

W. K. LIGGETT.
CRUSHING MACHINE.
APPLICATION FILED JAN. 5, 1917.

1,358,005.

Patented Nov. 9, 1920.

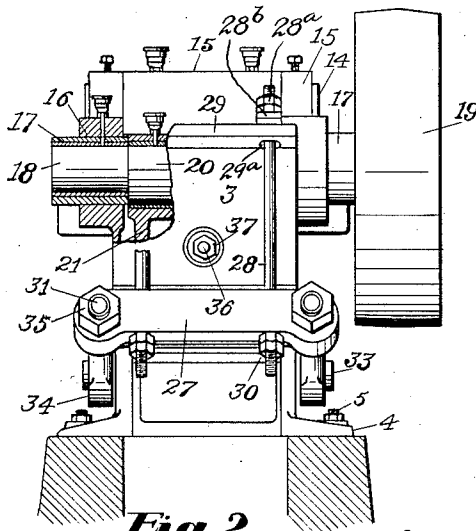


Fig. 2.

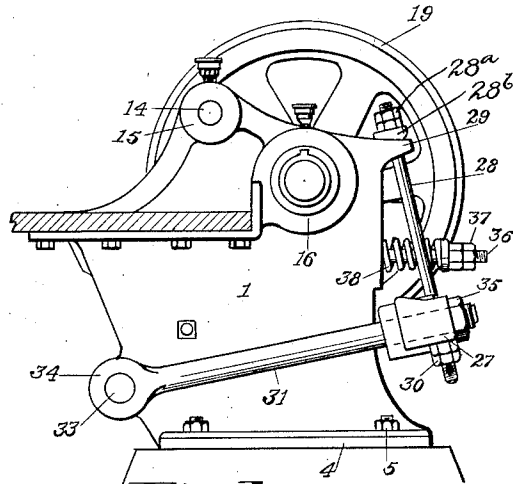


Fig. 1.

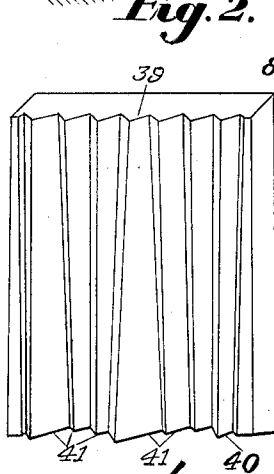


Fig. 4.

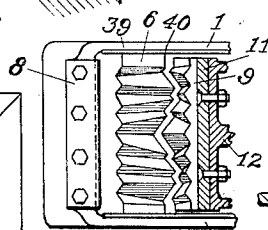


Fig. 5.

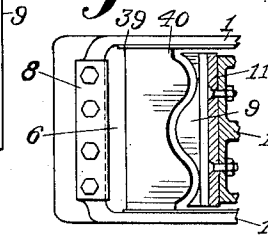


Fig. 6.

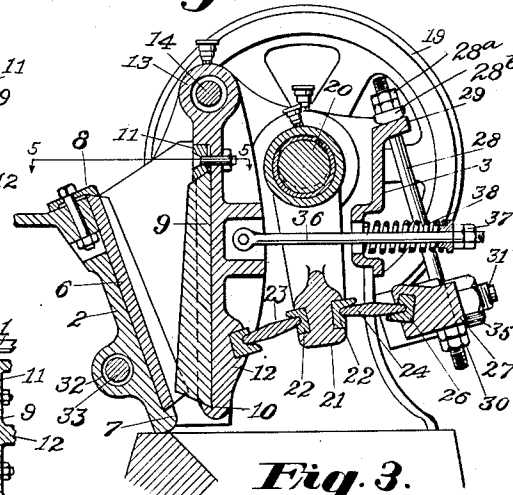


Fig. 3.

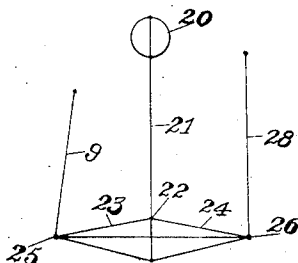


Fig. 7.

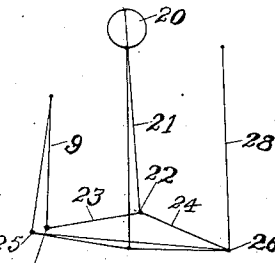


Fig. 8.

