(No Model.) 4 Sheets—Sheet 1.

G. & A. RAYMOND.

ORE CRUSHER.

No. 464,083. Patented Dec. 1, 1891.

Fig. 1.

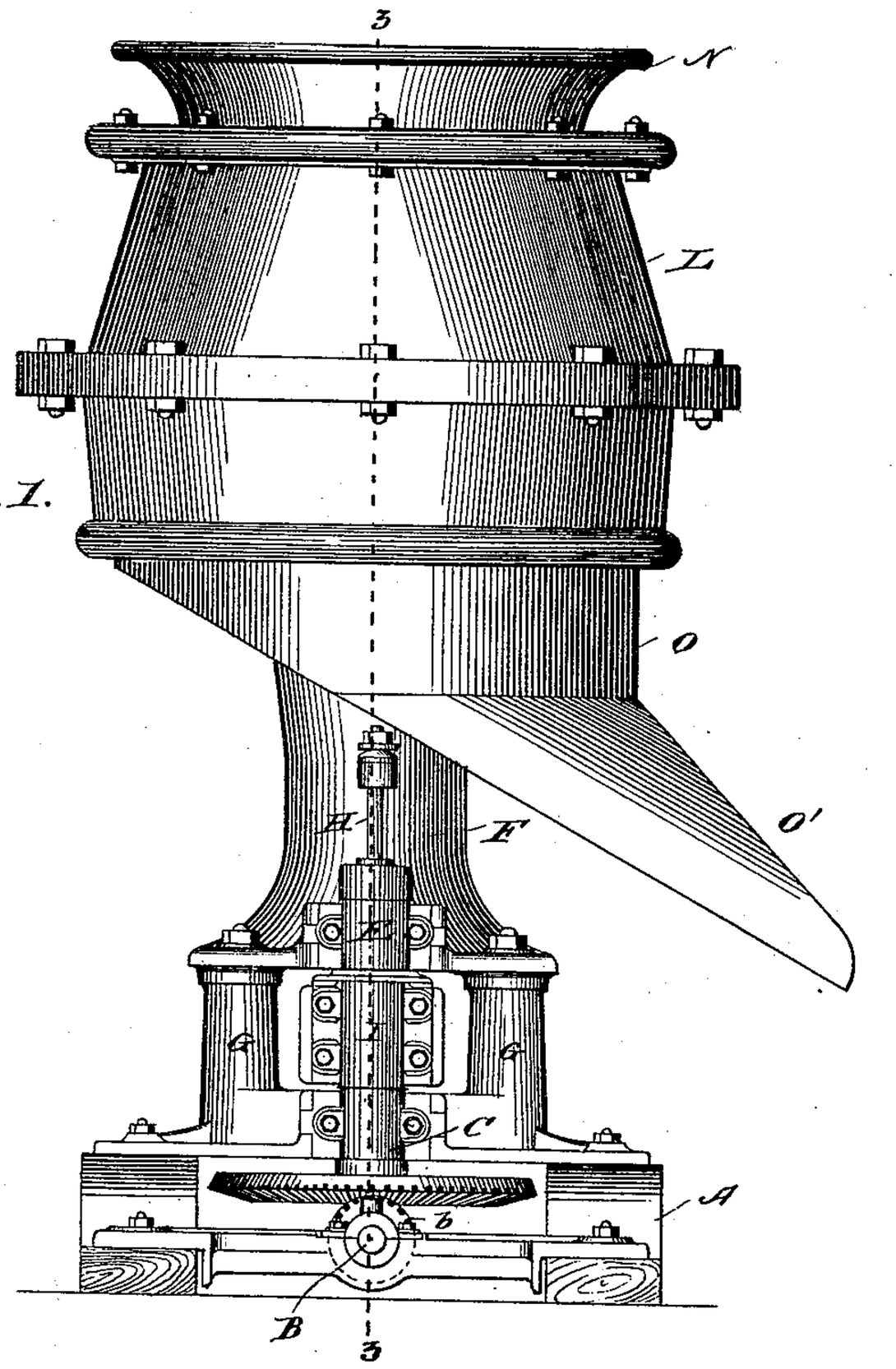
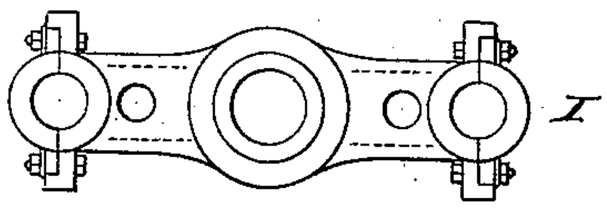


Fig. 7



Witnesses,
F. G. Mann
Frederick L. Goodwin

Inventors,
George Raymond
Albert Raymond
By, Offield & Towle Atty's

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Fig. 2.

