

(No Model.)

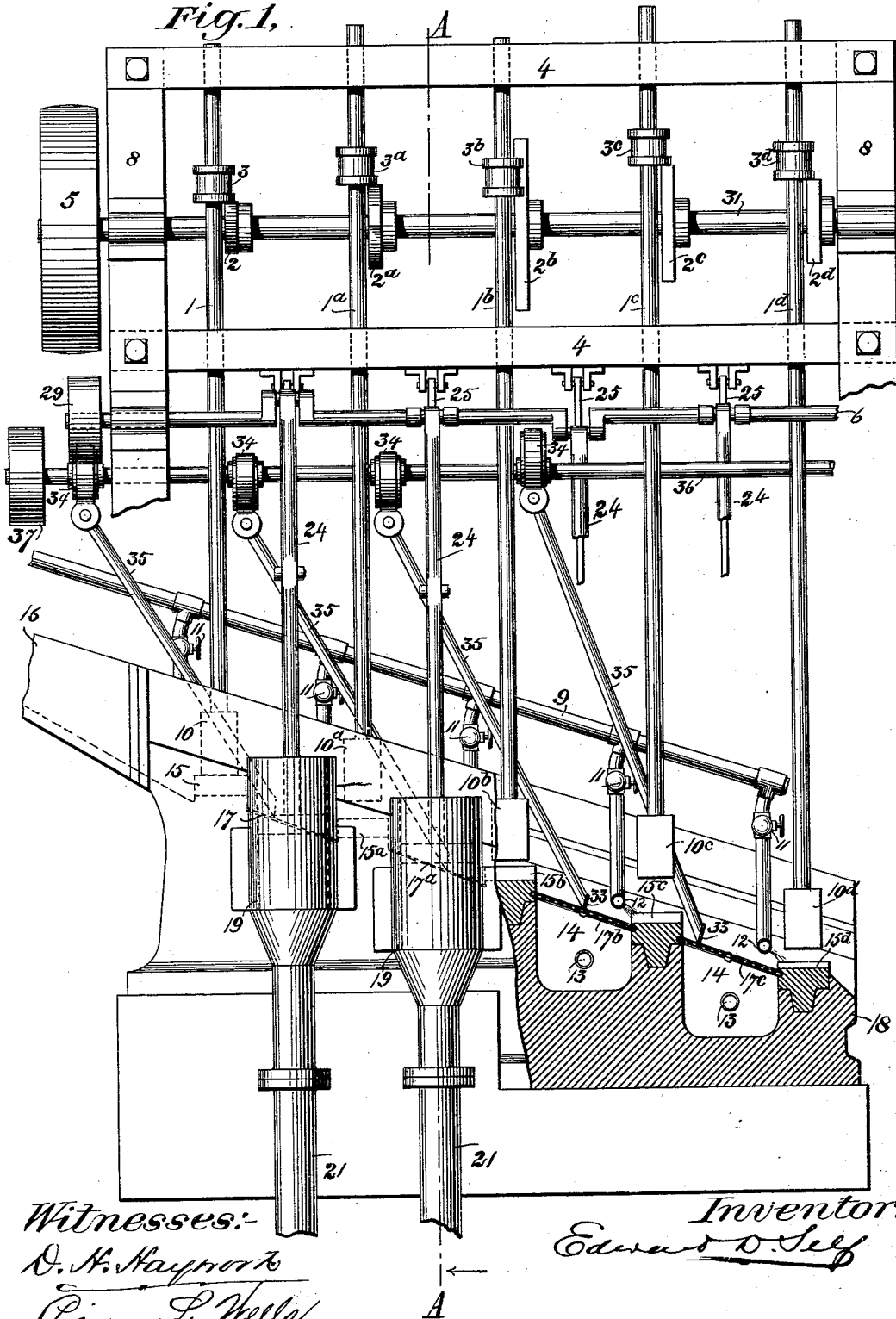
2 Sheets—Sheet 1.

E. D. SELF.
CRUSHING APPARATUS.

No. 568,926.

Patented Oct. 6, 1896.

Fig. 1.



