No. 672,617. Patented Apr. 23, 1901.

T. A. EDISON.

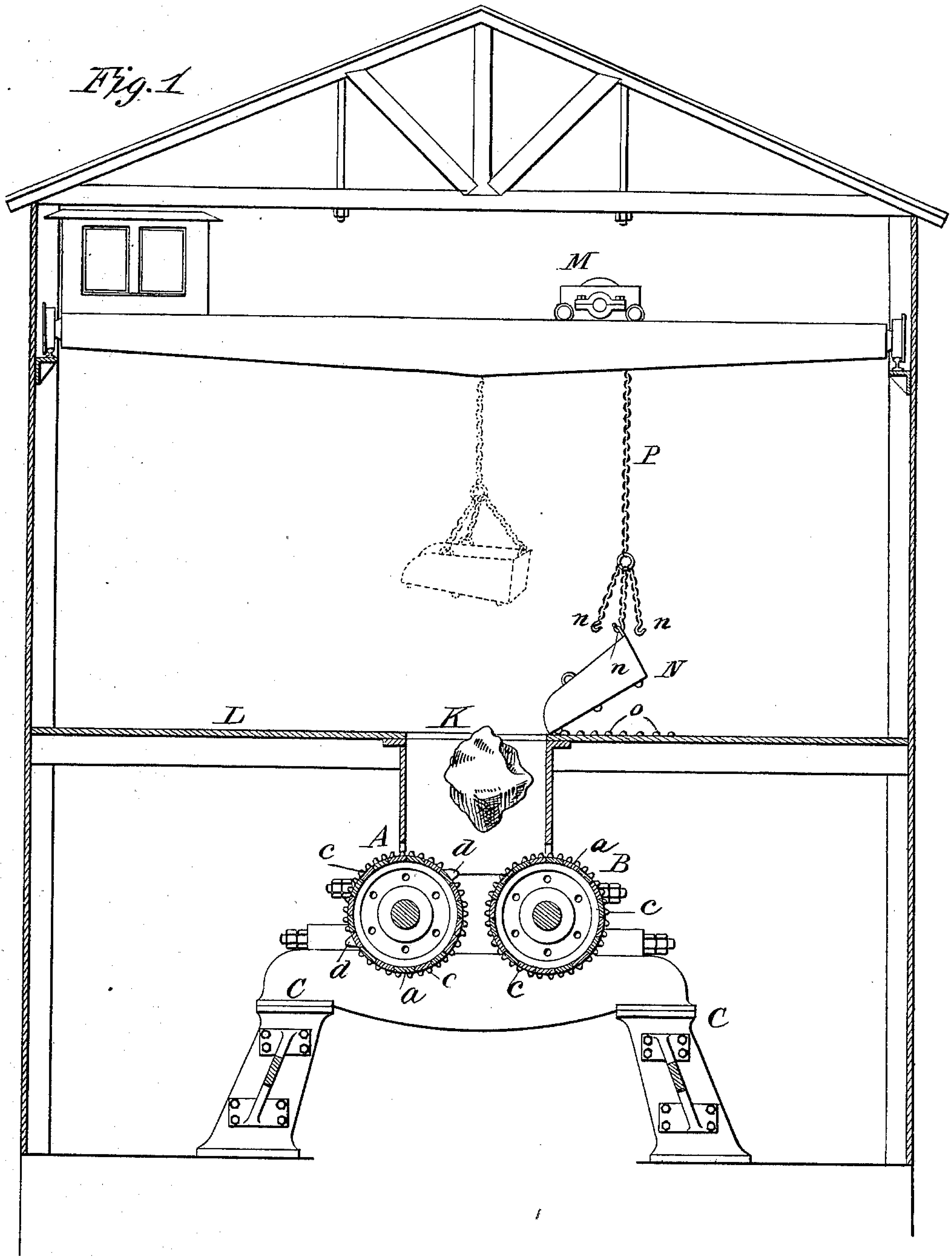
APPARATUS FOR BREAKING ROCK

(Application filed Aug. 9, 1900.)

(No Model.)

4 Sheets—Sheet 1.

Fig. 1



Witnesses:

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Jno. R. Taylor

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(No Model.) 4 Sheets—Sheet 2.

