No. 652,208. Patented June 19, 1900.

R. A. HADFIELD & A. G. McK. JACK.

CRUSHING MILL.

(No Model.)

Fig. 1.

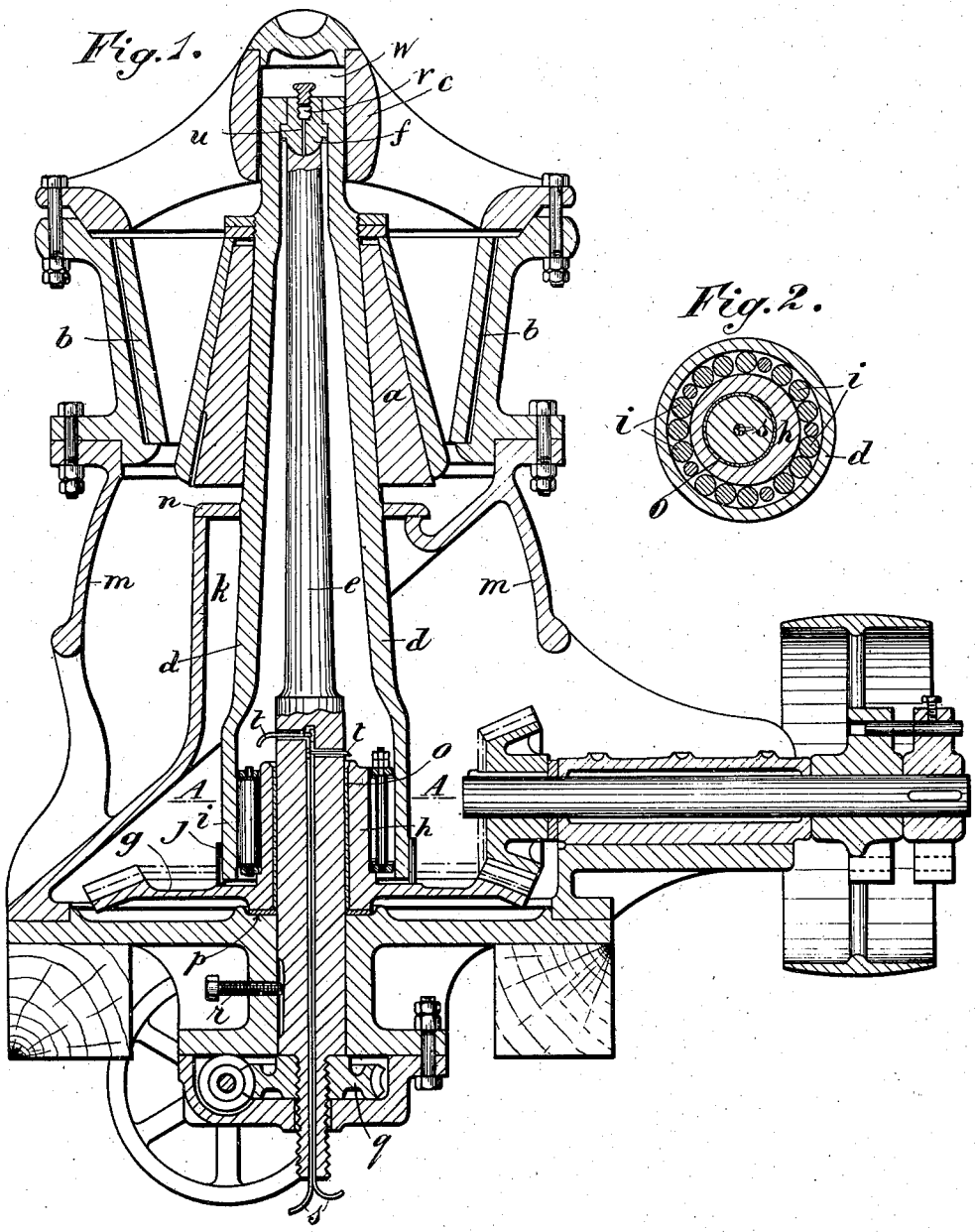


Fig. 2.

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UNITED STATES PATENT OFFICE.

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CRUSHING-MILL.

SPECIFICATION forming part of Letters Patent No. 652,208, dated June 19, 1900.

Application filed August 2, 1899. Serial No. 725,879. (No model.)

To all whom it may concern:

Be it known that we, ROBERT ABBOTT HADFIELD and ALEXANDER GEORGE McKENZIE JACK, subjects of the Queen of Great Britain and Ireland, residing at Sheffield, in the county of York, England, have invented Improvements in Crushing-Mills, of which the following is a specification.