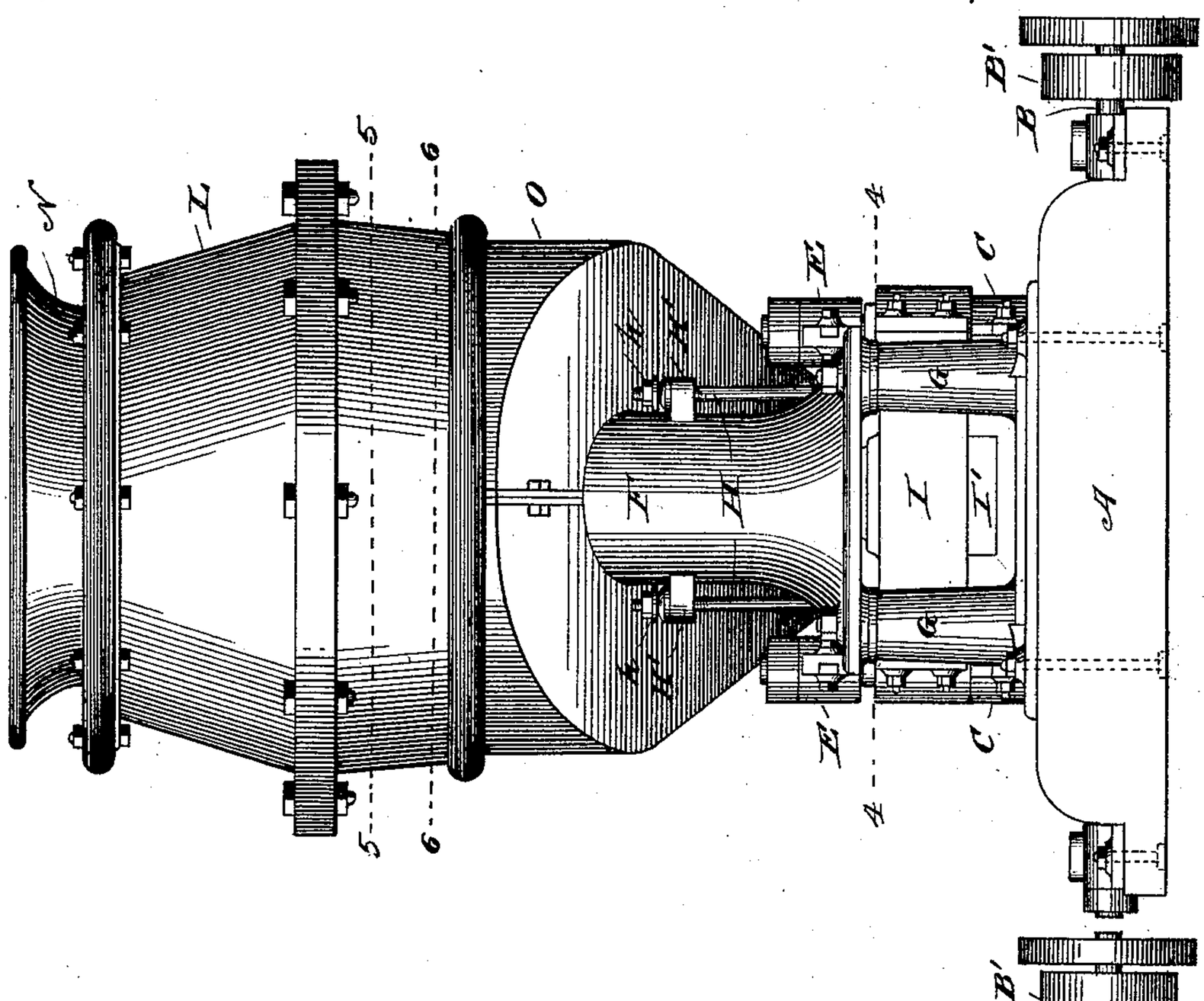