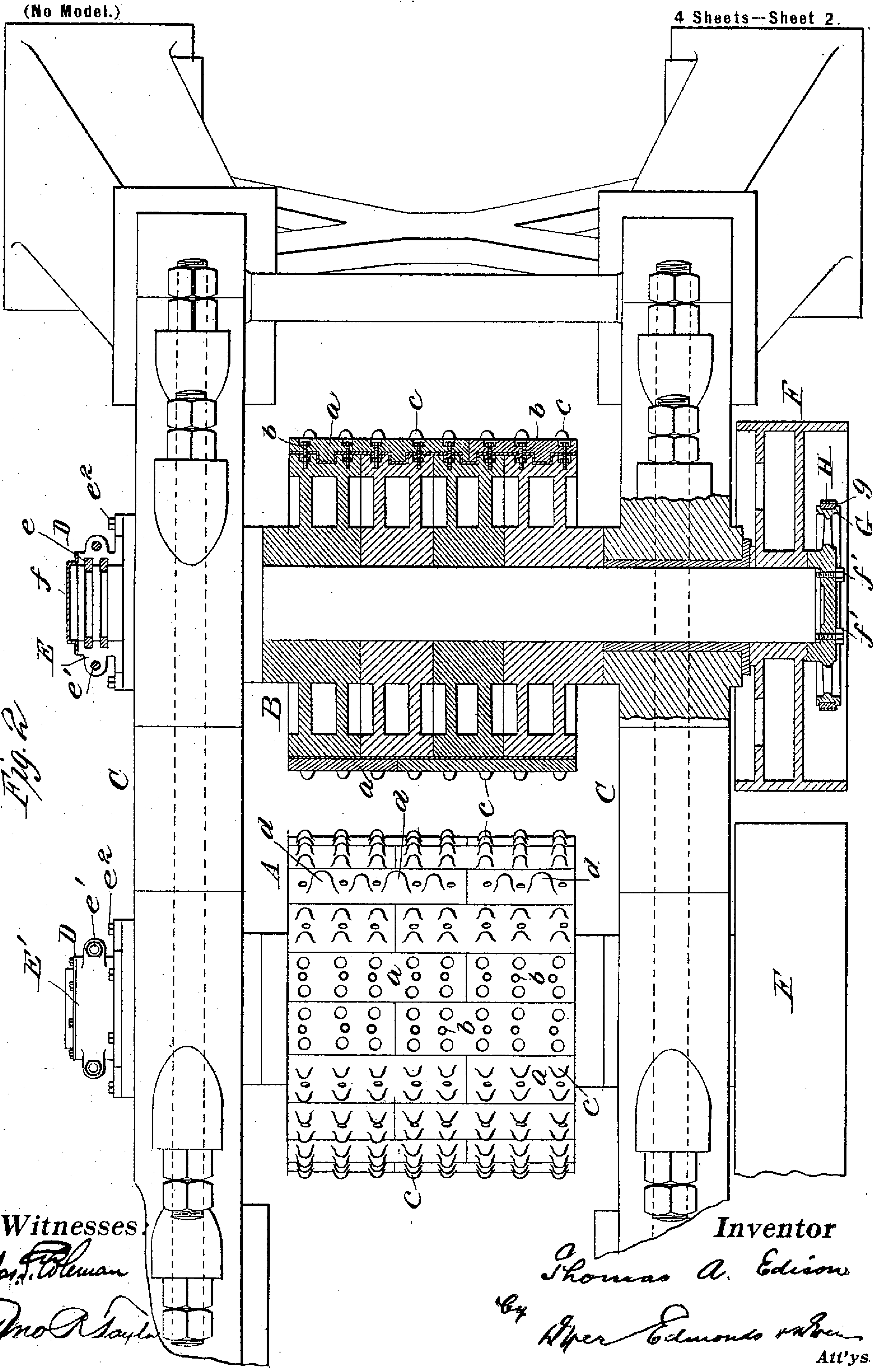

Fig. 2

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(No Model.) 4 Sheets—Sheet 3.

