

JOHN M. CRAWFORD.
Improvement in Stamp-Mills.

No. 115,172.

Patented May 23, 1871.

Fig. 1.

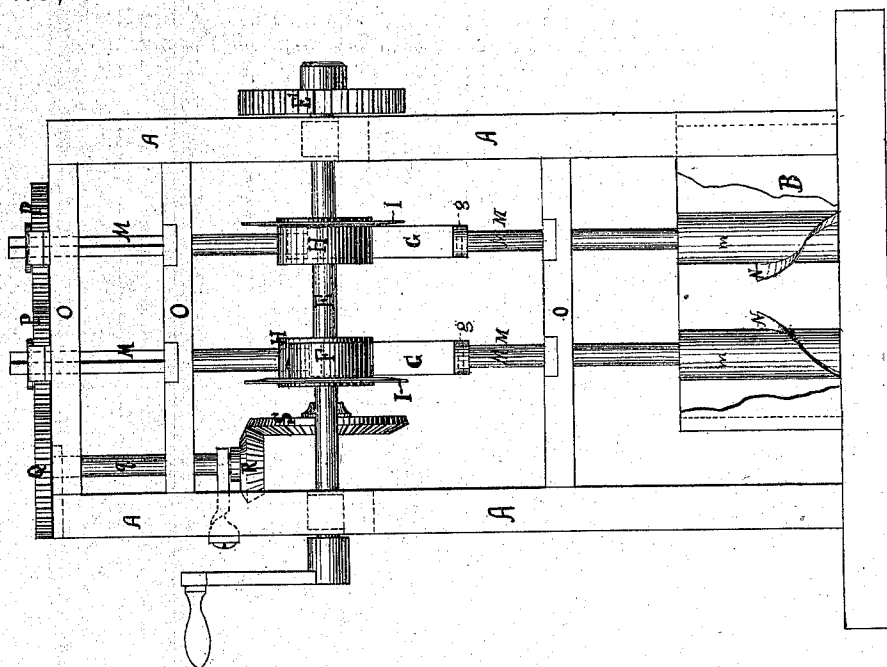


Fig. 2.

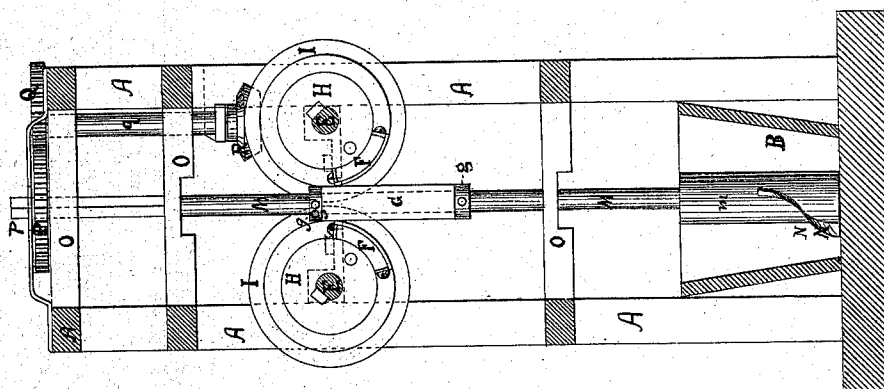
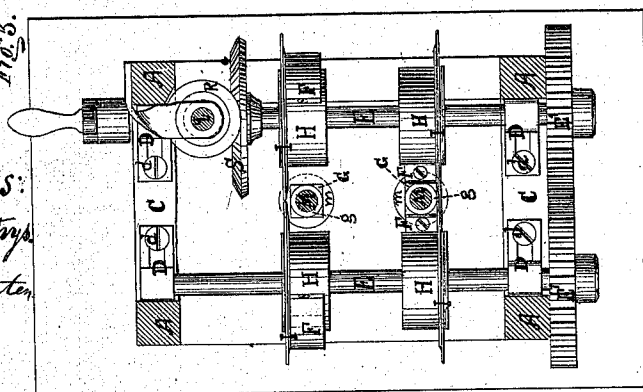


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN M. CRAWFORD, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN STAMP-MILLS.

Specification forming part of Letters Patent No. 115,172, dated May 23, 1871.

To all whom it may concern:

Be it known that I, JOHN M. CRAWFORD, of the city and county of Philadelphia and in the State of Pennsylvania, have invented certain new and useful Improvements in Stamp-Mills for Reducing Quartz, Ore, &c.; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing and to the letters of reference marked thereon.

The nature of my invention consists in constructing a stamp-mill for crushing, pulverizing, and reducing quartz, rock, ore, &c., by means of friction-cams, sleeve, and stamp-stem, to elevate the stamp to a certain regular height, whatever may be the variation of the depth of pulp in the mortar; also, by means of cog-gearing acting with said stem, cams, and sleeve, producing a rotary thrust motion to the stamp in its fall or drop, and also obtaining by these means, when the stamp has dropped, a grinding action of the stamp upon the pulp; and also by these means, acting with the flanges on the stamp, procuring the feed of the pulp under the stamp as it ascends. These, with other functions, will be more fully hereinafter set forth.

