W. M. MUELLER.

CRUSHING MILL.

APPLICATION FILED MAR. 13, 1907.

899,176. Patented Sept. 22, 1908.

2 SHEETS—SHEET 1.

Fig. 2.

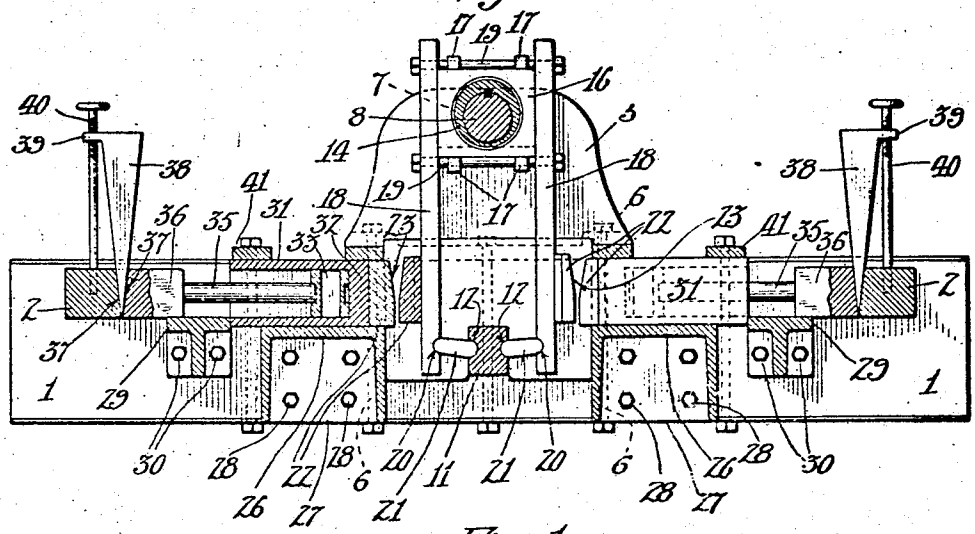
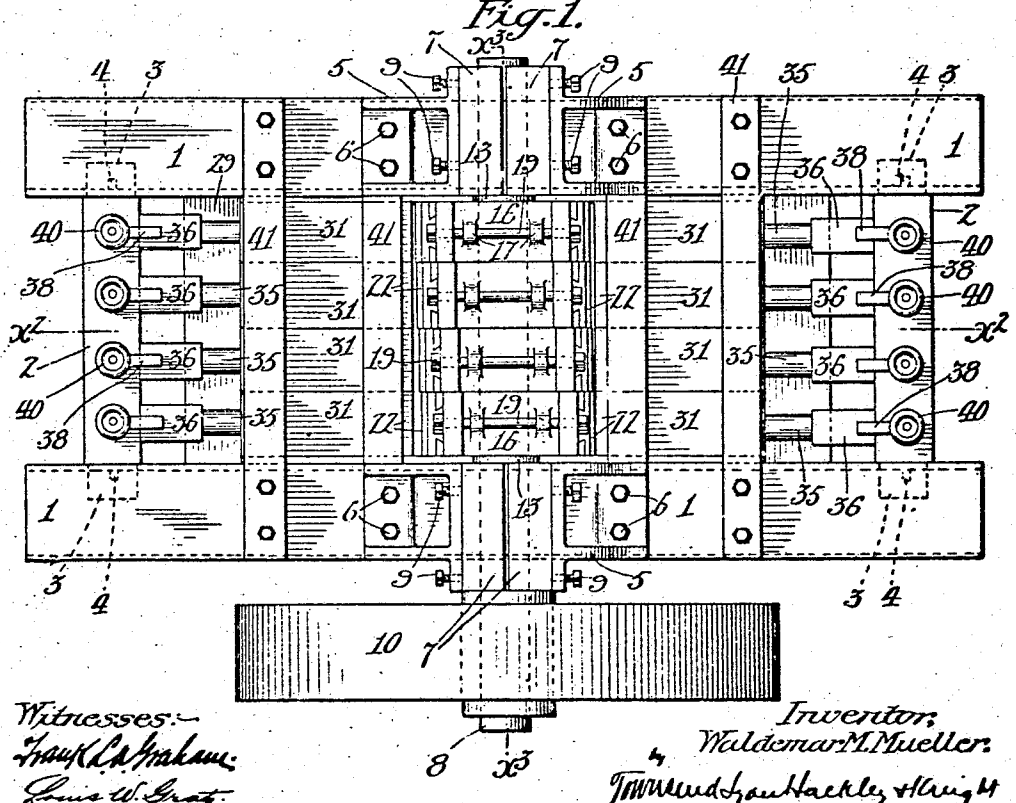


