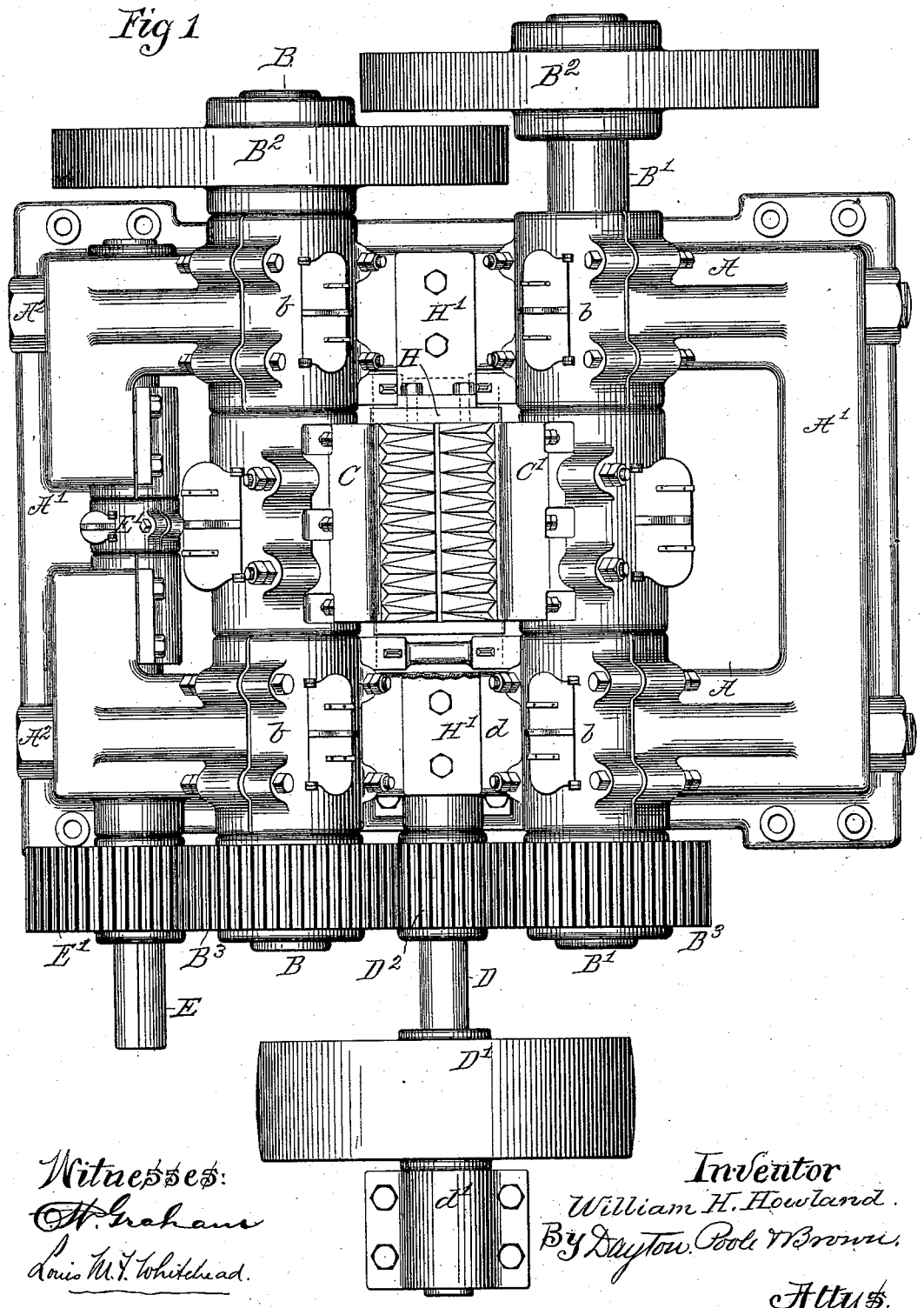
(No Model.) 3 Sheets—Sheet 1.

W. H. HOWLAND.

CRUSHING AND GRINDING MACHINE.

No. 523,938. Patented July 31, 1894.

Fig 1



Witnesses:
W. Graham
Louis M. T. Whitehead.

