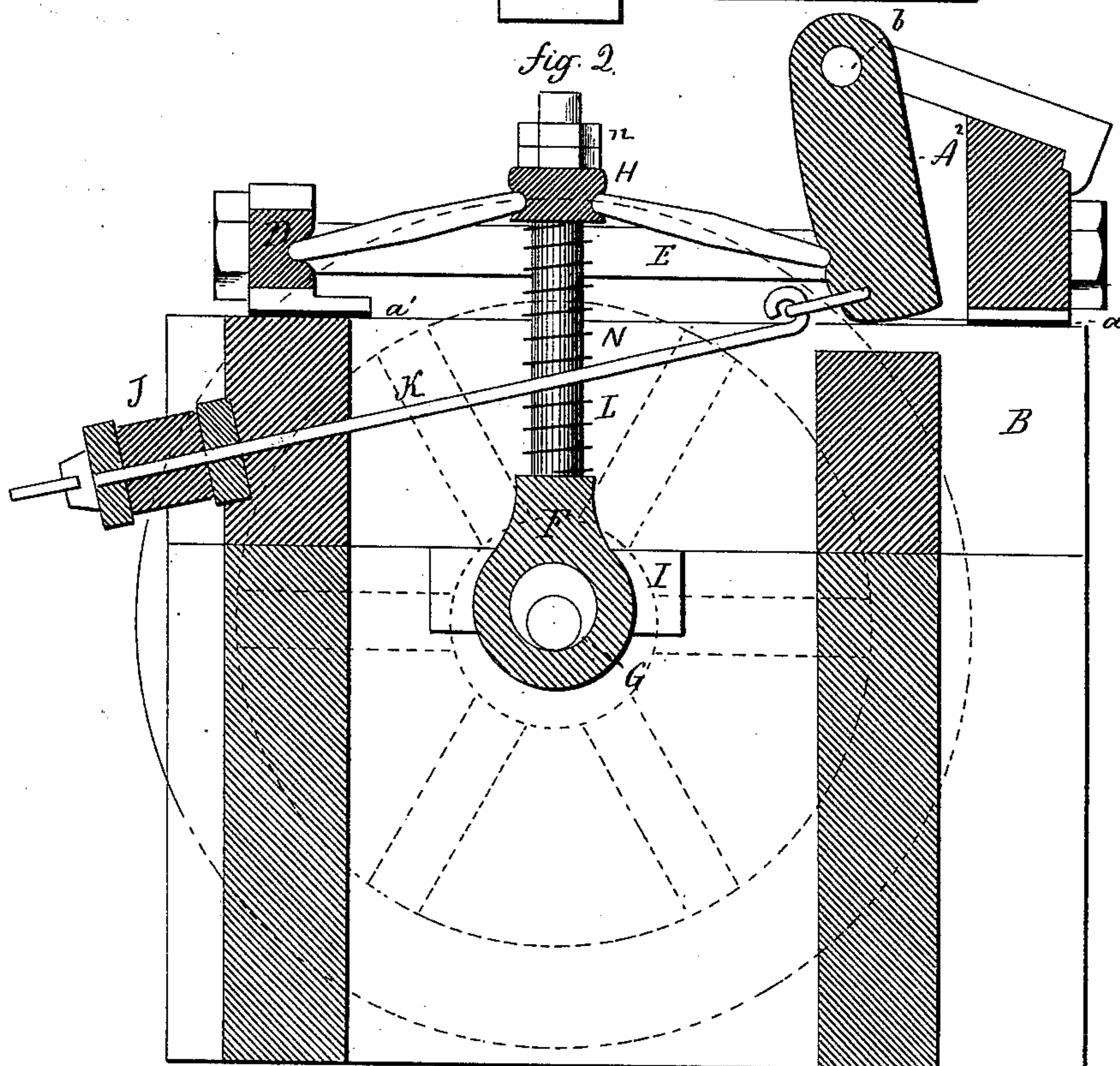
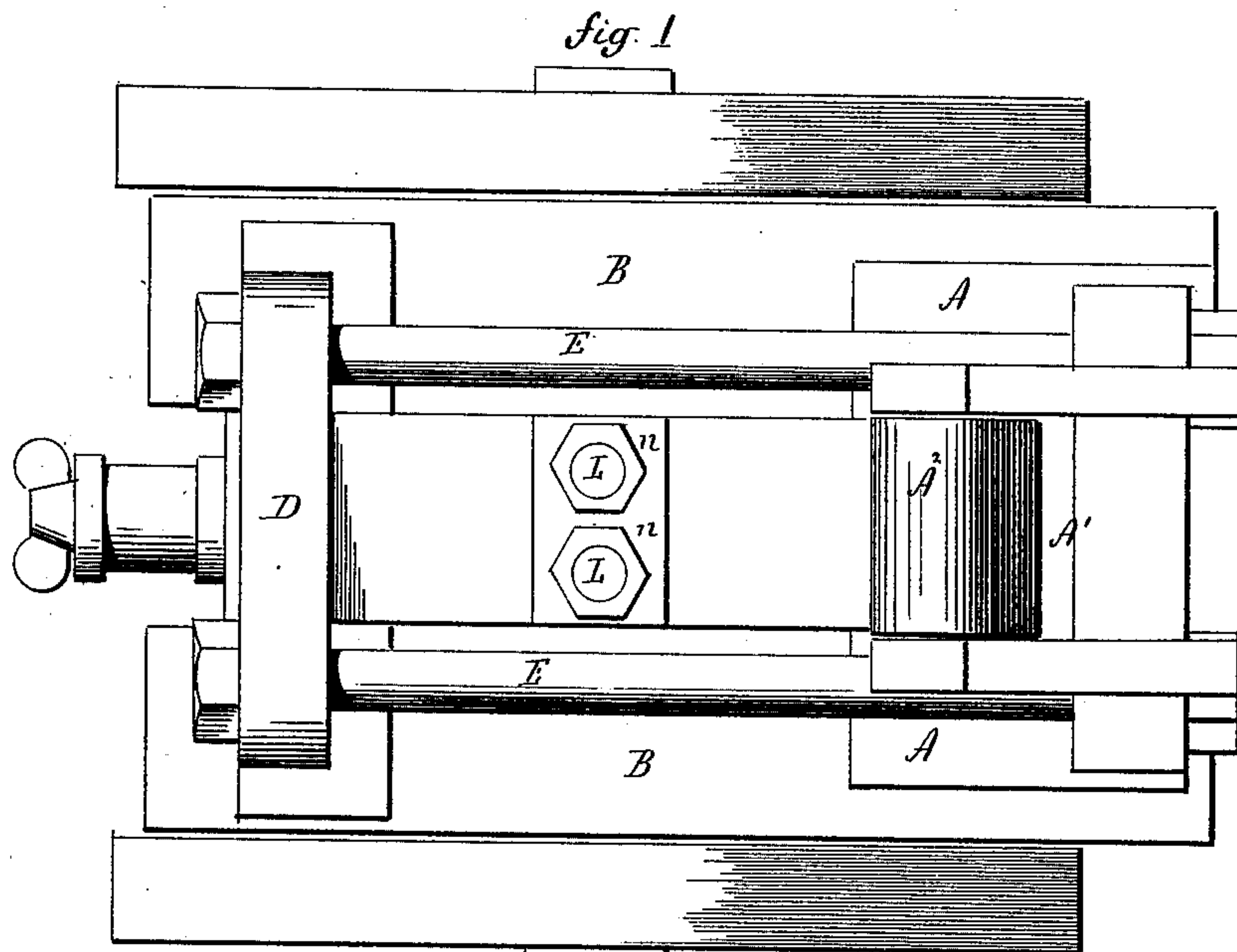


