(No Model.) 2 Sheets—Sheet 1.

H. L. KENT.

ROCK CRUSHER.

No. 513,114. Patented Jan. 23, 1894.

Fig. 1

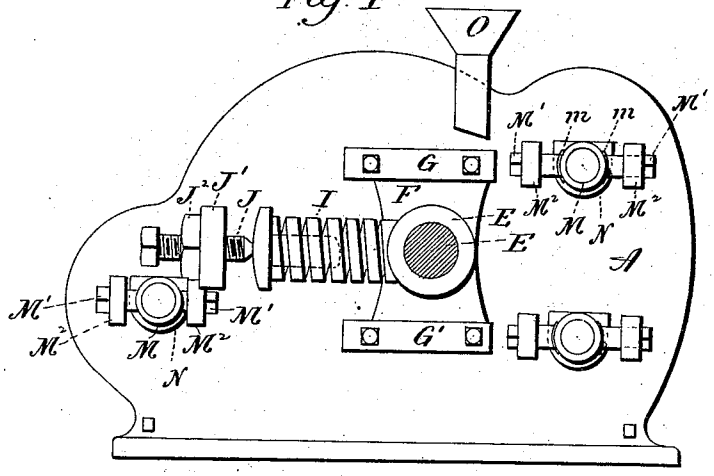
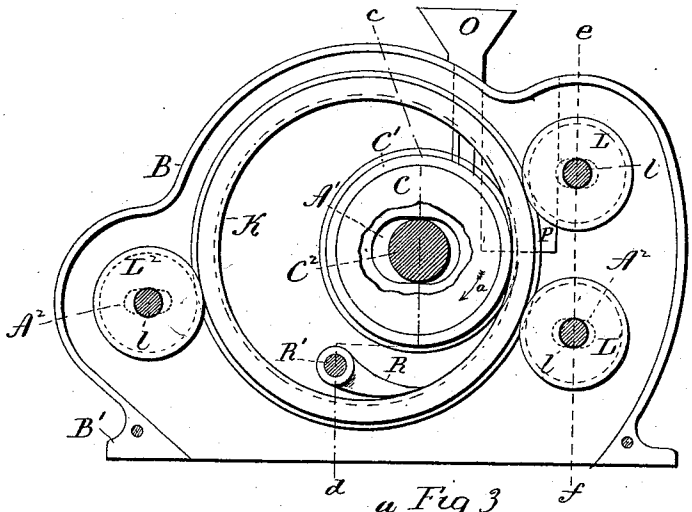
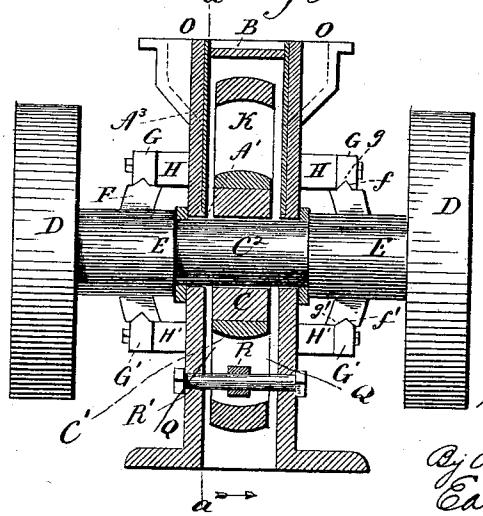


Fig. 2



a Fig 3



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(No Model.)

2 Sheets—Sheet 2

H. L. KENT.

ROCK CRUSHER.

No. 513,114. Patented Jan. 23, 1894.

Fig. 4

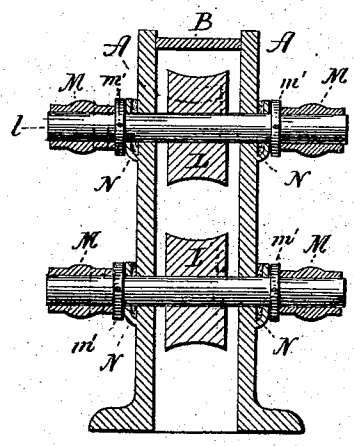


Fig. 6

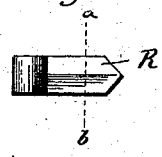
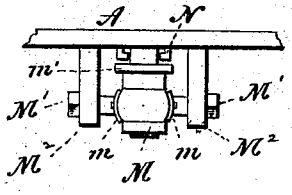


Fig. 7

Fig. 5



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UNITED STATES PATENT OFFICE.