Inventor
William H. Howland.
By Dayton, Poole & Brown.
Attys.

(No Model.) 3 Sheets—Sheet 2.

W. H. HOWLAND.

CRUSHING AND GRINDING MACHINE.

No. 523,938. Patented July 31, 1894.

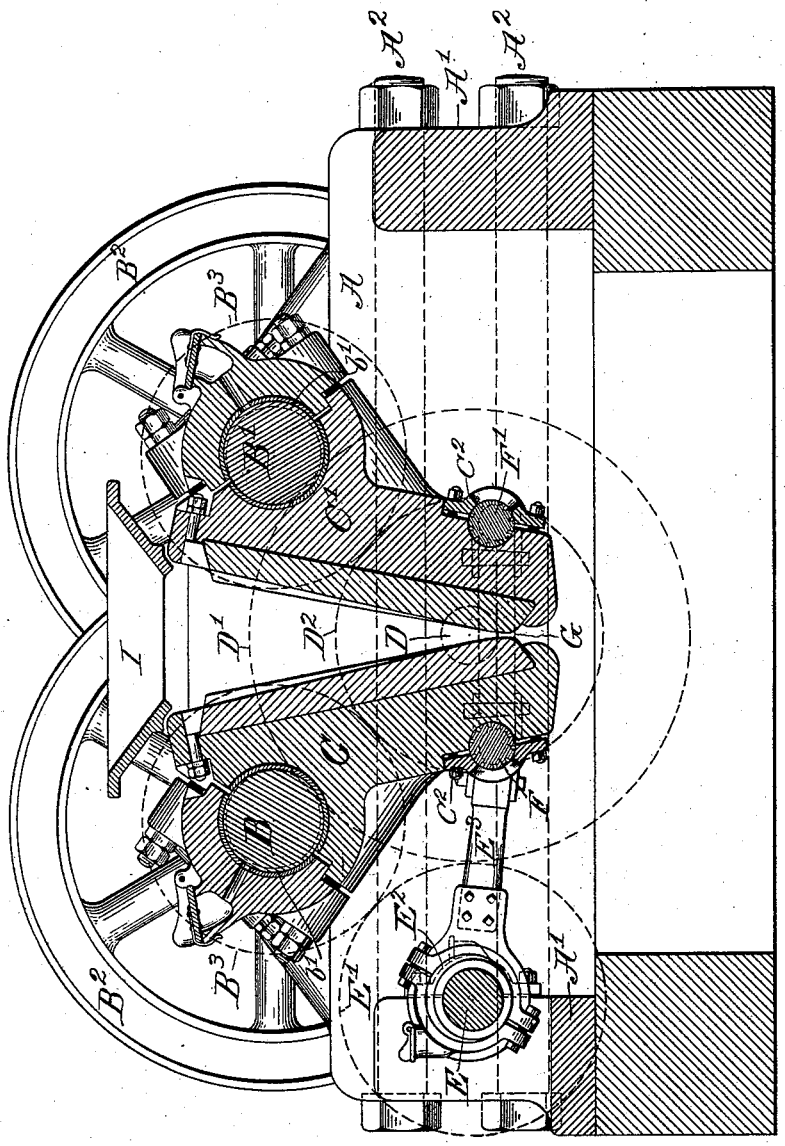


Fig. 2.

Witnesses.
A. Graham.
Louis W. Whitehead.

Inventor.
William H. Howland.
by Dayton, Poole & Brown.
his Attorneys.

(No Model.) 3 Sheets—Sheet 3.

W. H. HOWLAND.

CRUSHING AND GRINDING MACHINE.

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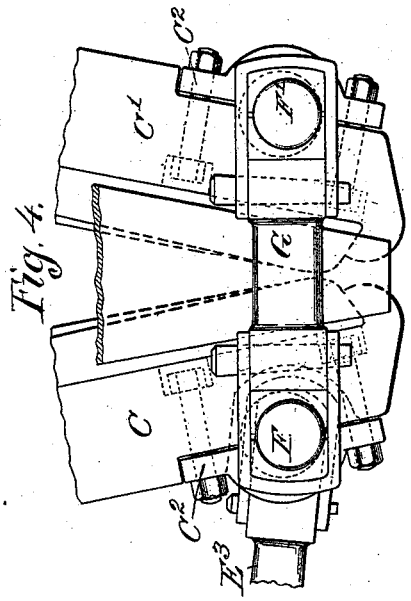

Fig. 4.

