2 Sheets--Sheet 1.

S. R. KROM.

Ore-Crushing Machines.

No. 158,800. Patented Jan. 19, 1875.

Fig. 1.

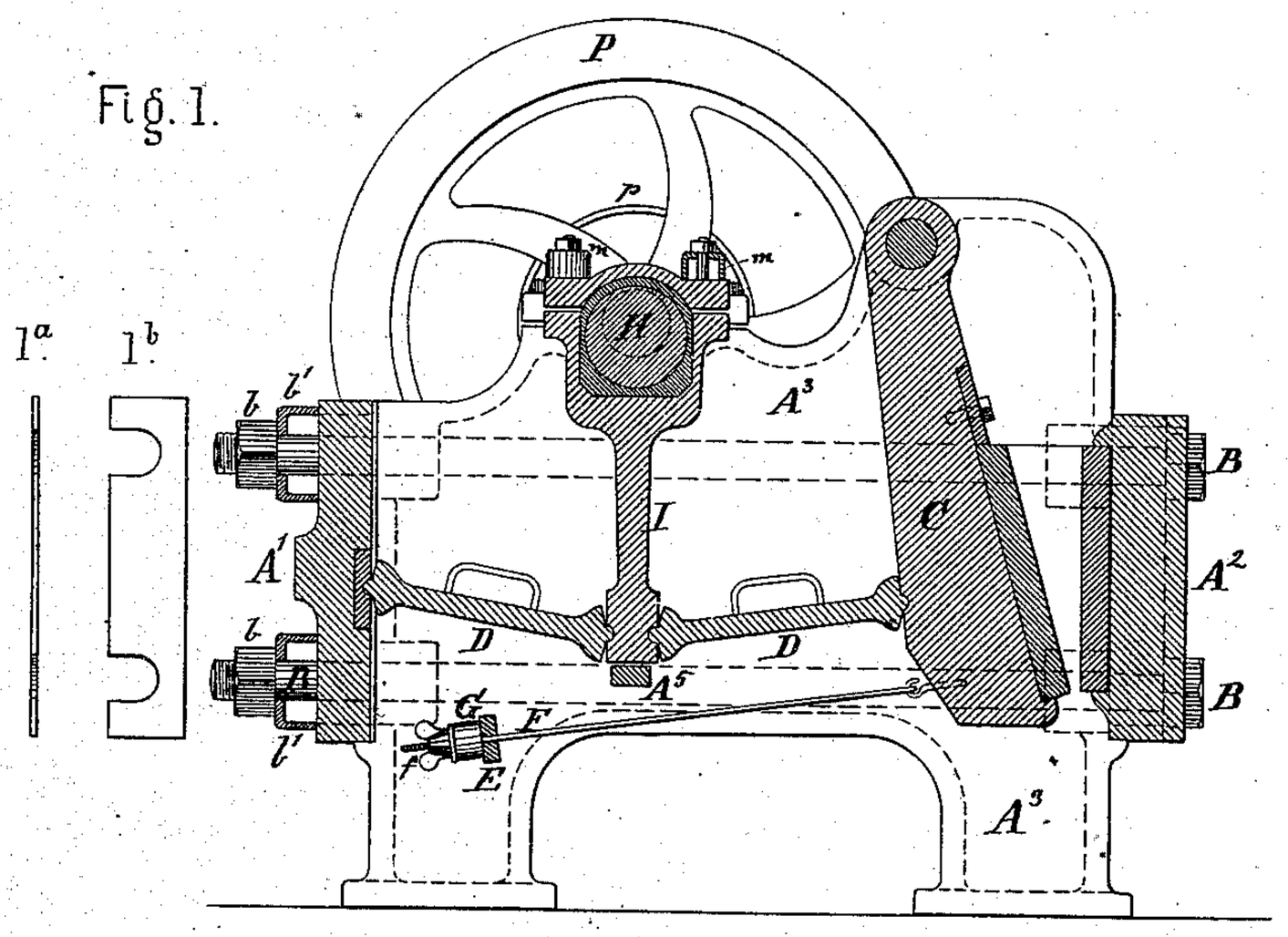
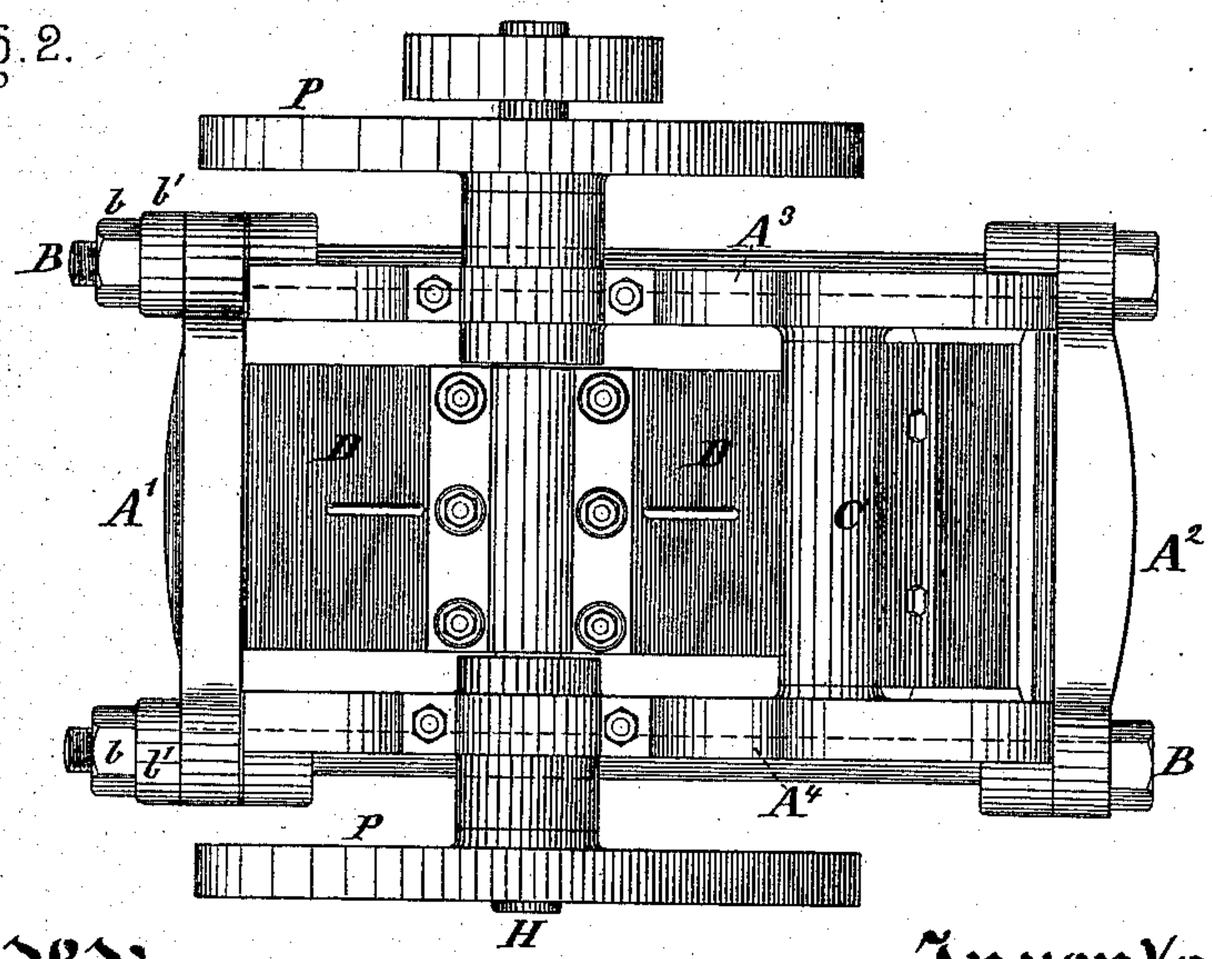


