

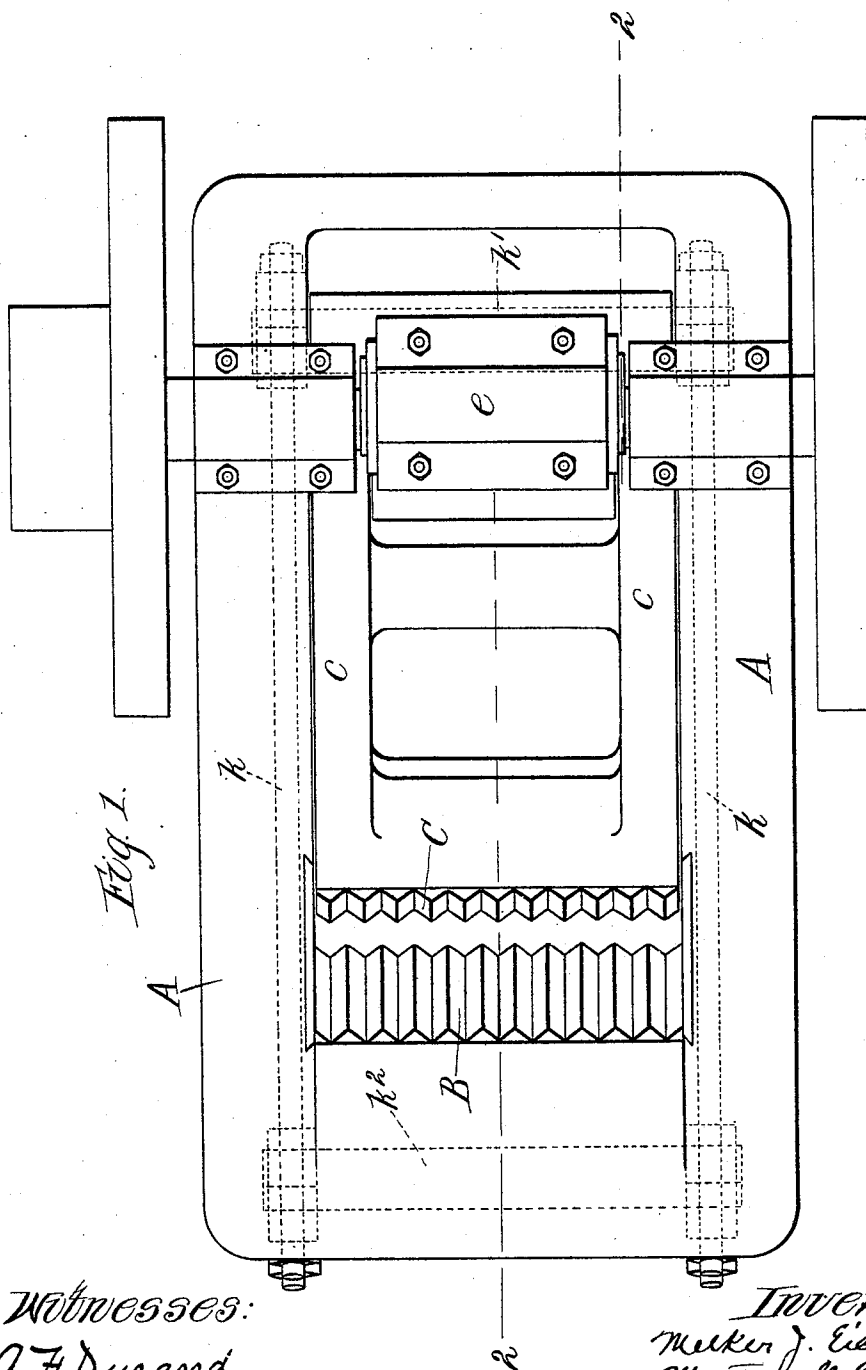
(No Model.)

5 Sheets—Sheet 1.

M. J. EICHORN & M. G. BUNNELL.
CRUSHING MACHINE.

No. 585,191.

Patented June 29, 1897.