T. A. BLAKE.
Stone-Crusher.

No. 221,768.

Patented Nov. 18, 1879.



Witnesses

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THEODORE A. BLAKE, OF NEW HAVEN, CONNECTICUT.

IMPROVEMENT IN STONE-CRUSHERS.

Specification forming part of Letters Patent No. **221,768**, dated November 18, 1879; application filed October 16, 1879.

To all whom it may concern:

Be it known that I, THEODORE A. BLAKE, of New Haven, in the county of New Haven and State of Connecticut, have invented a new Improvement in Stone-Crushers; and I do hereby declare the following, when taken in connection with the accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a plan or top view; Fig. 2, longitudinal section.

The object of my invention is to construct a stone-breaking machine in which the tensile strains due to the performance of its work shall be almost wholly upon wrought-iron or steel, instead of cast-iron, giving lightness and strength combined, and to provide for the adjustment of the opening at the bottom of the jaws and the length of stroke of the movable jaw without the substitution of parts, and also to provide against breakage from undue and excessive strains to which such machines are likely to be subjected.

The invention consists in the introduction of an elastic or yielding material between the point where the power takes its bearing and the jaw to which the power is applied; also, in combining in a stone-breaking machine a pitman adjustable as to its length, with a toggle-block adjustable on the rods which connect the front and rear parts of the machine, in this case the toggle-block being said rear part.