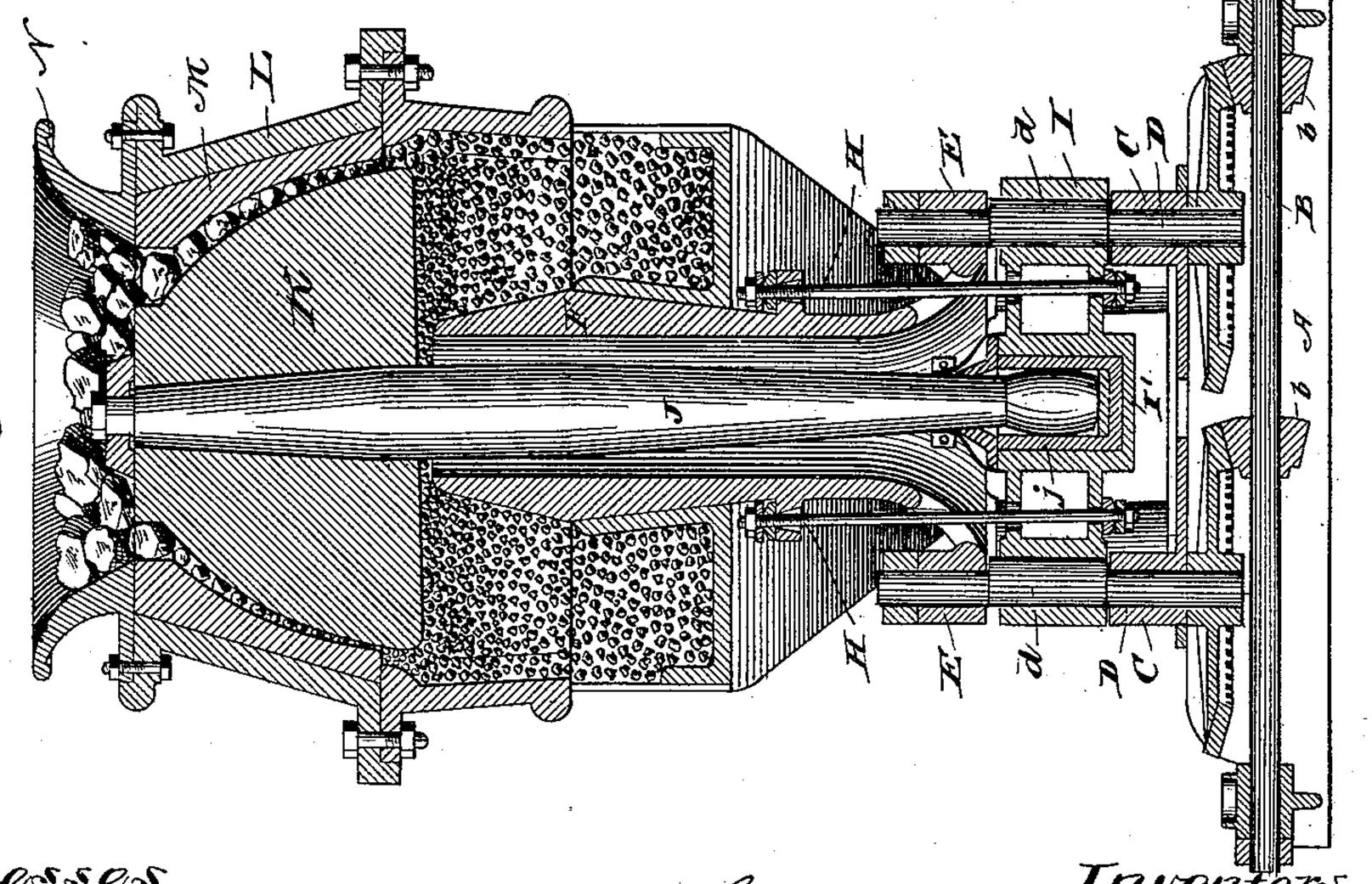