Witnesses:
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Inventor:
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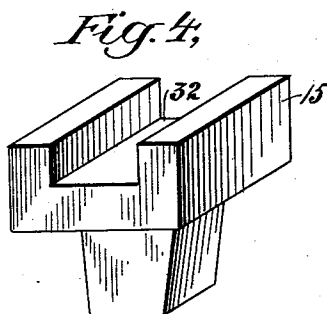
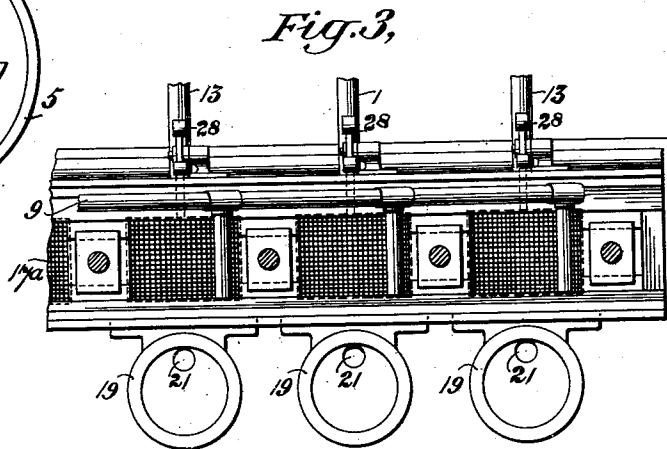
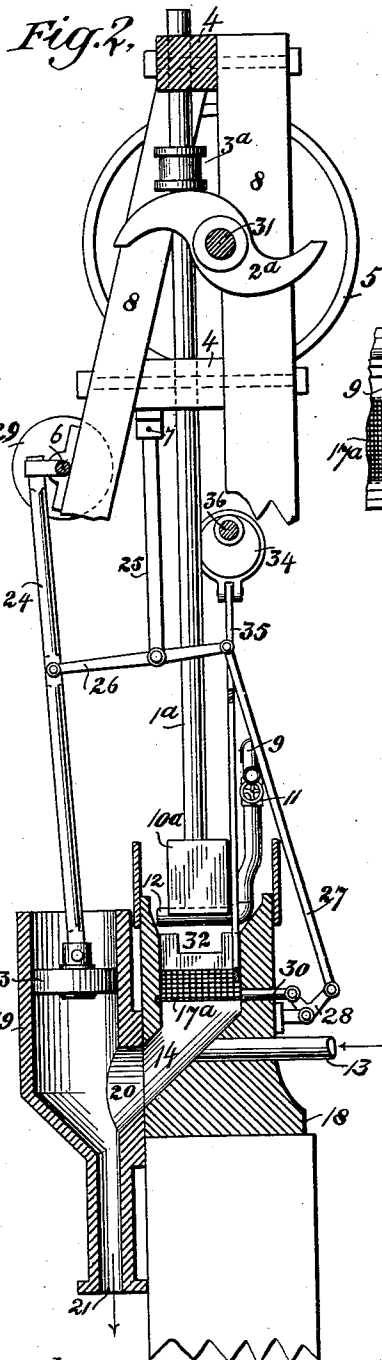
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Inventor:-

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UNITED STATES PATENT OFFICE.

EDWARD D. SELF, OF SOUTH ORANGE, NEW JERSEY.

CRUSHING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 568,926, dated October 6, 1896.

Application filed July 27, 1894. Serial No. 518,709. (No model.)

To all whom it may concern:

Be it known that I, EDWARD D. SELF, of South Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Crushing Apparatus, of which the following is a specification.

In the use of many of the constructions heretofore designed for crushing purposes fine material is retained beneath the crushing surfaces to such an extent that it becomes excessively comminuted, resulting, oftentimes, in the production of a large amount of finer material, technically known as "slimes" or "fines." Frequently these slimes or fines contain a large percentage of valuable mineral which it is difficult to concentrate or separate subsequently.

The object of my invention is to decrease as much as possible the production of this excessively fine material or slimes. To this end I separate the fine material from the larger pieces by passing the crushed material over a series of sieves located contiguous to the crushing-surfaces.

I will describe a crushing apparatus embodying my invention, and then point out the novel features in claims.

In the accompanying drawings, in which similar figures of reference designate corresponding parts, Figure 1 is an elevation of a crushing apparatus embodying my improvement, certain parts being shown in section while certain other parts are wholly omitted. Fig. 2 is a cross-section taken on the line A A of Fig. 1. Fig. 3 is a plan view of the apparatus represented in Fig. 1. Fig. 4 is a perspective view of a die on an enlarged scale. Fig. 5 is an end view of a shaft, showing a number of cams affixed thereto in end elevation.