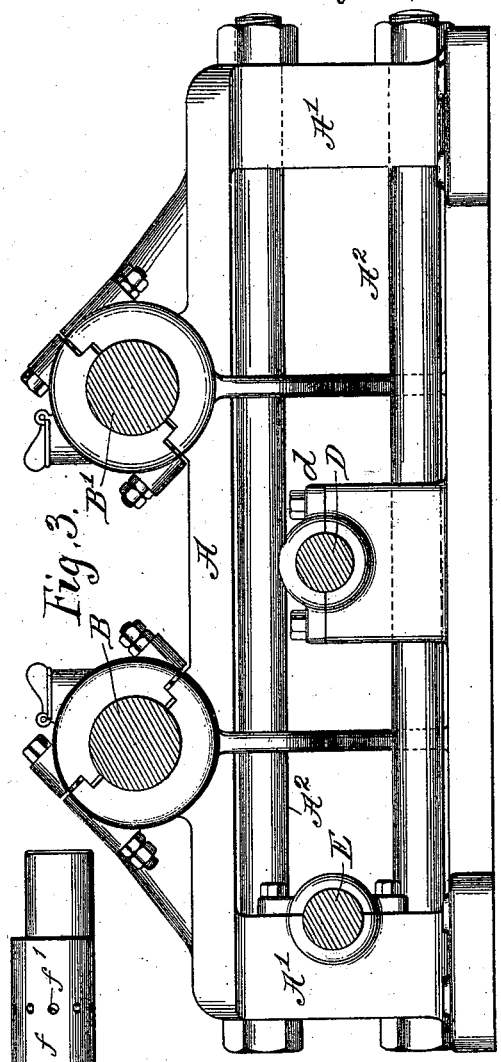

Fig. 3.

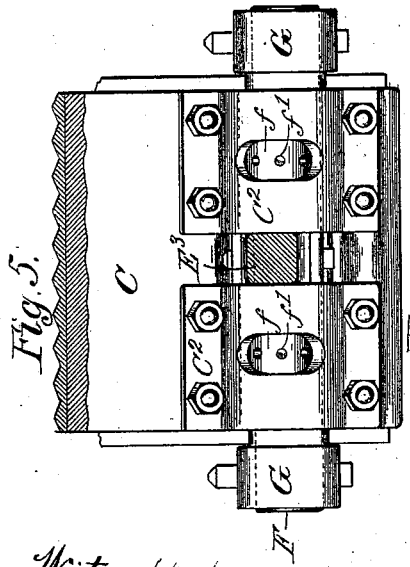

Fig. 5.

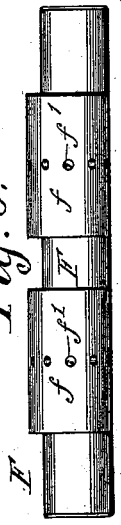

Fig. 6.

Witnesses.
A. Graham.
Louis M. Whitehead.

Inventor.
William H. Howland.
by Dayton, Poole & Brown
his Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM H. HOWLAND, OF CHICAGO, ILLINOIS.

CRUSHING AND GRINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 523,938, dated July 31, 1894.

Application filed April 6, 1893. Serial No. 469,245. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. HOWLAND, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Crushing and Grinding or Pulverizing Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention is in the nature of an improvement upon the machine shown in Letters Patent No. 450,488, granted to me April 14, 1891, the improvements herein described and claimed relating principally to the movements of the crushing and grinding jaws.

The objects of the invention are, first, to obtain a more effective crushing movement of the upper ends of the jaws; second, to give an added and a more distinctive grinding movement to the lower ends of the jaws, and, third, to provide a construction by which the latter movement may be at pleasure discontinued or restored, so that the same machine may be used either for the more purely crushing operation or with a crushing and more extensive grinding action.