HORACE L. KENT, OF BIRMINGHAM, ASSIGNOR TO THE KENT PULVERIZER COMPANY, OF DERBY, CONNECTICUT.

ROCK-CRUSHER.

SPECIFICATION forming part of Letters Patent No. 513,114, dated January 23, 1894.

Application filed February 27, 1893. Serial No. 463,786. (No model.)

To all whom it may concern:

Be it known that I, HORACE L. KENT, of Birmingham, in the county of New Haven and State of Connecticut, have invented a new Improvement in Rock-Crushers; and I do hereby declare the following, when taken in connection with accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a view in side elevation of a rock-crusher constructed in accordance with my invention; Fig. 2, a view thereof in vertical longitudinal section on the line *a—b* of Fig. 3; Fig. 3, a view in vertical transverse section on the irregular line *c—d* of Fig. 2; Fig. 4, a similar view on the line *e—f* of the same figure; Fig. 5, a detached plan view showing one of the bearings of one of the anti-friction rollers; Fig. 6, a detached plan view of the scraper; Fig. 7, a view thereof in transverse section on the line *a—b* of the preceding figure.

My invention relates to an improvement in rock-crushers of that type in which a crushing-roll works against the inner surface of an independently movable ring, considerably larger than it is in diameter, and mounted eccentrically to it, as shown and described in United States Patent No. 482,957, granted to me September 17, 1892, upon which my present invention is an improvement, its object being to produce a simple, durable and effective mill, having a large capacity for reducing ore to a condition of very fine, or coarse pulverization, as may be desired.

With this end in view, my invention consists in a rock-crusher having certain details of construction and combinations of parts as will be hereinafter described, and pointed out in the claims.

In carrying out my invention, I construct a mill having a case composed of two corresponding upright frame-pieces A A, adapted at their lower ends to be bolted down, and a shield B, arranged in a horizontal plane between the ends and upper edges of the said frame-pieces, and terminating at their respective ends in feet B′ B′, by means of which the shield is secured in place. In about the center of the chamber inclosed by the case thus formed, I locate a crushing-roll C, having a hardened rim C′, and mounted on a horizontal shaft C^2, provided at its ends with large driving-pulleys D D, which receive belts, run from any convenient source of power. The said shaft is mounted in bearings made yielding in a horizontal plane, to provide for which the frame-pieces are constructed with horizontal slots A′ A′, through which the respective ends of the shaft pass, to enter the horizontal sleeves E E, of the horizontally movable vertical bearings F F, each of which is supported between two gibs G and G′, bolted to horizontal blocks H and H′ applied to the sides of the frame-pieces A A. The upper edge of each of the bearings F, is made V-shaped, as at *f*, to take into a corresponding groove *g*, formed in its gib G, while the lower edges of the bearings are constructed with V-shaped grooves *f′*, which receive the V-shaped upper edges *g′*, of the gibs G′. By constructing the bearings and gibs in this manner, they are adapted to be self-clearing of dust, and fine particles that may be lodged upon them while the mill is in operation. By thus providing the shaft C^2, with sliding bearings, it is adapted to yield, and thus avoid a breakage of the mill in case the roll C, fails, at any time, to crush the rock, or in case that any other obstruction presents itself. The roll is, however, maintained in its normal working position, by means of two very heavy springs I, respectively engaged with the rear edges of the bearings F, and adjusted in tension by means of set-screws J, mounted in lugs J′, offsetting from the frame-pieces A A, and each carrying a check-nut J^2. By means of the said screws J, the tension of the springs I, may be varied to produce a fine or coarse pulverization of the rock. I do not, however, limit myself to this particular way of mounting the shaft C^2, so that it will yield, and so that the normal position of the roll may be changed. The said roll co-operates with the concaved inner surface of an independently movable crushing ring K, supported eccentrically to it within the case, by means of three anti-friction rollers L, L′ and L^2, upon which the convexed outer edge of the ring has direct bearing, the peripheries of the said rollers being thereto concaved.