To enable others skilled in the art to make and use my invention, I will now proceed to more specifically describe its construction and operation.

In the drawing, Figure 1 is a front elevation of my invention, showing two stamps combined and ready to be used. Fig. 2 is a transverse vertical section of the same; and Fig. 3 is a plan view of Fig. 1, with the part of the apparatus above the friction-cams removed.

A is the framing, of stout timber or other suitable material firmly put together. B is the mortar to contain the substance to be crushed. C are braces that serve to strengthen the framing, and also serve as seats for the journal-boxes D of the main shafts E. These journal-boxes D, by means of a screw-bolt and nut, *d*, Fig. 3, which pass through a slot in the braces C, (see Fig. 3,) are movable to or from the center of the braces C, so as to move the shafts E with the friction-cams F, in order to adjust said cams to the friction-sleeve G, as desired. The shafts E may be driven by hand-power, as the drawing illustrates, or by steam or other powers. There is a cog-wheel, E', on

the outer end of each of the shafts E, the teeth of one meshing in between the teeth of the other wheel, and by this means the prime mover will actuate both of the shafts E at the same moment, and the two shafts will revolve in opposite directions. On a cylinder, H, on each shaft E, there is secured a cam, F, the cam being inserted in one side of cylinder H, and held by bolts or keys, so that, if desired, the cam F can be removed without disturbing or moving the cylinder H, which is permanently connected with shaft E. The face of the cam F may be covered with India rubber, leather, or other suitable material. Cams F revolve with their shafts E, and are placed so that, in turning or making a complete revolution, they will in one part of their course face each other. (See Figs. 2 and 3.) Each of the cylinders H has firmly secured to the outer edge of its periphery a flange or guide, I, which acts as a guide to the friction-sleeve G on the stamp-stem L, as shown in the drawing. The stamp-stem M is round, from a point some distance above the cams F to the head of the boss or shoe *m*. A square sleeve, G, is fitted on the stem M between two collars, *g*, secured by pins, (see Fig. 2,) so that the top of the sleeve G, when the bottom of the stamp is resting on the bottom of the mortar, will be just about the height of the shafts E, or at the point where the friction-cams F get to be close enough to clasp the sleeve G. The length of the sleeve G will be determined by the greatest depth of pulp ever used in the mortar, added to the height it is desired to raise the stamp, which is of the same distance as the friction-lifting surface of the cam F. The boss or shoe *m* is of the usual form and material used in stamp-mills, and is provided with a flange, wings, or blades, N. (See Figs. 1 and 2.) The upper part of the stamp-stem M is square for a distance equal to the length of the sleeve G. The cross-ties O of the frame have openings, through which the stamp-stem M passes, and serve as guides for said stem. On the top of the framing A, and permanently journaled thereto, is a cog-wheel, P, with a square eye or opening in its center, through which the square end of the stamp-stem M freely passes when actuated by the cams F. These wheels P interlock with each other. One of these wheels, P, is connected by a cog-wheel, Q,

shaft *g*, beveled wheels R and S to the driving-shaft E, and is set in motion by said means.

The apparatus thus constructed is operated as follows: Any desired or convenient power is applied to shaft E when the apparatus is in the position shown in the drawing. Cog-wheel E' communicates motion through shaft E or driving-shaft to the opposite cam-shaft, (also marked E,) by means of the cog-wheel on that shaft. The cams F, with cylinders H on shafts E, are now revolved, and as they (cams F) are biting with a friction-gripe the opposite sides of the square sleeve G, as shown in Fig. 2, as they turn upward together, the sleeve G is raised, and with it the stamp-stem M, by reason of the collar *g*. As the sleeve and stem are elevated the guides I direct the sleeve G and prevent it from turning, and the stamp-stem is guided by the cross-ties O. The revolutions of the cams F are continued upward until the cams lose their friction-hold on the sleeve G, and the cams F leave the sleeve G, permitting it, with the stamp, to have an entirely unbroken and unobstructed fall; and whatever may be the depth of the pulp in the mortar when the cams F revolve and take hold of the sleeve G matters not, because the cams F will carry the sleeve and the stamp the same height above the top of the pulp as the stamp was carried by the first revolution of the cams F above the bottom of the mortar, and the blow of the stamp will be just as powerful whether there is an eighth of an inch depth of pulp in the mortar or three inches in depth, because the distance through which the stamp falls is the same. As the stamp-stem M ascends, its upper and square end passes through the square opening in the center of the cog-wheel P, and this wheel P, set in motion by the power which passes from shaft E through the beveled wheels S and R, shaft *g*, and cog-wheel Q, imparts to the stem M a rotary motion without effecting its own motion. As the stamp ascends this rotary motion imparted by wheel P causes the flange N to scrape the pulp down and turn it under the stamp, causing the work to be done more rapidly and efficiently than by the usual mode. As the stamp descends the rotary motion of the cog-wheels, acting on the square end of the stem M, gives a rotary thrust motion to the stamp, thus combining the crushing effects of the thrust and the tearing effects of the rotary grinding motion at the instant of impact. The stamp, when it has delivered this rotary thrust motion is continuously rotated, and so grinding and reducing the pulp until the cams F are revolved and ready to raise the stamp again.