Witnesses:
A. F. Durand.
Bela M. Wagner

Inventors:
Melker J. Eichhorn
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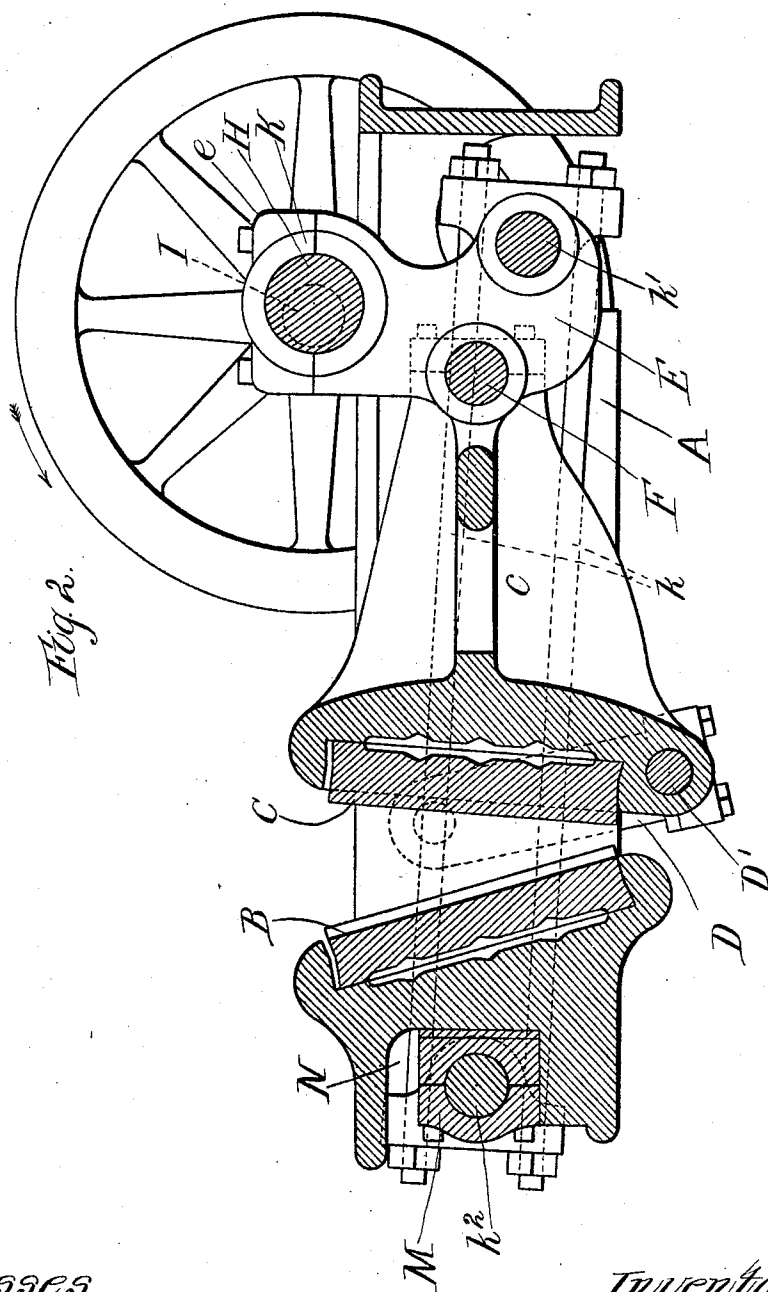
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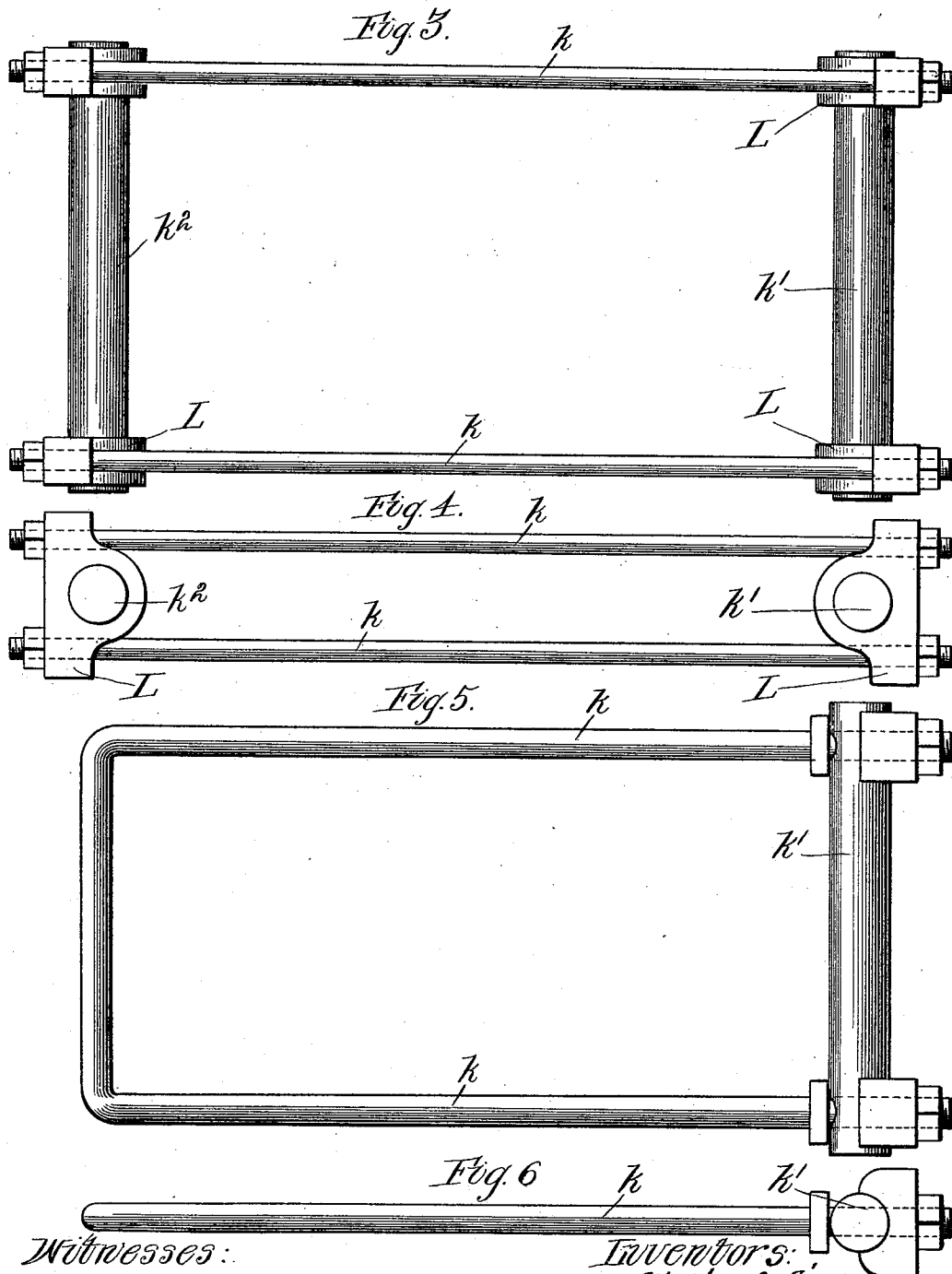
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M. J. EICHORN & M. G. BUNNELL.
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Fig. 7.