Fig. 2.



Witnesses:

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W. C. Dey.

Inventor:

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New York Lith.

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Fig. 5.

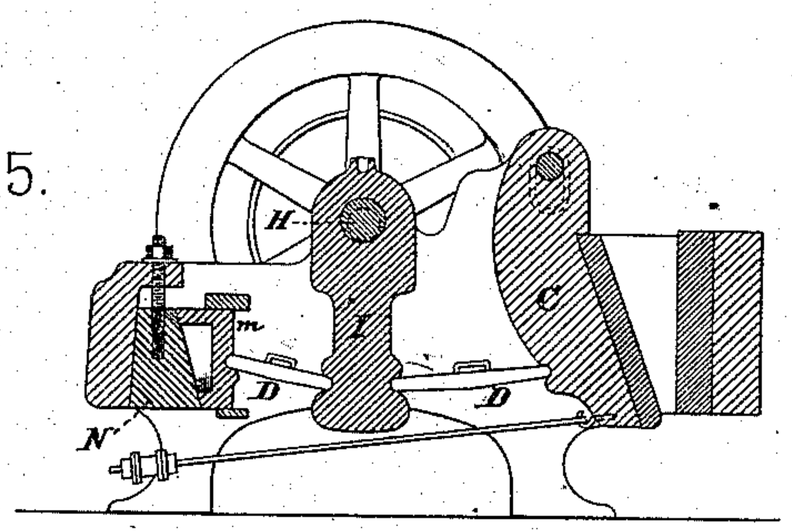


Fig. 6.