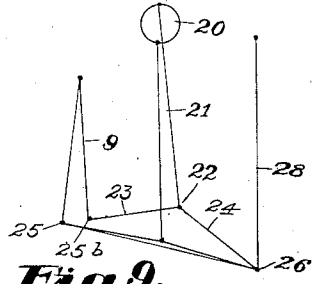


Fig. 9.

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CRUSHING-MACHINE.

1,358,005.

Specification of Letters Patent.

Patented Nov. 9, 1920.

Application filed January 5, 1917. Serial No. 140,753.

To all whom it may concern:

Be it known that I, WILLIAM K. LIGGETT, a citizen of the United States, residing at Columbus, in the county of Franklin and the State of Ohio, have invented certain new and useful Improvements in Crushing-Machines, of which the following is a specification, reference being had therein to the accompanying drawing.

10 The present invention relates to certain new and useful improvements in crushing machines, and especially to that class of crushing machines in which the material to be crushed is engaged between the opposing faces of two oppositely disposed crushing jaws one of which has a vibratory motion relative to the other.

15 In machines of this class the maximum dimensions of the fragments to which the material is crushed bears a direct relation to the width of the throat between the crushing jaws through which the material must pass. Furthermore, when the material to be crushed is friable and inelastic, the crushing operation is best effected by a relatively small movement of the crushing jaws, but when material that is softer or more elastic is to be crushed the movement of the crushing jaw must be sufficient to produce a distortion in the mass of material exceeding the limit of its elasticity.

20 Crushing machines have heretofore been produced including devices whereby the width of the throat between the crushing jaws, and the amplitude of their relative movement, might be adjusted to adapt the machine to crush materials of different characteristics or to crush such materials to different degrees of fineness. In machines of this character, however, with which I am familiar, these adjusting devices are inconvenient and inaccessible, requiring the partial dismantling of the machine to effect their manipulation.

25 It is the especial object of this invention to provide, in a machine of the class described, improved means whereby the parts may be conveniently adjusted for variations in the character of the material to be crushed and the fineness of the product, without discontinuing the operation of the machine.

The devices by which I attain this object are fully set forth in the following specification and illustrated in the accompanying

55 drawings of which—

Figure 1 is a side elevation of a machine embodying my invention.

Fig. 2 is an end elevation of the machine illustrated in Fig. 1.

Fig. 3 is a section along the central vertical longitudinal plane of the machine illustrated in Figs. 1 and 2.

Fig. 4 is a detail perspective view of the movable crushing jaw.

Fig. 5 is a fragmentary section along the line 5—5 of Fig. 3 showing a preferred arrangement of the crushing jaws.

Fig. 6 is a view similar to Fig. 5 showing a modification of the crushing jaws.

Figs. 7, 8 and 9 are diagrams illustrating the method of adjustment of the movement of the crushing jaw.

Like numerals refer to similar parts in the several figures.

As illustrated in the drawings, this machine is mounted in a unitary cast metal frame comprising the side walls 1 and the end walls 2 and 3. On the side walls 1 are formed foot flanges 4 adapted to rest upon a suitable foundation, provision being made for attachment thereto by suitable anchor bolts 5. Attached to the end frame 2 is the stationary crushing jaw consisting of a hard metal plate 6 the beveled ends of which are securely clamped between the flange 7 and the clamping member 8. The movable jaw is a similar hard metal plate 9 with beveled ends engaging the flange 10 and clamping member 11 by which it is securely attached to the pendulum casting 12. The plates 6 and 9 converge downwardly to form a hopper adapted to receive the material to be crushed. Formed at the upper end of the pendulum casting 12 is a journal bearing 13 rotatably mounted upon a cross shaft 14, the ends of which are supported in the apertures of the bosses 15 of the side frame. In the upper part of the side frames 1 are formed apertures 16 into which are fitted sleeves 17 which constitute bearings for the eccentric shaft 18. To the projecting end of the shaft 18 is fixed a fly wheel pulley 19 adapted to be connected by a suitable belt with any convenient source of motive power to drive the machine. Formed on the shaft 18 is an eccentric 20 upon which is mounted the pitman 21 adapted for vertical, longitudinal