Fig. 1.



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Louis W. Gratz.

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THE NORRIS PETERS CO., WASHINGTON, D. C.

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2 SHEETS—SHEET 2.

Fig. 3.

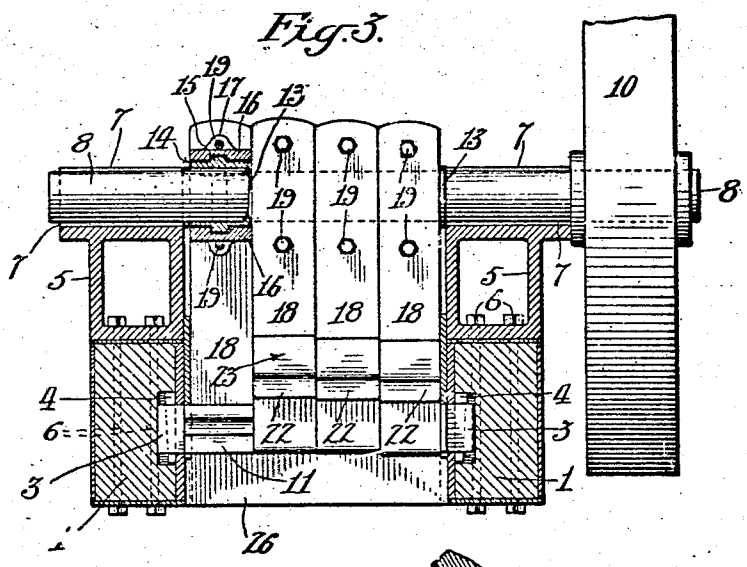


Fig. 4.

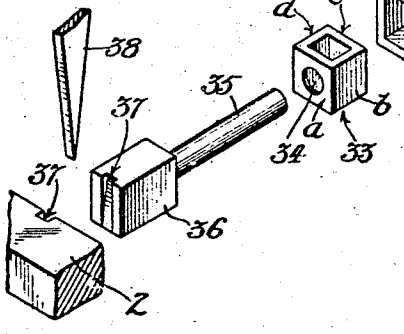


Fig. 5.

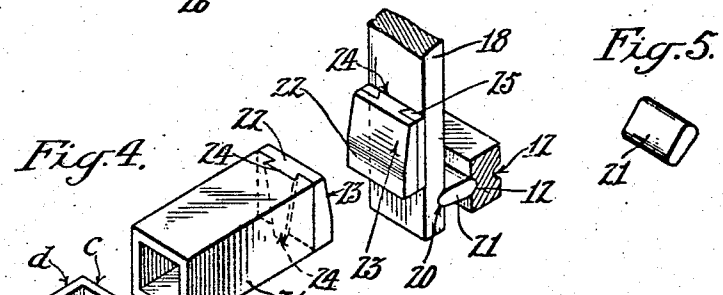
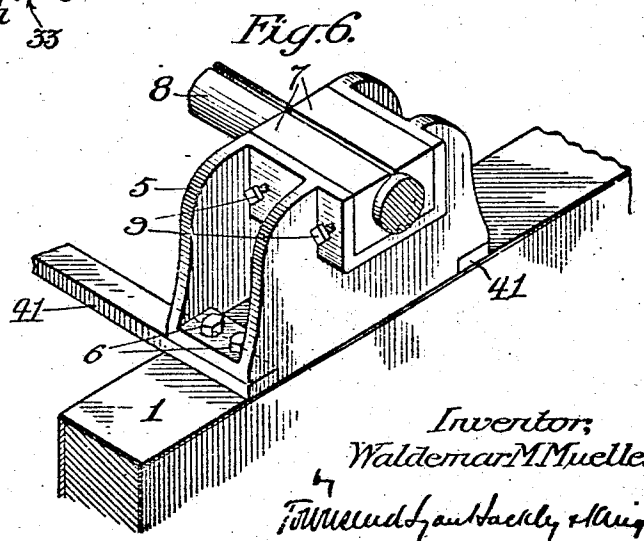