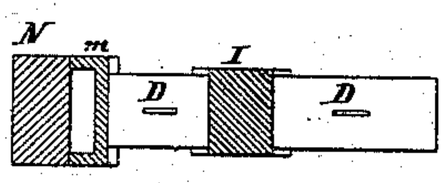


Fig. 3.

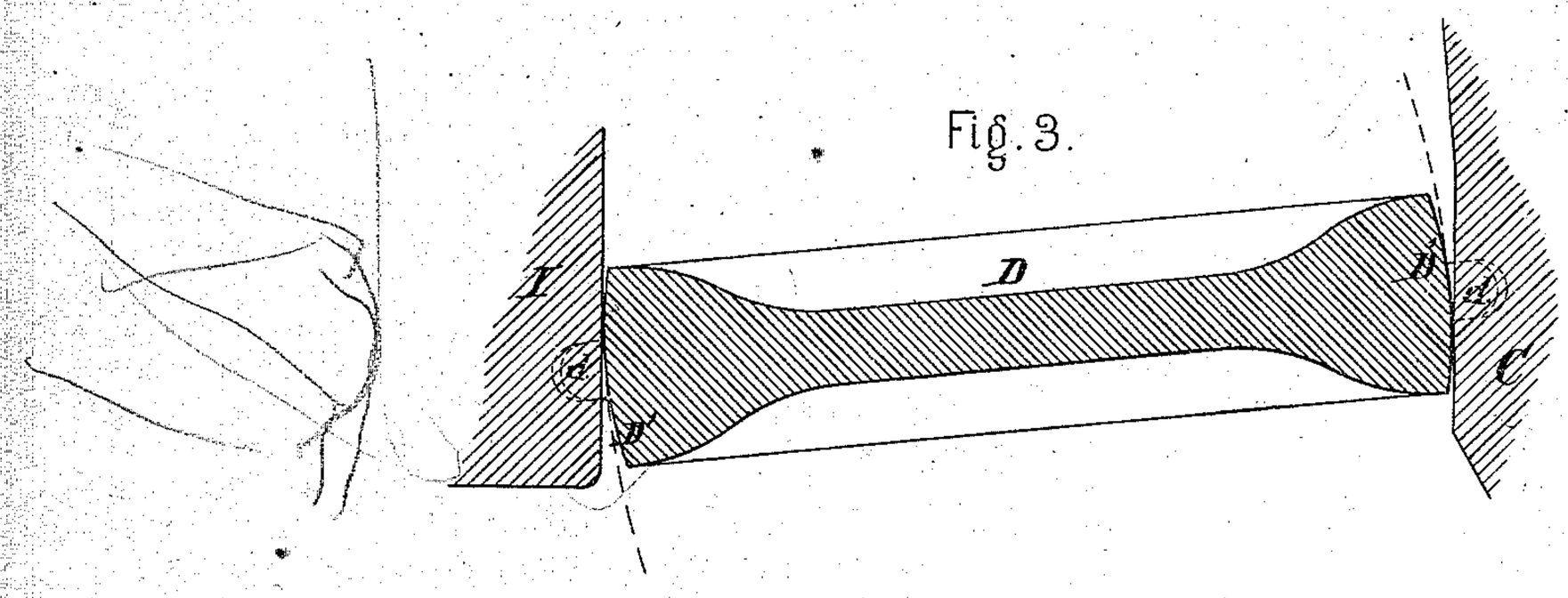
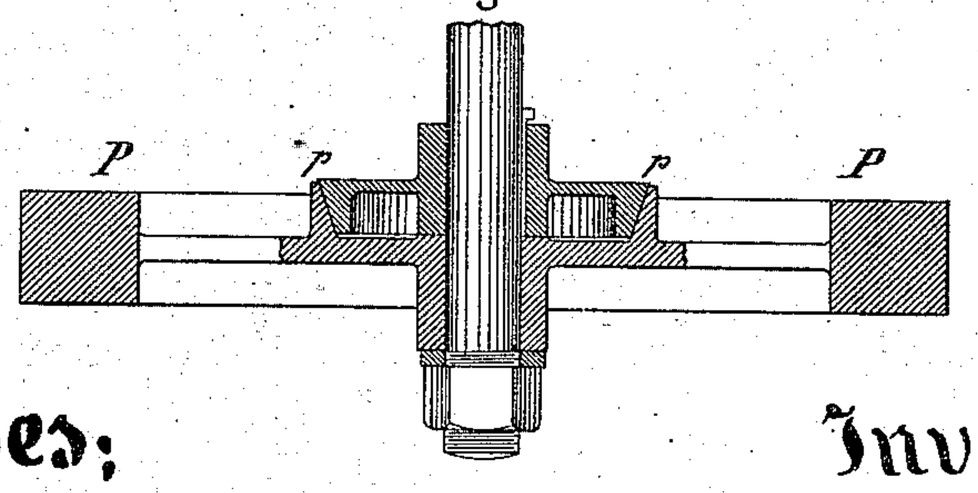


