

No. 672,616.

Patented Apr. 23, 1901.

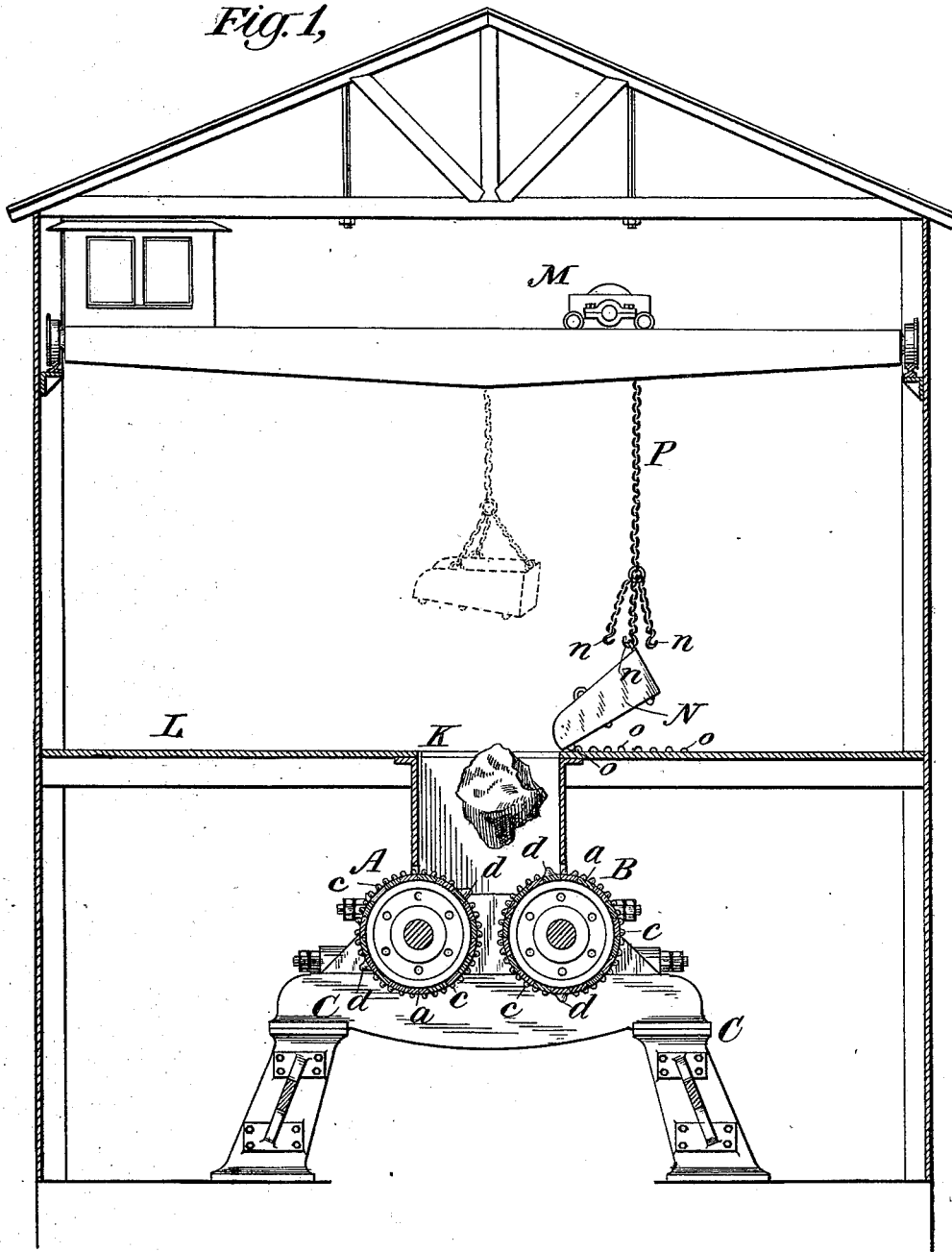
T. A. EDISON.
METHOD OF BREAKING ROCK.