Fig. 6.



Witnesses:-

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THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WALDEMAR M. MUELLER, OF LOS ANGELES, CALIFORNIA.

CRUSHING-MILL.

No. 899,176. Specification of Letters Patent. Patented Sept. 22, 1908.

Application filed March 13, 1907. Serial No. 362,237.

To all whom it may concern:

Be it known that I, WALDEMAR M. MUELLER, a citizen of the United States, residing at Los Angeles, county of Los Angeles, and State of California, have invented new and useful Improvements in Crushing-Mills, of which the following is a specification.

This invention relates to crushing mills, and the main objects of the invention are to provide a simple and strong crushing mill of great durability which can be taken apart and readily transported and put together.

Another object is to provide a construction in which screws and bolts are dispensed with as much as possible.

Other advantages of the invention reside in details of construction, arrangement and combination, as will appear in the following description.

Referring to the drawings:—Figure 1 is a plan view of the machine. Fig. 2 is a vertical section on line x^2—x^2 Fig. 1. Fig. 3 is a cross section on line x^3—x^3 Fig. 1. Fig. 4 is a perspective view, showing in detail a stationary shoe support and its train of related regulating parts slightly separated in the order in which they are assembled, the lower portion of a rocking shoe and its arm being also shown. Fig. 5 is a perspective of a fulcrum link. Fig. 6 is a perspective in detail, of a journal bracket and adjacent parts.

1 designates a pair of beams each of which is preferably constructed of wood with an iron or steel surface armor, by the use of which rigidity and strength are secured without undue weight. The beams 1 are connected together near their ends by a pair of cross bars 2, each cross bar having a tongue 3 which passes through a slot in the armor of the beams 1, and is secured by a key 4 passing through the tongue and lying close against the armor, as clearly shown in Figs. 1 and 3.

Journal brackets 5 are mounted above the beams 1 and are secured thereto by long bolts 6, as shown in Fig. 3, which pass completely through the beam 1. Mounted in each bracket 5 is a split bearing sleeve 7, the two sections of which are arranged on opposite sides of a vertical line through the center of the journal, and mounted in the split sleeves 7 is a shaft 8. The sleeves 7 are held in place by screws 9, which afford means for taking up wear. The shaft 8 carries a fly-wheel 10.

A fulcrum bar 11 extends across between the beams 1 and is provided on each side with a concave groove 12, the fulcrum bar being secured to the beams 1 by tongues 3, and keys 4 similar to those of the cross bars 2. Keyed to the shaft 8 is a sleeve 13 which is provided with a series of eccentrics 14, the eccentrics being preferably formed integral with the sleeve, and in the present embodiment four eccentrics are employed, each eccentric, as shown in Fig. 3, having a central flange 15. Mounted on each eccentric is a split head-block 16, each section of which is provided with upper and lower lugs 17, and secured to each head-block by means of bolts 19, is a pair of operating arms 18, the bolts passing through the arms 18 and through the lugs 17, thus holding the two sections of the head-block together and holding the arms 18 in position thereon. Each operating arm 18 near the lower end is provided with a transverse concave groove 20 similar to the grooves 12 in the fulcrum bar 11. The lower end of each operating arm 18 has an operative connection with the fulcrum bar 11 by means of a solid fulcrum rocker or link 21 having rounded ends as shown in detail in Fig. 5, which link engages in the concave groove 20 in arm 18, and concave groove 12 in fulcrum bar 11. Near the lower end of each operating arm 18 is a crushing shoe 22, the upper portion of which has a sloping face 23, the crushing shoe being detachably fastened to the operating arm 18 by means of a wedge-shaped dove-tail 24 which engages in a correspondingly shaped socket 25 on the operating arm 18. Each crushing shoe may thus be quickly detached and replaced by a new one when necessary.