In crushing-mills of the class generally known as "gyratory" crushing-mills the substances to be broken or crushed are passed through an annular chamber or space which is usually formed by and between a crusher-head whose general configuration is conical and to which a gyratory motion is given and a surrounding cylindrical or other ring or wall, the crushing being effected between the head and the ring or wall by the gyratory motion of the head causing it to approach and recede from every part of the ring in succession. Usually in apparatus of this kind the head has been mounted upon an approximately-upright shaft, the upper end of which has been held laterally in a skeleton cover or "spider" secured upon the ring, while its lower portion has passed through a bearing formed eccentrically through the boss of a rotating wheel, the arrangement being such as to impart to the shaft a gyratory motion. The lower end of the shaft has been supported by an adjustable block, which has taken the weight of the shaft and head and also the downward thrust caused by the crushing operation, or sometimes the shaft has been suspended from its upper end, for instance, by an external collar with suitable bearing-surface. With apparatus thus constructed it is found that owing to the friction between the shaft and its support and also between the shaft and its eccentric bearing rapid wear is caused, and consequently frequent repairs are necessary.

Referring to the accompanying drawings, Figure 1 is a central vertical section of a crushing-mill constructed according to this invention, and Fig. 2 is a sectional detail view on the line A A, Fig. 1.

a is the crusher-head, *b* the surrounding ring or wall, and *c* the skeleton cover or spider.

The crusher-head *a* is, according to this invention, carried by a hollow shaft *d*, which is supported at or near its upper end by means of an upright pillar *e*, that extends from the lower part of the mill upward within the hollow shaft. The hollow shaft *d*, which may advantageously be cast in steel, preferably mild steel, is closed at its upper end and is there formed or provided with an internal surface or bearing *f*, that rests upon the top of the upright pillar *e*, whose lower end is or may be fitted in a socket formed in the base-plate of the apparatus. The upright pillar *e* carries the weight of the shaft *d* and crusher-head *a* and takes the downward thrust due to the crushing operation. The skeleton cover or spider *c* laterally supports the top of the shaft *d*.

About the lower portion of the pillar *e* and resting upon the base-plate is mounted a bevel-wheel *g*, having a boss *h*, which is eccentric to the axis, about which the wheel rotates, and is formed with parallel sides that are slightly inclined to the vertical. The eccentric boss *h* extends upwardly within the hollow shaft *d*, and its rotation causes the lower end of the said shaft to travel in a circular path, and thus imparts the necessary gyratory motion to the shaft and its crushing-head. Between the eccentric boss *h* and the internal surface of the hollow shaft *d* there is preferably interposed a ring of anti-friction-rollers *i*, carried in a suitable cage or frame. Fig. 2 illustrates this feature. In order to prevent dust getting to the bearing-surfaces within the hollow shaft, the upper surface of the bevel-wheel *g* may be faced and a ring *j*, of metal, leather, or other suitable material, so arranged as to loosely fit the lower end of the hollow shaft and to rest upon the faced portion of the wheel. The hollow shaft extends through a central flanged aperture *k* in an inclined diaphragm *l*, which, as usual, divides the tubular frame *m* of the apparatus, the said aperture being closed by a ring *n*, fitting the hollow shaft and resting on the flange of the aperture. The upper part of the frame forms the crushing-chamber, and the diaphragm serves as a discharge-chute, while the lower part of the frame contains the bevel-wheel *g*, which is driven by means of a bevel-pinion from a belt-pulley, as well understood. Between the bevel-wheel

g and the upright pillar *e* a gun-metal bush *o* may be provided, and a gun-metal ring *p* may also be introduced between the base-plate and the bevel-wheel *g*, which ring may be replaced by one of different thickness should the vertical position of the wheel *g* require adjustment.

To enable the pillar *e*, and consequently the crushing-head *a*, to be adjusted vertically, the lower end of the pillar may be screw-threaded and arranged to extend through the base-plate, as shown, where it may be fitted with a nut *q*, supported in a bracket attached to the base-plate. The pillar is prevented from turning within its socket by means of a screw *r*, projecting into a keyway, so that by rotating the nut *q*, which may conveniently be formed as a worm-wheel and driven by a worm, the pillar may be raised or lowered, as required. By this means wear of the crushing-head *a* and ring *b* may be taken up or the degree of fineness of the crushed material regulated.

For the purpose of facilitating the proper lubrication of the antifriction-rollers *i* and the gun-metal bush *o* the lower portion of the pillar may be made hollow and fitted with a couple of pipes *s s*, leading from one or more oil-reservoirs (not shown) mounted at a suitable height on the frame of the apparatus, the said pipes having branches *t t* extending through lateral openings in the wall of the pillar *e* to just above the rollers and bush, respectively.

The bearing *f* will require but little lubrication, as it will be well protected from dust; but it may be formed with a passage *u*, leading from an external grease-cup *v*, that is formed therein and is closed by a screw-plug *w*.