A is a three-sided frame-work of cast-iron or steel with broad flanged base resting upon thin elastic cushions *a* placed between it and the two parallel timbers B B upon which it is supported. This casting forms the front and two sides of the jaw-opening A', and affords a support for the shaft *b*, on which the swing or movable jaw A² is suspended, and, together with the movable jaw A², constitutes the upright convergent jaws of the well-known Blake stone-breaker. Holes in the sides of this casting are left or bored to receive the main tension-rods of the machine E E, and it

is held in position on the parallel timbers by means of bolts or screws passing through the bottom flanges.

C C are wrought-iron or steel clamps, one on each side of the jaw-opening, which serve to take a portion of the strain due to the crushing of material in the upper portion of the jaws to hold the shaft of the movable jaw in position, and to form a part of the walls of the jaw-opening. These clamps may be closely fitted or bolted onto the cast frame, or both.

D is a casting of iron or steel forming the back end of the machine or toggle-block, against which one end of a toggle of the toggle-joint hereinafter referred to abuts, and which is perforated with holes corresponding to those in the front casting to receive bolts of wrought-iron or steel forming the main tension-rods E E above referred to. This casting D also rests upon elastic cushions *a'* on the parallel timbers which support the front casting.

The main tension-rods E E may be either round, square, or flat bars. They connect the front and rear castings and are provided with screw thread and nuts, or with some equivalent arrangement, by means of which the position of the rear part D with reference to the front part A' may be adjusted as desired.

The necessary short vibrating motion of the swing-jaw is derived from the toggle or elbow joint between the back of the movable jaw suspended in the front part and the rear part, which, for convenience, may be called the "toggle-block." This toggle-joint is worked by means of an eccentric or crank shaft, G, through the pitman hereinafter described, which connects the toggle-joint and main shaft. The main shaft is held in position and revolves in bearings I bolted onto the under side of the timbers B B on which the front and rear parts of the machine are cushioned and supported.

The pitman connecting the shaft and the toggle-joint consists of a block, F, in which the main eccentric or crank shaft works; wrought-iron or steel rods L L screwed, cast, or keyed into the said block; the pitman-head H, in which are holes to receive the rods

L L, and which is free to slide up and down on said rods; spiral springs N N on the rods; and the nuts *n n* above the head to hold the head-block in position. The object of the spiral springs is to cause the pitman-head to follow when the nuts are unscrewed. They may be replaced by nuts on the rods, by means of which the position of the pitman-head on the rods may be adjusted as desired.

Oil-holes drilled through the length of the pitman-rods furnish a convenient means of oiling the main shaft.

In operation the toggle-joint works only on one side of a line joining the toggle-bearing in the movable jaw, and the toggle-bearing in the main toggle-block or rear part of the machine.

The stroke of the jaw will depend upon the length and inclination of the toggles, as well as upon the eccentricity of the shaft.

If the pitman-head be so adjusted as to bring the toggles into line at the end of the forward stroke of the movable jaw, the minimum stroke would be employed.

The proportion adopted in making a working stone-crushing machine is such that when the toggles are brought into a straight line the stroke of the jaw would be hardly appreciable; but if, by means of the adjustment of the pitman-head on the rods, we give the toggles an inclination of five degrees—say, at the end of the forward stroke of the movable jaw—and then revolve the shaft, the inclination of the toggles to a line joining the toggle-bearing in the movable jaw, and the toggle-bearing in the toggle-block will, of course, increase until the end of the backward motion of the jaw is attained. We shall then find the length of the toggles and eccentricity of the shaft remaining the same; that the motion of the movable jaw, instead of being hardly appreciable, would be nearly one-half an inch—a stroke sufficiently great for practical work of stone-breaking on a large scale. A still greater inclination of the toggles would give a longer stroke.

To illustrate by example the increase of stroke of the movable jaw by the increase of inclination of the toggles by means of the adjustment of the pitman-head, let us suppose the eccentricity of the shaft to be five-eighths of an inch. The stroke of the pitman would be one and one-quarter inch. Suppose the toggles to be of equal length, and that length fifteen inches. The stroke of the movable jaw, when the pitman-head is adjusted so as to bring the toggles into line at the end of the forward stroke of the jaw, would be equal to the sum of the versines of the arc through which the ends of the toggles bearing on the pitman-head move. The sine of the arc would be equal to the stroke of the pitman—*i. e.*, one and one-fourth inch, and the inclination of the toggles at the back end of the stroke of the movable jaw would be four degrees forty-seven minutes.