By making the periphery of the said ring convex, and the peripheries of the said rollers concaved, the ring is kept properly centered within the case. This ring, it will be understood, is not positively driven, but is rotated frictionally from the roll C. The said anti-friction rollers are mounted upon horizontal shafts *l*, supported in universal bearings. The ends of the shaft are passed through elongated horizontal slots A^2, formed in the frame-pieces A A, the projecting outer ends of the said shafts running in bearing-sleeves M, each of which has a curved annular rib formed about midway of its ends, and is supported in two cups *m m*, located at the inner ends of adjusting-screws M′, mounted in lugs M^2, offsetting from the frame-pieces A A. The said ribs and cups co-operate to form universal bearings which prevent the said shafts from binding under the shocks and strains to which they must be subjected when the mill is in operation. The said shafts are held against endwise play by means of set-collars *m′*, located between the inner ends of their bearing-sleeves M, and stuffing-boxes N, secured to the frame-pieces in front of the holes A^2. By means of the screws M′, and the construction just described, the said anti-friction-rollers may be laterally adjusted with respect to the crushing-ring K, for the purpose of taking up wear, or for any other reason which may make such adjustment necessary or desirable. Each of the frame-pieces is provided at its upper edge at a point in front of the shaft C^2, with a hopper O, the said hoppers being arranged to discharge the rock thrown into them, through openings A^3 A^3 formed in the frame-pieces, at a point within the crushing-ring K, and in the center of the periphery of the roll A′, which is rotated in the direction of the arrow *a*, seen in Fig. 2, in which, it will be observed that the rock enters from the hoppers into a curved wedge-shaped space formed by the difference in curvature of the ring and roll, and terminating at the point where the surfaces of the roll and ring are in contact. The rock being drawn by the rotation of the roll and by the action of gravity and the force of the incoming rock, into the narrowest part of this space, is crushed by the combined action of the ring and roll, and then falls down under the roll. The inner faces of the frame-pieces are provided at points opposite the meeting points of the ring and roll, with hardened plates P P, which may be removed and replaced when worn, for it is here that the greatest wear of the frame-pieces occurs.

It will be observed by reference to Figs. 3 and 4 of the drawings, that the case is adapted in width to leave spaces Q Q between the opposite faces of the roll, ring and anti-friction rollers, which permit the crushed rock to fall into the bottom of the case, from which it is removed.

In Figs. 2 and 3 of the drawings, I have shown a scraper R, located under and a little behind the roll C, and suspended on a horizontal shaft R′, mounted in the frame-pieces A A of the case, the forward end of this scraper being engaged with the concaved inner face or periphery of the crushing-ring K.

I have already described how the rock is introduced into the mill and crushed. If it is desired to reduce it to a state of fine pulverization, I drive the crushing-roll C, at a very high rate of speed, in which I have discovered that it delivers what I may term a striking blow, the ratio of its effectiveness in reducing rock to pulverization, increasing much faster than the speed with which it is driven. The effectiveness of the roll when driven at a comparatively slow speed, is proportional to the tension of the springs I I engaged with the bearings of its shaft, but when the roll is driven at a high speed, it adds to the effect derived from the tension of the springs the force of inertia, and thus becomes more effective, as set forth. When the roll is being driven at a high rate of speed, the ring partaking of this motion, the pulverized rock will be carried around by centrifugal force, and repeatedly passed between the roll and ring, until it gets so fine that it works readily outward and laterally over the edges of the concaved inner face or periphery of the ring, for I have observed that the coarser and heavier particles of the crushed rock will be found in the center of the ring, and the finer, lighter particles thereof at the edge of the same. When, therefore, I desire to reduce the rock to a very fine powder, I run the machine without the scraper, whereby the rock is passed between the ring and roll by the action of centrifugal force, until it is reduced to that state of comminution in which it is so fine and light that it is so little affected by the centrifugal force that it works laterally over the edges of the ring, and drops into the bottom of the case. On the other hand, if I do not wish to crush the rock so fine, I employ the scraper, which forces the crushed rock to leave the ring after it has once been subjected to the action of the roll.