movement caused by the rotation of the eccentric 20 with the shaft 18. The proportion of parts is such that when assembling the machine the shaft 18 together with the eccentric 20 may be inserted endwise through the apertures 16 and the bearing sleeves 17 afterward put into place, thereby avoiding the necessity for dividing the bearings with the accompanying complication of the structure. At the lower end of the pitman 21 are oppositely disposed seats 22 in which bear the adjacent ends of the toggle levers 23 and 24. The outer ends of the toggle levers 23 engage a similar seat 25 in the pendulum casting 12, and the outer end of the toggle lever 24 engages the seat 26 in the abutment block 27. The abutment block 27 is supported upon pendulum rods 28 which extend through apertures 29^a in the flange 29 of the machine frame and are fitted at their lower ends with screw nuts 30 affording means to vertically adjust the abutment block. At their upper ends the pendulum rods 28 are provided with heads or nuts 28^a between which and the flange 29 are interposed washers 28^b having convex lower surfaces upon which the rods 28 may rock. The ends of the abutment block 27 project beyond the sides of the frame casting and are provided with apertures through which extends the tension rods 31 which hold the thrust of the toggle levers 23 and 24. Formed in the end walls 2 of the machine frame is a projection 32 having an aperture in which is mounted a cross shaft 33 the extended ends of which engage the eyes 34 of the tension rods 31. Suitable screw nuts 35 fitted to the tension rods 31 afford means for horizontally adjusting the position of the abutment block 27. By the adjustment of the nuts 30 and 35 the abutment block 27 may be moved both vertically and horizontally to adjust the width of the throat between the jaws 6 and 9 to produce products of different degrees of fineness and to vary the amplitude of vibrations of the pendulum 12 to adapt the machine to the crushing of the materials of different character, as will be more fully hereinafter explained.

Pivotaly attached to the pendulum casting 12 is a rod 36 which extends rearwardly through an aperture in the wall 3 of the machine frame and is fitted with suitable nuts 37 between which and the wall 3 is positioned a compression spring 38, the pressure of which tends to draw the movable jaw 9 away from the stationary jaw 6. When now the shaft 18 revolves the eccentric 20 causes the pitman 21 to oscillate vertically thereby alternately moving the abutting ends of the toggle levers 23 and 24 transversely of a straight line connecting the seats 25 and 26. At each straightening out of the toggle levers the jaw 9 is pushed toward the jaw 6, a distance depending on the degree of devi-

ation of the toggle levers from the said straight line, to exert a crushing pressure upon any body which may be between the opposing faces of the jaws. At each deflection of the toggle levers from the said straight lines the spring 38 draws the jaw 9 away from the jaw 6 to allow the material between the jaws to move downward in the inter-jaw space to be again crushed by the next movement of the pitman.

Such material as limestone and shale often contains broad slabs no thicker than the width of the throat between the lower ends of the crushing jaw. I have, therefore, provided crushing jaws of an improved form by which the passage of such slabs uncrushed through the machine is prevented, without, at the same time, interfering with the regular downward movement of the material between the jaws. At their upper edges 39 the surfaces of these crushing jaws lie in straight transverse lines, while at the lower edges 40 their surfaces lie in sinuous transverse lines, all longitudinal lines being straight and the adjacent surfaces of the plates complementary of each other. The simplest form of this jaw plate is illustrated in Fig. 6. In order that the material may be more positively engaged by the crushing jaws, I have superimposed upon the sinuous surface above described longitudinal corrugations 41 the lines of which are straight from top to bottom of the plates. By this formation of the plates the throat between the lower ends of the crushing jaws is given a sinuosity exceeding the maximum width of the throat, as shown in Figs. 5 and 6, without obstructing the hopper formed at the upper parts of the jaws, or interfering with the downward movement of material between the jaws.

In Figs. 7, 8 and 9 I have shown diagrammatically the effect of vertical adjustment of the abutment block 27 upon the movement of the movable jaw 9. In Fig. 7 the abutment block is so placed that a straight line joining the seats 25 and 26 passes through the center of the path of travel of the toggle seats 22. As a result the distance from 25 to 26 will be the same at both ends of the travel of the pitman and there will be no material movement of the jaw 9. In Fig. 8 the abutment block has been lowered so that the line 25—26 passes below the center of the path of travel of the toggle seats 22 with the result that the distance 25^a—26 will be less than the distance 25—26, producing a movement of the jaw 9 from 25^a to 25. In Fig. 9 the abutment block has been still further lowered, so that the line 25—26 falls below the limit of the path of travel of the toggle seats 22, the result being a still greater movement of the jaw 9 from 25^b to 25.