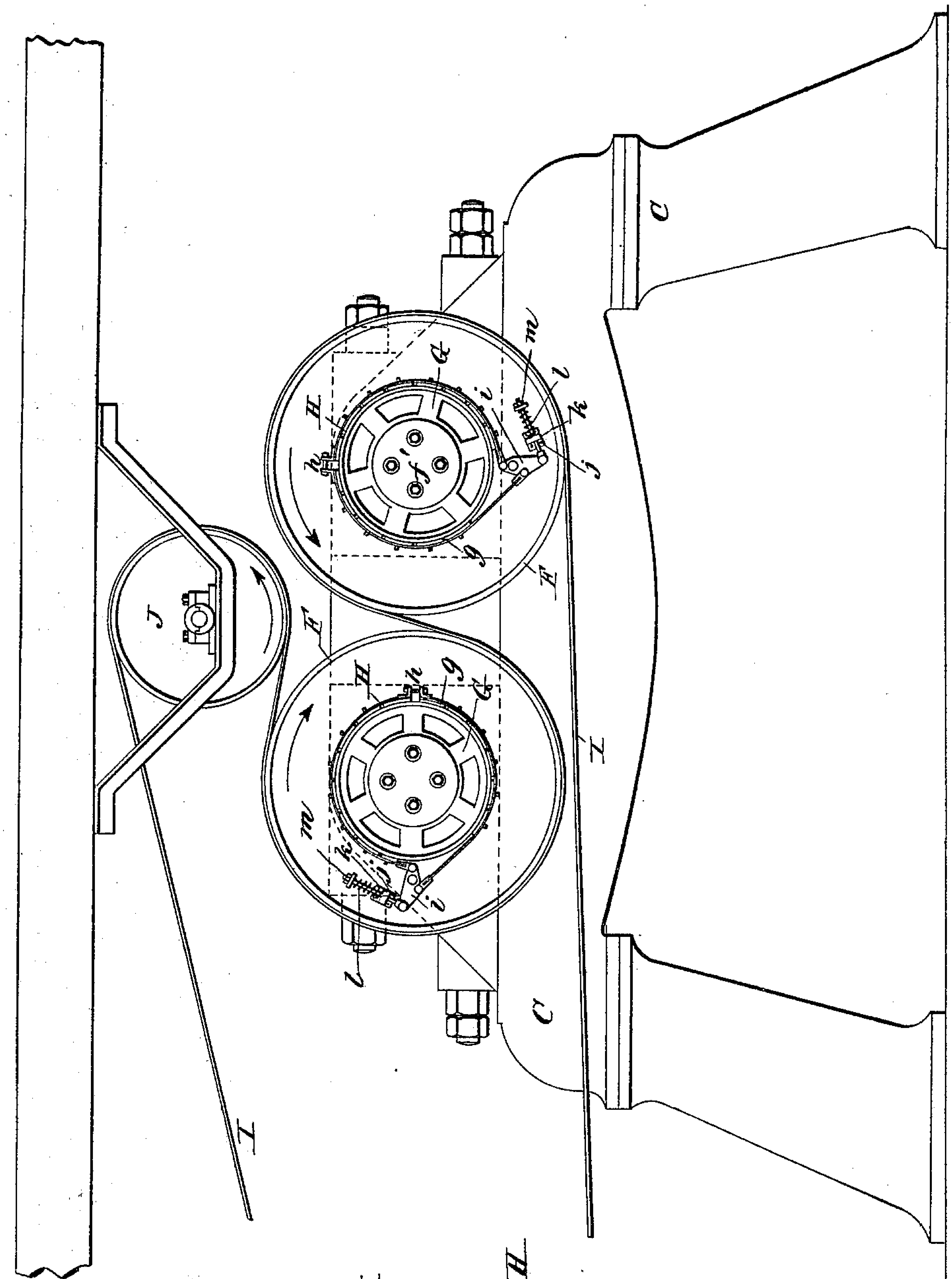

Fig. 3

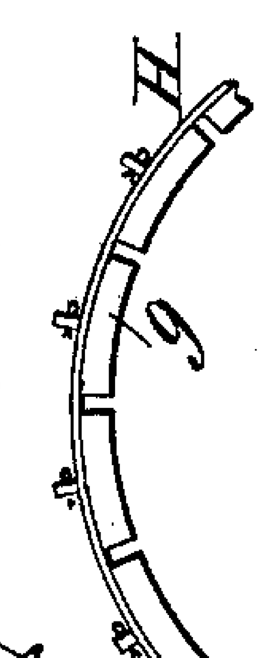

Fig. 6

Fig. 7

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(No Model.)