(Application filed July 16, 1897.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1,



WITNESSES:

D. H. Raymond
Jno. A. Taylor

INVENTOR

Thomas A. Edison
BY
Jyer & Driscoll
ATTORNEYS

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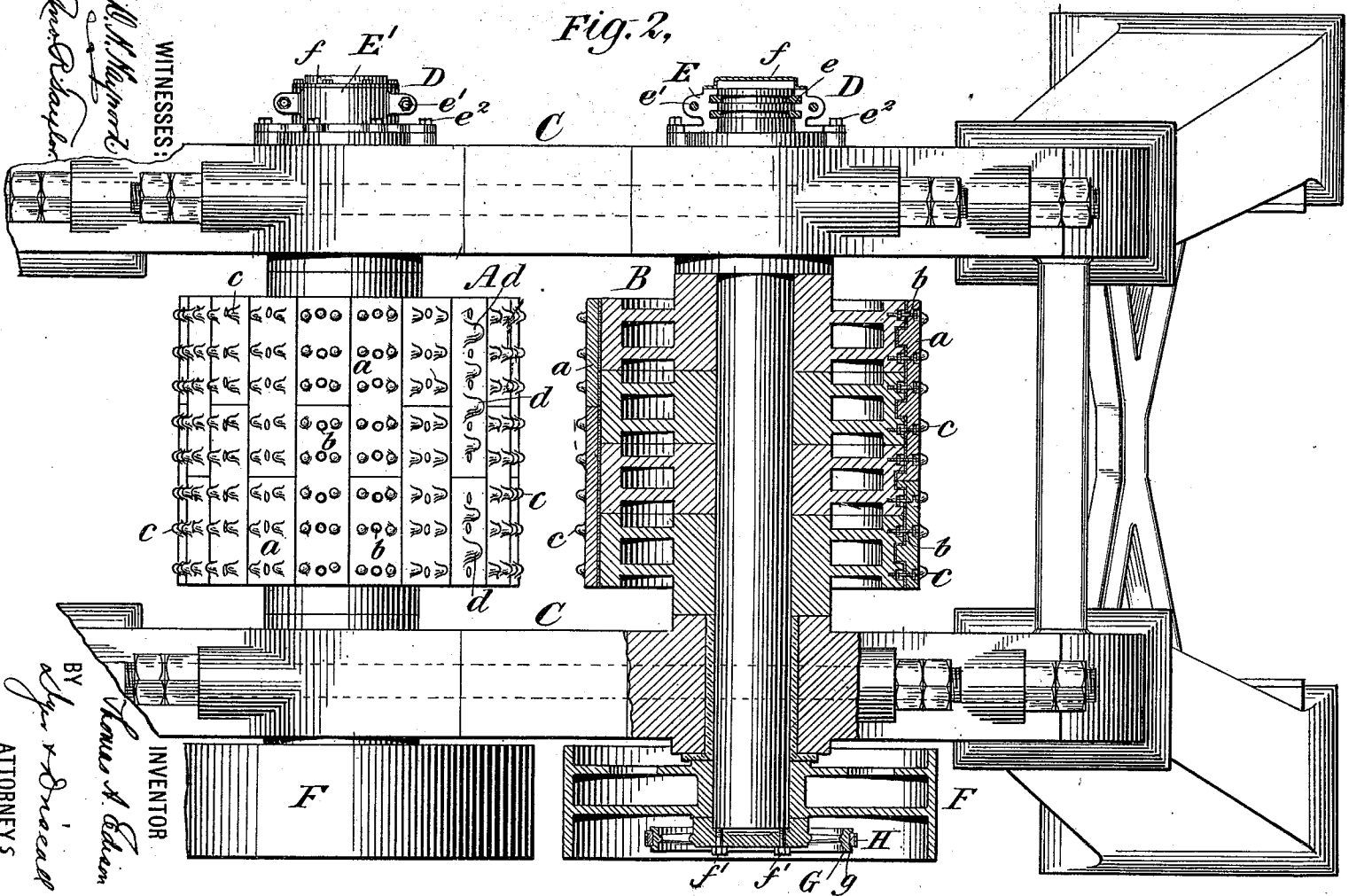
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(No Model.)