Fig. 3.



Witnesses,
F. E. Mann,
Frederick L. Goodwin

Inventors,
George Raymond,
Albert Raymond,
By Offield & Towle Att'ys.

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ORE CRUSHER.

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Fig. 4.

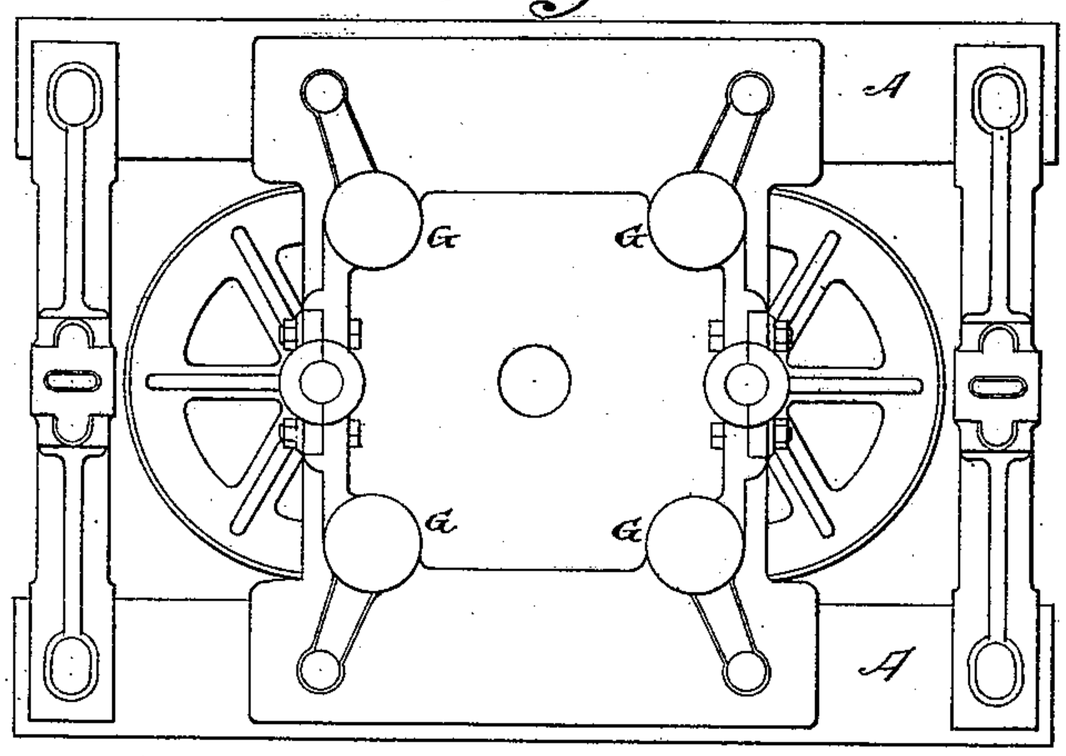


Fig. 5.

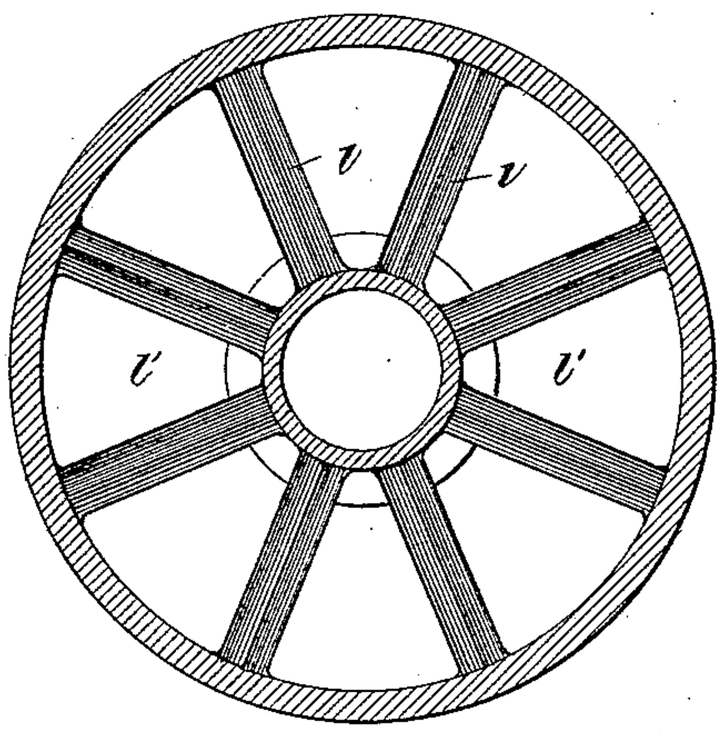


Fig. 6.