4 Sheets—Sheet 4.

Fig. 5

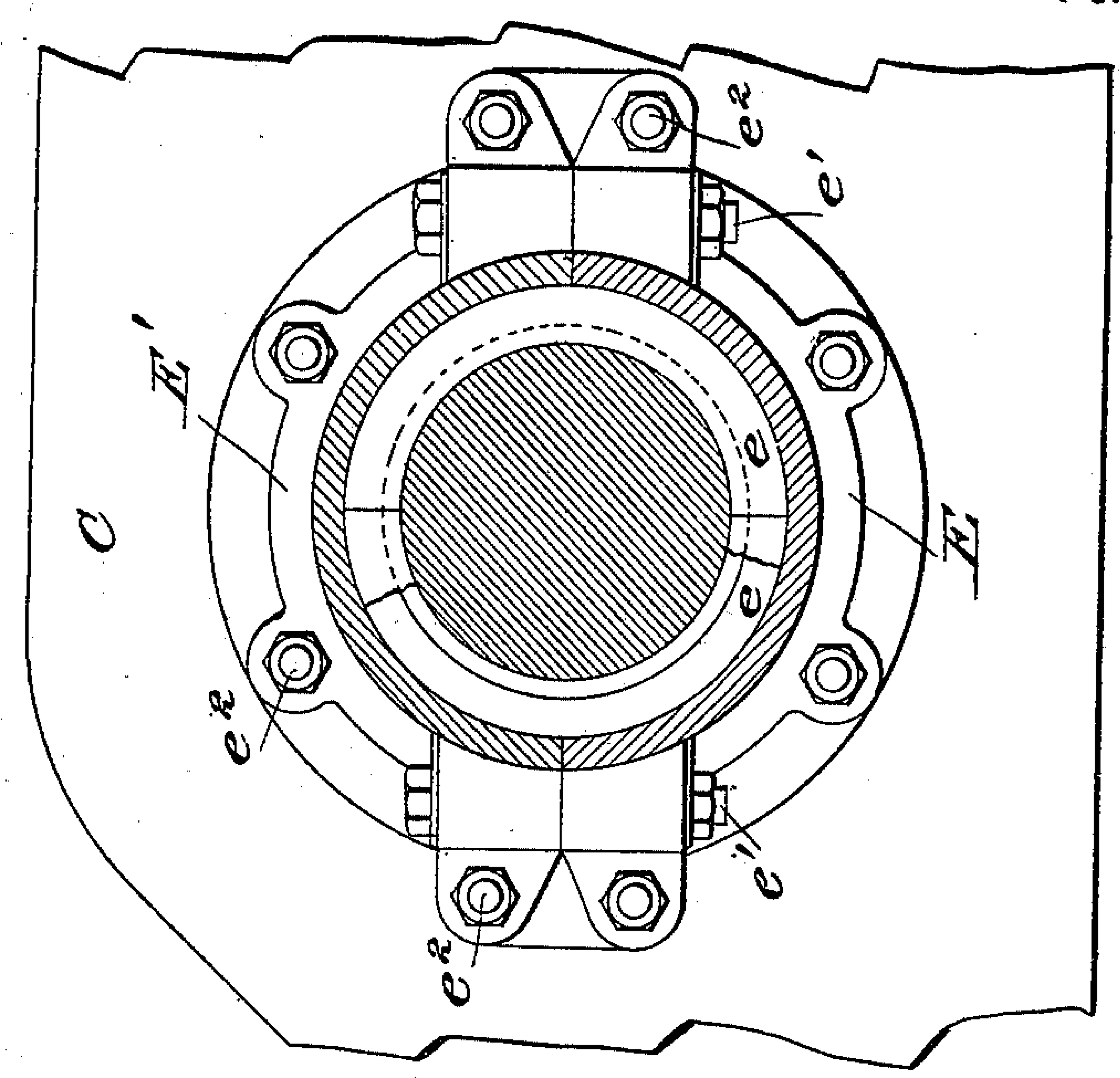