3 Sheets—Sheet 2.



WITNESSES:
W. H. Hayward
James D. Hayden

INVENTOR:
Thomas A. Edison
BY
Oliver S. Brown
ATTORNEYS

THE MORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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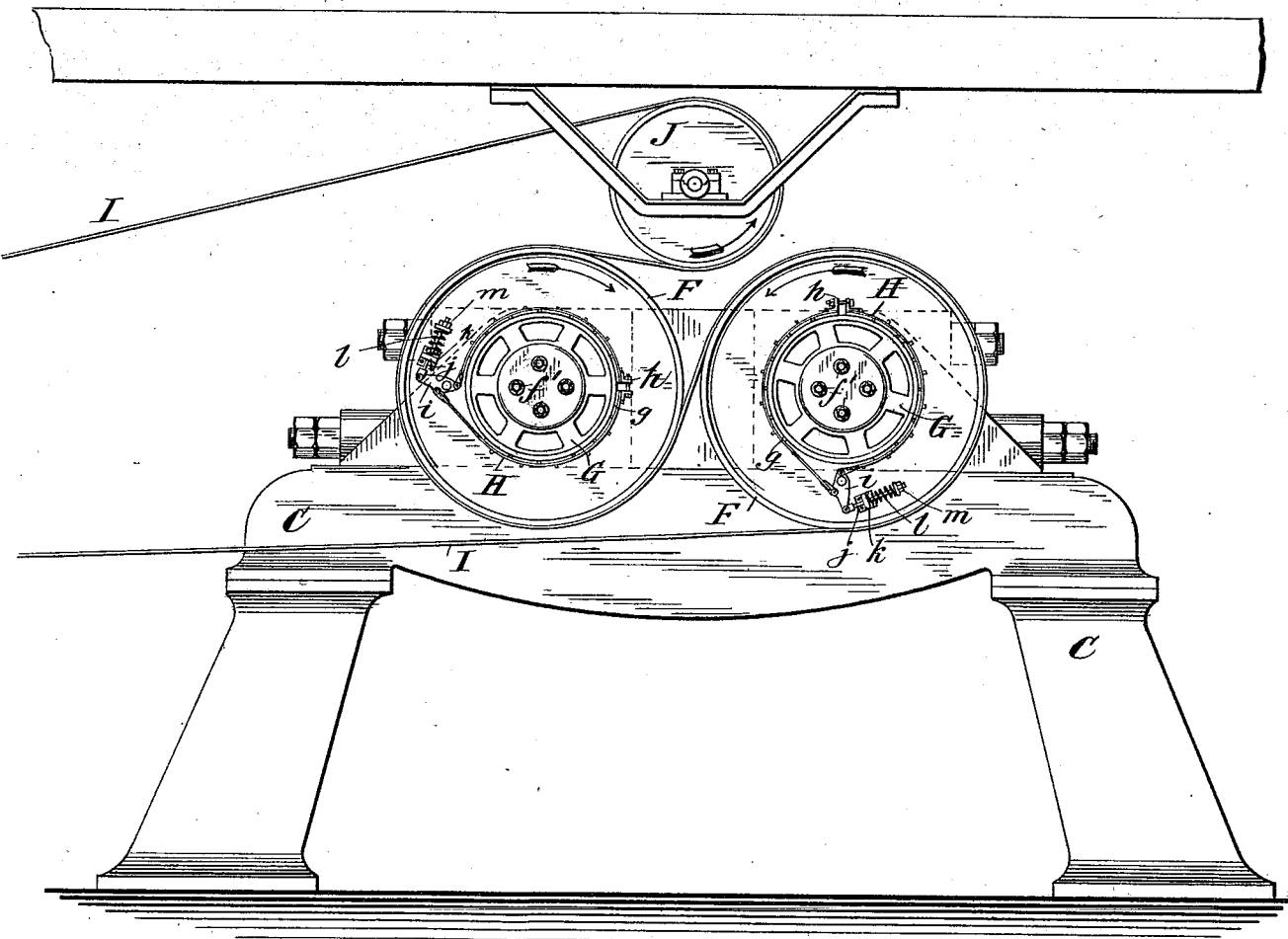
T. A. EDISON.
METHOD OF BREAKING ROCK.

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(No Model.)

3 Sheets—Sheet 3.

Fig. 3.



WITNESSES:

W. H. Hayward
Geo. P. Sawyer

INVENTOR

Thomas A. Edison

BY

Wm. & Duval
ATTORNEYS

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

METHOD OF BREAKING ROCK.

