusher frame for yieldingly resisting the downward movement of the upper part of said spindle.

7. In a crushing machine, the combination with a spindle and a crushing concave, the axes of which are coincident, said spindle comprising separately formed upper and lower parts, the upper portion of the upper part of the spindle being inclined with respect to the coincident axes of the spindle and crushing concave, and mounted to rotate within and move vertically upon the lower part of a crushing head mounted to rotate on the inclined upper part of the spindle within said crushing concave, springs arranged between the upper part of the spindle and a fixed part of the crusher frame for yieldingly resisting the downward movement of the upper part of said spindle, means for imparting rotary motion to the upper part of the spindle and means for adjusting the vertical position of said crushing concave.

8. In a crushing machine, a spindle mounted for rotation on a vertical axis, said spindle comprising a lower part and an upper part, springs supported by a fixed part of the machine for yieldingly supporting the upper part, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereto, a crushing head mounted for rotation on the upper part of said spindle, that portion of the upper part of the spindle upon which the crushing head is mounted being inclined with respect to the axis of the spindle and a crushing concave disposed above and adjacent to said crushing head.

9. In a crushing machine, a spindle mounted for rotation on a vertical axis, said spindle comprising a lower part and an upper part, springs supported by a fixed part of the machine for yieldingly supporting the upper part, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereto, a crushing head mounted for rotation on the upper part of said spindle, that portion of the upper part of the spindle upon which the crushing head is mounted being inclined with respect to the axis of the spindle, a crushing concave disposed above and adjacent to said crushing head and means for imparting rotary motion to the lower part of said spindle.

10. In a crushing machine, a spindle mounted to rotate on a vertical axis, said spindle comprising a lower part and an upper part, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereof, springs arranged between the upper part of the spindle and a fixed part of the machine frame for yieldingly resisting the downward movement of the upper part of said spindle which springs are stressed to their normal bearing tension, a crushing head mounted for rotation on the upper part of said spindle, that portion of the upper part of the spindle upon which the crushing head is mounted being inclined with respect to the axis of the spindle and a crushing concave surrounding said crushing head.

11. In a crushing machine, a spindle mounted to rotate on a vertical axis, said spindle comprising an upper part and a lower part, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereto, springs arranged between the upper part of the spindle and a fixed part of the machine frame for yieldingly resisting the downward movement of the upper part of said spindle which springs are stressed to their normal bearing tension, a crushing head mounted for rotation on the upper part of said spindle, that portion of the upper part of the spindle upon which the crushing head is mounted being inclined with respect to the axis of the spindle, a vertically adjustable crushing concave surrounding said crushing head and means for imparting rotary motion to said spindle.

12. In a crushing machine, a spindle mounted to rotate on a vertical axis, said spindle comprising a lower part and an upper part, springs resting on a fixed part of the machine for resisting the downward movement of the upper part of said spindle, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereto, the upper part of said spindle being inclined with respect to the axis of the lower portion of said spindle, a crushing head mounted to rotate on the inclined upper part of said spindle, a vertically adjustable crushing concave surrounding said crushing head and means for lubricating the bearings of said spindle and crushing head.

13. In a crushing machine, a spindle mounted to rotate on a vertical axis, said spindle comprising a lower part and an upper part, springs bearing on a fixed part of the machine for resisting the downward movement of the upper part of said spindle, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereto, the upper part of said spindle being inclined with respect to the axis of the lower portion of said spindle, a crushing head mounted to rotate on the inclined upper part of said spindle, a vertically adjustable crushing concave surrounding said crushing head, means for imparting rotary motion to said spindle and means for lubricating the bearings of said spindle, said spindle driving means and the bearings for the crushing head.

14. In a crushing machine, a spindle mounted to rotate on a vertical axis, said spindle comprising a lower part and an upper part, springs bearing on a fixed part of the machine for resisting the downward movement of the upper part of said spindle, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereto, a substantially conical member projecting upwardly from the upper part of said spindle, which conical member is slightly inclined with respect to the axis of rotation of said spindle, a crushing head mounted for rotation on the inclined portion of said conical member and a crushing concave arranged above said crushing head.

15. In a crushing machine, a spindle mounted to rotate on a vertical axis, said spindle comprising a lower part and an upper part, springs bearing on a fixed part of the machine for resisting the downward movement of the upper part of said spindle, said upper part being connected to the lower part so as to rotate therewith and move vertically relative thereto, a substantially conical member projecting upwardly from the upper part of said spindle, which conical member is slightly inclined with respect to the axis of rotation of said spindle, a crushing head mounted for rotation on the inclined portion of said conical member, a crushing concave arranged above said crushing head and means for adjusting the vertical position of said concave.

16. In a crushing machine, the combination with a spindle mounted to rotate on a vertical axis, said spindle comprising a lower part and an

upper part, springs bearing on a fixed part of the machine for yieldingly resisting the downward movement of the upper part of said spindle, said upper part being connected to the lower part so as to rotate therewith and moving vertically relative thereto, the upper portion of said spindle being inclined with respect to the axis of rotation of said spindle, of a crushing head mounted to rotate on the inclined upper portion of said spindle and an adjustable concave surrounding said cushing head.

17. In a crushing machine, a spindle formed in two parts, the upper part being mounted to rotate with and move vertically for a limited distance relative to the lower part and to rotate on a vertical axis, springs arranged beneath the upper part of said spindle and a fixed part of the crusher frame for supporting the upper vertically movable part of said spindle which springs are stressed to their normal bearing tension, means for regulating the tension of said springs, the upper portion of said spindle being slightly inclined with respect to the axis of rotation of said spindle, a crushing head mounted to rotate on the inclined upper portion of said spindle, a crushing concave surrounding said crushing head and means for driving said spindle.

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