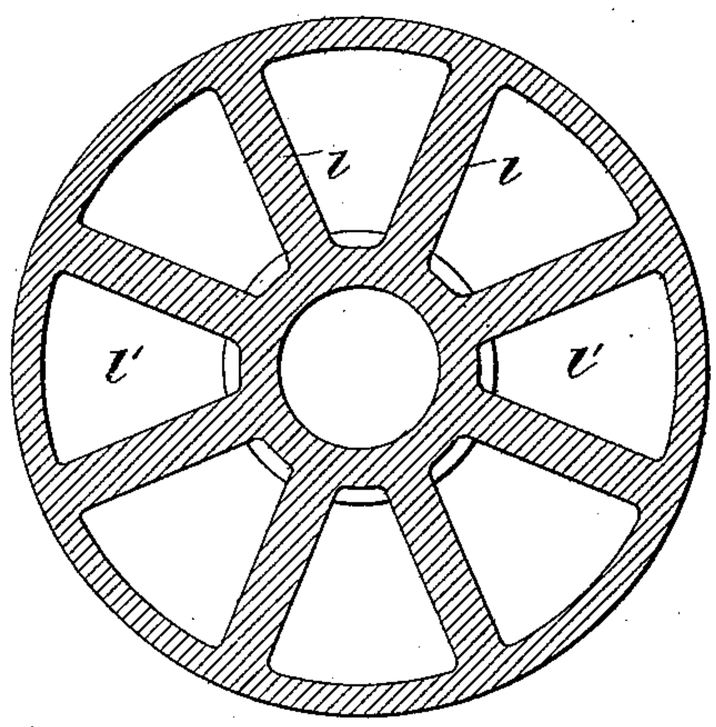
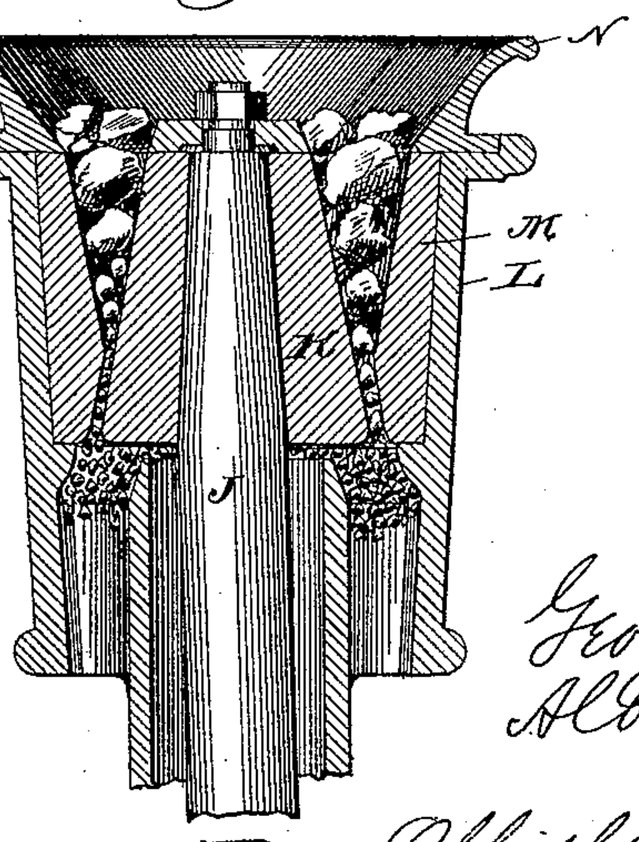


Fig. 8.



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F. G. Mann.
Frederick P. Goodwin

Inventors,
George Raymond
Albert Raymond
By Offield & Towle Attys.

(No Model.)

4 Sheets—Sheet 4.

G. &. A. RAYMOND.

ORE CRUSHER.