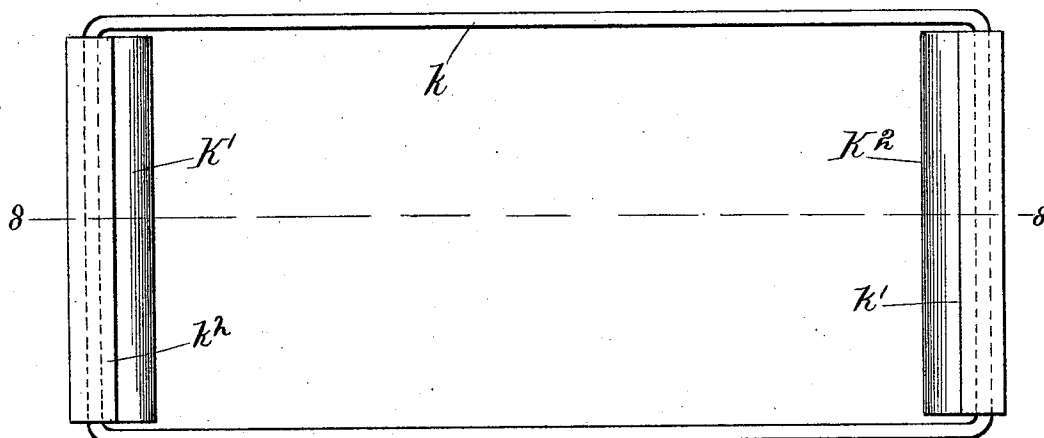


Fig. 8.