Modifications in the construction and operation of several parts of my invention will now be given in addition to the above description, which is the mode of formation and action of the machine, as a whole, and which will generally be used.

The cog-wheels E', which cause the cam-shafts E to revolve in the same time and make

the cams F on the two shafts E act simultaneously, may be substituted by two pulleys and cross-belt; but as the wear upon the face of the cams F will necessitate the regular advancement of the journal-boxes D so as to always keep the cams in proper grasping or friction position, the cog-wheels E' are preferred to the pulleys and belt, as the slight adjustment caused by thus moving the journal-boxes could be more readily conformed to by the cogs than by the belt.

The faces of the cams F may be circular, grooved, or other form, as may be found desirable, and covered with leather, gutta-percha, or other suitable material; but I do not confine myself to the use of such covering for the cams will operate equally as well without it, the only difference being that the wear of the cams or sleeve would be more rapid without the covering than with it.

I describe the upper end of the stamp-stem as being made square; but instead of the form being square, any angular shape by which the wheel P could readily act upon the stamp-stem would answer.

The square sleeve G, through which the stamp-stem revolves, and by which it is elevated, may be made in one continuous piece, or in two or more sections, and suitably fastened together.

When it is desired to dispense with the grinding or revolving of the stamps, that part of the machine can be thrown out of gear, and the apparatus then be used simply as a stamp-mill.

In cases where it is not desired to erect a combination mill, such as above described, but only a crushing-mill, I dispense with the sleeve G, the angular stamp-stem, and cog-wheels, or other devices producing a rotary motion in the stamp, and use simply the plain round or square ordinary stamp-stem, causing the friction-lifting cams to bite or act immediately upon the plain stem.

In this case, when round stems are used, I deem it best to have the cam-face made with a deeply-grooved or semicircular form, so as to grasp one-half or less of the stem on either side, although the plain or square-faced cam will act or perform well on a round stem.

When more than one stamp is used, they will be added one after the other by simply lengthening shafts E and framing A, adding cross-ties O and a cog-wheel, P, for each additional stamp with cams F, cylinders H, and guides I. The requisite number to form a battery is usually five stamps.

The chief advantage my invention possesses over other stamp-mills is that gained by means of the friction-hold of the cams F elevating the stamp to a certain height above the pulp, whatever may be its depth or the distance of its top from the bottom of the mortar, and then completely letting go the sleeve or stem, so that the fall of the stamp will be free and entirely unobstructed in its descent; and this advantage is seen to be very impor-

tant when it is perceived to result in preserving the efficiency of the blow of the stamp in the few last moments of its descent, when, according to the law of physics in regard to the acceleration of the velocity of falling bodies, its accelerated velocity and its momentum are greatest. This advantage, combined with the means for producing rotary motion in the stamp, by which a rotary thrust or crushing and tearing action of the stamp on the pulp is produced at the instant of impact, a grinding motion when the stamp has dropped upon the pulp, and by the wings or flanges on the stamp when the stamp is on the ascent scraping down and throwing under the stamp the pulp that adheres and forms a wall on the sides of ordinary mortars, presents, with the compact combination of the whole, a most complete, simple, and efficient stamp-mill.

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

1. The cylinder H, provided with frictional lifting-cams F and guide-flange I, in combination with sleeve G and stamp-stem M, when

constructed and operated substantially in the manner and for the purposes specified.

2. The sleeve G and collars *g*, in combination with stamp-stem M, when constructed and operated substantially in the manner and for the purposes set forth.

3. The combination of wheels E', cam-shafts E, cylinders H with cams F, and flanges I, stamp-stem M, beveled wheels S and R, shaft *q*, and cog-wheels Q and P, when constructed and operated substantially in the manner and for the purposes described.

4. The wing or flange N on the boss on shoe *m*, in combination with the stamp-stem M, having a square or angular portion, for the purposes and in the manner specified.

In testimony that I claim the above-described stamp-mill for crushing and reducing quartz, ore, &c., I have hereunto signed my name this 22d day of April, 1871.

JOHN M. CRAWFORD.

Witnesses:

F. W. NEWBOLD,

JNO. L. NEWBOLD.