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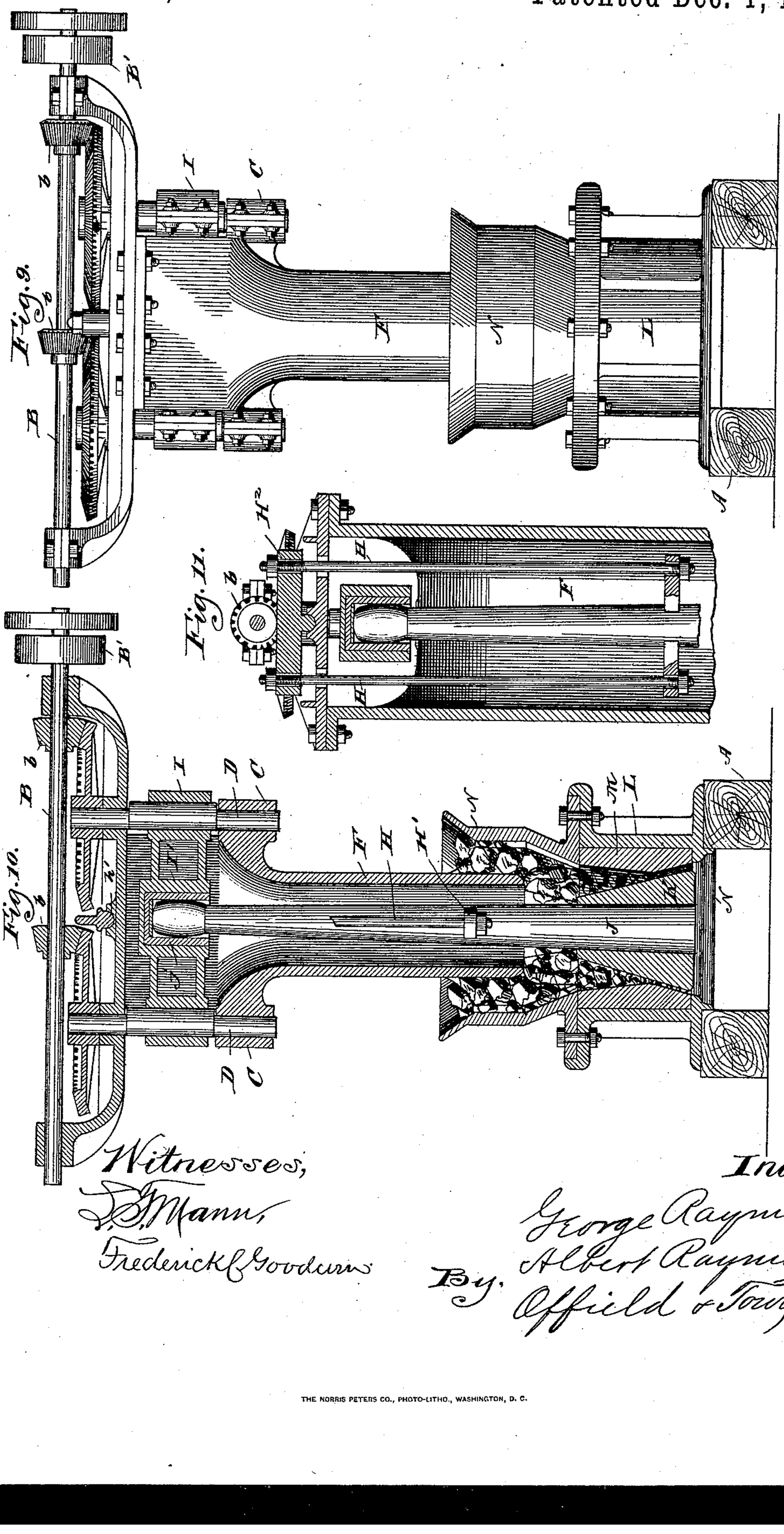

Witnesses,
F. G. Mann,
Frederick L. Goodwin

Inventors,
George Raymond
Albert Raymond
By, Offield & Towle Attys.

UNITED STATES PATENT OFFICE.

GEORGE RAYMOND AND ALBERT RAYMOND, OF CHICAGO, ILLINOIS.

ORE-CRUSHER.

SPECIFICATION forming part of Letters Patent No. 464,083, dated December 1, 1891.

Application filed May 4, 1890. Serial No. 342,539. (No model.)

To all whom it may concern:

Be it known that we, GEORGE RAYMOND and ALBERT RAYMOND, both citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Ore-Crushers, of which the following is a specification.

Our invention relates to a machine for crushing ores or other materials wherein a crushing-head operates in conjunction with a casing to crush the ore or other material between them.

More specifically stated, our invention relates to a crusher wherein an upright shaft carries on one end a crushing-head surrounded by a casing to confine the material, the other end of said shaft being caused to gyrate. The crushing-head is left free, and the material falls between the head and surrounding casing and is crushed between their opposing surfaces, the material itself forming a fulcrum over which the head rocks, and the material, when reduced, dropping out at the bottom of the crushing-chamber.