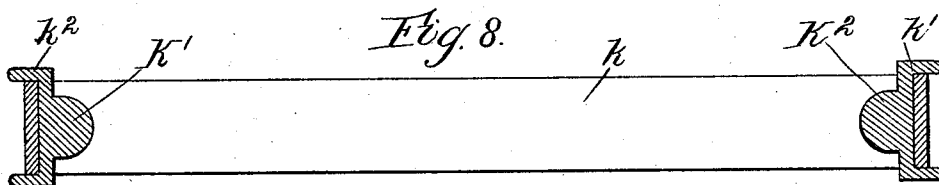
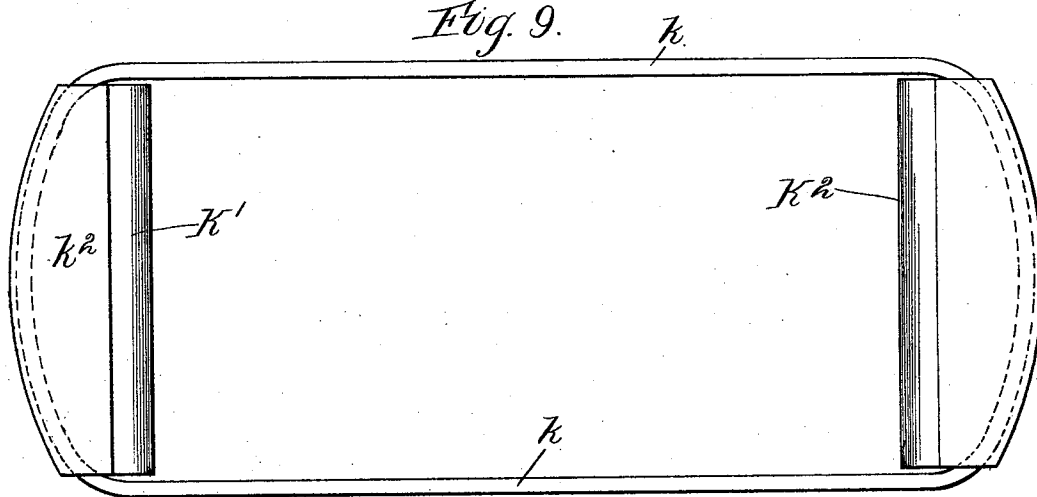


Fig. 9.



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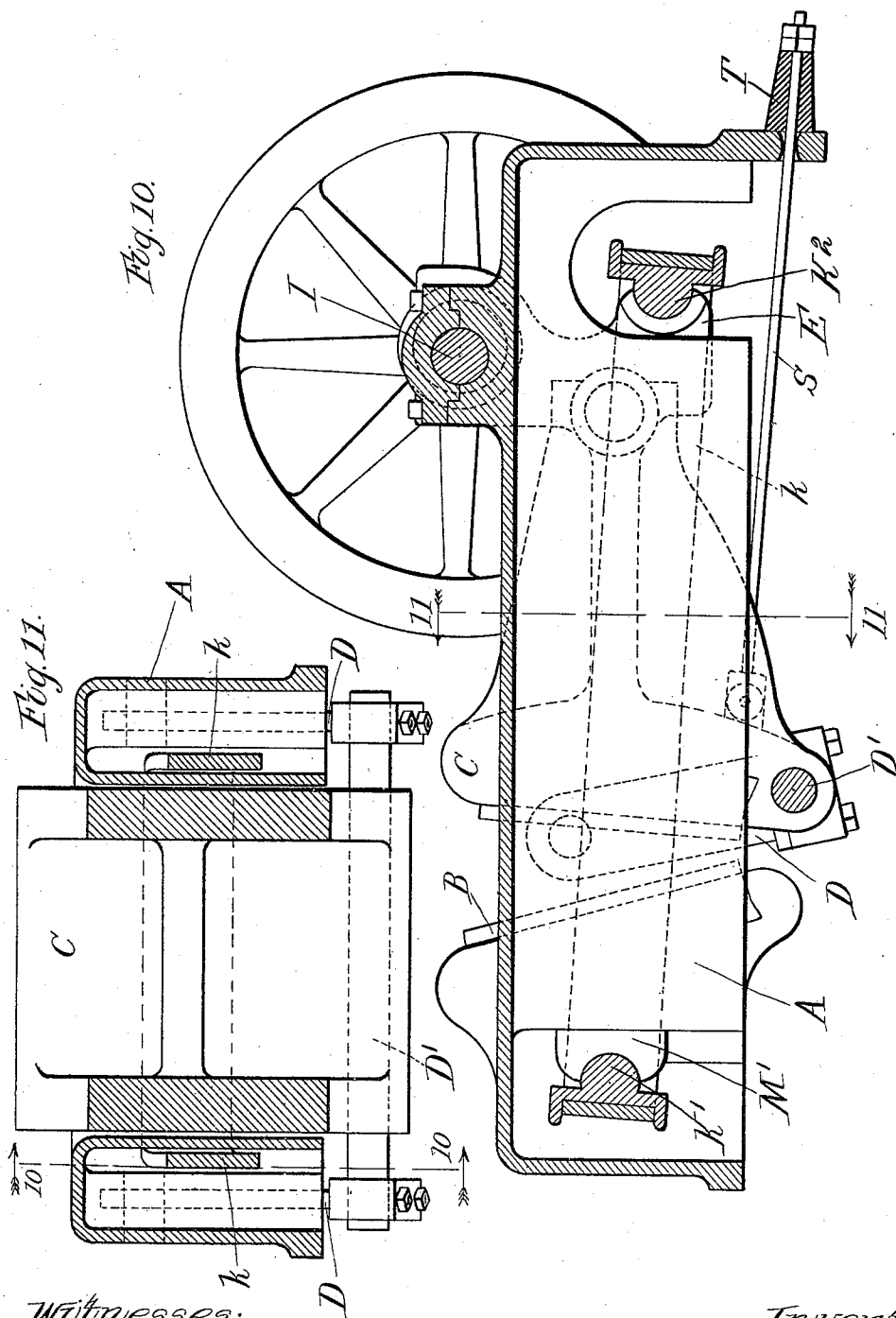
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Patented June 29, 1897.