What we claim is—

1. Crushing apparatus of the kind referred to, comprising a hollow shaft, a crushing-head carried by said shaft, a fixed ring surrounding said crusher-head and mounted independently thereof, an upright pillar extending upwardly within the shaft which rests upon and is vertically supported internally at or near its upper end solely by said pillar, and means for imparting gyratory motion to said shaft, as set forth.

2. Crushing apparatus of the kind referred to, comprising a hollow cast-steel shaft, a crushing-head carried by said shaft, a fixed ring surrounding said crusher-head and mounted independently thereof, an upright pillar extending upwardly within the shaft which rests upon and is vertically supported internally at or near its upper end solely by said pillar, and means for imparting gyratory motion to said shaft, as set forth.

3. Crushing apparatus of the kind referred to, comprising a hollow shaft, a crusher-head carried by said shaft, a fixed ring surrounding said crusher-head and mounted independently thereof, an upright pillar extending upwardly within the shaft which rests upon and is vertically supported internally at or near its upper end solely by said pillar, and an eccentric boss that extends upwardly within said shaft and is adapted to impart gyratory motion to said head and shaft as set forth.

4. Crushing apparatus of the kind referred to, comprising a hollow shaft, a crusher-head carried by said shaft, an upright pillar extending upwardly within the shaft which rests upon and is vertically supported internally at or near its upper end solely by said pillar, an eccentric boss that extends upwardly within said shaft, and an antifriction-bearing located between said boss and shaft and adapted to transmit gyratory motion from said boss to said shaft and head as set forth.

5. Crushing apparatus of the kind referred to, comprising a hollow shaft, a crusher-head carried by said shaft, a fixed ring surrounding said crusher-head and mounted independently thereof, an upright pillar extending upwardly within the shaft which rests upon and is vertically supported internally at or near its upper end solely by said pillar, and a fixed spider adapted to laterally support said shaft, as set forth.

6. In crushing apparatus of the kind referred to, the combination of an upright pillar extending upwardly through a crushing-chamber, a hollow shaft carrying within said chamber a crushing-head and having a closed upper end which rests upon said pillar, a wheel capable of rotation about said upright pillar and having an eccentric boss extending upwardly within said hollow shaft and a dust-excluding ring encircling the lower end of said hollow shaft and resting on said wheel, as set forth.

7. In a crushing apparatus of the kind referred to, the combination of a vertically-adjustable pillar extending upwardly through a crushing-chamber, a hollow shaft carrying within said chamber a crushing-head and having a closed upper end which rests upon said pillar, a wheel capable of rotation about said upright pillar and having an eccentric boss extending upwardly within said hollow shaft, and a dust-excluding ring encircling the lower end of said hollow shaft and resting on said wheel, as set forth.

8. In a crushing apparatus of the kind referred to, the combination of an upright pillar extending upwardly through a crushing-chamber, a hollow shaft carrying within said chamber a crushing-head and having a closed upper end which rests upon said pillar, a wheel capable of rotation about said upright pillar and having an eccentric boss extending upwardly within said hollow shaft and a lubricant-supply pipe extending through longitudinal and lateral passages in said upright pillar to above said eccentric boss, as set forth.

9. In a crushing apparatus of the kind referred to, the combination of an upright pil-

lar extending upwardly through a crushing-chamber, a hollow shaft carrying within said chamber a crushing-head and having a closed upper end which rests upon said pillar, a wheel capable of rotation about said upright pillar and having an eccentric boss extending upwardly within said hollow shaft, antifriction-rollers interposed between said eccentric boss and said hollow shaft, and independent lubricant-supply pipes extending through longitudinal and lateral passages in said upright pillar to above said boss and said antifriction-rollers respectively, as set forth.

10. In crushing apparatus of the kind referred to, the combination of an upright pillar extending upwardly through a crushing-chamber, a hollow shaft carrying within said chamber a crushing-head and having a closed upper end which rests upon said pillar, a wheel capable of rotation about said upright pillar and having an eccentric boss extending upwardly within said hollow shaft, and means for adjusting said pillar and crushing-head vertically, as set forth.

11. In crushing apparatus of the kind referred to, the combination of a crushing-head, a ring or wall surrounding said head, a hollow shaft, a spider laterally supporting said hollow shaft, a bearing at the upper end of said shaft, an upright pillar within said shaft, a bevel-wheel with means for driving same, an eccentric boss formed on said wheel and extending upwardly within said shaft, a ring of antifriction-rollers between said boss and said shaft, a dust-excluding ring, means for vertically adjusting the pillar and crushing-head, and for lubricating the bearings and antifriction-rollers as set forth.

Signed at Sheffield, England, this 14th day of July, 1899.

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Witnesses:
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