In the accompanying drawings, which illustrate my present improvements, Figure 1 is a plan view of the machine. Fig. 2 is a central vertical section. Fig. 3 is a side view of the machine frame and section of the transverse shafts. Fig. 4 is a side view of the lower portions of the crushing and grinding jaws, particularly illustrating their connection by links. Fig. 5 is a rear view of the lower portion of one of said jaws, illustrating the links in end view and the actuating pitman in section, and Fig. 6 is a detached side elevation of one of the eccentric shafts which are applied to the lower ends of the jaws and by which the space between said lower ends of the jaws may be varied.

A represents the side members and A′ the end members of a rectangular frame which is strengthened against tensile strain by heavy longitudinal tie-bolts A^2 A^2.

B B′ are two parallel transverse shafts mounted in suitable bearings *b* on the sides of the frame, as indicated, and provided with eccentric portions *b′* between said bearings.

C C′ are two crushing and grinding jaws mounted at their upper ends on the eccentrics *b′* of the shafts B B′ so that in the rotation of said shafts within the jaws each of said jaws will be given a bodily up-and-down movement and a lateral, vibratory movement at its upper end by the eccentric which carries it.

The shafts B B′ are each shown as carrying at one end a fly wheel B^2 and at its opposite end a gear wheel B^3.

D is a third shaft arranged in a vertical plane midway between the shafts B B′, and having its bearings at *d* on one of the sides A of the frame and the other at *d′* upon a suitable outer support. This shaft D carries a driving pulley D′ and also a gear wheel D^2 which meshes with both the equal gear wheels B^3 on the shafts B B′.

The gear wheels B^3 on the shafts B B′ being out of mesh with each other and in mesh with said intermediate wheel D^2, rotation of the latter gives rotation to the shafts B B′ in the same direction. In this respect the machine here shown differs from that shown in my aforesaid prior patent wherein the wheels upon the shafts B B′ were of larger diameter and intermesh with each other and the shafts D and E and their connections of the present construction are absent.

E is a fourth shaft parallel with the others and having a gear wheel E′ secured thereon and intermeshed with one of the wheels B^3 with which it is equal in diameter. Said shaft E has also a central eccentric portion E^2 to which is fitted one end of a pitman E^3 the opposite end of which is jointed upon a wrist or shaft F connected with the lower end of the adjacent crushing jaw C. This shaft F extends across the outer face of the crushing jaw C and projects at its ends beyond it. The opposite jaw is provided with a similar shaft F′, and upon the projecting ends of said shafts F F′ are fitted links G G which hold the lower ends of the jaws at a given required distance apart and communicate motion from the jaw which is actuated by the pitman E^3 to the opposing jaw. In the rotation of the eccentric shaft E, therefore, the lower ends of the jaws C C′ are swung sidewise on the eccentric portions *b′* of the shafts B B′ as their axes, and if, at the same time,

said shafts B B′ be rotated, the jaws have both a vertically reciprocating and a horizontally vibrating movement at their upper ends together with a laterally and vertically vibratory movement at their lower ends.

The shafts B B′ may be set with the longer radii of their eccentrics b' in any desired relation to each other, as, for example, either oppositely directed or at right angles. In the former case they will obviously give the utmost possible range of approach and recession to the upper ends of the jaws and the vertical movements of the jaws will be synchronous throughout. In the latter case there will be a less range of recession and approach on the part of the upper ends of the jaws, which will then have movement in the same lateral direction at different speeds and with relative approach during a part of their vibration, and relative recession at unequal speeds during the remainder of such vibration, while the vertical, bodily movements of the jaws will be correspondingly anachronous.

With the shaft E in operation simultaneously with the shafts B B′, whatever the relative adjustment of the eccentrics b' to each other, the relative movements of the jaws will be modified, the normal effect of vibration of the lower ends of the jaws being to produce a relative vertical reciprocating movement of the inner faces of the jaws in opposite directions. The practical effect of such vibration of the lower ends of the jaws C C′ is to produce a vertical rubbing or riddling between them of the substances being operated upon, which may be called a grinding action as distinguished from a crushing action. The vibration of the lower ends of the jaws, therefore, increases the grinding action of the machine and better adapts it to the combined work of crushing and grinding or pulverizing. By making the shaft E of sufficient length to allow the gear wheel thereon to be slipped out of engagement with the adjacent gear wheel B^3, said shaft E either may be rendered non-rotative or independently rotative. In the former case it will serve, through the pitman E^2, to hold the lower ends of the jaws C C′ in place while they are actuated exclusively by the shafts B B′. In the latter case the shafts B B′ may be left at rest and the sole movement of the jaws may be the vibration of their lower ends. For such separate rotation of the shaft E it should, of course, be provided with a belt pulley, not shown.