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UNITED STATES PATENT OFFICE.

MELKER J. EICHHORN AND MORTON G. BUNNELL, OF CHICAGO, ILLINOIS,
ASSIGNORS TO FREDERICK C. AUSTIN, OF SAME PLACE.

CRUSHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 585,191, dated June 29, 1897.

Application filed June 22, 1896. Serial No. 596,421. (No model.)

To all whom it may concern:

Be it known that we, MELKER J. EICHHORN, a subject of the King of Sweden and Norway, and MORTON G. BUNNELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Crushing-Machines, of which the following is a specification.

Our invention relates to machines for crushing or breaking ores, rock, and like material by means of a crushing-hopper having one or more movable jaws.

Prominent objects of the invention are to lighten and reduce the size of the machine, so that the space occupied will be less; to provide for an equal and advantageous distribution of the strain incident to the crushing of hard materials and at the same time to relieve the framework of the machine from such strain as much as possible; to simplify the working parts, and to arrange the same with a view to procuring an efficient and uniform crushing action with the greatest economy of power.

In the machine for carrying out our invention, more particularly described hereinafter, the crushing-hopper comprises a couple of jaws, one of which is movable and has a combined vibratory, forward-and-back, and up-and-down movement. This movable jaw is suspended by swinging links, preferably having their upper ends pivoted forward of their lower ends and having said lower ends pivotally connected with the lower portion of the movable jaw. By such arrangement the jaw may have a vibratory action independently of the links, and may also move with the latter. This movable crushing-jaw is provided with a rear extension which is desirably rigid with the jaw and connected with a pitman by a suitable jointed connection. The pitman is also connected at a point non-coincident with the point of connection of the movable jaw therewith to a tension-link, whose opposite end is supported forward of the point of connection with the pitman—that is to say, on the same side of the pitman as the movable jaw—and desirably forward also of the opposing crushing member. By such arrangement the pitman receives a bodily up-

and-down movement in conformity with the reciprocation of the swinging end of the tension-link and also a rocking or vibratory motion about such connection with the tension-link. Thus the pitman serves as a lever and the end of the tension-link connected therewith as a movable fulcrum therefor. Furthermore, the crushing force received by the movable jaw is imparted to the link as a tensile strain exerted along its length. Consequently this link has a dual function or purpose—first, to provide a movable fulcrum for the pitman, and, second, to relieve the frame or bed of the machine of injurious tensile strains.

Another advantage is that the working parts are all confined to the same side of the pitman, thereby reducing greatly the size of the machine.