Extending across between the beams 1 are two tables 26 which, for strength, are U-shaped in cross section, as shown in Fig. 2, and have end plates 27 through which fastening bolts 28 pass to secure the tables to the beams 1. Auxiliary tables 29 are provided slightly back of each table 26, each table 29 being T-shaped in cross section, as shown in Fig. 2, and being fastened by bolts 30 to the beams 1. Resting upon each table 26 are four shoe holders 31, shown in detail in Fig. 4, each shoe holder being hollow but having a solid end 32 which is provided with a dove-tail socket 24 similar to the dove-tail sockets on the operating arms 18, and a similar crushing shoe 22 is carried by each shoe holder 31. Within each shoe holder 31, abutting against the head 32, is a safety block 33 which is hollow, as shown, and has four solid faces *a*, *b*,

c, *d*. Each face *a* and *c* is puncturable being provided with a shallow pocket 34, while the faces *b* and *d* are plain although they might also be provided with such pockets if desired. A resistance pin 35, having a head 36, is mounted back of each safety block 33, the end of the pin 35 resting in the adjacent pocket 34, and the head 36 resting upon the table 29. The rear face of each head 36 is provided with an inclined groove 37, and the cross bars 2, before described, are provided with a series of corresponding grooves 37, and engaging in the grooves 37, between the heads 36 and the cross bars 2, are wedges 38 each having a lug 39 through which passes an adjusting screw 40, the lower end of which screw is swiveled in the cross bar 2. The wedges 38 provide a strong and simple means of adjusting the position of the shoe holders 31 to give the necessary space between the crushing shoes 22, while the screws 40 prevent the wedges 38 from working down and forcing forward the shoe holders 31. If the wedges 38 were not supported, the jar of the machine would cause the wedges 38 to gradually creep down and force forward the resistance pins 35, and thus advance the shoe holders 31. The shoe holders 31 are held down upon the tables 26 by straps 41.

In operation, as the shaft 8 rotates the eccentrics impart a combined reciprocatory and rocking motion to the operating arms 18, the lower ends of the arms 18 easily partaking of the necessary two combined movements of rocking and moving bodily by reason of the fulcrum links 21. Ore or rock to be crushed is fed to each set of crushing shoes, and as one set of crushing shoes is opened up ore falls between them, and as they close the ore is crushed by the operation of the adjacent crushing shoes. The crushing shoe which is carried by the operating arm 18 has a substantially vertical movement and also a rocking movement, and the combination of these two movements results in effectively crushing the ore. As the movable crushing shoe retracts from the stationary shoe it partakes first of a slight vertical raise and then of a downward movement which facilitates the movement of crushed ore past the shoes as well as facilitating the crushing operation itself.

It will be noted that a large amount of friction has been eliminated by the method of articulating the lower ends of the operating arms 18, and yet a very strong construction is provided. The relative movement between the rounded ends of each fulcrum block 21, with their coacting parts, is very slight and there is thus little friction even though the fulcrum link is under a heavy compression strain, whereas in other constructions of this type of mill in which the lower ends of the arms 18 slide along a support, there is a great amount of friction developed. Thus the present construction enables the mill to be operated with less power and with less wear of the parts.