In one form of construction we employ a suitable base, on which are mounted vertically in proper bearings two shafts, on the lower ends of which are driving-gears enmeshed with pinions carried upon a rotating shaft, and near the middle of said upright shafts are provided enlargements to form eccentrics which operate within sleeve-bearings on either end of a driving-beam, and the latter is provided between the eccentrics with a suitable bearing to receive the end of the crushing-shaft, a hollow column extending centrally above the base and through which the crushing-shaft is passed, an annular frame formed integrally with or bolted to the hollow column and having on its interior a lining to form the crushing-surface surrounding the crushing-head carried upon the upper end of the crushing-shaft, and a hopper in which the material is placed and from which it feeds down by gravity into the crushing-chamber. The driving-beam is preferably suspended by means of rods depending from the hollow column, and these rods are made adjustable, so as to raise or lower the crushing-head, whereby to regulate the fineness of the material crushed. We also prefer to make the crushing-head in the form of the frustum of a globular body where fine crushing is desired; but where only coarse work is to be done the crushing-head may be in the form of a frustum of a cone and surrounded by a casing whose walls are in the form of the frustum of two cones joined at their smaller ends. In another form of construction the head is mounted on the lower end of the shaft and its other end is gyrated.

In the accompanying drawings, Figure 1 is an end elevation of the machine. Fig. 2 is a side elevation. Fig. 3 is a vertical section on line 3 3 of Fig. 1. Fig. 4 is a plan below the line 4 4 of Fig. 2. Fig. 5 is a sectional detail taken on line 5 5 of Fig. 2. Fig. 6 is the same on line 6 6 of the same figure. Fig. 7 is a plan view of the driving-beam. Fig. 8 is a sectional detail showing the crushing-head of the machine in modified form. Figs. 9 and 10 are respectively side and sectional elevations of a crusher, in which the crushing-shaft is geared at its upper end and the head and crushing-chamber are at the lower end of the shaft; and Fig. 11 is a cross-section of the upper part of the crusher shown in Figs. 9 and 10 and taken at a right angle to Fig. 9.

In the drawings, Figs. 1 to 8, inclusive, A indicates a suitable wooden or iron base, upon which is mounted a rotatable driving-shaft B, carrying pinions *b b*, a pulley B′, and a balance-wheel. Mounted upon this frame are the bearings C C to receive the eccentric-shafts D D, the eccentric portions thereof being marked *d d*. The upper ends of these shafts are carried in bearings E E, formed at the base of a hollow column F, which is supported by the uprights G, which are made separately from the hollow column, as shown, or formed integrally therewith.

H H represent suspending rods or bars whose upper ends are passed through apertured lugs H′ and have the securing and adjusting nuts *h*. These rods pass downwardly through openings in the hollow column, and their lower ends are passed through apertures in the driving-beam I. This beam is particularly shown in Figs. 3 and 7 of the drawings and is a skeleton casting having formed cen-

trally thereof a box I′ and at each end thereof bearings to receive the eccentric portions *d* of the shaft D.

J represents the crushing-shaft, whose lower end is seated within the box I′ and preferably surrounded by a bushing *j*. The upper end of this crushing-shaft projects above the top of the column F and bears thereon a crushing-head K, which is preferably made separable from the shaft, so that it can be replaced when worn, and which may have a smooth or corrugated surface, as desired.

L is an annular frame, which may be formed integrally with or bolted to the upper part of the column, and which is provided with the lining M to form a crushing-surface, and N is a hopper from which the material is fed.

By referring to Figs. 5 and 6 of the drawings, it will be seen that the annular frame L is connected to the central column by means of the ribs *l*, which will preferably be thinned off on their upper surfaces, as clearly shown in Fig. 5, to prevent lodgment of the material and providing the discharge-openings L′ between them. An annular receptacle or bin O surrounds the column and will be provided with one or more discharge-spouts O′ for the discharge of the crushed material. This receptacle is cast in separable pieces, as shown in Fig. 2, so as to be bolted around the column, and the spout or spouts are cast integrally with the sections. The form of crushing-head K shown in Fig. 3 is adapted to fine crushing and is substantially in the shape of a frustum of a sphere, and the surrounding casing has concave walls corresponding thereto. The form of crushing-head shown in the remaining figures and particularly illustrated in Fig. 8 is in the form of a frustum of a cone and is adapted to the crushing of large stones by making the surrounding casing flaring at the top, the finer reduction taking place as the material is discharged.

In Figs. 9, 10, and 11 of the drawings a crusher is shown in which the crushing-chamber is arranged at the base of the machine, and the shaft has the crushing-head provided also at its lower end and its upper end is gyrated by means of the driving-beam, which is operated by substantially the same gearing shown in the preceding figures. The driving-beam in this case is supported by the column F; but the shaft is hung by the rods H, connected to the lugs H′, which in this instance are secured with the shaft itself. The upper ends of these rods are connected to a head-block H″, which has a ball-and-socket bearing, as shown at *h′*, Figs. 10 and 11. This bearing permits the rods to rock or vibrate with the shaft. In this construction the hopper N surrounds the lower end of the column F and the material may discharge into a suitable receptacle or spout beneath the machine. The principle involved in the use of the two constructions is precisely the same and the structural adaptations are only very slightly different. We regard both forms as being substantially the same and therefore equally within the scope of our invention.