SPECIFICATION forming part of Letters Patent No. 672,616, dated April 23, 1901.

Application filed July 16, 1897. Serial No. 644,747. (No specimens.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Methods of Breaking Rock, (Case No. 977,) of which the following is a specification.

In the mining and milling of ore in the form of rock a very considerable expense has been added to the cost of the mining operations by the necessity for blasting and sledging the pieces of rock, so as to reduce them in size to the point where they can be handled by stone-crushers or stamp-mills, such as are at present employed.

The object of my invention is to produce a method for the breaking of rock which will be simple and effective, will not require the hand-sledging or blasting of the rock down to pieces of moderate size, and will involve the consumption of a small amount of power.

In carrying out my invention I employ a pair of rolls of massive size and weight and having suitably roughened or irregular surfaces—the irregular surface, for instance, being formed by providing the rolls with projections or knobs, which is the preferred construction. To these rolls I apply a small power sufficient to gradually run the rolls up to a high speed when no work is being done, but which power may not be sufficient to start the rolls from a state of rest. The rolls are mounted side by side in a suitable frame and have a wide gap between their opposing surfaces. The rolls run in opposite directions, so that the movement of the irregular surfaces is toward each other on the top of the rolls and downward through the gap. After the rolls acquire their full speed a large piece of rock or several pieces carried by a skip will be elevated by a suitable crane over the rolls, and the skip being dumped, the rock, guided by a hopper, will fall upon the rolls over the gap. The effect is to almost instantaneously partially arrest the motion of the rolls, effecting within a fraction of a second a considerable reduction in their speed, and thereby developing or expending an enormous amount of energy, which cracks the rock and breaks it into sizes small enough to pass through the gap. In order to permit this reduction in the

speed of the rolls, I prefer to apply the power to the rolls through slipping friction-clutches, which slip without materially reducing the speed of the driving-pulleys; but it is evident that the same result can be accomplished, although not so conveniently, by employing any suitable device for disconnecting the rolls from the driving-shaft just before the rock is dumped upon the rolls and reconnecting them with the driving-shaft immediately after the rock is broken or even by maintaining the connection with the driving-engine of small power and allowing its speed to be reduced with that of the rolls. While another skip is being elevated into position for dumping, the rolls will be gradually run up to their full speed. The time required to attain full speed after a rock has been broken is of course many times that required to break the rock. This interval of time is afforded by the hoisting of another skip and bringing it into position for dumping. The power applied to the rolls will be sufficient to enable them to regain their speed during this interval.

As an illustration of an efficient embodiment of my invention I will say that the pair of giant rolls which I have built and operated have, including all moving parts, a combined weight of one hundred and sixty-seven thousand pounds. Each roll is six feet in diameter and five feet long, and the gap between the rolls is fourteen inches. These rolls are given a surface speed of about four thousand feet per minute. The speed of the driving-belt, which operates through slipping friction, is practically constant; but the speed of the rolls is reduced about ten per cent. in the breaking of a rock and during a fraction of a second, while an interval of from twenty to forty seconds is required for the rolls to recover their full speed. The friction employed is not sufficient to start the rolls from a state of rest, and consequently in starting hand-levers are employed. The energy of the blow which these rolls are capable of delivering is enormous. I may say that I have been able to break with these rolls single chunks of rock of the magnetic iron ore upon which I have been operating as large as six feet through and weighing as much as four or five tons. The rolls are faced with removable wearing-plates, which in the preferred con-

struction are provided with radially-projecting knobs, so that a rock in falling upon the rolls will be caught between the knobs on the approaching surfaces of the two rolls. Since
 5 a large rock presenting a flat surface might ride on these knobs if they were of uniform height, I provide at one or more points (preferably two points) in the diameter of each
 10 roll a line of larger knobs, which serve to sledge such a large rock and reduce it to such a size that it will be caught and finally forced through the rolls by the smaller knobs. This double operation of sledging by the larger
 15 knobs and then breaking by a rolling action with the smaller knobs makes the rolls effective for the breaking of pieces as large as the distance between the centers of the rolls.