In the accompanying drawings, Figure 1 is a plan of a crushing-machine embodying our invention. Fig. 2 is a section on line 2 2 in Fig. 1. Figs. 3 to 9, inclusive, illustrate different forms of link arrangement. Fig. 10 is a vertical longitudinal section of a machine particularly adapted to operate with the link shown in Figs. 7 and 8, said section being taken on line 10 10 in Fig. 11. Fig. 11 is a section taken on line 11 11 in Fig. 10.

The crushing-hopper is arranged within an oblong frame A and comprises in the machine shown a stationary jaw B and a movable jaw C. This movable jaw is suspended by the swinging links D, preferably having their upper ends pivoted forward of their lower ends and having said lower ends pivotally connected with the lower portion of the jaw. One of these links is illustrated, partially in full lines and partially in dotted lines, in Fig. 2, it being understood that one of these links is arranged at each side of the crushing-hopper and that they are desirably connected by the pivot-bolt D'. This movable crushing-jaw is provided with the rear extension c, which is rigid therewith and which is connected with the pitman E by some suitable jointed connection, the jointed connection shown being provided by a pivot F. Other modes of articulation can, however, be employed.

The pitman E is operated by an eccentric

II, arranged upon the rotary power-driven shaft I. In Fig. 2 the eccentric is shown arranged within a two-part annular bearing K, fitted with the recessed upper portion of the pitman, which latter has a removable cap or top *e*, held down by bolts, whereby the pitman can be removed when so desired.

The tension-link controlling the pitman could be a single link of suitable construction and arrangement, but as a matter of further and specific improvement we employ a yoke or frame whose sides extend on either side of the pitman and movable jaw and whose ends are adapted for use as pivotal connections with the pitman and the framework of the machine, respectively. Various forms of such a yoke are shown in Figs. 3 to 9, inclusive.

In Figs. 3 and 4 the double side bars *k* are bolted to a suitable head L, in which the cylindrical rods *k'* *k*² are fitted. In that shown in Figs. 5 and 6 three sides of the yoke are composed of a single bar *k*, the ends of which are passed through the rod *k'* and firmly bolted.

In Figs. 7 and 8 the yoke is formed of a continuous band or strap *k*, the ends of which support the rods *k'* *k*², which are provided with the semicircular beads K' and K² on one side and are channeled on the opposite side to fit the band *k*.

In Fig. 9 the end portions of the strap or band *k* are curved outwardly, and the surfaces of the rods *k'* bearing against the same are correspondingly convex. This arrangement renders the strain upon the end portions more longitudinal and less transverse, and thereby reduces their liability of breaking, especially at the corners.

The yoke illustrated in Figs. 3 and 4 is pivotally connected to the pitman, as shown in Figs. 1 and 2, by passing the bar *k'* through a hole in the pitman, Fig. 2, preferably in such a manner that a line passed through this point of connection and through the point of connection of the movable jaw at F lies oblique to a line along the length of the pitman. The points of connection of the yoke and jaw with the pitman could bear various relations with one another in accordance with the well-known laws of leverage. As a preferred arrangement, however, the point of connection of the jaw with the lever is between the point of connection of the yoke therewith and the eccentric where power is applied, and said points of connection are on opposite sides of the length of the pitman, with the point of connection of the jaw in advance, as shown in Fig. 2. The yoke is also supported by the frame of the machine forward of the stationary crushing-jaw B, as by arranging the rod *k*² in a suitable bearing M and securing the latter in the recess N, formed in the body portion of the jaw B.

The arrangement of the machine when the link shown in Figs. 7 and 8 is employed is illustrated in Figs. 10 and 11. In such case

it will be noticed that the beads K' and K² on the ends of the link fit into corresponding grooves in the pitman and the block M', respectively. The rod S, attached to the movable jaw and connected to the frame through the medium of a spring or cushion T, prevents the loosening and displacement of the link when the crushing strain is insufficient to hold it in position.

In each case it is evident that the up-and-down motion of the pitman causes the yoke to vibrate or swing about the center *k*², the point *k'* therefore describing an arc of a circle during its rise and fall.

During the operation of the machine the movable crushing-jaw has the following action, to wit: a compound movement involving a certain extent of bodily forward-and-back movement, an up-and-down movement, and a rocking or vibratory movement. During such compound movement on the part of the crushing-jaw the pitman has an up-and-down movement and also a vibratory movement about a point between its upper and lower ends.