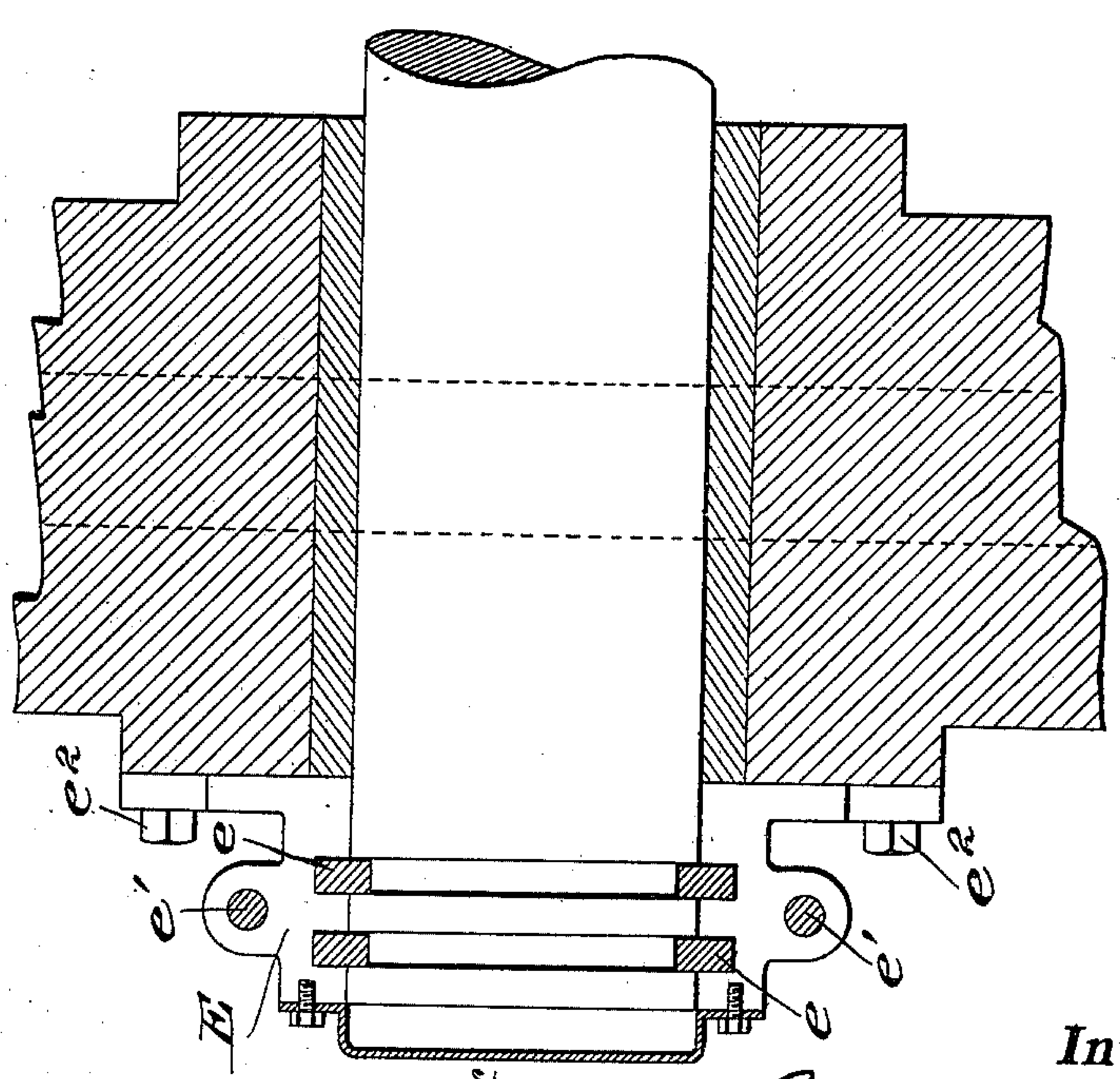