My improvement is especially applicable to the crushing of ores, and I have for the sake of illustration shown and described the same as embodied in a stamp-mill for crushing ores. I do not, however, confine myself to its application to this particular purpose nor to this particular construction, as it is applicable to crushing operations in general.

Referring to the drawings, 10 10^a 10^b 10^c 10^d represent a series of stamp-heads secured at

the extremities of rods 1 1^a 1^b 1^c 1^d. As here shown, this series of stamp-heads comprises five units, but of course any suitable number may be used. These stamp-heads 10 10^a 10^b 10^c 10^d and rods 1 1^a 1^b 1^c 1^d are suitably supported in a framework to have a vertically-reciprocating movement. As here shown, this framework comprises uprights 8 8 and cross-bars 4 4. Dies 15 15^a 15^b 15^c 15^d are placed on a suitable foundation 18 to coact with the respective stamp-heads 10 10^a 10^b 10^c 10^d.

The ore to be crushed preferably passes to the apparatus by means of the chute 16, which delivers it to the first (see 10) of the series of stamp-heads, between which and its corresponding die the ore is crushed.

The stamps are shown as having a rectangular cross-section, although other shapes may be used. The dies are intended to be arranged one beyond the other, and with pockets between adjacent dies, which pockets are extended laterally as chutes beyond the line of the dies. Such laterally-extending chutes are shown at 14. Over these pockets and extending between the adjacent dies 15 15^a 15^b 15^c 15^d are spread a series of screens or sieves 17 17^a 17^b 17^c.

At 23 is shown a series of pistons adapted to reciprocate in corresponding cylinders 19. Each cylinder 19 communicates with a corresponding chute 14 through an opening 20. A shaft 6, journaled in suitable bearings attached to the framework, is provided with a number of cranks, through which cranks and connecting-rods 24 a reciprocating motion may be communicated to the respective pistons 23. The shaft 6 may be driven through a pulley 29, secured to the shaft. For facilitating a freer movement of the material over the screens 17 17^a 17^b 17^c a vibrating movement may be imparted to them. For this purpose the screens are suitably supported, and to each screen or seive there is secured a rod 30, which is attached at its opposite end to one arm of one of a series of bell-crank levers 28. The bell-crank levers are vibrated by means of the several connecting-rods 24 through the intermediate links 26 27. Each pair of links 26 and 27, transmitting motion from a connecting-rod 24 to a bell-crank le-

ver 28, is suspended from the frame of the apparatus by a vibrating hanger 25, pivoted at 7.

At 33 are shown scrapers, one for each of the screens 17 17^a 17^b 17^c 17^d, and each operated by a suitable eccentric 34 and eccentric-rod 35 from the shaft 36. This shaft may be driven in any suitable manner, as through a pulley 37.

The stamps may be operated by any desired method. A method commonly employed is shown where tappets 3 3^a 3^b 3^c 3^d are attached to the respective rods 1 1^a 1^b 1^c 1^d. These tappets are operated by cams 2 2^a 2^b 2^c 2^d, which are preferably of different radii, or, in other words, of different throw, lifting the several stamps to different heights, and they are attached to the shaft 31 and designed to raise the tappets, and consequently the stamps, to such heights as experience may indicate as affording the most efficient blow for the size of grains passing under the stamps. This is clearly shown in Fig. 5, which represents an end view of shaft 31, showing the cams 2 2^a 2^b 2^c 2^d affixed thereto in end elevation. Shaft 31 may be conveniently driven by a pulley 5.

The dies 15 15^a 15^b 15^c 15^d are each provided with a groove 32, running through their upper surface from one side of the die to the other. This formation of the die is best shown in Fig. 4.

After leaving the first stamp-head 10 the material passes over the screen or sieve 17. The fine portion of the heavy material passes through the screen into the chute 14 and escapes through channel 21, with which each chute is provided. The pieces too large to go through the interstices of the screen pass on between the second head 10^a and die 15^a. To assist in this passage of the material over the screens the latter may be inclined and the dies arranged one below the other upon a series of steps descending from one side of the foundation to the other.