To adjust the distance between the lower ends of the converging jaws C C′ and therefore to vary the fineness of the product, or to compensate wear of the jaw faces, any suitable form of device may be provided, that herein shown consisting in the provision of eccentric portions f upon the shafts F, F′. These eccentric portions of the said shafts are embraced beneath caps C^2 which are bolted to the jaws and are adapted to be clamped so firmly against the shafts as to prevent their rotation. By relaxing the clamping bolts the shafts will be loosened and they may then be turned to any desired extent by means of a lever inserted in either of the holes f' in said shafts, or by other means. When adjusted, they are again secured against rotation by setting up the cap bolts, as before.

H H are stationary plates which are supported one on each side of the converging jaws C C′ and opposite the space between them to confine the material being operated upon. As shown in Fig. 1, where one of said plates is seen in top view, they may be conveniently held in place by angle plates or brackets H′ which project horizontally from them and are bolted to the side members A of the frame.

A suitable hopper I (Fig. 2) may, if desired, be supported over the space between the jaws by legs which rest upon the brackets H′ and may be bolted in place with the latter.

It is to be understood that other forms of means for vibrating the lower ends of the jaws C C′ may be employed if desired, and that the means used for that purpose may be employed in connection with the eccentric shafts geared directly to each other or otherwise geared to run in opposite directions, as set forth in my aforesaid prior patent; and, generally, I desire it to be understood that changes in form and detail may be made throughout the machine without departure from my invention.

I claim as my invention—

1. The combination with the converging jaws, of rotary shafts having eccentrics engaging the ends of said jaws, and means for vibrating their other ends whereby said jaws are given a combined opening and closing and relative longitudinal rubbing movement tending to both crush and pulverize the material.

2. In a crushing and pulverizing machine, the combination with two downwardly converging jaws, of rotary shafts having eccentrics engaging the upper ends of said jaws, links connecting their lower ends and means for vibrating said lower linked ends.

3. In a crushing and pulverizing machine the combination with two downwardly converging jaws, of rotary shafts having eccentrics engaging the upper ends of the jaws, links connecting their lower ends, and a driving shaft and pitman connected with said lower ends to vibrate the same.

4. The combination with the downwardly converging jaws, of rotary shafts geared to rotate in opposite directions and provided with eccentrics engaging the jaws, and means for vibrating the lower ends of the jaws.

5. In combination with downwardly converging crushing jaws, rotative shafts having eccentrics on which said jaws are severally supported, links connecting the lower ends of the jaws, and an eccentric shaft carrying a pitman which is connected with the lower end

of one of said jaws, the said shafts being geared to run at equal speeds.

6. In combination with the eccentric, jaw-carrying shafts, having equal gear wheels thereon, and links connecting the lower ends of the jaws, a third eccentric shaft and a pitman connected therewith and with one of said jaws, and a gear wheel on said pitman-actuating shaft adapted to be engaged with and disengaged from one of the gears of the jaw-carrying shafts, whereby either the upper ends or the lower ends of said jaws may be alone actuated or both ends of said jaws may be simultaneously actuated, as desired.

7. The combination of the shafts B B′ having eccentrics *b′ b′*, the jaws C C′ mounted on said eccentrics, the shaft D geared with each of the shafts B B′, links connecting the lower ends of the jaws, the shaft E provided with an eccentric and geared with one of the shafts B B′, and the pitman connecting the eccentric of the shaft E with the adjacent jaw.

8. In combination with the vibrating jaws, the adjustable eccentric shafts applied to said jaws and carrying the connecting links.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

WILLIAM H. HOWLAND.

Witnesses:
M. E. DAYTON,
TAYLOR E. BROWN.