Fig. 4.



Witnesses:

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Inventor:

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UNITED STATES PATENT OFFICE.

STEPHEN R. KROM, OF NEW YORK, N. Y.

IMPROVEMENT IN ORE-CRUSHING MACHINES.

Specification forming part of Letters Patent No. **158,800**, dated January 19, 1875; application filed March 28, 1874.

To all whom it may concern:

Be it known that I, STEPHEN R. KROM, of New York city, in the State of New York, have invented certain Improvements relating to Crushing-Machines, for crushing ore and analogous materials, of which the following is a specification:

I employ a link and two toggles to communicate the motion from the cranked shaft to the stout reciprocating jaw, which effects the crushing, and provide peculiar means for adjusting the relations of the parts to vary the action. I also employ peculiar provisions against the fracture of any important part in case of an over strain.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a longitudinal section, and Fig. 2 is a plan view. Fig. 3 is a view of a portion on a larger scale; and Fig. 4 is a central section through the fly-wheel, and a frictional connection or clutch employed therewith to allow the fly-wheel to slip, when necessary, to relieve excessive strain. Figs. 1^a and 1^b give two views of certain removable and exchangeable pieces, usually termed shimming-pieces. Figs. 5 and 6 represent an application of a portion of the improvement to the style of machine known as the Blake crusher. Fig. 5 is a longitudinal section, and Fig. 6 is a horizontal section, showing a portion of the working parts.

Similar letters of reference indicate corresponding parts wherever they occur.

I make the stout framing A^1 A^2, &c., in several parts, capable of being readily separated for more convenient transportation.

In some situations it is important to be able to transport the machine at intervals over bad roads, and sometimes even on the backs of animals. The division of the framing into four parts, in connection with my means of connecting them for use, affords an important advantage in this respect.

B B are longitudinal through-bolts, provided with nuts *b*, and with hollow washers *b′* of thin cast-iron, indicated in section in Fig. 1.

In case of an extraordinary strain in consequence of receiving a hammer-head, drill-point, or the like into the crusher, these hollow washers still further insure against a breakage of any important part by providing breaking-places additional to the peculiar provisions to be described below. The crushing of these washers *b′*, which may be employed at both ends, or at either end, of the machine, will relieve the strain, and prevent the fracture of the more important parts.

The jaw C is held back to a tight bearing on the double toggle D by means of one or more rods, F, connecting it with a cross-bar, E, through the medium of a sufficient mass of rubber, G. A thumb-nut, *f*, allows the tension of this rubber G to be varied. The toggles D D are operated from the stout cranked shaft H by a connecting-link, I, which carries also breaking-cups *m*, conveniently placed to crush whenever the resistance becomes too great. It is at these points, rather than by a breakage of the hollow washers *b′*, that I prefer the machine to yield whenever the resistance becomes too great.

The strain on the cups *m* is gentle in comparison with that on the washers *b′*, and cheap and easily-replaceable hollow castings *m* may be employed, so as to allow the fracture to be repaired with little expense, and only a few moments' delay.

The link I is equipped with boxes to embrace the crank.

The construction causing the strain or crushing to be felt entirely in the up motion, the breaking-cups *m* are mounted above the cap or binder; but the breaking-cups might, by a slight modification of the construction, be placed under the lower box, so as to serve in receiving the strain, and allowing the parts to yield in the opposite direction, if the other parts should be modified so as to involve a strain in that direction.

As here shown, the upward movement of the link I induces the closing of the jaw C by acting on the double toggle D D. The construction of these parts is such as allows a considerable variation in the extent of motion of the jaw, by simply removing the toggle-pieces D D and introducing others which are differently formed on their rolling-faces.