The length of stroke of the movable jaw

would be about one-tenth of an inch, or practically nothing. If, now, we set the pitman-head so that the toggles, when the end of the forward stroke of the jaw is attained, shall be inclined to the line joining the bearings on the swing-jaw and main toggle-block at an angle of four degrees forty-seven minutes, the angle of their inclination to the same line when the end of the backward stroke of the swing-jaw is attained would be measured by an arc whose sine is two and one-half inches. This, with a radius of fifteen inches, would be nine degrees thirty-six minutes, and the length of the stroke would be over three-tenths of an inch—a stroke sufficiently great for the practical work of stone-breaking on a large scale.

The length of the stroke of the swing-jaw having been adjusted as desired, the adjustment of the opening at the bottom of the jaws is made by screwing up or unscrewing the nut on the main tension-rods at the rear of the machine. It is evident, therefore, that an adjustable pitman combined with a toggle-joint gives the means of adjusting the length of the stroke of the movable jaw within any reasonable working limits without substitution of parts.

The main shaft is provided with fly-wheels, and pulley or other means, for communicating power to the machine. The movable jaw A² is withdrawn by means of a rubber spring, J, and rod K, which passes through a transverse timber, connecting the two parallel timbers on which the main castings are cushioned, and hooks into an eye in the bottom of the movable jaw.

The timbers B B and the elastic cushions between them and the body of the machine or main castings form component parts of the machine. The former may be regarded as inverted beams, in which the front and rear parts or castings form the points of support, and the strain upon the pitman is the load. They act as springs. They are calculated to resist all normal strains upon the shaft, but are intended to yield by their elasticity, and, in the case of undue strains, by compression of fibers. In case of such compression of the fibers, the machine may be readjusted by means of the nuts on the pitman and main tension-rods to the jaw-opening and length of stroke it is desirable to employ. The timbers B B may be replaced by an elastic beam or girder of wrought-iron. The cushions *a a'* between the body and beams B B may be of rubber or other elastic material, one-fourth to three-eighths of an inch in thickness. It is evident that the same result might be obtained by cushioning the main shaft-boxes on the under side of the beams B B, or by a cushion above the pitman-head block between the block and a plate on which the pitman-rod nuts should bear.

I have adopted the method of cushioning between the body and supporting timbers or beams on account of its convenience, and of

the larger bearing-surface there obtainable. The bearing-surfaces of the cushions beneath the body or main castings are so large, and the strain tending to compress them so small, compared with that on the main tension-rods of the machine, that they will not yield materially under the strains on the pitman incident to the ordinary work of stone-breaking, but will yield in case of an undue or excessive strain—such, for example, as the accidental intrusion of a wedge-shaped piece of stone presenting an exceptionally-large surface, or fragments of cast-iron, steel, or other metals offering extraordinary resistance to compression. The result in case of such undue strains would be a stoppage of the motion of the swing-jaw before reaching the full limit of its ordinary stroke, combined with a subsequent partial revolution of the fly-wheels before they come to a full stop, thus producing a great diminution of strains on the parts of the machine, compared with those whose parts are so rigid that the fly-wheels must under similar circumstances come almost instantly to a stand-still and subject the parts of the machine to sudden and enormous strains, which must necessarily cause breakage.

It is evident that with a pitman of the construction described a greater number of rods may be used, or a single rod might be substituted for the two shown in the drawings.

I do not herein broadly claim an adjustable pitman in a stone-crusher, or such a pitman combined with an adjustable toggle-block, as I have made broad claims to such construction in my application for Letters Patent filed April 9, 1879, such invention being shown in English Patent No. 4,135, of 1877, and over

which I claim priority, and propose to prove it in connection with said application of April 9.

I claim—

1. In a stone-breaking machine, the combination of a pair of upright convergent jaws, mechanism for imparting a reciprocating or vibrating movement to one of said jaws, and an elastic or yielding material between said jaws and the point where the power takes its bearing, substantially as described.

2. The combination of the block F and sliding head H with rod or rods connecting said head and block, and nuts and springs, so that the sliding of the head adjusts the length of the pitman, substantially as described.

3. The combination, in a stone-breaking machine, of a pitman, adjustable as to its length with the toggle-block D, adjustable on the rods E, substantially as described.

4. The combination, in a stone-breaking machine, of a pitman, with the toggle-block D, adjustable on the rods E, substantially as described.

5. The combination, in a stone-breaking machine with upright convergent jaws, of the front and rear parts, a tension bar or rod, E, at each side, connecting said rear and front parts, and a clamp, C, embracing the front part, each side the jaw-opening, substantially as described.

6. In a stone-breaking machine with upright convergent jaws, the clamps C C, embracing the front part of the frame each side of the opening, substantially as described.

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Witnesses:

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J. H. SHUMWAY.