With reference to Figs. 2 and 10 it will be seen that when the pitman makes its down-stroke it forces the movable crushing-jaw forward, and at the same time the forward swing of the links causes the jaw to move downwardly, thereby contracting the discharge-opening at the bottom of the crushing-hopper, and also feeding the crushed material downwardly through such contracting opening.

When the pitman is raised, the links will swing rearwardly and the jaw will rise and swing back. During the forward movement, however, of the jaw its lower end portion will have the greatest extent of movement; but before such lower end portion of the jaw reaches the limit of its forward movement its upper end portion tilts, thereby permitting the material at the top of the hopper to settle down between the crushing-jaws. The links then swing back and the jaw commences to have a back-and-up movement; but before the lower end portion of the jaw reaches the limit of its back movement the upper portion of the jaw commences to again tilt forward and move downwardly. The down-feed and crushing action are therefore practically continuous, since the material will be crushed in alternation between the jaw B and the upper and lower portions of the vibratory movable jaw, which portions will have a grinding as well as a direct crushing action.

The tension-link, which is connected with the pitman and the frame forward of the pitman, has an exceedingly important and efficient action. Its rise and fall imparts to the pitman, and therefore to the movable jaw, the desired forward-and-back motion, which may be regulated to meet the requirements of the case by varying its length—that is to say, by varying the distance between its points of connection with the frame and pitman.

What we claim as our invention is—

1. A crushing-machine having a crushing-hopper comprising a movable jaw supported for bodily forward-and-back swinging movement; a lever having a jointed connection with said jaw; and a link having one end pivotally connected with said lever, and the other end supported forward of such point of connection, whereby the lever, which is thus provided with a reciprocating fulcrum by its connection with the swinging link, imparts to the movable jaw a bodily forward-and-back movement by its vibratory motion about such reciprocating fulcrum, and also whereby the resistance offered to the movement of the crushing-jaw is received by the link as a tensile strain, as set forth.

2. A crushing-machine having a crushing-hopper comprising a movable jaw supported for bodily forward-and-back swinging movement; a lever having a jointed connection with said jaw; and a link having one end pivotally connected with said lever and the other end supported forward of the opposing crushing member, as set forth.

3. A crushing-machine having a crushing-hopper comprising a movable jaw supported for bodily forward-and-back swinging movement; a lever having a jointed connection with said jaw; and a link having one end pivotally connected with said lever, and the other end supported forward of such point of connection the point of connection of the jaw with the lever being between the point of connection of the link therewith and the point of application of power thereto, and such points of connection being situated on opposite sides of the length of the lever with the point of connection of the jaw in advance of the point of connection of the link, as set forth.

4. A crushing-machine having a crushing-hopper comprising a movable jaw; swinging links by which said jaw is suspended; a lever having a jointed connection with the jaw; and a tension-link having one end pivotally connected with said lever, and the other end supported forward of such point of connection, as set forth.

5. A crushing-machine having a crushing-hopper comprising a movable jaw; swinging

links to which said jaw is pivotally connected; a lever having a jointed connection with the movable jaw; and a tension-link having one end pivotally connected with said lever, and the other end supported forward of the opposing crushing member, as set forth.

6. A crushing-machine having a crushing-hopper comprising a movable jaw; swinging links for said jaw, said links being supported at their upper ends in front of the jaw and the jaw being pivotally connected therewith at their lower ends; a lever having a jointed connection with the movable jaw; and a tension-link having one end pivotally connected with said lever, and the other end supported forward of the opposing crushing member, as set forth.

7. A crushing-machine having a crushing-hopper comprising a movable jaw; swinging links supported at their upper ends forward of the jaw, and pivotally connected at their lower ends to the lower portion of the latter; a pitman having a jointed connection with said movable jaw; and a yoke adapted to form a tension-link, and having one end pivotally connected with said pitman at a point non-coincident with the point of connection of the jaw therewith, and the other end supported forward of the opposing crushing member, and having its sides arranged on either side of the crushing members, substantially as described.

8. In a crushing-machine, the combination with the movable crushing-jaw and means for operating the same, of a yoke or frame adapted to form a tension-link for connecting the said jaw with the bed of the machine, said yoke or frame having outwardly-curved or convex ends, and being provided with end pieces constructed with one side correspondingly curved to fit the convexity of the yoke ends, and with the other sides adapted to engage suitable bearing portions on the crushing-jaw and on the bed of the machine, substantially as described.

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