It is, of course, apparent that move-

ments of the nuts 35 relative to the rods 31 will directly vary the width of the throat between the plates 6 and 9, thereby varying the size of the fragments which may be passed between them. As the nuts 30 and 35 are accessible during the operation of the machine adjustments may be effected at any time, and with each change of adjustment changes in the character of the product may be immediately observed.

It will thus be seen that the nuts 30 and 35 may be manipulated during the operation of the machine to adjust the position of the abutment block 27 thereby controlling the movements of the jaw 9 relative to the jaw 6. By such convenient adjustment the machine is adapted to a wide range of usefulness in the crushing of material of different degrees of hardness to products of different degrees of fineness.

What I claim is—

1. In a crusher of the class described, the combination of a stationary crushing jaw and a movable crushing jaw, a pitman adapted to longitudinal oscillation, means to oscillate the pitman, a toggle lever between the pitman and the movable jaw, a second toggle lever between the pitman and an abutment, a pendulum upon which said abutment may swing, and tension rods to hold said abutment against the thrust of the toggle levers.

2. In a crusher of the class described, the combination of a stationary crushing jaw and a movable crushing jaw, a pitman adapted to longitudinal oscillation, means to oscillate the pitman, a toggle lever between the pitman and the movable jaw, a second toggle lever between the pitman and an abutment, a longitudinally adjustable pendulum upon which said abutment may swing, and tension rods to hold said abutment against the thrust of the toggle levers.

3. In a crusher of the class described, the combination of a stationary crushing jaw and a movable crushing jaw, a pitman adapted to longitudinal oscillation, means to oscillate the pitman, a toggle lever between the pitman and the movable jaw, a second toggle lever between the pitman and an abutment, a longitudinally adjustable pendulum upon which said abutment may swing, and longitudinally adjustable tension rods to hold said abutment against the thrust of the toggle levers.

4. In a crusher of the class described, the combination with a stationary crushing jaw and a movable crushing jaw, a pitman adapted

to longitudinal oscillation, means to oscillate the pitman, a toggle lever between the pitman and the movable jaw, a second toggle lever between the pitman and an abutment, a pendulum upon which said abutment may swing, means outside the frame of the machine to adjust the length of said pendulum, and tension rods to hold said abutment against the thrust of the toggle levers.

5. In a crusher of the class described, the combination of a stationary crushing jaw and a movable crushing jaw, a pitman adapted to longitudinal oscillation, means to oscillate the pitman, a toggle lever between the pitman and the movable jaw, a second toggle lever between the pitman and an abutment, a pendulum upon which said abutment may swing, tension rods to hold said abutments against the thrust of the toggle levers, and means outside the frame of the machine to adjust the effective length of said tension rods.

6. In a crusher of the class described, the combination of a stationary crushing jaw and a movable crushing jaw, a pitman adapted to longitudinal oscillation, means to oscillate the pitman, a toggle lever between the pitman and the movable jaw, a second toggle lever between the pitman and an abutment, pivotally mounted supports upon which said abutment may swing for horizontal adjustment, pivotally mounted supports upon which said abutment may swing for vertical adjustment, and means to adjust the radial length of said supports relative to their respective pivots.

7. In a crusher of the class described, the combination of a stationary crushing jaw and a movable crushing jaw, a pitman adapted to longitudinal oscillation, means to oscillate the pitman, a toggle lever between the pitman and the movable jaw, a second toggle lever between the pitman and an abutment, pivotally mounted supports upon which said abutment may swing for horizontal adjustment, pivotally mounted supports upon which said abutment may swing for vertical adjustment, and means outside the frame of the machine to adjust the radial length of said supports relative to their respective pivots.

In testimony whereof I affix my signature, in the presence of two witnesses.

WILLIAM K. LIGGETT.

Witnesses:

DUDLEY T. FISHER,
HARRY C. DEAN.