In operation the material is placed within the hopper and falls down by gravity between the crushing-head and the annular lining. The driving-shaft being put in motion, the eccentrics will cause the driving-beam to gyrate and impart a corresponding motion to the end of the crushing-shaft opposite the head. The other end of this shaft carrying the crushing-head being left free, it will center itself within the crushing-chamber, and the material falling down between its surface and the surrounding lining will be crushed on either side of the head. This results from the fact that the material in working its way down after being partly reduced will be wedged between the lower end of the crushing-head and the surrounding casing, and as the shaft is moved this material forms a fulcrum over which the crushing-head rocks, thus further reducing the material forming the fulcrum, while at the same time the upper end of the head forms the initial reduction by impinging upon the coarser material between it and the surrounding casing, and the lower end crushes the material on the side that part of the head approximates.

This construction and method of working secures important advantages, which may be summarized as follows: The crushing is effected on opposite sides of the head simultaneously, alternating with the movement of the lower end of the shaft, and as this movement causes a slight rocking around the vertical axis of the crushing-head it will therefore give a vertical movement to the periphery of the crushing-head at the base sufficient to prevent the packing or clinging of the material where fine crushing is desired. It is obvious that the shorter the crushing-head the greater the leverage will be on the material to be crushed, and that the greater the diameter of the head the greater will be the vertical movement at its periphery.

Of course we do not limit our invention to the details of construction of the several parts, as variations may be made in the structural features without departing from the spirit of our invention. The driving-beam may be operated by means of a single eccentric.

We claim—

1. In a crusher, the combination, with an upright shaft bearing a crushing-head at one end thereof, of an exterior casing to provide a chamber surrounding said head, and said casing and said head being outwardly flared toward the discharge end of the chamber, and means for gyrating the opposite end of said shaft, said means comprising a beam movable in a plane at right angles to the shaft and gearing for driving said beam, substantially as described.

2. In an ore-crusher, the combination, with an upright shaft bearing a crushing-head at its upper end and having its lower end loosely mounted in a bearing carried by a driving-beam movable in a plane at right angles to the shaft, of means for moving said beam and an annular casing surrounding the crushing-head whereby to provide a crushing-chamber, substantially as described.

3. In an ore-crusher, the combination, with an upright shaft having a crushing-head secured upon its upper end, of an annular casing to provide a crushing-chamber surrounding said head, a beam arranged at right angles to the shaft and having a bearing centrally thereof to receive its lower end, and eccentrics for gyrating said beam in a plane at right angles to the shaft, substantially as described.

4. In an ore-crusher, the combination, with an upright shaft bearing thereon a crushing-head, of an annular casing surrounding said crushing-head to provide an operating-chamber, a driving-beam located in a plane at right angles to the shaft and having a bearing between its ends to receive the lower end thereof, bearings at either end of said beam, upright shafts having an eccentric portion adapted to the bearings in the ends of the beam and gear-wheels on their lower ends, and a driving-shaft rotatably mounted parallel to the driving-beam and having pinions enmeshed with the gears, substantially as described.

5. In an ore-crusher, the combination, with an upright shaft bearing a crushing-head at its upper end and having its lower end loosely mounted in a bearing carried by a driving-beam, of a frame-work from which said beam is adjustably suspended and means for gyrating said beam, substantially as described.

6. In an ore-crusher, the combination, with a base having a driving-shaft rotatably mounted thereon, an upright frame-work whose body portion is a hollow columnar projection, eccentric driving-shafts vertically and rotatably mounted above the base, a driving-beam having bearings at its ends adapted to the eccentric portions of said shafts and a central bearing, said beam being adjustably connected to the frame-work, an upright shaft having its lower end loosely inserted in said central bearing and its upper end provided with a crushing-head, and an annular casing surrounding said head to provide an operating chamber and having suitable feed and discharge openings for the material, substantially as described.

GEORGE RAYMOND.
ALBERT RAYMOND.

Witnesses:
C. C. LINTHICUM,
FREDERICK C. GOODWIN.