When a substance composed of ingredients of different friability is crushed, there may be produced a certain amount made up of fine pieces of heavy specific gravity which passes through the sieve, as described. There is also produced fine material of lighter specific gravity which it may be desired to separate from the pieces of heavy material having approximately the same size. To effect this separation, the pistons hereinbefore mentioned are utilized for producing upward currents of water or other fluid through the sieves and superincumbent material, the lighter material thereby being carried across the screens, while the heavy grains of the same size pass through the screens and are finally discharged at the channels 21. The material crushed between any stamp and its die passes onward to the next screen, where the heavy fine material passes through the screen downward and outward through channel 21. The larger material, which cannot pass through

the interstices of the screen, passes onward between the next stamp and die. Furthermore, the light fine material, being prevented from passing downward through the screen by the upward currents of fluid produced by piston 23 through the opening 20 and the chute 14, is carried along by the said currents to the next stamp, where the process is repeated, and so on, as many times as the character of the ore or the amount of friable material contained in it may make it desirable.

The heights of the dies 15 15^a 15^b 15^c 15^d decrease as the ore reaches them in finer condition. The dies are each provided with a groove 32, through which the material passes under the stamp-head, and which prevents the stamp-heads from coming in contact with the top of the die, thus producing fines, and allows the escape of the finely-crushed material which would otherwise be further crushed by the successive blows of the stamp.

The passage of the ore through the apparatus may be further aided by means of a current of water or other fluid introduced by a pipe 9, from which extends a jet-pipe 12 for each stamp. Cocks 11 may be introduced in the connecting-pipes to control the flow through the jet-pipes. The velocity of the fluid upward through the screens may be controlled by other fluid introduced into the chutes through pipes 13.

The material that passes through the discharge-outlets 21 may be led to any convenient place for further treatment, as also the material leaving the last stamp.

The foundation may be of any suitable material and design. As here shown, it, for example, may consist of a timber structure, upon which rests the mortar-piece 18.

As I do not confine myself to any specific number of stamps, I may make use of but one. In such a case the screens are preferably arranged on different sides of the stamp contiguous thereto, being, for example, grouped around the stamp upon four sides. The crushed material from the stamp after passing over the screens may be led to any convenient place for further treatment.

I preferably time the descent of the stamp-heads relatively to each other to facilitate the movement of material from one side of the apparatus to the other.

Having described my invention and its method of operation, what I claim as novel, and desire to secure by Letters Patent, is the following:

1. An ore-crushing apparatus having a mortar comprising successive dies and stamps, and having screens over which the crushed material passes intermediately of the successive dies and stamps, in combination with an apparatus for producing upward currents of a fluid through the screens substantially as specified.

2. In a stamp-mill, the combination with a mortar and stamps of dies arranged in series and provided with grooves through which

fine material may pass, the grooves decreasing in depth as the ore reaches them in finer condition, substantially as specified.

3. In an ore crushing and separating apparatus, the combination of a number of stamps arranged in series, dies for said stamps provided with grooves decreasing in depth as the ore reaches them in finer condition, screens intermediate of the dies and supply-pipes for introducing currents of water into the apparatus, substantially as specified.

4. In an apparatus for separating substances of different specific gravities, the combination with crushing-surfaces and intermediate screens, of an apparatus for producing an upward flow of a fluid through the screens, and over the dies, whereby the finer, lighter material is prevented from passing through the screens, substantially as specified.

5. In a stamp-mill, the combination with a series of dies, of a motor supporting said dies and having a series of passage-ways extending through it to the spaces between the dies, the passage-ways being adapted to convey currents of a fluid, substantially as specified.

6. In a stamp-mill, the combination with a series of stamps and corresponding dies of a series of screens interposed between the dies over which the crushed material passes, reciprocating rods and connecting linkwork 25, 26, 27, and 28 for transmitting motion

from the rods to the screens, substantially as specified.

7. In an apparatus for crushing and separating ores, the combination of a series of stamps, means for raising the successive stamps to different heights decreasing as the material passes through the apparatus, dies for the stamps, screens intermediate of the dies and means for producing upward currents of a fluid through the screens, substantially as specified.

8. In an apparatus for crushing ore the combination of a series of stamps and corresponding dies, the dies being provided with grooves extending lengthwise of the apparatus, substantially as specified.

9. In an apparatus for separating substances of different specific gravities, the combination of a series of stamps and corresponding dies arranged adjacent to each other, screens intermediate of these dies and means for producing an upward intermittent or pulsating current through the screens, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD D. SELF.

Witnesses:

ANTHONY GREF,
PIERSON L. WELLS.