In Fig. 3 it will be seen that the small head *d* at each end of these parts is simply to support the weight and maintain the proper position of the toggle-pieces.

The end strain is all received on the rolling-surfaces D′ D′. These may be portions of true cylinders, or they may be variously modified.

On removing the thumb-nut *f*, and thus liberating the rod F, the jaw C may be swung forward sufficiently to allow the toggle-pieces D to be successively displaced and others substituted. If the substituted toggle-pieces be longer or shorter than those removed, but with the same form of the ends, the jaw C will vibrate to about the same extent as before, but its mean opening will be greater or less than before. If, with the same length of the toggle-pieces D, a different form of their rolling ends D′ be adopted, the motion of the jaw C from a given vertical movement of the link I will be greater or less.

By providing several sets of toggle-pieces, each differing a little from the others, I can, with little labor or delay, vary sufficiently the action of the machine to adapt it to all ordinary varieties of work.

I propose to compensate for the gradual wear, which is inevitable, on the face of the crushing-jaw C and of the adjacent surface by substituting successively longer toggle-pieces D D. Another plan which I can substitute or use in connection is to introduce shimming-pieces in the joint between the stout end pieces A^1 A^2, and the adjacent side frames A^3 A^4. Figs. 1^a and 1^b show two views of one of the shimming-pieces. When it becomes necessary to compensate for wear I slack the nuts *b*, remove the shimming-pieces, and again set up the nuts, when the framing will be found contracted by the thickness of the shimming-pieces, and the jaw C will, in consequence, work correspondingly closer.

In practice, I propose to introduce three or more shimming-pieces in each joint, and remove them, one at a time, as it becomes necessary.

I prefer to form the breaking-cups *b′* and *m* of cast-iron. A sufficient stock being provided, they are to be successively introduced after removing the fragments of the preceding cup. The depth of each cup *m* should be somewhat greater than the whole motion of the link I, so that in case of the crusher being tightly filled with an unyielding material the link I may, after the fracture of the cups *m*, stand idly, resting on the cross-bar or stop A^5, and allow the crank to play idly around without causing any motion to the jaw C.

Another plan might be to make the holes through the flange of the cap, so as to allow the nut which rests on the breaking-cup to pass completely through when the cup is broken, thus allowing the link to fall away completely.

The bolts B, connecting the sectional framing, may be very readily applied and removed, and by their position they receive the strain directly, relieving the framing of most of the strain due to ordinary arrangements. This construction also enables me to make a very light frame in comparison to the plan of making the frame of one solid casting.

The frictional connection *p* of the fly-wheel P may be sometimes available by slipping around, when for any reason all the other safeguards fail, or do not become effective in time.

Referring to Figs. 5 and 6, D D are the toggles, and I the operating-link, which, through the medium of the toggles, gives motion to the jaw C. The link I is operated by the crank H, and is free to swing as required, so as to always stand between and properly operate the toggles D, one of which abuts against the adjustable piece *m*, adjustable by means of the stout wedge N, as will be understood. The piece *m* is made hollow, and care being taken to provide a number of these of about uniform size and strength, they may be introduced in succession as they are broken. The effect of the fracture of the piece *m* in this modification of the Blake crusher, Figs. 5 and 6, is, in the more important respects, equivalent to that of the breaking-cups *m* in the preferable form of the machine, Figs. 1 and 2.

I claim as my invention—

1. The hollow washers *b′*, on the tie-bolts B, in combination with the stout framing A A^1 A^2, and with the parts C D D I H, as specified.

2. The breaking-cups *m*, in combination with the crank H, link I, toggles D D, and crushing-jaw C, as specified.

3. In a crushing-machine having a vibrating jaw, C, and operating shaft H, the fly-wheel P, connected to the said shaft by a friction-coupling, *p*, as and for the purposes specified.

4. The exchangeable toggles D D, having the supporting-beads *d d*, in combination with the crushing-jaw C and link I, as specified.

5. The crushing-machine described, operating by a vibrating jaw, C, crank H, link I, and toggles D, and having the friction-coupling *p* to the fly-wheel P, so combined and arranged that the breaking of either set or the slipping of the friction-coupling will relieve the machine from overstrain, as herein specified.

6. The combination of the sectional framing A^1 A^2 and longitudinal tie-bolts B with the ore-crushing jaw C, when the tie-bolts are arranged parallel to, and directly in the line of, the strain, as herein specified.

In testimony whereof I have hereunto set my hand this 23d day of March, 1874, in the presence of two subscribing witnesses.

S. R. KROM.

Witnesses:
WILLIAM C. DEY,
ARNOLD HÖRMANN.