I would call attention to the fact that the spaces Q Q between the opposite faces of the roll, the ring, and the upright frame-pieces A A, of the case, act as a screen to prevent any rock which has not been crushed from dropping into the bottom of the case, for while the powdered or finely crushed rock will sift through the said spaces, any pieces of rock too large to pass through the same will be held back and subjected to further crushing action. In this way the spaces act, as it were, to screen the rock. My observation is that unless the rock is very soft, it should be allowed to pass between the roll and ring several times.

I would have it understood that I do not limit myself to the exact construction herein shown and described, but hold myself at liberty to make such changes as fairly fall within the spirit and scope of my invention.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a rock-crusher, the combination with a case comprising two upright frame-pieces and a shield, of a crushing-roll mounted in the said case, on a shaft having yielding bearings, a crushing-ring frictionally driven by the said roll, which is located within it near its inner face or periphery, and with which it co-operates; and a scraper pivotally hung in the case and located within the ring below the roll, substantially as described.

2. In a rock-crusher, the combination with a case comprising two upright frame-pieces and a shield, of a crushing-roll mounted therein on a shaft having yielding bearings, a crushing-ring encircling the crushing-roll, which is located within it near its inner face or periphery, which is concaved, and anti-friction rollers mounted in the case in position to support the said ring, which is frictionally driven by the said roll, substantially as described.

3. In a rock-crusher, the combination with the case thereof comprising two upright frame-pieces and a shield, of a crushing-roll mounted in the said case, a crushing-ring encircling the said roll, which is located near its inner face or periphery, and anti-friction rollers mounted in the case, in position to support the ring, which is frictionally driven by the roll, the said rollers and ring having their outer faces or peripheries shaped to keep the ring centered with respect to the case and roll, substantially as set forth.

4. In a rock-crusher, the combination with a case comprising two upright frame-pieces and a shield connecting the same, of a crushing roll mounted in the said case on a shaft having yielding bearings, a crushing-ring encircling the said roll, which is located near its inner face or periphery, and anti-friction-rollers mounted in the said frame-pieces for supporting the ring, which is frictionally driven by the crushing-roll, the said parts being constructed for the formation of clearance spaces between the opposite faces of the roll, the ring, the anti-friction rollers and the frame-pieces of the case, and the said spaces being adapted to screen the rock, permitting it to sift down into the base of the case when sufficiently comminuted, but retaining all the pieces not reduced sufficiently where they will be again subjected to the action of the roll and ring, substantially as described.

5. In a rock-crusher, the combination with a case comprising two upright frame-pieces and a shield, of a crushing-roll located within the case and mounted on a shaft having yielding bearings, a crushing ring encircling the said roll, which is located near its inner surface or periphery, anti-friction rolls mounted in the said frame-pieces in position to support the ring, which is frictionally driven by the said roll, and two hoppers located upon the respective frame-pieces and arranged to discharge rock upon the center of the periphery of the roll, the said parts being constructed for the formation of clearance spaces between the opposite faces of the roll, the ring, the anti-friction rollers and the frame-pieces of the case, whereby the rock is screened as it passes from the ring through the said spaces to the bottom of the case, substantially as described.

6. In a rock-crusher, the combination with a case composed of two upright frame-pieces and a shield, of a positively driven crushing roll located in the said case, a crushing ring encircling the said roll, which is located near its inner periphery or face, anti-friction rollers mounted in the said frame-pieces in position to support the said ring which is frictionally driven by the roll, a shaft carrying the said roll, passing through slots formed in the said frame-pieces, sliding bearings for the respective ends of the shaft, gibs applied to the outer faces of the said frame-pieces for supporting the said bearings, and adjustable tension springs mounted upon the outer faces of the said frame-pieces, and combined with the said bearings for forcing the edge of the said roll against the inner face or periphery of the ring, substantially as described.

7. In a rock-crusher, the combination with a case comprising two upright frame-pieces and a shield, of a positively driven crushing roll located within the case, and mounted upon a shaft having yielding bearings, a crushing-ring encircling the said roll which is located near its inner face or periphery, anti-friction rollers mounted in the said frame-pieces in position to support the ring which is frictionally driven by the roll, hoppers located upon the said frame-pieces for discharging rock to the roll, and removable wearing-plates located upon the inner faces of the respective frame-pieces adjacent to the crushing engagement of the ring and roll, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

HORACE L. KENT.

Witnesses:
HARMON S. BASSETT,
HENRY F. E. GAUNN.