If in operation anything should be fed to the crushing shoes which the latter were unable to crush, the resisting shoe holder 31 would sustain an extraordinary backward pressure, as the movable shoe can not yield, and this strong back pressure on the shoe holder would result in forcing back the associated safety block 6, causing the resistance pin 35 to puncture the wall *a* at the pocket 34, whereupon the shoe holder and safety block together with the crushing shoe would be moved back for quite a distance until the end of the resistance pin 35 contacted with the wall *c* of the safety block, and this yielding movement would obviously in many instances prevent great damage to the machine and moreover would not necessitate the mill being stopped, as the interfering non-crushable piece would fall through between the jaws upon the backward movement of the shoe holder. When the wall *a* has been thus punctured the safety block is slipped out from the shoe holder and reversed so that its wall *a* rests against head 32, and its non-punctured face *c* is placed in conjunction with the resistance pin 35. After the wall *c* has been punctured in similar manner, the safety block may be replaced by another one, or as is obvious the faces *b* and *d* could serve in their turn, although with both walls *a* and *c* punctured it would be preferable to substitute a new safety block as the punctured walls *a* and *c* would probably not give sufficient supporting strength to the other walls. Obviously the walls of the safety block are made sufficiently strong to stand the ordinary heavy crushing pressure, but are made with a limited margin of strength such that an extraordinary pressure will result in a puncture and thus relieve the mill from strain or breakage.

What I claim is:—

1. In a crushing mill, crushing shoes, means for producing a relative movement between the shoes, means for resisting the retraction of a shoe including a hollow safety block having a plurality of puncturable faces, and a resistance pin abutting against one of the puncturable faces.

2. In a crushing mill, a frame provided with a fulcrum bar and two tables upon each side thereof, a hollow shoe holder upon one of said tables, one end of which is open and the other end is provided with a crushing shoe, a safety block in said holder, a pin adjustably mounted on the other table at one end with its opposite end in engagement with said block, a cam shaft, a head block thereon, two arms secured at their upper ends to said block and having their lower ends, one upon each side of said fulcrum bar, each arm being provided with a crushing shoe opposite one

of the shoes on said holders, and a link engaging with each bar and the fulcrum bar.

3. In a crushing mill, a shoe holder, a crushing shoe carried thereby, a movable crushing shoe, a hollow safety block in said shoe holder, a resistance pin abutting against said safety block, a head on the resistance pin, a stationary bar, and a wedge between said bar and head for adjusting said resistance pin and shoe holder.

4. In a crushing mill, a frame comprising a pair of metal armored beams, cross braces connecting said beams, each cross brace having a tongue projecting through the metal armor, a key passing through each tongue back of the armor, journal brackets bolted to said beams, a shaft mounted in the journal brackets, a cam keyed on said shaft, a plurality of heads mounted on the respective cams, each head being split and having lugs, a pair of operating arms for each head, bolts passing through the operating arms and lugs of each head, thus securing the arms and head together on the associated eccentric, the other ends of the arms having concave grooves, a fulcrum bar having concave grooves in opposite faces, fulcrum blocks having rounded ends interposed between the fulcrum bar and the operating arms and engaging in said concave grooves, crushing shoes carried by the operating arms, and stationary adjustable shoes for coöperating with the first named shoes.

5. In a crushing mill, a frame provided with a fulcrum bar and a recessed cross bar on each side thereof, supports between said bars and the fulcrum bar, oppositely located shoe holders on said supports, a removable shoe on the inner end of each holder, a pin for each holder having a recessed head to register with one of the recesses in said bars, a wedge for each pair of registering recesses, means for adjusting said wedge, a shaft above the fulcrum bar provided with a plurality of cams, one for each pair of oppositely located removable shoes, a pair of depending arms for each cam having their lower ends, one upon each side of the fulcrum bar, each arm being provided with a crushing shoe, and a link between each arm and the fulcrum bar.

In testimony whereof, I have hereunto set my hand at Los Angeles California this 23d day of January 1907.

WALDEMAR M. MUELLER.

In presence of—
GEORGE T. HACKLEY,
FRANK L. A. GRAHAM.