In the accompanying drawings, forming a part hereof, Figure 1 is a side elevation and
 20 partial section representing the rolls and indicating the location of the crane for delivering the rock intermittently to the rolls. Fig. 2 is a top view of the rolls, one roll and its bearings being in section. Fig. 3 is a side
 25 elevation showing the friction-clutches for driving the rolls.

A and B are the two rolls, provided with removable wearing-plates *a*, which are secured by bolts *b*, Fig. 2. The wearing-plates have
 30 projecting knobs *c* of uniform height, and at opposite points in the diameter of each roll is a line of larger knobs *d*. The rolls are mounted in a suitable frame C. Upon the end of each of the roll-shafts is loosely mounted a pulley F.
 35 Outside of this pulley and secured by bolts *f'* to the end of the roll-shaft is a band-wheel G. Around each of these band-wheels is placed a band H, of steel, carrying friction-plates *g*, of soft iron. The band H may be divided and
 40 the two parts secured together by a bolt *h* to give adjustment. Carried by the outer face of each pulley F and pivoted thereto is a bell-crank *i*, which is secured on opposite sides of its pivot to the ends of the friction-band H.
 45 The extreme end of the bell-crank *i* is connected with the rod *j*, passing through a plate *k* and carrying outside of that plate a coiled spring *l*, whose tension is adjustable by means of a nut *m*. The driving-belt I extends from
 50 the driving-shaft to the rolls, and at the rolls passes over an idler J, located centrally above the two pulleys F. From this idler the belt I passes over one of the pulleys and then in the opposite direction over the other pulley
 55 and returns to the driving-shaft. The power applied through the belt I tends to drive the rolls in opposite directions, as indicated by the arrows, through the friction-bands H; but when a rock is dropped upon the rolls and their speed of rotation is partially arrested these friction-bands slip upon the band-wheels G, and after the rock has passed
 60 through the rolls the friction-bands continue to slip until the rolls are again brought up to
 65 speed.

Referring particularly to Fig. 1, the hop-

per K opens downwardly from the platform L, below which the rolls are located, and above this platform is located an electric crane M. The space between the platform L and
 70 the crane M is open at the front of the building. The rock to be broken is loaded on skips N, which are brought on cars to the front of the building opposite the space between the platform and the crane. The crane
 75 is run out over the cars and the hoisting-chain P is lowered and its three hooks *n* are attached to one of the loaded skips. The skip is carried by the hoisting-chain in a horizontal position, so as not to dump its load,
 80 and is hoisted to the position shown in dotted lines in Fig. 1, when the crane is run back over the hopper. The skip is then moved to one side of the hopper and lowered until it rests on the platform at one side of the hop-
 85 per. At this point the platform is provided with bars *o*, of wood, upon which the skip is lowered. The two forward hoisting-hooks attached to the sides of the skip are then detached from the skip by an attendant, and
 90 the crane then pulls up on the hoisting-chain. This lifts up the rear end of the skip and tilts it, so that its load is dumped into the hopper K, the point of the skip or its forward strengthening-rib engaging with one of the
 95 bars *o*, so that the skip does not slide forward. In Fig. 1 the skip is illustrated in full lines in the act of dumping its load. After the load is dumped the skip is again lowered onto the bars *o*, the forward hooks attached,
 100 and the skip raised and the crane moved, so as to place the empty skip again on the car, when the hoist-chain is attached to a loaded skip and the operation is repeated.

What I claim is—

1. The method of breaking rock consisting in causing two independently-driven and disconnected massive bodies to travel toward each other at a high speed, partially arresting the motion of such bodies by successively
 110 and periodically introducing charges of rock between them, thereby breaking the rock by kinetic energy, and restoring the speed of such bodies during the intervals, substantially as set forth.

2. The method of breaking rock consisting in driving a pair of independently-driven and disconnected massive rolls at a high speed by means of a small power capable of running the rolls up to speed when no work is being
 120 done, partially arresting the motion of the rolls by successively and periodically delivering charges of rock to them, thereby breaking the rock by kinetic energy, and restoring the speed of the rolls during the intervals,
 125 substantially as set forth.

This specification signed and witnessed this 14th day of May, 1897.

THOMAS A. EDISON.

Witnesses:

JNO. R. TAYLOR,
 EUGENE COURAN.