Fig. 4



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UNITED STATES PATENT OFFICE.

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

APPARATUS FOR BREAKING ROCK.

SPECIFICATION forming part of Letters Patent No. 672,617, dated April 23, 1901.

Application filed August 9, 1900. Serial No. 26,356. (No model.)

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 Apparatus for Breaking Rock, (Case No. 1,045,) of which the following is a description.

In an application for Letters Patent filed July 16, 1897, Serial No. 644,747, I describe an improved method of breaking rock by kinetic energy, consisting in causing two independently-driven and disconnected massive bodies to travel toward each other at a high speed, in partially arresting the motion of such bodies by successively and periodically introducing charges of rock between them, thereby breaking the rock by kinetic energy, and in restoring the speed of such bodies during the intervals between the breaking operations. The present application relates to an improved apparatus for carrying such method into effect.

In carrying out my invention I preferably employ a pair of independently-driven and disconnected massive rolls, and feed the material periodically to the gap between such rolls. 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 have in practice 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 construction 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 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 one 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 with the larger 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. The rock often strikes the rolls at an angle and produces end thrusts of the rolls. To compensate for this and prevent the grinding of the rolls against the frame or the journal-boxes, I provide each roll-shaft with an inclosed centralizing bearing which prevents the longitudinal movement of the shaft in either direction. This centralizing bearing consists of divided steel rings which are placed in grooves in the shaft and form ribs thereon, which ribs are inclosed by a divided encircling collar having corresponding grooves and firmly secured to the journal-box.

In the accompanying drawings, forming a part hereof, Figure 1 is a side elevation and 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 elevation showing the friction-clutches for driving the rolls. Figs. 4 and 5 are views of the centralizing bearing, and Figs. 6 and 7 are respectively a side elevation and a top plan view of a portion of one of the friction-bands.

In all of the above views corresponding parts are represented by the same letters of reference.

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 projecting knobs c of uniform height, and at opposite points in the diameter of one roll is a line of larger knobs d. The rolls are mounted in a suitable frame C. On one end of each roll-shaft outside of the frame is a centralizing-bearing D. This is composed of split steel rings e, carried by grooves in the shaft and forming ribs thereon. The shaft at this point is surrounded by a collar composed of two parts E E', having grooves corresponding with the ribs on the shaft, which grooves are babbitted. The parts of the encircling collar are bolted together by bolts e' and are securely bolted to the journal-box by bolts e^2. A dust-cap f, secured to the collar, closes the opening over the end of the shaft. Upon the other end of each of the roll-shafts is loosely mounted a pulley F. 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 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. 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 the driving-shaft to the rolls and at the rolls passes over an idler J, located centrally above the two pulleys P. From this idler the belt I passes over one of the pulleys and then in the opposite direction over the other pulley 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 through the rolls the friction-bands continue to slip until the rolls are again brought up to speed.

Referring particularly to Fig. 1, the hopper 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 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 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, 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 hopper. 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 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 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, 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.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. In apparatus for breaking rock by kinetic energy, the combination of a pair of independently-driven and disconnected massive rolls having roughened or irregular surfaces, a power connection delivering power to both the rolls insufficient to break the rock by the direct application of the power, and means for periodically delivering charges of rock to such rolls at sufficiently infrequent intervals to permit the rolls to recover sufficient speed to effect the successive breaking operations, substantially as set forth.

2. In apparatus for breaking rock by kinetic energy, the combination of a pair of independently-driven and disconnected massive rolls having roughened or irregular surfaces, a power connection delivering power to both the rolls insufficient to start the rolls from a state of rest, and means for periodically delivering charges of rock to such rolls at sufficiently infrequent intervals to permit the rolls to recover sufficient speed to effect the successive breaking operations, substantially as set forth.

3. In apparatus for breaking rock by kinetic energy, the combination of a pair of independently-driven and disconnected massive rolls, knobs of substantially uniform height on the rolls for catching the rock and subjecting it to a rolling action, larger and higher knobs disposed in a longitudinal row on one of the rolls for sledging large pieces of rock and reducing them to a size small enough to be subjected to the rolling action, a power connection delivering power to both the rolls insufficient to break the rock by the direct application of the power, and means for periodically delivering charges of rock to such rolls at sufficiently infrequent intervals to permit the rolls to recover sufficient speed to effect the successive breaking operations, substantially as set forth.

4. In apparatus for breaking rock by kinetic energy, the combination of the two independent massive rolls having roughened or irregular surfaces, and the slipping power connections for both rolls, substantially as set forth.

5. In apparatus for breaking rock by kinetic energy, the combination with the independent massive rolls having roughened or irregular surfaces, of the pulleys mounted loosely on the roll-shafts, the band-wheels, friction-bands, and driving-belt, substantially as set forth.

6. In apparatus for breaking rock by kinetic energy, the combination with the independent massive rolls having roughened or irregular surfaces, of the pulleys mounted loosely on the roll-shafts, the band-wheels, friction-bands, driving-belt, and the idler, substantially as set forth.

7. In apparatus for breaking rock by kinetic energy, the combination with independent massive rolls having roughened or irregular surfaces, of slipping power connections, and means for periodically delivering rock to the rolls, substantially as set forth.

This specification signed and witnessed this 1st day of August, 1900.

THOMAS A. EDISON.

Witnesses:
J. F. RANDOLPH,
J. A. BOEHME.